FORM DQP 2.01-1
LEVEL 1 CHECK PRINT SIGN-OFF SHEET

Client Name:	**Ohio Department of Transportation**
Job Title:	**Cleveland Innerbelt Design-Build Contract**
Job Number:	**CUY-90-14.90**
Document Title:	Unit 2 - Walsh CW check - Field splice spreadsheets

Check Level (Mark One):

- [ ] 1A 100% Document Check
- [X] 1B 100% Input Check

Enter description below:

	Print Name	Signature	Date
[X] Originator	David Glastetter	David Glastetter	5/11/12
[X] Checker	SARAH LARSON	Sarah Larson	6-18-12
[X] Backchecker	David Glastetter	David Glastetter	6/18/12
[X] Updater	David Glastetter	David Glastetter	6/18/12
[X] Validater	SARAH LARSON	Sarah Larson	6-18-12

Insert an "X" in the box to indicate a required QC activity.

Field Splice Design

Field Splice

Summary Table

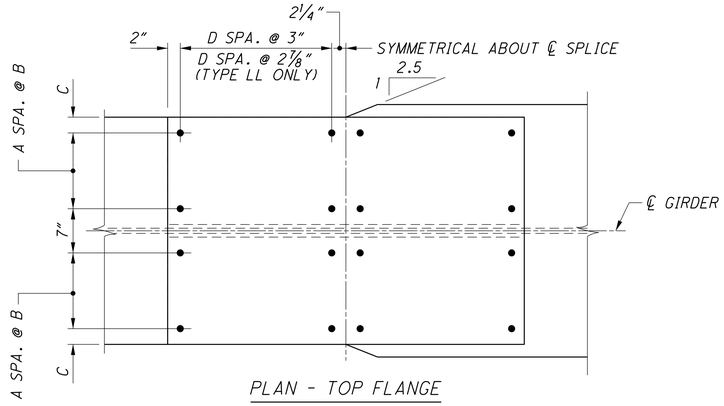
HNTB	The HNTB Companies Engineers Architects Planners	Made SAE	Date **8/5/2011**	Job Number **49633**	
		Checked WME	Date **8/5/2011**		
For **Cleveland Innerbelt**		Backchk'd SAE	Date **8/5/2011**	Sheet No.	
\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice.xlsm]Summary		Revised DJG	Date **5/15/2012**		
		Checked SJL	Date **5/16/2012**		
		Backchk'd DJG	Date **5/16/2012**		

Field Splice Variable Table

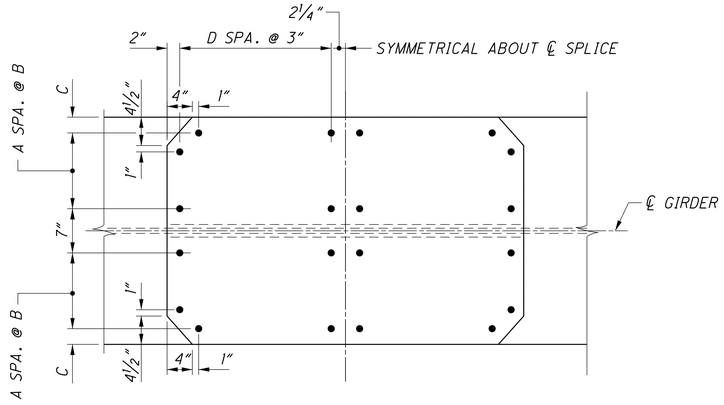
Ref. Sketches for Variable Definitions and Splice Type Locations

	Top Flange							Bottom Flange							Web			
Type	A	B	C	D	E	F	Fill Pl	G	H	J	K	L	M	Fill Pl	N	P	Q	Fill Pl
A	5	3.000	2.500	8	1.125 x 42.000 x 56.500 GR 70	1.250 x 19.500 x 56.500 GR 70	---	6	3.000	2.500	10	1.375 x 48.000 x 68.500 GR 70	1.500 x 22.500 x 68.500 GR 70	---	28	3	0.750 x 26.500 x 89.000 GR 50	---
B	5	3.000	2.500	7	0.875 x 42.000 x 50.500 GR 70	0.875 x 19.500 x 50.500 GR 70	0.250 x 42.000 x 25.000 GR 50	5	3.000	2.500	7	0.875 x 42.000 x 50.500 GR 70	0.875 x 19.500 x 50.500 GR 70	1.000 x 42.000 x 25.000 GR 50	28	3	0.875 x 26.500 x 89.000 GR 50	(2) 0.125 x 13.000 x 89.000 GR 50
C	4	3.250	2.500	9	1.125 x 38.000 x 62.500 GR 70	1.125 x 17.500 x 62.500 GR 70	---	4	3.250	2.500	7	0.875 x 38.000 x 50.500 GR 70	0.875 x 17.500 x 50.500 GR 70	0.250 x 38.000 x 25.000 GR 50	28	4	0.750 x 32.500 x 89.000 GR 50	(2) 0.250 x 16.000 x 89.000 GR 50
D	3	3.500	2.000	6	0.875 x 32.000 x 44.500 GR 70	1.000 x 14.500 x 44.500 GR 70	---	3	3.500	2.000	7	0.875 x 32.000 x 50.500 GR 70	1.000 x 14.500 x 50.500 GR 70	---	28	3	0.750 x 26.500 x 89.000 GR 50	(2) 0.125 x 13.000 x 89.000 GR 50
E	3	3.500	2.000	7	1.250 x 32.000 x 50.500 GR 50	1.375 x 14.500 x 50.500 GR 50	t x 32.000 x 25.000 GR 50	3	3.500	2.000	7	1.125 x 32.000 x 50.500 GR 50	1.250 x 14.500 x 50.500 GR 50	t x 32.000 x 25.000 GR 50	28	2	0.625 x 20.500 x 89.000 GR 50	(2) t x 10.000 x 89.000 GR 50
F	3	3.500	2.000	10	1.500 x 32.000 x 68.500 GR 50	1.750 x 14.500 x 68.500 GR 50	t x 32.000 x 34.000 GR 50	3	3.500	2.000	7	1.250 x 32.000 x 50.500 GR 50	1.375 x 14.500 x 50.500 GR 50	t x 32.000 x 25.000 GR 50	28	4	0.875 x 32.500 x 89.000 GR 50	(2) t x 16.000 x 89.000 GR 50
G	4	3.000	2.500	9	1.500 x 36.000 x 62.500 GR 50	1.625 x 16.500 x 62.500 GR 50	t x 36.000 x 31.000 GR 50	4	3.000	2.500	6	1.000 x 36.000 x 44.500 GR 50	1.250 x 16.500 x 44.500 GR 50	0.250 x 36.000 x 22.000 GR 50	28	4	0.875 x 32.500 x 89.000 GR 50	(2) 0.188 x 16.000 x 89.000 GR 50
H	3	3.500	2.000	7	1.000 x 32.000 x 50.500 GR 50	1.125 x 14.500 x 50.500 GR 50	0.750 x 32.000 x 25.000 GR 50	3	3.500	2.000	7	1.250 x 32.000 x 50.500 GR 50	1.375 x 14.500 x 50.500 GR 50	0.250 x 32.000 x 25.000 GR 50	28	2	0.625 x 20.500 x 89.000 GR 50	---
I	3	3.500	2.000	5	1.000 x 32.000 x 38.500 GR 50	1.125 x 14.500 x 38.500 GR 50	t x 32.000 x 19.000 GR 50	3	3.500	2.000	6	0.875 x 32.000 x 44.500 GR 50	1.000 x 14.500 x 44.500 GR 50	t x 32.000 x 22.000 GR 50	28	2	0.500 x 20.500 x 89.000 GR 50	---
J	3	3.500	2.000	5	0.750 x 32.000 x 38.500 GR 50	0.875 x 14.500 x 38.500 GR 50	0.250 x 32.000 x 19.000 GR 50	3	3.500	2.000	5	0.750 x 32.000 x 38.500 GR 50	0.875 x 14.500 x 38.500 GR 50	0.250 x 32.000 x 19.000 GR 50	28	2	0.500 x 20.500 x 89.000 GR 50	---
K	3	3.000	2.500	7	1.375 x 30.000 x 50.500 GR 50	1.500 x 13.500 x 50.500 GR 50	---	3	3.000	2.500	6	1.000 x 30.000 x 44.500 GR 50	1.125 x 13.500 x 44.500 GR 50	0.500 x 30.000 x 22.000 GR 50	28	3	0.625 x 26.500 x 89.000 GR 50	(2) 0.188 x 13.000 x 89.000 GR 50
L	5	3.375	2.125	8	1.500 x 45.000 x 56.500 GR 50	1.625 x 21.000 x 56.500 GR 50	---	5	3.000	2.500	7	1.375 x 42.000 x 50.500 GR 50	1.500 x 19.500 x 50.500 GR 50	---	28	3	0.625 x 26.500 x 89.000 GR 50	(2) 0.063 x 13.000 x 89.000 GR 50
L2	5	3.375	2.125	8	1.500 x 45.000 x 56.500 GR 50	1.625 x 21.000 x 56.500 GR 50	---	5	3.375	2.125	7	1.250 x 45.000 x 50.500 GR 50	1.375 x 21.000 x 50.500 GR 50	---	28	3	0.688 x 26.500 x 89.000 GR 50	(2) 0.063 x 13.000 x 89.000 GR 50
M	4	3.000	2.500	7	1.125 x 36.000 x 50.500 GR 50	1.250 x 16.500 x 50.500 GR 50	t x 36.000 x 25.000 GR 50	4	3.375	2.500	9	1.375 x 39.000 x 62.500 GR 50	1.500 x 18.000 x 62.500 GR 50	t x 39.000 x 31.000 GR 50	28	3	0.625 x 26.500 x 89.000 GR 50	(2) t x 13.000 x 89.000 GR 50
N	5	3.375	2.125	13	1.625 x 45.000 x 86.500 GR 70	1.750 x 21.000 x 86.500 GR 70	---	5	3.375	2.125	10	1.250 x 45.000 x 68.500 GR 70	1.375 x 21.000 x 68.500 GR 70	---	28	4	0.875 x 32.500 x 89.000 GR 50	(2) 0.250 x 16.000 x 89.000 GR 50
O	5	3.000	2.500	9	1.000 x 42.000 x 62.500 GR 70	1.125 x 19.500 x 62.500 GR 70	0.500 x 42.000 x 31.000 GR 50	5	3.000	2.500	9	1.000 x 42.000 x 62.500 GR 70	1.125 x 19.500 x 62.500 GR 70	0.500 x 42.000 x 31.000 GR 50	34	3	0.875 x 26.500 x 107.000 GR 50	(2) 0.125 x 13.000 x 107.000 GR 50
P	6	3.000	2.500	9	1.250 x 48.000 x 62.500 GR 70	1.375 x 22.500 x 62.500 GR 70	---	5	3.625	2.375	13	1.500 x 48.000 x 86.500 GR 70	1.500 x 22.500 x 86.500 GR 70	---	34	5	1.125 x 38.500 x 107.000 GR 50	---

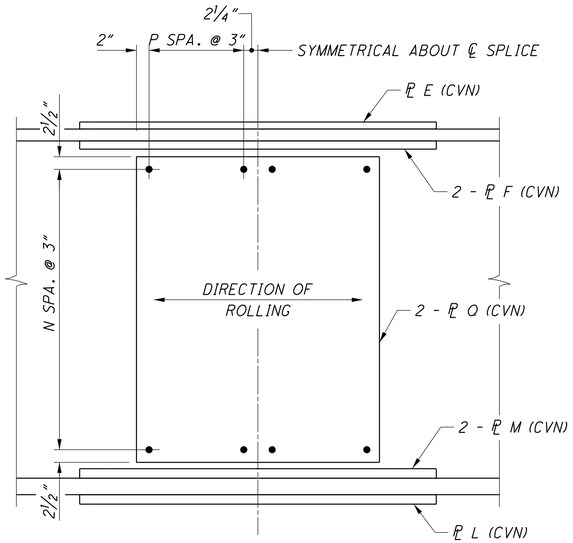
Notes: Where fill plate thickness varies within a given "Type" a value of "t" is provided for plate thickness.
Connections shall have threads excluded from the shear plane.



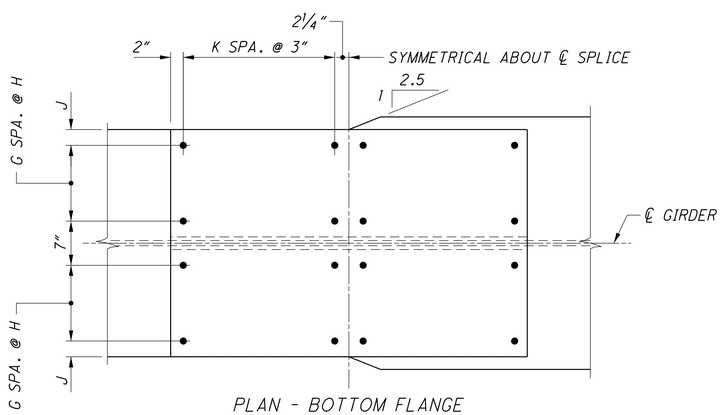
PLAN - TOP FLANGE



TOP FLANGE SPLICE DETAIL AT F.S. 16



ELEVATION



PLAN - BOTTOM FLANGE

FIELD SPLICE

NOTES:

1. HIGH STRENGTH BOLTS FOR FIELD SPLICES SHALL BE 1" ϕ A325 TYPE 1 BOLTS.
2. WHERE A SHAPE OR PLATE IS LABELED (CVN), THE MATERIAL SHALL MEET THE MINIMUM NOTCH TOUGHNESS REQUIREMENTS IN ACCORDANCE WITH 711.01.

PRELIMINARY NOT FOR CONSTRUCTION

CHECKED BY:
CORRECTED BY:
BACKCHECKED BY:
VERIFIED BY:
CHECK PRINT (INITIAL & DATE)
MADE BY:

Date:5/5/2011
Model:WorkSheet
File:49633-S-BR-FSD02-U2StSteel.dgn

ENGINEER'S SEAL

NO.	REVISIONS	DATE
B	FINAL SUBMITTAL	05/05/11

DESIGN AGENCY
WALSH CONSTRUCTION
HNTB

CLEVELAND'S INNERBELT BRIDGE
OHIO DEPARTMENT OF TRANSPORTATION

MAIN SPAN
UNIT 2
STRUCTURAL STEEL

FIELD SPLICE DETAILS

BRIDGE NO. CUY-90-1566
I-90 WEST BOUND

DESIGNED	SAE	REVIEWED	HRH 05/03/11
DRAWN	FWC	STRUCTURE FILE NUMBER	1809431
CHECKED	MCC	CHECKED	LJD

CUY-90-14.90
PID No. 77332/85531

29/79

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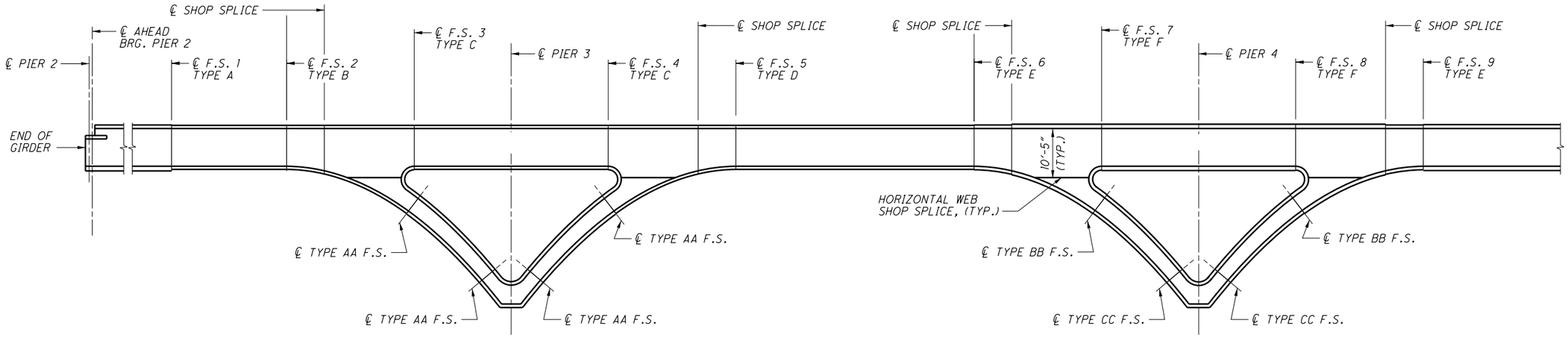
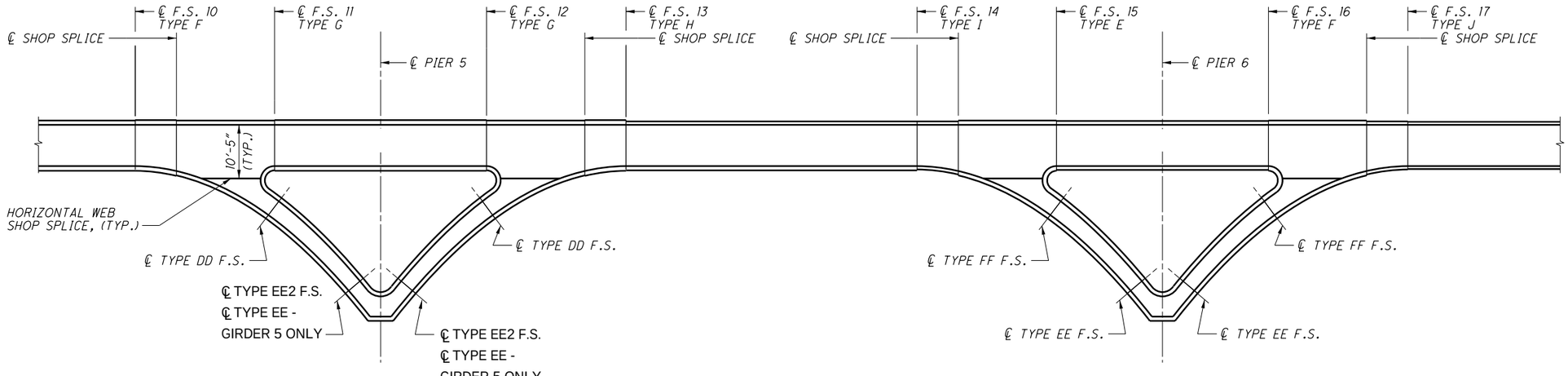


GIRDER ELEVATION



NOTES:

1. ALL STEEL SHALL BE PAINTED WITH AN IZEU COATING SYSTEM.
2. ALL FLANGE, WEB AND SPLICE PLATES SHALL BE DESIGNATED "CVN" AND SHALL MEET THE MINIMUM NOTCH TOUCHNESS REQUIREMENTS IN ACCORDANCE WITH 711.01.

PRELIMINARY NOT FOR CONSTRUCTION

ENGINEER'S SEAL

NO.	REVISIONS	DATE
B	FINAL SUBMITTAL	05/05/11

DESIGN AGENCY: WILSH CONSTRUCTION, HNTB

CLEVELAND'S INNERBELT BRIDGE — OHIO DEPARTMENT OF TRANSPORTATION

MAIN SPAN UNIT 2
STRUCTURAL STEEL
SUPPLEMENTAL GIRDER ELEVATIONS
BRIDGE NO. CUY-90-1566
I-90 WEST BOUND

DESIGNED	DRAWN	REVIEWED	DATE
SAE	FWG	HRH	05/03/11
CHECKED	CHECKED	STRUCTURE FILE NUMBER	
MCC	LJD	1809431	

CUY-90-14.90
PID No. 77332/85531

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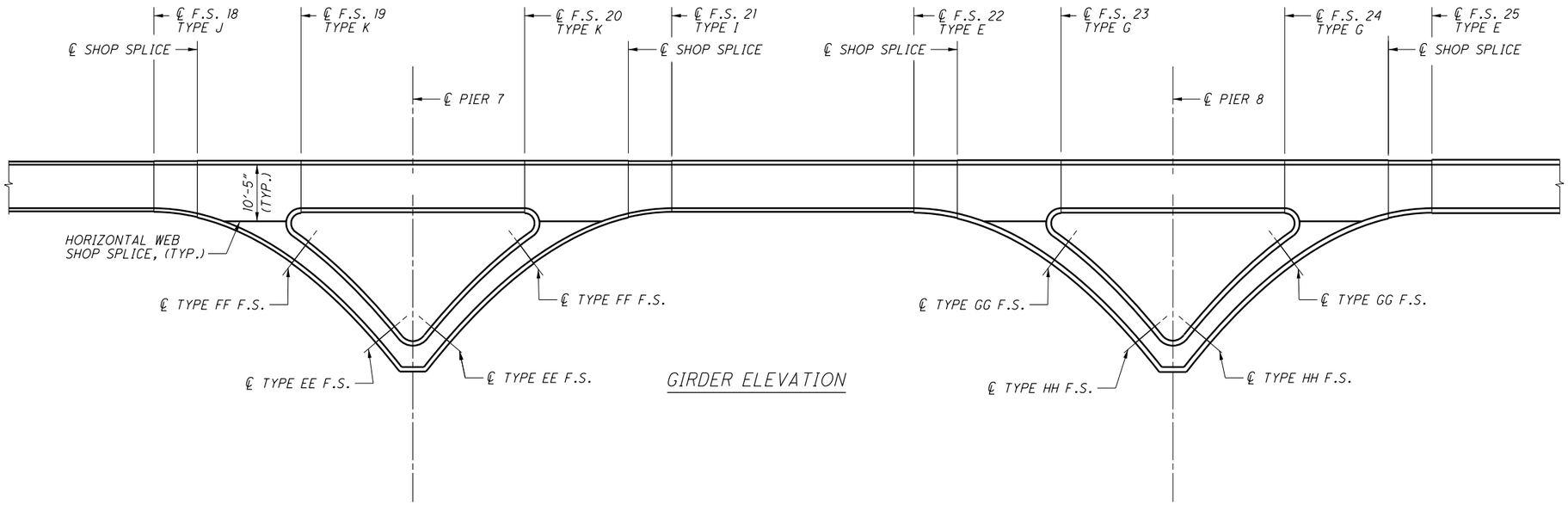
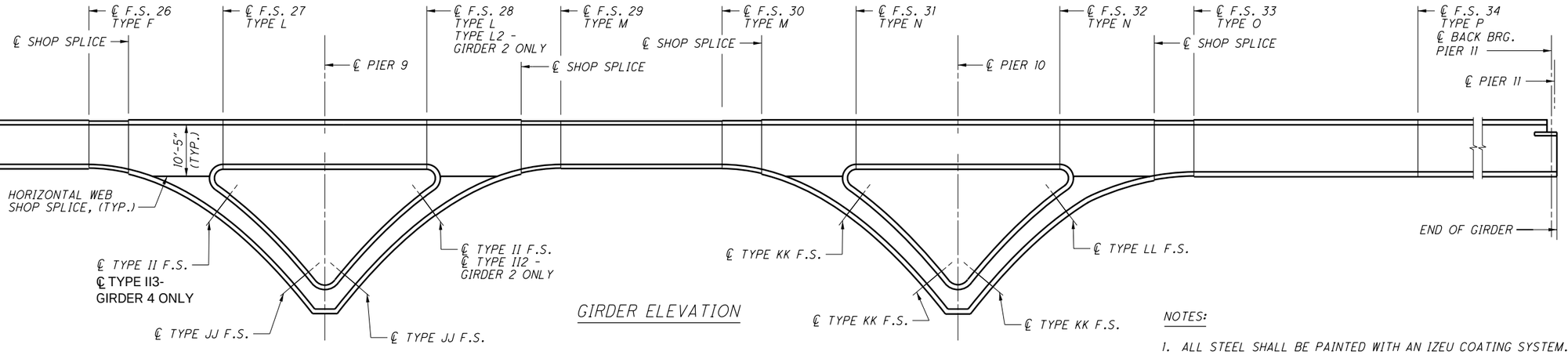
VERIFIED BY:
CHECK PRINT (INITIAL & DATE)
MADE BY:

Date:5/5/2011
Model:WorkSheet
File:49633-S-BR-FSD07-U2StSteel.dgn



GIRDER ELEVATION



GIRDER ELEVATION

NOTES:

1. ALL STEEL SHALL BE PAINTED WITH AN IZEU COATING SYSTEM.
2. ALL FLANGE, WEB AND SPLICE PLATES SHALL BE DESIGNATED "CVN" AND SHALL MEET THE MINIMUM NOTCH TOUCHNESS REQUIREMENTS IN ACCORDANCE WITH 711.01.

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CORRECTED BY:
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CHECK PRINT (INITIAL & DATE)
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Date:5/5/2011
Model:WorkSheet
File:49633-S-BR-FSD08-U2StSteel.dgn

ENGINEER'S SEAL

NO.	REVISIONS	DATE
B	FINAL SUBMITTAL	05/05/11

DESIGN AGENCY: WILSH CONSTRUCTION, HNTB

CLEVELAND'S INNERBELT BRIDGE 90

OHIO DEPARTMENT OF TRANSPORTATION

MAIN SPAN UNIT 2
STRUCTURAL STEEL

SUPPLEMENTAL GIRDER ELEVATIONS

BRIDGE NO. CUY-90-1566
I-90 WEST BOUND

DESIGNED	DRAWN	REVIEWED	DATE
SAE	FWG	HRH	05/03/11
CHECKED	CHECKED	STRUCTURE FILE NUMBER	
MCC	LJD	1809431	

CUY-90-14.90
PID No. 77332/85531

32/79

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0

Section Properties & Force Results

Ref. Delta Frame Design

Splice Node	Splice Side	Top Flange		Web		Bottom Flange		Fytf	Fyw	Fybf	Rh	STRENGTH I																											
												MAX FX					MIN FX					MAX FY					MIN FY					MAX MY					MIN MY		
												Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Ca
		b (in)	t (in)	h (in)	t (in)	b (in)	t (in)	(ksi)	(ksi)	(ksi)		TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF
1007.0	1007 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-35.33	28.64	69.06	69.06	71.94	-44.78	43.31	69.06	69.06	214.89	-36.18	29.91	69.06	69.06	-38.22	-44.38	42.64	69.06	69.06	310.53	-36.57	30.10	69.06	69.06	101.61	-37.01	30.74	69.06
	1007 R	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-44.78	43.31	69.06	69.06	130.11	-35.33	28.64	69.06	69.06	71.94	-44.25	42.41	69.06	69.06	288.10	-37.93	32.74	69.06	69.06	-57.04	-37.01	30.74	69.06	69.06	97.31	-36.57	30.10	69.06
1015.0	1015 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-6.06	4.84	69.06	69.06	-650.81	-14.34	15.74	69.06	69.06	-876.41	-10.30	9.65	69.06	69.06	-943.07	-15.08	17.33	69.06	69.06	-536.73	4.46	-4.51	69.06	68.15	-689.89	-17.07	19.96	69.06
	1015 R	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	-16.46	23.65	68.08	68.08	-927.64	-6.88	7.14	68.08	68.08	-649.91	-16.38	24.22	68.08	68.08	-542.48	-12.49	15.89	68.08	68.08	-981.07	-18.95	28.21	68.08	68.08	-758.81	4.71	-6.03	68.08
1021.0	1021 L	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	25.09	9.08	68.04	68.04	276.11	13.97	11.26	68.04	68.04	184.55	14.81	16.72	68.04	68.04	77.00	22.83	5.72	68.04	68.04	530.68	22.72	7.08	68.04	68.04	242.99	22.00	12.41	68.04
	1021 R	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	17.99	14.85	68.21	68.21	184.55	30.72	12.52	68.21	68.21	267.07	29.13	7.08	68.21	68.21	508.46	18.75	22.27	68.21	68.21	70.59	26.64	15.82	68.21	68.21	242.12	27.07	8.96	68.21
1035.0	1035 L	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	43.31	-5.07	68.21	62.45	-450.71	31.16	-5.00	68.21	62.45	-433.08	41.40	-10.21	68.21	62.45	-668.56	28.67	9.09	68.21	68.21	-236.14	39.39	-5.42	68.21	62.45	-414.32	35.82	-2.41	68.21
	1035 R	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	25.37	-4.35	68.04	62.87	-433.10	35.91	-5.16	68.04	62.87	-459.75	23.62	5.86	68.04	68.04	-242.69	31.28	-4.42	68.04	62.87	-687.89	29.83	-3.06	68.04	62.87	-418.17	32.85	-5.64	68.04
1041.0	1041 L	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	15.99	-15.16	68.08	59.12	526.05	12.60	-17.09	68.08	59.12	619.11	9.22	-10.35	68.08	59.12	318.52	11.56	-14.20	68.08	59.12	813.61	26.27	-28.62	68.08	59.12	483.83	5.82	-7.35	68.08
	1041 R	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	15.36	-21.79	67.93	62.33	533.20	19.37	-19.06	67.93	62.56	521.89	16.87	-20.84	67.93	62.41	778.18	10.17	-12.05	67.93	62.44	311.21	6.74	-9.03	67.93	62.36	602.45	31.96	-36.17	67.93
1051.0	1051 L	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	6.17	-1.82	67.93	63.26	-345.59	8.70	-12.20	67.93	62.33	-439.73	9.27	-10.88	67.93	62.45	-639.09	3.69	2.59	67.93	67.93	-185.91	25.36	-27.08	67.93	62.50	-382.18	3.24	7.12	67.93
	1051 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	7.79	-11.03	50.00	47.20	-450.37	5.61	-1.58	50.00	47.77	-349.42	3.47	1.64	50.00	50.00	-193.63	6.09	-6.82	50.00	47.28	-674.89	2.74	6.77	50.00	50.00	-457.11	23.49	-24.88	50.00
1057.0	1057 L	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	26.53	0.91	50.00	50.00	388.65	16.09	3.64	50.00	50.00	338.20	16.82	9.85	50.00	50.00	195.57	23.37	1.03	50.00	50.00	646.68	24.83	2.67	50.00	50.00	366.80	23.34	4.45	50.00
	1057 R	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	16.68	3.96	50.00	50.00	338.20	27.32	1.32	50.00	50.00	381.75	28.54	-4.50	50.00	47.91	626.01	17.21	10.99	50.00	50.00	188.76	24.05	4.62	50.00	50.00	358.05	25.41	2.70	50.00
1071.0	1071 L	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	25.90	5.38	50.00	50.00	-328.59	16.22	6.99	50.00	50.00	-299.24	22.51	3.66	50.00	50.00	-575.43	16.92	14.76	50.00	50.00	-133.93	21.57	4.43	50.00	50.00	-309.40	22.41	8.84	50.00
	1071 R	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	15.57	6.62	50.00	50.00	-299.24	25.09	4.90	50.00	50.00	-335.50	16.46	13.56	50.00	50.00	-140.59	20.97	4.33	50.00	50.00	-597.33	21.67	8.56	50.00	50.00	-316.84	21.12	4.24	50.00
1077.0	1077 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	-10.11	13.31	50.00	50.00	453.49	-8.54	4.53	50.00	50.00	558.89	-13.92	14.62	50.00	50.00	270.53	-10.86	8.88	50.00	50.00	767.57	8.65	-11.18	50.00	47.23	451.85	-16.40	21.24	50.00
	1077 R	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	-7.57	3.62	50.00	50.00	495.55	-8.75	10.44	50.00	50.00	449.25	-8.03	5.52	50.00	50.00	738.61	-13.04	12.20	50.00	50.00	263.10	-14.87	17.14	50.00	50.00	537.99	8.30	-9.18	50.00
1089.0	1089 L	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	3.74	1.50	50.00	50.00	-544.09	8.86	-10.73	50.00	48.36	-640.94	4.48	-4.29	50.00	48.42	-843.23	1.13	3.14	50.00	50.00	-361.43	18.93	-18.26	50.00	48.42	-538.80	-1.87	7.94	50.00
	1089 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	8.44	-11.66	50.00	47.36	-647.43	3.52	1.63	50.00	50.00	-548.20	1.22	2.69	50.00	50.00	-368.13	3.58	-2.97	50.00	47.52	-871.93	-2.13	8.47	50.00	50.00	-669.86	18.12	-19.62	50.00
1095.0	1095 L	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	29.47	2.93	50.00	50.00	329.03	19.50	3.20	50.00	50.00	303.33	18.43	10.43	50.00	50.00	142.94	27.12	2.10	50.00	50.00	596.41	29.33	3.80	50.00	50.00	309.09	26.31	2.88	50.00
	1095 R	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	19.81	3.99	50.00	50.00	303.33	29.88	4.28	50.00	50.00	322.13	31.51	-3.91	50.00	48.83	576.78	18.49	11.97	50.00	50.00	136.13	26.78	4.13	50.00	50.00	312.61	29.63	4.94	50.00
1109.0	1109 L	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	34.23	-1.54	50.00	48.90	-386.54	21.26	2.64	50.00	50.00	-311.64	34.34	-6.27	50.00	48.78	-603.14	21.50	9.53	50.00	50.00	-162.98	32.79	3.38	50.00	50.00	-341.89	27.59	2.69	50.00
	1109 R	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	20.99	1.73	50.00	50.00	-311.64	33.95	-3.16	50.00	48.82	-393.45	21.37	7.95	50.00	50.00	-169.88	30.23	-3.09	50.00	48.81	-623.68	27.17	1.42	50.00	50.00	-343.30	32.55	-4.55	50.00
1115.0	1115 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	11.40	-9.70	50.00	47.52	517.17	3.29	-7.59	50.00	47.21	659.64	-1.31	1.51	50.00	50.00	363.59	6.19	-9.06	50.00	47.34	841.92	22.36	-24.04	50.00	47.44	553.14	-6.62	5.27	50.00
	1115 R	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	3.69	-8.23	50.00	47.14	650.47	13.37	-10.53	50.00	47.49	512.43	9.15	-11.81	50.00	47.32	812.89	-2.69	2.57	50.00	50.00	355.50	-8.08	5.84	50.00	50.00	606.31	26.67	-26.27	50.00
1127.0	1127 L	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	1.06	4.23	50.00	50.00	-375.35	-1.18	-1.19	50.00	43.56	-588.14	0.93	-2.09	50.00	47.14	-739.96	-4.25	9.56	50.00	50.00	-232.30	9.32	-7.99	50.00	47.46	-398.25	-4.01	7.72	50.00
	1127 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-1.24	-1.45	50.00	42.82	-594.60	0.95	4.90	50.00	50.00	-379.71	-3.94	9.85	50.00	50.00	-239.52	-0.87	-0.19	50.00	42.82	-767.75	-4.06	8.85	50.00	50.00	-568.64	9.50	-9.18	50.00
1133.0	1133 L	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	24.19	6.95	50.00	50.00	287.17	15.38	5.79	50.00	50.00	288.49	15.46	12.93	50.00	50.00	147.59	22.47	3.63	50.00	50.00	592.02	20.17	9.47	50.00	50.00	245.60	20.50	3.65	50.00
	1133 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	19.60	7.37	50.00	50.00	288.49	29.92	9.16	50.00	50.00	280.26	28.81	3.65	50.00	50.00	568.71	19.04	17.31	50.00	50.00	141.51	25.68	5.13	50.00	50.00	344.61	25.00	11.74	50.00
1147.0	1147 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	38.49	-3.45	50.00	48.00	-395.84	22.23	5.51	50.00	50.00	-307.72	32.09	-2.16	50.00	48.03	-596.01	23.18	13.20	50.00	50.00	-183.80	31.80	7.29	50.00	50.00	-294.52	26.69	2.22	50.00
	1147 R	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	17.49	4.38	50.00	50.00	-307.73	31.55	-2.75	50.00	48.84	-402.75	18.49	10.03	50.00	50.00	-189.74	25.13	1.93	50.00	50.00	-619.56	21.30	1.49	50.00	50.00	-436.85	25.93	6.19	50.00
1153.0	1153 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	13.79	-10.81	50.00	47.34	395.23	-6.50	1.77	50.00	50.00	589.86	-4.35	5.44	50.00	50.00	200.01	2.43	-5.95	50.00	46.84	692.47	18.37	-17.94	50.00	47.25	407.42	-7.05	4.79	50.00
	1153 R	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	-7.15	2.03	50.00	50.00	532.12	14.62	-11.76	50.00	47.22	389.07	5.46	-9.50	50.00	46.86	664.33	-5.81	6.97	50.00	50.00	191.32	-7.70	5.24	50.00	50.00	478.53	19.60	-19.58	50.00
1163.0	1163 L	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	6.40	-0.48	50.00	47.99	-266.17	-2.12	2.40	50.00	50.00	-537.81	2.80	-5.10	50.00	46.84	-615.55	-1.18	8.35	50.00	50.00	-134.49	13.88	-10.64	50.00	47.25	-331.90	-2.74	5.60	50.00
	1163 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-2.18	2.40	50.00	50.00	-568.86	5.95	-0.44	50.00	48.01	-272.28	-0.87	6.93	50.00	50.00	-143.79	0.78	-1.68	50.00	46.93	-643.56	-2.67	5.14	50.00	50.00	-449.86	12.77	-9.66	50.00
1169.0	1169 L	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	25.85	2.03	50.00	50.00	390.48	14.13	3.66	50.00	50.00	308.15	14.57	9.66	50.00	50.00	187.82	22.20	1.24	50.00	50.00	616.49	20.99	6.03	50.00	50.00	288.81	20.30	2.69	50.00
	1169 R	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	17.87	4.63	50.00	50.00	308.15	31.44	2.16	50.00	50.00	383.57	28.26	-0.41	50.00	47.63	593.01	18.21	13.07	50.00	50.00	182.05	24.57	2.57	50.00	50.00	412.81	25.63	7.09	50.00
1183.0	1183 L	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	27.05	7.50	50.00	50.00	-316.49	17.97	5.81	50.00	50.00	-298.58	25.93	2.39	50.00	50.00	-579.30	19.48	13.24	50.00	50.00	-164.84	23.42	8.22	50.00	50.00	-267.69	24.41	4.27	50.00
	1183 R	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	14.12	4.58	50.00	50.00	-298.58	21.87	5.86	50.00	50.00	-323.40	15.60	9.86	50.00	50.00	-170.58	20.09	2.86	50.00	50.00	-602.73	20.13	3.96	50.00	50.00	-425.79	18.99	6.85	50.00
1189.0	1189 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-3.71	7.70	50.00	50.00	335.97	-8.24	3.87	50.00	50.00	555.22	-10.39	11.13	50.00	50.00	163.31	-5.04	2.34	50.00	50.00	653.38	5.91	-7.42	50.00	47.14	321.56	-10.90	11.02	50.00
	1189 R	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-7.50	3.71	50.00	50.00	499.24	-3.34	7.64	50.00	50.00	330.53	-2.47	-0.28	50.00	42.82	621.21	-10.28	11.80	50.00	50.00	155.13	-9.94	10.74	50.00	50.00	463.57	5.58	-7.26	50.00
1199.0	1199 L	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	5.78	0.26	50.00	50.00	-441.15	2.88	-5.27	50.00	46.99	-524.63	9.95	-12.50	50.00	47.14	-740.45	0.59	8.12	50.00	50.00	-197.18	23.55	-24.93	50.00	47.21	-458.97	-2.71	11.89	50.00
	1199 R	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	2.76	-4.59	50.00	47.23	-549.46	5.69	0.25	50.00	50.00	-447.53	1.02	5.75	50.00	50.00	-208.03	8.01	-9.07	50.00	47.36	-768.64	-2.60	10.28	50.00	50.00	-524.63	22.87	-21.50	50.00
1205.0	1205 L	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	29.17	2.63	50.00	50.00	411.15	15.30	3.49	50.00	50.00	318.01	15.92	10.53	50.00	50.00	150.24	28.37	-3.61	50.00	49.31	689.41	26.67	4.03	50.00	50.00	352.14	20.82	5.12	50.00
	1205 R	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	17.14	4.67	50.00	50.00	318.01	31.95	3.96	50.00	50.00	402.22	31.82	-4.33	50.00	48.80	670.80	18.16	13.35	50.00	50.00	142.01	22.93	6.49	50.00	50.00	333.79	29.18	5.09	50.00
1219.0	1219 L	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	30.44	5.72	50.00	50.00	-365.40	19.57	4.51	50.00	50.00	-332.45	33.47	-4.41	50.00	48.81	-672.01	19.63	13.61	50.00	50.00	-144.37	29.17	4.74	50.00	50.00	-346.68	25.71	6.07	50.00
	1219 R	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	17.50	3.43	50.00	50.00	-332.46	27.58	3.96	50.00	50.00	-374.33	17.19	10.65	50.00	50.00	-152.68	29.78	-3.59	50.00	49.32	-690.67	23.39	4.77	50.00	50.00	-384.48	26.55	3.77	50.00
1225.0	1225 L	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	-4.41	8.40	50.00	50.00	435.19	1.23	-7.55	50.00	45.24	598.41	-8.39	7.33	50.00	50.00	232.52	-3.45	1.18	50.00	50.00	808.91	17.05	-20.53	50.00	47.34	474.60	-10.29	14.73	50.00
	1225 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	1.20	-6.93	50.00	45.49	580.67	-3.56	7.63	50.00	50.00	429.39	5.44	-7.77	50.00	47.35	775.02	-7.98	7.81	50.00	50.00	224.04	-8.91	13.55	50.00	50.00	566.81	15.16	-18.87	50.00
1234.0	1234 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	-3.90	9.21	50.00	50.00	-419.10	-5.04	2.93	50.00	50.00	-467.36	-5.02	5.17	50.00	50.00	-696.60	-7.29	13.77	50.00	50.00	-136.84	12.98	-14.15	50.00	47.43	-402.65	-9.34	18.16	50.00
	1234 R	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	-4.57	2.63	50.00	50.00	-527.88	-3.42	8.42	50.00	50.00	-421.87	-6.46	12.30	50.00	50.00	-140.58	-5.06	6.02	50.00	50.00	-725.42	-8.65	16.91	50.00	50.00	-404.33	11.88	-12.87	50.00
1242.0	1242 L	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	20.24	5.41	48.92	68.49	444.76	11.68	6.10	48.92	68.49	412.80	12.56	12.31	48.92	68.49	223.85	18.56	2.24	48.92	68.49	756.03	17.12	2.25	48.92	68.49	507.36	13.79	11.41	48.92
	1242 R	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	11.57	6.19	50.00	50.00	412.81	20.11	5.81	50.00	50.00	438.19	18.71	2.25	50.00	50.00	748.31	11.92	13.00	50.00	50.00	213.54	13.64	11.57	50.00	50.00	371.09	17.03	2.55	50.00
1253.0	1253 L	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	27.57	7.14	50.00	50.00	-486.44	16.96	9.52	50.00	50.00	-401.78	27.16	-7.38	50.00	50.00	-741.48	17.77	15.51	50.00	50.00	-242.22	22.81	4.01	50.00	50.00	-469.27	21.92	11.98	50.00
	1253 R	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	17.44	9.50	48.92	68.49	-401.78	28.04	6.74	48.92	68.49	-493.89	18.34	15.33	48.92	68.49	-246.08	26.97	-7.31	48.92	66.67	-762.63	22.42	11.77	48.92	68.49	-419.30	23.25	-4.17	48.92
1261.0	1261 L	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	-3.17	6.52	50.00	50.00	342.38	-1.64	-5.90	50.00	45.96	461.78	-9.04	9.79	50.00	50.00	144.99	-3.12	-1.97	50.00	45.96	715.87	15.33	-19.05	50.00	49.35	379.32	-9.99	13.22	50.00
	1261 R	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	-1.97	-5.85	50.00	45.58	458.89	-3.67	6.59	50.00	50.00	336.17	-2.84	-2.68	50.00	45.58	705.90	-11.10	10.89	50.00	50.00	134.71	-10.86	13.14	50.00	50.00	540.74	16.60	-18.98	50.00
1272.0	1272 L	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	22.70	-19.67	50.00	48.98	-620.53	20.92	-26.38	50.00	48.89	-673.41	20.43	-22.56	50.00	48.92	-922.71	14.76	-16.10	50.00	48.93	-364.28	35.46	-36.98	50.00	48.94	-582.71	10.65	-11.69	50.00
	1272 R	42.00	2.50	96.00	1.25	42.00	2.50	70.00	50.00	70.00	0.98	17.24	-23.39	68.34	65.93	-736.63	18.70	-17.61	68.34	66.08	-623.96	12.54	-14.73	68.34	65.99	-368.13	15.62	-18.65	68.34	65.98	-951.46	8.98	-10.43	68.34	65.99	-815.86	29.40	-33.28	68.34
1280.0	1280 L	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	33.99	-6.56	68.64	67.75	615.41	26.53	-8.53	68.64	67.75	626.45	25.20	4.23	68.64	68.64	381.42	32.09	-9.67	68.64	67.75	926.23	35.13	-11.37	68.64	67.75	702.63	25.13	2.94	68.64
	1280 R	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	30.31	-9.07	68.96	67.77	626.45	38.65	-6.34	68.96	67.87	607.68	36.98	-10.63	68.96	67.78	914.84	28.57	6.11	68.96	68.96	371.50	29.08	4.17	68.96	68.96	437.82	39.69	-11.71	68.96
1290.0	1290 L	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	26.29	8.35	68.96	68.96	-403.06	13.26	11.67	68.96	68.96	-260.85	25.75	4.08	68.96	68.96	-658.99	14.01	16.35	68.96	68.96	-147.08	23.97	6.71	68.96	68.96	-368.52	20.15	13.23	68.96
	1290 R	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	11.00	10.14	68.64	68.64	-260.85	22.80	6.87	68.64	68.64	-410.06	11.77	13.73	68.64	68.64	-157.27	22.05	3.53	68.64	68.64	-668.39	17.38	11.49	68.64	68.64	-334.59	20.94	5.72	68.64
1298.0	1298 L	42.00	2.50	114.00	1.25	42.00	2.50	70.00	50.00	70.00	0.97	-9.61	9.88	68.22	68.22	833.74	-18.48	25.01	68.22	68.22	1121.17	-19.55	27.88	68.22	68.22	680.97	-15.35	20.00	68.22	68.22	1194.99	-13.49	16.52	68.22	68.22	785.62	-16.90	22.02	68.22
	1298 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-14.78	18.91	68.45	68.45	1067.63	-7.21	7.44	68.45	68.45	833.75	-11.70	14.41	68.45	68.45	1173.76	-15.95	21.44	68.45	68.45	677.53	-13.47	16.72	68.45	68.45	995.76	-10.61	12.60	68.45
1307.0	1307 L	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-28.47	30.80	68.45	68.45	-184.41	-35.75	42.06	68.45	68.45	-394.36	-36.61	43.81	68.45	68.45	-495.37	-28.83	31.12	68.45	68.45	-45.76	-34.97	41.21	68.45	68.45	-322.98	-28.64	30.68	68.45
	1307 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-35.75	42.06	68.45	68.45	-447.58	-28.47	30.80	68.45	68.45	-184.41	-28.28	30.20	68.45	68.45	-61.13	-37.15	44.73	68.45	68.45	-517.15	-28.64	30.68	68.45	68.45	-187.54	-34.97	41.21	68.45
1402.0	1402 L	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-28.88	-4.85	63.56	59.60	-408.57	-32.62	-19.14	63.56	59.60	-483.61	-41.25	-7.00	63.56	59.60	-571.79	-21.16	-18.74	63.56	59.60	-355.50	-39.05	-15.66	63.56	59.60	-486.62	-25.97	-15.67	63.56
	1402 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-33.72	-20.48	63.86	63.86	-355.85	-29.79	-6.18	63.86	63.86	-322.58	-22.13	-21.02	63.86	63.86	-245.78	-42.45	-7.84	63.86	63.86	-458.03	-27.02	-16.90	63.86	63.86	-305.48	-39.85	-16.88	63.86
1407.0	1407 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-12.62	-20.97	63.86	63.86	64.54	-22.88	-24.25	63.86	63.86	242.63	-11.64	-25.68	63.86	63.86	21.32	-24.58	-21.21	63.86	63.86	287.53	-24.05	-27.52	63.86	63.86	139.61	-24.44	-29.06	63.86
	1407 R	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-21.78	-23.12	63.76	63.76	354.40	-11.93	-20.14	63.76	63.76	141.03	-23.27	-20.25	63.76	63.76	394.13	-10.91	-23.78	63.76	63.76	106.08	-23.61	-28.15	63.76	63.76	230.92	-23.27	-26.68	63.76
1411.0	1411 L	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-10.47	-20.21	63.76	63.76	-183.98	-20.56	-24.12	63.76	63.76	-375.61	-22.44	-20.89	63.76	63.76	-427.04	-9.43	-23.98	63.76	63.76	-152.57	-22.08	-27.30	63.76	63.76	-257.95	-23.19	-29.01	63.76
	1411 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-21.64	-25.26	63.86	63.86	-264.81	-11.15	-21.06	63.86	63.86	-108.97	-10.21	-25.98	63.86	63.86	-69.06	-23.51	-21.80	63.86	63.86	-320.97	-23.99	-29.92	63.86	63.86	-179.68	-22.85	-28.17	63.86
1416.0	1416 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-20.80	-11.10	63.86	63.86	264.78	-27.69	-23.87	63.86	63.86	324.45	-16.10	-22.18	63.86	63.86	216.85	-31.65	-9.67	63.86	63.86	406.10	-31.29	-24.96	63.86	63.86	307.43	-25.96	-22.71	63.86
	1416 R	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-26.59	-22.70	63.56	59.60	447.98	-20.00	-10.12	63.56	59.60	346.09	-30.14	-9.19	63.56	59.60	513.49	-15.84	-19.26	63.56	59.60	319.08	-25.30	-21.93	63.56	59.60	382.04	-30.44	-24.29	63.56
1422.0	1422 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-24.39	1.80	50.00	50.00	-369.16	-30.68	-12.72	50.00	50.00	-471.19	-36.97	4.26	50.00	50.00	-533.90	-20.67	-8.95	50.00	50.00	-341.98	-35.22	-12.59	50.00	50.00	-439.82	-27.43	-11.88	50.00
	1422 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-35.48	-15.14	68.13	68.13	-361.54	-28.09	1.56	68.14	69.30	-303.52	-22.87	-14.14	68.13	68.13	-254.97	-42.45	5.58	68.19	69.30	-440.96	-31.61	-14.01	68.13	68.13	-310.42	-40.44	-14.71	68.13
1427.0	1427 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-6.18	-22.25	68.13	68.13	-9.40	-18.62	-26.63	68.13	68.13	168.93	-5.13	-27.60	68.13	68.13	-46.63	-20.15	-23.32	68.13	68.13	204.46	-21.17	-31.71	68.13	68.13	63.97	-21.84	-33.61	68.13
	1427 R	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-17.50	-25.35	67.81	67.81	265.95	-5.56	-21.31	67.81	67.81	50.86	-19.04	-22.29	67.81	67.81	296.93	-4.42	-25.28	67.81	67.81	22.14	-21.07	-32.59	67.81	67.81	141.00	-20.41	-30.74	67.81
1431.0	1431 L	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-5.88	-21.26	67.81	67.81	-45.61	-16.68	-25.73	67.81	67.81	-237.28	-19.20	-21.99	67.81	67.81	-289.89	-4.75	-25.32	67.81	67.81	-15.92	-20.75	-30.90	67.81	67.81	-126.30	-21.25	-32.26	67.81
	1431 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-17.81	-27.02	68.13	68.13	-140.65	-6.50	-22.19	68.13	68.13	14.60	-5.40	-27.42	68.13	68.13	52.86	-20.32	-23.03	68.13	68.13	-197.67	-22.03	-33.28	68.13	68.13	-60.59	-21.51	-31.86	68.13
1436.0	1436 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-29.99	3.41	68.18	69.30	311.74	-40.35	-16.67	68.13	68.13	373.76	-25.10	-14.25	68.13	68.13	262.53	-45.00	7.76	68.21	69.30	449.49	-43.39	-16.63	68.13	68.13	353.80	-31.84	-11.30	68.13
	1436 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-35.03	-14.11	50.00	50.00	482.05	-26.06	3.43	50.00	50.00	376.73	-39.02	5.99	50.00	50.00	542.27	-22.21	-10.53	50.00	50.00	349.80	-27.68	-9.46	50.00	50.00	406.83	-37.76	-14.37	50.00
1442.0	1442 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-21.96	-7.64	50.00	50.00	-345.44	-29.23	-20.61	50.00	50.00	-453.38	-32.95	-8.42	50.00	50.00	-512.45	-17.00	-17.37	50.00	50.00	-319.34	-29.90	-20.45	50.00	50.00	-410.77	-24.65	-17.68	50.00
	1442 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-34.78	-24.89	67.05	67.05	-328.13	-25.85	-9.44	67.05	67.05	-265.18	-19.98	-22.85	67.05	67.05	-216.63	-38.63	-8.74	67.05	67.05	-403.64	-29.39	-21.40	67.05	67.05	-280.28	-35.77	-24.93	67.05
1447.0	1447 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-13.95	-21.56	67.05	67.05	101.39	-27.02	-27.28	67.05	67.05	262.40	-12.93	-26.84	67.05	67.05	65.74	-29.34	-23.34	67.05	67.05	317.54	-27.07	-30.21	67.05	67.05	164.84	-29.81	-32.07	67.05
	1447 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-25.60	-25.86	66.71	66.71	370.55	-13.09	-20.55	66.71	66.71	172.39	-27.93	-22.20	66.71	66.71	420.94	-11.94	-24.59	66.71	66.71	145.18	-28.74	-30.95	66.71	66.71	265.45	-26.08	-29.16	66.71
1451.0	1451 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-13.22	-20.75	66.71	66.71	-174.71	-25.92	-25.02	66.71	66.71	-397.09	-27.43	-22.13	66.71	66.71	-427.74	-12.04	-24.70	66.71	66.71	-147.15	-26.07	-29.32	66.71	66.71	-245.74	-28.25	-30.61	66.71
	1451 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-27.35	-26.43	67.05	67.05	-289.17	-14.07	-21.75	67.05	67.05	-103.77	-12.96	-26.88	67.05	67.05	-68.19	-28.82	-23.27	67.05	67.05	-324.42	-29.33	-31.73	67.05	67.05	-186.88	-27.04	-30.36	67.05
1456.0	1456 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-24.83	-9.14	67.05	67.05	265.10	-30.66	-23.64	67.05	67.05	321.42	-19.38	-24.50	67.05	67.05	212.79	-38.17	-9.74	67.05	67.05	400.51	-35.81	-21.43	67.05	67.05	315.63	-27.83	-24.12	67.05
	1456 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-25.86	-19.74	50.00	50.00	443.90	-21.11	-7.42	50.00	50.00	343.26	-32.24	-9.08	50.00	50.00	506.40	-16.44	-18.15	50.00	50.00	313.69	-23.28	-20.03	50.00	50.00	373.31	-29.91	-17.62	50.00
1462.0	1462 L	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-26.17	5.85	50.00	50.00	-344.49	-26.69	-11.47	50.00	49.25	-480.13	-32.99	-0.77	50.00	49.25	-558.09	-23.15	-11.76	50.00	49.25	-304.66	-29.19	-8.93	50.00	49.25	-469.59	-29.06	-10.68	50.00
	1462 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-31.75	-14.54	67.05	67.05	-364.85	-31.14	5.78	67.14	69.29	-281.25	-26.08	-16.92	67.05	67.05	-223.96	-41.01	-1.42	67.05	67.05	-456.14	-34.37	-14.41	67.05	67.05	-291.43	-34.62	-12.18	67.05
1467.0	1467 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-7.41	-20.16	67.05	67.05	4.01	-19.17	-27.22	67.05	67.05	191.46	-5.44	-27.58	67.05	67.05	-39.84	-20.70	-22.86	67.05	67.05	229.53	-14.84	-23.89	67.05	67.05	85.05	-14.03	-23.81	67.05
	1467 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-17.99	-25.88	66.71	66.71	289.39	-6.88	-19.37	66.71	66.71	57.79	-19.56	-21.87	66.71	66.71	321.96	-4.81	-25.25	66.71	66.71	24.29	-13.22	-22.80	66.71	66.71	151.41	-14.12	-22.98	66.71

Section Properties & Force Results

Ref. Delta Frame Design

Splice Node	Splice Side	Top Flange b (in)	Top Flange t (in)	Web h (in)	Web t (in)	Bottom Flange b (in)	Bottom Flange t (in)	Fytf (ksi)	Fyw (ksi)	Fybf (ksi)	Rh	STRENGTH I MAX FX Flange Stress (ksi) TF	MAX FX Flange Stress (ksi) BF
1471.0	1471 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-6.81	-19.24
	1471 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-17.97	-27.23
1476.0	1476 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-26.27	-1.44
	1476 R	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-27.39	-11.08
1482.0	1482 L	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-22.75	6.65
	1482 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-34.45	-10.18
1487.0	1487 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-4.49	-20.50
	1487 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-13.79	-26.29
1491.0	1491 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-4.02	-19.45
	1491 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-13.89	-27.38
1496.0	1496 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-27.39	5.14
	1496 R	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-30.64	-6.27
1502.0	1502 L	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-23.22	2.71
	1502 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-30.97	-15.33
1507.0	1507 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-7.11	-21.44
	1507 R	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-17.62	-25.93
1511.0	1511 L	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-6.38	-21.02
	1511 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-18.74	-27.23
1516.0	1516 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-24.62	0.72
	1516 R	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-29.23	-15.17
1522.0	1522 L	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-26.22	9.11
	1522 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-30.75	-9.02
1527.0	1527 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-1.18	-19.73
	1527 R	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	-10.42	-22.32
1531.0	1531 L	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	0.57	-18.81
	1531 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-10.60	-23.41
1536.0	1536 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-24.74	6.78
	1536 R	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-26.42	-8.24
1542.0	1542 L	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-23.39	-12.93
	1542 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-29.46	-25.36
1547.0	1547 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-8.28	-19.22
	1547 R	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-17.70	-22.63
1551.0	1551 L	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-8.36	-18.62
	1551 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-19.33	-25.40
1556.0	1556 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-29.99	-6.54
	1556 R	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-27.76	-14.21
3007.0	3007 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-37.97	30.71
	3007 R	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-45.80	43.52
3015.0	3015 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-3.00	2.06
	3015 R	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	-15.10	21.17
3021.0	3021 L	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	31.39	6.11
	3021 R	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	22.96	13.95
3035.0	3035 L	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	44.07	-2.33
	3035 R	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	27.76	-3.23
3041.0	3041 L	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	18.76	-20.63
	3041 R	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	10.33	-15.95
3051.0	3051 L	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	8.14	-7.00
	3051 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	3.90	-3.72
3057.0	3057 L	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	30.72	-1.81
	3057 R	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	20.63	4.08
3071.0	3071 L	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	29.45	4.89
	3071 R	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	19.01	6.65
3077.0	3077 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	-7.34	7.21
	3077 R	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	-10.16	6.25
3089.0	3089 L	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	4.36	-2.94
	3089 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	2.21	-3.20
3095.0	3095 L	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	32.69	-0.71
	3095 R	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	22.25	3.03
3109.0	3109 L	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	36.71	-2.79
	3109 R	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	23.03	0.98
3115.0	3115 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	11.48	-12.84
	3115 R	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	1.38	-5.84
3127.0	3127 L	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	1.51	0.36
	3127 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-2.55	1.88
3133.0	3133 L	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	27.63	4.77
	3133 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	21.36	6.48
3147.0	3147 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	40.52	-2.85
	3147 R	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	19.91	3.99
3153.0	3153 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	15.42	-16.25
	3153 R	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	-9.62	3.41
3163.0	3163 L	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	8.67	-6.85
	3163 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-2.89	2.45
3169.0	3169 L	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	29.50	1.82
	3169 R	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	21.53	5.16
3183.0	3183 L	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	32.31	5.66
	3183 R	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	17.49	4.18
3189.0	3189 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-2.46	1.84
	3189 R	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-8.45	3.78
3199.0	3199 L	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	8.71	-8.19
	3199 R	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	0.69	-0.84
3205.0	3205 L	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	31.13	1.24
	3205 R	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	20.14	4.16
3219.0	3219 L	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	35.98	1.10
	3219 R	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	20.34	2.49
3225.0	3225 L	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	1.02	-1.68
	3225 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	-6.51	1.54
3234.0	3234 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	-2.63	3.97
	3234 R	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	-7.21	7.14
3242.0	3242 L	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	23.80	6.26
	3242 R	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	14.07	6.67
3253.0	3253 L	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	28.88	5.94
	3253 R	45.00	3.00	96.00	1.38	46.00	3.00	50.00	50.00	70.00	0.98	17.84	9.23
3262.0	3262 L	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	1.75	-2.27
	3262 R	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	-7.64	1.91
3272.0	3272 L	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	28.55	-30.11
	3272 R	42.00	2.50	96.00	1.25	42.00	2.50	70.00	50.00	70.00	0.98	14.13	-20.53

Splice Side	MAX FX Flange Capacity (ksi) TF	MAX FX Flange Capacity (ksi) BF	MAX FX FY (kip)	MIN FX Flange Stress (ksi) TF	MIN FX Flange Stress BF	MIN FX Flange Capacity (ksi) TF	MIN FX Flange Capacity BF	MIN FX FY (kip)	MAX FY Flange Stress (ksi) TF	MAX FY Flange Stress BF	MAX FY Flange Capacity (ksi) TF	MAX FY Flange Capacity BF	MAX FY FY (kip)	MIN FY Flange Stress (ksi) TF
1471 L	66.71	66.71	-65.68	-16.85	-25.92	66.71	66.71	-260.79	-19.78	-20.30	66.71	66.71	-327.55	-4.74
1471 R	67.05	67.05	-166.47	-7.36	-20.04	67.05	67.05	-11.76	-5.48	-27.12	67.05	67.05	40.41	-21.11
1476 L	67.05	67.05	268.63	-32.56	-14.23	67.05	67.05	359.44	-22.27	-16.40	67.05	67.05	208.11	-39.62
1476 R	50.00	49.25	470.79	-21.95	2.31	50.00	50.00	330.62	-33.15	1.34	50.00	50.00	535.76	-19.03
1482 L	50.00	50.00	-327.49	-29.76	-7.05	50.00	49.18	-473.85	-34.74	5.84	50.00	50.00	-530.90	-20.72
1482 R	67.05	67.05	-370.84	-26.74	5.20	67.15	69.29	-273.85	-23.38	-9.76	67.05	67.05	-231.77	-40.39
1487 L	67.05	67.05	-44.57	-14.73	-27.49	67.05	67.05	108.55	-2.92	-27.12	67.05	67.05	-89.14	-17.30
1487 R	66.71	66.71	193.46	-4.12	-19.80	66.71	66.71	0.40	-16.34	-21.14	66.71	66.71	247.64	-2.51
1491 L	66.71	66.71	-4.59	-12.94	-26.15	66.71	66.71	-187.09	-16.04	-20.34	66.71	66.71	-242.20	-1.76
1491 R	67.05	67.05	-101.58	-4.43	-20.18	67.05	67.05	41.35	-2.12	-27.59	67.05	67.05	90.41	-16.99
1496 L	67.15	69.29	278.07	-35.55	-9.51	67.05	67.05	377.23	-22.87	-9.18	67.05	67.05	223.83	-41.25
1496 R	50.00	49.18	480.20	-23.40	6.62	50.00	50.00	333.48	-35.49	6.38	50.00	50.00	543.59	-20.28
1502 L	50.00	50.00	-385.83	-28.08	-13.26	50.00	50.00	-504.01	-34.71	3.67	50.00	50.00	-584.10	-18.70
1502 R	68.37	68.37	-380.23	-25.59	2.08	68.39	69.42	-317.07	-20.27	-14.52	68.37	68.37	-259.23	-38.47
1507 L	68.37	68.37	-18.53	-18.54	-27.00	68.37	68.37	171.52	-5.67	-27.55	68.37	68.37	-72.80	-20.92
1507 R	68.10	68.10	277.12	-6.64	-20.72	68.10	68.10	43.47	-20.09	-21.87	68.10	68.10	344.68	-5.19
1511 L	68.10	68.10	-47.33	-17.81	-26.17	68.10	68.10	-275.34	-19.80	-21.48	68.10	68.10	-348.26	-4.84
1511 R	68.37	68.37	-169.72	-6.87	-21.75	68.37	68.37	14.90	-5.44	-27.78	68.37	68.37	71.64	-20.67
1516 L	68.37	69.42	316.47	-32.16	-17.44	68.37	68.37	375.91	-20.79	-16.93	68.37	68.37	256.04	-38.76
1516 R	50.00	50.00	500.70	-22.31	1.48	50.00	50.00	386.42	-35.51	3.62	50.00	50.00	587.94	-18.84
1522 L	69.43	49.59	-452.63	-28.40	-8.42	69.43	49.59	-544.87	-35.49	8.88	69.43	49.59	-655.78	-23.31
1522 R	67.97	67.97	-431.32	-28.00	9.64	67.97	69.53	-389.39	-24.84	-9.82	67.97	67.97	-325.11	-38.03
1527 L	67.97	67.97	-136.63	-11.02	-23.07	67.97	67.97	69.85	0.61	-24.41	69.53	67.97	-191.48	-12.19
1527 R	67.87	67.87	170.75	-0.91	-19.21	67.87	67.87	-78.20	-11.61	-18.84	67.87	67.87	219.73	1.00
1531 L	69.42	67.87	74.66	-10.00	-22.70	67.87	67.87	-169.89	-11.66	-19.61	67.87	67.87	-235.43	1.38
1531 R	67.97	67.97	-71.96	-0.62	-19.32	67.97	67.97	131.09	1.16	-24.85	69.53	67.97	186.70	-12.19
1536 L	67.97	69.53	383.63	-28.57	-8.99	67.97	67.97	430.19	-21.55	-8.50	67.97	67.97	315.79	-35.27
1536 R	69.43	49.59	549.77	-23.17	6.26	69.43	49.59	446.96	-33.04	5.50	69.43	49.59	659.79	-19.90
1542 L	68.43	69.35	-429.87	-27.10	-22.80	68.43	69.35	-524.25	-32.18	-13.08	68.43	69.35	-628.50	-20.36
1542 R	69.57	69.57	-371.75	-25.34	-14.68	69.57	69.57	-326.84	-22.24	-26.55	69.57	69.57	-240.71	-35.00
1547 L	69.57	69.57	90.05	-18.41	-23.40	69.57	69.57	282.83	-9.83	-25.79	69.57	69.57	41.12	-21.50
1547 R	69.47	69.47	407.40	-7.83	-18.64	69.47	69.47	175.80	-19.29	-18.26	69.47	69.47	461.67	-7.38
1551 L	69.47	69.47	-156.30	-18.61	-24.61	69.47	69.47	-414.53	-18.22	-18.50	69.47	69.47	-501.57	-7.55
1551 R	69.57	69.57	-268.27	-8.82	-19.21	69.57	69.57	-56.40	-8.24	-22.92	69.57	69.57	-11.89	-18.97
1556 L	69.57	69.57	446.70	-30.41	-16.27	69.57	69.57	511.28	-18.90	-17.04	69.57	69.57	330.14	-39.35
1556 R	68.43	69.35	689.08	-27.57	-5.10	68.43	69.35	564.40	-36.10	-5.94	68.43	69.35	794.13	-17.74
3007 L	69.04	69.04	68.40	-45.80	43.52	69.04	69.04	166.60	-37.99	30.54	69.04	69.04	-51.70	-46.73
3007 R	69.04	69.04	125.31	-37.97	30.71	69.04	69.04	68.39	-46.13	44.23	69.04	69.04	309.05	-38.57
3015 L	69.04	69.04	-752.47	-12.83	13.80	69.04	69.04	-915.33	-9.77	8.97	69.04	69.04	-999.93	-13.02
3015 R	68.06	68.06	-984.65	-4.14	3.82	68.06	68.06	-747.35	-14.94	21.82	68.06	68.06	-606.77	-11.81
3021 L	68.02	68.02	409.97	18.20	10.57	68.02	68.02	296.45	19.67	14.94	68.02	68.02	194.84	30.84
3021 R	68.19	68.19	296.45	38.35	8.89	68.19	68.19	399.41	38.51	3.35	68.19	68.19	637.14	24.57
3035 L	68.19	62.44	-512.41	34.18	-3.53	68.19	62.44	-498.14	43.77	-8.06	68.19	62.44	-789.02	33.69
3035 R	68.02	62.86	-498.14	36.14	-2.68	68.02	62.86	-522.98	27.86	4.47	68.02	68.02	-347.20	35.32
3041 L	68.06	59.11	593.20	8.61	-12.57	68.06	59.11	667.58	9.38	-11.88	68.06	59.11	367.61	10.42
3041 R	67.91	62.17	571.48	22.76	-26.13	67.91	62.44	591.93	14.65	-19.26	67.91	62.36	823.29	10.39
3051 L	67.91	62.63	-393.40	4.40	-4.02	67.91	62.59	-478.44	9.32	-11.44	67.91	62.40	-686.34	3.57
3051 R	50.00	47.35	-583.42	7.48	-6.40	50.00	47.39	-394.61	3.46	-0.41	50.00	47.96	-241.46	6.76
3057 L	50.00	48.87	495.72	19.88	3.75	50.00	50.00	415.42	20.42	8.01	50.00	50.00	296.71	29.83
3057 R	50.00	50.00	415.42	31.67	-1.58	50.00	48.07	485.16	31.41	-5.04	50.00	47.91	740.68	20.93
3071 L	50.00	50.00	-421.40	19.81	7.04	50.00	50.00	-374.93	28.47	-2.54	50.00	48.01	-682.69	20.63
3071 R	50.00	50.00	-374.93	28.51	4.40	50.00	50.00	-431.96	20.06	11.96	50.00	50.00	-237.48	26.90
3077 L	50.00	50.00	500.31	-12.16	8.77	50.00	50.00	654.76	-12.64	11.57	50.00	50.00	310.75	-11.02
3077 R	50.00	50.00	508.86	-6.32	5.65	50.00	50.00	499.26	-8.31	5.60	50.00	50.00	778.88	-12.19
3089 L	50.00	48.51	-594.42	2.58	-3.36	50.00	48.34	-620.29	4.01	-4.34	50.00	48.39	-881.60	1.15
3089 R	50.00	47.35	-775.99	4.13	-3.18	50.00	47.55	-595.49	1.39	0.65	50.00	50.00	-407.89	3.23
3095 L	50.00	48.92	425.58	21.90	2.09	50.00	50.00	381.82	21.80	7.82	50.00	50.00	242.63	32.11
3095 R	50.00	50.00	381.82	33.10	1.26	50.00	50.00	415.02	33.06	-3.77	50.00	48.83	688.42	21.83
3109 L	50.00	48.87	-465.25	23.41	2.08	50.00	50.00	-383.27	34.76	-5.13	50.00	48.81	-708.68	22.41
3109 R	50.00	50.00	-383.27	36.41	-4.46	50.00	48.78	-475.81	22.43	6.40	50.00	50.00	-265.01	33.86
3115 L	50.00	47.43	573.61	1.47	-5.52	50.00	46.25	736.98	-0.79	-1.34	50.00	43.85	395.18	5.44
3115 R	50.00	45.93	645.24	14.38	-14.82	50.00	47.39	580.42	8.06	-11.18	50.00	47.29	843.55	-2.35
3127 L	50.00	50.00	-439.51	-2.55	1.69	50.00	50.00	-569.91	0.65	-1.88	50.00	46.73	-778.63	-3.87
3127 R	50.00	50.00	-662.22	1.49	0.37	50.00	50.00	-439.99	-3.50	6.78	50.00	50.00	-280.85	-0.82
3133 L	50.00	50.00	391.16	16.87	5.02	50.00	50.00	350.22	19.50	9.34	50.00	50.00	248.52	23.96
3133 R	50.00	50.00	350.22	33.87	6.20	50.00	50.00	380.11	30.29	1.87	50.00	50.00	639.67	23.89
3147 L	50.00	48.03	-469.40	25.14	4.98	50.00	50.00	-380.11	39.44	-5.49	50.00	47.93	-683.57	25.19
3147 R	50.00	50.00	-380.11	33.15	-2.14	50.00	48.87	-479.97	20.10	8.47	50.00	50.00	-284.62	31.57
3153 L	50.00	47.21	459.08	-9.19	3.49	50.00	50.00	610.71	-4.54	2.97	50.00	50.00	243.29	3.48
3153 R	50.00	50.00	575.27	16.28	-17.69	50.00	47.08	456.53	6.56	-13.20	50.00	46.80	721.79	-7.56
3163 L	50.00	47.23	-335.47	-3.02	2.71	50.00	50.00	-561.56	4.80	-9.54	50.00	46.81	-683.27	-2.03
3163 R	50.00	50.00	-616.78	7.93	-6.21	50.00	47.34	-337.97	-1.23	4.42	50.00	50.00	-191.61	1.56
3169 L	50.00	50.00	489.85	17.24	4.22	50.00	50.00	388.76	17.18	8.71	50.00	50.00	293.44	28.83
3169 R	50.00	50.00	388.76	35.81	1.81	50.00	50.00	479.29	35.79	-2.48	50.00	47.53	692.35	21.41
3183 L	50.00	50.00	-424.18	21.99	5.18	50.00	50.00	-386.82	30.57	0.42	50.00	50.00	-679.95	22.29
3183 R	50.00	50.00	-386.82	26.28	4.59	50.00	50.00	-434.75	18.31	9.17	50.00	50.00	-280.01	24.38
3189 L	50.00	50.00	411.24	-9.28	3.97	50.00	50.00	612.66	-10.65	8.47	50.00	50.00	223.99	-4.71
3189 R	50.00	50.00	521.67	-2.16	1.78	50.00	50.00	410.12	-2.72	-1.54	50.00	42.82	694.06	-10.73
3199 L	50.00	47.26	-504.50	0.80	-0.93	50.00	47.17	-656.04	4.56	-7.88	50.00	47.01	-839.00	0.30
3199 R	50.00	47.33	-685.42	8.39	-7.02	50.00	47.47	-506.03	0.70	2.26	50.00	50.00	-261.59	2.27
3205 L	50.00	50.00	510.29	18.06	3.12	50.00	50.00	428.54	18.06	9.33	50.00	50.00	285.21	29.51
3205 R	50.00	50.00	428.54	34.01	2.48	50.00	50.00	496.17	33.27	-3.40	50.00	48.84	839.57	19.37
3219 L	50.00	50.00	-516.43	22.67	3.53	50.00	50.00	-433.71	35.56	-3.84	50.00	48.83	-834.61	22.39
3219 R	50.00	50.00	-433.71	32.76	0.08	50.00	50.00	-530.54	20.26	8.56	50.00	50.00	-277.51	31.52
3225 L	50.00	47.23	496.05	-7.62	1.76	50.00	50.00	752.20	-8.89	6.09	50.00	50.00	265.68	-1.92
3225 R	50.00	50.00	614.31	1.15	-1.61	50.00	47.36	494.49	1.87	-5.98	50.00	46.57	844.90	-8.76
3234 L	50.00	50.00	-434.20	-7.88	7.85	50.00	50.00	-617.61	-5.36	3.01	50.00	50.00	-810.92	-7.93
3234 R	50.00	50.00	-648.37	-2.25	3.51	50.00	50.00	-435.80	-6.80	9.85	50.00	50.00	-194.08	-5.88
3242 L	48.89	68.45	614.97	14.22	6.53	48.89	68.45	569.97	14.61	13.11	48.89	68.45	369.58	21.55
3242 R	50.00	50.00	569.97	23.59	6.78	50.00	50.00	600.92	22.06	3.56	50.00	50.00	941.83	15.62
3253 L	50.00	50.00	-602.78	18.40	9.51	50.00	50.00	-487.09	27.62	4.56	50.00	50.00	-882.91	18.41
3253 R	48.99	68.58	-487.09	28.12	5.73	48.99	68.58	-615.95	18.05	13.33	48.99	68.58	-336.74	26.21
3262 L	50.00	49.34	356.63	-7.23	2.32	50.00	50.00	614.69	-7.77	6.48	50.00	50.00	169.01	1.08
3262 R	50.00	50.00	595.22	1.46	-2.19	50.00	48.85	354.92	1.85	-6.81	50.00	47.93	776.02	-10.04
3272 L	50.00	48.93	-776.02	16.75	-23.05	50.00	48.87	-886.26	21.77	-26.39	50.00	48.90	-1126.88	16.13
3272 R	68.29	65.86	-1018.96	23.59	-26.75	68.29	65.96	-777.87	14.35	-18.49	68.29	65.91	-516.13	17.11

Splice Side	MIN FY Flange Stress (ksi) BF	MIN FY Flange Capacity (ksi) TF	MIN FY Flange Capacity BF	MIN FY FY (kip)	MAX MY Flange Stress (ksi) TF	MAX MY Flange Stress BF	MAX MY Flange Capacity (ksi) TF	MAX MY Flange Capacity BF	MAX MY FY (kip)	MIN MY Flange Stress (ksi) TF	MIN MY Flange Stress BF	MIN MY Flange Ca[pacity] TF
1471 L	-25.09	66.71	66.71	-22.82	-14.31	-22.65	66.71	66.71	-148.55	-13.20	-22.80	66.71
1471 R	-20.39	67.05	67.05	-240.74	-14.00	-23.79	67.05	67.05	-90.96	-15.03	-23.55	67.05
1476 L	-3.07	67.05	67.05	436.76	-36.58	-9.61	67.05	67.05	370.09	-28.22	-16.08	67.05
1476 R	-12.24	50.00	49.25	289.78	-23.87	-12.73	50.00	49.25	347.53	-30.78	-6.49	50.00
1482 L	-4.96	50.00	49.18	-302.93	-32.43	4.54	50.00	50.00	-456.34	-25.36	-6.56	50.00
1482 R	4.58	67.10	69.29	-439.34	-29.36	-9.43	67.05	67.05	-283.68	-37.30	-6.54	67.05
1487 L	-22.04	67.05	67.05	169.01	-12.39	-23.96	67.05	67.05	34.06	-9.53	-22.81	67.05
1487 R	-24.84	66.71	66.71	-33.95	-8.86	-21.88	66.71	66.71	95.82	-11.82	-23.15	66.71
1491 L	-25.10	66.71	66.71	33.19	-11.05	-23.00	66.71	66.71	-89.68	-9.37	-21.76	66.71
1491 R	-21.24	67.05	67.05	-164.04	-10.02	-22.67	67.05	67.05	-29.81	-11.64	-23.84	67.05
1496 L	4.94	67.10	69.29	451.37	-37.23	-6.71	67.05	67.05	364.70	-30.41	-8.32	67.05
1496 R	-5.56	50.00	49.18	294.85	-26.31	-5.39	50.00	49.18	370.90	-32.11	3.90	50.00
1502 L	-10.29	50.00	50.00	-355.94	-33.65	-9.01	50.00	50.00	-490.10	-26.41	-13.07	50.00
1502 R	4.98	68.41	69.42	-483.72	-28.95	-15.11	68.37	68.37	-328.76	-36.85	-11.10	68.37
1507 L	-22.55	68.37	68.37	245.38	-17.91	-27.13	68.37	68.37	73.22	-19.19	-28.76	68.37
1507 R	-25.43	68.10	68.10	0.95	-18.55	-27.95	68.10	68.10	161.02	-17.30	-26.37	68.10
1511 L	-25.55	68.10	68.10	-2.46	-17.36	-26.57	68.10	68.10	-143.86	-18.67	-28.11	68.10
1511 R	-22.33	68.37	68.37	-249.12	-19.31	-28.91	68.37	68.37	-85.28	-17.98	-27.34	68.37
1516 L	4.83	68.41	69.42	485.64	-37.66	-13.49	68.37	68.37	387.23	-27.84	-12.84	68.37
1516 R	-11.52	50.00	50.00	355.27	-25.32	-11.01	50.00	50.00	431.32	-34.50	-11.13	50.00
1522 L	-7.21	69.43	49.59	-415.62	-30.50	-6.49	69.43	49.59	-498.47	-23.43	-1.02	69.43
1522 R	10.33	67.97	69.53	-558.86	-25.17	-1.26	67.97	67.97	-392.05	-32.79	-6.58	67.97
1527 L	-19.36	67.97	67.97	125.35	-11.65	-25.85	67.97	67.97	-33.64	-11.57	-25.35	67.97
1527 R	-22.55	69.42	67.87	-120.69	-11.22	-24.81	67.87	67.87	33.81	-11.27	-25.28	67.87
1531 L	-22.74	69.42	67.87	118.50	-10.47	-24.49	67.87	67.87	-24.75	-11.42	-25.53	67.87
1531 R	-20.09	67.97	67.97	-142.78	-11.78	-26.09	67.97	67.97	15.15	-10.82	-25.03	67.97
1536 L	7.50	67.97	69.53	559.23	-33.56	7.82	67.97	69.53	463.32	-26.98	-10.06	67.97
1536 R	-5.22	69.43	49.59	406.30	-25.04	-9.54	69.43	49.59	462.78	-31.35	7.58	69.43
1542 L	-22.66	68.43	69.35	-368.46	-21.94	-17.86	68.43	69.35	-464.84	-28.12	-20.66	68.43
1542 R	-14.38	69.57	69.57	-492.21	-30.40	-23.22	69.57	69.57	-355.62	-23.98	-19.78	69.57
1547 L	-20.36	69.57	69.57	345.80	-21.23	-24.88	69.57	69.57	253.66	-19.75	-27.42	69.57
1547 R	-22.36	69.47	69.47	136.72	-19.18	-26.76	69.47	69.47	294.00	-20.61	-24.21	69.47
1551 L	-22.00	69.47	69.47	-122.15	-17.24	-23.10	69.47	69.47	-257.69	-17.91	-24.54	69.47
1551 R	-19.14	69.57	69.57	-364.28	-18.46	-25.17	69.57	69.57	-183.04	-17.77	-23.69	69.57
1556 L	-7.53	69.57	69.57	633.00	-38.44	-8.77	69.57	69.57	558.22	-19.98	-16.69	69.57
1556 R	-15.08	68.43	69.35	476.44	-18.12	-14.97	68.43	69.35	530.31	-35.37	-6.92	68.43
3007 L	45.26	69.04	69.04	336.65	-39.29	32.36	69.04	69.04	107.37	-39.65	32.94	69.04
3007 R	31.53	69.04	69.04	-74.98	-39.65	32.94	69.04	69.04	103.85	-39.29	32.36	69.04
3015 L	14.44	69.04	69.04	-591.63	1.10	-1.77	69.04	67.95	-761.92	-15.05	17.38	69.04
3015 R	14.46	68.06	68.06	-1041.54	-16.88	24.55	68.06	68.06	-835.76	1.04	-2.07	68.06
3021 L	2.51	68.02	68.02	662.30	25.93	5.81	68.02	68.02	363.90	27.72	11.60	68.02
3021 R	20.13	68.19	68.19	184.09	33.54	14.84	68.19	68.19	341.85	30.94	7.40	68.19
3035 L	7.34	68.19	68.19	-336.27	40.85	-3.00	68.19	62.44	-521.18	42.93	-5.10	68.19
3035 R	-6.32	68.02	62.86	-814.12	35.65	-5.33	68.02	62.86	-506.19	34.12	-3.81	68.02
3041 L	-13.29	68.06	59.11	862.61	22.91	-25.74	68.06	59.11	563.35	6.38	-9.46	68.06
3041 R	-14.06	67.91	62.34	353.45	7.34	-11.71	67.91	62.05	625.95	27.69	-32.47	67.91
3051 L	0.82	67.91	67.91	-226.69	20.30	-22.28	67.91	62.47	-446.23	3.38	3.48	67.91
3051 R	-8.43	50.00	47.24	-725.73	2.94	3.43	50.00	50.00	-569.14	18.89	-20.54	50.00
3057 L	-4.34	50.00	48.75	765.75	26.93	1.60	50.00	50.00	471.62	27.57	4.02	50.00
3057 R	9.12	50.00	50.00	285.38	28.45	4.18	50.00	50.00	443.72	27.50	1.61	50.00
3071 L	13.15	50.00	50.00	-226.25	23.58	3.86	50.00	50.00	-409.86	26.39	8.67	50.00
3071 R	-2.02	50.00	48.84	-707.82	25.51	8.40	50.00	50.00	-397.73	22.98	3.48	50.00
3077 L	8.82	50.00	50.00	814.67	4.46	-7.65	50.00	47.13	514.16	-15.24	16.79	50.00
3077 R	10.07	50.00	50.00	296.46	-13.83	13.66	50.00	50.00	576.72	4.51	-6.41	50.00
3089 L	1.40	50.00	50.00	-393.87	15.18	-15.25	50.00	48.41	-608.44	-1.33	4.95	50.00
3089 R	-3.23	50.00	47.46	-916.39	-1.59	5.22	50.00	50.00	-724.71	14.58	-16.40	50.00
3095 L	-4.43	50.00	48.76	713.67	31.65	-3.17	50.00	48.81	416.09	29.59	2.24	50.00
3095 R	9.51	50.00	50.00	231.24	30.04	3.57	50.00	50.00	391.94	32.00	4.04	50.00
3109 L	8.14	50.00	50.00	-253.55	34.05	-2.95	50.00	48.86	-439.53	31.23	2.56	50.00
3109 R	-5.86	50.00	48.72	-733.96	30.85	-2.73	50.00	48.82	-423.07	33.75	-4.45	50.00
3115 L	-8.65	50.00	47.32	878.95	17.76	-20.82	50.00	47.41	602.01	-4.40	1.75	50.00
3115 R	0.47	50.00	50.00	380.22	-5.41	2.02	50.00	50.00	635.46	21.09	-22.70	50.00
3127 L	6.78	50.00	50.00	-266.80	6.45	-6.57	50.00	47.40	-465.12	-4.06	5.81	50.00
3127 R	-0.28	50.00	42.82	-813.27	-4.07	6.60	50.00	50.00	-605.03	6.58	-7.56	50.00
3133 L	2.21	50.00	50.00	666.59	24.84	5.77	50.00	50.00	400.67	22.02	4.94	50.00
3133 R	12.84	50.00	50.00	236.31	26.72	5.79	50.00	50.00	352.08	30.41	6.88	50.00
3147 L	11.45	50.00	50.00	-273.13	34.76	6.05	50.00	50.00	-410.93	30.44	2.02	50.00
3147 R	-3.33	50.00	48.81	-709.78	24.72	1.69	50.00	50.00	-432.93	28.38	5.32	50.00
3153 L	-8.27	50.00	46.89	754.25	15.07	-17.32	50.00	47.18	476.81	-7.41	2.90	50.00
3153 R	6.83	50.00	50.00	228.00	-8.04	3.15	50.00	50.00	499.40	15.86	-18.78	50.00
3163 L	7.67	50.00	50.00	-176.22	10.70	-10.11	50.00	47.15	-406.07	-2.66	2.11	50.00
3163 R	-4.87	50.00	46.23	-715.66	-2.53	1.90	50.00	50.00	-504.36	9.75	-9.16	50.00
3169 L	-0.66	50.00	48.93	718.49	25.01	5.41	50.00	50.00	422.07	23.56	4.15	50.00
3169 R	12.04	50.00	50.00	282.29	28.64	4.49	50.00	50.00	426.78	30.42	6.16	50.00
3183 L	12.70	50.00	50.00	-268.90	28.32	6.88	50.00	50.00	-404.77	29.71	5.68	50.00
3183 R	1.61	50.00	50.00	-705.98	24.38	5.10	50.00	50.00	-427.18	23.11	5.96	50.00
3189 L	0.86	50.00	50.00	727.83	2.54	-5.52	50.00	46.93	397.31	-11.38	7.86	50.00
3189 R	9.41	50.00	50.00	210.35	-10.34	7.54	50.00	50.00	510.85	2.39	-5.35	50.00
3199 L	4.01	50.00	50.00	-242.94	17.26	-20.19	50.00	47.17	-524.18	-2.18	6.49	50.00
3199 R	-4.59	50.00	47.17	-883.75	-2.07	5.60	50.00	50.00	-592.01	16.61	-17.35	50.00
3205 L	-2.64	50.00	49.35	873.03	27.94	3.44	50.00	50.00	480.45	26.81	3.33	50.00
3205 R	12.81	50.00	50.00	270.87	29.44	4.45	50.00	50.00	466.13	30.52	4.54	50.00
3219 L	11.79	50.00	50.00	-263.10	31.26	4.83	50.00	50.00	-473.87	30.91	4.77	50.00
3219 R	-2.96	50.00	49.34	-867.97	28.13	3.66	50.00	50.00	-480.55	28.45	3.75	50.00
3225 L	-3.99	50.00	43.56	897.05	9.81	-14.04	50.00	47.28	511.81	-11.27	11.67	50.00
3225 R	6.83	50.00	50.00	248.59	-9.63	10.60	50.00	50.00	572.99	8.76	-12.90	50.00
3234 L	11.88	50.00	50.00	-177.61	7.62	-9.84	50.00	47.38	-464.78	-10.28	15.73	50.00
3234 R	5.35	50.00	50.00	-837.05	-9.45	14.57	50.00	50.00	-606.76	6.88	-8.94	50.00
3242 L	3.98	48.89	68.45	968.76	19.86	4.20	48.89	68.45	665.21	18.82	9.74	48.89
3242 R	12.66	50.00	50.00	348.51	18.61	10.06	50.00	50.00	529.78	19.68	4.55	50.00
3253 L	14.31	50.00	50.00	-320.73	22.03	6.63	50.00	50.00	-575.05	25.19	9.69	50.00
3253 R	5.30	48.99	68.58	-913.92	24.53	9.46	48.99	68.58	-537.58	21.38	6.34	48.99
3262 L	-5.67	50.00	47.75	800.55	9.83	-13.59	50.00	49.32	440.88	-12.11	9.50	50.00
3262 R	7.86	50.00	50.00	150.32	-13.18	9.40	50.00	50.00	558.05	10.06	-13.17	50.00
3272 L	-19.71	50.00	48.90	-499.80	33.54	-37.06	50.00	48.92	-766.79	11.42	-15.79	50.00
3272 R	-22.24	68.29	65.90	-1151.10	9.64	-13.90	68.29	65.87	-1004.05	27.60	-32.89	68.29

Made By: SAE 8/5/11 Checked By: WME 8/5/11 BackChecked By: SAE 8/5/11

Section Properties & Force Results

Ref. Delta Frame Design

												STRENGTH I																											
												MAX FX					MIN FX					MAX FY					MIN FY					MAX MY					MIN MY		
Splice	Splice	Top Flange		Web		Bottom Flange		Fytf	Fyw	Fybf	Rh	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Ca
Node	Side	b (in)	t (in)	h (in)	t (in)	b (in)	t (in)	(ksi)	(ksi)	(ksi)		TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF
3281.0	3281 L	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	35.07	-2.23	68.63	67.75	689.83	25.79	-1.99	68.63	67.75	639.26	26.17	5.61	68.63	68.63	432.21	31.93	-3.09	68.63	67.75	1018.18	32.98	-4.27	68.63	67.75	653.71	34.91	-4.90	68.63
	3281 R	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	29.86	-1.76	68.95	67.95	639.26	40.09	1.46	68.95	68.95	676.80	37.55	-3.67	68.95	67.91	984.51	30.53	7.91	68.95	68.95	418.82	39.58	-4.19	68.95	67.91	650.08	37.25	-3.39	68.95
3291.0	3291 L	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	31.92	10.89	68.95	68.95	-482.58	21.54	13.23	68.95	68.95	-376.01	32.66	7.18	68.95	68.95	-780.59	22.24	18.99	68.95	68.95	-216.38	27.35	9.06	68.95	68.95	-500.37	29.23	13.84	68.95
	3291 R	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	18.22	11.36	68.63	68.63	-376.01	27.47	8.89	68.63	68.63	-495.46	19.06	15.93	68.63	68.63	-234.13	27.58	6.54	68.63	68.63	-808.77	25.36	11.96	68.63	68.63	-424.60	23.22	7.16	68.63
3300.0	3300 L	42.00	2.50	114.00	1.25	42.00	2.50	70.00	50.00	70.00	0.97	-10.68	11.09	68.21	68.21	1062.92	-19.51	26.93	68.21	68.21	1240.80	-18.10	24.78	68.21	68.21	851.15	-16.29	21.51	68.21	68.21	1416.52	-13.70	16.16	68.21	68.21	1086.50	-15.84	19.52	68.21
	3300 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-15.65	20.37	68.44	68.44	1220.72	-8.15	8.38	68.44	68.44	1062.93	-12.50	15.59	68.44	68.44	1392.35	-14.79	19.34	68.44	68.44	832.14	-12.53	14.82	68.44	68.44	1093.64	-10.82	12.37	68.44
3310.0	3310 L	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-30.49	32.84	68.44	68.44	-336.62	-36.07	41.80	68.44	68.44	-564.06	-37.48	44.36	68.44	68.44	-671.97	-30.98	33.55	68.44	68.44	-147.18	-34.00	38.65	68.44	68.44	-364.56	-32.17	35.34	68.44
	3310 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-36.07	41.80	68.44	68.44	-583.94	-30.49	32.84	68.44	68.44	-336.62	-30.34	32.44	68.44	68.44	-178.23	-38.10	45.44	68.44	68.44	-708.46	-32.17	35.34	68.44	68.44	-403.02	-34.00	38.65	68.44
3402.0	3402 L	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-31.27	-7.64	63.56	59.60	-454.29	-32.50	-21.12	63.56	59.60	-508.10	-41.60	-6.88	63.56	59.60	-605.22	-23.81	-19.25	63.56	59.60	-406.56	-40.07	-18.47	63.56	59.60	-523.46	-27.60	-17.49	63.56
	3402 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-35.69	-22.26	63.86	63.86	-382.38	-32.33	-9.12	63.86	63.86	-354.56	-25.13	-21.77	63.86	63.86	-286.13	-42.76	-7.89	63.86	63.86	-482.46	-28.77	-18.86	63.86	63.86	-331.08	-41.08	-19.84	63.86
3407.0	3407 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-13.68	-23.03	63.86	63.86	86.77	-22.96	-25.58	63.86	63.86	254.25	-12.50	-26.77	63.86	63.86	45.94	-24.65	-22.94	63.86	63.86	300.22	-25.66	-30.42	63.86	63.86	157.93	-25.48	-31.27	63.86
	3407 R	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-21.78	-24.37	63.76	63.76	369.88	-12.89	-22.07	63.76	63.76	171.19	-23.50	-21.94	63.76	63.76	410.99	-11.64	-25.57	63.76	63.76	137.18	-24.60	-30.28	63.76	63.76	246.01	-24.76	-29.44	63.76
3411.0	3411 L	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-11.61	-22.46	63.76	63.76	-213.71	-22.03	-25.83	63.76	63.76	-407.38	-23.23	-23.28	63.76	63.76	-437.62	-10.38	-25.91	63.76	63.76	-180.86	-23.75	-30.02	63.76	63.76	-284.13	-24.37	-31.23	63.76
	3411 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-23.18	-27.05	63.86	63.86	-285.91	-12.39	-23.44	63.86	63.86	-125.32	-11.21	-27.09	63.86	63.86	-85.31	-24.45	-24.01	63.86	63.86	-320.61	-25.23	-32.23	63.86	63.86	-185.01	-24.64	-31.02	63.86
3416.0	3416 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-23.63	-11.62	63.86	63.86	314.94	-27.87	-22.43	63.86	63.86	358.51	-23.42	-25.60	63.86	63.86	270.40	-34.49	-10.92	63.86	63.86	443.20	-33.44	-27.73	63.86	63.86	329.76	-30.83	-22.44	63.86
	3416 R	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-26.49	-20.95	63.56	59.60	495.51	-22.53	-10.30	63.56	59.60	413.28	-32.72	-10.20	63.56	59.60	563.92	-22.32	-21.89	63.56	59.60	390.38	-29.88	-21.33	63.56	59.60	460.98	-32.57	-26.77	63.56
3422.0	3422 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-26.65	-1.70	50.00	50.00	-410.51	-31.70	-15.24	50.00	50.00	-490.23	-37.49	-2.76	50.00	50.00	-558.90	-23.12	-11.28	50.00	50.00	-390.44	-36.68	-14.69	50.00	50.00	-476.37	-29.30	-13.87	50.00
	3422 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-36.69	-18.05	68.13	68.13	-371.38	-30.74	-2.48	68.13	68.13	-332.39	-26.70	-16.24	68.13	68.13	-290.27	-42.98	2.75	68.15	69.30	-457.60	-33.82	-16.35	68.13	68.13	-334.34	-42.16	-17.25	68.13
3427.0	3427 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-8.07	-24.51	68.13	68.13	12.75	-19.87	-27.79	68.13	68.13	186.73	-7.07	-29.27	68.13	68.13	-23.67	-20.71	-24.85	68.13	68.13	213.69	-22.80	-34.33	68.13	68.13	79.62	-23.14	-34.96	68.13
	3427 R	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-18.66	-26.41	67.81	67.81	287.67	-7.36	-23.46	67.81	67.81	80.84	-19.52	-23.69	67.81	67.81	310.46	-6.04	-27.21	67.81	67.81	51.74	-22.28	-33.86	67.81	67.81	159.25	-21.94	-33.24	67.81
3431.0	3431 L	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-7.88	-23.81	67.81	67.81	-75.80	-19.04	-26.46	67.81	67.81	-279.43	-19.87	-23.61	67.81	67.81	-302.12	-6.70	-27.63	67.81	67.81	-45.43	-22.56	-33.75	67.81	67.81	-148.54	-22.25	-33.44	67.81
	3431 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-20.25	-27.83	68.13	68.13	-176.06	-8.56	-24.82	68.13	68.13	-5.83	-7.63	-29.65	68.13	68.13	32.16	-21.06	-24.75	68.13	68.13	-203.09	-23.14	-34.56	68.13	68.13	-73.03	-23.40	-34.82	68.13
3436.0	3436 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-33.07	-2.48	68.13	68.13	341.51	-39.23	-16.74	68.13	68.13	384.97	-29.71	-16.78	68.13	68.13	297.77	-45.84	5.21	68.18	69.30	466.95	-45.28	-18.26	68.13	68.13	378.48	-34.26	-13.99	68.13
	3436 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-33.93	-14.08	50.00	50.00	507.28	-28.69	-1.68	50.00	50.00	422.98	-39.99	4.17	50.00	50.00	572.13	-25.48	-11.92	50.00	50.00	401.26	-29.71	-11.78	50.00	50.00	445.82	-39.40	-15.63	50.00
3442.0	3442 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-23.05	-8.51	50.00	50.00	-382.98	-29.20	-22.29	50.00	50.00	-466.05	-33.74	-9.13	50.00	50.00	-531.53	-19.79	-18.78	50.00	50.00	-359.80	-31.72	-21.34	50.00	50.00	-446.61	-25.97	-19.63	50.00
	3442 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-34.75	-26.82	67.05	67.05	-332.18	-27.06	-10.40	67.05	67.05	-290.50	-23.35	-24.85	67.05	67.05	-245.15	-39.43	-9.47	67.05	67.05	-415.44	-30.94	-23.68	67.05	67.05	-294.38	-37.88	-25.97	67.05
3447.0	3447 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-15.18	-23.25	67.05	67.05	117.87	-27.15	-26.83	67.05	67.05	283.96	-14.18	-27.95	67.05	67.05	82.75	-28.75	-23.53	67.05	67.05	322.16	-28.75	-32.39	67.05	67.05	178.42	-30.09	-32.92	67.05
	3447 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-25.66	-25.36	66.71	66.71	396.18	-14.25	-22.15	66.71	66.71	196.69	-27.31	-22.39	66.71	66.71	430.28	-13.09	-26.11	66.71	66.71	169.29	-28.96	-31.73	66.71	66.71	275.15	-27.68	-31.24	66.71
3451.0	3451 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-14.06	-22.13	66.71	66.71	-197.86	-26.27	-25.36	66.71	66.71	-412.40	-27.22	-22.85	66.71	66.71	-435.12	-12.73	-25.81	66.71	66.71	-170.87	-27.32	-31.20	66.71	66.71	-267.21	-28.84	-31.84	66.71
	3451 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-27.76	-26.83	67.05	67.05	-299.77	-15.00	-23.24	67.05	67.05	-118.99	-13.84	-27.43	67.05	67.05	-84.74	-28.67	-24.00	67.05	67.05	-326.75	-29.96	-33.03	67.05	67.05	-191.08	-28.40	-32.35	67.05
3456.0	3456 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-27.42	-11.20	67.05	67.05	289.92	-30.85	-25.72	67.05	67.05	323.70	-22.38	-25.70	67.05	67.05	241.32	-38.84	-10.15	67.05	67.05	411.53	-37.24	-23.74	67.05	67.05	331.15	-30.07	-25.84	67.05
	3456 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-26.02	-21.55	50.00	50.00	458.37	-23.30	-9.16	50.00	50.00	382.65	-32.93	-9.63	50.00	50.00	527.74	-18.96	-19.19	50.00	50.00	357.11	-25.19	-21.49	50.00	50.00	404.41	-31.26	-19.49	50.00
3462.0	3462 L	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-25.91	-2.15	50.00	49.25	-381.36	-28.98	-13.87	50.00	49.25	-491.99	-34.68	-3.12	50.00	49.25	-561.17	-23.36	-11.28	50.00	49.25	-348.57	-31.67	-12.18	50.00	49.25	-482.71	-28.69	-10.90	50.00
	3462 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-34.43	-17.41	67.05	67.05	-366.58	-30.94	-4.30	67.05	67.05	-304.34	-26.49	-16.74	67.05	67.05	-254.02	-41.00	-1.91	67.05	67.05	-450.94	-34.00	-14.45	67.05	67.05	-300.19	-37.56	-15.94	67.05
3467.0	3467 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-8.61	-24.16	67.05	67.05	-3.41	-21.68	-30.88	67.05	67.05	171.55	-7.19	-31.00	67.05	67.05	-48.60	-23.22	-25.81	67.05	67.05	210.08	-16.40	-27.73	67.05	67.05	73.64	-17.13	-28.82	67.05
	3467 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-20.35	-29.36	66.71	66.71	281.41	-7.88	-23.11	66.71	66.71	66.58	-21.96	-25.49	66.71	66.71	313.01	-6.24	-28.83	66.71	66.71	31.49	-16.21	-27.66	66.71	66.71	145.51	-15.48	-26.58	66.71
3471.0	3471 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-8.38	-22.41	66.71	66.71	-73.79	-19.21	-29.99	66.71	66.71	-273.33	-21.34	-24.75	66.71	66.71	-320.84	-6.47	-27.92	66.71	66.71	-31.56	-15.86	-26.21	66.71	66.71	-154.65	-15.96	-28.35	66.71
	3471 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-20.51	-31.53	67.05	67.05	-163.72	-9.11	-23.44	67.05	67.05	-4.68	-7.19	-30.64	67.05	67.05	47.52	-22.81	-25.13	67.05	67.05	-218.94	-16.90	-29.54	67.05	67.05	-68.83	-16.76	-27.33	67.05
3476.0	3476 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-29.44	-2.88	67.05	67.05	305.40	-36.24	-17.36	67.05	67.05	385.35	-25.82	-16.52	67.05	67.05	256.22	-42.72	-3.60	67.05	67.05	466.87	-40.46	-12.25	67.05	67.05	401.15	-31.99	-17.49	67.05
	3476 R	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-30.53	-13.69	50.00	49.25	511.09	-24.57	-1.03	50.00	49.25	382.35	-35.81	-2.24	50.00	49.25	578.54	-21.90	-12.25	50.00	49.25	352.88	-26.97	-13.85	50.00	49.25	402.09	-34.10	-8.69	50.00
3482.0	3482 L	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-27.95	5.52	50.00	50.00	-414.62	-34.71	-8.03	50.00	49.18	-557.50	-39.53	4.39	50.00	50.00	-616.61	-26.33	-4.12	50.00	49.18	-398.50	-37.47	-4.13	50.00	49.18	-539.89	-31.54	-7.35	50.00
	3482 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-40.25	-11.66	67.05	67.05	-434.54	-32.78	3.41	67.09	69.29	-341.45	-30.28	-9.11	67.05	67.05	-308.63	-46.19	2.33	67.05	69.29	-505.62	-36.53	-10.84	67.05	67.05	-358.33	-43.45	-7.99	67.05
3487.0	3487 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-7.05	-25.75	67.05	67.05	-51.85	-17.27	-33.99	67.05	67.05	100.57	-5.47	-33.79	67.05	67.05	-99.26	-19.31	-28.62	67.05	67.05	147.81	-14.86	-30.04	67.05	67.05	22.35	-13.86	-31.32	67.05
	3487 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-16.03	-32.41	66.71	66.71	209.79	-6.39	-24.70	66.71	66.71	15.34	-18.19	-27.62	66.71	66.71	250.35	-4.54	-30.47	66.71	66.71	-20.62	-12.99	-30.10	66.71	66.71	96.25	-14.01	-28.88	66.71
3491.0	3491 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-5.96	-25.71	66.71	66.71	-22.10	-16.05	-32.27	66.71	66.71	-198.83	-18.40	-26.58	66.71	66.71	-248.60	-3.75	-32.06	66.71	66.71	19.61	-13.25	-29.41	66.71	66.71	-101.64	-13.45	-29.64	66.71
	3491 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-17.28	-33.83	67.05	67.05	-91.02	-6.65	-26.81	67.05	67.05	48.12	-4.77	-34.94	67.05	67.05	101.37	-19.54	-27.54	67.05	67.05	-147.94	-14.32	-30.85	67.05	67.05	-12.96	-14.11	-30.60	67.05
3496.0	3496 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-33.72	3.16	67.08	69.29	354.31	-40.93	-10.83	67.05	67.05	435.04	-29.77	-10.35	67.05	67.05	300.94	-46.93	3.83	67.07	69.29	516.74	-43.43	-8.16	67.05	67.05	430.73	-36.71	-10.57	67.05
	3496 R	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-35.21	-7.16	50.00	49.18	556.66	-28.85	5.32	50.00	50.00	430.42	-40.13	5.59	50.00	50.00	626.15	-26.01	-6.04	50.00	49.18	392.89	-31.78	-7.05	50.00	49.18	458.49	-37.37	-4.27	50.00
3502.0	3502 L	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-26.04	-1.02	50.00	50.00	-450.62	-32.08	-13.62	50.00	50.00	-571.75	-38.06	1.90	50.00	50.00	-652.31	-22.99	-10.64	50.00	50.00	-431.35	-35.45	-12.54	50.00	50.00	-541.71	-29.72	-13.33	50.00
	3502 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-35.41	-15.88	68.37	68.37	-433.40	-28.73	-2.15	68.37	68.37	-364.82	-25.15	-15.95	68.37	68.37	-318.69	-42.23	3.16	68.38	69.42	-536.90	-32.57	-15.55	68.37	68.37	-378.37	-38.91	-14.93	68.37
3507.0	3507 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-8.00	-23.75	68.37	68.37	0.63	-20.06	-28.73	68.37	68.37	195.88	-6.26	-30.23	68.37	68.37	-56.18	-21.92	-25.16	68.37	68.37	249.13	-19.31	-30.11	68.37	68.37	84.54	-19.97	-31.08	68.37
	3507 R	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-19.02	-27.54	68.10	68.10	312.50	-7.43	-22.92	68.10	68.10	74.74	-20.90	-24.21	68.10	68.10	360.67	-5.70	-27.54	68.10	68.10	28.82	-19.25	-30.18	68.10	68.10	172.67	-18.60	-29.23	68.10
3511.0	3511 L	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-7.55	-23.14	68.10	68.10	-77.28	-18.86	-27.64	68.10	68.10	-318.15	-20.56	-24.07	68.10	68.10	-365.68	-5.73	-27.66	68.10	68.10	-28.36	-18.87	-29.53	68.10	68.10	-166.99	-19.21	-30.14	68.10
	3511 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-19.91	-28.82	68.37	68.37	-202.00	-8.11	-23.97	68.37	68.37	-3.22	-6.47	-30.48	68.37	68.37	57.51	-21.59	-25.02	68.37	68.37	-254.06	-19.93	-31.05	68.37	68.37	-89.02	-19.57	-30.41	68.37
3516.0	3516 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-28.37	-1.79	68.37	68.37	363.96	-35.57	-17.96	68.37	68.37	426.51	-25.30	-17.48	68.37	68.37	311.74	-42.21	3.10	68.38	69.42	538.46	-38.98	-15.99	68.37	68.37	415.28	-31.81	-13.45	68.37
	3516 R	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-32.28	-15.55	50.00	50.00	564.42	-25.72	-0.72	50.00	50.00	449.53	-38.74	2.32	50.00	50.00	655.08	-22.66	-12.15	50.00	50.00	423.98	-28.94	-11.44	50.00	50.00	492.72	-35.56	-13.52	50.00
3522.0	3522 L	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-32.39	9.87	69.43	49.59	-585.26	-38.84	-8.12	69.43	49.59	-718.26	-44.29	12.47	69.43	49.59	-805.66	-28.87	-4.76	69.43	49.59	-559.18	-40.87	8.93	69.43	49.59	-690.46	-29.79	0.92	69.43
	3522 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-41.79	-8.53	67.97	67.97	-582.90	-34.60	10.38	67.97	69.53	-501.80	-31.46	-7.90	67.97	67.97	-449.66	-46.77	14.04	67.97	69.53	-690.44	-32.02	0.80	67.97	69.53	-508.90	-43.88	8.83	67.97
3527.0	3527 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-1.76	-23.12	67.97	67.97	-128.31	-12.18	-27.60	67.97	67.97	61.61	-1.12	-29.17	67.97	67.97	-181.70	-13.15	-24.05	67.97	67.97	119.90	-12.92	-29.67	67.97	67.97	-28.65	-12.31	-29.34	67.97
	3527 R	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	-11.49	-26.69	67.87	67.87	181.38	-1.39	-22.46	67.87	67.87	-53.16	-12.52	-23.39	67.87	67.87	233.99	-0.38	-26.68	67.87	67.87	-94.68	-11.91	-28.70	67.87	67.87	41.43	-12.45	-28.98	67.87
3531.0	3531 L	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	-1.27	-22.58	67.87	67.87	47.31	-11.60	-27.04	67.87	67.87	-217.51	-12.52	-24.22	67.87	67.87	-253.77	-0.53	-27.04	67.87	67.87	88.85	-11.45	-28.19	67.87	67.87	-50.94	-12.17	-29.67	67.87
	3531 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-12.25	-27.89	67.97	67.97	-97.02	-1.55	-23.15	67.97	67.97	122.67	-1.07	-29.02	67.97	67.97	174.33	-13.14	-24.88	67.97	67.97	-138.46	-12.58	-30.32	67.97	67.97	18.68	-11.91	-28.88	67.97
3536.0	3536 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-28.47	4.50	67.97	69.53	450.94	-33.21	-8.17	67.97	67.97	521.56	-25.21	-8.14	67.97	67.97	399.39	-38.85	6.13	67.97	69.53	624.35	-36.51	-5.76	67.97	67.97	513.52	-31.31	-7.06	67.97
	3536 R	46.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-29.07	-6.67	69.41	49.58	663.60	-24.98	4.41	69.41	49.58	536.50	-34.22	4.52	69.41	49.58	743.58	-22.19	-4.51	69.41	49.58	513.70	-27.63	-5.78	69.41	49.58	585.25	-31.78	-4.87	69.41
3542.0	3542 L	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-23.55	-9.80	68.43	69.35	-578.10	-29.29	-17.55	68.43	69.35	-727.82	-33.11	-10.30	68.43	69.35	-799.41	-21.52	-15.80	68.43	69.35	-550.40	-26.65	-18.99	68.43	69.35	-627.52	-28.34	-8.73	68.43
	3542 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-32.20	-19.87	69.57	69.57	-545.95	-25.78	-11.49	69.57	69.57	-444.59	-24.20	-21.43	69.57	69.57	-397.50	-36.08	-10.22	69.57	69.57	-634.49	-31.10	-10.42	69.57	69.57	-549.44	-29.23	-21.28	69.57
3547.0	3547 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-12.41	-24.92	69.57	69.57	131.92	-20.90	-28.53	69.57	69.57	322.78	-11.32	-29.58	69.57	69.57	80.96	-22.29	-25.40	69.57	69.57	366.82	-20.35	-29.54	69.57	69.57	219.89	-21.10	-29.80	69.57
	3547 R	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-20.04	-27.59	69.47	69.47	487.91	-11.85	-24.21	69.47	69.47	252.19	-21.98	-25.47	69.47	69.47	525.26	-10.58	-27.64	69.47	69.47	212.73	-20.46	-29.05	69.47	69.47	323.33	-19.66	-28.75	69.47
3551.0	3551 L	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-11.50	-23.98	69.47	69.47	-253.72	-20.94	-29.37	69.47	69.47	-520.83	-21.45	-25.99	69.47	69.47	-567.44	-10.80	-27.81	69.47	69.47	-216.88	-19.15	-28.16	69.47	69.47	-335.16	-20.51	-30.06	69.47
	3551 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-21.79	-30.32	69.57	69.57	-346.03	-12.05	-24.69	69.57	69.57	-126.21	-11.51	-29.00	69.57	69.57	-79.34	-21.87	-26.19	69.57	69.57	-399.45	-21.15	-30.83	69.57	69.57	-230.00	-19.83	-28.95	69.57
3556.0	3556 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-32.88	-8.56	69.57	69.57	560.07	-34.97	-18.40	69.57	69.57	638.81	-26.81	-18.47	69.57	69.57	492.90	-42.31	-7.79	69.57	69.57	750.65	-42.01	-12.13	69.57	69.57	692.07	-27.38	-17.77	69.57
	3556 R	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-31.86	-16.08	68.43	69.35	852.11	-30.11	-6.92	68.43	69.35	714.70	-38.46	-6.51	68.43	69.35	944.01	-24.83	-15.32	68.43	69.35	674.28	-24.84	-15.74	68.43	69.35	729.57	-38.53	-9.95	68.43
5007.0	5007 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-39.21	32.36	69.04	69.04	113.38	-45.26	42.71	69.04	69.04	166.16	-38.52	31.07	69.04	69.04	-26.54	-46.13	44.28	69.04	69.04	345.37	-39.53	32.60	69.04	69.04	121.02	-39.75	32.86	69.04
	5007 R	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-45.26	42.71	69.04	69.04	126.85	-39.21	32.36	69.04	69.04	113.40	-45.56	43.29	69.04	69.04	318.92	-39.06	32.00	69.04	69.04	-49.07	-39.75	32.86	69.04	69.04	120.09	-39.53	32.60	69.04
5015.0	5015 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-8.39	6.91	69.04	69.04	-734.17	-10.75	11.08	69.04	69.04	-943.73	-8.68	7.25	69.04	69.04	-1033.44	-12.76	14.67	69.04	69.04	-621.38	-7.72	5.75	69.04	69.04	-802.66	-11.36	11.40	69.04
	5015 R	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	-12.70	17.50	68.06	68.06	-1007.63	-9.71	10.26	68.06	68.06	-732.21	-14.17	21.14	68.06	68.06	-635.49	-10.53	11.83	68.06	68.06	-1072.27	-12.89	15.98	68.06	68.06	-859.23	-8.49	7.98	68.06
5021.0	5021 L	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	34.22	6.67	68.02	68.02	425.65	19.70	11.47	68.02	68.02	292.58	18.63	16.07	68.02	68.02	207.87	33.47	4.87	68.02	68.02	656.75	25.33	6.40	68.02	68.02	330.84	30.82	11.86	68.02
	5021 R	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	24.99	15.28	68.19	68.19	292.58	41.76	9.53	68.19	68.19	415.60	41.54	6.26	68.19	68.19	632.05	26.44	20.08	68.19	68.19	197.03	37.34	15.23	68.19	68.19	366.58	32.08	9.94	68.19
5035.0	5035 L	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	43.81	1.56	68.19	68.19	-482.82	35.49	-3.61	68.19	62.44	-487.44	43.94	-7.45	68.19	62.44	-762.96	34.50	7.86	68.19	68.19	-332.75	39.58	0.40	68.19	68.19	-465.65	43.58	-5.22	68.19
	5035 R	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	28.83	-3.35	68.02	62.86	-487.44	35.85	-1.78	68.02	62.86	-492.86	28.37	4.76	68.02	68.02	-343.68	35.53	-6.04	68.02	62.86	-787.71	36.12	-5.42	68.02	62.86	-512.76	33.01	-1.63	68.02
5041.0	5041 L	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	20.65	-22.76	68.06	59.11	583.43	5.98	-10.02	68.06	59.11	797.58	9.31	-11.83	68.06	59.11	397.87	10.57	-14.26	68.06	59.11	881.40	16.77	-19.09	68.06	59.11	609.49	11.00	-14.77	68.06
	5041 R	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	7.26	-12.88	67.91	61.65	687.61	25.19	-28.97	67.91	62.44	582.08	14.78	-20.42	67.91	62.33	844.91	10.41	-14.12	67.91	62.34	384.53	13.14	-18.60	67.91	62.31	662.65	20.07	-23.90	67.91
5051.0	5051 L	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	10.44	-9.66	67.91	62.58	-376.82	4.13	-4.27	67.91	62.51	-604.94	10.16	-13.29	67.91	62.36	-714.81	3.83	-0.50	67.91	63.56	-263.15	9.41	-9.53	67.91	62.52	-455.14	7.33	-9.69	67.91
	5051 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	3.63	-3.92	50.00	47.30	-615.81	9.56	-8.78	50.00	47.36	-378.09	3.70	-1.31	50.00	47.71	-276.95	7.69	-10.31	50.00	47.22	-751.52	6.79	-9.01	50.00	47.22	-591.42	8.79	-8.87	50.00
5057.0	5057 L	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	31.95	-2.74	50.00	48.83	487.06	20.13	4.82	50.00	50.00	408.03	19.38	9.49	50.00	50.00	301.60	31.29	-5.22	50.00	48.72	748.71	25.36	1.19	50.00	50.00	420.11	29.64	4.59	50.00
	5057 R	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	20.98	5.18	50.00	50.00	408.03	33.03	-2.48	50.00	48.03	477.01	32.95	-5.76	50.00	47.89	724.00	21.79	9.51	50.00	50.00	290.29	30.66	4.74	50.00	50.00	464.20	26.22	1.67	50.00
5071.0	5071 L	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	30.43	6.28	50.00	50.00	-412.06	21.03	7.81	50.00	50.00	-368.68	29.83	3.30	50.00	50.00	-667.37	21.09	13.21	50.00	50.00	-232.99	23.94	5.77	50.00	50.00	-366.49	28.44	8.75	50.00
	5071 R	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	20.13	7.37	50.00	50.00	-368.68	29.38	5.78	50.00	50.00	-422.12	20.43	11.98	50.00	50.00	-244.15	28.21	3.69	50.00	50.00	-692.17	27.44	8.47	50.00	50.00	-412.68	22.99	5.09	50.00
5077.0	5077 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	-3.62	2.78	50.00	50.00	488.72	-14.32	10.89	50.00	50.00	735.38	-11.65	10.14	50.00	50.00	342.43	-9.08	6.03	50.00	50.00	833.94	-4.15	1.89	50.00	50.00	552.79	-9.49	6.43	50.00
	5077 R	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	-12.84	8.63	50.00	50.00	646.85	-2.91	2.11	50.00	50.00	487.93	-6.72	3.48	50.00	50.00	800.76	-11.13	8.84	50.00	50.00	328.99	-8.50	5.44	50.00	50.00	654.60	-3.65	1.75	50.00
5089.0	5089 L	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	7.26	-5.98	50.00	48.46	-579.66	0.97	-0.29	50.00	48.69	-751.66	4.94	-6.05	50.00	48.36	-897.92	1.48	0.67	50.00	50.00	-421.71	8.59	-8.57	50.00	48.41	-651.14	4.09	-5.33	50.00
	5089 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	0.84	-0.32	50.00	47.76	-838.07	6.88	-6.49	50.00	47.48	-580.32	1.68	-0.26	50.00	47.95	-435.12	3.45	-5.12	50.00	47.34	-929.91	4.16	-5.80	50.00	47.36	-749.97	8.26	-9.17	50.00
5095.0	5095 L	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	33.27	-1.25	50.00	48.90	431.20	22.39	1.66	50.00	50.00	378.50	21.60	7.48	50.00	50.00	249.76	32.15	-3.97	50.00	48.78	700.55	30.40	2.31	50.00	50.00	376.54	30.87	3.11	50.00
	5095 R	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	22.76	2.66	50.00	50.00	378.50	33.68	0.98	50.00	50.00	421.15	33.02	-3.19	50.00	48.85	675.64	21.96	8.96	50.00	50.00	238.35	31.26	4.39	50.00	50.00	402.55	30.85	3.65	50.00
5109.0	5109 L	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	35.07	-0.95	50.00	48.92	-444.43	22.69	2.68	50.00	50.00	-373.44	34.60	-4.10	50.00	48.83	-694.25	22.56	8.04	50.00	50.00	-258.12	32.24	2.84	50.00	50.00	-391.34	32.80	3.02	50.00
	5109 R	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	22.30	1.65	50.00	50.00	-373.44	34.71	-2.57	50.00	48.84	-454.48	22.56	6.30	50.00	50.00	-269.53	33.76	-4.94	50.00	48.75	-719.18	32.46	-3.35	50.00	48.80	-436.50	31.86	-2.70	50.00

Made By: SAE 8/5/11 Checked By: WME 8/5/11 BackChecked By: SAE 8/5/11

Section Properties & Force Results

Ref. Delta Frame Design

Splice Node	Splice Side	Top Flange b (in)	Top Flange t (in)	Web h (in)	Web t (in)	Bottom Flange b (in)	Bottom Flange t (in)	Fytf (ksi)	Fyw (ksi)	Fybf (ksi)	Rh
5115.0	5115 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00
	5115 R	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00
5127.0	5127 L	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00
	5127 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00
5133.0	5133 L	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00
	5133 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00
5147.0	5147 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00
	5147 R	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00
5153.0	5153 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00
	5153 R	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00
5163.0	5163 L	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00
	5163 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00
5169.0	5169 L	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00
	5169 R	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00
5183.0	5183 L	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00
	5183 R	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00
5189.0	5189 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00
	5189 R	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00
5199.0	5199 L	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00
	5199 R	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00
5205.0	5205 L	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00
	5205 R	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00
5219.0	5219 L	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00
	5219 R	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00
5225.0	5225 L	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00
	5225 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00
5233.0	5233 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00
	5233 R	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00
5241.0	5241 L	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98
	5241 R	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00
5253.0	5253 L	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00
	5253 R	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98
5262.0	5262 L	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00
	5262 R	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00
5271.0	5271 L	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00
	5271 R	42.00	2.50	96.00	1.25	42.00	2.50	70.00	50.00	70.00	0.98
5279.0	5279 L	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98
	5279 R	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99
5289.0	5289 L	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99
	5289 R	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98
5297.0	5297 L	42.00	2.50	114.00	1.25	42.00	2.50	70.00	50.00	70.00	0.97
	5297 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98
5306.0	5306 L	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98
	5306 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98
5402.0	5402 L	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99
	5402 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99
5407.0	5407 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99
	5407 R	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99
5411.0	5411 L	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99
	5411 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99
5416.0	5416 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99
	5416 R	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99
5422.0	5422 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00
	5422 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99
5427.0	5427 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99
	5427 R	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99
5431.0	5431 L	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99
	5431 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99
5436.0	5436 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99
	5436 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00
5442.0	5442 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00
	5442 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
5447.0	5447 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
	5447 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99
5451.0	5451 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99
	5451 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
5456.0	5456 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
	5456 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00
5462.0	5462 L	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00
	5462 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
5467.0	5467 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
	5467 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99
5471.0	5471 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99
	5471 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
5476.0	5476 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
	5476 R	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00
5482.0	5482 L	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00
	5482 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
5487.0	5487 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
	5487 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99
5491.0	5491 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99
	5491 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
5496.0	5496 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99
	5496 R	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00
5502.0	5502 L	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00
	5502 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99
5507.0	5507 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99
	5507 R	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99
5511.0	5511 L	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99
	5511 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99
5516.0	5516 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99
	5516 R	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00
5522.0	5522 L	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99
	5522 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99
5527.0	5527 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99
	5527 R	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99

STRENGTH I

Splice Side	MAX FX Flange Stress (ksi) TF	MAX FX Flange Stress (ksi) BF	MAX FX Flange Capacity (ksi) TF	MAX FX Flange Capacity (ksi) BF	MAX FX FY (kip)	MIN FX Flange Stress (ksi) TF	MIN FX Flange Stress (ksi) BF	MIN FX Flange Capacity (ksi) TF	MIN FX Flange Capacity (ksi) BF	MIN FX FY (kip)
5115 L	10.45	-11.74	50.00	47.43	551.75	0.50	-4.65	50.00	44.83	811.26
5115 R	-0.53	-4.96	50.00	43.56	723.42	12.43	-12.85	50.00	47.39	550.79
5127 L	6.25	-5.13	50.00	47.47	-470.15	-3.73	4.16	50.00	50.00	-618.00
5127 R	-3.79	4.79	50.00	50.00	-703.90	6.36	-5.94	50.00	47.27	-471.09
5133 L	28.14	4.30	50.00	50.00	406.77	17.09	4.94	50.00	50.00	364.58
5133 R	21.52	6.16	50.00	50.00	364.58	34.50	5.54	50.00	50.00	396.71
5147 L	39.01	-1.94	50.00	48.06	-465.67	24.95	3.85	50.00	50.00	-379.74
5147 R	19.89	3.17	50.00	50.00	-379.74	31.94	-1.29	50.00	48.90	-475.72
5153 L	11.86	-11.94	50.00	47.23	452.51	-8.21	2.23	50.00	50.00	630.41
5153 R	-9.02	2.56	50.00	50.00	603.72	12.48	-13.00	50.00	47.10	449.71
5163 L	8.54	-6.43	50.00	47.26	-370.18	-2.05	1.17	50.00	50.00	-593.93
5163 R	-2.01	1.05	50.00	50.00	-647.56	7.82	-5.82	50.00	47.36	-372.93
5169 L	29.58	1.01	50.00	50.00	487.41	16.69	3.96	50.00	50.00	389.21
5169 R	20.87	4.79	50.00	50.00	389.21	35.89	0.77	50.00	50.00	477.36
5183 L	32.76	5.09	50.00	50.00	-418.28	22.67	4.60	50.00	50.00	-387.09
5183 R	18.11	3.82	50.00	50.00	-387.09	26.72	4.28	50.00	50.00	-428.33
5189 L	2.06	-3.57	50.00	47.01	418.17	-12.80	8.00	50.00	50.00	653.20
5189 R	-11.79	7.84	50.00	50.00	566.81	2.02	-3.53	50.00	47.00	417.29
5199 L	10.83	-11.19	50.00	47.22	-474.84	-0.45	1.12	50.00	50.00	-764.30
5199 R	-0.66	1.44	50.00	50.00	-806.01	10.43	-9.58	50.00	47.43	-475.93
5205 L	32.12	1.40	50.00	50.00	516.15	19.39	3.70	50.00	50.00	425.97
5205 R	21.66	4.87	50.00	50.00	425.97	35.30	2.81	50.00	50.00	502.44
5219 L	35.49	3.30	50.00	50.00	-489.45	22.82	4.83	50.00	50.00	-413.31
5219 R	20.44	3.55	50.00	50.00	-413.31	32.23	1.96	50.00	50.00	-503.16
5225 L	2.18	-3.02	50.00	47.29	461.61	-9.62	4.06	50.00	50.00	779.55
5225 R	-8.27	3.67	50.00	50.00	648.90	2.17	-2.85	50.00	47.38	460.20
5233 L	-1.28	1.91	50.00	50.00	-432.06	-9.64	10.61	50.00	50.00	-624.19
5233 R	-8.87	9.92	50.00	50.00	-714.81	1.01	1.60	50.00	50.00	-433.11
5241 L	24.92	9.09	48.89	68.45	565.86	15.83	10.01	48.89	68.45	494.10
5241 R	15.48	10.05	50.00	50.00	494.10	24.51	9.50	50.00	50.00	551.44
5253 L	25.35	3.67	50.00	50.00	-649.18	14.84	6.24	50.00	50.00	-530.48
5253 R	14.88	6.07	48.89	68.45	-530.48	25.37	3.13	48.89	68.45	-661.70
5262 L	3.90	-4.92	50.00	49.34	261.60	-8.96	4.28	50.00	50.00	577.01
5262 R	-9.92	4.22	50.00	50.00	551.98	3.79	-4.77	50.00	48.89	260.86
5271 L	32.33	-34.76	50.00	48.93	-722.05	10.01	-16.36	50.00	48.83	-764.62
5271 R	8.44	-14.41	68.29	65.80	-879.01	26.81	-31.02	68.29	65.95	-722.88
5279 L	36.06	-2.48	68.63	67.75	822.34	27.31	-2.52	68.63	67.75	761.99
5279 R	31.55	-2.30	68.95	67.94	762.00	41.23	-1.66	68.95	67.97	809.60
5289 L	37.57	12.50	68.95	68.95	-503.62	25.17	15.17	68.95	68.95	-403.75
5289 R	22.57	12.79	68.63	68.63	-403.75	32.54	10.33	68.63	68.63	-514.35
5297 L	-10.55	11.38	68.21	68.21	989.76	-17.85	24.34	68.21	68.21	1305.12
5297 R	-14.45	18.54	68.44	68.44	1292.68	-8.09	8.53	68.44	68.44	989.76
5306 L	-33.33	35.45	68.44	68.44	-191.36	-41.84	49.42	68.44	68.44	-264.18
5306 R	-41.84	49.42	68.44	68.44	-371.55	-33.33	35.45	68.44	68.44	-191.35
5402 L	-30.58	-6.71	63.56	59.60	-467.80	-32.89	-20.85	63.56	59.60	-523.76
5402 R	-34.20	-22.37	63.86	63.86	-383.17	-31.76	-8.31	63.86	63.86	-364.51
5407 L	-13.81	-23.65	63.86	63.86	94.12	-22.97	-26.49	63.86	63.86	256.68
5407 R	-21.77	-25.24	63.76	63.76	378.90	-13.01	-22.67	63.76	63.76	184.95
5411 L	-12.17	-23.19	63.76	63.76	-219.73	-21.16	-25.99	63.76	63.76	-401.89
5411 R	-22.34	-27.25	63.86	63.86	-279.47	-12.98	-24.19	63.86	63.86	-129.19
5416 L	-26.07	-12.89	63.86	63.86	326.26	-28.47	-22.64	63.86	63.86	364.58
5416 R	-27.02	-21.09	63.56	59.60	509.17	-24.96	-11.54	63.56	59.60	431.38
5422 L	-26.77	-2.04	50.00	50.00	-420.26	-30.15	-14.70	50.00	50.00	-494.15
5422 R	-34.98	-17.50	68.13	68.13	-370.93	-30.91	-2.91	68.13	68.13	-337.69
5427 L	-9.21	-25.55	68.13	68.13	23.81	-19.89	-29.01	68.13	68.13	181.51
5427 R	-18.68	-27.61	67.81	67.81	284.91	-8.50	-24.50	67.81	67.81	95.33
5431 L	-8.33	-24.02	67.81	67.81	-93.26	-18.83	-27.43	67.81	67.81	-279.64
5431 R	-20.07	-28.86	68.13	68.13	-170.25	-9.08	-25.09	68.13	68.13	-17.28
5436 L	-34.40	-4.02	68.13	68.13	347.94	-37.76	-16.23	68.13	68.13	387.24
5436 R	-32.63	-13.62	50.00	50.00	508.01	-29.90	-3.08	50.00	50.00	430.28
5442 L	-23.87	-9.11	50.00	50.00	-393.25	-27.01	-20.49	50.00	50.00	-470.67
5442 R	-31.96	-24.48	67.05	67.05	-335.78	-28.06	-11.14	67.05	67.05	-298.33
5447 L	-15.87	-23.94	67.05	67.05	124.71	-27.02	-27.24	67.05	67.05	285.73
5447 R	-25.53	-25.75	66.71	66.71	399.68	-14.89	-22.80	66.71	66.71	206.29
5451 L	-14.71	-22.78	66.71	66.71	-210.40	-25.29	-25.81	66.71	66.71	-407.94
5451 R	-26.78	-27.32	67.05	67.05	-289.68	-15.69	-23.93	67.05	67.05	-125.96
5456 L	-27.17	-11.07	67.05	67.05	294.92	-30.58	-25.47	67.05	67.05	326.91
5456 R	-25.70	-21.38	50.00	50.00	462.92	-23.15	-9.10	50.00	50.00	390.44
5462 L	-26.57	1.58	50.00	50.00	-415.76	-31.29	-13.89	50.00	49.25	-525.70
5462 R	-37.16	-17.76	67.05	67.05	-401.81	-31.75	-3.62	67.05	67.05	-337.57
5467 L	-8.80	-22.52	67.05	67.05	55.16	-20.61	-28.35	67.05	67.05	224.13
5467 R	-19.36	-26.95	66.71	66.71	326.99	-8.11	-21.55	66.71	66.71	121.59
5471 L	-8.33	-20.28	66.71	66.71	-125.12	-18.87	-26.69	66.71	66.71	-332.04
5471 R	-20.14	-28.12	67.05	67.05	-226.96	-9.03	-21.23	67.05	67.05	-59.06
5476 L	-29.10	-3.40	67.05	67.05	312.15	-33.22	-16.98	67.05	67.05	382.75
5476 R	-27.89	-13.63	50.00	49.25	506.09	-24.33	-1.53	50.00	49.25	388.61
5482 L	-27.16	4.52	50.00	50.00	-423.55	-32.80	-7.95	50.00	49.18	-562.70
5482 R	-38.06	-11.31	67.05	67.05	-439.33	-31.78	2.25	67.06	69.29	-349.21
5487 L	-6.80	-23.31	67.05	67.05	9.37	-17.17	-31.84	67.05	67.05	162.98
5487 R	-16.00	-30.37	66.71	66.71	265.71	-6.17	-22.34	66.71	66.71	72.61
5491 L	-6.29	-23.79	66.71	66.71	-82.39	-15.67	-29.41	66.71	66.71	-257.53
5491 R	-16.83	-30.85	67.05	67.05	-156.33	-6.95	-24.81	67.05	67.05	-15.54
5496 L	-33.08	1.86	67.05	69.29	364.74	-38.09	-10.56	67.05	67.05	436.26
5496 R	-32.76	-7.21	50.00	49.18	557.36	-28.31	4.15	50.00	50.00	442.52
5502 L	-27.30	-1.26	50.00	50.00	-465.03	-31.74	-13.47	50.00	50.00	-587.84
5502 R	-35.11	-15.64	68.37	68.37	-444.67	-30.10	-2.45	68.37	68.37	-376.18
5507 L	-7.38	-23.85	68.37	68.37	3.95	-20.18	-29.24	68.37	68.37	204.05
5507 R	-19.10	-28.01	68.10	68.10	324.23	-6.81	-23.00	68.10	68.10	80.96
5511 L	-6.87	-22.88	68.10	68.10	-80.44	-19.32	-28.00	68.10	68.10	-328.78
5511 R	-20.38	-29.20	68.37	68.37	-209.01	-7.49	-23.76	68.37	68.37	-3.68
5516 L	-29.26	-1.67	68.37	68.37	374.07	-34.77	-15.99	68.37	68.37	441.86
5516 R	-31.46	-13.76	50.00	50.00	583.25	-26.50	-0.56	50.00	50.00	461.94
5522 L	-27.58	5.44	69.43	49.59	-518.49	-33.53	-9.85	69.43	49.59	-651.12
5522 R	-36.25	-10.65	67.97	67.97	-508.84	-29.57	5.73	67.97	69.53	-433.05
5527 L	-0.99	-23.97	67.97	67.97	-141.07	-11.38	-28.56	67.97	67.97	60.81
5527 R	-10.70	-27.65	67.87	67.87	182.08	-0.66	-23.33	67.87	67.87	-66.21

Splice Side	MAX FY Flange Stress (ksi) TF	MAX FY Flange Stress (ksi) BF	MAX FY Flange Capacity (ksi) TF	MAX FY Flange Capacity (ksi) BF	MAX FY FY (kip)	MIN FY Flange Stress (ksi) TF	MIN FY Flange Stress (ksi) BF	MIN FY Flange Capacity (ksi) TF	MIN FY Flange Capacity (ksi) BF	MIN FY FY (kip)
5115 L	0.28	-1.75	50.00	45.37	421.86	7.27	-11.47	50.00	47.32	897.57
5115 R	10.16	-14.11	50.00	47.29	864.82	-1.52	-0.76	50.00	43.56	407.61
5127 L	1.18	-2.55	50.00	47.15	-784.92	-3.53	5.77	50.00	50.00	-291.89
5127 R	-3.21	5.75	50.00	50.00	-305.08	-0.80	-1.34	50.00	42.82	-817.86
5133 L	21.34	8.52	50.00	50.00	263.56	24.34	1.94	50.00	50.00	681.30
5133 R	30.69	1.54	50.00	50.00	655.94	25.85	11.71	50.00	50.00	251.83
5147 L	38.01	-4.75	50.00	47.95	-679.87	25.41	9.59	50.00	50.00	-277.71
5147 R	20.47	7.12	50.00	50.00	-289.30	30.51	-2.73	50.00	48.83	-705.39
5153 L	-5.05	4.57	50.00	50.00	268.61	5.16	-11.21	50.00	46.93	769.94
5153 R	7.05	-14.10	50.00	46.81	738.86	-6.78	6.26	50.00	50.00	253.63
5163 L	3.64	-7.43	50.00	46.80	-702.42	-0.97	4.61	50.00	50.00	-207.06
5163 R	-0.61	3.35	50.00	50.00	-221.58	1.79	-5.12	50.00	46.44	-733.95
5169 L	16.26	9.04	50.00	50.00	300.92	28.64	-0.84	50.00	48.92	716.61
5169 R	35.39	-2.54	50.00	47.53	691.24	22.54	10.79	50.00	50.00	289.76
5183 L	30.67	0.60	50.00	50.00	-677.11	23.77	11.10	50.00	50.00	-274.24
5183 R	19.63	8.06	50.00	50.00	-285.47	24.47	1.69	50.00	50.00	-702.38
5189 L	-10.07	7.55	50.00	50.00	260.96	-4.06	-0.66	50.00	42.82	745.88
5189 R	-2.26	-2.33	50.00	42.82	713.75	-10.12	8.41	50.00	50.00	248.27
5199 L	4.23	-8.67	50.00	46.94	-884.89	0.44	3.43	50.00	50.00	-271.27
5199 R	0.90	1.66	50.00	50.00	-289.50	2.09	-4.50	50.00	47.15	-928.19
5205 L	20.07	9.11	50.00	50.00	293.05	30.06	-2.13	50.00	49.37	866.46
5205 R	33.89	-2.62	50.00	48.86	833.06	21.63	12.50	50.00	50.00	278.44
5219 L	34.92	-2.52	50.00	48.87	-814.26	23.11	12.72	50.00	50.00	-257.08
5219 R	20.90	9.41	50.00	50.00	-271.74	30.96	-2.01	50.00	49.38	-847.55
5225 L	-8.44	6.44	50.00	50.00	269.64	-4.25	-1.37	50.00	43.56	908.30
5225 R	-1.71	-3.40	50.00	43.85	859.38	-8.25	7.06	50.00	50.00	251.32
5233 L	-7.37	5.71	50.00	50.00	-828.47	-8.76	11.49	50.00	50.00	-180.78
5233 R	-7.69	9.65	50.00	50.00	-195.83	-7.14	6.34	50.00	50.00	-857.91
5241 L	16.14	15.31	48.89	68.45	329.24	21.87	8.57	48.89	68.45	897.82
5241 R	22.02	8.20	50.00	50.00	873.72	16.29	15.00	50.00	50.00	303.33
5253 L	23.36	2.50	50.00	50.00	-950.03	15.24	11.04	50.00	50.00	-357.94
5253 R	15.54	10.35	48.89	68.45	-377.86	22.81	2.73	48.89	68.45	-973.52
5262 L	-7.81	6.81	50.00	50.00	110.05	-2.25	-3.18	50.00	45.96	753.28
5262 R	-1.16	-4.74	50.00	45.58	715.66	-9.72	7.78	50.00	50.00	96.44
5271 L	18.02	-23.43	50.00	48.88	-1060.51	15.21	-19.15	50.00	48.89	-435.65
5271 R	13.40	-17.76	68.29	65.90	-447.08	13.99	-19.58	68.29	65.88	-1089.04
5279 L	27.87	5.07	68.63	68.63	546.87	32.86	-2.85	68.63	67.75	1153.77
5279 R	38.39	-3.11	68.95	67.93	1131.64	31.52	7.16	68.95	68.95	525.68
5289 L	34.96	10.32	68.95	68.95	-845.77	28.16	20.27	68.95	68.95	-203.74
5289 R	24.71	16.93	68.63	68.63	-227.66	29.80	8.87	68.63	68.63	-859.47
5297 L	-18.35	25.98	68.21	68.21	828.02	-14.54	18.27	68.21	68.21	1418.18
5297 R	-11.19	13.20	68.44	68.44	1386.75	-14.82	19.66	68.44	68.44	818.47
5306 L	-41.09	48.43	68.44	68.44	-488.07	-34.52	37.12	68.44	68.44	-2.68
5306 R	-33.92	36.08	68.44	68.44	-31.81	-41.72	49.52	68.44	68.44	-523.50
5402 L	-39.73	-5.28	63.56	59.60	-613.73	-26.33	-20.28	63.56	59.60	-424.16
5402 R	-27.34	-22.75	63.86	63.86	-300.81	-41.32	-6.45	63.86	63.86	-488.51
5407 L	-12.75	-27.61	63.86	63.86	49.12	-24.32	-23.72	63.86	63.86	298.00
5407 R	-23.15	-22.68	63.76	63.76	415.77	-11.93	-26.43	63.76	63.76	146.29
5411 L	-22.63	-23.25	63.76	63.76	-434.56	-10.98	-26.77	63.76	63.76	-183.35
5411 R	-11.89	-28.67	63.86	63.86	-85.80	-23.91	-24.04	63.86	63.86	-316.43
5416 L	-22.68	-22.59	63.86	63.86	287.02	-35.46	-11.00	63.86	63.86	451.08
5416 R	-33.89	-11.09	63.56	59.60	579.36	-21.59	-17.36	63.56	59.60	411.92
5422 L	-36.32	-2.27	50.00	50.00	-565.12	-24.08	-10.70	50.00	50.00	-402.77
5422 R	-28.20	-16.28	68.13	68.13	-300.18	-41.80	-1.04	68.13	68.13	-458.94
5427 L	-8.49	-31.47	68.13	68.13	-15.39	-21.08	-25.88	68.13	68.13	214.87
5427 R	-19.87	-24.87	67.81	67.81	314.53	-7.45	-28.47	67.81	67.81	62.63
5431 L	-20.32	-24.95	67.81	67.81	-309.70	-7.19	-27.87	67.81	67.81	-59.84
5431 R	-8.02	-30.30	68.13	68.13	22.89	-21.52	-25.94	68.13	68.13	-204.42
5436 L	-31.39	-17.11	68.13	68.13	309.44	-44.99	2.98	68.15	69.30	469.66
5436 R	-38.96	-2.41	50.00	50.00	574.41	-27.09	-12.14	50.00	50.00	410.91
5442 L	-32.64	-8.49	50.00	50.00	-536.19	-20.69	-18.20	50.00	50.00	-371.64
5442 R	-24.09	-23.97	67.05	67.05	-256.87	-38.47	-8.73	67.05	67.05	-418.35
5447 L	-15.24	-29.83	67.05	67.05	87.77	-27.93	-23.70	67.05	67.05	319.41
5447 R	-26.48	-22.53	66.71	66.71	429.37	-13.88	-26.74	66.71	66.71	175.91
5451 L	-26.57	-22.91	66.71	66.71	-438.20	-13.67	-26.72	66.71	66.71	-180.55
5451 R	-14.69	-28.14	67.05	67.05	-89.84	-28.01	-24.07	67.05	67.05	-323.95
5456 L	-23.30	-24.69	67.05	67.05	252.06	-37.62	-9.18	67.05	67.05	412.91
5456 R	-31.97	-9.05	50.00	50.00	531.78	-19.76	-18.25	50.00	50.00	368.42
5462 L	-37.28	-2.47	50.00	49.25	-598.96	-23.50	-10.71	50.00	49.25	-377.76
5462 R	-28.00	-16.78	67.05	67.05	-282.11	-44.63	-2.86	67.05	67.05	-490.89
5467 L	-7.18	-29.05	67.05	67.05	10.92	-22.32	-23.05	67.05	67.05	261.88
5467 R	-20.94	-22.96	66.71	66.71	358.25	-6.40	-27.01	66.71	66.71	85.64
5471 L	-20.54	-23.15	66.71	66.71	-365.72	-6.41	-25.36	66.71	66.71	-82.85
5471 R	-7.00	-27.44	67.05	67.05	-9.30	-21.94	-23.02	67.05	67.05	-266.11
5476 L	-24.25	-15.43	67.05	67.05	263.78	-41.58	-3.95	67.05	67.05	466.49
5476 R	-34.60	-2.15	50.00	49.25	575.95	-20.69	-11.45	50.00	49.25	359.04
5482 L	-37.84	3.10	50.00	50.00	-620.03	-25.21	-3.70	50.00	49.18	-408.04
5482 R	-28.91	-8.10	67.05	67.05	-318.09	-44.54	1.18	67.05	69.29	-509.15
5487 L	-5.23	-31.28	67.05	67.05	-36.47	-19.30	-26.78	67.05	67.05	206.76
5487 R	-18.14	-25.60	66.71	66.71	303.31	-4.41	-27.90	66.71	66.71	36.46
5491 L	-17.96	-24.26	66.71	66.71	-300.76	-4.13	-29.90	66.71	66.71	-39.17
5491 R	-5.05	-32.71	67.05	67.05	37.70	-19.11	-25.39	67.05	67.05	-205.86
5496 L	-28.54	-9.60	67.05	67.05	311.92	-45.66	2.82	67.06	69.29	519.57
5496 R	-38.83	4.61	50.00	50.00	628.07	-24.90	-5.60	50.00	49.18	404.41
5502 L	-38.79	1.30	50.00	50.00	-674.47	-23.85	-9.66	50.00	50.00	-447.01
5502 R	-26.29	-15.63	68.37	68.37	-332.89	-42.98	2.37	68.37	69.42	-553.95
5507 L	-5.72	-31.38	68.37	68.37	-62.69	-21.42	-25.56	68.37	68.37	250.69
5507 R	-20.36	-24.56	68.10	68.10	365.76	-5.06	-28.14	68.10	68.10	27.38
5511 L	-20.33	-24.43	68.10	68.10	-368.25	-5.15	-28.13	68.10	68.10	-22.63
5511 R	-5.90	-31.42	68.37	68.37	67.05	-21.38	-25.39	68.37	68.37	-253.41
5516 L	-26.11	-16.44	68.37	68.37	326.06	-42.90	2.33	68.37	69.42	556.91
5516 R	-38.81	1.53	50.00	50.00	677.87	-24.07	-11.77	50.00	50.00	439.34
5522 L	-39.22	6.58	69.43	49.59	-730.06	-25.02	-3.50	69.43	49.59	-503.34
5522 R	-27.51	-8.49	67.97	67.97	-394.31	-41.77	8.77	67.97	69.53	-607.92
5527 L	0.85	-30.06	69.53	67.97	-200.05	-12.35	-25.33	67.97	67.97	105.88
5527 R	-11.75	-24.65	67.87	67.87	221.14	1.24	-28.10	69.42	67.87	-112.05

Splice Side	MAX MY Flange Stress (ksi) TF	MAX MY Flange Stress (ksi) BF	MAX MY Flange Capacity (ksi) TF	MAX MY Flange Capacity (ksi) BF	MAX MY FY (kip)	MIN MY Flange Stress (ksi) TF	MIN MY Flange Stress (ksi) BF	MIN MY Flange Ca TF
5115 L	10.53	-13.16	50.00	47.39	623.45	5.60	-8.86	50.00
5115 R	6.36	-9.57	50.00	47.27	676.15	12.32	-14.26	50.00
5127 L	-1.58	1.32	50.00	50.00	-466.10	0.76	-2.14	50.00
5127 R	0.74	-2.43	50.00	46.11	-586.65	-1.62	1.40	50.00
5133 L	23.58	5.62	50.00	50.00	368.03	22.05	4.26	50.00
5133 R	26.95	5.21	50.00	50.00	384.82	28.98	6.62	50.00
5147 L	33.49	3.59	50.00	50.00	-415.36	29.11	3.20	50.00
5147 R	23.95	3.04	50.00	50.00	-405.50	27.40	3.35	50.00
5153 L	7.90	-10.69	50.00	47.11	493.46	2.17	-5.12	50.00
5153 R	1.96	-5.36	50.00	46.38	498.10	8.16	-11.50	50.00
5163 L	5.17	-5.13	50.00	47.12	-446.00	1.22	-2.95	50.00
5163 R	0.92	-3.57	50.00	45.71	-449.22	4.69	-4.66	50.00
5169 L	23.49	5.26	50.00	50.00	400.64	24.11	3.46	50.00
5169 R	29.30	3.55	50.00	50.00	442.25	28.65	6.03	50.00
5183 L	26.75	6.94	50.00	50.00	-369.84	29.66	4.54	50.00
5183 R	24.31	4.29	50.00	50.00	-454.75	21.78	5.94	50.00
5189 L	-4.41	2.20	50.00	50.00	435.64	-4.11	-1.66	50.00
5189 R	-3.59	-1.59	50.00	42.82	513.88	-3.89	2.00	50.00
5199 L	10.32	-12.82	50.00	47.14	-564.44	1.71	-1.19	50.00
5199 R	1.54	-1.05	50.00	47.54	-599.32	9.87	-11.04	50.00
5205 L	27.61	2.20	50.00	50.00	459.56	28.22	4.90	50.00
5205 R	31.04	6.32	50.00	50.00	469.82	30.13	3.12	50.00
5219 L	32.73	3.77	50.00	50.00	-477.34	27.69	7.73	50.00
5219 R	25.07	6.26	50.00	50.00	-439.30	29.83	2.73	50.00
5225 L	4.37	-7.76	50.00	47.21	562.40	-6.40	2.29	50.00
5225 R	-5.37	1.95	50.00	50.00	671.82	4.02	-7.15	50.00
5233 L	1.79	-3.59	50.00	47.25	-490.47	-9.11	10.25	50.00
5233 R	-8.38	9.42	50.00	50.00	-627.87	1.43	-3.12	50.00
5241 L	19.60	7.98	48.89	68.45	535.45	20.54	12.23	48.89
5241 R	20.13	12.48	50.00	50.00	532.00	19.22	8.17	50.00
5253 L	22.88	4.69	50.00	50.00	-635.78	15.23	8.18	50.00
5253 R	15.27	8.05	48.89	68.45	-648.20	22.91	4.20	48.89
5262 L	-3.96	1.98	50.00	50.00	288.04	3.14	-7.80	50.00
5262 R	2.73	-7.48	50.00	48.49	483.52	-4.52	1.96	50.00
5271 L	29.07	-32.51	50.00	48.92	-717.22	10.82	-16.19	50.00
5271 R	9.19	-14.32	68.29	65.84	-833.85	24.02	-28.93	68.29
5279 L	34.25	-4.05	68.63	67.75	787.29	34.90	-4.51	68.63
5279 R	39.65	-3.82	68.95	67.92	790.60	38.80	-3.20	68.95
5289 L	32.99	9.88	68.95	68.95	-635.11	34.98	15.73	68.95
5289 R	30.49	13.60	68.63	68.63	-363.90	28.26	7.88	68.63
5297 L	-16.47	21.36	68.21	68.21	1070.62	-11.27	11.96	68.21
5297 R	-8.77	9.09	68.44	68.44	1081.23	-13.32	16.37	68.44
5306 L	-33.97	36.29	68.44	68.44	-221.50	-34.44	36.72	68.44
5306 R	-34.44	36.72	68.44	68.44	-215.72	-33.97	36.29	68.44
5402 L	-36.71	-20.48	63.56	59.60	-509.78	-30.28	-15.84	63.56
5402 R	-31.47	-17.38	63.86	63.86	-360.00	-37.88	-21.75	63.86
5407 L	-25.21	-31.44	63.86	63.86	154.62	-25.52	-31.51	63.86
5407 R	-24.61	-30.50	63.76	63.76	256.53	-24.30	-30.41	63.76
5411 L	-23.86	-31.28	63.76	63.76	-279.94	-24.05	-30.86	63.76
5411 R	-24.96	-31.89	63.86	63.86	-188.21	-24.75	-32.30	63.86
5416 L	-35.00	-25.19	63.86	63.86	369.61	-30.91	-24.23	63.86
5416 R	-30.02	-23.05	63.56	59.60	463.63	-33.58	-24.59	63.56
5422 L	-33.85	-15.78	50.00	50.00	-469.23	-30.84	-12.64	50.00
5422 R	-35.53	-14.97	68.13	68.13	-344.95	-39.03	-18.52	68.13
5427 L	-23.08	-34.68	68.13	68.13	88.18	-23.30	-35.61	68.13
5427 R	-22.44	-34.50	67.81	67.81	161.01	-22.15	-33.52	67.81
5431 L	-22.78	-33.97	67.81	67.81	-163.08	-22.31	-33.92	67.81
5431 R	-23.20	-35.05	68.13	68.13	-73.78	-23.69	-35.10	68.13
5436 L	-42.25	-19.93	68.13	68.13	364.09	-36.33	-11.44	68.13
5436 R	-31.38	-9.60	50.00	50.00	457.12	-36.93	-16.97	50.00
5442 L	-28.80	-21.47	50.00	50.00	-434.00	-27.68	-19.82	50.00
5442 R	-32.84	-24.02	67.05	67.05	-305.53	-34.42	-25.91	67.05
5447 L	-28.73	-32.84	67.05	67.05	180.13	-30.19	-33.37	67.05
5447 R	-29.06	-32.18	66.71	66.71	276.70	-27.61	-31.64	66.71
5451 L	-27.39	-31.75	66.71	66.71	-275.41	-28.63	-31.95	66.71
5451 R	-29.76	-33.16	67.05	67.05	-191.20	-28.50	-32.95	67.05
5456 L	-33.46	-25.81	67.05	67.05	311.36	-31.74	-24.54	67.05
5456 R	-26.79	-20.28	50.00	50.00	420.70	-27.88	-21.51	50.00
5462 L	-28.09	-9.55	50.00	49.25	-465.68	-31.98	-11.17	50.00
5462 R	-38.08	-14.93	67.05	67.05	-357.51	-33.19	-12.82	67.05
5467 L	-16.71	-26.80	67.05	67.05	123.57	-16.37	-25.81	67.05
5467 R	-15.47	-24.72	66.71	66.71	196.23	-15.85	-25.73	66.71
5471 L	-15.86	-24.82	66.71	66.71	-198.93	-15.65	-25.48	66.71
5471 R	-16.52	-26.56	67.05	67.05	-124.08	-16.74	-25.88	67.05
5476 L	-33.24	-13.18	67.05	67.05	350.54	-32.97	-16.48	67.05
5476 R	-27.75	-12.93	50.00	49.25	424.69	-28.06	-9.91	50.00
5482 L	-32.37	-8.50	50.00	49.18	-497.74	-32.19	-3.75	50.00
5482 R	-39.54	-5.72	67.05	67.05	-417.51	-37.04	-12.29	67.05
5487 L	-14.80	-28.41	67.05	67.05	77.19	-13.82	-28.59	67.05
5487 R	-12.98	-27.46	66.71	66.71	151.26	-13.99	-27.32	66.71
5491 L	-13.15	-27.52	66.71	66.71	-153.34	-13.65	-27.42	66.71
5491 R	-14.46	-28.51	67.05	67.05	-73.57	-14.00	-28.66	67.05
5496 L	-38.32	-9.09	67.05	67.05	401.46	-36.92	-8.71	67.05
5496 R	-32.31	-5.21	50.00	49.18	481.05	-32.60	-5.74	50.00
5502 L	-33.30	-13.59	50.00	50.00	-537.58	-30.92	-12.57	50.00
5502 R	-33.92	-14.78	68.37	68.37	-395.32	-36.69	-15.88	68.37
5507 L	-19.06	-31.07	68.37	68.37	80.66	-19.63	-31.27	68.37
5507 R	-18.89	-30.33	68.10	68.10	172.51	-18.34	-30.16	68.10
5511 L	-18.27	-30.01	68.10	68.10	-164.20	-19.33	-30.73	68.10
5511 R	-20.04	-31.64	68.37	68.37	-85.47	-19.01	-30.95	68.37
5516 L	-36.15	-14.99	68.37	68.37	408.20	-33.22	-12.90	68.37
5516 R	-30.28	-10.85	50.00	50.00	509.41	-32.80	-12.79	50.00
5522 L	-35.33	-6.14	69.43	49.59	-637.11	-26.09	-2.09	69.43
5522 R	-27.87	-2.57	67.97	67.97	-434.79	-38.22	-6.28	67.97
5527 L	-11.37	-30.38	67.97	67.97	-50.21	-11.15	-29.57	67.97
5527 R	-10.75	-28.91	67.87	67.87	29.60	-10.93	-29.69	67.87

Made By: SAE 8/5/11 Checked By: WME 8/5/11 BackChecked By: SAE 8/5/11

Section Properties & Force Results

Ref. Delta Frame Design

STRENGTH I

Splice	Splice	Top Flange		Web		Bottom Flange		Fytf	Fyw	Fybf	Rh	MAX FX					MIN FX					MAX FY					MIN FY					MAX MY					MIN MY		
Node	Side	b (in)	t (in)	h (in)	t (in)	b (in)	t (in)	(ksi)	(ksi)	(ksi)		Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Ca
												TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF
5531.0	5531 L	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	-0.85	-23.07	67.87	67.87	75.76	-11.31	-28.56	67.87	67.87	-172.00	-12.21	-25.09	67.87	67.87	-220.77	0.89	-27.87	69.42	67.87	126.36	-10.54	-28.82	67.87	67.87	-16.90	-11.32	-29.65	67.87
	5531 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-11.97	-29.42	67.97	67.97	-52.84	-1.20	-23.72	67.97	67.97	149.12	0.41	-29.72	69.53	67.97	213.33	-12.82	-25.76	67.97	67.97	-106.95	-11.72	-30.30	67.97	67.97	47.53	-10.99	-29.52	67.97
5536.0	5536 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-33.51	10.06	67.97	69.53	501.06	-40.59	-5.78	67.97	67.97	602.91	-31.28	-6.26	67.97	67.97	455.10	-46.93	13.38	67.97	69.53	709.83	-36.03	3.89	67.97	69.53	571.44	-37.58	5.67	67.97
	5536 R	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-37.73	-5.41	69.43	49.59	741.29	-31.42	9.49	69.43	49.59	581.82	-43.87	10.77	69.43	49.59	828.72	-29.15	-3.26	69.43	49.59	560.80	-35.04	5.86	69.43	49.59	633.18	-33.62	3.68	69.43
5542.0	5542 L	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-24.53	-8.67	68.43	69.35	-612.61	-31.71	-16.17	68.43	69.35	-786.70	-36.29	-8.70	68.43	69.35	-864.37	-23.02	-15.63	68.43	69.35	-588.43	-27.92	-18.19	68.43	69.35	-663.10	-31.06	-9.16	68.43
	5542 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-34.88	-18.50	69.57	69.57	-588.81	-26.97	-10.22	69.57	69.57	-471.41	-24.79	-19.57	69.57	69.57	-423.42	-39.61	-8.75	69.57	69.57	-684.41	-34.01	-10.97	69.57	69.57	-578.74	-30.65	-20.49	69.57
5547.0	5547 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-13.22	-25.88	69.57	69.57	135.65	-21.42	-30.09	69.57	69.57	313.50	-11.78	-31.51	69.57	69.57	65.91	-22.96	-26.40	69.57	69.57	369.08	-20.34	-30.05	69.57	69.57	217.07	-21.06	-30.62	69.57
	5547 R	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-20.53	-29.09	69.47	69.47	476.17	-12.63	-25.13	69.47	69.47	254.06	-22.10	-26.05	69.47	69.47	524.08	-11.15	-29.52	69.47	69.47	198.54	-20.40	-29.84	69.47	69.47	312.02	-19.64	-29.23	69.47
5551.0	5551 L	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-12.49	-25.18	69.47	69.47	-259.57	-21.45	-30.80	69.47	69.47	-518.49	-21.85	-26.95	69.47	69.47	-563.43	-11.70	-30.13	69.47	69.47	-208.84	-19.01	-28.56	69.47	69.47	-329.30	-20.69	-30.85	69.47
	5551 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-22.34	-31.79	69.57	69.57	-338.32	-13.08	-25.93	69.57	69.57	-127.43	-12.38	-32.16	69.57	69.57	-63.09	-22.64	-27.42	69.57	69.57	-390.69	-21.36	-31.65	69.57	69.57	-219.46	-19.70	-29.37	69.57
5556.0	5556 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-33.92	-7.99	69.57	69.57	575.73	-38.20	-18.05	69.57	69.57	672.15	-28.84	-18.07	69.57	69.57	502.85	-44.74	-6.94	69.57	69.57	791.26	-43.43	-12.25	69.57	69.57	706.56	-30.32	-15.98	69.57
	5556 R	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-34.82	-15.61	68.43	69.35	895.16	-31.01	-6.32	68.43	69.35	737.01	-40.58	-5.79	68.43	69.35	995.87	-26.81	-14.59	68.43	69.35	687.43	-27.65	-13.90	68.43	69.35	775.97	-39.73	-10.03	68.43
7007.0	7007 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-35.61	28.99	69.04	69.04	92.12	-42.16	39.91	69.04	69.04	222.06	-35.29	28.46	69.04	69.04	-34.12	-43.29	42.06	69.04	69.04	354.19	-36.68	30.47	69.04	69.04	121.22	-36.75	30.40	69.04
	7007 R	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-42.16	39.91	69.04	69.04	138.64	-35.61	28.99	69.04	69.04	92.12	-42.69	41.03	69.04	69.04	326.83	-35.86	29.45	69.04	69.04	-57.21	-36.75	30.40	69.04	69.04	121.44	-36.68	30.47	69.04
7015.0	7015 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-4.45	3.74	69.04	69.04	-725.84	-11.50	12.37	69.04	69.04	-886.92	-8.55	7.58	69.04	69.04	-974.34	-11.80	13.39	69.04	69.04	-570.23	-12.89	14.60	69.04	69.04	-801.54	-3.87	3.30	69.04
	7015 R	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	-12.80	18.13	68.06	68.06	-947.08	-6.95	6.97	68.06	68.06	-717.09	-13.94	20.72	68.06	68.06	-584.81	-10.33	13.06	68.06	68.06	-1014.46	-4.65	4.22	68.06	68.06	-729.02	-14.12	20.64	68.06
7021.0	7021 L	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	34.01	7.26	68.02	68.02	438.33	20.11	12.12	68.02	68.02	309.81	21.30	16.43	68.02	68.02	210.90	33.19	4.94	68.02	68.02	672.04	25.22	7.77	68.02	68.02	373.01	31.10	12.43	68.02
	7021 R	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	25.45	16.00	68.19	68.19	309.81	41.62	10.36	68.19	68.19	427.76	41.45	6.38	68.19	68.19	646.85	26.78	22.16	68.19	68.19	200.10	37.63	15.83	68.19	68.19	365.30	31.99	11.68	68.19
7035.0	7035 L	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	43.06	2.32	68.19	68.19	-489.47	33.76	-3.38	68.19	62.44	-491.95	43.27	-7.91	68.19	62.44	-778.97	33.42	8.85	68.19	68.19	-334.04	38.67	-1.29	68.19	62.44	-493.27	42.31	-4.54	68.19
	7035 R	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	27.33	-3.07	68.02	62.86	-491.95	35.32	-2.14	68.02	62.86	-500.03	27.56	5.62	68.02	68.02	-344.90	34.84	-6.19	68.02	62.86	-804.22	35.11	-4.92	68.02	62.86	-505.46	32.32	-2.42	68.02
7041.0	7041 L	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	16.79	-18.30	68.06	59.11	578.25	8.13	-12.02	68.06	59.11	663.75	8.16	-10.23	68.06	59.11	360.59	8.55	-11.34	68.06	59.11	849.07	6.55	-9.51	68.06	59.11	663.21	18.09	-20.44	68.06
	7041 R	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	9.64	-15.18	67.91	62.10	568.60	20.46	-23.28	67.91	62.45	576.88	12.19	-16.63	67.91	62.34	811.21	8.85	-11.89	67.91	62.35	346.08	21.85	-25.80	67.91	62.43	554.52	7.42	-11.66	67.91
7051.0	7051 L	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	8.23	-7.01	67.91	62.63	-402.34	3.68	-3.59	67.91	62.55	-473.24	8.27	-10.04	67.91	62.41	-688.66	3.24	1.20	67.91	67.91	-235.11	3.04	1.93	67.91	67.91	-488.37	17.97	-19.62	67.91
	7051 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	3.19	-3.24	50.00	47.32	-580.91	7.56	-6.40	50.00	47.39	-403.64	3.19	-0.38	50.00	47.96	-249.71	5.87	-7.22	50.00	47.25	-727.06	16.72	-18.11	50.00	47.30	-450.82	2.68	2.00	50.00
7057.0	7057 L	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	32.21	-3.28	50.00	48.81	497.37	20.70	4.97	50.00	50.00	416.80	19.62	10.47	50.00	50.00	302.40	31.24	-5.59	50.00	48.71	762.95	25.45	1.43	50.00	50.00	458.53	29.48	5.63	50.00
	7057 R	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	21.61	5.36	50.00	50.00	416.80	33.34	-3.02	50.00	48.00	486.80	33.04	-6.29	50.00	47.87	737.75	22.12	10.44	50.00	50.00	291.07	30.55	5.77	50.00	50.00	465.95	26.46	2.01	50.00
7071.0	7071 L	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	31.05	6.75	50.00	50.00	-424.69	21.20	8.41	50.00	50.00	-380.59	29.94	-3.84	50.00	47.95	-683.98	21.76	14.13	50.00	50.00	-236.13	24.50	6.21	50.00	50.00	-395.25	28.43	9.63	50.00
	7071 R	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	20.24	7.99	50.00	50.00	-380.59	29.94	6.25	50.00	50.00	-435.25	21.03	12.89	50.00	50.00	-247.33	28.17	3.39	50.00	50.00	-709.23	27.37	9.36	50.00	50.00	-406.35	23.49	5.51	50.00
7077.0	7077 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	-4.63	4.19	50.00	50.00	504.61	-11.52	8.19	50.00	50.00	647.85	-12.11	10.97	50.00	50.00	310.08	-9.88	7.89	50.00	50.00	809.41	-14.38	12.85	50.00	50.00	571.63	-2.11	-2.82	50.00
	7077 R	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	-10.24	6.41	50.00	50.00	551.61	-3.85	3.32	50.00	50.00	503.51	-7.28	4.74	50.00	50.00	774.76	-11.63	9.54	50.00	50.00	295.75	-1.71	-2.70	50.00	45.08	501.29	-13.02	10.40	50.00
7089.0	7089 L	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	5.39	-3.93	50.00	48.49	-579.86	2.64	-3.35	50.00	48.35	-680.01	3.70	-4.18	50.00	48.38	-872.64	1.29	1.54	50.00	50.00	-388.42	1.98	2.27	50.00	50.00	-674.62	10.82	-10.86	50.00
	7089 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	2.49	-3.66	50.00	47.34	-771.92	5.12	-4.26	50.00	47.52	-581.00	1.52	0.78	50.00	50.00	-402.85	2.92	-3.08	50.00	47.45	-905.99	10.44	-11.62	50.00	47.43	-593.93	1.86	2.31	50.00
7095.0	7095 L	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	32.09	0.90	50.00	50.00	434.66	22.43	2.21	50.00	50.00	387.48	22.10	8.39	50.00	50.00	250.99	31.98	-4.28	50.00	48.76	713.81	29.55	1.70	50.00	50.00	411.47	31.02	3.75	50.00
	7095 R	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	22.74	3.12	50.00	50.00	387.48	32.48	2.30	50.00	50.00	424.10	32.88	-3.59	50.00	48.84	688.45	22.08	10.03	50.00	50.00	239.60	31.34	4.94	50.00	50.00	411.37	30.04	3.08	50.00
7109.0	7109 L	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	35.74	-2.04	50.00	48.89	-470.02	22.35	2.92	50.00	50.00	-381.44	34.22	-4.50	50.00	48.82	-704.89	22.62	8.85	50.00	50.00	-257.58	31.04	2.13	50.00	50.00	-417.39	33.17	3.96	50.00
	7109 R	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	23.20	1.71	50.00	50.00	-381.44	35.44	-3.69	50.00	48.80	-480.58	22.67	7.15	50.00	50.00	-269.00	33.33	-5.25	50.00	48.73	-730.30	32.87	-3.71	50.00	48.79	-430.21	30.64	-2.52	50.00
7115.0	7115 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	11.59	-12.78	50.00	47.43	558.85	0.59	-4.48	50.00	45.08	738.42	-0.75	-0.72	50.00	43.85	390.23	5.40	-8.85	50.00	47.31	870.50	-1.54	-3.23	50.00	43.85	668.83	12.52	-14.66	50.00
	7115 R	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	-0.32	-4.60	50.00	43.56	645.86	13.82	-14.09	50.00	47.40	558.45	7.97	-11.30	50.00	47.28	836.65	-2.31	0.76	50.00	50.00	374.97	14.72	-15.97	50.00	47.38	578.52	-1.92	-3.33	50.00
7127.0	7127 L	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	3.79	-2.46	50.00	47.56	-454.06	-3.16	3.00	50.00	50.00	-559.56	1.28	-2.23	50.00	47.22	-774.50	-3.65	6.34	50.00	50.00	-269.04	-3.27	3.95	50.00	50.00	-584.28	5.87	-5.77	50.00
	7127 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-3.21	3.42	50.00	50.00	-652.45	3.21	-2.16	50.00	47.40	-447.58	-3.29	6.34	50.00	50.00	-282.98	-0.97	-0.80	50.00	42.82	-808.75	5.96	-6.64	50.00	47.19	-472.22	-3.31	4.44	50.00
7133.0	7133 L	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	27.07	4.06	50.00	50.00	391.48	17.01	4.75	50.00	50.00	347.96	18.70	8.41	50.00	50.00	246.68	24.20	1.83	50.00	50.00	666.84	24.08	5.05	50.00	50.00	376.05	22.19	5.16	50.00
	7133 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	21.33	5.94	50.00	50.00	347.96	33.12	5.36	50.00	50.00	380.41	30.40	1.26	50.00	50.00	639.96	22.58	11.90	50.00	50.00	234.44	27.01	6.07	50.00	50.00	371.37	29.41	5.94	50.00
7147.0	7147 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	38.93	-1.36	50.00	48.08	-463.00	24.19	4.41	50.00	50.00	-374.07	38.22	-4.62	50.00	47.96	-677.11	23.76	10.56	50.00	50.00	-266.55	32.56	3.79	50.00	50.00	-416.52	31.25	4.22	50.00
	7147 R	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	19.25	3.58	50.00	50.00	-374.07	31.89	-0.89	50.00	48.92	-473.56	18.98	7.66	50.00	50.00	-278.04	30.71	-2.71	50.00	48.84	-703.30	25.77	3.84	50.00	50.00	-403.09	26.64	3.52	50.00
7153.0	7153 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	14.52	-14.98	50.00	47.22	454.00	-9.60	3.80	50.00	50.00	607.68	-5.79	5.43	50.00	50.00	242.34	4.41	-10.12	50.00	46.91	748.57	-3.32	-3.79	50.00	42.82	544.87	8.08	-9.21	50.00
	7153 R	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	-10.15	3.85	50.00	50.00	571.73	15.30	-16.28	50.00	47.09	451.15	6.31	-13.00	50.00	46.79	716.28	-7.67	7.32	50.00	50.00	226.68	8.28	-9.85	50.00	47.04	438.81	-3.64	-3.92	50.00
7163.0	7163 L	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	9.16	-7.04	50.00	47.25	-341.46	-2.50	1.97	50.00	50.00	-565.24	3.62	-7.05	50.00	46.82	-686.09	-1.44	5.37	50.00	50.00	-183.49	-1.94	2.80	50.00	50.00	-481.84	8.82	-9.68	50.00
	7163 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-2.43	1.81	50.00	50.00	-621.08	8.37	-6.37	50.00	47.35	-344.27	-1.02	3.97	50.00	50.00	-198.53	1.64	-4.62	50.00	46.49	-719.00	8.01	-8.77	50.00	47.20	-408.45	-1.87	2.55	50.00
7169.0	7169 L	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	29.49	1.57	50.00	50.00	493.00	16.48	4.22	50.00	50.00	388.94	17.41	8.49	50.00	50.00	294.93	28.86	-0.74	50.00	48.92	719.59	24.73	4.00	50.00	50.00	441.54	24.57	5.41	50.00
	7169 R	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	20.62	5.12	50.00	50.00	388.94	35.82	1.58	50.00	50.00	482.43	35.76	-2.53	50.00	47.53	693.48	21.64	11.74	50.00	50.00	283.80	29.87	6.20	50.00	50.00	422.62	30.05	4.26	50.00
7183.0	7183 L	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	32.57	6.40	50.00	50.00	-422.20	22.52	5.16	50.00	50.00	-387.65	31.30	0.77	50.00	50.00	-679.47	22.39	12.98	50.00	50.00	-268.74	28.29	6.47	50.00	50.00	-401.41	30.16	6.23	50.00
	7183 R	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	17.92	4.20	50.00	50.00	-387.65	26.48	5.19	50.00	50.00	-432.76	18.39	9.41	50.00	50.00	-279.83	24.83	1.73	50.00	50.00	-705.46	24.68	5.56	50.00	50.00	-419.32	23.16	5.62	50.00
7189.0	7189 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-0.77	-0.09	50.00	42.82	429.39	-9.79	4.76	50.00	50.00	600.69	-10.56	8.05	50.00	50.00	237.47	-4.55	1.25	50.00	50.00	722.79	-11.85	8.75	50.00	50.00	500.65	2.34	-5.40	50.00
	7189 R	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-8.94	4.59	50.00	50.00	509.55	-0.59	-0.10	50.00	42.82	428.28	-2.57	-1.10	50.00	42.82	688.49	-10.66	9.01	50.00	50.00	224.20	2.21	-5.26	50.00	46.89	427.92	-10.79	8.44	50.00
7199.0	7199 L	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	7.42	-6.54	50.00	47.29	-483.77	0.93	-2.01	50.00	46.93	-669.56	4.07	-7.54	50.00	46.98	-834.50	0.18	4.38	50.00	50.00	-241.74	1.61	-1.38	50.00	47.30	-555.96	8.79	-9.67	50.00
	7199 R	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	0.81	-1.76	50.00	47.15	-699.73	7.14	-5.60	50.00	47.49	-485.30	0.58	2.60	50.00	50.00	-260.58	2.25	-4.00	50.00	47.21	-879.13	8.43	-8.33	50.00	47.41	-501.20	1.43	-1.22	50.00
7205.0	7205 L	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	30.51	4.37	50.00	50.00	501.05	19.59	3.21	50.00	50.00	446.45	20.01	10.24	50.00	50.00	301.17	30.00	-3.37	50.00	49.32	879.58	26.56	0.78	50.00	50.00	509.03	28.57	5.61	50.00
	7205 R	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	21.93	4.32	50.00	50.00	446.45	33.62	6.14	50.00	50.00	486.93	33.96	-4.22	50.00	48.81	845.99	21.60	13.73	50.00	50.00	286.99	31.45	7.07	50.00	50.00	477.86	28.96	1.50	50.00
7219.0	7219 L	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	36.09	1.64	50.00	50.00	-542.67	22.72	5.43	50.00	50.00	-423.33	35.16	-3.25	50.00	48.85	-824.73	22.34	13.67	50.00	50.00	-266.92	30.61	3.83	50.00	50.00	-480.96	29.29	7.61	50.00
	7219 R	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	20.36	4.17	50.00	50.00	-423.33	32.79	-0.60	50.00	49.43	-556.79	20.18	10.28	50.00	50.00	-281.28	31.09	-2.52	50.00	49.36	-858.18	26.56	6.18	50.00	50.00	-448.28	27.90	2.77	50.00
7225.0	7225 L	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	1.65	-1.86	50.00	47.36	443.70	-7.83	2.21	50.00	50.00	725.36	-8.08	6.22	50.00	50.00	228.98	-1.61	-3.25	50.00	43.56	859.09	-10.58	7.31	50.00	50.00	591.93	6.50	-9.56	50.00
	7225 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	-6.77	2.06	50.00	50.00	579.21	1.71	-1.77	50.00	47.45	441.86	0.84	-5.22	50.00	45.37	810.77	-8.01	6.94	50.00	50.00	210.27	5.86	-8.75	50.00	47.34	485.07	-9.03	6.58	50.00
7233.0	7233 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	-3.83	4.88	50.00	50.00	-393.49	-11.33	11.84	50.00	50.00	-474.81	-9.34	8.57	50.00	50.00	-762.03	-10.89	13.47	50.00	50.00	-89.56	-9.21	8.94	50.00	50.00	-426.48	-4.80	4.00	50.00
	7233 R	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	-10.36	10.82	50.00	50.00	-588.21	-3.39	4.41	50.00	50.00	-394.82	-9.71	11.69	50.00	50.00	-102.53	-8.70	8.29	50.00	50.00	-772.12	-4.35	3.60	50.00	50.00	-387.06	-8.35	8.08	50.00
7241.0	7241 L	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	26.12	10.99	48.89	68.45	582.77	16.94	10.98	48.89	68.45	516.09	18.31	16.82	48.89	68.45	326.60	23.64	8.00	48.89	68.45	918.71	20.51	9.87	48.89	68.45	545.16	23.31	13.44	48.89
	7241 R	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	16.40	10.95	50.00	50.00	516.09	25.52	11.34	50.00	50.00	569.44	23.84	7.40	50.00	50.00	886.55	17.53	17.30	50.00	50.00	311.33	22.72	13.69	50.00	50.00	519.09	19.95	9.97	50.00
7252.0	7252 L	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	22.68	4.40	50.00	50.00	-664.44	13.04	6.06	50.00	50.00	-537.46	22.12	2.02	50.00	50.00	-934.39	13.44	10.91	50.00	50.00	-360.18	20.53	5.53	50.00	50.00	-598.94	16.76	4.64	50.00
	7252 R	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	13.06	5.93	48.89	68.45	-537.46	22.68	3.95	48.89	68.45	-678.56	13.74	10.24	48.89	68.45	-381.05	21.42	2.44	48.89	68.45	-961.21	16.57	4.21	48.89	68.45	-624.35	20.54	5.10	48.89
7260.0	7260 L	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	2.19	-1.35	50.00	49.50	202.05	-6.82	3.20	50.00	50.00	486.83	-7.15	6.69	50.00	50.00	23.10	0.89	-3.98	50.00	48.01	656.11	-7.89	9.22	50.00	50.00	370.36	11.43	-13.99	50.00
	7260 R	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	-7.75	3.30	50.00	50.00	466.60	1.87	-1.18	50.00	49.06	199.57	1.85	-5.18	50.00	48.46	625.43	-9.09	7.77	50.00	50.00	7.83	11.66	-13.55	50.00	48.91	301.68	-8.63	9.06	50.00
7269.0	7269 L	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	28.01	-28.97	50.00	48.94	-766.02	13.15	-18.76	50.00	48.86	-880.57	18.00	-22.39	50.00	48.89	-1100.53	15.81	-18.58	50.00	48.91	-452.51	19.36	-23.37	50.00	48.90	-894.35	25.37	-28.06	50.00
	7269 R	42.00	2.50	96.00	1.25	42.00	2.50	70.00	50.00	70.00	0.98	10.86	-16.41	68.29	65.85	-913.60	23.38	-25.89	68.29	65.97	-769.13	14.27	-17.64	68.29	65.92	-473.28	14.34	-19.08	68.29	65.90	-1114.32	21.28	-25.06	68.29	65.94	-780.94	16.02	-20.69	68.29
7277.0	7277 L	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	40.00	-8.22	68.63	67.75	749.23	30.54	-7.08	68.63	67.75	671.28	31.28	10.43	68.63	68.63	483.88	36.63	-8.40	68.63	67.75	1045.19	31.55	-2.67	68.63	67.75	668.37	40.65	-11.51	68.63
	7277 R	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	35.18	-7.49	68.95	67.83	671.28	45.60	-8.16	68.95	67.85	737.67	42.91	-9.74	68.95	67.82	1009.72	35.56	12.74	68.95	68.95	475.24	45.79	-11.43	68.95	67.80	709.73	36.76	-2.72	68.95
7287.0	7287 L	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	36.41	18.51	68.95	68.95	-452.02	26.66	18.55	68.95	68.95	-371.57	37.08	12.46	68.95	68.95	-794.42	25.87	25.82	68.95	68.95	-199.61	30.82	14.10	68.95	68.95	-493.92	35.52	20.09	68.95
	7287 R	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	22.79	16.08	68.63	68.63	-371.57	31.54	15.80	68.63	68.63	-464.59	22.55	21.89	68.63	68.63	-217.35	31.49	11.13	68.63	68.63	-821.08	31.03	17.56	68.63	68.63	-402.45	26.30	11.69	68.63
7295.0	7295 L	42.00	2.50	114.00	1.25	42.00	2.50	70.00	50.00	70.00	0.97	-9.58	10.07	68.21	68.21	1010.05	-20.34	25.98	68.21	68.21	1196.69	-18.87	24.03	68.21	68.21	824.25	-17.01	20.86	68.21	68.21	1377.44	-21.01	27.15	68.21	68.21	1116.67	-6.65	6.64	68.21
	7295 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-16.13	19.70	68.44	68.44	1158.42	-6.90	7.28	68.44	68.44	1010.05	-12.85	15.06	68.44	68.44	1352.30	-15.24	18.84	68.44	68.44	803.12	-5.15	5.20	68.44	68.44	1035.89	-16.74	20.65	68.44
7305.0	7305 L	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-30.23	32.60	68.44	68.44	-262.67	-36.11	41.67	68.44	68.44	-474.11	-37.35	44.07	68.44	68.44	-575.60	-31.21	34.10	68.44	68.44	-84.51	-30.90	33.22	68.44	68.44	-299.18	-31.19	33.43	68.44
	7305 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-36.11	41.67	68.44	68.44	-493.57	-30.23	32.60	68.44	68.44	-262.67	-30.58	33.01	68.44	68.44	-115.30	-37.97	45.15	68.44	68.44	-610.61	-31.19	33.43	68.44	68.44	-293.73	-30.90	33.22	68.44
7402.0	7402 L	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-30.42	-5.19	63.56	59.60	-462.18	-31.24	-16.42	63.56	59.60	-527.50	-39.42	-2.77	63.56	59.60	-615.38	-25.62	-18.62	63.56	59.60	-419.96	-35.51	-17.54	63.56	59.60	-486.45	-34.35	-13.24	63.56
	7402 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-32.68	-18.12	63.86	63.86	-391.03	-31.57	-6.78	63.86	63.86	-363.93	-26.47	-20.83	63.86	63.86	-300.41	-41.14	-4.33	63.86	63.86	-494.29	-35.55	-14.93	63.86	63.86	-401.26	-36.51	-18.81	63.86
7407.0	7407 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-12.74	-23.60	63.86	63.86	69.44	-22.04	-26.13	63.86	63.86	240.51	-11.55	-27.40	63.86	63.86	28.00	-23.44	-23.57	63.86	63.86	278.55	-24.72	-31.68	63.86	63.86	138.28	-24.49	-31.32	63.86
	7407 R	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-20.90	-24.91	63.76	63.76	359.03	-11.98	-22.65	63.76	63.76	155.80	-22.26	-22.53	63.76	63.76	392.25	-10.74	-26.22	63.76	63.76	121.46	-23.63	-30.35	63.76	63.76	228.78	-23.85	-30.68	63.76
7411.0	7411 L	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-11.29	-23.36	63.76	63.76	-191.55	-20.22	-26.21	63.76	63.76	-368.91	-21.99	-23.07	63.76	63.76	-409.77	-10.10	-26.91	63.76	63.76	-158.66	-23.27	-31.44	63.76	63.76	-259.62	-23.15	-30.77	63.76
	7411 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-21.35	-27.45	63.86	63.86	-250.40	-12.04	-24.32	63.86	63.86	-105.47	-10.96	-28.51	63.86	63.86	-65.39	-23.24	-24.03	63.86	63.86	-295.81	-24.00	-31.76	63.86	63.86	-166.17	-24.14	-32.45	63.86
7416.0	7416 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-27.08	-12.34	63.86	63.86	327.47	-29.90	-20.55	63.86	63.86	375.65	-22.83	-21.45	63.86	63.86	286.98	-35.22	-8.86	63.86	63.86	457.46	-34.33	-22.33	63.86	63.86	352.92	-32.40	-23.63	63.86
	7416 R	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-28.51	-18.98	63.56	59.60	511.47	-26.09	-11.10	63.56	59.60	424.79	-33.83	-8.60	63.56	59.60	577.80	-22.76	-17.56	63.56	59.60	404.87	-31.34	-22.43	63.56	59.60	477.81	-33.50	-21.27	63.56
7422.0	7422 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-27.34	-2.02	50.00	50.00	-415.82	-30.42	-12.70	50.00	50.00	-499.94	-35.82	-0.76	50.00	50.00	-566.05	-24.59	-11.21	50.00	50.00	-399.11	-31.95	-13.88	50.00	50.00	-445.65	-34.90	-12.28	50.00
	7422 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-35.26	-15.20	68.13	68.13	-379.47	-31.52	-2.85	68.13	68.13	-336.03	-27.41	-15.31	68.13	68.13	-298.21	-41.43	0.80	68.13	69.30	-462.45	-40.18	-14.59	68.13	68.13	-376.57	-36.80	-16.31	68.13
7427.0	7427 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-8.24	-24.85	68.13	68.13	12.75	-19.34	-29.14	68.13	68.13	168.63	-7.34	-29.76	68.13	68.13	-24.34	-20.84	-25.82	68.13	68.13	205.67	-22.66	-35.04	68.13	68.13	76.02	-23.08	-34.97	68.13
	7427 R	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-18.14	-27.74	67.81	67.81	270.16	-7.54	-23.82	67.81	67.81	81.69	-19.72	-24.93	67.81	67.81	303.02	-6.36	-27.72	67.81	67.81	51.99	-22.24	-33.89	67.81	67.81	154.65	-21.78	-33.90	67.81
7431.0	7431 L	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-7.67	-23.74	67.81	67.81	-75.69	-18.58	-27.73	67.81	67.81	-259.92	-19.70	-24.46	67.81	67.81	-294.33	-6.38	-27.48	67.81	67.81	-45.08	-22.17	-34.18	67.81	67.81	-145.13	-22.43	-33.65	67.81
	7431 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-19.78	-29.12	68.13	68.13	-158.56	-8.36	-24.77	68.13	68.13	-6.69	-7.35	-29.56	68.13	68.13	31.47	-20.82	-25.34	68.13	68.13	-197.17	-23.28	-34.73	68.13	68.13	-71.87	-23.06	-35.32	68.13
7436.0	7436 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-34.79	-3.86	68.13	68.13	344.70	-36.75	-12.32	68.13	68.13	396.00	-30.48	-16.06	68.13	68.13	306.14	-44.19	3.17	68.15	69.30	471.38	-39.91	-18.77	68.13	68.13	348.52	-40.55	-12.06	68.13
	7436 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-31.09	-10.17	50.00	50.00	511.78	-30.24	-2.93	50.00	50.00	424.39	-37.95	1.63	50.00	50.00	574.57	-26.92	-11.78	50.00	50.00	406.25	-35.25	-10.02	50.00	50.00	493.76	-34.69	-16.09	50.00

Section Properties & Force Results

Ref. Delta Frame Design

STRENGTH I

Splice	Splice	Top Flange		Web		Bottom Flange		Fytf	Fyw	Fybf	Rh	MAX FX					MIN FX					MAX FY					MIN FY					MAX MY					MIN MY		
Node	Side	b (in)	t (in)	h (in)	t (in)	b (in)	t (in)	(ksi)	(ksi)	(ksi)		Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Ca
												TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF
7442.0	7442 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-24.07	-8.61	50.00	50.00	-388.18	-27.97	-19.84	50.00	50.00	-472.80	-33.69	-8.35	50.00	50.00	-538.07	-20.84	-17.94	50.00	50.00	-367.73	-27.07	-20.31	50.00	50.00	-413.50	-31.48	-18.67	50.00
	7442 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-33.11	-23.79	67.05	67.05	-339.42	-28.31	-10.59	67.05	67.05	-296.02	-23.86	-23.49	67.05	67.05	-254.17	-39.13	-8.04	67.05	67.05	-421.95	-37.44	-22.76	67.05	67.05	-336.43	-32.32	-24.56	67.05
7447.0	7447 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-15.50	-24.27	67.05	67.05	112.34	-26.50	-27.40	67.05	67.05	273.78	-14.74	-29.24	67.05	67.05	76.95	-27.51	-23.57	67.05	67.05	311.62	-28.36	-32.69	67.05	67.05	176.89	-29.41	-33.29	67.05
	7447 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-25.05	-25.92	66.71	66.71	383.53	-14.59	-23.17	66.71	66.71	189.46	-26.06	-22.32	66.71	66.71	417.17	-13.67	-27.37	66.71	66.71	161.71	-28.35	-32.14	66.71	66.71	257.71	-27.25	-31.49	66.71
7451.0	7451 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-14.18	-22.83	66.71	66.71	-190.59	-24.50	-25.68	66.71	66.71	-388.96	-25.82	-22.39	66.71	66.71	-421.65	-12.96	-26.69	66.71	66.71	-163.06	-27.38	-31.86	66.71	66.71	-266.13	-27.74	-31.63	66.71
	7451 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-26.29	-26.66	67.05	67.05	-287.61	-15.12	-23.95	67.05	67.05	-113.55	-14.11	-28.36	67.05	67.05	-78.99	-27.25	-23.63	67.05	67.05	-316.01	-28.82	-32.78	67.05	67.05	-177.87	-28.48	-33.06	67.05
7456.0	7456 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-27.30	-9.83	67.05	67.05	296.34	-31.32	-24.15	67.05	67.05	334.13	-23.63	-24.73	67.05	67.05	252.03	-38.74	-8.68	67.05	67.05	419.30	-31.41	-25.13	67.05	67.05	296.63	-37.32	-22.01	67.05
	7456 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-26.47	-20.22	50.00	50.00	462.66	-23.26	-8.02	50.00	50.00	385.05	-32.91	-8.43	50.00	50.00	530.67	-20.06	-18.34	50.00	50.00	361.90	-31.41	-18.05	50.00	50.00	457.56	-26.31	-20.85	50.00
7462.0	7462 L	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-24.48	-1.09	50.00	49.25	-383.66	-31.11	-15.36	50.00	49.25	-493.73	-36.83	-4.62	50.00	49.25	-563.72	-20.96	-9.36	50.00	49.25	-350.01	-26.23	-9.99	50.00	49.25	-399.99	-33.98	-13.28	50.00
	7462 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-36.89	-19.42	67.05	67.05	-369.41	-29.30	-2.90	67.05	67.05	-306.57	-24.94	-15.10	67.05	67.05	-255.78	-43.52	-4.37	67.05	67.05	-454.18	-40.28	-17.50	67.05	67.05	-371.60	-31.13	-13.06	67.05
7467.0	7467 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-8.95	-24.28	67.05	67.05	0.35	-21.42	-30.88	67.05	67.05	167.73	-7.61	-31.21	67.05	67.05	-45.44	-22.81	-25.43	67.05	67.05	207.06	-17.31	-28.72	67.05	67.05	66.53	-16.01	-27.52	67.05
	7467 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-20.11	-29.40	66.71	66.71	276.19	-8.23	-23.24	66.71	66.71	70.26	-21.61	-25.00	66.71	66.71	308.25	-6.69	-29.13	66.71	66.71	34.65	-15.09	-26.36	66.71	66.71	152.14	-16.39	-27.57	66.71
7471.0	7471 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-8.58	-22.38	66.71	66.71	-74.16	-19.32	-30.02	66.71	66.71	-270.48	-21.27	-25.08	66.71	66.71	-316.06	-6.86	-27.99	66.71	66.71	-32.47	-16.28	-28.38	66.71	66.71	-151.79	-15.39	-25.70	66.71
	7471 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-20.61	-31.53	67.05	67.05	-159.53	-9.31	-23.40	67.05	67.05	-3.98	-7.64	-30.77	67.05	67.05	47.30	-22.72	-25.20	67.05	67.05	-212.35	-16.30	-26.82	67.05	67.05	-72.72	-17.21	-29.56	67.05
7476.0	7476 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-29.07	-2.69	67.05	67.05	302.98	-37.09	-18.20	67.05	67.05	382.97	-24.30	-14.84	67.05	67.05	255.31	-43.43	-4.47	67.05	67.05	463.47	-31.33	-15.36	67.05	67.05	308.40	-40.80	-13.84	67.05
	7476 R	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-31.22	-14.32	50.00	49.25	507.41	-24.29	-0.93	50.00	49.25	379.50	-36.26	-2.78	50.00	49.25	574.40	-20.62	-10.91	50.00	49.25	350.98	-34.34	-10.06	50.00	49.25	500.38	-26.43	-12.03	50.00
7482.0	7482 L	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-28.01	5.18	50.00	50.00	-414.84	-34.53	-7.97	50.00	49.18	-557.47	-39.03	3.67	50.00	50.00	-614.80	-26.40	-4.01	50.00	49.18	-400.94	-31.53	-7.64	50.00	49.18	-454.24	-37.47	-3.70	50.00
	7482 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-40.13	-11.65	67.05	67.05	-434.32	-32.74	2.99	67.08	69.29	-340.72	-30.35	-9.12	67.05	67.05	-310.87	-45.87	1.87	67.05	69.29	-503.26	-43.84	-7.29	67.05	67.05	-441.26	-36.38	-11.16	67.05
7487.0	7487 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-6.77	-25.19	67.05	67.05	-45.94	-17.84	-34.51	67.05	67.05	102.50	-5.54	-33.38	67.05	67.05	-92.49	-19.59	-29.32	67.05	67.05	147.74	-14.80	-31.83	67.05	67.05	19.01	-14.29	-29.45	67.05
	7487 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-16.61	-32.95	66.71	66.71	211.84	-6.11	-24.16	66.71	66.71	22.09	-18.40	-28.07	66.71	66.71	250.47	-4.60	-30.07	66.71	66.71	-13.13	-13.42	-28.27	66.71	66.71	103.40	-13.93	-30.62	66.71
7491.0	7491 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-6.60	-25.91	66.71	66.71	-32.26	-15.59	-32.05	66.71	66.71	-194.92	-18.26	-26.42	66.71	66.71	-248.04	-4.35	-32.47	66.71	66.71	12.02	-13.28	-29.95	66.71	66.71	-102.51	-13.78	-29.04	66.71
	7491 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-16.79	-33.59	67.05	67.05	-85.08	-7.29	-27.00	67.05	67.05	40.89	-5.40	-35.23	67.05	67.05	96.79	-19.45	-27.64	67.05	67.05	-145.42	-14.62	-30.20	67.05	67.05	-20.21	-14.19	-31.20	67.05
7496.0	7496 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-33.14	1.92	67.05	69.29	353.89	-41.25	-10.97	67.05	67.05	434.70	-29.53	-10.54	67.05	67.05	300.64	-47.36	4.27	67.08	69.29	515.81	-36.51	-9.65	67.05	67.05	359.05	-43.61	-8.74	67.05
	7496 R	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-35.54	-7.25	50.00	49.18	556.18	-28.31	4.19	50.00	50.00	431.68	-40.40	6.01	50.00	50.00	624.94	-25.58	-6.24	50.00	49.18	393.89	-37.58	-4.80	50.00	49.18	542.24	-31.55	-6.21	50.00
7502.0	7502 L	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-27.12	1.23	50.00	50.00	-457.79	-32.94	-12.64	50.00	50.00	-582.78	-37.42	1.54	50.00	50.00	-661.14	-23.81	-9.10	50.00	50.00	-441.99	-31.51	-10.09	50.00	50.00	-506.19	-34.74	-11.73	50.00
	7502 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-36.33	-14.84	68.37	68.37	-445.06	-29.88	-2.08	68.37	68.37	-372.38	-26.10	-14.62	68.37	68.37	-330.71	-41.37	2.36	68.37	69.42	-545.80	-38.15	-14.01	68.37	68.37	-425.55	-34.59	-12.12	68.37
7507.0	7507 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-7.11	-23.93	68.37	68.37	-6.86	-18.71	-28.65	68.37	68.37	178.62	-5.48	-30.53	68.37	68.37	-65.30	-20.04	-24.59	68.37	68.37	231.82	-18.93	-31.06	68.37	68.37	76.00	-18.91	-30.74	68.37
	7507 R	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-17.69	-27.47	68.10	68.10	294.61	-6.54	-23.09	68.10	68.10	66.81	-19.05	-23.65	68.10	68.10	342.44	-4.80	-27.78	68.10	68.10	20.22	-18.21	-29.85	68.10	68.10	154.18	-18.24	-30.16	68.10
7511.0	7511 L	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-6.58	-22.74	68.10	68.10	-66.63	-17.58	-27.23	68.10	68.10	-305.17	-19.31	-24.07	68.10	68.10	-347.40	-5.09	-27.77	68.10	68.10	-13.75	-18.02	-29.86	68.10	68.10	-158.71	-18.59	-30.18	68.10
	7511 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-18.60	-28.40	68.37	68.37	-189.36	-7.12	-23.56	68.37	68.37	6.91	-5.70	-30.49	68.37	68.37	70.75	-20.27	-24.93	68.37	68.37	-236.66	-19.26	-31.05	68.37	68.37	-70.23	-18.74	-30.78	68.37
7516.0	7516 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-29.66	-1.75	68.37	68.37	368.70	-33.99	-14.77	68.37	68.37	434.28	-25.58	-15.29	68.37	68.37	322.02	-41.62	2.47	68.38	69.42	546.18	-33.68	-13.26	68.37	68.37	381.41	-37.90	-11.66	68.37
	7516 R	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-30.78	-12.75	50.00	50.00	570.67	-26.85	1.33	50.00	50.00	452.98	-37.71	1.77	50.00	50.00	662.95	-23.42	-10.76	50.00	50.00	431.81	-34.68	-9.49	50.00	50.00	557.98	-30.58	-11.18	50.00
7522.0	7522 L	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-36.51	15.73	69.43	49.59	-631.36	-43.19	8.33	69.43	49.59	-788.31	-50.03	18.96	69.43	49.59	-873.04	-33.47	8.14	69.43	49.59	-612.83	-45.75	16.66	69.43	49.59	-739.71	-36.94	8.13	69.43
	7522 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-46.34	8.46	67.97	69.53	-656.88	-38.86	16.73	67.97	69.53	-554.38	-35.44	4.98	67.97	69.53	-512.52	-52.90	21.30	67.97	69.53	-760.18	-39.49	8.79	67.97	69.53	-624.45	-48.87	17.11	67.97
7527.0	7527 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	1.76	-24.12	69.53	67.97	-210.07	-8.69	-28.66	67.97	67.97	-26.57	2.88	-30.83	69.53	67.97	-269.43	-10.19	-25.49	67.97	67.97	28.24	-10.22	-31.19	67.97	67.97	-114.81	-9.65	-29.70	67.97
	7527 R	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	-8.10	-27.80	67.87	67.87	85.18	1.97	-23.48	69.42	67.87	-143.06	-9.70	-24.91	67.87	67.87	133.75	3.24	-28.09	69.42	67.87	-188.94	-9.33	-29.09	67.87	67.87	-44.59	-9.80	-30.48	67.87
7531.0	7531 L	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	2.16	-23.29	69.42	67.87	133.56	-9.17	-28.83	67.87	67.87	-117.45	-9.71	-25.77	67.87	67.87	-152.35	2.99	-27.36	69.42	67.87	180.20	-8.66	-29.59	67.87	67.87	37.73	-9.49	-30.06	67.87
	7531 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-9.71	-29.64	67.97	67.97	-5.77	1.98	-23.94	69.53	67.97	200.18	2.64	-30.06	69.53	67.97	258.39	-10.17	-26.28	67.97	67.97	-46.27	-9.80	-30.65	67.97	67.97	95.06	-9.08	-30.29	67.97
7536.0	7536 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-32.51	11.49	67.97	69.53	486.94	-40.23	-4.41	67.97	67.97	588.48	-30.55	-3.91	67.97	67.97	448.39	-44.89	14.33	67.97	69.53	678.16	-32.27	7.56	67.97	69.53	503.51	-37.66	-6.05	67.97
	7536 R	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-37.51	-4.30	69.43	49.59	715.78	-30.57	10.82	69.43	49.59	559.52	-42.18	11.91	69.43	49.59	787.81	-28.53	4.32	69.43	49.59	544.05	-35.21	-5.88	69.43	49.59	648.38	-30.20	7.07	69.43
7542.0	7542 L	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-27.67	-11.54	68.43	69.35	-586.66	-33.04	-19.48	68.43	69.35	-725.34	-38.17	-11.70	68.43	69.35	-805.91	-24.19	-15.81	68.43	69.35	-563.01	-35.02	-16.32	68.43	69.35	-710.86	-25.48	-13.95	68.43
	7542 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-36.08	-22.08	69.57	69.57	-541.93	-30.14	-13.40	69.57	69.57	-455.33	-26.62	-20.72	69.57	69.57	-408.91	-41.50	-12.63	69.57	69.57	-640.38	-27.88	-15.93	69.57	69.57	-453.65	-38.16	-18.75	69.57
7547.0	7547 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-11.71	-25.84	69.57	69.57	94.85	-19.20	-28.48	69.57	69.57	276.86	-10.61	-30.94	69.57	69.57	35.15	-19.63	-25.26	69.57	69.57	318.01	-18.21	-29.18	69.57	69.57	175.86	-19.61	-30.12	69.57
	7547 R	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-18.41	-27.58	69.47	69.47	430.68	-11.20	-25.15	69.47	69.47	207.17	-18.88	-24.65	69.47	69.47	465.51	-9.91	-28.61	69.47	69.47	159.51	-19.02	-29.40	69.47	69.47	270.39	-17.56	-28.40	69.47
7551.0	7551 L	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-11.12	-24.28	69.47	69.47	-197.41	-20.47	-30.10	69.47	69.47	-444.55	-20.17	-26.21	69.47	69.47	-481.28	-10.69	-28.94	69.47	69.47	-152.48	-17.17	-27.27	69.47	69.47	-268.68	-19.72	-30.45	69.47
	7551 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-21.27	-31.02	69.57	69.57	-272.81	-11.65	-24.97	69.57	69.57	-71.28	-11.16	-30.74	69.57	69.57	-13.98	-20.89	-26.79	69.57	69.57	-316.62	-20.33	-31.19	69.57	69.57	-164.37	-17.80	-28.03	69.57
7556.0	7556 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-34.41	-3.84	69.57	69.57	583.32	-38.70	-10.74	69.57	69.57	693.54	-29.94	-13.44	69.57	69.57	515.23	-43.75	-1.92	69.57	69.57	784.71	-42.17	-6.09	69.57	69.57	703.22	-32.32	-10.36	69.57
	7556 R	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-35.30	-8.76	68.43	69.35	897.17	-31.49	-2.43	68.43	69.35	731.27	-39.53	1.36	68.43	69.35	971.63	-27.96	-10.36	68.43	69.35	685.20	-29.41	-8.62	68.43	69.35	797.85	-38.63	-4.28	68.43
9007.0	9007 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-29.07	23.30	69.06	69.06	94.09	-37.31	36.27	69.06	69.06	294.67	-29.17	23.33	69.06	69.06	-7.84	-37.67	36.82	69.06	69.06	344.76	-30.80	25.70	69.06	69.06	124.19	-30.91	25.55	69.06
	9007 R	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-37.31	36.27	69.06	69.06	210.86	-29.54	24.09	69.06	69.06	109.17	-37.42	36.40	69.06	69.06	320.73	-32.12	28.08	69.06	69.06	-23.79	-30.91	25.55	69.06	69.06	125.73	-30.80	25.70	69.06
9015.0	9015 L	42.00	2.25	96.00	1.00	48.00	3.00	70.00	50.00	70.00	0.99	-7.32	5.88	69.06	69.06	-574.61	-11.21	11.96	69.06	69.06	-740.07	-9.13	8.85	69.06	69.06	-874.01	-13.56	15.98	69.06	69.06	-471.96	-14.23	16.74	69.06	69.06	-678.60	4.76	-4.87	69.06
	9015 R	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	-12.64	17.70	68.08	68.08	-797.09	-8.54	8.68	68.08	68.08	-573.27	-14.69	22.40	68.08	68.08	-477.90	-11.11	14.68	68.08	68.08	-911.74	5.42	-6.42	68.08	59.12	-625.30	-15.46	23.64	68.08
9021.0	9021 L	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	27.78	10.41	68.04	68.04	311.38	16.85	14.70	68.04	68.04	191.26	16.30	19.22	68.04	68.04	84.42	26.36	9.93	68.04	68.04	539.83	20.05	10.31	68.04	68.04	261.66	26.79	13.39	68.04
	9021 R	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	21.56	19.07	68.21	68.21	191.27	34.27	14.42	68.21	68.21	302.34	33.51	12.27	68.21	68.21	517.96	20.95	25.66	68.21	68.21	77.79	32.45	17.00	68.21	68.21	249.04	25.72	14.75	68.21
9035.0	9035 L	38.00	2.00	96.00	1.00	38.00	2.00	70.00	50.00	70.00	0.97	40.06	3.15	68.21	68.21	-419.88	29.88	-4.25	68.21	62.45	-425.21	39.50	-9.01	68.21	62.45	-659.95	27.86	11.80	68.21	68.21	-227.60	33.38	-1.00	68.21	62.45	-403.32	38.23	4.47	68.21
	9035 R	42.00	2.00	96.00	1.50	42.00	2.25	70.00	50.00	70.00	0.97	24.11	-3.59	68.04	62.87	-425.21	32.93	-2.61	68.04	62.87	-428.92	22.85	7.97	68.04	68.04	-234.25	29.92	-3.52	68.04	62.87	-680.87	31.71	-4.56	68.04	62.87	-402.26	27.45	-1.57	68.04
9041.0	9041 L	42.00	2.00	96.00	1.25	42.00	2.00	70.00	50.00	70.00	0.97	12.53	-11.26	68.08	59.12	491.98	10.91	-15.42	68.08	59.12	594.78	6.71	-7.32	68.08	59.12	296.63	7.85	-10.41	68.08	59.12	773.99	3.24	-4.60	68.08	59.12	561.60	21.53	-23.22	68.08
	9041 R	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	13.03	-19.41	67.93	62.30	503.76	15.14	-14.12	67.93	62.59	487.71	11.98	-15.70	67.93	62.38	740.00	7.19	-8.29	67.93	62.46	288.84	26.19	-29.37	67.93	62.47	472.66	3.37	-5.36	67.93
9051.0	9051 L	32.00	2.00	96.00	1.00	32.00	2.00	70.00	50.00	70.00	0.97	5.54	-1.23	67.93	63.39	-351.45	7.89	-11.77	67.93	62.30	-436.52	7.54	-8.70	67.93	62.46	-635.54	2.65	4.00	67.93	67.93	-196.04	2.49	5.57	67.93	67.93	-440.57	21.71	-22.81	67.93
	9051 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	7.15	-10.75	50.00	47.17	-444.28	5.09	-1.10	50.00	47.84	-355.40	2.82	1.95	50.00	50.00	-203.44	4.18	-5.26	50.00	47.24	-670.23	20.13	-20.97	50.00	47.31	-387.83	2.12	5.33	50.00
9057.0	9057 L	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	28.78	4.50	50.00	50.00	387.98	17.74	6.06	50.00	50.00	334.35	17.99	11.82	50.00	50.00	194.99	25.94	4.80	50.00	50.00	642.62	21.97	3.21	50.00	50.00	372.20	26.91	6.61	50.00
	9057 R	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	18.59	6.44	50.00	50.00	334.35	29.85	4.92	50.00	50.00	381.07	27.88	4.17	50.00	50.00	620.84	18.63	13.05	50.00	50.00	188.09	27.93	6.79	50.00	50.00	361.59	22.91	3.82	50.00
9071.0	9071 L	32.00	2.75	96.00	1.25	32.00	2.75	50.00	50.00	50.00	1.00	27.96	8.37	50.00	50.00	-329.33	18.10	9.28	50.00	50.00	-297.71	25.16	6.99	50.00	50.00	-573.11	18.27	16.69	50.00	50.00	-134.81	21.43	7.60	50.00	50.00	-311.70	25.78	10.35	50.00
	9071 R	32.00	2.75	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	17.20	8.86	50.00	50.00	-297.71	26.89	7.83	50.00	50.00	-336.24	17.58	15.39	50.00	50.00	-141.59	23.21	7.55	50.00	50.00	-594.91	24.76	10.08	50.00	50.00	-302.99	20.47	6.90	50.00
9077.0	9077 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	-8.74	12.01	50.00	50.00	440.33	-7.94	4.15	50.00	50.00	541.20	-12.89	13.23	50.00	50.00	261.10	-9.82	8.15	50.00	50.00	747.36	-13.60	17.41	50.00	50.00	526.06	5.63	-7.33	50.00
	9077 R	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	-7.17	3.42	50.00	50.00	468.06	-7.55	9.47	50.00	50.00	431.48	-6.74	4.79	50.00	50.00	714.37	-12.14	11.20	50.00	50.00	248.84	5.46	-6.23	50.00	48.38	428.12	-12.36	14.02	50.00
9089.0	9089 L	32.00	2.50	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	3.32	1.61	50.00	50.00	-513.48	8.98	-10.83	50.00	48.36	-622.42	3.77	-3.78	50.00	48.41	-812.28	1.32	3.25	50.00	50.00	-341.82	1.18	5.96	50.00	50.00	-620.26	15.81	-14.85	50.00
	9089 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	8.42	-11.59	50.00	47.36	-632.26	3.09	1.78	50.00	50.00	-517.88	1.44	2.79	50.00	50.00	-349.50	3.08	-2.53	50.00	47.53	-838.89	15.16	-15.92	50.00	47.45	-521.36	-1.25	6.33	50.00
9095.0	9095 L	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	28.87	4.08	50.00	50.00	333.27	19.80	4.02	50.00	50.00	305.41	18.37	11.54	50.00	50.00	148.94	27.10	2.63	50.00	50.00	601.57	26.07	2.73	50.00	50.00	333.16	28.54	5.04	50.00
	9095 R	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	20.08	4.77	50.00	50.00	305.42	29.26	5.36	50.00	50.00	326.36	31.29	-3.68	50.00	48.83	580.68	18.41	13.02	50.00	50.00	142.08	28.83	6.10	50.00	50.00	310.36	26.60	4.04	50.00
9109.0	9109 L	36.00	2.75	96.00	1.00	36.00	2.75	50.00	50.00	50.00	1.00	33.03	2.38	50.00	50.00	-385.90	20.73	3.11	50.00	50.00	-311.27	30.46	-1.52	50.00	48.90	-599.22	21.05	10.47	50.00	50.00	-161.03	27.21	2.95	50.00	50.00	-339.84	31.30	5.04	50.00
	9109 R	36.00	2.50	96.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	20.44	2.22	50.00	50.00	-311.27	32.72	-1.97	50.00	48.86	-392.81	20.90	8.92	50.00	50.00	-167.99	29.26	-1.87	50.00	48.86	-621.10	31.01	3.82	50.00	50.00	-333.60	26.79	1.69	50.00
9115.0	9115 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	10.36	-8.19	50.00	47.54	487.91	3.59	-7.67	50.00	47.23	618.47	-2.24	3.47	50.00	50.00	342.77	3.77	-6.61	50.00	47.29	811.91	-4.79	3.58	50.00	50.00	584.53	16.99	-17.52	50.00
	9115 R	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	4.09	-8.28	50.00	47.17	609.39	12.13	-8.93	50.00	47.51	482.94	7.00	-9.55	50.00	47.30	784.38	-3.86	4.79	50.00	50.00	333.52	20.13	-19.14	50.00	47.42	517.74	-5.84	3.93	50.00
9127.0	9127 L	32.00	2.00	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	2.42	2.27	50.00	50.00	-380.52	-1.28	-1.00	50.00	43.56	-540.51	1.26	-1.76	50.00	47.29	-723.34	-3.43	8.42	50.00	50.00	-230.55	-3.31	6.39	50.00	50.00	-543.91	7.90	-6.45	50.00
	9127 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-1.42	-0.95	50.00	42.82	-550.56	2.33	2.62	50.00	50.00	-385.29	-3.20	8.97	50.00	50.00	-237.90	-0.62	0.49	50.00	50.00	-750.99	8.00	-7.41	50.00	47.27	-393.89	-3.39	7.30	50.00
9133.0	9133 L	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	23.62	5.11	50.00	50.00	297.02	14.63	3.50	50.00	50.00	300.35	14.89	10.66	50.00	50.00	162.16	22.00	1.92	50.00	50.00	601.43	20.82	3.96	50.00	50.00	426.43	20.59	7.06	50.00
	9133 R	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	18.39	4.44	50.00	50.00	300.35	28.92	6.75	50.00	50.00	290.12	27.78	1.22	50.00	50.00	577.93	18.05	14.37	50.00	50.00	156.38	25.17	8.63	50.00	50.00	264.34	25.32	4.58	50.00
9147.0	9147 L	32.00	2.25	96.00	1.00	32.00	2.25	50.00	50.00	50.00	1.00	35.03	-0.34	50.00	48.12	-384.72	20.17	4.36	50.00	50.00	-299.23	30.02	-0.87	50.00	48.09	-587.31	20.07	11.42	50.00	50.00	-172.22	28.34	2.70	50.00	50.00	-393.29	27.12	6.38	50.00
	9147 R	32.00	2.50	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	15.99	3.48	50.00	50.00	-299.23	28.85	-0.20	50.00	48.95	-391.63	16.24	8.61	50.00	50.00	-178.18	23.75	1.45	50.00	50.00	-610.73	22.33	5.41	50.00	50.00	-276.16	23.23	2.62	50.00
9153.0	9153 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	12.47	-8.89	50.00	47.38	384.95	-7.50	2.61	50.00	50.00	582.34	-5.91	8.09	50.00	50.00	197.13	2.95	-7.16	50.00	46.87	679.74	-4.88	1.93	50.00	50.00	482.48	11.41	-9.69	50.00
	9153 R	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	-8.20	2.93	50.00	50.00	523.54	13.17	-9.66	50.00	47.27	378.47	6.01	-10.82	50.00	46.85	651.50	-7.56	9.95	50.00	50.00	187.62	12.01	-10.48	50.00	47.18	370.30	-5.35	2.09	50.00
9163.0	9163 L	32.00	1.75	96.00	1.00	32.00	1.75	50.00	50.00	50.00	1.00	7.14	-0.76	50.00	47.93	-275.46	-1.62	1.66	50.00	50.00	-545.06	3.12	-4.90	50.00	46.91	-619.90	-0.76	7.39	50.00	50.00	-146.51	-1.71	5.37	50.00	50.00	-448.19	12.66	-10.57	50.00
	9163 R	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-1.65	1.53	50.00	50.00	-574.62	6.63	-0.69	50.00	47.96	-282.05	-0.50	6.06	50.00	50.00	-155.43	1.05	-1.63	50.00	47.05	-648.82	11.62	-9.59	50.00	47.32	-337.53	-1.72	4.94	50.00
9169.0	9169 L	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	26.22	2.04	50.00	50.00	395.44	14.66	3.49	50.00	50.00	307.55	15.13	9.61	50.00	50.00	190.42	22.39	1.11	50.00	50.00	616.33	20.42	2.74	50.00	50.00	432.89	21.76	5.66	50.00
	9169 R	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	18.48	4.36	50.00	50.00	307.55	31.93	2.23	50.00	50.00	388.54	28.50	-0.73	50.00	47.61	592.93	18.89	12.99	50.00	50.00	184.65	26.56	6.62	50.00	50.00	299.42	24.70	2.62	50.00
9183.0	9183 L	30.00	2.25	96.00	1.00	30.00	2.25	50.00	50.00	50.00	1.00	27.36	8.54	50.00	50.00	-312.58	18.73	5.63	50.00	50.00	-299.13	26.68	3.18	50.00	50.00	-575.45	19.85	13.50	50.00	50.00	-163.54	22.65	5.64	50.00	50.00	-373.11	25.75	7.12	50.00
	9183 R	32.00	2.25	96.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	14.76	4.50	50.00	50.00	-299.13	22.10	6.69	50.00	50.00	-319.49	15.87	10.08	50.00	50.00	-169.28	20.70	3.51	50.00	50.00	-598.85	20.97	6.11	50.00	50.00	-289.18	18.61	4.90	50.00
9189.0	9189 L	32.00	2.00	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-1.94	6.05	50.00	50.00	352.25	-5.49	0.82	50.00	50.00	478.30	-10.15	10.54	50.00	50.00	182.19	-4.78	2.82	50.00	50.00	648.02	-12.12	12.40	50.00	50.00	447.38	6.33	-7.08	50.00
	9189 R	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	-4.94	0.71	50.00	50.00	418.44	-1.70	6.03	50.00	50.00	346.45	-2.50	0.58	50.00	50.00	613.69	-10.03	11.27	50.00	50.00	174.32	5.97	-6.90	50.00	47.17	349.38	-11.09	12.11	50.00
9199.0	9199 L	32.00	2.25	96.00	1.00	32.00	2.00	50.00	50.00	50.00	1.00	4.72	2.12	50.00	50.00	-419.86	2.49	-5.10	50.00	46.94	-525.15	7.15	-9.30	50.00	47.12	-722.04	0.65	6.77	50.00	50.00	-195.94	-1.61	8.17	50.00	50.00	-508.46	14.77	-13.92	50.00
	9199 R	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	2.22	-4.04	50.00	47.20	-551.46	4.68	1.83	50.00	50.00	-426.66	0.97	4.94	50.00	50.00	-206.55	2.26	-1.94	50.00	47.46	-754.68	14.35	-12.03	50.00	47.47	-436.19	-1.53	7.08	50.00
9205.0	9205 L	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	26.41	7.73	50.00	50.00	354.92	16.88	4.00	50.00	50.00	334.86	18.01	11.80	50.00	50.00	166.14	28.00	-3.96	50.00	49.30	693.93	20.53	2.66	50.00	50.00	423.23	26.77	6.22	50.00
	9205 R	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	19.03	5.23	50.00	50.00	334.86	29.24	9.97	50.00	50.00	345.98	31.64	-4.81	50.00	48.79	675.31	20.66	14.70	50.00	50.00	158.29	29.52	7.67	50.00	50.00	355.09	23.00	4.16	50.00
9219.0	9219 L	36.00	2.50	96.00	1.00	36.00	2.50	50.00	50.00	50.00	1.00	33.79	5.40	50.00	50.00	-422.48	20.55	7.83	50.00	50.00	-313.66	34.20	-4.66	50.00	48.80	-656.57	19.80	17.53	50.00	50.00	-132.51	24.07	7.90	50.00	50.00	-339.96	28.53	8.38	50.00
	9219 R	36.00	2.50	96.00	1.38	39.00	2.75	50.00	50.00	50.00	1.00	18.27	6.43	50.00	50.00	-318.44	30.57	3.86	50.00	50.00	-436.19	17.64	13.71	50.00	50.00	-146.00	30.27	-3.95	50.00	49.31	-679.80	25.79	7.01	50.00	50.00	-332.92	21.44	5.81	50.00

Section Properties & Force Results

Ref. Delta Frame Design

STRENGTH I

Splice Node	Splice Side	Top Flange		Web		Bottom Flange		Fytf	Fyw	Fybf	Rh	MAX FX					MIN FX					MAX FY					MIN FY					MAX MY					MIN MY		
												Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Ca
		b (in)	t (in)	h (in)	t (in)	b (in)	t (in)	(ksi)	(ksi)	(ksi)		TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF
9225.0	9225 L	32.00	2.25	96.00	1.00	32.00	2.50	50.00	50.00	50.00	1.00	-3.00	7.45	50.00	50.00	352.46	0.34	-5.92	50.00	44.02	555.92	-7.05	7.85	50.00	50.00	150.41	5.75	-8.60	50.00	47.26	717.01	-8.33	12.73	50.00	50.00	460.11	16.02	-19.23	50.00
	9225 R	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	0.28	-5.29	50.00	44.19	469.72	-2.32	6.76	50.00	50.00	346.31	6.61	-9.54	50.00	47.35	687.47	-6.85	8.15	50.00	50.00	138.67	14.25	-17.66	50.00	47.39	425.63	-7.17	11.71	50.00
9232.0	9232 L	32.00	2.75	96.00	1.00	32.00	2.75	50.00	50.00	50.00	1.00	-9.66	14.99	50.00	50.00	-206.98	-11.25	9.55	50.00	50.00	-196.87	-5.90	5.31	50.00	50.00	-481.34	-11.95	15.40	50.00	50.00	75.56	-11.81	16.26	50.00	50.00	-276.26	3.85	-4.30	50.00
	9232 R	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	-10.32	8.71	50.00	50.00	-251.30	-8.77	13.82	50.00	50.00	-209.93	-10.83	13.85	50.00	50.00	71.70	-9.80	9.35	50.00	50.00	-504.72	3.64	-3.97	50.00	49.38	-190.20	-10.70	14.88	50.00
9242.0	9242 L	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	19.74	11.71	48.92	68.49	393.49	10.66	11.30	48.92	68.49	345.59	12.31	17.52	48.92	68.49	171.40	17.82	7.69	48.92	68.49	675.10	11.05	11.99	48.92	68.49	440.05	16.77	14.33	48.92
	9242 R	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	10.17	11.13	50.00	50.00	345.60	19.22	11.88	50.00	50.00	385.44	18.14	6.98	50.00	50.00	651.49	11.71	17.54	50.00	50.00	167.62	16.23	14.40	50.00	50.00	335.84	10.56	11.81	50.00
9253.0	9253 L	45.00	3.00	96.00	1.25	45.00	3.00	50.00	50.00	50.00	1.00	17.96	4.25	50.00	50.00	-505.46	8.47	5.27	50.00	50.00	-419.06	17.25	0.92	50.00	50.00	-773.74	9.91	10.66	50.00	50.00	-265.96	12.27	8.81	50.00	50.00	-456.18	14.00	2.97	50.00
	9253 R	45.00	3.00	96.00	1.38	42.00	3.00	50.00	50.00	70.00	0.98	8.52	5.23	48.92	68.49	-419.06	17.99	3.91	48.92	68.49	-512.02	10.17	10.13	48.92	68.49	-276.60	17.02	-1.00	48.92	66.92	-781.62	13.84	2.55	48.92	68.49	-510.68	12.34	8.66	48.92
9261.0	9261 L	42.00	2.25	96.00	1.00	42.00	2.25	50.00	50.00	50.00	1.00	1.01	3.38	50.00	50.00	78.38	-1.90	-2.86	50.00	45.96	185.20	-6.11	5.45	50.00	50.00	-127.08	0.68	-2.10	50.00	48.70	416.47	-6.30	10.46	50.00	50.00	148.18	16.71	-19.63	50.00
	9261 R	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	-2.19	-2.79	50.00	45.58	162.50	0.83	3.37	50.00	50.00	75.13	1.98	-3.56	50.00	48.81	386.78	-7.21	5.83	50.00	50.00	-130.90	17.75	-19.29	50.00	48.93	162.02	-6.78	10.26	50.00
9269.0	9269 L	36.00	2.25	96.00	1.00	39.00	2.50	50.00	50.00	50.00	1.00	22.34	-18.99	50.00	48.99	-514.46	21.66	-27.41	50.00	48.89	-596.16	19.29	-21.59	50.00	48.92	-805.33	17.01	-18.03	50.00	48.93	-273.90	12.98	-15.80	50.00	48.90	-609.04	29.44	-29.28	50.00
	9269 R	42.00	2.50	96.00	1.25	42.00	2.50	70.00	50.00	70.00	0.98	17.47	-23.87	68.34	65.93	-651.11	18.52	-16.98	68.34	66.09	-521.99	14.88	-16.87	68.34	66.00	-285.49	14.86	-18.00	68.34	65.98	-824.91	24.39	-26.11	68.34	66.02	-469.44	10.52	-13.81	68.34
9277.0	9277 L	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	29.44	7.58	68.64	68.64	500.31	24.39	-7.36	68.64	67.75	561.77	23.66	11.24	68.64	68.64	332.78	29.47	-7.81	68.64	67.75	865.15	24.36	2.53	68.64	68.64	556.21	30.54	8.11	68.64
	9277 R	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	27.69	-7.69	68.96	67.79	561.78	33.35	9.40	68.96	68.96	493.14	34.20	-8.86	68.96	67.80	847.07	26.64	13.63	68.96	68.96	327.22	34.26	9.59	68.96	68.96	501.01	28.02	3.96	68.96
9287.0	9287 L	45.00	3.00	96.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	27.43	9.20	68.96	68.96	-424.61	14.42	13.41	68.96	68.96	-236.67	23.92	10.44	68.96	68.96	-638.86	14.60	17.64	68.96	68.96	-105.19	15.82	12.25	68.96	68.96	-241.95	26.21	11.46	68.96
	9287 R	48.00	3.00	96.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	11.99	11.60	68.64	68.64	-236.66	23.78	7.58	68.64	68.64	-431.61	12.25	14.80	68.64	68.64	-115.25	20.23	9.29	68.64	68.64	-650.62	22.93	9.93	68.64	68.64	-404.72	13.08	10.22	68.64
9295.0	9295 L	42.00	2.50	114.00	1.25	42.00	2.50	70.00	50.00	70.00	0.97	-17.33	22.69	68.22	68.22	716.52	-14.41	15.27	68.22	68.22	929.16	-20.54	27.70	68.22	68.22	570.73	-17.22	21.51	68.22	68.22	1069.55	-22.98	31.54	68.22	68.22	920.56	-3.37	3.30	68.22
	9295 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-10.83	11.31	68.45	68.45	919.47	-13.38	17.02	68.45	68.45	716.52	-12.85	15.39	68.45	68.45	1043.67	-16.32	21.15	68.45	68.45	567.00	-2.57	2.64	68.45	68.45	748.47	-18.36	23.99	68.45
9305.0	9305 L	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-26.17	30.70	68.45	68.45	-278.06	-27.37	31.11	68.45	68.45	-296.83	-30.51	36.79	68.45	68.45	-467.49	-24.68	27.38	68.45	68.45	-70.53	-24.69	27.58	68.45	68.45	-230.34	-25.12	27.30	68.45
	9305 R	48.00	3.00	114.00	1.50	48.00	3.00	70.00	50.00	70.00	0.98	-27.37	31.11	68.45	68.45	-379.62	-26.17	30.70	68.45	68.45	-358.98	-24.05	26.41	68.45	68.45	-140.50	-31.32	38.42	68.45	68.45	-564.18	-25.13	27.31	68.45	68.45	-292.06	-24.69	27.58	68.45
9402.0	9402 L	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-30.60	3.87	63.56	68.99	-434.31	-32.38	-11.12	63.56	59.60	-531.08	-37.68	1.66	63.56	68.99	-603.61	-25.76	-17.47	63.56	59.60	-389.71	-33.85	-17.49	63.56	59.60	-448.61	-35.17	-7.63	63.56
	9402 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-33.78	-12.89	63.86	63.86	-404.84	-31.57	-3.64	63.86	63.86	-350.23	-25.95	-19.11	63.86	63.86	-281.95	-39.26	-0.09	63.86	63.86	-490.74	-36.31	-9.28	63.86	63.86	-408.65	-34.65	-18.55	63.86
9407.0	9407 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-9.79	-21.23	63.86	63.86	31.95	-20.00	-25.67	63.86	63.86	197.64	-9.83	-27.19	63.86	63.86	-12.61	-21.28	-22.36	63.86	63.86	246.06	-22.74	-30.58	63.86	63.86	108.26	-22.18	-29.40	63.86
	9407 R	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-18.14	-25.16	63.76	63.76	290.65	-9.14	-20.38	63.76	63.76	106.29	-21.31	-22.35	63.76	63.76	348.48	-9.20	-25.29	63.76	63.76	70.15	-21.44	-28.52	63.76	63.76	184.80	-21.94	-29.64	63.76
9411.0	9411 L	42.00	2.25	48.00	1.25	42.00	2.25	70.00	50.00	70.00	0.99	-9.75	-22.68	63.76	63.76	-144.08	-18.19	-26.14	63.76	63.76	-320.17	-20.57	-22.56	63.76	63.76	-372.67	-8.77	-26.33	63.76	63.76	-112.88	-21.13	-30.35	63.76	63.76	-220.93	-20.85	-29.03	63.76
	9411 R	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-19.24	-27.33	63.86	63.86	-212.28	-10.37	-23.53	63.86	63.86	-70.34	-9.20	-28.24	63.86	63.86	-30.35	-21.59	-23.49	63.86	63.86	-269.50	-21.57	-29.90	63.86	63.86	-135.91	-21.92	-31.31	63.86
9416.0	9416 L	42.00	2.25	48.00	1.00	42.00	2.25	70.00	50.00	70.00	0.99	-26.37	-10.10	63.86	63.86	305.32	-29.30	-17.47	63.86	63.86	370.65	-20.21	-17.80	63.86	63.86	264.26	-34.76	-6.07	63.86	63.86	448.86	-32.03	-20.51	63.86	63.86	330.67	-32.07	-19.33	63.86
	9416 R	42.00	2.25	48.00	1.50	42.00	2.00	70.00	50.00	70.00	0.99	-28.02	-15.98	63.56	59.60	499.09	-25.60	-9.03	63.56	59.60	390.69	-33.42	-6.04	63.56	59.60	562.43	-20.57	-14.27	63.56	59.60	367.26	-31.18	-18.21	63.56	59.60	461.60	-31.36	-19.63	63.56
9422.0	9422 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-26.98	3.57	50.00	50.00	-386.64	-29.90	-9.16	50.00	50.00	-497.95	-35.68	1.32	50.00	50.00	-555.75	-24.28	-8.99	50.00	50.00	-368.10	-31.69	-12.78	50.00	50.00	-428.10	-33.89	-9.67	50.00
	9422 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-34.64	-11.16	68.13	68.13	-385.26	-31.02	3.52	68.18	69.30	-317.88	-26.91	-14.31	68.13	68.13	-280.02	-40.98	2.82	68.15	69.30	-458.15	-38.95	-11.54	68.13	68.13	-370.34	-36.43	-14.98	68.13
9427.0	9427 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-6.60	-23.17	68.13	68.13	-8.73	-18.06	-27.82	68.13	68.13	158.24	-5.78	-28.68	68.13	68.13	-45.77	-19.35	-24.37	68.13	68.13	192.49	-21.79	-34.19	68.13	68.13	65.95	-21.39	-33.44	68.13
	9427 R	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-16.91	-26.48	67.81	67.81	255.58	-6.01	-22.24	67.81	67.81	52.96	-18.22	-23.28	67.81	67.81	285.25	-5.02	-26.42	67.81	67.81	24.46	-20.65	-32.46	67.81	67.81	126.28	-20.95	-33.10	67.81
9431.0	9431 L	36.00	2.25	48.00	1.25	36.00	2.25	70.00	50.00	70.00	0.99	-6.28	-22.28	67.81	67.81	-48.42	-16.32	-27.14	67.81	67.81	-226.61	-18.37	-23.05	67.81	67.81	-277.57	-5.09	-26.25	67.81	67.81	-18.20	-21.19	-33.14	67.81	67.81	-131.22	-20.76	-32.07	67.81
	9431 R	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-17.44	-28.49	68.13	68.13	-129.59	-6.89	-23.21	68.13	68.13	13.02	-5.76	-28.43	68.13	68.13	52.02	-19.50	-24.13	68.13	68.13	-185.22	-21.50	-33.05	68.13	68.13	-52.34	-22.02	-34.22	68.13
9436.0	9436 L	36.00	2.25	48.00	1.00	36.00	2.25	70.00	50.00	70.00	0.99	-33.75	6.46	68.22	69.30	323.49	-35.90	-9.86	68.13	68.13	391.70	-29.60	-15.33	68.13	68.13	284.70	-42.85	4.57	68.17	69.30	463.72	-39.17	-16.15	68.13	68.13	337.67	-38.75	-9.78	68.13
	9436 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-30.98	-7.99	50.00	50.00	507.04	-29.41	6.18	50.00	50.00	393.76	-36.84	2.70	50.00	50.00	564.42	-26.56	-9.90	50.00	50.00	374.91	-33.84	-7.97	50.00	50.00	474.26	-34.13	-13.83	50.00
9442.0	9442 L	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-24.03	-7.58	50.00	50.00	-361.64	-29.15	-17.54	50.00	50.00	-475.72	-33.28	-6.83	50.00	50.00	-531.67	-20.41	-15.34	50.00	50.00	-340.35	-27.13	-17.55	50.00	50.00	-401.96	-30.41	-17.17	50.00
	9442 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-34.50	-21.19	67.05	67.05	-349.50	-28.35	-9.49	67.05	67.05	-280.24	-22.84	-21.82	67.05	67.05	-238.24	-38.78	-6.23	67.05	67.05	-420.88	-36.19	-21.02	67.05	67.05	-326.76	-32.37	-21.38	67.05
9447.0	9447 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-14.20	-23.33	67.05	67.05	87.11	-24.23	-27.32	67.05	67.05	238.15	-13.40	-28.90	67.05	67.05	50.94	-26.68	-23.27	67.05	67.05	293.13	-27.34	-32.03	67.05	67.05	161.65	-27.63	-32.01	67.05
	9447 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-22.83	-25.87	66.71	66.71	350.17	-13.39	-22.34	66.71	66.71	161.18	-25.31	-22.13	66.71	66.71	400.23	-12.46	-26.59	66.71	66.71	134.17	-26.67	-30.96	66.71	66.71	231.46	-26.27	-30.88	66.71
9451.0	9451 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-13.01	-21.98	66.71	66.71	-160.34	-24.04	-25.55	66.71	66.71	-372.54	-25.48	-22.48	66.71	66.71	-401.91	-11.90	-26.04	66.71	66.71	-132.63	-26.44	-31.24	66.71	66.71	-249.64	-26.08	-30.34	66.71
	9451 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-25.44	-26.99	67.05	67.05	-264.69	-13.85	-23.00	67.05	67.05	-89.10	-12.80	-28.30	67.05	67.05	-52.96	-26.85	-23.64	67.05	67.05	-298.67	-27.05	-31.40	67.05	67.05	-154.05	-27.49	-32.39	67.05
9456.0	9456 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-25.68	-7.24	67.05	67.05	279.21	-31.62	-20.46	67.05	67.05	341.62	-22.33	-23.00	67.05	67.05	234.09	-38.59	-7.17	67.05	67.05	416.57	-30.79	-22.63	67.05	67.05	290.07	-36.31	-18.70	67.05
	9456 R	36.00	2.50	48.00	1.38	36.00	2.50	50.00	50.00	50.00	1.00	-26.79	-17.05	50.00	50.00	466.22	-21.88	-5.81	50.00	50.00	358.85	-32.75	-7.22	50.00	50.00	525.19	-19.30	-15.65	50.00	50.00	334.29	-30.57	-15.19	50.00	50.00	440.88	-25.77	-18.68	50.00
9462.0	9462 L	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-21.70	2.06	50.00	50.00	-325.23	-30.28	-12.66	50.00	49.25	-475.44	-34.92	-3.25	50.00	49.25	-538.26	-18.60	-9.01	50.00	49.25	-286.04	-24.76	-8.76	50.00	49.25	-362.94	-31.58	-10.87	50.00
	9462 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-35.94	-16.37	67.05	67.05	-363.62	-25.95	-1.27	67.05	67.05	-263.18	-21.03	-13.20	67.05	67.05	-207.30	-41.28	-3.06	67.05	67.05	-438.78	-37.43	-14.70	67.05	67.05	-346.22	-29.35	-11.69	67.05
9467.0	9467 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-7.40	-19.19	67.05	67.05	7.30	-18.15	-26.44	67.05	67.05	177.62	-5.22	-26.60	67.05	67.05	-38.31	-20.33	-20.90	67.05	67.05	219.99	-13.98	-23.09	67.05	67.05	80.70	-14.48	-23.03	67.05
	9467 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-17.01	-25.14	66.71	66.71	274.37	-6.87	-18.41	66.71	66.71	60.84	-18.76	-21.05	66.71	66.71	309.45	-4.85	-24.06	66.71	66.71	26.37	-13.77	-22.15	66.71	66.71	146.51	-13.20	-22.13	66.71
9471.0	9471 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-6.69	-18.07	66.71	66.71	-65.07	-15.82	-25.45	66.71	66.71	-253.26	-18.66	-19.49	66.71	66.71	-316.27	-4.64	-23.76	66.71	66.71	-23.78	-13.56	-22.92	66.71	66.71	-156.01	-13.62	-21.65	66.71
	9471 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-16.91	-26.73	67.05	67.05	-160.90	-7.26	-18.88	67.05	67.05	-12.19	-5.38	-25.82	67.05	67.05	38.88	-19.25	-20.26	67.05	67.05	-231.26	-14.35	-22.54	67.05	67.05	-83.40	-14.32	-23.87	67.05
9476.0	9476 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-24.44	-0.12	67.05	67.05	261.89	-33.48	-15.09	67.05	67.05	353.74	-20.31	-14.41	67.05	67.05	204.38	-40.19	-3.83	67.05	67.05	428.72	-26.66	-13.86	67.05	67.05	261.41	-37.09	-11.10	67.05
	9476 R	36.00	2.75	48.00	1.38	32.00	2.50	50.00	50.00	50.00	1.00	-28.20	-11.72	50.00	49.25	463.13	-20.38	1.23	50.00	50.00	322.72	-33.64	2.32	50.00	50.00	526.10	-17.35	-10.55	50.00	49.25	284.11	-31.27	-7.72	50.00	49.25	449.03	-22.49	-10.91	50.00
9482.0	9482 L	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-22.55	5.73	50.00	50.00	-327.61	-29.68	-7.36	50.00	49.18	-475.67	-34.32	4.88	50.00	50.00	-529.71	-20.77	-4.85	50.00	49.18	-307.23	-25.44	-6.49	50.00	49.18	-363.64	-31.93	-3.85	50.00
	9482 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-34.40	-10.55	67.05	67.05	-367.97	-26.41	4.19	67.13	69.29	-269.97	-23.38	-9.65	67.05	67.05	-232.91	-40.03	3.88	67.08	69.29	-433.18	-37.00	-7.26	67.05	67.05	-365.36	-29.38	-9.38	67.05
9487.0	9487 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-4.41	-19.42	67.05	67.05	-32.37	-13.75	-26.57	67.05	67.05	110.51	-2.71	-25.99	67.05	67.05	-77.19	-16.28	-21.27	67.05	67.05	169.05	-10.80	-23.49	67.05	67.05	42.53	-11.91	-23.04	67.05
	9487 R	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-12.74	-25.32	66.71	66.71	195.57	-3.94	-18.65	66.71	66.71	13.86	-15.31	-20.33	66.71	66.71	247.97	-2.21	-23.65	66.71	66.71	-20.58	-11.28	-22.19	66.71	66.71	95.99	-10.18	-22.61	66.71
9491.0	9491 L	32.00	2.50	48.00	1.25	32.00	2.50	70.00	50.00	70.00	0.99	-4.92	-19.36	66.71	66.71	-22.27	-12.83	-26.06	66.71	66.71	-185.63	-15.98	-20.24	66.71	66.71	-242.04	-2.34	-26.25	66.71	66.71	19.13	-9.76	-21.72	66.71	66.71	-96.95	-11.45	-22.96	66.71
	9491 R	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-13.81	-27.31	67.05	67.05	-98.48	-5.40	-20.14	67.05	67.05	26.73	-2.85	-27.52	67.05	67.05	79.99	-16.94	-21.14	67.05	67.05	-162.25	-12.08	-23.82	67.05	67.05	-39.05	-10.39	-22.60	67.05
9496.0	9496 L	32.00	2.50	48.00	1.00	32.00	2.50	70.00	50.00	70.00	0.99	-26.81	3.75	67.11	69.29	275.31	-35.98	-9.74	67.05	67.05	377.60	-22.68	-9.32	67.05	67.05	222.99	-41.61	5.02	67.10	69.29	449.99	-29.76	-7.77	67.05	67.05	288.44	-37.67	-7.64	67.05
	9496 R	36.00	2.75	48.00	1.38	32.00	2.25	50.00	50.00	50.00	1.00	-31.04	-6.45	50.00	49.18	475.91	-22.89	5.30	50.00	50.00	330.39	-35.72	6.78	50.00	50.00	538.50	-19.91	-6.05	50.00	49.18	292.01	-32.54	-4.16	50.00	49.18	457.79	-25.69	-4.95	50.00
9502.0	9502 L	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-23.91	3.23	50.00	50.00	-399.48	-30.44	-10.64	50.00	50.00	-530.04	-33.84	2.75	50.00	50.00	-599.66	-20.70	-6.19	50.00	50.00	-379.54	-29.12	-8.98	50.00	50.00	-460.35	-33.37	-8.57	50.00
	9502 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-33.50	-12.59	68.37	68.37	-409.86	-26.37	2.66	68.40	69.42	-330.83	-22.01	-11.96	68.37	68.37	-288.19	-38.05	4.59	68.41	69.42	-500.28	-36.38	-10.68	68.37	68.37	-402.41	-31.97	-10.88	68.37
9507.0	9507 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-5.86	-22.45	68.37	68.37	-35.31	-16.41	-26.66	68.37	68.37	140.29	-4.54	-28.73	68.37	68.37	-90.67	-17.96	-22.10	68.37	68.37	203.38	-17.28	-29.03	68.37	68.37	57.56	-17.22	-28.42	68.37
	9507 R	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-15.48	-25.56	68.10	68.10	247.51	-5.44	-21.76	68.10	68.10	28.09	-17.13	-21.53	68.10	68.10	303.49	-4.04	-27.61	68.10	68.10	-13.46	-16.66	-27.68	68.10	68.10	119.62	-16.63	-28.19	68.10
9511.0	9511 L	36.00	2.75	48.00	1.25	36.00	2.75	70.00	50.00	70.00	0.99	-5.52	-21.17	68.10	68.10	-22.41	-15.13	-25.38	68.10	68.10	-269.33	-17.33	-22.06	68.10	68.10	-314.38	-4.37	-26.28	68.10	68.10	23.87	-16.64	-28.03	68.10	68.10	-133.65	-16.98	-27.95	68.10
	9511 R	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-16.07	-26.49	68.37	68.37	-163.83	-5.94	-21.86	68.37	68.37	39.23	-4.71	-28.47	68.37	68.37	98.56	-18.24	-22.78	68.37	68.37	-215.09	-17.54	-28.70	68.37	68.37	-46.43	-17.30	-28.87	68.37
9516.0	9516 L	36.00	2.75	48.00	1.00	36.00	2.75	70.00	50.00	70.00	0.99	-28.19	5.01	68.44	69.42	333.55	-31.30	-12.51	68.37	68.37	407.46	-24.32	-14.38	68.37	68.37	287.56	-38.49	4.02	68.40	69.42	507.15	-32.05	-13.62	68.37	68.37	354.02	-36.85	-6.91	68.37
	9516 R	39.00	2.75	48.00	1.38	36.00	2.75	50.00	50.00	50.00	1.00	-28.34	-10.65	50.00	50.00	530.17	-25.66	5.41	50.00	50.00	400.64	-35.07	3.18	50.00	50.00	610.38	-23.16	-8.31	50.00	50.00	380.40	-33.59	-5.13	50.00	50.00	529.79	-29.26	-11.56	50.00
9522.0	9522 L	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-29.94	18.12	69.43	49.59	-436.60	-31.99	5.85	69.43	49.59	-583.87	-36.37	12.52	69.43	49.59	-659.93	-29.56	15.09	69.43	49.59	-429.74	-33.38	15.32	69.43	49.59	-473.29	-31.19	9.38	69.43
	9522 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-34.27	5.93	67.97	69.53	-485.54	-31.71	19.13	67.97	69.53	-392.81	-30.78	11.26	67.97	69.53	-368.60	-39.10	15.65	67.97	69.53	-574.29	-33.24	10.11	67.97	69.53	-503.40	-35.57	15.62	67.97
9527.0	9527 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	4.34	-18.62	69.53	67.97	-240.37	-6.01	-23.74	67.97	67.97	-58.86	5.45	-24.75	69.53	67.97	-292.19	-6.74	-20.51	67.97	67.97	-14.10	-7.86	-26.84	67.97	67.97	-142.38	-7.03	-24.94	67.97
	9527 R	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	-5.52	-23.02	67.87	67.87	25.88	4.51	-18.25	69.42	67.87	-198.57	-6.47	-20.54	67.87	67.87	64.68	5.46	-22.52	69.42	67.87	-237.92	6.90	-24.51	69.42	67.87	-95.85	-7.55	-26.28	67.87
9531.0	9531 L	45.00	2.75	48.00	1.25	45.00	2.75	70.00	50.00	70.00	0.99	4.38	-18.19	69.42	67.87	190.12	-5.74	-24.06	67.87	67.87	-59.76	-6.82	-21.90	67.87	67.87	-90.36	5.46	-22.44	69.42	67.87	227.30	-6.78	-25.87	67.87	67.87	77.45	7.43	-25.53	69.42
	9531 R	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-6.16	-24.73	67.97	67.97	26.43	4.30	-18.64	69.53	67.97	232.49	5.45	-24.59	69.53	67.97	281.57	-6.99	-21.82	67.97	67.97	-10.04	-7.19	-25.99	67.97	67.97	121.99	-7.06	-26.41	67.97
9536.0	9536 L	45.00	2.75	48.00	1.00	45.00	2.75	70.00	50.00	70.00	0.99	-27.20	14.58	67.97	69.53	399.55	-32.87	4.36	67.97	69.53	486.36	-26.03	5.49	67.97	69.53	369.93	-38.01	14.97	67.97	69.53	577.39	-26.33	8.64	67.97	69.53	404.38	-31.06	8.27	67.97
	9536 R	42.00	3.00	48.00	1.38	45.00	3.00	70.00	50.00	50.00	0.99	-30.63	4.42	69.43	49.59	585.09	-25.70	13.62	69.43	49.59	443.51	-35.35	11.31	69.43	49.59	661.97	-25.04	10.61	69.43	49.59	434.59	-29.20	8.19	69.43	49.59	521.42	-24.65	8.04	69.43
9542.0	9542 L	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-25.39	-12.73	68.43	69.35	-443.23	-27.19	-15.50	68.43	69.35	-610.95	-31.64	-9.12	68.43	69.35	-682.35	-25.03	-14.74	68.43	69.35	-436.14	-29.44	-18.53	68.43	69.35	-503.61	-25.28	-9.39	68.43
	9542 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-29.71	-17.60	69.57	69.57	-463.71	-27.44	-14.58	69.57	69.57	-347.52	-26.63	-20.63	69.57	69.57	-326.57	-34.54	-9.87	69.57	69.57	-545.05	-27.72	-11.03	69.57	69.57	-464.49	-31.78	-20.92	69.57
9547.0	9547 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-12.21	-23.20	69.57	69.57	70.83	-16.09	-24.39	69.57	69.57	225.89	-8.36	-25.89	69.57	69.57	12.76	-17.92	-21.94	69.57	69.57	277.77	-19.00	-27.40	69.57	69.57	180.27	-19.05	-27.61	69.57
	9547 R	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-15.39	-23.59	69.47	69.47	350.55	-11.79	-22.65	69.47	69.47	154.69	-17.03	-21.16	69.47	69.47	395.32	-8.12	-24.37	69.47	69.47	109.91	-18.50	-26.97	69.47	69.47	268.94	-18.37	-26.67	69.47
9551.0	9551 L	45.00	3.00	48.00	1.25	45.00	3.00	70.00	50.00	70.00	0.99	-10.08	-20.87	69.47	69.47	-151.83	-16.73	-25.49	69.47	69.47	-373.79	-19.41	-24.02	69.47	69.47	-427.51	-7.78	-22.92	69.47	69.47	-107.60	-17.46	-26.11	69.47	69.47	-294.98	-20.62	-29.14	69.47
	9551 R	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-17.40	-26.27	69.57	69.57	-229.94	-10.49	-21.42	69.57	69.57	-52.67	-7.93	-24.98	69.57	69.57	3.92	-20.08	-24.61	69.57	69.57	-290.70	-21.18	-29.80	69.57	69.57	-174.10	-18.08	-26.84	69.57
9556.0	9556 L	45.00	3.00	48.00	1.00	45.00	3.00	70.00	50.00	70.00	0.99	-26.62	-1.67	69.57	69.57	464.74	-28.31	-11.17	69.57	69.57	536.33	-22.63	-10.84	69.57	69.57	417.16	-34.52	-2.12	69.57	69.57	640.52	-29.17	-5.73	69.57	69.57	517.52	-27.32	-9.29	69.57
	9556 R	48.00	3.00	48.00	1.50	45.00	3.00	70.00	50.00	70.00	0.99	-25.73	-9.53	68.43	69.35	701.94	-24.34	1.41	68.43	69.35	575.44	-31.18	-2.69	68.43	69.35	793.77	-21.41	-6.04	68.43	69.35	550.58	-24.92	-7.75	68.43	69.35	659.39	-26.54	-4.51	68.43

Made By: SAE 8/5/11   Checked By: WME 8/5/11   BackChecked By: SAE 8/5/11

Section Properties

Ref. Delta Frame Desig

Splice	Splice	pacity (ksi)	FY	MAX MZ					MIN MZ					ϕvVn
				Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	
Node	Side	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	(kip)
1007.0	1007 L	69.06	97.31	-46.18	45.83	69.06	69.06	224.20	-32.53	23.67	69.06	69.06	10.36	1375.39
	1007 R	69.06	101.61	-32.53	23.67	69.06	69.06	10.36	-46.18	45.83	69.06	69.06	141.94	1375.39
1015.0	1015 L	69.06	-744.28	-18.08	21.95	69.06	69.06	-701.19	7.08	-6.58	69.06	68.15	-715.43	1375.39
	1015 R	59.12	-690.15	7.64	-9.46	68.08	59.12	-715.66	-19.97	31.38	68.08	68.08	-764.44	2686.30
1021.0	1021 L	68.04	249.02	13.04	17.34	68.04	68.04	157.22	30.42	-2.53	68.04	62.87	409.84	3935.48
	1021 R	68.21	242.99	37.06	-2.42	68.21	62.45	409.73	17.07	22.53	68.21	68.21	96.82	1375.39
1035.0	1035 L	62.45	-402.81	25.23	11.07	68.21	68.21	-290.77	46.51	-13.02	68.21	62.45	-563.39	1375.39
	1035 R	62.87	-414.32	38.66	-11.16	68.04	62.87	-560.03	22.95	7.00	68.04	68.04	-351.41	3935.48
1041.0	1041 L	59.12	616.88	2.23	-1.94	68.08	59.12	577.17	27.73	-31.71	68.08	59.12	551.37	2686.30
	1041 R	62.47	481.74	34.17	-40.62	67.93	62.44	551.71	2.53	-2.34	67.93	62.60	503.89	1375.39
1051.0	1051 L	67.93	-442.19	0.94	12.79	67.93	67.93	-323.51	28.89	-33.03	67.93	62.46	-435.00	1375.39
	1051 R	47.31	-383.78	26.66	-30.24	50.00	47.28	-434.81	-0.77	11.94	50.00	50.00	-391.21	1375.39
1057.0	1057 L	50.00	369.18	14.27	11.39	50.00	50.00	296.99	31.68	-7.56	50.00	48.64	515.19	3306.90
	1057 R	50.00	366.80	32.53	-7.64	50.00	47.82	515.20	14.89	12.11	50.00	50.00	236.49	2686.30
1071.0	1071 L	50.00	-305.71	14.54	15.76	50.00	50.00	-190.84	30.53	-5.34	50.00	47.89	-454.13	2686.30
	1071 R	50.00	-309.40	29.66	-5.42	50.00	48.70	-454.08	13.86	14.99	50.00	50.00	-251.38	3306.90
1077.0	1077 L	50.00	552.44	-17.01	25.36	50.00	50.00	549.49	11.05	-15.58	50.00	47.20	482.00	1375.39
	1077 R	48.39	450.46	10.40	-12.41	50.00	48.37	480.60	-15.44	20.21	50.00	50.00	486.27	1375.39
1089.0	1089 L	50.00	-654.94	-2.95	11.05	50.00	50.00	-583.37	21.88	-21.45	50.00	48.42	-588.10	1375.39
	1089 R	47.44	-539.48	20.85	-23.23	50.00	47.43	-589.45	-3.15	12.01	50.00	50.00	-646.35	1375.39
1095.0	1095 L	50.00	321.64	18.27	11.69	50.00	50.00	252.26	36.34	-8.81	50.00	48.64	459.28	3306.90
	1095 R	50.00	309.09	36.47	-7.23	50.00	48.77	459.31	18.73	12.62	50.00	50.00	191.76	1375.39
1109.0	1109 L	50.00	-336.39	20.29	11.30	50.00	50.00	-213.37	38.65	-9.20	50.00	48.74	-488.71	1375.39
	1109 R	48.76	-341.89	38.60	-10.87	50.00	48.60	-488.64	19.88	10.31	50.00	50.00	-273.90	3306.90
1115.0	1115 L	50.00	619.44	-4.30	9.44	50.00	50.00	553.43	24.09	-28.54	50.00	47.41	604.82	1375.39
	1115 R	47.41	550.31	29.05	-31.31	50.00	47.38	604.53	-5.28	10.30	50.00	50.00	487.54	1375.39
1127.0	1127 L	50.00	-559.76	-5.94	14.15	50.00	50.00	-378.83	14.38	-14.45	50.00	47.40	-504.95	1375.39
	1127 R	47.25	-400.09	14.71	-16.81	50.00	47.18	-505.39	-6.03	16.53	50.00	50.00	-433.66	1375.39
1133.0	1133 L	50.00	405.09	14.83	13.18	50.00	50.00	251.32	29.29	-4.45	50.00	48.76	439.56	3306.90
	1133 R	50.00	245.60	35.75	-6.09	50.00	47.90	439.58	19.21	17.05	50.00	50.00	190.80	1375.39
1147.0	1147 L	50.00	-376.36	21.06	14.78	50.00	50.00	-225.90	41.19	-9.60	50.00	47.82	-467.48	1375.39
	1147 R	50.00	-294.52	33.88	-7.14	50.00	48.70	-467.89	16.24	11.46	50.00	50.00	-285.99	3306.90
1153.0	1153 L	50.00	485.88	-6.45	12.18	50.00	50.00	359.38	22.73	-25.26	50.00	47.19	513.04	1375.39
	1153 R	47.12	402.94	24.47	-27.75	50.00	47.06	510.82	-7.06	13.38	50.00	50.00	295.54	1375.39
1163.0	1163 L	50.00	-443.10	-4.13	15.27	50.00	50.00	-248.62	19.35	-21.06	50.00	47.08	-449.21	1375.39
	1163 R	47.36	-336.84	17.65	-19.06	50.00	47.20	-450.60	-4.01	14.00	50.00	50.00	-313.07	1375.39
1169.0	1169 L	50.00	438.06	12.93	10.98	50.00	50.00	281.15	29.66	-4.73	50.00	48.75	463.18	3306.90
	1169 R	50.00	288.81	35.73	-7.21	50.00	47.34	464.34	16.77	14.54	50.00	50.00	220.54	1375.39
1183.0	1183 L	50.00	-400.54	17.15	15.10	50.00	50.00	-215.55	33.46	-5.08	50.00	47.40	-439.18	1375.39
	1183 R	50.00	-267.69	27.55	-3.16	50.00	48.80	-439.24	13.16	11.42	50.00	50.00	-275.97	3306.90
1189.0	1189 L	50.00	473.54	-12.09	17.95	50.00	50.00	361.89	11.40	-14.79	50.00	47.13	415.72	1375.39
	1189 R	47.12	319.69	10.76	-14.65	50.00	47.10	414.83	-11.00	17.70	50.00	50.00	296.76	1375.39
1199.0	1199 L	50.00	-513.47	-2.78	18.10	50.00	50.00	-374.24	25.41	-31.18	50.00	47.15	-514.99	1375.39
	1199 R	47.43	-462.43	24.64	-26.82	50.00	47.37	-513.90	-2.67	15.56	50.00	50.00	-459.39	1375.39
1205.0	1205 L	50.00	353.58	14.45	12.05	50.00	50.00	278.13	34.11	-7.06	50.00	49.24	535.85	3306.90
	1205 R	50.00	352.14	37.14	-7.39	50.00	48.75	536.20	16.42	15.02	50.00	50.00	200.05	1375.39
1219.0	1219 L	50.00	-353.81	18.00	15.26	50.00	50.00	-201.89	38.42	-7.91	50.00	48.74	-541.44	1375.39
	1219 R	50.00	-346.68	35.17	-7.40	50.00	49.23	-537.56	15.80	12.20	50.00	50.00	-279.50	3306.90
1225.0	1225 L	50.00	580.92	-11.75	19.57	50.00	50.00	566.36	21.29	-25.53	50.00	47.34	525.04	1375.39
	1225 R	47.39	473.58	18.84	-23.46	50.00	47.39	524.16	-10.30	18.07	50.00	50.00	483.23	1375.39
1234.0	1234 L	50.00	-395.98	-11.05	24.42	50.00	50.00	-352.87	16.00	-19.20	50.00	47.40	-429.24	1375.39
	1234 R	49.38	-403.52	14.76	-17.64	50.00	49.35	-428.96	-10.18	22.71	50.00	50.00	-431.02	1375.39
1242.0	1242 L	68.49	377.66	10.84	13.45	48.92	68.49	395.75	24.12	-4.47	48.92	66.76	585.31	3306.90
	1242 R	50.00	507.36	24.02	-3.68	50.00	50.00	585.38	10.74	13.39	50.00	50.00	320.23	2686.30
1253.0	1253 L	50.00	-411.86	15.96	16.46	50.00	50.00	-311.11	30.69	-10.38	50.00	50.00	-609.88	2686.30
	1253 R	66.77	-469.27	31.13	-11.31	48.92	66.59	-609.88	16.42	16.62	48.92	68.49	-387.45	3306.90
1261.0	1261 L	50.00	548.09	-11.29	19.77	50.00	50.00	388.10	19.80	-25.49	50.00	49.34	454.09	1375.39
	1261 R	48.91	377.74	21.37	-25.31	50.00	48.91	453.83	-12.28	19.58	50.00	50.00	309.47	1375.39
1272.0	1272 L	48.92	-756.38	6.18	-5.48	50.00	48.97	-624.61	37.63	-40.55	50.00	48.93	-640.69	1375.39
	1272 R	66.00	-583.75	30.87	-36.10	68.34	65.99	-640.73	5.20	-4.87	68.34	66.08	-702.89	2686.30
1280.0	1280 L	68.64	507.87	22.49	7.14	68.64	68.64	564.09	37.40	-13.50	68.64	67.75	757.80	3935.48
	1280 R	67.78	702.63	42.31	-14.21	68.96	67.75	758.03	26.00	8.58	68.96	68.96	487.23	1375.39
1290.0	1290 L	68.96	-327.59	12.18	16.88	68.96	68.96	-204.06	30.00	-0.54	68.96	67.99	-521.30	1375.39
	1290 R	68.64	-368.52	26.20	-1.16	68.64	67.75	-521.32	9.80	14.66	68.64	68.64	-279.93	3935.48
1298.0	1298 L	68.22	1000.76	-22.92	34.23	68.22	68.22	968.91	1.82	-2.23	68.22	65.71	890.62	2262.15
	1298 R	68.45	785.62	1.61	-1.77	68.45	67.26	890.63	-18.66	25.97	68.45	68.45	893.53	3908.99
1307.0	1307 L	68.45	-187.54	-38.03	46.59	68.45	68.45	-354.06	-25.84	25.73	68.45	68.45	-114.96	3908.99
	1307 R	68.45	-404.56	-25.84	25.73	68.45	68.45	-114.96	-38.03	46.59	68.45	68.45	-435.64	3908.99
1402.0	1402 L	59.60	-416.41	-38.81	5.93	63.56	68.99	-546.25	-21.39	-21.47	63.56	59.60	-368.20	2088.00
	1402 R	63.86	-375.16	-22.40	-22.48	63.86	63.86	-252.02	-39.97	3.67	63.86	69.39	-443.00	1392.00
1407.0	1407 L	63.86	142.95	-24.35	-20.59	63.86	63.86	282.38	-12.56	-27.99	63.86	63.86	38.27	1392.00
	1407 R	63.76	221.26	-11.77	-26.92	63.76	63.76	132.33	-23.27	-19.58	63.76	63.76	386.33	1740.00
1411.0	1411 L	63.76	-266.19	-21.92	-19.32	63.76	63.76	-404.15	-10.16	-27.03	63.76	63.76	-172.46	1740.00
	1411 R	63.86	-177.21	-10.95	-28.13	63.86	63.86	-79.87	-22.97	-20.31	63.86	63.86	-303.55	1392.00
1416.0	1416 L	63.86	280.32	-31.95	-8.91	63.86	63.86	400.83	-17.48	-25.47	63.86	63.86	226.78	1392.00
	1416 R	59.60	415.80	-16.57	-24.71	63.56	59.60	337.64	-30.67	-7.22	63.56	59.60	502.62	2088.00
1422.0	1422 L	50.00	-400.12	-37.11	7.24	50.00	50.00	-522.47	-21.22	-15.64	50.00	50.00	-362.82	1914.00
	1422 R	68.13	-347.82	-24.70	-18.38	68.13	68.13	-264.16	-42.60	7.51	68.21	69.30	-435.67	1392.00
1427.0	1427 L	68.13	67.87	-19.15	-21.73	68.13	68.13	188.46	-6.07	-30.10	68.13	68.13	-36.63	1392.00
	1427 R	67.81	130.69	-5.31	-28.84	67.81	67.81	41.17	-18.09	-20.62	67.81	67.81	275.08	1740.00
1431.0	1431 L	67.81	-133.29	-18.16	-20.29	67.81	67.81	-269.46	-5.72	-28.95	67.81	67.81	-36.02	1740.00
	1431 R	68.13	-59.43	-6.48	-30.19	68.13	68.13	41.64	-19.24	-21.41	68.13	68.13	-182.69	1392.00
1436.0	1436 L	68.13	318.66	-44.70	9.29	68.23	69.30	444.30	-27.90	-19.14	68.13	68.13	271.21	1392.00
	1436 R	50.00	445.84	-24.08	-16.34	50.00	50.00	368.33	-38.94	8.80	50.00	50.00	530.88	1914.00
1442.0	1442 L	50.00	-382.69	-32.64	-5.54	50.00	50.00	-501.04	-18.50	-23.16	50.00	50.00	-339.19	1914.00
	1442 R	67.05	-299.46	-22.14	-27.48	67.05	67.05	-225.88	-38.31	-7.25	67.05	67.05	-398.47	1392.00
1447.0	1447 L	67.05	181.59	-28.30	-21.57	67.05	67.05	305.06	-13.97	-29.37	67.05	67.05	76.71	1392.00
	1447 R	66.71	241.54	-12.95	-28.04	66.71	66.71	165.39	-26.92	-20.33	66.71	66.71	403.24	1740.00
1451.0	1451 L	66.71	-270.56	-26.41	-20.08	66.71	66.71	-411.36	-13.09	-28.27	66.71	66.71	-169.22	1740.00
	1451 R	67.05	-169.15	-14.07	-29.57	67.05	67.05	-80.75	-27.77	-21.31	67.05	67.05	-313.20	1392.00
1456.0	1456 L	67.05	269.91	-38.06	-8.43	67.05	67.05	395.03	-19.86	-27.41	67.05	67.05	222.28	1392.00
	1456 R	50.00	419.13	-16.62	-23.20	50.00	50.00	333.66	-32.36	-6.52	50.00	50.00	494.80	1914.00
1462.0	1462 L	49.25	-373.91	-34.53	7.08	50.00	50.00	-529.89	-20.40	-15.65	50.00	49.25	-349.25	1914.00
	1462 R	67.05	-366.17	-24.09	-18.91	67.05	67.05	-250.96	-41.38	6.05	67.12	69.29	-441.83	1392.00
1467.0	1467 L	67.05	82.62	-20.33	-18.56	67.05	67.05	206.65	-6.17	-30.56	67.05	67.05	-23.11	1392.00
	1467 R	66.71	149.50	-5.51	-29.41	66.71	66.71	51.54	-19.27	-17.53	66.71	66.71	286.47	1740.00

Splice	Splice	SERVICE II																							
		MAX FX			MIN FX			MAX FY			MIN FY			MAX MY			MIN MY			MAX MZ			MIN MZ		
		Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY
Node	Side	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)
1007.0	1007 L	-26.33	21.30	52.81	-33.01	31.36	156.12	-26.93	22.19	-25.02	-32.73	30.89	223.69	-25.36	19.09	27.87	-31.77	29.79	155.37	-33.99	33.45	160.38	-24.36	17.49	11.61
	1007 R	-33.01	31.36	96.22	-26.33	21.30	52.81	-32.64	30.73	207.84	-28.17	24.20	-38.31	-31.77	29.79	152.23	-25.36	19.09	24.12	-24.36	17.49	11.61	-33.99	33.45	102.27
1015.0	1015 L	-4.96	3.20	-484.31	-10.55	11.31	-636.73	-7.55	7.09	-686.26	-11.08	12.43	-396.75	-2.58	-2.22	-507.39	-12.48	14.28	-543.38	-13.19	15.69	-512.94	-1.06	-3.49	-525.43
	1015 R	-12.10	16.99	-672.62	-5.61	4.83	-483.59	-12.04	17.39	-400.49	-9.14	11.63	-713.32	-13.85	20.21	-553.33	-2.95	-2.64	-507.78	-1.33	-4.73	-525.80	-14.58	22.45	-557.31
1021.0	1021 L	16.17	6.19	202.32	10.45	8.21	138.56	11.21	12.14	61.65	14.54	4.12	383.11	14.69	4.88	178.92	15.38	8.56	184.11	9.80	12.51	119.25	22.27	-1.67	296.80
	1021 R	13.47	10.81	138.56	19.66	8.23	195.94	18.14	4.97	367.41	14.19	16.16	57.11	18.58	10.72	179.23	17.37	5.98	178.92	27.16	-1.54	296.72	12.82	16.24	76.57
1035.0	1035 L	27.59	-4.42	-330.62	22.18	-3.39	-317.04	26.20	-7.09	-484.54	22.13	5.01	-177.90	26.35	-4.43	-303.79	24.14	-2.21	-296.78	21.11	6.54	-216.50	34.10	-9.28	-410.24
	1035 R	18.05	-2.94	-317.05	23.05	-4.03	-337.01	18.02	3.19	-182.53	21.06	-3.35	-498.19	20.22	-2.42	-307.63	22.07	-4.28	-303.79	28.30	-7.95	-407.86	16.97	4.89	-259.34
1041.0	1041 L	11.19	-10.44	386.66	5.55	-10.68	448.48	4.61	-6.66	236.10	5.52	-9.02	589.82	18.12	-19.96	352.90	4.01	-4.85	450.83	2.44	-1.44	418.85	19.48	-22.14	404.54
	1041 R	6.05	-13.39	388.07	13.53	-13.11	383.51	11.79	-14.38	564.59	4.69	-7.63	231.23	4.33	-5.84	440.43	22.02	-25.21	351.71	23.99	-28.34	404.59	2.78	-1.75	367.36
1051.0	1051 L	4.75	-1.34	-252.53	4.99	-7.81	-322.48	5.33	-7.13	-463.33	2.28	2.47	-139.71	10.16	-16.70	-278.38	1.98	5.13	-324.22	-0.55	9.68	-236.93	20.10	-23.30	-319.14
	1051 R	4.54	-7.10	-329.72	4.31	-1.14	-255.43	2.14	1.75	-145.36	4.02	-4.75	-488.35	1.64	4.87	-334.49	9.70	-15.48	-279.71	18.55	-21.34	-318.73	-0.85	9.03	-284.95
1057.0	1057 L	16.93	0.40	285.37	12.13	2.50	251.04	12.64	7.10	148.96	15.45	0.28	468.99	16.53	1.71	269.93	16.23	2.81	272.93	10.83	8.19	220.61	18.42	-5.13	376.09
	1057 R	12.58	2.73	251.04	17.43	0.62	280.50	17.52	-3.21	454.39	12.94	7.92	144.15	16.73	2.89	265.07	16.90	1.69	269.93	18.91	-5.24	376.10	11.30	8.71	177.87
1071.0	1071 L	17.01	3.44	-242.19	12.16	5.06	-219.82	15.36	2.60	-416.59	12.65	10.55	-103.03	14.64	2.70	-227.00	16.19	6.00	-226.02	11.07	11.37	-144.87	18.13	-3.60	-329.26
	1071 R	11.67	4.80	-219.82	16.46	3.17	-247.07	12.30	9.70	-107.73	14.60	3.02	-432.06	15.64	5.84	-233.89	14.34	2.61	-227.00	17.60	-3.62	-329.22	10.56	10.82	-187.64
1077.0	1077 L	-7.79	9.25	331.33	-8.07	4.10	408.92	-9.14	10.26	202.07	-8.67	6.69	556.36	5.78	-7.92	333.29	-11.98	15.26	401.25	-12.41	18.17	399.16	7.48	-11.03	354.59
	1077 R	-7.04	3.20	364.43	-6.73	7.25	328.17	-7.10	4.31	536.15	-8.27	8.51	196.65	-10.83	12.31	390.86	5.57	-6.51	332.57	7.05	-8.79	353.86	-11.24	14.47	354.32
1089.0	1089 L	2.90	0.83	-401.13	4.08	-6.66	-466.16	3.41	-3.17	-612.48	0.68	2.37	-268.68	8.27	-12.04	-397.39	-1.43	5.76	-476.05	-2.19	7.96	-425.49	15.84	-15.39	-432.22
	1089 R	3.92	-7.29	-470.48	2.73	0.90	-404.21	0.75	2.06	-273.15	2.77	-2.34	-632.93	-1.62	6.15	-486.33	8.07	-12.99	-398.05	15.10	-16.66	-433.35	-2.34	8.65	-469.72
1095.0	1095 L	19.44	1.47	243.16	14.85	2.37	222.63	14.87	6.47	109.32	18.47	1.24	432.07	19.91	2.44	229.06	17.80	1.82	235.57	13.50	8.33	186.55	26.66	-6.30	335.18
	1095 R	15.08	2.99	222.63	19.72	2.29	238.28	19.98	-2.76	418.20	15.02	7.57	104.50	18.14	2.64	229.19	20.14	3.16	229.06	26.77	-5.14	335.20	13.84	9.02	143.81
1109.0	1109 L	22.28	-1.68	-282.67	15.78	1.80	-231.81	21.57	-4.49	-437.76	16.17	6.76	-124.71	21.97	-2.67	-253.19	19.52	1.57	-247.23	15.09	7.92	-162.38	28.28	-6.47	-354.85
	1109 R	15.58	1.13	-231.81	22.08	-2.67	-287.55	16.06	5.61	-129.59	20.19	-2.49	-452.28	19.22	-1.17	-252.12	21.80	-3.61	-253.19	28.23	-7.70	-354.80	14.80	7.19	-205.15
1115.0	1115 L	7.73	-6.32	383.94	0.81	-4.48	474.91	-0.77	1.10	265.74	1.80	-5.20	613.38	15.46	-16.82	399.66	-3.09	3.99	456.19	-3.23	7.15	409.56	16.68	-20.00	436.17
	1115 R	-0.94	-4.67	468.69	9.05	-6.86	380.41	2.06	-6.66	592.69	-1.50	1.80	260.29	-3.77	4.38	446.74	18.44	-18.38	397.92	20.13	-21.94	436.23	-3.93	7.79	362.82
1127.0	1127 L	0.59	3.14	-272.75	-0.44	-1.99	-432.41	0.52	-2.27	-539.68	-3.24	7.44	-171.68	3.52	-6.13	-298.25	-3.04	6.10	-403.04	-4.44	10.68	-275.21	4.64	-9.98	-373.64
	1127 R	-0.48	-2.36	-436.72	0.55	3.63	-276.01	-3.02	7.75	-176.96	-0.23	-1.47	-559.05	-3.07	7.01	-409.49	3.52	-7.04	-299.30	4.66	-11.57	-373.69	-4.50	12.47	-314.13
1133.0	1133 L	16.13	3.92	222.47	11.30	4.50	205.82	12.59	8.66	106.28	15.06	2.09	437.86	14.41	6.62	175.53	14.07	2.02	305.79	10.91	9.73	179.56	17.46	-3.25	330.14
	1133 R	14.46	5.75	205.83	19.81	4.92	217.59	18.87	1.91	421.38	15.80	11.42	101.98	17.54	2.76	263.05	17.88	8.08	175.53	21.10	-4.63	330.16	14.19	12.59	136.81
1147.0	1147 L	23.62	-2.52	-279.44	16.79	3.51	-233.96	21.24	-2.32	-437.64	17.15	10.01	-129.62	21.71	5.04	-207.85	18.93	0.90	-282.45	15.65	11.13	-159.37	30.32	-7.37	-346.83
	1147 R	13.22	2.82	-233.96	19.46	-1.81	-284.32	13.62	7.62	-133.82	16.98	-0.97	-454.28	15.13	0.62	-325.19	17.71	4.42	-207.85	20.15	-5.15	-347.12	12.03	8.63	-201.83
1153.0	1153 L	9.00	-6.59	290.46	-3.37	0.82	426.50	-2.20	2.68	151.07	-1.06	-2.30	500.46	13.71	-13.75	297.60	-4.02	4.35	354.50	-4.95	9.52	265.13	16.79	-18.93	372.23
	1153 R	-3.81	1.01	385.85	9.51	-7.15	285.83	-0.66	-4.24	480.30	-2.88	3.58	145.07	-4.45	4.78	349.04	14.64	-15.02	294.59	18.08	-20.79	370.80	-5.41	10.45	219.75
1163.0	1163 L	2.86	0.61	-197.01	-1.20	0.80	-388.52	1.15	-1.90	-443.85	-0.54	5.01	-103.56	4.83	-5.77	-243.44	-1.64	3.06	-321.60	-3.17	11.88	-184.60	6.29	-13.76	-325.92
	1163 R	-1.26	0.88	-410.31	2.69	0.59	-201.60	-0.33	4.08	-109.99	0.31	-0.18	-463.92	-1.61	2.81	-326.24	4.57	-5.31	-247.21	5.95	-12.60	-326.76	-3.07	10.89	-230.42
1169.0	1169 L	15.57	1.65	273.81	10.69	2.23	234.92	10.69	7.36	130.62	14.25	0.42	452.76	14.17	4.34	201.97	13.80	1.54	326.70	9.53	8.29	196.56	16.76	-3.26	344.45
	1169 R	13.50	2.77	234.92	18.85	1.59	268.93	17.70	-0.90	436.18	13.43	9.95	126.54	16.62	1.19	308.86	17.27	4.98	201.97	26.34	-5.66	345.27	12.41	10.99	153.74
1183.0	1183 L	18.21	3.44	-243.87	13.21	4.66	-212.42	17.27	0.67	-429.55	14.27	9.91	-117.92	16.52	5.66	-190.59	16.89	1.86	-303.25	12.63	11.22	-153.75	19.62	-4.12	-330.55
	1183 R	10.33	3.64	-212.42	14.84	2.95	-248.75	11.37	7.37	-121.98	13.75	1.29	-446.10	14.03	2.08	-321.09	13.39	4.80	-190.59	16.27	-2.45	-330.59	9.65	8.47	-196.44
1189.0	1189 L	-5.16	6.30	240.76	-6.62	2.26	409.30	-7.41	8.72	118.77	-5.57	1.18	478.65	3.32	-4.12	230.58	-7.28	6.42	351.59	-9.15	13.70	259.07	9.02	-12.07	310.74
	1189 R	-6.18	2.21	370.08	-4.85	6.24	236.65	-4.68	-0.47	456.25	-7.03	9.11	112.73	-6.71	6.26	344.87	-3.32	-2.62	228.99	8.52	-11.96	310.44	-8.33	13.51	212.79
1199.0	1199 L	3.94	-0.60	-328.76	2.03	-3.98	-374.03	4.58	-7.84	-540.23	0.41	5.44	-142.68	8.55	-16.10	-327.64	-1.78	8.44	-379.86	-1.82	12.83	-281.50	17.98	-22.41	-367.21
	1199 R	1.94	-3.46	-391.25	3.85	-0.52	-333.54	0.71	3.81	-150.02	4.01	-5.72	-560.41	-1.70	7.30	-388.02	8.31	-13.91	-329.76	17.42	-19.28	-366.12	-1.75	11.03	-341.92
1205.0	1205 L	17.86	1.29	300.72	11.30	2.47	235.00	12.02	7.42	116.38	16.66	-2.34	497.40	16.97	2.53	259.11	14.90	3.34	260.05	10.70	8.52	206.82	24.94	-4.91	388.83
	1205 R	12.67	3.31	235.00	19.48	1.88	294.41	18.42	-2.92	484.25	13.69	9.43	110.57	16.39	4.17	246.07	18.53	3.05	259.11	27.18	-5.11	389.07	12.16	10.62	151.66
1219.0	1219 L	19.73	2.88	-268.17	14.41	3.18	-244.56	20.15	-3.11	-484.80	14.45	9.61	-111.67	19.63	2.91	-254.94	17.81	3.67	-259.65	13.30	10.77	-152.31	28.18	-5.53	-392.55
	1219 R	12.86	2.39	-244.56	17.93	2.01	-274.48	12.64	7.50	-117.55	18.18	-2.44	-497.98	16.21	2.95	-281.32	17.89	2.40	-254.94	20.13	-4.93	-389.81	11.66	8.59	-207.15
1225.0	1225 L	-3.69	5.18	321.29	-3.57	-3.68	432.83	-5.49	5.18	174.32	-4.00	1.23	585.33	12.39	-14.70	349.14	-7.74	10.51	420.47	-8.78	13.94	410.18	15.38	-18.23	384.78
	1225 R	-2.81	-3.53	420.72	-2.92	4.70	316.87	-1.27	-4.59	561.07	-4.83	5.40	168.75	-6.71	9.67	410.92	11.02	-13.51	348.09	13.62	-16.75	383.83	-7.69	12.86	351.87
1234.0	1234 L	-2.41	5.90	-305.35	-3.73	1.98	-342.82	-3.72	3.57	-504.79	-5.13	9.84	-105.93	3.02	-8.82	-297.11	-6.59	12.94	-289.02	-7.97	17.16	-261.93	4.17	-11.76	-312.52
	1234 R	-3.37	1.76	-385.38	-2.08	5.37	-307.46	-4.53	8.78	-108.73	-3.71	4.15	-524.94	-6.09	12.04	-295.07	2.57	-8.01	-297.52	3.69	-10.82	-312.48	-7.33	15.94	-316.95
1242.0	1242 L	12.95	3.50	327.22	8.73	4.41	302.48	10.20	8.07	168.98	11.95	1.76	547.15	10.93	1.53	369.29	10.96	7.70	279.81	8.14	9.60	290.43	13.96	-3.02	426.53
	1242 R	8.65	4.48	302.48	12.85	3.76	322.59	11.94	1.77	541.69	9.95	8.53	161.70	10.86	7.84	275.18	10.86	1.72	369.29	13.86	-2.52	426.57	8.06	9.57	237.08
1253.0	1253 L	17.96	5.00	-355.88	12.82	6.98	-298.53	17.48	-5.75	-538.53	13.38	11.44	-183.33	15.29	3.14	-343.75	16.23	8.24	-305.65	12.10	12.11	-232.01	18.65	-7.71	-445.55
	1253 R	13.19	6.96	-298.53	18.33	4.76	-361.14	13.81	11.32	-186.06	17.66	-5.74	-553.47	16.61	8.09	-310.91	15.64	-3.19	-343.75	19.02	-8.31	-445.55	12.46	12.23	-285.94
1261.0	1261 L	-3.54	4.47	249.31	-3.92	-3.53	338.30	-5.38	6.77	109.85	-4.19	-1.27	517.82	10.86	-13.27	275.41	-7.29	8.84	399.28	-8.12	14.15	281.61	14.13	-18.74	332.87
	1261 R	-4.67	-3.36	336.79	-4.24	4.55	244.49	-4.71	-1.61	511.31	-6.41	7.46	102.15	-7.96	8.80	394.62	11.74	-13.22	273.86	15.25	-18.61	333.21	-8.88	14.03	225.62
1272.0	1272 L	16.00	-13.54	-457.19	14.10	-18.37	-489.13	14.40	-15.58	-670.69	7.02	-10.31	-270.73	24.39	-25.89	-425.05	6.72	-7.69	-553.17	5.09	-3.91	-454.65	26.55	-28.29	-471.43
	1272 R	7.54	-14.70	-533.50	13.19	-12.13	-459.85	6.27	-9.50	-273.15	7.71	-11.98	-691.24	5.96	-6.94	-595.44	20.23	-23.29	-425.48	21.79	-25.19	-471.70	4.38	-3.49	-509.66
1280.0	1280 L	23.29	-5.19	451.99	19.08	-6.18	459.56	18.67	2.43	286.45	22.11	-6.97	671.59	23.58	-8.39	513.39	18.73	1.68	376.01	17.68	4.44	415.50	27.51	-9.68	552.59
	1280 R	21.81	-6.57	459.56	26.37	-5.26	446.53	25.26	-7.72	663.54	21.32	3.59	279.43	21.63	2.44	326.51	26.54	-8.80	513.39	31.15	-10.19	552.75	20.44	5.37	361.20
1290.0	1290 L	17.19	5.57	-294.91	9.65	8.24	-194.75	16.34	2.93	-476.04	10.66	11.83	-114.05	16.13	4.87	-270.50	14.64	9.00	-241.90	9.16	12.19	-154.62	21.99	0.08	-378.45
	1290 R	7.98	7.14	-194.75	14.99	4.70	-299.85	8.96	9.94	-121.25	14.14	2.64	-482.68	12.66	7.89	-246.84	14.14	4.23	-270.50	15.97	-0.48	-378.46	7.39	10.60	-208.22
1298.0	1298 L	-7.11	7.52	615.60	-13.66	18.00	813.51	-14.39	19.99	502.50	-11.18	14.67	870.83	-7.08	6.96	616.65	-13.25	17.25	773.50	-16.81	24.51	705.94	-3.31	-0.08	655.79
	1298 R	-10.92	13.60	775.69	-5.33	5.66	615.60	-8.50	10.59	855.83	-11.72	15.37	500.08	-10.59	13.09	768.91	-5.32	5.28	616.65	-2.03	-0.24	655.79	-13.64	18.57	652.69
1307.0	1307 L	-21.25	23.05	-135.93	-26.13	30.23	-287.49	-26.74	31.47	-358.85	-21.50	23.27	-37.97	-25.75	29.81	-237.05	-21.37	22.97	-138.14	-28.01	34.21	-255.79	-19.13	18.70	-90.08
	1307 R	-26.13	30.23	-325.09	-21.25	23.05	-135.93	-21.12	22.63	-48.83	-27.13	32.12	-374.24	-21.37	22.97	-138.14	-25.75	29.81	-294.69	-19.13	18.70	-90.08	-28.01	34.21	-313.43
1402.0	1402 L	-21.05	-3.73	-298.35	-23.86	-14.18	-351.14	-29.78	-5.25	-413.67	-15.77	-13.90	-260.63	-28.40	-11.73	-353.28	-18.94	-11.34	-303.90	-28.06	3.93	-395.62	-15.92	-15.84	-269.61
	1402 R	-24.66	-15.15	-257.87	-21.71	-4.70	-234.84	-16.47	-15.53	-180.10	-30.66	-5.88	-330.54	-19.72	-12.24	-222.76	-28.98	-12.61	-271.51	-16.66	-16.57	-184.51	-28.91	-2.91	-319.92
1407.0	1407 L	-10.33	-16.32	49.24	-17.37	-18.32	176.87	-9.64	-19.65	18.70	-18.56	-16.17	208.59	-12.93	-18.22	84.28	-16.42	-16.75	154.81	-18.40	-15.74	204.95	-10.29	-21.28	30.68
	1407 R	-16.56	-17.50	258.47	-9.82	-15.71	105.71	-17.61	-15.47	286.54	-9.10	-18.28	81.02	-15.71	-16.05	226.23	-12.35	-17.53	148.47	-9.70	-20.50	99.56	-17.62	-15.00	281.03
1411.0	1411 L	-8.74	-15.77	-137.22	-15.66	-18.22	-275.08	-16.99	-15.94	-311.42	-8.01	-18.44	-115.02	-10.49	-17.53	-165.25	-15.02	-17.19	-255.57	-16.63	-14.83	-295.24	-8.52	-20.59	-129.08
	1411 R	-16.45	-19.06	-194.17	-9.24	-16.40	-81.83	-8.58	-19.87	-53.62	-17.77	-16.62	-233.85	-15.77	-17.88	-184.39	-11.02	-18.25	-103.00	-9.11	-21.39	-61.27	-17.39	-15.56	-221.54
1416.0	1416 L	-14.97	-8.15	192.62	-19.97	-17.59	234.07	-11.79	-16.39	158.05	-23.00	-7.51	292.46	-22.74	-18.31	222.75	-18.70	-16.71	202.89	-23.21	-6.98	288.74	-12.76	-18.72	165.06
	1416 R	-19.17	-16.74	324.30	-14.36	-7.43	252.69	-21.91	-7.16	370.96	-11.58	-14.31	233.24	-18.20	-16.13	277.72	-22.12	-17.83	301.94	-12.09	-18.16	246.35	-22.29	-5.77	363.28
1422.0	1422 L	-17.97	1.26	-270.33	-22.26	-9.40	-341.75	-26.85	3.00	-386.72	-14.97	-7.43	-251.00	-25.62	-9.15	-320.25	-19.86	-8.70	-291.54	-26.95	5.10	-378.64	-15.57	-11.46	-265.18
	1422 R	-25.74	-11.18	-261.69	-20.69	1.06	-221.77	-16.83	-10.48	-186.39	-30.84	3.90	-318.88	-22.89	-10.27	-225.57	-29.42	-10.69	-253.08	-18.13	-13.47	-192.89	-30.94	5.27	-315.14
1427.0	1427 L	-4.66	-16.38	-5.79	-13.96	-19.76	123.33	-4.47	-20.72	-32.09	-14.75	-17.14	148.44	-8.58	-20.32	17.05	-14.29	-19.03	106.36	-14.05	-16.01	137.13	-4.80	-22.14	-25.03
	1427 R	-13.11	-18.79	194.18	-4.25	-15.73	38.74	-13.93	-16.37	216.06	-3.82	-18.93	18.45	-13.54	-18.26	167.40	-8.08	-19.50	68.52	-4.30	-21.29	31.89	-13.26	-15.19	200.63
1431.0	1431 L	-4.32	-15.55	-34.91	-12.91	-19.42	-173.50	-14.18	-16.26	-210.67	-3.84	-18.74	-13.93	-8.77	-19.63	-69.48	-13.46	-18.24	-157.47	-13.64	-15.26	-196.24	-4.26	-21.03	-28.13
	1431 R	-13.76	-20.37	-102.95	-4.75	-16.20	9.59	-4.53	-20.46	36.62	-15.00	-17.02	-143.23	-14.21	-19.02	-97.04	-9.31	-20.43	-17.49	-4.77	-21.89	28.69	-14.44	-16.09	-132.64
1436.0	1436 L	-22.09	2.41	227.85	-29.38	-12.30	270.75	-18.60	-10.59	192.16	-32.70	5.48	325.18	-31.52	-12.27	256.64	-23.08	-7.98	232.74	-32.49	6.56	321.51	-20.58	-14.05	198.29
	1436 R	-25.50	-10.42	349.77	-19.20	2.44	275.98	-28.36	4.25	392.94	-16.44	-7.89	256.34	-20.06	-6.67	297.25	-27.43	-10.60	324.19	-17.76	-11.99	269.43	-28.30	6.24	384.89
1442.0	1442 L	-16.07	-5.64	-253.22	-21.14	-15.23	-328.50	-23.88	-6.24	-371.21	-12.40	-12.84	-233.80	-21.62	-15.12	-298.40	-17.97	-12.73	-279.54	-23.66	-4.20	-363.16	-13.56	-17.04	-247.82
	1442 R	-25.16	-18.39	-236.90	-18.92	-6.96	-194.04	-14.70	-16.94	-158.12	-28.00	-6.52	-291.86	-21.42	-15.41	-204.71	-25.86	-18.42	-216.64	-16.23	-20.22	-164.65	-27.78	-5.47	-288.21
1447.0	1447 L	-11.03	-16.61	74.49	-20.32	-20.35	193.21	-10.31	-20.33	49.31	-21.96	-17.57	232.16	-13.25	-18.42	98.97	-20.05	-18.43	189.66	-21.22	-16.32	223.35	-11.04	-22.12	57.06
	1447 R	-19.29	-19.31	272.28	-10.39	-15.86	126.81	-20.93	-16.73	307.88	-9.58	-18.71	107.59	-19.06	-17.55	259.96	-12.56	-17.57	157.39	-10.30	-21.15	121.86	-20.22	-15.41	295.37
1451.0	1451 L	-10.48	-16.01	-128.97	-19.50	-18.71	-290.98	-20.56	-16.67	-312.63	-9.65	-18.80	-109.50	-14.36	-18.56	-182.77	-18.68	-17.69	-257.11	-19.85	-15.22	-301.06	-10.38	-21.32	-125.09
	1451 R	-20.54	-19.74	-212.07	-11.10	-16.75	-76.70	-10.32	-20.37	-51.56	-21.58	-17.51	-236.98	-19.61	-18.60	-187.31	-15.13	-19.41	-120.91	-11.11	-22.27	-60.43	-20.84	-16.12	-229.05
1456.0	1456 L	-18.18	-6.90	193.51	-22.25	-17.50	232.24	-14.15	-17.97	155.49	-27.60	-7.32	289.18	-25.89	-15.93	228.15	-20.22	-17.40	196.90	-27.52	-6.40	285.31	-14.62	-20.15	162.20
	1456 R	-18.76	-14.61	321.80	-15.45	-5.61	251.14	-23.31	-6.78	366.40	-12.00	-13.39	229.80	-16.92	-14.46	272.37	-21.63	-13.12	304.30	-12.23	-17.06	243.92	-23.40	-4.97	358.20
1462.0	1462 L	-19.04	4.19	-247.70	-19.58	-8.66	-353.68	-24.07	-1.14	-408.76	-16.90	-8.52	-219.57	-21.23	-6.76	-346.24	-21.08	-7.76	-268.49	-24.95	5.06	-378.69	-15.18	-11.65	-261.21
	1462 R	-23.31	-10.96	-268.65	-22.65	4.14	-201.56	-19.07	-12.24	-161.08	-29.88	-1.72	-333.15	-24.93	-10.46	-208.75	-25.17	-9.13	-269.58	-17.92	-14.08	-188.19	-29.89	4.33	-315.02
1467.0	1467 L	-5.52	-14.39	4.23	-14.06	-20.41	140.48	-4.13	-19.63	-26.76	-15.14	-17.33	167.38	-8.98	-19.03	45.26	-12.48	-17.24	124.58	-14.65	-13.25	147.39	-4.88	-22.77	-11.12
	1467 R	-13.20	-19.42	212.83	-5.13	-13.82	43.27	-14.30	-16.59	235.84	-3.67	-17.97	19.60	-11.83	-16.30	189.16	-8.21	-18.42	95.38	-4.38	-21.91	44.79	-13.89	-12.52	204.83

Section Properties

Ref. Delta Frame Desig

Splice Node	Splice Side	pacity (ksi)	FY	MAX MZ					MIN MZ					$\phi_v V_n$
				Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	
		BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	(kip)
1471.0	1471 L	66.71	-159.29	-19.69	-17.54	66.71	66.71	-302.16	-6.00	-29.07	66.71	66.71	-54.18	1740.00
	1471 R	67.05	-85.32	-6.68	-30.24	67.05	67.05	20.50	-20.76	-18.57	67.05	67.05	-222.20	1392.00
1476.0	1476 L	67.05	260.31	-38.82	4.54	67.10	69.29	421.07	-21.12	-20.74	67.05	67.05	228.64	1392.00
	1476 R	49.25	464.11	-17.93	-17.47	50.00	49.25	326.38	-32.39	5.84	50.00	50.00	506.48	1914.00
1482.0	1482 L	49.18	-360.78	-34.03	11.15	50.00	50.00	-502.56	-19.50	-11.52	50.00	49.18	-345.55	1914.00
	1482 R	67.05	-367.27	-22.48	-13.91	67.05	67.05	-255.93	-39.84	8.84	67.17	69.29	-425.40	1392.00
1487.0	1487 L	67.05	36.06	-16.62	-19.62	67.05	67.05	144.91	-3.98	-30.38	67.05	67.05	-72.75	1392.00
	1487 R	66.71	89.11	-3.47	-29.34	66.71	66.71	-7.54	-15.74	-18.69	66.71	66.71	214.90	1740.00
1491.0	1491 L	66.71	-89.04	-15.44	-17.28	66.71	66.71	-209.69	-2.27	-28.97	66.71	66.71	9.36	1740.00
	1491 R	67.05	-33.67	-2.79	-30.04	67.05	67.05	74.58	-16.30	-18.18	67.05	67.05	-141.41	1392.00
1496.0	1496 L	67.05	293.82	-39.97	8.22	67.16	69.29	436.56	-22.61	-12.76	67.05	67.05	248.47	1392.00
	1496 R	50.00	451.95	-19.60	-10.44	50.00	49.18	335.81	-34.02	10.61	50.00	50.00	515.63	1914.00
1502.0	1502 L	50.00	-430.32	-34.15	7.36	50.00	50.00	-562.46	-18.56	-15.94	50.00	50.00	-383.69	1914.00
	1502 R	68.37	-387.78	-20.59	-17.77	68.37	68.37	-271.70	-37.60	6.68	68.44	69.42	-472.03	1392.00
1507.0	1507 L	68.37	83.50	-21.07	-21.51	68.37	68.37	230.47	-5.96	-29.38	68.37	68.37	-57.37	1392.00
	1507 R	68.10	144.38	-5.37	-28.40	68.10	68.10	24.10	-20.16	-20.59	68.10	68.10	325.86	1740.00
1511.0	1511 L	68.10	-162.95	-20.30	-20.98	68.10	68.10	-330.12	-5.48	-28.55	68.10	68.10	-23.42	1740.00
	1511 R	68.37	-72.70	-6.09	-29.55	68.37	68.37	58.12	-21.21	-21.90	68.37	68.37	-234.44	1392.00
1516.0	1516 L	68.37	332.46	-38.39	6.74	68.44	69.42	477.46	-22.17	-20.41	68.37	68.37	266.19	1392.00
	1516 R	50.00	495.33	-20.09	-18.31	50.00	50.00	378.96	-34.91	7.44	50.00	50.00	570.02	1914.00
1522.0	1522 L	49.59	-479.99	-35.25	12.52	69.43	49.59	-621.67	-22.61	-10.45	69.43	49.59	-438.80	1914.00
	1522 R	67.97	-406.43	-24.53	-11.32	67.97	67.97	-335.57	-37.62	13.32	67.97	69.53	-537.96	1392.00
1527.0	1527 L	67.97	-38.95	-12.05	-18.57	67.97	67.97	109.77	0.29	-25.37	69.53	67.97	-179.42	1392.00
	1527 R	67.87	35.46	0.56	-24.68	69.42	67.87	-103.47	-11.49	-17.93	67.87	67.87	200.15	1740.00
1531.0	1531 L	67.87	-57.65	-11.11	-18.12	67.87	67.87	-215.73	0.89	-24.98	69.42	67.87	98.89	1740.00
	1531 R	67.97	41.00	0.55	-25.60	69.53	67.97	173.39	-11.64	-18.76	67.97	67.97	-127.03	1392.00
1536.0	1536 L	67.97	365.97	-34.96	10.66	67.97	69.53	540.79	-23.15	-12.25	67.97	67.97	327.57	1392.00
	1536 R	49.59	553.98	-21.33	-11.33	69.43	49.59	432.28	-32.77	9.87	69.43	49.59	626.48	1914.00
1542.0	1542 L	69.35	-494.86	-31.32	-10.39	68.43	69.35	-597.92	-20.94	-25.79	68.43	69.35	-388.08	2088.00
	1542 R	69.57	-337.93	-22.75	-28.33	69.57	69.57	-250.07	-33.97	-12.28	69.57	69.57	-473.30	1392.00
1547.0	1547 L	69.57	188.05	-19.82	-18.06	69.57	69.57	337.86	-8.51	-25.19	69.57	69.57	54.00	1392.00
	1547 R	69.47	360.96	-8.02	-24.50	69.47	69.47	157.17	-19.13	-17.39	69.47	69.47	450.94	1740.00
1551.0	1551 L	69.47	-298.10	-20.44	-19.58	69.47	69.47	-471.98	-10.62	-26.66	69.47	69.47	-160.05	1740.00
	1551 R	69.57	-150.90	-11.12	-27.36	69.57	69.57	-37.99	-21.13	-20.25	69.57	69.57	-343.12	1392.00
1556.0	1556 L	69.57	374.54	-38.96	5.71	69.57	69.57	610.09	-19.42	-18.93	69.57	69.57	347.54	1392.00
	1556 R	69.35	702.50	-17.61	-17.10	68.43	69.35	505.30	-35.79	6.29	68.43	69.35	754.86	2088.00
3007.0	3007 L	69.04	103.85	-47.97	47.59	69.04	69.04	248.51	-35.69	26.45	69.04	69.04	20.26	1375.39
	3007 R	69.04	107.37	-35.69	26.45	69.04	69.04	20.26	-47.97	47.59	69.04	69.04	152.35	1375.39
3015.0	3015 L	69.04	-821.09	-16.85	21.00	69.04	69.04	-792.33	5.99	-5.84	69.04	68.14	-777.59	1375.39
	3015 R	59.11	-761.98	6.75	-8.66	68.06	59.11	-777.60	-18.74	30.11	68.06	68.06	-891.31	2686.30
3021.0	3021 L	68.02	352.41	18.61	15.76	68.02	68.02	308.52	34.37	-3.59	68.02	62.86	507.95	3935.48
	3021 R	68.19	363.90	41.88	-3.63	68.19	62.44	507.89	23.77	20.65	68.19	68.19	216.14	1375.39
3035.0	3035 L	62.44	-495.62	29.76	7.84	68.19	68.19	-392.76	48.82	-10.73	68.19	62.44	-651.32	1375.39
	3035 R	62.86	-521.18	40.35	-9.28	68.02	62.86	-650.28	23.83	5.39	68.02	68.02	-485.86	3935.48
3041.0	3041 L	59.11	719.83	1.43	-2.87	68.06	59.11	703.86	25.77	-30.04	68.06	59.11	583.46	2686.30
	3041 R	62.43	562.37	31.67	-38.49	67.91	62.41	585.07	1.54	-3.58	67.91	60.60	597.27	1375.39
3051.0	3051 L	67.91	-476.85	-0.80	11.03	67.91	67.91	-407.68	26.15	-30.38	67.91	62.44	-472.01	1375.39
	3051 R	47.30	-446.72	24.24	-27.82	50.00	47.27	-468.71	-1.30	10.29	50.00	50.00	-508.54	1375.39
3057.0	3057 L	50.00	454.28	18.42	9.75	50.00	50.00	441.38	34.44	-7.97	50.00	48.65	594.32	3306.90
	3057 R	50.00	471.62	35.43	-8.01	50.00	47.83	594.34	19.18	10.38	50.00	50.00	349.55	2686.30
3071.0	3071 L	50.00	-387.17	18.53	14.36	50.00	50.00	-297.66	33.09	-5.36	50.00	47.91	-528.64	2686.30
	3071 R	50.00	-409.86	32.10	-5.52	50.00	48.72	-528.58	17.71	13.66	50.00	50.00	-389.54	3306.90
3077.0	3077 L	50.00	601.43	-16.71	23.02	50.00	50.00	612.67	9.23	-14.20	50.00	47.17	516.79	1375.39
	3077 R	48.32	514.20	8.65	-11.20	50.00	48.35	516.99	-15.23	18.34	50.00	50.00	517.71	1375.39
3089.0	3089 L	50.00	-681.41	-3.04	9.59	50.00	50.00	-618.54	20.00	-20.13	50.00	48.41	-616.82	1375.39
	3089 R	47.42	-608.05	19.10	-21.83	50.00	47.42	-616.75	-3.22	10.43	50.00	50.00	-712.20	1375.39
3095.0	3095 L	50.00	402.50	21.02	8.92	50.00	50.00	395.48	37.49	-8.09	50.00	48.67	535.03	3306.90
	3095 R	50.00	416.09	37.71	-6.47	50.00	48.79	535.05	21.49	9.97	50.00	50.00	303.65	1375.39
3109.0	3109 L	50.00	-412.51	22.50	8.43	50.00	50.00	-321.04	39.18	-7.85	50.00	48.76	-549.41	1375.39
	3109 R	48.77	-439.53	39.03	-9.54	50.00	48.64	-549.39	22.07	7.31	50.00	50.00	-412.91	3306.90
3115.0	3115 L	50.00	678.33	-4.64	7.55	50.00	50.00	650.74	21.67	-26.65	50.00	47.40	626.43	1375.39
	3115 R	47.38	601.67	26.12	-29.23	50.00	47.37	627.45	-5.74	8.31	50.00	50.00	555.52	1375.39
3127.0	3127 L	50.00	-586.16	-6.24	12.25	50.00	50.00	-446.01	13.13	-14.03	50.00	47.38	-547.52	1375.39
	3127 R	47.18	-465.07	13.45	-16.34	50.00	47.15	-546.75	-6.31	14.20	50.00	50.00	-539.86	1375.39
3133.0	3133 L	50.00	360.61	16.43	10.54	50.00	50.00	391.07	30.51	-2.82	50.00	48.83	491.49	3306.90
	3133 R	50.00	400.67	37.13	-3.96	50.00	47.98	493.92	21.04	13.73	50.00	50.00	298.78	1375.39
3147.0	3147 L	50.00	-422.36	23.97	12.43	50.00	50.00	-321.33	43.51	-8.59	50.00	47.86	-553.58	1375.39
	3147 R	50.00	-410.93	35.78	-6.43	50.00	48.73	-553.65	18.67	9.62	50.00	50.00	-413.05	3306.90
3153.0	3153 L	50.00	508.93	-7.94	11.16	50.00	50.00	453.48	20.48	-24.99	50.00	47.15	560.35	1375.39
	3153 R	47.04	475.60	21.87	-27.35	50.00	47.01	560.60	-8.68	12.35	50.00	50.00	360.65	1375.39
3163.0	3163 L	50.00	-489.97	-4.91	13.24	50.00	50.00	-320.68	17.90	-21.48	50.00	47.03	-509.90	1375.39
	3163 R	47.26	-407.88	16.27	-19.47	50.00	47.16	-509.21	-4.68	12.11	50.00	50.00	-413.87	1375.39
3169.0	3169 L	50.00	437.34	16.14	9.87	50.00	50.00	421.10	32.56	-3.39	50.00	48.82	566.30	3306.90
	3169 R	50.00	422.07	39.21	-5.29	50.00	47.43	574.12	20.61	13.02	50.00	50.00	329.32	1375.39
3183.0	3183 L	50.00	-416.62	21.54	13.15	50.00	50.00	-328.85	37.15	-3.85	50.00	47.48	-551.42	1375.39
	3183 R	50.00	-404.77	30.62	-2.25	50.00	48.86	-551.46	16.87	10.03	50.00	50.00	-420.63	3306.90
3189.0	3189 L	50.00	523.11	-13.61	16.75	50.00	50.00	485.01	9.71	-14.95	50.00	47.06	475.33	1375.39
	3189 R	46.91	397.47	9.15	-14.81	50.00	47.03	476.49	-12.41	16.47	50.00	50.00	391.40	1375.39
3199.0	3199 L	50.00	-575.65	-3.28	14.71	50.00	50.00	-470.35	21.80	-28.27	50.00	47.12	-559.68	1375.39
	3199 R	47.39	-524.61	21.03	-24.27	50.00	47.35	-556.57	-3.17	12.62	50.00	50.00	-597.96	1375.39
3205.0	3205 L	50.00	480.25	17.89	9.16	50.00	50.00	475.70	35.37	-6.17	50.00	49.26	661.89	3306.90
	3205 R	50.00	480.45	38.62	-6.46	50.00	48.78	662.12	20.30	11.88	50.00	50.00	352.00	1375.39
3219.0	3219 L	50.00	-466.44	21.50	12.84	50.00	50.00	-339.83	40.16	-6.91	50.00	48.77	-649.54	1375.39
	3219 R	50.00	-473.87	36.71	-6.55	50.00	49.26	-649.59	19.07	10.12	50.00	50.00	-462.82	3306.90
3225.0	3225 L	50.00	699.57	-12.99	19.00	50.00	50.00	614.72	17.76	-23.55	50.00	47.31	564.99	1375.39
	3225 R	47.34	512.27	15.70	-21.65	50.00	47.36	565.83	-11.29	17.48	50.00	50.00	483.90	1375.39
3234.0	3234 L	50.00	-562.02	-11.48	21.91	50.00	50.00	-437.72	12.86	-17.11	50.00	47.37	-479.57	1375.39
	3234 R	49.34	-464.69	11.81	-15.77	50.00	49.33	-478.35	-10.48	20.31	50.00	50.00	-559.21	1375.39
3242.0	3242 L	68.45	543.83	14.13	14.02	48.89	68.45	586.60	27.21	-4.67	48.89	66.74	752.00	3306.90
	3242 R	50.00	665.21	27.02	-3.81	50.00	50.00	752.14	13.98	14.03	50.00	50.00	463.48	2686.30
3253.0	3253 L	50.00	-524.42	17.34	15.64	50.00	50.00	-412.46	31.70	-8.13	50.00	50.00	-702.73	2686.30
	3253 R	68.58	-575.05	30.93	-8.08	48.99	67.57	-702.72	16.75	15.15	48.99	68.58	-534.56	3306.90
3262.0	3262 L	50.00	643.07	-11.29	17.36	50.00	50.00	492.09	16.68	-22.79	50.00	49.33	491.65	1375.39
	3262 R	48.88	440.84	17.64	-22.47	50.00	48.89	492.51	-12.33	17.18	50.00	50.00	370.54	1375.39
3272.0	3272 L	48.87	-918.32	7.09	-9.95	50.00	48.87	-823.64	37.53	-42.18	50.00	48.92	-786.60	1375.39
	3272 R	65.94	-767.06	30.98	-37.47	68.29	65.93	-785.77	5.98	-8.67	68.29	65.86	-944.25	2686.30

Splice Node	Splice Side	SERVICE II																							
		MAX FX			MIN FX			MAX FY			MIN FY			MAX MY			MIN MY			MAX MZ			MIN MZ		
		Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY
		TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)
1471.0	1471 L	-4.93	-14.18	-51.19	-12.62	-18.75	-189.53	-14.69	-14.78	-236.70	-3.46	-18.32	-20.90	-8.68	-16.73	-97.75	-10.58	-16.86	-180.16	-14.62	-12.83	-218.76	-4.35	-21.13	-43.06
	1471 R	-13.43	-19.69	-121.00	-5.33	-14.78	-11.22	-4.00	-19.78	25.64	-15.66	-14.86	-173.47	-11.27	-17.78	-117.51	-9.67	-17.65	-53.25	-4.86	-21.98	11.57	-15.41	-13.57	-160.38
1476.0	1476 L	-19.23	-1.23	194.16	-23.54	-10.53	260.52	-16.41	-11.80	151.40	-28.52	-2.65	315.14	-26.37	-7.27	268.04	-20.61	-11.57	188.29	-28.02	3.00	301.87	-15.42	-15.10	168.11
	1476 R	-19.80	-8.23	341.63	-16.08	1.54	239.97	-23.87	-1.34	387.53	-14.01	-8.80	211.11	-17.43	-9.14	251.91	-22.20	-4.99	336.91	-13.09	-12.72	239.60	-23.38	3.97	364.21
1482.0	1482 L	-16.55	4.65	-236.97	-21.47	-5.20	-343.81	-24.99	3.85	-384.12	-15.11	-3.46	-219.61	-23.50	3.26	-328.00	-18.43	-4.92	-263.92	-24.63	7.93	-360.65	-14.29	-8.42	-253.16
	1482 R	-24.85	-7.46	-268.90	-19.45	3.56	-197.40	-17.07	-6.88	-167.67	-29.05	2.89	-317.29	-21.34	-7.01	-207.32	-27.04	-4.73	-263.40	-16.48	-10.17	-187.71	-28.83	6.26	-304.47
1487.0	1487 L	-3.15	-15.11	-30.95	-11.16	-19.87	79.01	-2.03	-19.78	-62.44	-12.97	-16.02	121.73	-6.84	-17.73	-2.40	-8.98	-17.46	83.95	-12.49	-14.31	104.70	-2.78	-22.08	-50.86
	1487 R	-10.47	-19.00	140.61	-2.87	-14.59	2.28	-12.27	-15.37	178.89	-1.73	-18.15	-21.99	-8.45	-16.64	140.44	-6.30	-17.18	38.59	-2.41	-21.32	-3.33	-11.85	-13.63	155.76
1491.0	1491 L	-2.96	-13.85	-2.49	-9.57	-19.59	-139.94	-11.76	-15.48	-178.87	-1.36	-17.83	24.21	-6.55	-17.39	-61.41	-7.58	-15.89	-117.75	-11.02	-12.31	-147.40	-2.03	-21.58	-1.14
	1491 R	-10.27	-20.50	-76.59	-3.25	-14.37	30.55	-1.63	-19.60	65.20	-12.46	-16.16	-120.71	-8.16	-16.70	-64.10	-7.05	-18.06	-15.58	-2.43	-22.38	47.88	-11.64	-12.96	-98.58
1496.0	1496 L	-19.74	3.66	199.18	-25.78	-7.25	276.94	-16.54	-6.28	160.85	-29.81	2.75	329.32	-26.88	-4.72	260.38	-22.35	-6.62	218.01	-28.81	6.02	311.16	-16.63	-9.55	185.96
	1496 R	-22.22	-4.90	353.18	-16.86	4.75	239.23	-25.65	3.88	397.97	-14.65	-3.71	211.94	-19.35	-4.44	275.96	-23.17	2.97	322.94	-14.42	-7.84	251.17	-24.53	7.71	367.93
1502.0	1502 L	-17.08	2.00	-281.61	-20.34	-9.78	-365.44	-25.02	2.18	-422.03	-13.64	-7.19	-260.49	-24.45	-6.51	-355.28	-19.16	-9.64	-313.38	-24.79	5.29	-406.40	-13.61	-11.67	-280.43
	1502 R	-22.43	-11.29	-275.02	-18.81	1.54	-231.10	-14.88	-10.72	-189.53	-27.91	3.59	-348.85	-21.01	-11.14	-238.66	-26.77	-8.02	-281.06	-15.10	-13.01	-198.34	-27.30	4.79	-340.59
1507.0	1507 L	-6.18	-16.66	-13.57	-14.20	-20.29	125.88	-5.16	-20.98	-51.91	-15.88	-17.14	178.06	-7.94	-19.24	2.61	-14.90	-18.22	133.03	-15.99	-16.41	167.53	-5.36	-22.27	-41.01
	1507 R	-13.52	-19.51	202.96	-5.83	-16.14	32.02	-15.27	-16.64	250.69	-4.81	-19.47	1.98	-14.26	-17.57	200.54	-7.54	-18.62	55.81	-4.93	-21.56	18.33	-15.32	-15.73	237.40
1511.0	1511 L	-5.71	-16.42	-34.73	-13.70	-19.70	-201.74	-15.10	-16.39	-253.26	-4.62	-19.62	-3.03	-8.45	-19.27	-74.94	-14.67	-17.73	-202.59	-15.45	-16.03	-240.44	-5.07	-21.74	-17.84
	1511 R	-14.37	-20.48	-124.67	-6.07	-16.96	11.06	-5.06	-21.22	51.15	-15.74	-17.02	-180.77	-15.32	-18.37	-134.82	-8.88	-19.94	-18.59	-5.52	-22.47	41.60	-16.12	-16.71	-170.39
1516.0	1516 L	-18.06	0.42	231.22	-23.41	-12.94	271.57	-15.38	-12.58	186.88	-28.05	3.32	350.74	-27.30	-10.15	279.57	-20.34	-9.17	242.51	-27.79	4.67	344.96	-16.35	-15.04	194.05
	1516 R	-21.29	-11.27	362.52	-16.37	0.99	282.85	-25.69	2.49	425.23	-13.94	-8.69	259.77	-18.50	-7.84	314.58	-25.01	-8.42	358.73	-14.83	-13.49	276.51	-25.27	5.19	412.57
1522.0	1522 L	-19.31	6.57	-333.06	-20.92	-6.25	-397.62	-25.86	6.40	-476.59	-17.32	-5.40	-306.30	-22.40	-4.89	-364.83	-17.34	-0.78	-352.38	-25.69	8.98	-452.49	-16.83	-7.69	-322.67
	1522 R	-22.64	-6.68	-314.78	-20.63	6.94	-285.90	-18.47	-7.25	-239.74	-27.72	7.42	-405.64	-18.63	-0.95	-287.78	-24.09	-4.96	-297.19	-18.25	-8.31	-247.13	-27.43	9.54	-390.87
1527.0	1527 L	-0.47	-14.11	-100.35	-9.13	-17.96	50.70	0.93	-18.43	-139.11	-9.96	-15.34	89.92	-8.10	-19.78	-35.98	-9.30	-18.49	17.73	-9.86	-14.78	78.91	0.68	-19.08	-130.59
	1527 R	-8.69	-17.40	124.52	-0.31	-13.77	-56.99	-9.53	-14.95	159.12	1.26	-17.14	-87.01	-8.96	-18.04	79.59	-7.79	-19.30	23.13	0.93	-18.63	-74.85	-9.45	-14.30	145.28
1531.0	1531 L	-0.43	-14.00	52.99	-7.90	-17.19	-122.27	-9.57	-15.51	-168.58	1.65	-17.43	83.97	-5.74	-17.85	-18.61	-8.86	-18.03	-77.89	-8.77	-14.05	-154.66	1.30	-19.01	70.11
	1531 R	-8.34	-17.72	-50.79	-0.60	-14.35	95.00	1.48	-18.94	134.29	-9.95	-15.87	-100.83	-9.21	-18.49	-15.75	-6.00	-18.29	33.34	1.06	-19.47	124.89	-9.18	-14.53	-89.70
1536.0	1536 L	-18.47	5.12	282.17	-21.09	-6.83	312.63	-16.14	-6.49	231.80	-25.91	5.63	406.24	-24.70	5.86	338.48	-19.97	-7.59	267.26	-25.69	7.86	393.21	-17.27	-9.14	240.13
	1536 R	-19.51	-6.29	400.03	-17.30	4.75	329.25	-24.27	4.22	479.62	-14.90	-4.15	298.66	-18.54	-7.20	338.57	-23.08	5.68	404.86	-15.91	-8.47	317.02	-24.08	7.30	456.08
1542.0	1542 L	-17.30	-9.73	-315.17	-19.93	-16.96	-380.98	-23.51	-9.84	-455.51	-15.17	-16.86	-270.91	-16.27	-13.21	-339.88	-20.65	-15.45	-360.22	-22.90	-7.94	-433.90	-15.58	-19.08	-284.77
	1542 R	-21.65	-18.86	-269.27	-18.73	-11.04	-239.12	-16.55	-19.70	-176.69	-25.56	-10.83	-355.96	-22.32	-17.34	-257.87	-17.77	-14.64	-246.95	-16.91	-20.95	-183.30	-24.83	-9.34	-342.59
1547.0	1547 L	-7.19	-15.16	69.13	-14.10	-17.79	205.15	-8.04	-19.47	34.38	-16.54	-15.96	249.83	-16.50	-18.69	197.61	-14.74	-20.63	142.73	-13.73	-12.65	244.03	-6.69	-18.71	43.66
	1547 R	-13.58	-17.23	296.26	-6.86	-14.73	132.60	-13.40	-12.83	334.61	-6.08	-16.89	104.98	-14.30	-20.13	222.56	-16.03	-18.18	279.21	-6.31	-18.18	119.43	-13.23	-12.16	327.02
1551.0	1551 L	-7.26	-14.68	-114.66	-14.28	-18.70	-304.02	-13.92	-14.31	-365.52	-6.47	-16.85	-90.53	-15.54	-17.06	-305.74	-13.69	-20.39	-215.01	-15.79	-15.36	-337.69	-8.63	-20.14	-124.23
	1551 R	-14.80	-19.28	-196.76	-7.59	-15.11	-41.16	-6.78	-17.33	-9.71	-14.39	-14.70	-264.60	-14.14	-20.92	-118.37	-16.00	-17.57	-213.84	-9.01	-20.66	-34.07	-16.29	-15.85	-243.74
1556.0	1556 L	-21.48	-4.45	325.92	-22.66	-12.31	373.53	-13.65	-11.87	243.57	-28.98	-6.14	459.52	-28.33	-7.02	406.69	-15.16	-12.37	274.94	-27.82	3.46	441.36	-14.90	-14.19	257.84
	1556 R	-20.71	-10.77	503.68	-19.73	-3.43	412.89	-26.60	-4.92	577.91	-12.78	-10.48	350.75	-13.77	-11.08	388.80	-26.09	-5.62	513.16	-13.54	-12.81	373.84	-25.53	3.93	547.46
3007.0	3007 L	-28.20	22.66	50.25	-33.75	31.52	122.07	-28.21	22.54	-34.60	-34.41	32.75	242.21	-27.75	21.36	41.55	-33.35	31.13	160.14	-35.26	34.59	177.50	-26.61	19.46	18.68
	3007 R	-33.75	31.52	92.90	-28.20	22.66	50.24	-33.98	32.02	222.71	-28.62	23.25	-51.05	-33.35	31.13	149.61	-27.75	21.36	41.55	-26.61	19.46	18.68	-35.26	34.59	109.56
3015.0	3015 L	-4.26	1.96	-549.77	-9.46	9.96	-663.37	-7.16	6.56	-724.60	-9.60	10.41	-434.67	-3.62	0.60	-556.45	-11.02	12.49	-596.79	-12.30	15.05	-576.47	-1.50	-3.06	-567.52
	3015 R	-11.11	15.27	-712.12	-4.97	3.42	-546.30	-11.00	15.73	-445.13	-8.64	10.55	-754.15	-12.37	17.66	-606.93	-4.04	0.67	-556.63	-1.95	-4.33	-567.67	-13.68	21.59	-646.17
3021.0	3021 L	19.69	4.28	296.46	14.47	7.51	215.88	14.57	10.89	144.08	19.02	2.17	474.73	16.87	3.89	263.91	19.01	8.05	255.41	13.82	11.47	224.40	25.07	-2.45	365.68
	3021 R	18.25	9.90	215.88	23.90	5.87	289.00	23.37	2.67	456.95	18.24	14.65	136.49	22.95	10.08	247.95	20.10	4.83	263.91	30.59	-2.45	365.64	17.67	15.01	159.13
3035.0	3035 L	28.63	-2.73	-373.47	24.68	-2.60	-362.76	28.08	-5.87	-568.90	25.32	3.92	-248.39	27.27	-2.72	-379.04	28.91	-4.33	-361.61	23.73	4.41	-288.30	35.77	-7.74	-471.61
	3035 R	20.05	-2.34	-362.76	23.61	-2.47	-380.94	20.72	2.35	-256.11	22.99	-4.49	-586.63	24.11	-4.16	-369.07	22.88	-2.98	-379.04	29.53	-6.68	-470.87	19.03	2.99	-354.08
3041.0	3041 L	13.08	-14.30	432.48	4.12	-7.92	482.04	4.22	-7.55	270.11	4.81	-8.48	622.83	15.81	-17.90	408.40	3.80	-6.12	521.95	1.85	-1.97	507.67	18.03	-20.94	425.60
	3041 R	4.35	-9.88	414.31	15.85	-18.09	431.48	5.69	-12.07	594.94	4.26	-8.81	260.28	3.92	-7.42	455.52	19.09	-22.57	407.88	22.17	-26.85	426.64	2.00	-2.42	432.54
3051.0	3051 L	4.71	-4.49	-285.52	2.84	-2.72	-348.47	5.06	-7.50	-495.35	2.19	1.16	-167.73	8.24	-13.84	-322.85	2.12	2.60	-347.35	-0.89	8.37	-295.61	18.22	-21.36	-343.92
	3051 R	2.51	-2.52	-422.47	4.37	-4.12	-286.47	2.13	0.38	-178.27	4.19	-5.63	-523.01	1.83	2.55	-412.38	7.91	-12.88	-323.29	16.88	-19.56	-341.43	-1.22	7.80	-366.97
3057.0	3057 L	19.50	-1.62	360.28	14.88	2.66	304.19	15.20	5.81	219.67	18.94	-3.18	551.70	17.99	0.87	343.25	18.95	2.56	331.64	13.79	7.04	321.88	20.57	-5.52	430.58
	3057 R	15.44	2.89	304.19	20.10	-1.53	352.81	19.72	-3.65	533.99	15.60	6.60	211.66	19.55	2.63	324.18	18.35	0.84	343.25	21.16	-5.59	430.60	14.36	7.49	257.00
3071.0	3071 L	19.29	3.12	-306.74	14.77	5.17	-272.36	18.56	-1.80	-491.35	15.35	9.48	-167.31	16.35	2.48	-297.04	18.74	5.87	-282.56	13.91	10.41	-219.32	20.21	-3.73	-380.95
	3071 R	14.17	4.88	-272.36	18.65	2.85	-314.20	14.91	8.63	-175.24	17.73	-1.47	-509.10	18.10	5.71	-290.02	15.74	2.06	-297.04	19.58	-3.80	-380.91	13.29	9.90	-284.23
3077.0	3077 L	-7.28	5.48	363.02	-9.11	6.64	475.69	-8.97	8.31	229.09	-8.73	6.59	588.67	2.87	-5.36	376.36	-11.19	12.08	434.46	-12.23	16.48	442.40	6.23	-9.97	378.22
	3077 R	-7.83	4.79	372.75	-6.24	4.26	362.19	-7.21	4.31	563.52	-8.20	7.13	218.91	-10.12	9.81	416.92	-3.75	-3.40	376.52	5.87	-7.88	378.50	-11.11	13.12	375.23
3089.0	3089 L	3.22	-2.49	-435.59	1.74	-2.18	-450.35	3.06	-3.27	-638.49	0.73	1.18	-290.38	6.76	-10.19	-445.50	-1.02	3.69	-493.53	-2.22	6.97	-449.11	7.92	-13.17	-451.41
	3089 R	1.48	-2.05	-560.22	3.08	-2.69	-436.43	0.90	0.67	-300.14	2.50	-2.54	-663.15	-1.21	3.90	-523.98	6.63	-11.00	-445.30	7.74	-14.35	-451.45	-2.36	7.58	-515.14
3095.0	3095 L	21.13	-0.99	310.83	16.47	1.58	276.93	16.84	4.80	178.59	20.76	-3.12	514.36	21.46	-2.55	304.12	19.99	1.42	291.54	15.49	6.43	286.58	27.44	-5.80	388.16
	3095 R	16.73	2.29	276.93	21.42	0.25	303.37	21.23	-2.73	496.53	17.00	5.99	170.54	20.31	2.28	284.08	21.71	2.47	304.12	27.60	-4.62	388.17	15.84	7.20	221.70
3109.0	3109 L	23.67	-2.49	-337.43	17.35	1.46	-281.55	22.34	-3.72	-511.46	18.07	4.85	-187.86	23.01	-2.55	-321.30	21.80	1.43	-300.17	16.69	5.93	-237.58	24.17	-5.54	-396.89
	3109 R	17.07	0.64	-281.55	23.45	-3.49	-344.89	17.96	3.60	-195.95	21.91	-4.15	-529.32	21.53	-2.27	-307.63	22.80	-3.52	-321.30	23.99	-6.51	-396.87	16.38	5.11	-302.49
3115.0	3115 L	7.75	-8.57	422.36	-0.99	-3.23	528.53	-0.85	-0.72	287.05	1.39	-5.05	638.08	12.26	-14.49	433.17	-2.56	1.70	496.34	-3.50	5.79	476.85	15.03	-18.61	450.42
	3115 R	-1.61	-3.29	463.85	9.72	-9.92	427.09	1.52	-6.41	613.00	-1.75	0.54	276.62	-3.26	1.96	465.98	14.57	-15.80	433.07	18.13	-20.43	451.29	-4.29	6.36	409.50
3127.0	3127 L	0.30	0.72	-317.43	-1.35	0.10	-418.17	0.34	-2.18	-565.63	-2.97	5.40	-195.40	2.43	-5.24	-344.13	-3.08	4.69	-421.04	-4.64	9.26	-322.03	4.04	-9.74	-402.35
	3127 R	-1.35	0.06	-483.25	0.28	0.81	-317.84	-2.71	5.49	-205.41	-0.13	-1.44	-589.97	-3.09	5.35	-434.44	2.43	-6.02	-343.96	4.05	-11.31	-401.67	-4.69	10.74	-388.40
3133.0	3133 L	17.93	2.53	292.80	12.31	3.98	248.52	14.35	6.29	176.67	16.11	1.23	487.40	17.07	3.50	299.52	15.24	3.72	259.42	11.99	7.88	277.38	18.51	-2.22	363.69
	3133 R	15.66	5.15	248.52	21.80	3.00	284.99	19.98	0.83	468.38	17.83	8.46	168.04	18.45	4.25	251.61	20.79	3.93	299.52	22.32	-3.29	365.40	15.44	10.27	212.18
3147.0	3147 L	25.16	-2.11	-329.65	18.88	3.17	-284.42	24.71	-4.54	-498.82	18.64	8.83	-190.98	23.68	4.27	-288.34	21.24	0.61	-314.27	17.77	9.52	-225.03	26.12	-6.58	-406.98
	3147 R	14.95	2.57	-284.42	20.68	-1.39	-337.11	14.81	6.55	-199.09	20.10	-2.75	-517.34	17.22	0.60	-321.74	19.35	3.88	-288.34	21.65	-4.74	-407.03	13.80	7.37	-289.84
3153.0	3153 L	10.19	-10.28	334.03	-4.60	1.66	441.06	-2.89	1.05	181.47	-1.27	-3.72	542.58	11.35	-13.46	346.45	-4.59	3.26	369.26	-5.98	8.92	330.08	15.17	-18.88	405.47
	3153 R	-5.01	1.63	416.34	10.71	-11.17	331.81	-0.61	-8.56	519.86	-4.44	5.50	170.35	-5.07	3.59	362.09	11.95	-14.61	345.92	16.19	-20.67	405.97	-6.54	9.85	264.07
3163.0	3163 L	3.00	-3.55	-245.03	-1.89	0.92	-404.97	1.85	-6.80	-490.96	-1.60	6.55	-132.51	3.59	-5.48	-294.91	-1.64	-0.67	-354.39	-3.64	10.48	-234.58	5.36	-14.23	-368.48
	3163 R	-1.81	0.82	-443.67	2.79	-3.25	-247.21	-0.64	2.21	-143.28	0.61	-1.99	-514.05	-1.56	-0.60	-364.24	3.33	-5.01	-296.60	5.01	-13.04	-367.67	-3.47	9.59	-300.84
3169.0	3169 L	17.82	1.49	343.24	12.96	2.77	290.67	12.63	6.72	204.47	17.54	-0.68	523.63	16.60	3.96	295.34	16.12	2.49	325.00	11.90	7.54	294.66	18.78	-2.41	416.11
	3169 R	16.16	3.28	290.67	21.54	1.29	335.77	21.40	-2.21	505.17	15.81	9.25	196.59	19.52	2.40	317.53	20.16	4.35	295.34	22.46	-4.03	421.64	15.24	9.94	229.82
3183.0	3183 L	21.27	2.19	-318.61	16.14	4.25	-274.02	20.19	-0.56	-499.32	17.58	8.16	-190.71	19.56	4.73	-286.70	20.55	2.66	-313.26	15.82	9.88	-233.07	22.29	-3.37	-408.51
	3183 R	12.79	3.41	-274.02	17.43	2.10	-326.07	14.19	6.02	-198.55	16.44	0.63	-517.70	16.97	2.77	-320.73	15.96	4.21	-286.70	18.50	-1.88	-408.54	12.34	7.52	-297.91
3189.0	3189 L	-5.71	2.71	293.95	-7.43	2.29	448.89	-8.12	6.97	161.66	-6.06	0.24	530.26	-5.15	-1.77	284.11	-8.08	4.61	385.62	-10.24	12.73	346.07	7.83	-12.07	351.86
	3189 R	-6.94	2.23	384.81	-5.42	2.66	293.05	-5.37	-1.24	506.61	-7.76	7.55	151.90	-7.47	4.44	377.17	-4.93	-1.64	284.10	7.38	-11.97	352.89	-9.34	12.52	279.82
3199.0	3199 L	3.97	-5.64	-372.12	0.60	-0.92	-466.48	2.61	-5.10	-608.45	0.24	2.52	-174.61	6.22	-13.20	-373.31	-1.46	4.60	-422.39	-2.24	10.41	-347.99	6.82	-17.88	-398.39
	3199 R	0.52	-0.82	-487.02	3.80	-4.85	-373.31	0.53	1.34	-187.57	1.96	-3.04	-640.18	-1.38	3.97	-434.06	5.92	-11.37	-373.40	6.53	-15.36	-395.99	-2.16	8.93	-438.26
3205.0	3205 L	19.10	0.23	369.52	14.20	2.25	313.17	15.01	5.66	210.49	17.91	-1.80	627.21	18.21	1.99	349.85	18.07	2.13	348.30	13.25	6.49	346.49	20.08	-4.15	476.63
	3205 R	15.84	3.04	313.17	20.81	0.73	359.54	19.87	-2.42	603.57	16.52	7.83	200.36	19.83	2.74	338.32	19.88	2.51	349.85	21.86	-4.57	476.79	15.04	8.42	259.09
3219.0	3219 L	22.23	-0.31	-375.16	16.69	2.58	-314.35	21.71	-2.92	-599.96	16.52	8.44	-193.81	21.30	2.68	-345.08	20.84	2.80	-337.48	15.87	9.16	-248.03	23.14	-5.02	-469.20
	3219 R	14.95	1.80	-314.35	20.31	-0.67	-385.13	14.95	6.16	-203.99	19.58	-2.19	-623.53	18.99	2.24	-347.45	19.41	2.14	-345.08	21.23	-4.51	-469.24	14.06	7.20	-334.92
3225.0	3225 L	-3.51	-0.93	363.17	-6.48	2.19	539.67	-6.44	4.57	195.93	-4.65	-2.06	646.49	7.21	-10.21	374.31	-8.44	8.46	502.48	-9.66	13.64	442.54	12.80	-16.91	411.88
	3225 R	-5.45	1.90	442.50	-2.70	-0.99	361.91	-3.21	-3.44	609.48	-5.73	4.95	184.12	-7.21	7.68	413.31	-1.08	-7.84	374.47	11.33	-15.55	412.31	-8.38	12.54	350.37
3234.0	3234 L	-2.90	2.82	-313.93	-5.82	5.60	-447.89	-4.20	2.48	-584.47	-5.76	8.56	-132.64	-0.57	-5.90	-339.92	-7.43	11.29	-404.24	-8.36	15.54	-320.80	1.97	-10.31	-345.98
	3234 R	-5.31	5.08	-469.37	-2.57	2.47	-315.22	-4.95	7.11	-144.44	-4.37	3.82	-602.67	-6.82	10.45	-436.00	-0.40	-5.35	-339.59	1.60	-9.52	-345.28	-7.62	14.39	-406.37
3242.0	3242 L	15.14	4.00	448.61	11.17	4.82	415.06	11.93	8.57	273.47	14.00	2.84	698.58	12.98	2.80	482.34	13.64	6.58	398.35	10.56	10.06	426.80	15.88	-3.32	545.43
	3242 R	11.06	4.93	415.06	15.00	4.32	438.69	14.06	2.58	679.55	11.60	9.10	258.58	13.50	6.80	388.42	12.86	3.01	482.34	15.74	-2.78	545.53	10.44	10.06	339.82
3253.0	3253 L	18.42	3.88	-437.91	13.86	6.91	-357.84	17.92	-3.83	-637.49	13.79	10.42	-238.63	15.38	4.48	-418.31	17.69	6.54	-384.21	13.03	11.35	-303.44	19.23	-6.19	-510.19
	3253 R	13.44	6.71	-357.84	17.95	3.79	-447.21	13.51	9.71	-249.94	17.26	3.63	-659.40	17.24	6.42	-393.51	14.93	4.30	-418.31	18.77	-6.11	-510.18	12.60	11.00	-389.71
3262.0	3262 L	-2.79	-1.18	258.19	-5.63	1.76	444.15	-5.29	4.53	125.64	-3.85	-3.54	575.47	6.94	-9.53	317.72	-6.99	6.14	464.20	-8.17	12.34	353.90	11.96	-16.73	357.22
	3262 R	-6.34	1.60	430.76	-3.67	-1.06	256.80	-4.36	-4.11	558.50	-6.45	5.42	112.24	-7.69	6.11	404.50	7.06	-9.22	317.50	12.63	-16.49	358.19	-8.98	12.22	267.84
3272.0	3272 L	19.97	-20.89	-565.96	6.90	-14.45	-639.70	15.18	-18.27	-813.85	6.77	-12.61	-366.66	23.12	-25.87	-555.29	6.18	-10.18	-666.49	4.87	-6.65	-595.46	26.31	-29.42	-573.43
	3272 R	6.31	-12.98	-733.08	16.50	-18.55	-567.46	6.34	-11.86	-377.82	7.41	-14.20	-831.16	5.60	-9.03	-727.27	19.01	-22.92	-555.11	21.72	-26.13	-573.04	4.32	-5.82	-680.30

Section Properties

Ref. Delta Frame Desig

Splice	Splice	pacity (ksi)	FY	MAX MZ					MIN MZ					ϕvVn
				Flange Stress (ksi)		Flange Capacity (ksi)		FY	Flange Stress (ksi)		Flange Capacity (ksi)		FY	
Node	Side	BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	(kip)
3281.0	3281 L	67.75	663.11	22.37	6.00	68.63	68.63	643.67	37.10	-6.76	68.63	67.75	795.62	3935.48
	3281 R	67.92	653.71	42.37	-6.68	68.95	67.87	795.99	26.17	7.56	68.95	68.95	521.51	1375.39
3291.0	3291 L	68.95	-411.72	20.42	19.57	68.95	68.95	-296.80	36.68	3.62	68.95	68.95	-613.25	1375.39
	3291 R	68.63	-500.37	31.90	2.47	68.63	68.63	-612.79	17.03	16.96	68.63	68.63	-418.62	3935.48
3300.0	3300 L	68.21	1180.93	-22.56	33.46	68.21	68.21	1227.72	-1.43	0.84	68.21	68.21	1088.42	2262.15
	3300 R	68.44	1086.50	-0.89	0.54	68.44	68.44	1088.42	-18.25	25.31	68.44	68.44	1106.90	3908.99
3310.0	3310 L	68.44	-403.02	-38.86	46.99	68.44	68.44	-477.84	-28.25	28.63	68.44	68.44	-266.32	3908.99
	3310 R	68.44	-392.62	-28.25	28.63	68.44	68.44	-266.32	-38.86	46.99	68.44	68.44	-606.64	3908.99
3402.0	3402 L	59.60	-454.26	-40.45	-3.88	63.56	59.60	-593.36	-24.65	-22.49	63.56	59.60	-420.78	2088.00
	3402 R	63.86	-397.67	-25.80	-23.68	63.86	63.86	-292.93	-41.82	-5.89	63.86	63.86	-476.66	1392.00
3407.0	3407 L	63.86	154.10	-24.57	-22.44	63.86	63.86	294.48	-12.86	-28.76	63.86	63.86	54.70	1392.00
	3407 R	63.76	248.00	-11.98	-27.60	63.76	63.76	152.51	-23.43	-21.33	63.76	63.76	402.95	1740.00
3411.0	3411 L	63.76	-281.37	-23.17	-22.01	63.76	63.76	-430.13	-10.88	-28.17	63.76	63.76	-195.80	1740.00
	3411 R	63.86	-189.62	-11.68	-29.29	63.86	63.86	-93.20	-24.32	-23.13	63.86	63.86	-315.49	1392.00
3416.0	3416 L	63.86	342.23	-34.12	-9.27	63.86	63.86	436.97	-22.65	-26.53	63.86	63.86	278.12	1392.00
	3416 R	59.60	456.68	-21.51	-25.47	63.56	59.60	406.46	-32.78	-7.48	63.56	59.60	551.98	2088.00
3422.0	3422 L	50.00	-436.55	-37.00	4.29	50.00	50.00	-547.12	-24.18	-16.45	50.00	50.00	-407.24	1914.00
	3422 R	68.13	-369.81	-28.14	-19.38	68.13	68.13	-297.31	-42.57	4.14	68.17	69.30	-452.08	1392.00
3427.0	3427 L	68.13	82.24	-20.79	-24.37	68.13	68.13	208.03	-7.52	-31.19	68.13	68.13	-15.83	1392.00
	3427 R	67.81	154.77	-6.70	-29.89	67.81	67.81	66.28	-19.61	-23.12	67.81	67.81	302.19	1740.00
3431.0	3431 L	67.81	-151.70	-19.39	-22.59	67.81	67.81	-294.38	-7.18	-30.15	67.81	67.81	-59.86	1740.00
	3431 R	68.13	-71.38	-7.96	-31.41	68.13	68.13	24.29	-20.57	-23.84	68.13	68.13	-197.93	1392.00
3436.0	3436 L	68.13	341.06	-44.85	6.14	68.19	69.30	461.41	-30.09	-18.66	68.13	68.13	304.52	1392.00
	3436 R	50.00	489.14	-25.92	-15.82	50.00	50.00	416.52	-38.99	6.05	50.00	50.00	560.06	1914.00
3442.0	3442 L	50.00	-409.18	-32.93	-5.86	50.00	50.00	-519.97	-20.89	-23.61	50.00	50.00	-376.25	1914.00
	3442 R	67.05	-323.46	-24.92	-28.04	67.05	67.05	-252.26	-38.60	-7.56	67.05	67.05	-410.05	1392.00
3447.0	3447 L	67.05	187.34	-28.56	-22.96	67.05	67.05	317.17	-14.63	-29.74	67.05	67.05	90.34	1392.00
	3447 R	66.71	263.52	-13.59	-28.40	66.71	66.71	183.31	-27.12	-21.63	66.71	66.71	422.72	1740.00
3451.0	3451 L	66.71	-279.04	-27.05	-21.88	66.71	66.71	-427.30	-13.34	-28.40	66.71	66.71	-186.45	1740.00
	3451 R	67.05	-182.06	-14.39	-29.76	67.05	67.05	-93.46	-28.50	-23.22	67.05	67.05	-321.45	1392.00
3456.0	3456 L	67.05	286.61	-38.28	-8.50	67.05	67.05	406.22	-22.59	-27.48	67.05	67.05	248.24	1392.00
	3456 R	50.00	452.59	-18.98	-23.24	50.00	50.00	372.75	-32.61	-6.64	50.00	50.00	516.21	1914.00
3462.0	3462 L	49.25	-394.23	-34.61	3.77	50.00	50.00	-538.50	-21.80	-16.08	50.00	49.25	-382.44	1914.00
	3462 R	67.05	-368.17	-25.81	-19.38	67.05	67.05	-271.43	-41.50	2.11	67.05	69.29	-440.35	1392.00
3467.0	3467 L	67.05	64.14	-22.28	-23.37	67.05	67.05	194.81	-7.80	-33.81	67.05	67.05	-39.79	1392.00
	3467 R	66.71	153.67	-6.94	-32.43	66.71	66.71	48.56	-21.05	-22.11	66.71	66.71	290.42	1740.00
3471.0	3471 L	66.71	-151.35	-21.02	-22.19	66.71	66.71	-306.31	-7.18	-32.06	66.71	66.71	-53.23	1740.00
	3471 R	67.05	-75.90	-8.06	-33.45	67.05	67.05	35.19	-22.27	-23.47	67.05	67.05	-209.32	1392.00
3476.0	3476 L	67.05	299.84	-41.47	2.57	67.06	69.29	451.92	-26.03	-20.89	67.05	67.05	272.19	1392.00
	3476 R	49.25	513.57	-22.02	-17.38	50.00	49.25	384.74	-34.64	4.35	50.00	50.00	548.88	1914.00
3482.0	3482 L	49.18	-457.18	-38.34	10.07	50.00	50.00	-584.18	-26.36	-11.21	50.00	49.18	-440.01	1914.00
	3482 R	67.05	-430.71	-30.50	-14.21	67.05	67.05	-329.88	-44.97	7.15	67.13	69.29	-489.98	1392.00
3487.0	3487 L	67.05	14.26	-18.69	-26.31	67.05	67.05	135.04	-6.01	-36.01	67.05	67.05	-88.73	1392.00
	3487 R	66.71	100.47	-5.19	-34.59	66.71	66.71	-1.17	-17.54	-25.00	66.71	66.71	230.19	1740.00
3491.0	3491 L	66.71	-93.74	-17.66	-23.71	66.71	66.71	-228.73	-4.27	-35.12	66.71	66.71	4.40	1740.00
	3491 R	67.05	-21.68	-5.07	-36.56	67.05	67.05	93.19	-18.81	-24.98	67.05	67.05	-135.29	1392.00
3496.0	3496 L	67.05	359.25	-45.49	6.60	67.12	69.29	504.34	-29.57	-13.39	67.05	67.05	313.94	1392.00
	3496 R	49.18	540.31	-25.58	-10.52	50.00	49.18	419.27	-38.76	9.68	50.00	50.00	601.19	1914.00
3502.0	3502 L	50.00	-495.22	-37.79	5.49	50.00	50.00	-637.17	-23.31	-16.40	50.00	50.00	-456.17	1914.00
	3502 R	68.37	-419.37	-25.82	-18.46	68.37	68.37	-329.19	-41.66	4.53	68.40	69.42	-529.70	1392.00
3507.0	3507 L	68.37	86.99	-22.03	-24.50	68.37	68.37	242.26	-6.73	-31.55	68.37	68.37	-46.90	1392.00
	3507 R	68.10	167.89	-6.07	-30.48	68.10	68.10	44.93	-21.01	-23.45	68.10	68.10	350.60	1740.00
3511.0	3511 L	68.10	-174.67	-20.34	-22.95	68.10	68.10	-355.67	-6.36	-30.70	68.10	68.10	-43.98	1740.00
	3511 R	68.37	-83.68	-7.01	-31.76	68.37	68.37	48.05	-21.35	-24.01	68.37	68.37	-247.55	1392.00
3516.0	3516 L	68.37	379.95	-41.53	4.58	68.40	69.42	530.86	-26.80	-20.75	68.37	68.37	323.52	1392.00
	3516 R	50.00	538.38	-24.28	-18.47	50.00	50.00	450.51	-37.68	5.57	50.00	50.00	637.75	1914.00
3522.0	3522 L	49.59	-616.91	-43.31	14.17	69.43	49.59	-790.90	-30.86	-10.74	69.43	49.59	-585.84	1914.00
	3522 R	69.53	-570.28	-33.34	-11.49	67.97	67.97	-462.22	-46.24	14.98	67.97	69.53	-683.22	1392.00
3527.0	3527 L	67.97	-45.87	-12.91	-23.14	67.97	67.97	111.64	-1.47	-29.99	67.97	67.97	-172.57	1392.00
	3527 R	67.87	57.66	-1.02	-29.15	67.87	67.87	-77.55	-12.28	-22.38	67.87	67.87	221.99	1740.00
3531.0	3531 L	67.87	-70.48	-12.45	-23.24	67.87	67.87	-239.99	-1.18	-29.70	67.87	67.87	68.00	1740.00
	3531 R	67.97	34.33	-1.53	-30.44	67.97	67.97	163.49	-13.07	-24.01	67.97	67.97	-129.07	1392.00
3536.0	3536 L	67.97	466.85	-38.94	8.33	67.97	69.53	614.87	-25.87	-10.60	67.97	67.97	413.24	1392.00
	3536 R	49.58	629.55	-22.65	-9.00	69.41	49.58	543.05	-34.19	7.94	69.41	49.58	724.17	1914.00
3542.0	3542 L	69.35	-700.27	-32.50	-6.73	68.43	69.35	-777.94	-22.51	-21.19	68.43	69.35	-577.14	2088.00
	3542 R	69.57	-462.80	-24.81	-23.48	69.57	69.57	-409.66	-35.63	-8.47	69.57	69.57	-623.23	1392.00
3547.0	3547 L	69.57	194.36	-22.18	-24.46	69.57	69.57	356.77	-11.51	-30.55	69.57	69.57	93.92	1392.00
	3547 R	69.47	350.81	-10.89	-29.69	69.47	69.47	235.64	-21.35	-23.59	69.47	69.47	510.44	1740.00
3551.0	3551 L	69.47	-369.37	-20.27	-23.73	69.47	69.47	-547.07	-11.53	-30.61	69.47	69.47	-246.86	1740.00
	3551 R	69.57	-199.90	-12.14	-31.46	69.57	69.57	-96.76	-21.09	-24.59	69.57	69.57	-386.54	1392.00
3556.0	3556 L	69.57	537.40	-42.34	-6.50	69.57	69.57	738.45	-26.72	-20.20	69.57	69.57	507.43	1392.00
	3556 R	69.35	884.68	-24.25	-18.04	68.43	69.35	702.53	-38.78	-4.67	68.43	69.35	921.93	2088.00
5007.0	5007 L	69.04	120.09	-47.49	46.64	69.04	69.04	259.00	-36.41	27.43	69.04	69.04	41.04	1375.39
	5007 R	69.04	121.02	-36.41	27.43	69.04	69.04	41.04	-47.49	46.64	69.04	69.04	167.72	1375.39
5015.0	5015 L	69.04	-845.25	-15.49	19.33	69.04	69.04	-821.15	5.72	-5.86	69.04	68.14	-801.06	1375.39
	5015 R	68.06	-802.48	6.52	-8.42	68.06	59.11	-801.10	-17.21	27.96	68.06	68.06	-922.33	2686.30
5021.0	5021 L	68.02	376.64	20.20	15.82	68.02	68.02	333.32	36.76	-5.18	68.02	62.86	505.32	3935.48
	5021 R	68.19	330.84	44.65	-5.35	68.19	62.44	505.42	25.90	20.91	68.19	68.19	246.09	1375.39
5035.0	5035 L	62.44	-502.72	30.87	8.89	68.19	68.19	-407.16	48.88	-10.01	68.19	62.44	-610.41	1375.39
	5035 R	62.86	-465.65	40.38	-8.81	68.02	62.86	-610.34	24.70	6.19	68.02	68.02	-494.40	3935.48
5041.0	5041 L	59.11	759.89	1.56	-3.21	68.06	59.11	726.26	24.14	-28.33	68.06	59.11	596.96	2686.30
	5041 R	62.42	608.99	29.80	-36.45	67.91	62.40	598.64	1.59	-3.91	67.91	60.39	626.58	1375.39
5051.0	5051 L	62.36	-577.05	-0.18	9.42	67.91	67.91	-437.11	24.91	-29.12	67.91	62.43	-498.79	1375.39
	5051 R	47.32	-455.50	23.03	-26.68	50.00	47.27	-497.44	-0.59	8.75	50.00	50.00	-530.05	1375.39
5057.0	5057 L	50.00	474.25	19.53	9.90	50.00	50.00	443.24	35.59	-8.73	50.00	48.63	570.16	3306.90
	5057 R	50.00	420.11	36.70	-8.68	50.00	47.82	570.88	20.41	10.55	50.00	50.00	356.05	2686.30
5071.0	5071 L	50.00	-402.63	19.44	14.27	50.00	50.00	-304.44	34.16	-5.58	50.00	47.91	-517.86	2686.30
	5071 R	50.00	-366.49	33.07	-5.83	50.00	48.71	-517.86	18.46	13.47	50.00	50.00	-391.55	3306.90
5077.0	5077 L	50.00	665.73	-15.59	20.71	50.00	50.00	638.56	8.88	-13.69	50.00	47.16	533.80	1375.39
	5077 R	50.00	553.26	8.37	-10.93	50.00	48.34	537.06	-14.15	16.34	50.00	50.00	546.60	1375.39
5089.0	5089 L	48.34	-744.05	-2.32	8.29	50.00	50.00	-634.27	19.02	-19.52	50.00	48.41	-638.81	1375.39
	5089 R	47.43	-650.71	18.19	-21.18	50.00	47.41	-639.22	-2.46	9.05	50.00	50.00	-721.76	1375.39
5095.0	5095 L	50.00	412.60	21.03	8.15	50.00	50.00	396.76	36.91	-7.44	50.00	48.68	517.57	3306.90
	5095 R	50.00	376.54	37.15	-5.84	50.00	48.80	517.57	21.58	9.29	50.00	50.00	309.57	1375.39
5109.0	5109 L	50.00	-426.45	22.80	8.03	50.00	50.00	-327.60	38.59	-6.92	50.00	48.78	-535.02	1375.39
	5109 R	48.83	-391.34	38.40	-8.57	50.00	48.66	-534.12	22.34	6.86	50.00	50.00	-414.78	3306.90

Splice	SERVICE II																							
	MAX FX			MIN FX			MAX FY			MIN FY			MAX MY			MIN MY			MAX MZ			MIN MZ		
	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY	Flange Stress (ksi)		FY
Side	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)
3281 L	23.74	-2.12	502.49	18.67	-1.49	466.24	19.57	3.31	319.96	21.84	-2.43	734.47	22.80	-3.31	476.45	24.23	-3.87	483.61	17.61	3.59	469.36	27.22	-4.91	577.23
3281 R	21.62	-1.36	466.24	27.03	-1.78	493.28	25.33	-2.93	710.68	22.83	4.71	310.49	27.39	-3.54	474.40	25.69	-2.83	476.45	31.12	-4.86	577.49	20.60	4.58	383.05
3291 L	21.32	7.32	-351.54	15.97	9.77	-274.40	21.44	5.12	-562.09	16.47	13.84	-161.62	18.79	6.24	-364.11	20.55	9.72	-299.63	15.18	14.25	-218.44	26.80	2.91	-443.86
3291 R	13.51	8.41	-274.40	18.42	6.10	-360.64	14.10	11.63	-174.17	18.35	4.72	-582.00	17.86	8.49	-308.74	15.99	5.02	-364.11	20.14	2.06	-443.54	12.66	12.36	-304.51
3300 L	-7.88	8.31	776.48	-14.39	19.47	899.74	-13.39	17.95	624.44	-11.84	15.67	1026.31	-9.88	11.68	816.01	-12.16	14.96	898.30	-16.54	24.08	890.50	-4.71	1.84	794.49
3300 R	-11.52	14.73	885.55	-6.01	6.28	776.48	-9.07	11.36	1009.23	-10.92	14.00	611.01	-9.64	11.35	818.38	-7.77	8.93	816.01	-3.16	1.22	794.49	-13.37	18.21	805.13
3310 L	-22.61	24.33	-245.45	-26.34	30.09	-410.82	-27.33	31.90	-487.06	-22.96	24.82	-111.61	-24.98	27.96	-269.86	-23.80	26.09	-292.37	-28.53	34.32	-345.22	-20.82	20.79	-200.45
3310 R	-26.34	30.09	-424.86	-22.61	24.32	-245.45	-22.50	24.04	-133.55	-27.77	32.66	-512.83	-23.80	26.09	-292.37	-24.98	27.96	-289.69	-20.82	20.79	-200.45	-28.53	34.32	-436.22
3402 L	-22.72	-5.68	-330.79	-23.73	-15.57	-368.00	-30.03	-5.15	-437.42	-17.60	-14.25	-296.26	-29.08	-13.70	-378.84	-20.15	-12.66	-330.77	-29.21	-3.02	-429.04	-18.18	-16.53	-306.30
3402 R	-26.00	-16.39	-276.25	-23.51	-6.77	-257.49	-18.54	-16.04	-208.25	-30.88	-5.89	-347.86	-21.01	-13.66	-240.91	-29.81	-14.68	-287.06	-19.02	-17.40	-213.05	-30.21	-4.48	-343.76
3407 L	-10.61	-17.35	64.28	-17.00	-18.89	184.66	-9.77	-19.99	35.43	-18.30	-17.12	217.14	-15.01	-19.48	121.43	-16.73	-19.07	154.72	-18.24	-16.76	213.09	-10.03	-21.40	41.62
3407 R	-16.16	-18.01	268.91	-10.02	-16.65	126.27	-17.46	-16.38	297.95	-9.14	-19.12	102.24	-15.94	-18.30	229.83	-14.32	-18.67	193.83	-9.38	-20.55	113.07	-17.41	-15.95	292.27
3411 L	-9.06	-16.91	-157.60	-16.37	-19.15	-296.79	-17.23	-17.35	-318.15	-8.19	-19.35	-134.39	-12.18	-18.50	-207.72	-15.25	-19.19	-263.34	-17.18	-16.45	-312.86	-8.42	-20.82	-144.95
3411 R	-17.22	-20.04	-208.27	-9.64	-17.63	-92.74	-8.80	-20.21	-64.47	-18.11	-17.89	-232.79	-16.05	-19.97	-182.77	-12.49	-19.34	-129.14	-9.06	-21.69	-70.05	-18.02	-17.27	-229.18
3416 L	-17.32	-8.85	228.04	-20.12	-16.52	258.20	-16.98	-18.75	195.95	-25.01	-8.37	318.65	-24.26	-20.25	238.50	-22.18	-16.49	246.70	-24.75	-7.20	314.25	-16.43	-19.42	201.41
3416 R	-19.12	-15.45	357.98	-16.52	-7.90	300.13	-23.74	-7.84	406.56	-16.18	-16.11	283.70	-21.48	-15.68	333.58	-23.63	-19.55	330.79	-15.60	-18.64	295.06	-23.78	-5.92	398.12
3422 L	-19.52	-1.45	-299.03	-22.96	-11.13	-355.10	-27.18	-2.20	-403.87	-16.90	-8.34	-284.59	-26.61	-10.63	-345.56	-21.22	-10.11	-317.17	-26.83	2.98	-395.55	-17.65	-11.99	-296.46
3422 R	-26.58	-13.19	-268.57	-22.52	-2.05	-241.68	-19.52	-11.91	-211.27	-31.16	1.87	-330.15	-24.50	-11.93	-242.40	-30.58	-12.49	-268.12	-20.54	-14.12	-216.24	-30.87	2.85	-326.24
3427 L	-5.86	-17.83	9.79	-14.73	-20.52	135.06	-5.43	-21.47	-15.95	-15.36	-18.50	154.11	-10.82	-21.24	51.53	-14.39	-20.70	106.61	-14.89	-17.63	150.11	-5.79	-22.88	-10.41
3427 R	-13.83	-19.51	208.57	-5.35	-17.08	59.82	-14.49	-17.64	224.66	-4.81	-20.11	39.26	-13.60	-19.83	171.39	-10.18	-20.37	110.38	-5.21	-21.95	49.53	-14.03	-16.71	218.82
3431 L	-5.53	-17.14	-56.07	-14.28	-19.70	-202.32	-14.87	-17.69	-218.35	-4.70	-19.84	-34.61	-10.76	-20.67	-107.52	-13.27	-19.42	-162.36	-14.53	-16.97	-212.88	-5.05	-21.63	-44.80
3431 R	-15.17	-20.70	-127.06	-6.04	-17.89	-4.66	-5.38	-21.30	22.19	-15.74	-18.52	-146.15	-14.03	-20.35	-95.82	-11.44	-21.48	-47.64	-5.66	-22.59	16.62	-15.39	-17.88	-142.51
3436 L	-24.22	-2.04	248.41	-28.55	-12.30	278.47	-21.83	-12.33	216.86	-33.24	3.65	337.04	-32.83	-13.37	273.89	-24.81	-9.92	248.09	-32.54	4.30	333.12	-22.09	-13.65	221.64
3436 R	-24.70	-10.35	367.43	-21.01	-1.43	308.24	-28.99	2.93	413.62	-18.73	-8.83	292.53	-21.50	-8.34	324.38	-28.56	-11.44	354.62	-19.03	-11.58	303.31	-28.29	4.26	405.09
3442 L	-16.84	-6.25	-279.35	-21.10	-16.40	-337.04	-24.42	-6.70	-384.31	-14.45	-13.92	-261.97	-22.88	-15.73	-323.31	-18.91	-14.11	-297.86	-23.84	-4.39	-376.14	-15.22	-17.33	-273.60
3442 R	-25.11	-19.72	-239.39	-19.78	-7.63	-211.59	-17.05	-18.33	-177.90	-28.54	-7.00	-299.86	-22.52	-17.02	-214.33	-27.32	-19.12	-233.23	-18.16	-20.59	-182.93	-27.95	-5.65	-296.06
3447 L	-11.50	-17.41	85.53	-20.14	-19.79	207.93	-10.79	-20.74	60.72	-21.26	-17.45	234.92	-15.61	-19.32	131.03	-19.36	-19.58	182.41	-21.13	-17.06	231.39	-11.11	-22.01	66.08
3447 R	-19.05	-18.72	289.86	-10.82	-16.61	143.29	-20.21	-16.61	313.95	-10.00	-19.41	123.93	-18.44	-18.56	257.48	-14.77	-18.45	196.72	-10.35	-21.03	133.84	-20.08	-16.08	308.61
3451 L	-10.67	-16.60	-144.62	-19.48	-18.72	-301.25	-20.15	-16.95	-317.30	-9.73	-19.20	-125.54	-15.48	-18.87	-207.95	-18.65	-19.25	-257.49	-20.03	-16.26	-311.78	-10.16	-21.03	-136.55
3451 R	-20.57	-19.79	-219.02	-11.36	-17.42	-86.82	-10.54	-20.38	-62.62	-21.21	-17.80	-238.08	-19.61	-20.24	-183.24	-16.34	-19.78	-140.39	-10.92	-22.02	-68.78	-21.09	-17.24	-234.34
3456 L	-19.98	-8.31	210.60	-22.36	-18.93	233.52	-16.29	-18.83	175.32	-28.04	-7.58	296.52	-26.87	-17.53	238.78	-21.81	-18.62	208.26	-27.65	-6.41	292.77	-16.44	-20.09	180.21
3456 R	-18.85	-15.86	331.75	-16.98	-6.80	278.53	-23.78	-7.14	381.04	-13.79	-14.13	260.22	-18.28	-15.49	293.91	-22.55	-14.41	327.68	-13.81	-16.99	271.26	-23.55	-5.02	372.89
3462 L	-18.92	-1.63	-275.40	-20.98	-10.33	-359.67	-25.01	-2.74	-408.54	-17.12	-8.08	-252.23	-22.88	-9.14	-353.12	-20.89	-7.81	-284.49	-25.07	2.72	-386.42	-16.02	-11.99	-282.27
3462 R	-24.92	-12.93	-267.71	-22.60	-3.20	-219.24	-19.45	-11.99	-183.69	-29.69	-2.10	-327.31	-24.76	-10.37	-216.31	-27.14	-11.89	-268.83	-18.96	-14.44	-200.48	-30.06	1.53	-315.33
3467 L	-6.54	-17.48	-2.34	-15.63	-22.89	124.23	-5.53	-22.31	-34.27	-16.72	-19.31	151.45	-8.78	-21.51	22.44	-14.78	-20.45	104.76	-16.19	-16.92	137.71	-5.82	-24.97	-25.08
3467 R	-14.66	-21.77	204.86	-6.00	-16.71	48.82	-15.80	-19.04	227.18	-4.84	-20.75	24.03	-13.90	-19.48	175.75	-8.12	-20.56	85.59	-5.19	-23.94	40.34	-15.30	-16.01	206.97
3471 L	-6.46	-15.97	-55.68	-13.85	-22.22	-196.89	-15.36	-18.51	-230.46	-5.12	-19.87	-25.84	-8.68	-19.06	-89.09	-12.29	-20.68	-163.76	-15.34	-15.76	-219.96	-5.36	-23.68	-41.38
3471 R	-14.81	-23.34	-116.67	-7.00	-16.71	-5.44	-5.32	-22.64	32.58	-16.63	-17.85	-156.82	-13.12	-21.70	-91.90	-9.36	-19.93	-28.76	-6.01	-24.70	23.86	-16.24	-16.67	-150.03
3476 L	-21.28	-2.28	217.01	-26.34	-12.68	281.43	-18.72	-11.92	182.27	-30.93	-2.95	339.02	-29.33	-9.07	292.58	-23.08	-12.60	213.09	-30.04	1.40	328.46	-18.87	-15.01	193.55
3476 R	-22.20	-10.00	373.16	-17.77	-0.92	273.06	-25.93	-1.92	420.82	-15.88	-8.85	252.23	-19.46	-9.98	287.00	-24.72	-6.47	374.92	-15.96	-12.48	274.74	-25.10	2.74	399.86
3482 L	-20.11	3.77	-295.85	-25.21	-5.74	-407.45	-28.61	2.89	-449.21	-18.97	-2.93	-284.46	-26.96	-3.04	-384.36	-23.12	-5.40	-336.57	-27.77	6.90	-426.30	-18.99	-7.94	-313.79
3482 R	-29.24	-8.37	-317.82	-23.59	2.23	-242.63	-21.82	-6.48	-219.44	-33.43	1.34	-368.04	-26.78	-7.96	-263.97	-31.26	-5.82	-305.70	-21.98	-10.08	-234.46	-32.57	4.75	-356.99
3487 L	-5.58	-18.37	-35.39	-12.32	-25.12	69.55	-3.99	-24.99	-71.63	-14.24	-20.39	105.68	-8.00	-22.35	-12.15	-11.14	-22.95	53.52	-13.80	-18.76	96.66	-4.36	-26.55	-64.19
3487 R	-11.42	-23.96	149.43	-5.08	-17.61	13.44	-13.42	-19.67	179.48	-3.30	-22.59	-13.36	-10.32	-21.94	124.33	-7.37	-21.42	48.60	-3.76	-25.51	0.39	-12.96	-17.82	165.24
3491 L	-4.47	-18.52	-14.92	-11.58	-23.93	-145.92	-13.24	-19.91	-181.08	-2.91	-23.00	14.55	-7.15	-21.87	-58.96	-10.36	-21.77	-112.31	-12.78	-17.15	-160.90	-3.29	-25.98	-2.32
3491 R	-12.48	-25.09	-66.56	-4.98	-19.31	36.18	-3.64	-25.06	73.81	-14.08	-20.64	-106.78	-11.11	-22.81	-42.25	-7.81	-22.82	3.49	-3.89	-27.05	63.59	-13.61	-18.07	-93.40
3496 L	-24.47	2.32	255.26	-29.56	-8.18	317.55	-21.68	-7.11	217.55	-33.80	1.94	375.27	-31.45	-5.68	309.25	-26.82	-8.23	264.00	-32.87	4.83	361.25	-21.78	-10.22	231.99
3496 R	-25.44	-5.52	406.97	-20.93	3.90	310.44	-28.91	3.30	456.07	-18.92	-4.03	283.92	-23.23	-5.63	337.61	-27.06	-2.88	388.08	-18.85	-8.08	309.90	-27.95	7.00	431.09
3502 L	-19.06	-0.87	-327.22	-23.15	-10.01	-413.00	-27.37	0.92	-469.91	-16.68	-7.45	-313.61	-25.71	-9.00	-391.58	-21.53	-9.84	-358.92	-27.37	3.95	-459.02	-16.95	-11.97	-331.34
3502 R	-25.55	-11.65	-312.32	-21.03	-1.71	-264.67	-18.31	-11.69	-231.28	-30.56	2.29	-386.25	-23.60	-11.47	-273.44	-28.22	-10.73	-303.21	-18.78	-13.47	-238.70	-30.16	3.26	-381.16
3507 L	-6.30	-17.84	-0.69	-14.96	-21.20	142.71	-5.07	-22.41	-40.83	-16.27	-18.68	180.34	-9.51	-20.52	34.51	-14.81	-20.32	124.74	-16.35	-18.21	175.49	-5.40	-23.35	-34.27
3507 R	-14.20	-20.34	227.62	-5.88	-17.23	53.41	-15.53	-17.98	261.65	-4.66	-20.50	20.97	-14.14	-19.56	199.59	-9.00	-19.83	97.86	-4.92	-22.57	32.35	-15.61	-17.44	254.54
3511 L	-6.06	-17.48	-54.98	-14.13	-20.45	-231.86	-15.34	-17.93	-265.44	-4.77	-20.67	-20.42	-10.33	-20.27	-118.52	-14.19	-19.72	-198.63	-15.18	-17.14	-258.36	-5.21	-22.82	-31.45
3511 R	-14.90	-21.32	-147.31	-6.47	-18.08	-0.89	-5.31	-22.69	42.02	-16.09	-18.63	-184.10	-14.86	-20.48	-123.85	-10.87	-20.97	-53.15	-5.69	-23.59	35.33	-15.92	-17.91	-179.50
3516 L	-20.76	-1.36	264.61	-25.79	-13.32	306.96	-18.54	-12.98	225.87	-30.45	2.09	387.90	-28.20	-11.93	299.03	-23.19	-9.60	275.90	-29.97	3.14	382.52	-19.60	-15.29	234.20
3516 R	-23.41	-11.55	407.18	-18.82	-0.58	327.17	-27.94	1.57	472.40	-16.61	-9.15	307.96	-21.10	-8.15	357.68	-25.73	-10.12	388.78	-17.76	-13.61	326.70	-27.19	3.87	460.15
3522 L	-23.67	7.15	-426.37	-28.40	-6.08	-520.61	-32.25	9.09	-582.35	-21.19	-3.40	-407.94	-29.84	6.59	-500.96	-21.84	0.83	-448.73	-31.39	10.19	-571.65	-22.77	-7.93	-427.05
3522 R	-30.56	-6.37	-422.35	-25.29	7.51	-365.10	-23.26	-5.93	-328.22	-33.89	10.10	-498.38	-23.47	0.74	-370.12	-32.03	6.51	-413.44	-24.58	-8.47	-337.09	-33.52	10.76	-493.28
3527 L	-1.40	-17.02	-94.68	-9.39	-20.64	43.35	-0.91	-21.26	-132.41	-10.02	-18.08	84.53	-6.71	-21.36	-46.37	-9.07	-20.07	20.80	-9.86	-17.45	78.70	-1.12	-21.80	-125.96
3527 R	-8.88	-19.98	130.46	-1.19	-16.60	-39.55	-9.55	-17.59	167.63	-0.44	-19.56	-68.88	-8.67	-19.55	94.74	-6.36	-20.79	23.36	-0.86	-21.27	-56.78	-9.38	-16.87	159.15
3531 L	-1.38	-16.98	34.29	-8.23	-19.52	-155.45	-9.10	-17.74	-181.07	-0.86	-20.13	63.64	-5.67	-19.71	-39.32	-9.03	-20.70	-104.42	-8.77	-16.77	-171.34	-1.32	-22.01	48.91
3531 R	-8.74	-20.17	-67.90	-1.59	-17.40	89.65	-1.25	-21.55	126.14	-9.59	-18.26	-97.18	-9.45	-21.23	-26.99	-6.01	-20.28	27.58	-1.58	-22.55	118.49	-9.25	-17.36	-90.54
3536 L	-21.05	3.47	328.10	-23.93	-5.82	377.11	-18.29	-5.80	290.80	-28.38	4.62	450.62	-26.73	-4.31	372.31	-22.90	-5.34	338.46	-28.45	6.17	443.92	-19.06	-7.84	300.58
3536 R	-20.95	-4.74	480.42	-18.47	3.38	390.85	-25.01	3.46	537.15	-16.21	-3.34	374.51	-20.21	-4.38	425.06	-23.28	-3.65	456.59	-16.69	-6.66	395.25	-24.98	5.87	523.44
3542 L	-17.30	-7.36	-421.90	-21.09	-12.88	-525.40	-24.05	-7.72	-578.26	-15.60	-11.65	-400.05	-19.48	-13.86	-456.81	-20.50	-6.72	-505.93	-23.61	-5.20	-563.09	-16.31	-15.45	-418.94
3542 R	-23.19	-14.57	-393.04	-18.93	-8.62	-324.17	-17.54	-15.67	-288.15	-26.21	-7.71	-458.34	-22.50	-7.96	-395.50	-21.36	-15.53	-337.04	-17.97	-17.11	-296.74	-25.89	-6.48	-450.39
3547 L	-8.64	-17.79	97.54	-15.54	-21.10	233.81	-8.29	-21.50	61.53	-16.52	-18.89	264.92	-15.50	-22.55	180.44	-15.61	-22.09	185.73	-16.44	-18.22	257.82	-8.89	-22.65	70.69
3547 R	-14.91	-20.42	353.95	-8.22	-17.26	185.88	-16.28	-18.92	380.33	-7.64	-20.01	158.00	-15.03	-21.50	290.10	-14.98	-21.84	295.09	-8.39	-21.98	174.18	-15.84	-17.59	369.87
3551 L	-8.29	-17.39	-184.38	-15.61	-21.74	-378.50	-15.97	-19.35	-411.43	-7.43	-19.73	-158.35	-14.06	-19.81	-333.08	-14.09	-22.33	-282.53	-15.13	-17.75	-397.04	-7.92	-21.69	-179.53
3551 R	-16.22	-22.43	-251.20	-8.74	-17.96	-90.92	-7.95	-20.59	-57.81	-16.28	-19.51	-288.95	-14.63	-22.95	-167.27	-14.46	-20.51	-214.57	-8.44	-22.38	-70.12	-15.73	-18.38	-279.83
3556 L	-23.73	-6.00	408.50	-25.67	-13.70	462.26	-19.91	-13.74	359.17	-30.39	-5.46	543.15	-30.65	-9.26	499.89	-20.37	-13.04	392.49	-30.41	-4.55	534.53	-19.85	-14.97	369.43
3556 R	-23.41	-11.98	617.38	-21.71	-4.83	522.01	-27.61	-4.55	684.03	-18.44	-11.44	491.75	-18.49	-11.54	532.51	-28.12	-7.65	640.40	-18.03	-13.37	511.70	-27.84	-3.24	668.42
5007 L	-29.05	23.72	83.40	-33.32	31.01	120.25	-28.56	22.78	-15.90	-33.94	32.14	247.30	-29.46	24.33	90.43	-31.80	28.19	153.65	-34.90	33.81	186.29	-27.07	20.22	31.85
5007 R	-33.32	31.01	92.48	-29.05	23.72	83.41	-33.53	31.45	228.62	-28.94	23.44	-31.82	-31.80	28.19	139.48	-29.46	24.33	90.43	-27.07	20.22	31.85	-34.90	33.81	121.80
5015 L	-6.12	4.95	-538.60	-7.87	7.99	-684.14	-6.41	5.29	-747.53	-9.36	10.65	-455.66	-5.72	4.21	-584.47	-8.37	8.34	-613.82	-11.29	13.94	-596.79	-2.09	-3.20	-583.34
5015 R	-9.29	12.62	-729.29	-7.11	7.45	-536.81	-10.41	15.35	-465.63	-7.76	8.61	-774.95	-9.51	11.71	-623.70	-6.29	5.86	-584.34	-2.63	-4.35	-583.37	-12.56	20.17	-668.28
5021 L	21.43	4.74	307.71	15.62	8.17	212.93	15.58	10.80	153.08	20.95	3.77	470.99	17.10	4.48	240.73	20.86	8.34	272.32	15.02	11.58	241.72	22.06	-3.40	364.00
5021 R	19.82	10.87	212.93	26.01	6.41	300.61	25.64	4.62	453.54	19.67	14.70	145.42	25.21	10.48	265.22	21.64	6.75	240.73	32.53	-3.77	364.07	19.29	15.29	180.09
5035 L	28.78	-1.98	-351.95	25.45	-2.62	-355.13	28.52	-5.50	-549.87	25.68	4.42	-245.84	26.57	-0.82	-339.73	29.25	-4.36	-366.01	24.35	5.27	-298.41	35.72	-7.25	-442.09
5035 R	20.68	-2.38	-355.13	23.65	-1.90	-359.04	20.91	2.66	-253.56	23.36	-4.33	-567.36	24.33	-4.17	-373.10	22.25	-1.46	-339.73	25.14	-6.16	-442.04	19.50	3.65	-360.05
5041 L	14.32	-15.77	422.85	3.10	-6.34	576.08	4.15	-7.50	291.75	4.53	-9.01	635.30	11.58	-13.17	441.26	5.03	-9.40	549.45	1.77	-2.15	523.76	16.83	-19.77	434.33
5041 R	3.29	-7.99	498.40	17.45	-20.05	421.90	5.36	-12.69	609.53	4.21	-8.84	282.32	5.24	-11.63	480.76	13.83	-16.48	440.91	20.77	-25.43	435.54	1.78	-2.57	453.33
5051 L	5.42	-6.53	-276.10	2.57	-2.50	-435.23	5.16	-8.50	-514.90	2.36	0.54	-193.75	5.14	-6.09	-329.39	4.76	-6.38	-417.57	-0.49	7.18	-316.65	9.25	-18.29	-362.28
5051 R	2.23	-2.29	-442.89	5.03	-5.96	-277.00	2.29	-0.45	-203.48	4.34	-6.68	-540.83	4.45	-5.96	-427.72	4.86	-5.70	-329.63	8.86	-16.91	-361.32	-0.76	6.66	-382.30
5057 L	20.52	-2.43	354.47	15.72	3.44	298.19	15.73	6.05	223.00	20.15	-3.82	539.33	17.21	0.62	306.72	20.16	3.08	345.42	14.57	7.14	323.06	21.65	-6.06	413.18
5057 R	16.37	3.71	298.19	21.23	-2.32	347.37	21.04	-4.18	521.88	16.21	6.88	215.01	20.86	3.15	338.32	17.88	1.00	306.72	22.35	-6.08	413.69	15.23	7.61	261.47
5071 L	20.09	4.09	-298.57	15.67	5.78	-269.21	19.62	2.51	-480.23	15.73	9.58	-172.05	16.97	3.85	-266.37	19.81	5.99	-293.19	14.54	10.35	-223.81	21.22	-3.94	-373.32
5071 R	14.99	5.46	-269.21	19.37	3.80	-305.67	15.22	8.70	-179.93	18.73	2.76	-497.76	19.08	5.83	-300.29	16.28	3.40	-266.37	20.50	-4.06	-373.32	13.81	9.77	-285.36
5077 L	-6.04	2.63	358.21	-9.58	7.97	528.71	-8.56	7.34	251.08	-7.97	4.88	602.11	-6.47	2.21	403.48	-8.47	5.20	479.50	-11.44	14.80	464.07	6.07	-9.57	386.28
5077 R	-8.52	6.31	466.17	-5.03	1.96	357.64	-6.54	3.01	578.66	-7.75	6.29	241.60	-7.47	4.32	471.65	-5.59	1.86	403.79	5.73	-7.62	392.35	-10.37	11.68	395.35
5089 L	3.79	-3.91	-421.16	0.89	-0.48	-546.26	3.20	-4.33	-649.60	1.01	0.73	-309.57	4.69	-6.05	-475.24	3.06	-3.45	-537.30	-1.68	6.10	-459.74	7.61	-12.83	-466.53
5089 R	0.78	-0.52	-607.30	3.63	-4.24	-421.64	1.15	0.21	-319.05	2.67	-3.81	-672.19	3.04	-3.75	-541.50	4.57	-6.49	-474.93	7.46	-13.99	-466.81	-1.78	6.66	-521.57
5095 L	21.41	-1.33	314.60	16.69	1.36	274.35	16.74	4.63	183.39	20.81	-2.84	504.90	20.66	-1.30	275.98	20.88	2.12	298.44	15.51	5.92	287.25	22.58	-5.10	375.61
5095 R	16.97	2.10	274.35	21.70	-0.39	307.49	21.25	-2.38	487.30	17.04	5.70	175.33	21.16	2.93	291.34	20.98	2.12	275.98	22.81	-4.19	375.61	15.92	6.76	225.65
5109 L	22.84	-1.24	-322.47	17.69	1.77	-274.49	22.42	-3.03	-501.15	18.14	4.85	-190.83	22.24	1.57	-284.96	22.50	-1.76	-311.94	16.94	5.69	-242.10	24.00	-4.95	-386.47
5109 R	17.43	0.97	-274.49	22.58	-2.23	-329.57	18.00	3.59	-198.90	22.00	-3.54	-518.76	22.26	-2.70	-319.05	21.98	-2.27	-284.96	23.80	-5.91	-385.84	16.60	4.83	-303.70

Section Properties

Ref. Delta Frame Desig

Splice Node	Splice Side	pacity (ksi) BF	FY (kip)	MAX MZ Flange Stress (ksi) TF	MAX MZ Flange Stress (ksi) BF	MAX MZ Flange Capacity (ksi) TF	MAX MZ Flange Capacity (ksi) BF	MAX MZ FY (kip)	MIN MZ Flange Stress (ksi) TF	MIN MZ Flange Stress (ksi) BF	MIN MZ Flange Capacity (ksi) TF	MIN MZ Flange Capacity (ksi) BF	MIN MZ FY (kip)	φvVn (kip)
5115.0	5115 L	47.32	687.27	-7.34	6.87	50.00	50.00	672.30	20.76	-25.75	50.00	47.39	640.58	1375.39
	5115 R	47.35	623.86	24.96	-28.24	50.00	47.36	641.90	-9.28	7.75	50.00	50.00	582.47	1375.39
5127.0	5127 L	46.78	-587.98	-6.15	11.45	50.00	50.00	-462.74	12.75	-13.47	50.00	47.39	-560.35	1375.39
	5127 R	50.00	-498.79	13.08	-15.72	50.00	47.16	-559.79	-6.22	13.23	50.00	50.00	-551.17	1375.39
5133.0	5133 L	50.00	392.58	17.39	9.99	50.00	50.00	405.16	31.00	-3.69	50.00	48.80	514.01	3306.90
	5133 R	50.00	368.03	37.76	-5.11	50.00	47.94	515.62	22.14	12.84	50.00	50.00	317.97	1375.39
5147.0	5147 L	50.00	-401.96	23.73	10.99	50.00	50.00	-328.53	41.68	-7.73	50.00	47.88	-542.43	1375.39
	5147 R	50.00	-421.87	34.28	-5.59	50.00	48.75	-542.51	18.63	8.59	50.00	50.00	-415.64	3306.90
5153.0	5153 L	46.90	509.66	-7.88	10.90	50.00	50.00	474.39	19.01	-23.40	50.00	47.15	568.24	1375.39
	5153 R	46.96	493.78	20.33	-25.67	50.00	47.01	568.53	-8.60	12.02	50.00	50.00	386.17	1375.39
5163.0	5163 L	46.73	-423.22	-4.06	11.84	50.00	50.00	-350.12	17.45	-20.77	50.00	47.04	-522.71	1375.39
	5163 R	47.24	-446.45	15.86	-18.82	50.00	47.16	-522.10	-3.89	10.83	50.00	50.00	-438.71	1375.39
5169.0	5169 L	50.00	452.30	16.73	9.21	50.00	50.00	427.43	32.29	-3.65	50.00	48.81	557.71	3306.90
	5169 R	50.00	400.64	38.85	-5.61	50.00	47.41	560.16	21.20	11.99	50.00	50.00	340.34	1375.39
5183.0	5183 L	50.00	-444.69	22.08	12.09	50.00	50.00	-338.37	37.51	-4.39	50.00	47.45	-533.21	1375.39
	5183 R	50.00	-369.84	31.01	-2.77	50.00	48.84	-533.25	17.43	9.32	50.00	50.00	-425.52	3306.90
5189.0	5189 L	42.82	524.30	-13.45	15.95	50.00	50.00	523.56	9.21	-14.29	50.00	47.05	483.02	1375.39
	5189 R	50.00	436.02	8.66	-14.16	50.00	47.03	484.88	-12.26	15.68	50.00	50.00	434.51	1375.39
5199.0	5199 L	47.39	-584.19	-2.85	13.18	50.00	50.00	-502.61	20.21	-26.33	50.00	47.12	-589.07	1375.39
	5199 R	47.36	-563.65	19.48	-22.60	50.00	47.35	-586.72	-2.77	11.30	50.00	50.00	-625.39	1375.39
5205.0	5205 L	50.00	483.53	19.27	9.71	50.00	50.00	485.39	35.99	-6.23	50.00	49.27	631.84	3306.90
	5205 R	50.00	459.56	39.35	-6.42	50.00	48.78	634.40	21.81	12.44	50.00	50.00	366.36	1375.39
5219.0	5219 L	50.00	-425.59	21.96	14.07	50.00	50.00	-339.14	39.74	-5.76	50.00	48.80	-628.74	1375.39
	5219 R	50.00	-477.34	36.29	-5.63	50.00	49.28	-628.71	19.46	11.15	50.00	50.00	-458.87	3306.90
5225.0	5225 L	50.00	688.27	-12.79	18.68	50.00	50.00	622.15	17.12	-22.86	50.00	47.30	576.35	1375.39
	5225 R	47.28	562.87	15.15	-21.01	50.00	47.36	577.30	-11.10	17.20	50.00	50.00	496.12	1375.39
5233.0	5233 L	50.00	-616.83	-12.38	21.64	50.00	50.00	-475.13	11.25	-15.20	50.00	47.37	-487.42	1375.39
	5233 R	49.23	-490.02	10.33	-13.99	50.00	49.33	-486.68	-11.30	20.03	50.00	50.00	-592.98	1375.39
5241.0	5241 L	68.45	546.42	15.17	17.05	48.89	68.45	550.59	27.73	-4.73	48.89	66.74	664.34	3306.90
	5241 R	50.00	535.45	27.34	4.02	50.00	50.00	664.39	14.81	16.95	50.00	50.00	430.14	2686.30
5253.0	5253 L	50.00	-605.92	14.22	12.98	50.00	50.00	-469.54	27.99	-4.70	50.00	50.00	-753.90	2686.30
	5253 R	68.45	-635.78	28.00	-5.47	48.89	66.72	-753.91	14.24	12.98	48.89	68.45	-588.04	3306.90
5262.0	5262 L	49.14	481.26	-10.57	16.33	50.00	50.00	439.44	15.38	-21.25	50.00	49.32	444.28	1375.39
	5262 R	50.00	274.09	16.20	-20.88	50.00	48.89	444.66	-11.63	16.16	50.00	50.00	320.89	1375.39
5271.0	5271 L	48.85	-810.16	5.17	-8.84	50.00	48.82	-764.84	36.14	-40.90	50.00	48.92	-732.10	1375.39
	5271 R	65.93	-717.27	29.95	-36.45	68.29	65.93	-731.24	4.44	-7.74	68.29	65.80	-881.16	2686.30
5279.0	5279 L	67.75	803.34	24.03	6.81	68.63	68.63	775.87	38.58	-7.29	68.63	67.75	931.08	3935.48
	5279 R	67.93	787.29	44.00	-7.22	68.95	67.86	933.00	27.99	8.45	68.95	68.95	656.54	1375.39
5289.0	5289 L	68.95	-353.17	25.55	20.65	68.95	68.95	-338.11	41.58	5.64	68.95	68.95	-658.31	1375.39
	5289 R	68.63	-635.11	36.27	-5.02	68.63	67.75	-658.24	21.62	17.90	68.63	68.63	-454.89	3935.48
5297.0	5297 L	68.21	1081.23	-21.80	32.37	68.21	68.21	1216.68	-2.04	1.24	68.21	68.21	1050.48	2262.15
	5297 R	68.44	1062.39	-1.45	0.91	68.44	68.44	1050.26	-17.86	24.67	68.44	68.44	1100.26	3908.99
5306.0	5306 L	68.44	-215.72	-43.07	51.86	68.44	68.44	-284.04	-31.62	32.17	68.44	68.44	-126.37	3908.99
	5306 R	68.44	-221.50	-31.62	32.17	68.44	68.44	-126.37	-43.07	51.86	68.44	68.44	-409.13	3908.99
5402.0	5402 L	59.60	-486.81	-39.00	-2.30	63.56	59.60	-601.76	-26.82	-23.45	63.56	59.60	-438.80	2088.00
	5402 R	63.86	-382.38	-27.96	-24.65	63.86	63.86	-307.69	-40.49	-4.44	63.86	63.86	-483.08	1392.00
5407.0	5407 L	63.86	159.31	-23.93	-22.87	63.86	63.86	291.32	-13.00	-29.49	63.86	63.86	55.60	1392.00
	5407 R	63.76	251.43	-12.15	-28.35	63.76	63.76	158.64	-22.77	-21.73	63.76	63.76	406.54	1740.00
5411.0	5411 L	63.76	-285.14	-22.55	-22.23	63.76	63.76	-427.34	-11.21	-28.81	63.76	63.76	-197.28	1740.00
	5411 R	63.86	-182.98	-12.08	-30.01	63.86	63.86	-93.79	-23.71	-23.39	63.86	63.86	-311.39	1392.00
5416.0	5416 L	63.86	333.94	-34.58	-8.70	63.86	63.86	444.16	-23.70	-25.52	63.86	63.86	296.49	1392.00
	5416 R	59.60	496.05	-22.44	-24.29	63.56	59.60	433.55	-33.11	-6.78	63.56	59.60	565.47	2088.00
5422.0	5422 L	50.00	-448.81	-35.64	2.07	50.00	50.00	-551.27	-25.15	-16.42	50.00	50.00	-421.39	1914.00
	5422 R	68.13	-358.50	-29.26	-19.37	68.13	68.13	-307.55	-41.08	1.64	68.13	69.30	-452.66	1392.00
5427.0	5427 L	68.13	82.09	-20.78	-24.99	68.13	68.13	209.65	-8.51	-31.97	68.13	68.13	-7.28	1392.00
	5427 R	67.81	166.97	-7.73	-30.71	67.81	67.81	77.28	-19.67	-23.79	67.81	67.81	305.44	1740.00
5431.0	5431 L	67.81	-157.12	-20.00	-23.74	67.81	67.81	-301.82	-7.50	-30.20	67.81	67.81	-71.59	1740.00
	5431 R	68.13	-79.54	-8.33	-31.50	68.13	68.13	17.44	-21.22	-25.04	68.13	68.13	-198.75	1392.00
5436.0	5436 L	68.13	359.12	-44.04	4.07	68.16	69.30	463.88	-32.34	-19.75	68.13	68.13	316.62	1392.00
	5436 R	50.00	475.84	-27.92	-16.80	50.00	50.00	427.88	-38.31	4.29	50.00	50.00	561.76	1914.00
5442.0	5442 L	50.00	-424.34	-32.53	-5.55	50.00	50.00	-523.23	-21.18	-22.79	50.00	50.00	-389.11	1914.00
	5442 R	67.05	-312.63	-25.20	-27.04	67.05	67.05	-264.10	-38.05	-7.12	67.05	67.05	-412.43	1392.00
5447.0	5447 L	67.05	187.80	-27.91	-23.10	67.05	67.05	312.89	-15.37	-30.40	67.05	67.05	94.53	1392.00
	5447 R	66.71	268.31	-14.31	-29.03	66.71	66.71	189.06	-26.44	-21.73	66.71	66.71	420.33	1740.00
5451.0	5451 L	66.71	-283.27	-26.16	-21.78	66.71	66.71	-429.71	-13.98	-28.96	66.71	66.71	-195.60	1740.00
	5451 R	67.05	-184.00	-15.05	-30.35	67.05	67.05	-97.79	-27.62	-23.15	67.05	67.05	-318.14	1392.00
5456.0	5456 L	67.05	299.58	-37.44	-7.81	67.05	67.05	406.84	-24.45	-27.81	67.05	67.05	259.36	1392.00
	5456 R	50.00	432.73	-20.54	-23.47	50.00	50.00	386.52	-31.99	-6.15	50.00	50.00	518.28	1914.00
5462.0	5462 L	49.25	-451.53	-37.24	6.40	50.00	50.00	-578.47	-23.91	-16.29	50.00	49.25	-409.14	1914.00
	5462 R	67.05	-357.94	-28.28	-19.89	67.05	67.05	-299.31	-44.58	5.22	67.10	69.29	-480.41	1392.00
5467.0	5467 L	67.05	121.03	-21.72	-21.19	67.05	67.05	246.55	-7.59	-31.33	67.05	67.05	20.14	1392.00
	5467 R	66.71	199.58	-6.82	-30.08	66.71	66.71	102.36	-20.53	-20.02	66.71	66.71	336.80	1740.00
5471.0	5471 L	66.71	-201.57	-20.41	-20.01	66.71	66.71	-348.14	-7.04	-29.26	66.71	66.71	-103.61	1740.00
	5471 R	67.05	-122.82	-7.84	-30.51	67.05	67.05	-20.13	-21.60	-21.19	67.05	67.05	-255.49	1392.00
5476.0	5476 L	67.05	323.97	-40.81	2.73	67.06	69.29	449.29	-25.15	-20.07	67.05	67.05	280.14	1392.00
	5476 R	49.25	454.00	-21.26	-16.72	50.00	49.25	390.48	-34.05	4.29	50.00	50.00	544.20	1914.00
5482.0	5482 L	49.18	-484.45	-37.57	9.49	50.00	50.00	-585.77	-26.25	-11.33	50.00	49.18	-453.22	1914.00
	5482 R	67.05	-384.67	-30.32	-14.29	67.05	67.05	-342.40	-44.18	6.75	67.12	69.29	-491.54	1392.00
5487.0	5487 L	67.05	75.71	-18.50	-24.14	67.05	67.05	189.81	-5.81	-33.10	67.05	67.05	-24.10	1392.00
	5487 R	66.71	151.40	-5.06	-31.80	66.71	66.71	57.62	-17.41	-22.93	66.71	66.71	278.89	1740.00
5491.0	5491 L	66.71	-148.44	-17.41	-21.61	66.71	66.71	-278.35	-4.62	-32.59	66.71	66.71	-55.39	1740.00
	5491 R	67.05	-77.54	-5.36	-33.91	67.05	67.05	27.30	-18.52	-22.79	67.05	67.05	-190.15	1392.00
5496.0	5496 L	67.05	378.41	-45.28	6.47	67.12	69.29	507.40	-29.46	-13.70	67.05	67.05	329.00	1392.00
	5496 R	49.18	498.09	-25.49	-10.85	50.00	49.18	436.20	-38.66	9.45	50.00	50.00	604.05	1914.00
5502.0	5502 L	50.00	-516.27	-38.47	5.15	50.00	50.00	-656.82	-24.33	-16.27	50.00	50.00	-475.01	1914.00
	5502 R	68.37	-413.37	-26.95	-18.36	68.37	68.37	-344.23	-42.42	4.06	68.40	69.42	-545.81	1392.00
5507.0	5507 L	68.37	85.41	-21.36	-24.60	68.37	68.37	243.89	-5.87	-32.06	68.37	68.37	-55.14	1392.00
	5507 R	68.10	167.20	-5.22	-30.98	68.10	68.10	39.05	-20.32	-23.50	68.10	68.10	355.47	1740.00
5511.0	5511 L	68.10	-172.56	-20.00	-23.27	68.10	68.10	-356.88	-5.57	-31.14	68.10	68.10	-35.90	1740.00
	5511 R	68.37	-78.00	-6.19	-32.19	68.37	68.37	58.48	-21.04	-24.36	68.37	68.37	-245.86	1392.00
5516.0	5516 L	68.37	393.17	-42.54	4.57	68.40	69.42	548.70	-27.01	-19.38	68.37	68.37	338.92	1392.00
	5516 R	50.00	527.92	-24.41	-17.21	50.00	50.00	468.60	-38.55	5.62	50.00	50.00	658.53	1914.00
5522.0	5522 L	49.59	-548.00	-38.21	9.46	69.43	49.59	-710.09	-26.54	-10.81	69.43	49.59	-535.89	1914.00
	5522 R	67.97	-517.61	-28.80	-11.82	67.97	67.97	-407.23	-40.91	10.00	67.97	69.53	-599.30	1392.00
5527.0	5527 L	67.97	-57.02	-12.10	-24.34	67.97	67.97	97.53	-0.42	-31.65	67.97	67.97	-193.08	1392.00
	5527 R	67.87	35.99	0.78	-30.81	69.42	67.87	-97.14	-11.48	-23.55	67.87	67.87	208.35	1740.00

SERVICE II

Splice Side	MAX FX Flange Stress (ksi) TF	MAX FX Flange Stress (ksi) BF	MAX FX FY (kip)	MIN FX Flange Stress (ksi) TF	MIN FX Flange Stress (ksi) BF	MIN FX FY (kip)	MAX FY Flange Stress (ksi) TF	MAX FY Flange Stress (ksi) BF	MAX FY FY (kip)	MIN FY Flange Stress (ksi) TF	MIN FY Flange Stress (ksi) BF	MIN FY FY (kip)
5115 L	3.13	-7.33	397.35	-0.91	-2.46	589.88	-0.49	-0.93	305.58	1.90	-6.82	650.86
5115 R	-1.48	-2.51	527.85	8.53	-8.76	396.64	2.05	-8.20	627.74	-1.33	-0.26	295.48
5127 L	2.49	-4.39	-347.08	-2.89	3.52	-443.03	0.75	-2.61	-569.47	-2.75	4.65	-212.62
5127 R	-2.93	4.06	-503.70	2.50	-5.07	-347.77	-2.53	4.73	-221.93	0.35	-2.03	-592.77
5133 L	18.35	2.25	305.76	13.13	3.94	258.55	15.27	5.76	187.19	16.51	1.07	499.72
5133 R	16.61	4.96	258.55	22.32	2.59	298.65	20.45	-1.26	481.80	18.80	7.73	178.89
5147 L	24.26	-1.43	-326.85	18.71	2.32	-284.42	23.85	-4.03	-496.47	18.78	7.49	-194.05
5147 R	14.91	1.96	-284.42	19.96	-0.77	-333.95	15.07	5.58	-202.23	19.45	-2.35	-514.50
5153 L	7.71	-7.09	328.44	-4.38	0.89	454.97	-3.36	4.08	198.51	-0.44	-7.52	553.56
5153 R	-4.96	1.13	436.53	8.06	-7.69	325.86	-0.62	-9.15	532.00	-4.20	5.26	187.33
5163 L	3.11	-3.27	-269.31	-1.23	-0.31	-427.39	1.27	-3.39	-504.04	-0.47	2.25	-154.05
5163 R	-1.22	-0.29	-464.88	2.90	-2.99	-271.85	-0.23	1.44	-163.91	0.76	-2.10	-526.92
5169 L	17.89	0.95	342.07	13.25	2.49	290.82	13.45	6.15	210.31	17.56	-0.85	522.13
5169 R	16.55	2.95	290.82	21.62	0.60	334.97	21.35	-2.28	504.21	16.66	8.34	202.43
5183 L	21.67	1.91	-313.94	16.60	3.77	-274.83	20.54	-0.86	-496.81	18.09	7.00	-195.10
5183 R	13.20	3.08	-274.83	17.82	1.99	-321.05	14.70	5.23	-203.03	16.69	0.70	-514.67
5189 L	2.48	-3.84	310.47	-8.93	6.76	465.32	-7.99	6.30	188.19	-5.78	-0.59	542.00
5189 R	-8.25	6.67	404.31	-3.84	-2.58	309.84	-5.17	-1.56	519.29	-7.64	6.83	179.25
5199 L	4.44	-7.71	-338.75	-0.30	0.81	-555.01	2.21	-5.49	-640.20	0.46	2.20	-194.92
5199 R	-0.44	1.03	-584.45	4.24	-6.62	-339.53	0.78	0.98	-207.81	1.53	-3.19	-670.77
5205 L	19.75	0.52	373.08	15.04	2.66	311.87	15.94	5.60	215.46	18.61	-1.55	623.08
5205 R	16.81	3.54	311.87	21.68	1.15	363.39	20.69	-2.01	599.49	17.57	7.71	205.14
5219 L	22.19	1.20	-356.28	16.95	3.71	-299.19	21.57	-2.09	-585.76	17.15	9.28	-188.81
5219 R	15.16	2.75	-299.19	20.21	0.65	-365.97	15.49	6.89	-199.17	19.44	-1.60	-609.29
5225 L	-3.69	-1.22	333.45	-6.61	3.04	563.71	-6.26	4.86	197.82	-5.26	-0.45	654.67
5225 R	-5.57	2.71	471.43	-2.85	-1.26	332.46	-3.83	-1.83	620.14	-5.53	5.15	184.88
5233 L	-3.42	1.70	-317.07	-7.12	7.72	-447.11	-5.48	4.24	-597.14	-6.50	8.34	-133.83
5233 R	-6.55	7.20	-511.12	-3.07	1.43	-317.81	-5.71	7.01	-144.45	-5.29	4.65	-617.94
5241 L	15.85	6.10	408.89	11.88	7.40	361.60	12.84	10.35	241.71	14.57	6.04	646.84
5241 R	11.61	7.43	361.60	15.56	6.35	398.70	14.45	5.80	629.81	12.17	10.93	223.40
5253 L	15.92	1.96	-472.66	11.09	4.53	-387.80	14.98	1.41	-685.22	11.37	7.92	-265.90
5253 R	11.12	4.40	-387.80	15.95	1.61	-481.51	11.59	7.43	-279.97	14.83	1.54	-701.82
5262 L	-1.98	-3.28	192.97	-5.75	3.30	412.43	-5.12	4.54	82.51	-3.89	-1.80	540.35
5262 R	-6.54	3.33	394.79	-2.79	-3.08	192.47	-4.33	-2.64	513.79	-6.14	5.17	72.94
5271 L	22.41	-24.12	-523.10	4.48	-10.19	-555.84	12.33	-16.18	-764.89	5.73	-12.07	-320.75
5271 R	4.21	-9.09	-636.61	18.57	-21.50	-523.66	5.51	-11.26	-328.80	5.73	-12.38	-785.00
5279 L	24.36	-2.39	598.00	19.73	-1.80	556.32	20.78	3.02	403.37	22.42	-2.27	833.12
5279 R	22.80	-1.67	556.33	27.74	-2.08	589.00	25.94	-2.58	817.48	23.70	4.31	388.40
5289 L	25.17	8.51	-364.89	19.64	11.05	-294.13	23.70	7.26	-606.63	21.52	14.04	-152.82
5289 R	16.76	9.52	-294.13	21.89	7.17	-372.47	18.72	11.81	-169.72	20.36	6.32	-616.31
5297 L	-7.95	8.64	721.53	-12.98	17.56	945.15	-13.36	18.86	607.26	-10.65	13.27	1025.03
5297 R	-10.49	13.37	936.36	-6.10	6.48	721.53	-8.19	9.60	1002.82	-10.77	14.26	600.51
5306 L	-24.54	25.95	-141.82	-30.67	35.90	-191.34	-30.02	35.13	-351.45	-25.49	27.20	-6.58
5306 R	-30.67	35.90	-267.20	-24.54	25.95	-141.81	-25.07	26.47	-27.17	-30.46	35.89	-376.48
5402 L	-22.20	-4.97	-340.35	-23.98	-15.35	-378.98	-28.67	-3.95	-443.45	-19.35	-14.95	-308.61
5402 R	-24.93	-16.45	-276.73	-23.07	-6.14	-264.65	-20.08	-16.71	-218.54	-29.82	-4.82	-352.26
5407 L	-10.11	-17.25	69.09	-16.72	-19.25	186.21	-9.37	-20.05	37.30	-17.66	-17.27	215.40
5407 R	-15.86	-18.34	275.17	-9.53	-16.54	135.66	-16.81	-16.51	301.22	-8.76	-19.20	108.35
5411 L	-8.94	-16.95	-161.47	-15.40	-18.91	-292.46	-16.44	-16.97	-315.55	-8.10	-19.47	-135.76
5411 R	-16.26	-19.82	-203.37	-9.53	-17.68	-95.12	-8.76	-20.84	-64.47	-17.37	-17.56	-229.48
5416 L	-19.07	-9.73	236.29	-20.53	-16.60	262.53	-16.44	-16.56	207.72	-25.70	-8.40	324.47
5416 R	-19.48	-15.47	367.64	-18.27	-8.76	313.29	-24.57	-8.45	417.84	-15.64	-12.84	298.93
5422 L	-19.58	-1.69	-305.86	-21.85	-10.70	-357.90	-26.33	-1.85	-408.21	-17.56	-7.87	-293.34
5422 R	-25.35	-12.73	-268.35	-22.61	-2.35	-245.31	-20.56	-11.87	-218.36	-30.30	-1.03	-330.98
5427 L	-6.82	-18.71	17.68	-14.42	-21.10	131.00	-6.31	-22.90	-10.02	-15.30	-18.93	154.57
5427 R	-13.53	-20.08	206.20	-6.30	-17.95	70.14	-14.41	-18.19	227.13	-5.56	-20.75	47.05
5431 L	-6.15	-17.58	-68.54	-13.67	-19.96	-202.20	-14.73	-18.20	-223.43	-5.34	-20.30	-44.92
5431 R	-14.58	-20.99	-122.66	-6.70	-18.36	-12.80	-5.95	-22.05	15.59	-15.60	-18.93	-146.80
5436 L	-25.13	-3.12	252.85	-27.51	-11.91	280.22	-23.01	-12.53	225.26	-32.62	2.06	338.84
5436 R	-23.78	-10.00	367.96	-21.85	-2.41	313.18	-28.25	-1.94	415.01	-19.86	-8.95	299.36
5442 L	-17.44	-6.66	-286.61	-19.53	-15.11	-340.26	-23.63	-6.22	-387.60	-15.06	-13.49	-270.30
5442 R	-23.12	-18.05	-241.96	-20.50	-8.14	-217.19	-17.56	-17.68	-186.20	-27.86	-6.44	-301.99
5447 L	-11.55	-17.49	90.02	-19.80	-19.84	209.03	-11.11	-21.65	63.92	-20.44	-17.34	232.82
5447 R	-18.71	-18.75	292.16	-10.83	-16.65	149.69	-19.35	-16.45	313.14	-10.12	-19.43	128.23
5451 L	-10.70	-16.65	-153.17	-18.53	-18.80	-298.02	-19.38	-16.69	-319.40	-9.96	-19.44	-132.08
5451 R	-19.62	-19.89	-211.73	-11.41	-17.49	-91.42	-10.71	-20.46	-65.90	-20.44	-17.55	-235.95
5456 L	-19.77	-8.16	214.16	-22.16	-18.73	235.78	-17.01	-18.18	182.90	-27.17	-6.85	297.52
5456 R	-18.62	-15.73	334.92	-16.84	-6.71	283.96	-23.09	-6.69	383.83	-14.42	-13.52	268.16
5462 L	-19.42	1.22	-300.25	-22.72	-10.48	-383.00	-26.94	-2.41	-434.75	-17.24	-7.65	-273.40
5462 R	-26.97	-13.34	-292.46	-23.20	-2.70	-243.33	-20.55	-11.99	-204.15	-32.24	-2.82	-355.40
5467 L	-6.63	-16.22	40.87	-14.82	-20.90	164.05	-5.48	-20.84	9.62	-16.03	-17.16	190.72
5467 R	-13.92	-19.88	239.06	-6.12	-15.52	89.35	-15.03	-17.06	261.15	-4.91	-19.38	63.95
5471 L	-6.31	-14.26	-92.92	-13.56	-19.73	-240.76	-14.74	-17.22	-264.55	-4.95	-17.85	-63.05
5471 R	-14.48	-20.77	-163.94	-6.83	-14.95	-45.36	-5.22	-20.31	-10.16	-15.97	-16.22	-191.65
5476 L	-20.93	-2.67	220.68	-24.20	-12.40	280.12	-17.50	-11.17	186.51	-30.11	-3.19	339.29
5476 R	-20.32	-9.95	370.11	-17.50	-1.30	275.94	-25.06	-1.84	419.47	-14.93	-8.31	255.05
5482 L	-19.54	3.14	-301.09	-23.88	-5.70	-411.45	-27.52	2.11	-451.96	-18.17	-2.75	-290.14
5482 R	-27.71	-8.14	-321.62	-22.86	1.51	-247.34	-20.83	-5.90	-225.36	-32.38	0.68	-370.95
5487 L	-5.27	-16.45	9.84	-12.28	-23.49	116.45	-3.84	-23.10	-24.47	-14.11	-18.90	149.31
5487 R	-11.43	-22.42	191.45	-4.81	-15.76	55.36	-13.27	-18.06	218.35	-3.24	-20.67	29.48
5491 L	-4.74	-17.17	-59.48	-11.26	-21.64	-189.69	-12.88	-18.00	-220.24	-3.22	-21.49	-28.94
5491 R	-12.10	-22.70	-115.79	-5.23	-17.91	-10.86	-3.89	-23.49	26.76	-13.71	-18.84	-150.79
5496 L	-24.00	1.35	263.31	-27.59	-8.18	317.23	-20.83	-6.60	225.99	-32.97	1.49	376.09
5496 R	-23.78	-5.75	405.82	-20.53	3.04	319.71	-28.07	2.81	455.78	-18.12	-3.71	292.79
5502 L	-19.95	-1.03	-337.63	-22.88	-9.87	-424.11	-28.07	0.99	-485.60	-17.38	-7.25	-324.61
5502 R	-25.31	-11.45	-320.12	-21.99	-1.90	-272.92	-19.16	-11.52	-241.14	-31.09	1.74	-398.51
5507 L	-5.35	-17.45	1.17	-14.73	-21.22	148.56	-4.17	-22.78	-45.91	-15.61	-18.62	181.51
5507 R	-13.95	-20.33	235.97	-4.93	-16.83	57.28	-14.84	-17.90	265.30	-3.69	-20.47	19.43
5511 L	-5.07	-16.84	-56.48	-14.17	-20.40	-239.54	-14.88	-17.88	-267.43	-3.62	-20.31	-15.63
5511 R	-14.94	-21.27	-152.44	-5.52	-17.48	-0.54	-4.16	-22.65	49.43	-15.65	-18.58	-183.81
5516 L	-21.28	-1.12	271.91	-25.20	-11.91	317.77	-19.09	-12.23	235.96	-30.92	1.57	401.10
5516 R	-22.81	-10.28	420.52	-19.27	-0.31	335.95	-27.96	1.04	488.52	-17.58	-8.87	318.84
5522 L	-20.08	3.87	-376.84	-24.54	-7.28	-471.79	-28.56	4.83	-527.57	-18.27	-2.47	-366.13
5522 R	-26.52	-7.86	-368.61	-21.53	4.08	-314.30	-20.07	-6.00	-286.93	-30.42	6.37	-438.62
5527 L	-0.76	-17.53	-103.48	-8.20	-20.78	41.26	0.56	-21.83	-145.15	-8.88	-18.49	73.11
5527 R	-7.71	-20.12	129.27	-0.52	-17.06	-48.66	-8.45	-18.00	156.88	0.85	-20.42	-81.05

Splice Side	MAX MY Flange Stress (ksi) TF	MAX MY Flange Stress (ksi) BF	MAX MY FY (kip)	MIN MY Flange Stress (ksi) TF	MIN MY Flange Stress (ksi) BF	MIN MY FY (kip)	MAX MZ Flange Stress (ksi) TF	MAX MZ Flange Stress (ksi) BF	MAX MZ FY (kip)	MIN MZ Flange Stress (ksi) TF	MIN MZ Flange Stress (ksi) BF	MIN MZ FY (kip)
5115 L	3.34	-8.18	448.01	1.76	-5.28	502.28	-2.81	4.69	491.71	14.45	-17.90	460.11
5115 R	1.42	-5.54	494.45	8.43	-9.74	448.26	17.39	-19.63	461.01	-3.54	5.18	428.26
5127 L	-0.64	-1.30	-344.21	-0.57	-0.75	-421.82	-4.60	8.67	-333.33	4.06	-9.37	-410.81
5127 R	-0.55	-0.83	-420.86	-0.67	-1.44	-367.34	4.09	-10.90	-410.44	-4.65	10.02	-395.79
5133 L	16.90	3.57	277.98	15.24	3.13	286.48	12.69	7.51	287.22	18.92	-2.88	381.52
5133 R	18.73	3.86	279.38	20.67	4.02	277.98	22.84	-4.15	382.66	16.23	9.67	225.62
5147 L	23.06	-1.66	-309.59	20.58	2.34	-281.84	17.59	8.47	-229.96	25.03	-5.96	-399.37
5147 R	16.93	2.30	-284.34	18.93	1.77	-314.19	20.76	-4.16	-399.42	13.76	6.61	-291.50
5153 L	1.05	-7.52	358.22	-1.98	-1.83	368.82	-5.89	8.83	343.91	14.10	-17.82	411.05
5153 R	-2.47	-1.73	360.05	-0.74	-7.92	358.85	15.09	-19.55	411.66	-6.45	9.73	280.97
5163 L	2.25	-2.34	-322.88	1.10	-3.11	-306.77	-2.97	9.54	-255.14	5.42	-13.86	-377.07
5163 R	1.12	-3.25	-324.75	2.06	-2.14	-323.79	5.06	-12.69	-376.24	-2.85	8.73	-318.32
5169 L	16.10	3.86	280.76	16.33	2.02	335.39	12.36	7.05	299.69	18.73	-2.60	409.87
5169 R	19.79	1.78	328.29	19.62	4.30	280.76	22.37	-4.23	411.60	15.71	9.18	238.16
5183 L	19.05	4.71	-262.64	20.71	2.11	-332.60	16.19	9.08	-240.41	22.73	-3.77	-395.15
5183 R	17.06	2.35	-339.71	15.51	4.14	-262.64	18.93	-2.28	-395.17	12.74	6.99	-301.98
5189 L	-6.65	2.99	311.61	-6.02	-1.26	385.45	-10.17	12.09	373.73	7.54	-11.43	356.29
5189 R	-5.69	-1.14	378.08	-6.22	2.86	311.90	7.09	-11.32	357.59	-9.28	11.89	310.83
5199 L	4.45	-8.59	-402.05	1.27	-0.86	-427.76	-1.99	9.32	-370.11	6.42	-16.65	-419.45
5199 R	1.14	-0.76	-438.42	4.21	-7.40	-401.50	6.15	-14.31	-417.80	-1.94	8.00	-456.84
5205 L	18.00	1.25	335.60	18.96	3.09	350.04	14.30	6.91	353.85	20.66	-4.25	454.82
5205 R	20.85	3.87	340.35	19.61	1.68	335.60	22.55	-4.62	456.63	16.20	8.86	269.76
5219 L	21.38	1.87	-347.72	19.97	5.10	-307.86	16.34	10.23	-246.79	23.04	-4.29	-454.69
5219 R	18.08	4.19	-317.55	19.53	1.41	-347.72	21.10	-3.94	-454.67	14.47	8.12	-331.38
5225 L	-3.28	-4.58	410.29	-6.35	2.56	493.59	-9.47	13.56	446.88	12.30	-16.54	420.15
5225 R	-5.27	2.18	481.97	-2.47	-4.36	410.65	10.90	-15.21	420.84	-8.21	12.48	357.83
5233 L	-2.83	-1.74	-358.34	-6.75	7.46	-441.91	-9.02	15.49	-347.50	-0.95	-9.00	-350.48
5233 R	-6.20	6.85	-449.70	-2.49	-1.47	-358.02	-0.82	-8.30	-349.94	-8.22	14.33	-430.77
5241 L	13.32	5.64	387.40	14.63	8.50	398.57	11.39	12.37	398.10	16.54	-3.59	481.88
5241 R	14.34	8.66	388.38	13.05	5.74	387.40	16.24	-3.06	481.92	11.12	12.30	313.00
5253 L	15.11	2.99	-462.20	12.01	5.10	-442.10	10.65	9.30	-344.75	16.50	-3.48	-546.65
5253 R	12.03	4.98	-471.97	15.14	2.67	-462.20	16.54	-3.98	-546.65	10.67	9.28	-428.47
5262 L	-4.28	1.60	208.26	-3.23	-4.80	348.16	-7.68	11.50	315.22	11.11	-15.42	322.03
5262 R	-3.93	-4.45	349.78	-5.01	1.64	198.46	11.68	-15.14	322.32	-8.50	11.40	231.52
5271 L	20.10	-22.52	-519.68	4.90	-10.21	-588.01	3.46	-5.71	-553.33	25.14	-28.52	-532.86
5271 R	4.63	-9.13	-604.70	16.61	-20.03	-519.69	20.84	-25.40	-532.20	3.23	-5.05	-635.49
5279 L	23.45	-3.16	574.19	24.32	-3.68	584.57	18.84	4.12	566.13	28.21	-5.38	674.83
5279 R	27.56	-3.37	575.57	26.48	-2.71	574.19	32.20	-5.35	676.19	21.94	5.16	481.82
5289 L	22.55	6.92	-457.79	24.58	11.14	-258.40	19.03	15.14	-247.75	30.32	4.35	-474.18
5289 R	21.47	9.73	-265.98	19.36	5.61	-457.79	23.27	-3.60	-474.13	16.09	13.13	-330.26
5297 L	-12.51	16.42	806.81	-8.45	9.05	786.16	-15.80	23.37	881.86	-4.62	1.89	765.24
5297 R	-6.58	6.88	786.16	-10.13	12.58	799.28	-3.22	1.32	765.08	-12.92	17.80	799.60
5306 L	-25.55	27.60	-118.40	-28.28	31.84	-260.09	-31.42	37.55	-207.30	-23.44	23.70	-93.97
5306 R	-28.28	31.84	-267.05	-25.55	27.60	-124.94	-23.44	23.70	-93.97	-31.42	37.55	-295.68
5402 L	-26.68	-15.09	-369.10	-22.07	-11.49	-353.78	-28.15	-1.85	-435.00	-19.69	-17.18	-318.95
5402 R	-22.93	-12.61	-261.46	-27.52	-16.00	-276.17	-20.52	-18.05	-223.40	-29.24	-3.40	-348.42
5407 L	-14.40	-19.00	125.12	-16.45	-19.82	153.17	-17.38	-16.67	210.68	-9.54	-21.38	41.88
5407 R	-15.62	-19.00	233.52	-13.75	-18.21	201.67	-8.92	-20.55	117.08	-16.54	-15.84	294.70
5411 L	-12.85	-19.07	-226.48	-13.13	-18.60	-232.46	-16.38	-16.25	-310.44	-8.26	-20.92	-145.60
5411 R	-13.82	-19.48	-153.77	-13.69	-19.82	-149.97	-8.90	-21.79	-70.11	-17.23	-17.09	-225.92
5416 L	-25.37	-18.42	266.91	-22.27	-17.73	240.88	-25.08	-6.78	319.58	-17.16	-18.63	214.42
5416 R	-21.61	-16.88	335.46	-24.35	-17.99	358.97	-16.24	-17.74	314.21	-24.02	-5.40	408.02
5422 L	-24.59	-11.39	-340.46	-22.32	-9.23	-325.86	-25.85	1.38	-398.42	-18.32	-11.92	-306.50
5422 R	-25.73	-10.94	-249.99	-28.35	-13.38	-260.02	-21.31	-14.06	-223.56	-29.80	1.04	-326.54
5427 L	-10.71	-20.17	63.43	-13.69	-21.64	95.69	-15.08	-18.30	150.89	-6.33	-23.25	-4.29
5427 R	-12.94	-20.77	163.48	-10.03	-19.28	123.35	-5.75	-22.33	57.39	-14.23	-17.38	220.71
5431 L	-11.69	-19.98	-141.81	-11.56	-19.60	-141.22	-14.50	-17.35	-217.87	-5.56	-21.94	-53.23
5431 R	-12.30	-20.49	-74.32	-11.81	-20.66	-65.57	-6.17	-22.89	11.73	-15.39	-18.30	-142.79
5436 L	-30.69	-14.52	263.87	-26.27	-8.13	260.75	-31.95	2.82	334.76	-23.69	-14.39	230.33
5436 R	-22.69	-6.81	332.15	-26.81	-12.36	345.23	-20.45	-12.25	311.35	-27.79	3.00	406.08
5442 L	-20.79	-15.80	-314.36	-20.14	-14.23	-308.58	-23.57	-4.15	-378.45	-15.42	-16.73	-282.64
5442 R	-23.89	-17.25	-222.28	-24.86	-19.05	-225.60	-18.34	-19.85	-191.31	-27.57	-5.30	-297.80
5447 L	-16.70	-18.43	159.22	-16.72	-21.23	141.35	-20.42	-16.92	228.21	-11.20	-22.05	68.70
5447 R	-15.62	-20.22	211.50	-16.01	-17.52	232.90	-10.42	-21.06	137.52	-19.35	-15.92	306.75
5451 L	-16.86	-18.39	-247.12	-16.27	-20.16	-226.46	-19.15	-15.95	-313.40	-10.18	-21.02	-142.72
5451 R	-17.15	-21.19	-149.75	-17.80	-19.35	-171.89	-10.96	-22.03	-71.52	-20.21	-16.95	-231.85
5456 L	-24.19	-18.97	224.79	-22.99	-17.68	217.44	-27.02	-5.86	293.23	-17.82	-20.39	188.05
5456 R	-19.41	-14.61	305.34	-20.16	-15.82	313.59	-14.97	-17.21	280.95	-23.08	-4.63	374.29
5462 L	-20.28	-6.65	-335.51	-23.20	-8.56	-330.59	-26.95	4.62	-415.20	-17.50	-12.18	-300.64
5462 R	-27.61	-11.34	-261.15	-23.98	-8.96	-257.72	-20.69	-14.84	-220.04	-32.26	3.78	-344.25
5467 L	-10.24	-21.46	87.18	-11.96	-17.46	115.65	-15.75	-15.29	176.09	-5.62	-23.00	19.92
5467 R	-11.63	-16.41	183.36	-9.34	-20.60	147.53	-5.06	-22.09	80.36	-14.89	-14.44	241.40
5471 L	-9.21	-16.71	-136.80	-10.54	-17.94	-176.65	-14.87	-14.09	-250.48	-5.21	-21.56	-79.36
5471 R	-11.82	-18.55	-121.55	-9.67	-17.67	-75.92	-5.80	-22.48	-17.81	-15.73	-14.93	-184.15
5476 L	-24.22	-9.72	257.37	-23.66	-11.90	229.03	-29.56	1.52	327.14	-18.14	-14.44	198.07
5476 R	-19.91	-9.35	301.44	-20.44	-7.33	333.31	-15.33	-12.03	277.26	-24.67	2.70	397.03
5482 L	-23.23	-6.14	-353.51	-23.52	-2.80	-356.16	-27.33	6.62	-427.75	-18.90	-8.15	-322.06
5482 R	-28.85	-4.27	-306.20	-26.58	-8.87	-272.40	-21.83	-10.28	-242.53	-32.13	4.62	-358.51
5487 L	-8.81	-20.94	50.24	-9.57	-19.85	79.04	-13.54	-17.03	137.33	-4.25	-24.38	-15.73
5487 R	-8.89	-18.74	140.43	-8.13	-20.59	109.86	-3.70	-23.43	44.44	-12.75	-16.17	201.10
5491 L	-8.25	-18.67	-125.18	-9.06	-20.66	-132.05	-12.60	-15.63	-197.93	-3.45	-23.89	-46.87
5491 R	-9.91	-21.39	-70.84	-8.76	-19.69	-64.27	-4.00	-24.86	13.95	-13.40	-16.48	-134.22
5496 L	-27.88	-6.38	289.25	-26.80	-6.91	276.35	-32.61	4.61	364.10	-21.53	-10.43	241.45
5496 R	-23.46	-4.34	351.90	-23.72	-3.95	358.98	-18.64	-8.32	320.22	-27.84	6.78	433.84
5502 L	-24.19	-9.74	-388.89	-22.38	-9.31	-373.54	-27.85	3.71	-473.13	-17.64	-11.85	-344.40
5502 R	-24.55	-10.92	-285.25	-26.65	-11.39	-299.20	-19.55	-13.36	-249.16	-30.70	2.93	-392.77
5507 L	-10.28	-20.39	58.14	-12.21	-20.45	88.41	-15.57	-17.94	176.71	-4.28	-23.25	-40.58
5507 R	-11.60	-19.66	160.94	-9.71	-19.69	126.22	-3.81	-22.47	27.67	-14.81	-17.14	258.04
5511 L	-10.40	-19.20	-135.40	-12.40	-20.83	-165.69	-14.65	-17.06	-259.40	-3.92	-22.44	-25.01
5511 R	-13.18	-21.59	-93.80	-10.83	-19.95	-64.52	-4.37	-23.20	43.38	-15.40	-17.85	-178.46
5516 L	-26.17	-11.21	293.99	-24.22	-9.19	285.40	-30.66	3.16	395.29	-19.72	-14.31	245.05
5516 R	-22.07	-7.71	369.50	-23.75	-9.59	381.42	-17.82	-12.71	339.51	-27.78	3.93	474.85
5522 L	-25.81	-4.66	-461.90	-19.00	-1.45	-397.69	-27.58	6.71	-512.21	-19.60	-7.96	-390.38
5522 R	-20.33	-1.81	-315.54	-27.91	-4.77	-374.81	-21.26	-8.68	-296.83	-29.54	7.10	-431.77
5527 L	-6.24	-21.02	-27.55	-6.15	-20.08	-18.69	-8.70	-17.79	67.20	-0.36	-22.95	-140.22
5527 R	-5.78	-19.57	52.30	-5.87	-20.41	47.08	0.52	-22.34	-70.51	-8.25	-17.22	147.84

Section Properties

Ref. Delta Frame Desig

Splice Node	Splice Side	pacity (ksi) BF	FY (kip)	MAX MZ Flange Stress (ksi) TF	MAX MZ Flange Stress (ksi) BF	MAX MZ Flange Capacity (ksi) TF	MAX MZ Flange Capacity (ksi) BF	MAX MZ FY (kip)	MIN MZ Flange Stress (ksi) TF	MIN MZ Flange Stress (ksi) BF	MIN MZ Flange Capacity (ksi) TF	MIN MZ Flange Capacity (ksi) BF	MIN MZ FY (kip)	ϕvVn (kip)
5531.0	5531 L	67.87	-38.95	-11.75	-23.85	67.87	67.87	-206.73	0.40	-30.58	69.42	67.87	110.55	1740.00
	5531 R	67.97	66.99	-0.60	-31.34	67.97	67.97	205.35	-12.37	-24.62	67.97	67.97	-97.67	1392.00
5536.0	5536 L	69.53	523.28	-45.65	14.41	67.97	69.53	700.65	-32.97	-10.29	67.97	67.97	470.91	1392.00
	5536 R	49.59	682.20	-30.54	-9.58	69.43	49.59	594.81	-42.82	13.48	69.43	49.59	808.22	1914.00
5542.0	5542 L	69.35	-741.38	-35.54	-5.11	68.43	69.35	-845.00	-23.25	-19.72	68.43	69.35	-615.89	2088.00
	5542 R	69.57	-486.24	-25.67	-21.94	69.57	69.57	-436.09	-38.98	-6.87	69.57	69.57	-675.21	1392.00
5547.0	5547 L	69.57	186.20	-22.68	-25.62	69.57	69.57	361.34	-12.19	-32.90	69.57	69.57	74.43	1392.00
	5547 R	69.47	344.95	-11.53	-31.99	69.47	69.47	214.87	-21.82	-24.72	69.47	69.47	511.68	1740.00
5551.0	5551 L	69.47	-362.38	-20.42	-24.25	69.47	69.47	-538.58	-12.52	-33.25	69.47	69.47	-235.24	1740.00
	5551 R	69.57	-190.44	-13.17	-34.16	69.57	69.57	-78.43	-21.28	-25.15	69.57	69.57	-374.38	1392.00
5556.0	5556 L	69.57	576.69	-44.89	-5.40	69.57	69.57	776.53	-28.54	-19.91	69.57	69.57	522.69	1392.00
	5556 R	69.35	906.90	-25.92	-17.69	68.43	69.35	724.46	-41.06	-3.50	68.43	69.35	968.76	2088.00
7007.0	7007 L	69.04	121.44	-44.41	44.18	69.04	69.04	270.59	-33.28	24.76	69.04	69.04	35.38	1375.39
	7007 R	69.04	121.22	-33.28	24.76	69.04	69.04	35.38	-44.41	44.18	69.04	69.04	174.50	1375.39
7015.0	7015 L	69.04	-728.77	-15.53	19.78	69.04	69.04	-765.22	6.65	-6.65	69.04	68.14	-760.83	1375.39
	7015 R	68.06	-815.93	7.53	-9.57	68.06	59.11	-760.66	-17.22	28.66	68.06	68.06	-863.66	2686.30
7021.0	7021 L	68.02	365.30	20.59	17.56	68.02	68.02	322.73	36.85	-6.36	68.02	62.86	518.50	3935.48
	7021 R	68.19	362.45	44.84	-6.96	68.19	62.44	518.40	26.31	22.96	68.19	68.19	231.01	1375.39
7035.0	7035 L	62.44	-505.46	30.30	10.23	68.19	68.19	-390.59	47.83	-10.34	68.19	62.44	-640.96	1375.39
	7035 R	62.86	-503.83	39.46	-8.93	68.02	62.86	-640.69	24.36	7.41	68.02	68.02	-497.87	3935.48
7041.0	7041 L	59.11	555.27	0.11	-1.31	68.06	56.82	692.93	23.66	-27.65	68.06	59.11	573.05	2686.30
	7041 R	62.11	618.78	29.27	-35.63	67.91	62.41	574.23	-0.31	-1.69	67.91	54.70	589.36	1375.39
7051.0	7051 L	62.48	-450.38	-0.86	10.70	67.91	67.91	-412.38	25.67	-29.53	67.91	62.44	-477.07	1375.39
	7051 R	50.00	-523.24	23.78	-27.03	50.00	47.28	-474.58	-1.25	9.91	50.00	50.00	-511.58	1375.39
7057.0	7057 L	50.00	465.95	19.75	11.31	50.00	50.00	445.80	35.73	-9.14	50.00	48.62	591.47	3306.90
	7057 R	50.00	447.96	36.90	-9.14	50.00	47.81	591.48	20.69	11.94	50.00	50.00	353.96	2686.30
7071.0	7071 L	50.00	-406.35	19.86	15.48	50.00	50.00	-305.38	34.56	-6.48	50.00	47.88	-532.16	2686.30
	7071 R	50.00	-405.81	33.41	-6.66	50.00	48.68	-530.92	18.88	14.76	50.00	50.00	-397.25	3306.90
7077.0	7077 L	43.22	501.32	-15.62	21.68	50.00	50.00	609.30	9.79	-14.54	50.00	47.18	514.12	1375.39
	7077 R	50.00	537.18	9.19	-11.60	50.00	48.35	513.88	-14.16	17.11	50.00	50.00	515.85	1375.39
7089.0	7089 L	48.41	-594.30	-2.60	9.08	50.00	50.00	-607.79	19.75	-19.95	50.00	48.41	-612.69	1375.39
	7089 R	50.00	-717.11	18.90	-21.63	50.00	47.42	-612.31	-2.75	9.90	50.00	50.00	-701.50	1375.39
7095.0	7095 L	50.00	411.37	21.36	9.44	50.00	50.00	401.81	37.15	-7.94	50.00	48.67	536.82	3306.90
	7095 R	50.00	400.91	37.33	-6.30	50.00	48.79	536.83	21.79	10.44	50.00	50.00	309.98	1375.39
7109.0	7109 L	50.00	-430.21	22.69	9.16	50.00	50.00	-323.85	38.48	-7.31	50.00	48.77	-553.95	1375.39
	7109 R	48.83	-427.95	38.33	-8.99	50.00	48.65	-553.93	22.28	8.08	50.00	50.00	-415.68	3306.90
7115.0	7115 L	47.41	578.93	-4.30	7.21	50.00	50.00	643.20	21.20	-25.84	50.00	47.40	620.58	1375.39
	7115 R	43.56	626.75	25.51	-28.34	50.00	47.37	621.27	-5.36	7.96	50.00	50.00	549.21	1375.39
7127.0	7127 L	47.41	-472.06	-6.15	11.96	50.00	50.00	-443.23	13.36	-14.01	50.00	47.39	-547.60	1375.39
	7127 R	50.00	-601.09	13.70	-16.35	50.00	47.16	-547.09	-6.21	13.84	50.00	50.00	-536.77	1375.39
7133.0	7133 L	50.00	371.37	16.16	9.87	50.00	50.00	387.80	30.42	-2.76	50.00	48.83	492.41	3306.90
	7133 R	50.00	367.51	36.89	-3.80	50.00	47.98	494.89	20.59	12.85	50.00	50.00	295.50	1375.39
7147.0	7147 L	50.00	-403.09	22.94	11.86	50.00	50.00	-314.48	41.78	-7.30	50.00	47.89	-547.13	1375.39
	7147 R	50.00	-427.09	34.40	-5.33	50.00	48.76	-547.16	17.93	9.16	50.00	50.00	-406.20	3306.90
7153.0	7153 L	47.18	440.08	-8.24	11.72	50.00	50.00	452.01	19.44	-24.01	50.00	47.15	553.95	1375.39
	7153 R	42.35	528.11	20.79	-26.33	50.00	47.01	554.35	-8.98	12.92	50.00	50.00	358.83	1375.39
7163.0	7163 L	47.07	-408.20	-4.29	12.57	50.00	50.00	-328.75	17.90	-21.56	50.00	47.03	-510.67	1375.39
	7163 R	50.00	-497.73	16.26	-19.54	50.00	47.16	-509.88	-4.11	11.49	50.00	50.00	-422.29	1375.39
7169.0	7169 L	50.00	422.62	16.43	9.72	50.00	50.00	422.83	32.33	-3.26	50.00	48.82	575.46	3306.90
	7169 R	50.00	430.98	38.97	-5.17	50.00	47.43	575.52	20.91	12.80	50.00	50.00	330.98	1375.39
7183.0	7183 L	50.00	-419.32	21.97	13.26	50.00	50.00	-328.97	37.59	-3.87	50.00	47.48	-550.94	1375.39
	7183 R	50.00	-411.98	30.99	-2.32	50.00	48.85	-550.98	17.22	10.14	50.00	50.00	-420.74	3306.90
7189.0	7189 L	46.90	427.54	-13.56	16.57	50.00	50.00	493.89	9.86	-14.66	50.00	47.07	473.81	1375.39
	7189 R	50.00	489.43	9.29	-14.53	50.00	47.05	474.77	-12.36	16.29	50.00	50.00	400.31	1375.39
7199.0	7199 L	47.19	-500.78	-2.95	13.74	50.00	50.00	-445.36	19.61	-25.54	50.00	47.12	-572.02	1375.39
	7199 R	47.46	-600.44	18.91	-21.93	50.00	47.35	-570.54	-2.87	11.78	50.00	50.00	-571.47	1375.39
7205.0	7205 L	50.00	477.86	19.65	10.32	50.00	50.00	492.01	35.62	-7.07	50.00	49.24	667.96	3306.90
	7205 R	50.00	494.91	39.01	-7.45	50.00	48.75	668.41	22.43	13.23	50.00	50.00	368.85	1375.39
7219.0	7219 L	50.00	-448.28	21.72	14.71	50.00	50.00	-341.17	39.32	-6.23	50.00	48.78	-639.80	1375.39
	7219 R	50.00	-495.08	35.88	-6.00	50.00	49.27	-639.71	19.25	11.83	50.00	50.00	-464.30	3306.90
7225.0	7225 L	47.27	485.01	-12.30	18.52	50.00	50.00	567.27	18.10	-23.46	50.00	47.31	546.29	1375.39
	7225 R	50.00	567.77	16.00	-21.56	50.00	47.37	546.86	-10.69	17.07	50.00	50.00	438.66	1375.39
7233.0	7233 L	50.00	-387.23	-14.33	23.73	50.00	50.00	-386.18	8.87	-12.86	50.00	47.34	-412.74	1375.39
	7233 R	50.00	-432.52	8.13	-11.82	50.00	49.31	-412.07	-13.11	21.99	50.00	50.00	-501.99	1375.39
7241.0	7241 L	68.45	519.09	16.71	18.64	48.89	68.45	539.51	29.02	-7.33	48.89	66.66	696.78	3306.90
	7241 R	50.00	531.83	28.44	-6.44	50.00	50.00	696.88	16.17	18.51	50.00	50.00	416.92	2686.30
7252.0	7252 L	50.00	-624.35	12.28	12.24	50.00	50.00	-460.95	26.39	-3.82	50.00	50.00	-758.80	2686.30
	7252 R	68.45	-613.06	26.37	-4.55	48.89	66.74	-758.79	12.28	12.28	48.89	68.45	-584.00	3306.90
7260.0	7260 L	49.35	302.71	-9.45	16.34	50.00	50.00	345.25	16.33	-20.61	50.00	49.34	342.49	1375.39
	7260 R	50.00	352.53	17.21	-20.23	50.00	48.91	341.89	-10.38	16.17	50.00	50.00	223.73	1375.39
7269.0	7269 L	48.92	-780.00	5.28	-7.76	50.00	48.86	-823.40	36.21	-40.09	50.00	48.92	-758.96	1375.39
	7269 R	65.91	-904.24	30.05	-35.75	68.29	65.94	-759.53	4.57	-6.80	68.29	65.85	-943.34	2686.30
7277.0	7277 L	67.75	709.73	29.21	12.03	68.63	68.63	692.81	41.47	-11.89	68.63	67.75	824.69	3935.48
	7277 R	67.93	656.81	47.20	-12.42	68.95	67.79	824.76	33.63	14.13	68.95	68.95	572.25	1375.39
7287.0	7287 L	68.95	-402.45	26.44	25.52	68.95	68.95	-260.86	40.92	9.36	68.95	68.95	-628.87	1375.39
	7287 R	68.63	-506.49	35.68	7.59	68.63	68.63	-628.87	22.47	22.31	68.63	68.63	-382.36	3935.48
7295.0	7295 L	68.21	1035.89	-22.92	32.20	68.21	68.21	1194.55	-2.73	1.47	68.21	68.21	1040.71	2262.15
	7295 R	68.44	1071.02	-1.73	0.91	68.44	68.44	1040.55	-18.32	24.38	68.44	68.44	1072.97	3908.99
7305.0	7305 L	68.44	-293.73	-38.80	47.08	68.44	68.44	-375.28	-28.61	29.18	68.44	68.44	-208.22	3908.99
	7305 R	68.44	-299.18	-28.61	29.18	68.44	68.44	-208.22	-38.80	47.08	68.44	68.44	-503.71	3908.99
7402.0	7402 L	59.60	-528.13	-39.90	2.81	63.56	68.99	-604.09	-25.66	-21.13	63.56	59.60	-433.98	2088.00
	7402 R	63.86	-367.89	-26.82	-22.37	63.86	63.86	-307.21	-41.36	-3.51	63.86	63.86	-488.74	1392.00
7407.0	7407 L	63.86	136.48	-23.35	-23.07	63.86	63.86	272.81	-11.94	-29.47	63.86	63.86	36.50	1392.00
	7407 R	63.76	232.22	-11.11	-28.33	63.76	63.76	136.85	-22.23	-21.96	63.76	63.76	384.09	1740.00
7411.0	7411 L	63.76	-258.36	-21.96	-22.37	63.76	63.76	-403.22	-10.50	-29.14	63.76	63.76	-173.59	1740.00
	7411 R	63.86	-165.74	-11.32	-30.29	63.86	63.86	-73.41	-23.08	-23.50	63.86	63.86	-291.33	1392.00
7416.0	7416 L	63.86	350.50	-35.70	-8.00	63.86	63.86	451.00	-22.75	-23.09	63.86	63.86	295.62	1392.00
	7416 R	59.60	469.26	-21.49	-21.84	63.56	59.60	423.58	-34.36	-6.17	63.56	59.60	565.23	2088.00
7422.0	7422 L	50.00	-485.91	-35.77	2.76	50.00	50.00	-553.76	-23.83	-14.77	50.00	50.00	-416.61	1914.00
	7422 R	68.13	-344.44	-27.76	-17.50	68.13	68.13	-305.33	-41.22	2.44	68.14	69.30	-456.81	1392.00
7427.0	7427 L	68.13	78.77	-20.10	-24.52	68.13	68.13	199.83	-7.80	-31.76	68.13	68.13	-16.96	1392.00
	7427 R	67.81	153.51	-7.00	-30.48	67.81	67.81	66.04	-18.92	-23.25	67.81	67.81	294.45	1740.00
7431.0	7431 L	67.81	-147.66	-19.15	-23.17	67.81	67.81	-286.27	-6.94	-30.18	67.81	67.81	-58.55	1740.00
	7431 R	68.13	-67.73	-7.72	-31.44	68.13	68.13	24.32	-20.32	-24.44	68.13	68.13	-191.77	1392.00
7436.0	7436 L	68.13	385.99	-44.39	5.36	68.18	69.30	465.68	-31.13	-18.29	68.13	68.13	313.11	1392.00
	7436 R	50.00	450.91	-26.84	-15.50	50.00	50.00	422.03	-38.57	5.36	50.00	50.00	562.11	1914.00

SERVICE II

Splice Side	MAX FX Flange Stress (ksi) TF	MAX FX BF	MAX FX FY (kip)	MIN FX Flange Stress (ksi) TF	MIN FX BF	MIN FX FY (kip)	MAX FY Flange Stress (ksi) TF	MAX FY BF	MAX FY FY (kip)	MIN FY Flange Stress (ksi) TF	MIN FY BF	MIN FY FY (kip)
5531 L	-0.59	-16.80	55.29	-8.04	-20.68	-122.31	-8.68	-18.23	-156.77	0.64	-20.31	91.04
5531 R	-8.52	-21.30	-35.84	-0.84	-17.27	109.04	0.29	-21.64	154.41	-9.12	-18.71	-74.06
5536 L	-24.26	7.08	363.99	-29.73	-4.51	436.12	-22.68	-4.22	331.51	-34.21	9.77	511.65
5536 R	-27.64	-4.24	536.44	-22.74	6.66	423.18	-31.98	7.93	598.21	-21.14	-2.11	408.33
5542 L	-18.06	-6.63	-446.26	-22.69	-11.78	-566.81	-26.37	-6.65	-624.13	-16.84	-11.67	-426.74
5542 R	-24.97	-13.46	-423.09	-19.85	-7.79	-342.84	-18.14	-14.52	-306.25	-28.78	-6.75	-493.33
5547 L	-9.70	-18.98	99.01	-15.56	-21.84	227.86	-8.68	-22.95	49.74	-16.65	-19.24	267.13
5547 R	-14.92	-21.12	346.04	-9.26	-18.43	185.78	-16.02	-18.97	379.89	-8.22	-21.53	146.55
5551 L	-9.07	-18.36	-188.98	-15.63	-22.38	-375.76	-15.92	-19.66	-407.51	-8.51	-21.86	-153.14
5551 R	-16.28	-23.09	-244.85	-9.50	-18.91	-92.19	-9.01	-23.31	-46.73	-16.49	-20.01	-281.86
5556 L	-24.51	-5.62	419.64	-27.90	-13.40	484.92	-21.29	-13.42	365.30	-32.15	-4.88	571.91
5556 R	-25.44	-11.61	646.90	-22.39	-4.43	537.68	-29.16	-4.05	720.58	-19.79	-10.88	500.13
7007 L	-26.39	21.41	68.05	-31.03	28.88	160.34	-26.17	21.04	-21.14	-31.84	30.42	253.69
7007 R	-31.03	28.88	101.40	-26.39	21.41	68.05	-31.42	29.69	234.36	-26.58	21.74	-37.45
7015 L	-5.04	3.24	-529.48	-8.40	8.82	-643.58	-6.34	5.47	-705.35	-8.65	9.84	-419.54
7015 R	-9.34	12.94	-685.93	-6.38	5.70	-523.54	-10.19	14.81	-429.97	-7.66	9.76	-733.64
7021 L	21.31	5.28	315.98	15.87	8.56	226.51	15.86	12.06	155.30	20.68	3.82	482.43
7021 R	20.09	11.31	226.51	25.95	7.16	308.52	25.47	4.74	464.64	19.98	16.25	147.66
7035 L	28.33	-2.16	-356.99	24.42	-2.53	-358.43	27.81	-5.70	-561.53	25.10	5.01	-246.87
7035 R	19.77	-2.24	-358.43	23.34	-2.10	-364.45	20.49	3.17	-254.54	22.70	-4.34	-579.38
7041 L	11.72	-12.63	420.09	3.56	-7.52	481.08	3.72	-6.48	266.31	3.68	-7.14	612.02
7041 R	3.57	-9.31	413.98	14.27	-16.05	418.94	4.29	-10.30	585.39	3.67	-7.44	255.88
7051 L	4.89	-4.81	-293.81	2.25	-2.10	-342.77	4.40	-6.35	-496.10	1.94	1.31	-174.53
7051 R	1.92	-1.89	-418.72	4.53	-4.40	-294.90	1.92	0.54	-184.72	3.62	-4.62	-523.40
7057 L	20.65	-2.78	361.82	15.37	3.63	304.68	15.89	6.69	223.85	20.03	-4.03	549.46
7057 R	16.05	3.91	304.68	21.39	-2.67	354.35	20.99	-4.49	531.65	16.41	7.51	215.85
7071 L	20.47	4.44	-307.96	15.77	6.18	-277.93	19.58	-2.81	-492.29	16.25	10.27	-174.73
7071 R	15.05	5.88	-277.93	19.71	4.16	-315.42	15.69	9.38	-182.64	18.61	2.58	-510.13
7077 L	-6.30	3.58	369.98	-8.59	6.24	466.94	-8.63	7.82	228.30	-7.85	6.01	585.33
7077 R	-7.55	4.86	399.05	-5.30	2.78	369.05	-6.39	3.77	560.70	-7.87	6.72	218.28
7089 L	3.30	-2.58	-421.38	2.04	-2.68	-495.94	2.78	-3.19	-632.04	0.91	1.39	-286.12
7089 R	1.93	-2.92	-560.77	3.16	-2.79	-422.34	1.06	0.88	-296.47	2.22	-2.50	-655.49
7095 L	20.77	-0.49	314.34	16.92	1.45	283.98	17.15	5.32	184.56	20.64	-3.09	514.54
7095 R	17.15	2.14	283.98	21.04	1.26	306.87	21.08	-2.68	496.62	17.27	6.48	176.52
7109 L	23.13	-1.96	-342.87	17.51	1.92	-278.22	22.11	-3.24	-508.81	18.13	5.35	-190.71
7109 R	17.28	1.16	-278.22	22.91	-2.97	-350.33	18.03	4.13	-198.78	21.68	-3.70	-526.76
7115 L	8.04	-8.72	402.82	-0.84	-2.37	538.49	-0.69	-0.26	283.69	1.15	-5.19	631.82
7115 R	-1.40	-2.29	473.21	9.59	-9.61	402.40	1.22	-6.48	608.01	-1.55	0.78	272.76
7127 L	1.67	-2.68	-336.69	-2.51	2.66	-401.96	0.87	-2.41	-563.09	-2.86	5.02	-196.70
7127 R	-2.55	3.04	-467.47	1.50	-2.68	-332.25	-2.61	5.11	-206.43	0.43	-1.69	-587.43
7133 L	17.64	2.09	294.64	12.40	3.80	245.54	13.82	5.66	173.98	16.27	1.02	489.19
7133 R	15.62	4.77	245.54	21.38	2.47	286.82	20.01	-0.48	470.20	17.04	7.81	165.34
7147 L	24.13	-0.96	-324.55	18.16	2.73	-280.25	23.85	-4.00	-494.35	17.66	8.28	-185.76
7147 R	14.46	2.26	-280.25	19.87	-0.43	-332.02	14.06	6.05	-193.88	19.49	-2.39	-512.86
7153 L	9.64	-9.15	329.84	-4.99	1.83	439.25	-3.57	4.66	180.29	-1.08	-6.93	538.80
7153 R	-5.47	1.88	414.39	10.10	-9.91	327.09	-1.20	-8.56	516.51	-4.44	5.96	168.50
7163 L	3.44	-3.68	-250.24	-1.58	0.34	-407.02	1.31	-3.18	-493.73	-0.87	2.79	-137.30
7163 R	-1.55	0.32	-445.94	3.19	-3.36	-252.94	-0.59	1.88	-147.40	0.76	-1.82	-517.70
7169 L	17.92	1.34	346.46	13.12	2.71	290.09	12.92	6.60	206.52	17.57	-0.81	523.70
7169 R	16.39	3.22	290.09	21.66	1.15	339.00	21.39	-2.30	505.26	16.12	9.09	198.66
7183 L	21.68	2.85	-316.19	16.44	4.10	-275.36	20.69	-0.54	-497.96	17.67	8.23	-191.35
7183 R	13.01	3.29	-275.36	17.77	2.66	-323.66	14.25	6.08	-199.18	16.74	0.80	-516.32
7189 L	-4.44	-0.43	318.62	-8.18	4.71	428.58	-8.12	6.54	171.95	-5.79	0.64	525.91
7189 R	-7.58	4.62	364.34	-4.33	-0.41	317.65	-5.13	-0.78	501.49	-7.77	7.13	162.74
7199 L	3.57	-4.82	-345.77	0.63	-1.43	-487.75	2.18	-4.84	-604.28	0.32	2.89	-174.77
7199 R	0.54	-1.26	-508.90	3.41	-4.14	-347.03	0.60	1.66	-188.27	1.55	-2.84	-635.65
7205 L	19.49	2.39	365.76	15.14	2.39	323.90	16.08	6.31	221.26	18.65	-2.35	633.20
7205 R	16.95	3.23	323.90	21.47	3.28	355.78	20.79	-3.03	609.47	17.77	8.49	211.24
7219 L	21.93	0.62	-390.33	16.97	3.72	-310.07	21.37	-2.65	-593.66	16.63	10.04	-195.51
7219 R	15.20	2.84	-310.06	19.97	-0.75	-400.31	15.00	7.57	-205.65	19.22	-1.99	-617.30
7225 L	-3.56	-0.46	319.83	-5.95	1.77	525.39	-5.94	4.82	168.13	-4.30	-1.74	619.87
7225 R	-5.01	1.58	422.33	-2.75	-0.55	318.29	-2.95	-3.09	585.93	-5.27	5.17	154.67
7233 L	-5.14	3.84	-289.30	-8.45	8.57	-339.25	-6.90	6.38	-549.68	-8.14	9.73	-67.06
7233 R	-7.72	7.83	-419.23	-4.69	3.44	-290.42	-7.26	8.44	-76.08	-6.42	6.15	-556.99
7241 L	16.98	7.54	422.79	12.68	8.17	376.39	13.76	12.32	241.80	15.50	5.91	660.85
7241 R	12.28	8.14	376.39	16.54	7.74	413.37	15.32	5.50	638.13	13.17	12.65	231.01
7252 L	14.46	2.48	-483.37	9.75	4.38	-393.22	14.04	1.18	-674.09	10.03	7.81	-267.97
7252 R	9.76	4.28	-393.22	14.47	2.18	-493.34	10.24	7.32	-282.71	13.85	1.44	-693.04
7260 L	-2.01	-1.00	148.19	-4.57	2.49	347.30	-4.50	4.39	19.66	-2.25	-2.20	469.00
7260 R	-5.29	2.59	333.22	-2.65	-0.83	146.14	-2.67	-2.85	447.02	-5.43	5.09	9.09
7269 L	19.59	-19.95	-555.01	4.96	-11.64	-638.57	12.24	-15.53	-793.98	6.04	-11.70	-333.51
7269 R	4.63	-10.29	-661.64	16.35	-17.83	-557.59	5.92	-11.17	-348.56	5.71	-12.07	-803.45
7277 L	27.04	-6.21	544.99	22.30	-5.38	490.47	23.47	6.88	357.52	25.17	-6.47	754.64
7277 R	25.69	-5.73	490.47	30.75	-6.42	536.82	29.14	-7.55	729.58	26.82	8.40	351.42
7287 L	25.10	13.16	-326.31	19.81	13.62	-273.01	24.68	9.06	-571.76	20.74	18.16	-147.98
7287 R	16.92	11.80	-273.01	21.82	11.37	-335.20	17.91	15.47	-160.51	21.19	8.16	-590.59
7295 L	-7.55	6.94	750.63	-14.93	18.68	868.49	-13.89	17.31	605.36	-12.42	15.43	996.74
7295 R	-11.81	14.16	841.45	-5.35	4.98	750.63	-9.34	11.14	978.97	-11.18	13.55	590.43
7305 L	-22.02	23.79	-186.52	-26.55	30.21	-343.73	-27.42	31.91	-415.43	-22.93	25.14	-66.19
7305 R	-26.55	30.21	-357.48	-22.02	23.79	-186.52	-22.48	24.37	-87.94	-27.86	32.67	-440.16
7402 L	-22.08	-3.81	-336.77	-22.80	-12.17	-381.86	-28.43	-2.10	-445.00	-18.83	-13.72	-305.88
7402 R	-23.84	-13.39	-282.48	-22.92	-4.97	-264.71	-19.45	-15.31	-218.46	-29.68	-3.24	-356.81
7407 L	-9.82	-17.74	51.11	-16.28	-19.22	174.52	-8.98	-20.42	21.83	-17.37	-17.51	201.41
7407 R	-15.45	-18.33	260.86	-9.26	-17.04	114.52	-16.51	-16.75	284.33	-8.39	-19.57	90.25
7411 L	-8.79	-17.58	-141.16	-15.05	-19.39	-268.72	-16.31	-17.17	-297.59	-7.94	-20.09	-117.92
7411 R	-15.88	-20.29	-182.42	-9.34	-18.29	-77.94	-8.58	-21.24	-49.63	-17.21	-17.88	-214.51
7416 L	-19.83	-9.35	237.62	-21.57	-15.08	270.57	-16.57	-15.73	207.92	-25.58	-6.89	329.46
7416 R	-20.55	-13.95	369.33	-19.12	-8.45	309.13	-24.58	-6.68	417.23	-16.07	-13.26	294.11
7422 L	-19.98	-1.67	-302.92	-22.06	-9.25	-362.32	-25.85	-0.65	-409.06	-17.93	-8.18	-291.08
7422 R	-25.58	-11.07	-274.76	-23.04	-2.30	-244.26	-20.01	-11.13	-217.34	-30.04	0.42	-333.58
7427 L	-5.86	-17.94	10.06	-14.42	-21.64	121.42	-5.33	-21.51	-16.14	-15.48	-19.29	147.59
7427 R	-13.55	-20.62	195.29	-5.35	-17.18	60.75	-14.67	-18.63	218.51	-4.70	-20.12	39.77
7431 L	-5.48	-17.17	-56.22	-13.91	-20.62	-187.78	-14.70	-18.31	-212.08	-4.97	-20.21	-34.59
7431 R	-14.78	-21.63	-114.02	-6.03	-17.96	-5.51	-5.57	-21.60	21.46	-15.51	-18.97	-141.30
7436 L	-25.41	-3.00	250.62	-26.82	-9.12	286.78	-22.39	-11.76	223.30	-32.05	2.18	340.13
7436 R	-22.71	-7.54	371.06	-22.08	-2.30	309.13	-27.56	1.04	415.43	-19.74	-8.55	296.32

Splice Side	MAX MY Flange Stress (ksi) TF	MAX MY BF	MAX MY FY (kip)	MIN MY Flange Stress (ksi) TF	MIN MY BF	MIN MY FY (kip)	MAX MZ Flange Stress (ksi) TF	MAX MZ BF	MAX MZ FY (kip)	MIN MZ Flange Stress (ksi) TF	MIN MZ BF	MIN MZ FY (kip)
5531 L	-5.40	-19.39	-33.74	-7.67	-21.10	-73.61	-8.35	-17.35	-146.84	0.30	-22.23	79.87
5531 R	-8.07	-21.65	3.57	-5.76	-19.96	34.21	-0.54	-22.78	148.76	-8.80	-17.91	-67.50
5536 L	-27.22	3.08	430.63	-27.61	-4.38	379.86	-32.84	10.15	505.00	-24.35	-7.70	342.86
5536 R	-25.74	4.47	460.06	-25.41	2.91	513.82	-22.56	-7.20	432.95	-30.80	9.48	583.14
5542 L	-20.46	-13.36	-481.93	-22.52	-7.09	-534.80	-25.84	-4.12	-610.44	-16.71	-14.29	-446.14
5542 R	-24.65	-8.44	-415.98	-22.45	-15.05	-353.32	-18.46	-15.89	-315.19	-28.34	-5.42	-486.83
5547 L	-14.49	-21.39	183.70	-14.40	-21.97	177.52	-16.45	-18.68	261.66	-8.97	-23.94	55.76
5547 R	-13.84	-21.34	281.15	-13.89	-20.70	292.69	-8.49	-23.27	158.09	-15.83	-18.03	371.13
5551 L	-13.22	-19.39	-309.04	-14.39	-23.38	-296.84	-14.84	-17.68	-389.95	-9.10	-24.06	-171.79
5551 R	-14.97	-24.06	-174.82	-13.77	-20.07	-195.76	-9.57	-24.72	-57.56	-15.45	-18.33	-270.33
5556 L	-31.59	-9.30	509.23	-22.39	-11.69	420.32	-32.26	-3.79	561.51	-21.08	-14.71	379.32
5556 R	-20.42	-10.16	565.21	-28.91	-7.66	655.19	-19.15	-13.08	526.29	-29.49	-2.44	701.42
7007 L	-29.77	27.02	141.48	-27.07	22.03	84.29	-32.66	32.20	194.15	-24.80	18.22	28.44
7007 R	-27.07	22.03	84.29	-29.77	27.02	130.99	-24.80	18.22	28.44	-32.66	32.20	126.26
7015 L	-9.38	10.40	-583.26	-5.01	3.00	-531.55	-11.28	14.35	-557.31	-1.76	-3.76	-554.50
7015 R	-5.85	4.04	-531.97	-10.27	14.71	-593.27	-2.25	-5.16	-554.22	-12.53	20.79	-627.09
7021 L	17.11	5.34	271.17	21.09	8.87	264.38	15.35	12.86	234.31	21.98	-4.25	373.95
7021 R	25.46	11.09	264.38	21.70	7.85	263.70	32.63	-5.01	373.89	19.65	16.82	169.50
7035 L	25.79	-1.39	-359.68	28.54	-4.03	-367.98	24.14	6.17	-287.13	34.88	-7.52	-463.71
7035 R	23.76	-3.93	-367.98	21.67	-1.91	-367.14	24.30	-6.22	-463.52	19.43	4.47	-362.93
7041 L	3.46	-6.03	480.12	12.51	-14.23	404.43	1.11	-1.00	501.69	16.58	-19.23	416.41
7041 R	15.10	-17.96	404.03	3.36	-7.21	448.54	20.50	-24.79	417.07	1.17	-1.25	428.65
7051 L	1.77	1.80	-353.46	7.75	-12.51	-327.75	-0.99	8.02	-299.77	18.03	-20.56	-346.61
7051 R	7.43	-11.64	-328.23	1.54	1.81	-377.98	16.70	-18.82	-345.02	-1.24	7.42	-369.74
7057 L	17.24	0.83	334.16	20.18	3.83	339.62	14.70	8.10	325.17	21.63	-6.31	428.30
7057 R	20.92	3.89	339.62	17.94	1.21	326.70	22.36	-6.36	428.31	15.40	8.56	260.28
7071 L	17.30	4.17	-287.15	19.90	6.57	-296.13	14.83	11.19	-224.80	21.37	-4.52	-383.88
7071 R	19.14	6.42	-296.13	16.57	3.71	-294.61	20.61	-4.59	-383.01	14.09	10.66	-289.71
7077 L	-9.36	9.13	417.33	-6.13	1.00	363.42	-11.41	15.54	443.94	6.68	-10.24	372.46
7077 R	-5.18	-1.18	363.50	-8.44	7.39	392.85	6.29	-8.17	372.40	-10.31	12.25	377.78
7089 L	1.57	1.30	-492.13	5.24	-6.92	-431.58	-1.83	6.69	-441.12	7.80	-13.11	-448.37
7089 R	5.15	-7.42	-431.47	1.47	1.30	-522.05	7.65	-14.29	-448.00	-1.95	7.31	-507.47
7095 L	19.98	-0.97	300.93	21.06	2.62	297.88	15.83	6.91	291.12	27.14	-5.77	389.49
7095 R	21.29	3.38	297.88	20.33	1.67	293.47	22.77	-4.55	389.49	16.15	7.65	226.25
7109 L	21.39	-1.24	-303.62	22.72	2.38	-314.74	16.91	6.54	-239.59	23.74	-5.23	-400.10
7109 R	22.51	-2.98	-314.74	21.10	-2.11	-311.08	23.57	-6.20	-400.09	16.60	5.74	-304.48
7115 L	-1.35	-1.76	480.52	8.46	-9.99	425.81	-3.30	5.47	471.22	14.83	-17.94	446.43
7115 R	9.93	-10.88	425.64	-1.90	-1.71	450.65	17.85	-19.68	446.78	-4.08	6.03	404.93
7127 L	-1.79	1.80	-428.69	1.51	-3.12	-340.13	-4.63	9.00	-319.77	4.25	-9.67	-402.78
7127 R	1.48	-3.57	-340.14	-1.81	1.98	-440.71	4.27	-11.25	-402.56	-4.67	10.41	-385.74
7133 L	17.00	3.17	287.25	15.32	3.69	269.59	11.79	7.42	273.69	18.52	-2.17	365.95
7133 R	18.62	4.24	269.59	20.61	3.51	279.43	22.21	-3.16	367.70	15.09	9.65	208.47
7147 L	22.49	1.82	-310.24	21.39	2.94	-282.23	17.08	9.20	-219.62	24.94	-5.74	-402.52
7147 R	17.68	2.81	-282.23	18.46	1.95	-317.71	20.73	-4.05	-402.54	13.32	7.10	-284.42
7153 L	-3.30	-3.05	394.88	0.70	-4.47	320.00	-6.11	9.47	328.43	14.35	-18.31	401.29
7153 R	-0.71	-4.59	318.37	-3.84	-3.06	383.56	15.35	-20.09	402.10	-6.68	10.43	261.87
7163 L	-1.41	3.14	-349.42	3.47	-7.31	-296.07	-3.09	10.05	-241.26	5.44	-14.35	-368.46
7163 R	3.20	-6.68	-295.71	-1.36	2.87	-361.37	5.08	-13.13	-367.38	-2.95	9.19	-308.07
7169 L	16.57	2.37	327.25	16.53	3.94	296.74	12.24	7.47	296.88	18.66	-2.38	421.87
7169 R	20.06	4.37	296.74	20.07	2.21	319.79	22.33	-4.00	421.91	15.61	9.84	231.99
7183 L	19.40	4.29	-285.09	21.05	3.25	-314.15	16.05	9.82	-233.90	22.76	-3.31	-407.15
7183 R	17.33	3.23	-314.15	15.90	3.89	-292.55	18.89	-1.88	-407.18	12.52	7.49	-298.74
7189 L	-8.83	7.08	357.89	-4.39	-3.60	317.31	-10.28	12.44	353.12	8.05	-11.56	350.00
7189 R	-4.26	-3.45	317.39	-8.11	6.88	350.13	7.58	-11.44	350.50	-9.38	12.24	287.16
7199 L	1.34	-1.20	-396.77	3.87	-6.52	-368.50	-2.07	9.65	-329.35	6.22	-16.10	-408.12
7199 R	3.67	-5.63	-368.63	1.20	-1.06	-428.38	5.95	-13.84	-407.26	-2.02	8.27	-418.28
7205 L	17.28	0.31	371.39	19.20	3.53	346.09	14.64	7.37	359.37	20.50	-4.84	480.40
7205 R	21.13	4.32	346.09	18.90	0.72	361.42	22.42	-5.34	480.72	16.72	9.46	272.36
7219 L	20.20	1.85	-350.78	20.44	5.00	-323.64	16.19	10.77	-247.96	22.61	-4.66	-463.00
7219 R	18.55	4.15	-323.64	18.46	1.38	-360.76	20.70	-4.22	-462.94	14.34	8.67	-334.96
7225 L	-6.74	4.78	431.12	-3.30	-5.04	349.02	-9.07	13.57	407.14	12.96	-17.11	398.87
7225 R	-2.47	-4.75	348.82	-5.68	4.28	414.25	11.47	-15.73	399.47	-7.86	12.50	316.03
7233 L	-6.81	6.64	-312.61	-5.92	3.38	-277.37	-10.43	17.09	-284.13	-2.64	-7.36	-295.40
7233 R	-5.46	3.04	-277.11	-6.17	6.00	-317.05	-2.40	-6.77	-294.78	-9.54	15.82	-366.14
7241 L	14.29	7.05	396.22	16.20	9.37	378.51	12.52	13.58	392.94	17.48	-5.32	503.34
7241 R	15.76	9.52	378.51	13.87	7.09	386.80	17.04	-4.74	503.41	12.11	13.48	306.32
7252 L	13.79	3.53	-436.66	11.84	2.83	-455.04	9.21	8.75	-339.17	15.45	-2.81	-550.03
7252 R	11.71	2.52	-455.04	13.81	3.24	-446.63	15.47	-3.27	-550.03	9.22	8.76	-426.10
7260 L	-5.83	6.44	265.01	8.43	-10.08	219.31	-6.90	11.43	247.26	11.89	-14.76	247.42
7260 R	8.59	-9.76	218.28	-6.40	6.33	252.63	12.51	-14.48	246.69	-7.61	11.33	161.62
7269 L	13.48	-16.00	-645.68	17.45	-19.54	-567.52	3.50	-5.14	-598.18	25.38	-27.82	-550.02
7269 R	14.64	-17.43	-567.91	11.15	-14.16	-653.05	21.07	-24.79	-550.81	3.30	-4.55	-682.65
7277 L	22.02	-2.20	487.86	28.49	-8.84	517.63	22.65	8.00	505.13	30.33	-8.87	598.85
7277 R	32.03	-8.99	517.63	25.63	-2.41	479.69	34.55	-9.31	598.90	26.11	9.42	419.95
7287 L	21.59	10.12	-359.45	25.16	14.52	-291.29	19.81	18.86	-191.25	26.27	7.01	-454.79
7287 R	22.02	12.78	-291.29	18.46	8.47	-368.33	23.00	5.86	-454.79	16.83	16.48	-277.10
7295 L	-15.40	19.51	811.96	-6.95	5.80	755.42	-16.59	23.44	867.52	-5.92	2.19	758.29
7295 R	-5.22	4.48	755.42	-12.24	14.84	779.71	-3.96	1.41	758.18	-13.21	17.72	781.62
7305 L	-23.27	25.76	-227.79	-25.83	29.14	-305.36	-28.30	34.32	-271.62	-21.25	21.39	-155.87
7305 R	-25.83	29.14	-319.13	-23.27	25.76	-227.79	-21.25	21.39	-155.87	-28.30	34.32	-362.36
7402 L	-25.82	-12.96	-352.86	-24.99	-9.63	-383.36	-28.78	1.70	-437.03	-18.86	-15.49	-315.79
7402 R	-25.86	-10.86	-291.08	-26.55	-13.88	-266.13	-19.70	-16.40	-223.26	-29.84	-2.67	-352.89
7407 L	-16.33	-19.79	142.83	-15.18	-20.53	116.73	-17.31	-17.16	197.34	-9.26	-21.89	27.84
7407 R	-14.47	-19.74	192.44	-15.58	-18.98	221.01	-8.65	-21.06	101.13	-16.49	-16.35	278.56
7411 L	-14.93	-18.06	-253.28	-11.19	-19.46	-175.49	-16.29	-16.68	-292.96	-8.23	-21.66	-128.47
7411 R	-11.82	-20.23	-104.92	-15.66	-18.88	-174.79	-8.83	-22.50	-55.29	-17.10	-17.50	-211.34
7416 L	-24.95	-16.40	255.60	-23.33	-17.26	252.80	-25.92	-6.28	324.90	-16.51	-16.88	214.02
7416 R	-22.55	-16.38	345.55	-24.35	-15.64	340.55	-15.59	-15.96	307.24	-24.96	-4.97	408.35
7422 L	-23.24	-10.05	-324.00	-25.24	-8.95	-352.41	-25.94	1.84	-400.38	-17.39	-10.69	-303.45
7422 R	-29.06	-10.64	-272.71	-26.77	-11.81	-250.20	-20.26	-12.67	-222.38	-29.90	1.58	-329.60
7427 L	-13.88	-20.98	98.49	-11.64	-21.79	57.26	-14.96	-18.37	143.46	-5.64	-22.91	-10.93
7427 R	-10.95	-20.95	117.19	-13.10	-20.04	164.36	-5.03	-21.95	49.69	-14.10	-17.45	212.45
7431 L	-13.11	-19.67	-157.44	-10.40	-20.65	-104.35	-14.31	-17.40	-206.39	-5.31	-22.06	-44.11
7431 R	-11.07	-21.46	-45.69	-13.87	-20.61	-92.10	-5.93	-23.03	16.41	-15.16	-18.33	-137.48
7436 L	-29.05	-13.67	253.24	-29.27	-8.59	279.79	-32.19	3.72	336.10	-22.85	-13.33	228.22
7436 R	-25.44	-7.13	358.15	-25.26	-11.72	328.06	-19.71	-11.30	307.66	-27.97	3.74	406.44

Section Properties

Ref. Delta Frame Desig

Splice Node	Splice Side	pacity (ksi)	FY	MAX MZ Flange Stress (ksi)		MAX MZ Flange Capacity (ksi)		MAX MZ FY	MIN MZ Flange Stress (ksi)		MIN MZ Flange Capacity (ksi)		MIN MZ FY	ϕvVn
		BF	(kip)	TF	BF	TF	BF	(kip)	TF	BF	TF	BF	(kip)	(kip)
7442.0	7442 L	50.00	-458.09	-32.53	-4.42	50.00	50.00	-526.04	-20.55	-21.73	50.00	50.00	-384.89	1914.00
	7442 R	67.05	-298.20	-24.42	-25.76	67.05	67.05	-261.51	-38.05	-5.81	67.05	67.05	-416.43	1392.00
7447.0	7447 L	67.05	174.35	-27.02	-22.64	67.05	67.05	306.45	-15.24	-31.18	67.05	67.05	84.05	1392.00
	7447 R	66.71	262.45	-14.23	-29.85	66.71	66.71	175.02	-25.58	-21.29	66.71	66.71	409.45	1740.00
7451.0	7451 L	66.71	-261.02	-25.80	-21.72	66.71	66.71	-413.80	-13.73	-29.49	66.71	66.71	-178.17	1740.00
	7451 R	67.05	-180.42	-14.78	-30.86	67.05	67.05	-87.35	-27.24	-23.06	67.05	67.05	-310.71	1392.00
7456.0	7456 L	67.05	341.28	-38.16	-6.96	67.05	67.05	413.98	-23.81	-26.52	67.05	67.05	259.19	1392.00
	7456 R	50.00	408.75	-20.03	-22.39	50.00	50.00	377.80	-32.60	-5.39	50.00	50.00	519.22	1914.00
7462.0	7462 L	49.25	-483.90	-35.15	4.29	50.00	50.00	-540.70	-23.37	-17.14	50.00	49.25	-384.14	1914.00
	7462 R	67.05	-302.88	-27.62	-20.79	67.05	67.05	-274.13	-42.10	2.78	67.06	69.29	-442.71	1392.00
7467.0	7467 L	67.05	72.64	-22.03	-23.16	67.05	67.05	193.06	-8.15	-34.12	67.05	67.05	-37.81	1392.00
	7467 R	66.71	147.37	-7.32	-32.76	66.71	66.71	50.30	-20.81	-21.92	66.71	66.71	287.74	1740.00
7471.0	7471 L	66.71	-152.45	-21.05	-22.38	66.71	66.71	-300.82	-7.61	-32.17	66.71	66.71	-54.06	1740.00
	7471 R	67.05	-68.01	-8.47	-33.55	67.05	67.05	35.85	-22.29	-23.64	67.05	67.05	-202.95	1392.00
7476.0	7476 L	67.05	389.75	-42.31	3.53	67.07	69.29	448.84	-25.42	-19.98	67.05	67.05	270.81	1392.00
	7476 R	49.25	410.46	-21.48	-16.63	50.00	49.25	381.98	-35.31	5.02	50.00	50.00	545.47	1914.00
7482.0	7482 L	49.18	-547.31	-38.00	9.42	50.00	50.00	-582.86	-26.75	-11.43	50.00	49.18	-444.92	1914.00
	7482 R	67.05	-354.12	-30.89	-14.45	67.05	67.05	-333.86	-44.71	6.58	67.12	69.29	-487.87	1392.00
7487.0	7487 L	67.05	24.83	-18.60	-26.56	67.05	67.05	133.85	-6.16	-35.70	67.05	67.05	-82.20	1392.00
	7487 R	66.71	101.29	-5.37	-34.31	66.71	66.71	5.98	-17.45	-25.25	66.71	66.71	229.01	1740.00
7491.0	7491 L	66.71	-100.90	-17.97	-23.93	66.71	66.71	-230.16	-4.81	-35.34	66.71	66.71	-1.97	1740.00
	7491 R	67.05	-18.14	-5.60	-36.77	67.05	67.05	89.53	-19.11	-25.20	67.05	67.05	-134.64	1392.00
7496.0	7496 L	67.05	431.80	-45.67	6.34	67.11	69.29	503.72	-29.35	-13.16	67.05	67.05	313.28	1392.00
	7496 R	49.18	457.71	-25.36	-10.31	50.00	49.18	418.52	-38.88	9.36	50.00	50.00	601.71	1914.00
7502.0	7502 L	50.00	-550.25	-37.50	5.31	50.00	50.00	-645.77	-24.63	-15.57	50.00	50.00	-467.03	1914.00
	7502 R	68.37	-397.25	-27.23	-17.63	68.37	68.37	-341.55	-41.35	4.25	68.40	69.42	-538.40	1392.00
7507.0	7507 L	68.37	71.60	-20.26	-24.04	68.37	68.37	224.48	-6.09	-31.93	68.37	68.37	-56.47	1392.00
	7507 R	68.10	161.06	-5.43	-30.84	68.10	68.10	34.87	-19.27	-22.98	68.10	68.10	331.85	1740.00
7511.0	7511 L	68.10	-152.76	-18.63	-22.51	68.10	68.10	-332.47	-5.72	-30.94	68.10	68.10	-30.60	1740.00
	7511 R	68.37	-73.92	-6.34	-31.99	68.37	68.37	60.91	-19.62	-23.56	68.37	68.37	-226.41	1392.00
7516.0	7516 L	68.37	434.89	-41.83	5.29	68.41	69.42	537.67	-25.68	-17.45	68.37	68.37	332.38	1392.00
	7516 R	50.00	489.99	-23.17	-15.45	50.00	50.00	456.12	-37.85	6.18	50.00	50.00	643.43	1914.00
7522.0	7522 L	49.59	-731.44	-48.55	20.77	69.43	49.59	-854.23	-34.86	-5.13	69.43	49.59	-642.85	1914.00
	7522 R	69.53	-629.32	-37.45	-5.32	67.97	67.97	-525.89	-51.67	22.13	67.97	69.53	-751.48	1392.00
7527.0	7527 L	67.97	-122.90	-9.87	-24.55	67.97	67.97	19.84	2.50	-31.65	69.53	67.97	-260.80	1392.00
	7527 R	67.87	-34.54	2.78	-30.81	69.42	67.87	-173.48	-9.33	-23.81	67.87	67.87	121.56	1740.00
7531.0	7531 L	67.87	15.56	-8.98	-24.12	67.87	67.87	-137.74	2.34	-30.04	69.42	67.87	160.36	1740.00
	7531 R	67.97	116.14	2.01	-30.80	69.53	67.97	247.52	-9.50	-24.85	67.97	67.97	-36.28	1392.00
7536.0	7536 L	67.97	530.98	-43.34	15.31	67.97	69.53	666.44	-32.59	-8.35	67.97	67.97	464.72	1392.00
	7536 R	49.59	587.46	-30.28	-7.88	69.43	49.59	579.55	-40.77	14.36	69.43	49.59	763.23	1914.00
7542.0	7542 L	69.35	-608.17	-37.20	-8.34	68.43	69.35	-786.13	-25.82	-21.41	68.43	69.35	-594.82	2088.00
	7542 R	69.57	-547.96	-28.26	-23.84	69.57	69.57	-425.09	-40.53	-10.38	69.57	69.57	-630.04	1392.00
7547.0	7547 L	69.57	150.68	-19.70	-24.55	69.57	69.57	306.91	-10.84	-31.70	69.57	69.57	45.39	1392.00
	7547 R	69.47	297.58	-10.27	-30.88	69.47	69.47	177.65	-18.92	-23.72	69.47	69.47	450.10	1740.00
7551.0	7551 L	69.47	-300.97	-18.90	-23.92	69.47	69.47	-453.87	-11.54	-31.78	69.47	69.47	-176.73	1740.00
	7551 R	69.57	-135.69	-12.12	-32.61	69.57	69.57	-28.36	-19.68	-24.77	69.57	69.57	-297.07	1392.00
7556.0	7556 L	69.57	612.09	-44.34	4.16	69.57	69.57	771.18	-29.25	-14.99	69.57	69.57	530.84	1392.00
	7556 R	69.35	883.04	-26.61	-13.07	68.43	69.35	715.48	-40.60	5.22	68.43	69.35	946.96	2088.00
9007.0	9007 L	69.06	125.73	-39.04	39.32	69.06	69.06	265.30	-27.08	19.61	69.06	69.06	34.95	1375.39
	9007 R	69.06	124.19	-27.08	19.61	69.06	69.06	34.95	-39.04	39.32	69.06	69.06	183.16	1375.39
9015.0	9015 L	68.15	-624.89	-15.60	19.65	69.06	69.06	-625.21	8.40	-8.04	69.06	68.15	-662.74	1375.39
	9015 R	68.08	-691.61	9.43	-11.44	68.08	59.12	-662.67	-16.98	28.26	68.08	68.08	-688.64	2686.30
9021.0	9021 L	68.04	249.04	15.42	20.43	68.04	68.04	161.52	33.58	-6.24	68.04	62.87	421.69	3935.48
	9021 R	68.21	254.76	40.83	-6.85	68.21	62.45	421.56	20.21	26.52	68.21	68.21	101.16	1375.39
9035.0	9035 L	68.21	-402.26	24.56	13.38	68.21	68.21	-279.88	44.32	-11.61	68.21	62.45	-559.04	1375.39
	9035 R	62.87	-419.75	36.62	-9.83	68.04	62.87	-554.59	22.22	8.72	68.04	68.04	-340.54	3935.48
9041.0	9041 L	59.12	474.85	-0.74	1.38	68.08	68.08	554.04	23.35	-27.12	68.08	59.12	512.44	2686.30
	9041 R	62.07	547.80	28.91	-34.91	67.93	62.43	512.98	-1.05	1.76	67.93	67.93	484.93	1375.39
9051.0	9051 L	62.52	-386.09	-0.62	12.13	67.93	67.93	-325.08	27.19	-31.08	67.93	62.46	-441.79	1375.39
	9051 R	50.00	-454.80	25.09	-28.45	50.00	47.28	-441.71	-1.02	11.32	50.00	50.00	-391.10	1375.39
9057.0	9057 L	50.00	361.59	16.48	14.25	50.00	50.00	294.61	33.91	-9.41	50.00	48.60	512.50	3306.90
	9057 R	50.00	358.79	35.04	-9.41	50.00	47.78	512.51	17.37	14.96	50.00	50.00	234.11	2686.30
9071.0	9071 L	50.00	-302.99	16.63	18.17	50.00	50.00	-188.54	32.89	-6.89	50.00	47.85	-454.57	2686.30
	9071 R	50.00	-322.84	31.76	-7.04	50.00	48.66	-454.51	15.70	17.39	50.00	50.00	-249.10	3306.90
9077.0	9077 L	47.23	434.32	-14.71	22.76	50.00	50.00	535.09	11.77	-16.02	50.00	47.21	468.26	1375.39
	9077 R	50.00	507.12	10.94	-12.81	50.00	48.37	462.52	-13.34	17.96	50.00	50.00	466.78	1375.39
9089.0	9089 L	48.43	-520.30	-2.53	10.62	50.00	50.00	-550.92	20.91	-20.84	50.00	48.41	-571.17	1375.39
	9089 R	50.00	-634.62	19.96	-22.54	50.00	47.42	-571.58	-2.71	11.55	50.00	50.00	-614.64	1375.39
9095.0	9095 L	50.00	310.36	18.52	12.54	50.00	50.00	257.02	35.77	-8.38	50.00	48.65	465.38	3306.90
	9095 R	50.00	322.02	35.88	-6.77	50.00	48.77	465.39	18.95	13.43	50.00	50.00	196.52	1375.39
9109.0	9109 L	50.00	-333.60	19.93	12.22	50.00	50.00	-211.14	37.10	-7.91	50.00	48.75	-485.56	1375.39
	9109 R	50.00	-346.75	37.02	-9.53	50.00	48.62	-485.52	19.51	11.23	50.00	50.00	-271.67	3306.90
9115.0	9115 L	47.45	520.92	-3.94	9.26	50.00	50.00	527.87	22.60	-26.36	50.00	47.41	581.71	1375.39
	9115 R	50.00	571.50	27.21	-28.94	50.00	47.38	581.25	-4.80	10.04	50.00	50.00	462.93	1375.39
9127.0	9127 L	47.48	-391.81	-5.53	13.54	50.00	50.00	-370.35	14.36	-14.13	50.00	47.41	-498.36	1375.39
	9127 R	50.00	-552.89	14.64	-16.45	50.00	47.19	-498.86	-5.62	15.70	50.00	50.00	-435.03	1375.39
9133.0	9133 L	50.00	264.34	14.03	11.01	50.00	50.00	267.79	28.88	-4.02	50.00	48.77	445.74	3306.90
	9133 R	50.00	383.66	34.94	-5.57	50.00	47.91	445.72	17.96	14.25	50.00	50.00	207.30	1375.39
9147.0	9147 L	50.00	-276.16	18.45	13.31	50.00	50.00	-213.36	38.66	-8.07	50.00	47.85	-459.75	1375.39
	9147 R	50.00	-422.67	31.98	-6.00	50.00	48.72	-459.84	14.19	10.10	50.00	50.00	-273.71	3306.90
9153.0	9153 L	47.31	375.07	-7.08	13.23	50.00	50.00	354.17	21.24	-23.97	50.00	47.18	499.55	1375.39
	9153 R	50.00	475.38	22.88	-26.35	50.00	47.05	497.66	-7.76	14.54	50.00	50.00	289.82	1375.39
9163.0	9163 L	47.21	-333.84	-3.10	14.12	50.00	50.00	-261.84	19.04	-21.01	50.00	47.07	-451.16	1375.39
	9163 R	50.00	-456.29	17.37	-19.03	50.00	47.20	-452.21	-3.05	12.96	50.00	50.00	-326.87	1375.39
9169.0	9169 L	50.00	299.42	13.66	10.89	50.00	50.00	283.14	29.55	-4.78	50.00	48.75	466.15	3306.90
	9169 R	50.00	407.66	35.64	-7.32	50.00	47.33	466.56	17.61	14.37	50.00	50.00	222.54	1375.39
9183.0	9183 L	50.00	-289.18	17.72	15.24	50.00	50.00	-213.46	34.00	-5.06	50.00	47.41	-436.68	1375.39
	9183 R	50.00	-412.45	27.99	-3.21	50.00	48.80	-436.76	13.63	11.56	50.00	50.00	-273.85	3306.90
9189.0	9189 L	47.19	351.93	-11.86	17.68	50.00	50.00	368.18	11.69	-14.54	50.00	47.14	419.36	1375.39
	9189 R	50.00	437.54	11.04	-14.41	50.00	47.12	418.35	-10.82	17.43	50.00	50.00	302.90	1375.39
9199.0	9199 L	47.26	-432.52	-2.33	16.14	50.00	50.00	-356.30	21.05	-25.42	50.00	47.15	-505.54	1375.39
	9199 R	50.00	-519.87	20.43	-21.84	50.00	47.38	-506.45	-2.25	13.86	50.00	50.00	-439.81	1375.39
9205.0	9205 L	50.00	355.09	16.56	13.13	50.00	50.00	292.66	33.17	-7.33	50.00	49.22	549.07	3306.90
	9205 R	50.00	370.85	36.36	-7.82	50.00	48.74	549.47	18.88	16.19	50.00	50.00	214.50	1375.39
9219.0	9219 L	50.00	-328.14	18.67	18.83	50.00	50.00	-188.25	38.73	-7.97	50.00	48.74	-525.87	1375.39
	9219 R	50.00	-422.56	35.27	-7.59	50.00	49.23	-530.59	16.28	15.41	50.00	50.00	-270.80	3306.90

SERVICE II

Splice Node	Splice Side	MAX FX Flange Stress (ksi)		MAX FX FY	MIN FX Flange Stress (ksi)		MIN FX FY	MAX FY Flange Stress (ksi)		MAX FY FY	MIN FY Flange Stress (ksi)		MIN FY FY	MAX MY Flange Stress (ksi)		MAX MY FY	MIN MY Flange Stress (ksi)		MIN MY FY	MAX MZ Flange Stress (ksi)		MAX MZ FY	MIN MZ Flange Stress (ksi)		MIN MZ FY
		TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)	TF	BF	(kip)
7442.0	7442 L	-17.59	-6.27	-283.35	-20.17	-14.60	-341.96	-24.41	-6.11	-389.25	-15.18	-13.30	-267.72	-19.58	-14.97	-300.06	-22.85	-13.40	-332.75	-23.58	-3.32	-380.76	-14.93	-15.93	-279.84
	7442 R	-23.88	-17.49	-244.65	-20.69	-7.71	-215.88	-17.40	-17.33	-184.42	-28.36	-5.94	-304.85	-27.17	-16.34	-244.43	-23.38	-18.09	-215.53	-17.74	-18.88	-189.60	-27.57	-4.34	-300.95
7447.0	7447 L	-11.65	-18.11	81.07	-19.20	-19.72	200.64	-11.11	-21.62	56.07	-20.05	-17.17	227.37	-18.49	-18.68	182.51	-15.85	-20.88	122.48	-19.90	-16.70	223.72	-11.46	-22.99	61.08
	7447 R	-18.13	-18.64	280.77	-10.97	-17.31	137.56	-19.00	-16.26	304.54	-10.33	-20.27	117.95	-14.98	-20.01	187.77	-17.56	-17.68	254.93	-10.73	-22.02	127.36	-18.86	-15.72	299.09
7451.0	7451 L	-10.68	-17.07	-138.86	-18.17	-18.90	-284.53	-19.03	-16.51	-307.63	-9.82	-19.80	-119.41	-17.98	-18.47	-255.96	-15.19	-19.82	-195.56	-19.10	-16.10	-302.08	-10.36	-21.77	-130.09
	7451 R	-19.48	-19.63	-210.33	-11.37	-17.89	-82.44	-10.65	-21.01	-58.02	-20.09	-17.43	-230.39	-16.02	-20.76	-129.23	-18.94	-19.43	-184.08	-11.13	-22.78	-63.93	-20.14	-17.09	-226.65
7456.0	7456 L	-19.91	-7.28	215.55	-22.64	-17.74	241.07	-17.26	-18.20	183.06	-27.98	-6.46	302.42	-22.75	-18.48	214.57	-26.98	-15.88	247.30	-27.57	-5.24	298.67	-17.38	-19.46	188.12
	7456 R	-19.13	-14.86	334.84	-16.96	-5.95	280.52	-23.78	-6.22	383.40	-14.64	-13.57	263.65	-22.72	-13.02	331.74	-19.06	-15.35	296.75	-14.62	-16.43	274.89	-23.56	-4.08	375.31
7462.0	7462 L	-17.84	-0.83	-276.63	-22.69	-11.49	-362.01	-26.73	-3.90	-411.46	-15.35	-6.67	-252.85	-19.01	-7.07	-288.17	-24.72	-10.02	-355.07	-25.38	3.02	-387.58	-17.23	-12.74	-284.59
	7462 R	-26.90	-14.49	-270.79	-21.35	-2.16	-220.46	-18.27	-10.78	-184.57	-31.59	-3.85	-330.68	-29.29	-13.13	-272.33	-22.57	-9.27	-217.85	-20.35	-15.45	-203.47	-30.40	1.93	-316.64
7467.0	7467 L	-6.80	-17.52	0.66	-15.42	-22.98	121.02	-5.85	-22.42	-31.69	-16.40	-19.12	148.81	-13.22	-21.46	78.88	-10.53	-20.57	55.13	-16.04	-16.73	136.81	-6.04	-25.26	-24.20
	7467 R	-14.46	-21.88	200.66	-6.27	-16.77	51.74	-15.52	-18.77	223.32	-5.18	-20.93	26.58	-9.89	-19.53	122.92	-12.37	-20.54	147.56	-5.43	-24.25	41.07	-15.16	-15.83	205.39
7471.0	7471 L	-6.54	-15.91	-55.27	-13.94	-22.23	-195.27	-15.32	-18.74	-227.47	-5.32	-19.88	-25.81	-11.92	-21.06	-149.94	-8.84	-18.84	-100.43	-15.35	-15.91	-215.41	-5.67	-23.75	-42.37
	7471 R	-14.89	-23.34	-113.99	-7.08	-16.64	-4.36	-5.72	-22.80	32.14	-16.56	-17.92	-151.58	-9.52	-19.74	-36.99	-12.75	-22.04	-78.29	-6.31	-24.76	24.05	-16.25	-16.81	-144.93
7476.0	7476 L	-21.08	-2.16	215.30	-26.93	-13.28	279.70	-17.62	-10.65	181.62	-31.40	-3.58	336.58	-22.91	-11.33	227.01	-29.37	-10.03	276.61	-30.61	2.02	326.24	-18.50	-14.37	192.57
	7476 R	-22.67	-10.46	370.61	-17.62	-0.85	270.88	-26.22	-2.31	417.94	-15.03	-7.90	250.73	-24.72	-7.31	356.28	-19.32	-8.89	302.11	-15.64	-11.95	272.63	-25.56	3.16	397.50
7482.0	7482 L	-20.29	3.61	-296.92	-25.13	-5.77	-406.75	-28.30	2.44	-447.26	-19.15	-2.94	-287.10	-22.77	-5.50	-324.75	-27.20	-2.76	-399.57	-27.58	6.50	-424.69	-19.40	-8.18	-318.17
	7482 R	-29.20	-8.44	-317.07	-23.70	2.02	-242.90	-22.01	-6.60	-221.81	-33.26	1.09	-365.77	-31.82	-5.37	-321.97	-26.28	-8.04	-252.37	-22.40	-10.36	-238.05	-32.44	4.42	-354.90
7487.0	7487 L	-5.26	-17.98	-31.64	-12.81	-25.48	71.37	-4.12	-24.68	-66.39	-14.32	-20.90	105.20	-11.14	-24.42	45.16	-8.07	-20.79	-0.31	-13.62	-18.94	95.38	-4.56	-26.32	-59.12
	7487 R	-11.92	-24.33	151.31	-4.78	-17.23	17.86	-13.46	-20.00	179.21	-3.43	-22.30	-7.65	-7.48	-19.84	61.00	-10.31	-23.42	116.32	-3.97	-25.30	5.86	-12.79	-18.01	164.05
7491.0	7491 L	-4.99	-18.72	-22.73	-11.25	-23.77	-142.50	-13.13	-19.80	-180.03	-3.40	-23.35	8.56	-9.96	-22.04	-118.14	-8.22	-21.81	-67.48	-13.02	-17.32	-162.55	-3.63	-26.10	-6.18
	7491 R	-12.12	-24.91	-61.77	-5.50	-19.51	30.57	-4.16	-25.32	70.07	-14.00	-20.70	-104.39	-9.01	-22.64	-4.37	-10.70	-23.14	-45.19	-4.21	-27.16	61.60	-13.85	-18.24	-93.45
7496.0	7496 L	-24.24	1.56	255.01	-30.03	-8.45	317.18	-21.69	-7.48	217.39	-34.35	2.58	374.49	-26.62	-6.86	258.66	-31.70	-6.88	315.14	-32.86	4.44	360.88	-21.62	-10.00	231.40
	7496 R	-25.89	-5.71	406.32	-20.71	3.18	311.55	-29.32	3.87	454.90	-18.78	-4.37	284.84	-27.33	-3.99	396.47	-23.01	-4.35	329.94	-18.70	-7.88	309.07	-27.97	6.65	431.67
7502.0	7502 L	-19.84	0.93	-333.13	-23.83	-9.35	-420.63	-26.94	0.98	-476.81	-17.27	-6.75	-321.16	-22.94	-7.24	-367.33	-25.11	-8.71	-397.65	-27.18	3.82	-465.95	-17.96	-11.42	-338.86
	7502 R	-26.29	-10.96	-320.51	-21.86	-1.61	-270.77	-19.06	-10.80	-239.72	-29.78	1.53	-393.29	-27.57	-10.38	-306.73	-25.19	-8.71	-288.34	-19.86	-12.93	-247.38	-29.96	3.05	-388.06
7507.0	7507 L	-5.55	-17.96	-6.90	-13.97	-21.09	130.50	-4.40	-22.62	-48.19	-14.80	-18.10	168.09	-13.41	-20.21	105.71	-9.91	-21.14	39.53	-15.07	-17.83	162.90	-4.83	-23.61	-41.95
	7507 R	-13.23	-20.23	214.95	-5.13	-17.34	46.85	-14.07	-17.40	248.75	-3.90	-20.66	13.93	-9.40	-20.41	104.57	-12.76	-19.48	178.67	-4.35	-22.82	24.28	-14.35	-17.06	241.27
7511.0	7511 L	-5.08	-17.00	-46.02	-12.82	-19.74	-222.86	-13.84	-17.30	-252.70	-4.03	-20.55	-8.66	-12.01	-19.31	-164.96	-11.05	-21.04	-130.32	-13.83	-16.67	-242.15	-4.48	-22.79	-20.57
	7511 R	-13.58	-20.61	-138.52	-5.48	-17.60	7.60	-4.47	-22.49	52.71	-14.55	-17.94	-171.94	-11.62	-21.76	-60.91	-12.61	-20.08	-92.74	-4.93	-23.55	45.75	-14.55	-17.44	-164.70
7516.0	7516 L	-21.56	-1.10	268.40	-24.42	-10.82	312.53	-18.71	-11.40	233.21	-30.10	1.81	393.79	-24.43	-9.97	275.17	-27.54	-8.25	315.16	-30.17	3.72	387.78	-18.78	-12.94	240.53
	7516 R	-22.11	-9.35	411.82	-19.52	0.95	329.76	-27.35	1.40	478.11	-17.13	-8.14	313.71	-25.20	-6.69	403.95	-22.18	-8.44	354.82	-16.94	-11.45	330.89	-27.29	4.37	464.32
7522.0	7522 L	-26.68	11.45	-460.44	-31.70	6.41	-571.92	-36.54	13.92	-631.78	-24.11	5.40	-447.85	-33.51	12.29	-537.58	-26.99	6.08	-531.15	-35.18	15.01	-617.90	-25.82	-3.93	-469.15
	7522 R	-34.01	6.50	-476.47	-28.40	12.18	-404.02	-25.98	3.88	-374.44	-38.64	15.57	-549.46	-28.84	6.57	-453.52	-35.80	12.61	-457.00	-27.73	-4.05	-383.93	-37.45	16.00	-543.27
7527.0	7527 L	1.60	-18.04	-153.67	-6.73	-21.39	-23.23	2.39	-22.78	-195.61	-7.82	-19.17	15.50	-6.80	-21.71	-61.89	-5.27	-21.28	-78.11	-7.59	-18.50	9.57	2.13	-23.35	-189.51
	7527 R	-6.33	-20.79	57.89	1.76	-17.57	-104.44	-7.46	-18.74	92.20	2.65	-20.82	-136.85	-4.98	-20.80	-13.46	-6.43	-21.11	7.95	2.33	-22.74	-125.93	-7.20	-17.97	83.59
7531.0	7531 L	1.85	-17.36	97.91	-7.01	-21.47	-82.20	-7.40	-19.31	-106.86	2.43	-20.23	130.87	-4.93	-20.45	3.96	-6.30	-22.67	-20.78	-6.88	-18.15	-96.54	1.91	-22.07	116.85
	7531 R	-7.40	-22.06	-1.10	1.71	-17.84	146.82	2.18	-22.16	187.95	-7.73	-19.69	-29.71	-6.65	-23.15	50.40	-5.25	-21.04	69.19	1.73	-22.69	180.27	-7.25	-18.68	-22.66
7536.0	7536 L	-23.63	8.18	354.09	-29.45	-3.40	426.49	-22.25	-2.59	326.85	-32.74	10.49	489.84	-24.07	6.14	373.29	-27.64	-4.57	385.86	-31.29	10.88	480.91	-24.06	-6.19	339.04
	7536 R	-27.46	-3.33	518.68	-22.23	7.70	407.46	-30.76	8.79	569.57	-20.78	3.10	396.54	-25.84	-4.45	471.06	-22.53	5.73	433.92	-22.36	-5.87	422.43	-29.43	10.20	551.39
7542.0	7542 L	-19.99	-8.58	-425.57	-24.35	-14.49	-526.70	-27.98	-8.99	-583.62	-17.53	-11.60	-408.86	-25.75	-12.26	-516.47	-18.44	-10.28	-440.77	-27.29	-6.62	-569.65	-18.68	-15.55	-431.34
	7542 R	-26.57	-16.42	-393.36	-21.78	-9.94	-329.16	-19.29	-15.11	-296.36	-30.40	-9.73	-462.92	-20.18	-11.72	-327.97	-28.04	-14.06	-397.62	-20.45	-17.32	-307.79	-29.72	-8.15	-455.61
7547.0	7547 L	-9.07	-19.46	68.25	-13.63	-20.39	201.41	-8.29	-23.06	26.07	-14.45	-18.63	230.48	-14.23	-21.10	166.25	-14.00	-22.99	134.08	-14.11	-17.73	222.64	-8.45	-23.60	33.30
	7547 R	-13.05	-19.73	313.32	-8.69	-18.96	150.67	-13.87	-18.14	337.93	-7.78	-21.40	117.00	-13.51	-22.41	232.25	-13.70	-20.43	269.50	-8.04	-23.00	129.82	-13.53	-17.11	327.04
7551.0	7551 L	-7.97	-17.42	-146.78	-15.22	-22.43	-319.25	-14.36	-18.78	-347.34	-8.30	-21.60	-112.90	-13.86	-19.50	-281.45	-14.20	-24.75	-229.67	-14.01	-17.72	-327.97	-8.91	-23.61	-130.03
	7551 R	-15.80	-23.10	-194.35	-8.36	-17.92	-54.15	-8.65	-22.90	-11.48	-14.88	-19.21	-227.49	-14.71	-25.37	-114.33	-14.40	-20.13	-170.15	-9.33	-24.22	-21.64	-14.58	-18.33	-213.68
7556.0	7556 L	-25.04	-2.68	426.76	-28.22	-8.05	500.58	-22.03	-9.96	374.61	-31.64	-1.33	569.05	-30.67	-4.76	507.42	-23.73	-7.46	447.09	-32.06	2.80	559.48	-21.55	-11.06	385.63
	7556 R	-25.75	-6.59	648.76	-22.91	-1.67	535.10	-28.59	0.86	704.92	-20.56	-7.72	499.00	-21.60	-6.19	582.14	-28.10	-3.43	638.78	-19.61	-9.64	520.40	-29.35	3.59	687.49
9007.0	9007 L	-21.68	17.45	69.64	-27.47	26.23	212.25	-21.75	17.48	-2.38	-27.72	26.62	247.64	-26.09	24.41	169.46	-21.84	16.97	57.14	-28.78	28.84	190.60	-20.28	14.51	28.76
	9007 R	-27.47	26.23	153.03	-22.00	18.01	80.29	-27.54	26.32	230.66	-23.83	20.83	-13.64	-21.84	16.97	50.90	-26.09	24.41	168.87	-20.28	14.51	28.76	-28.78	28.84	132.57
9015.0	9015 L	-5.48	4.58	-424.27	-8.80	9.55	-574.71	-6.76	6.68	-635.80	-9.87	11.37	-350.38	-10.32	11.87	-496.38	-3.09	-2.50	-459.80	-11.27	14.24	-460.02	-1.14	-4.74	-485.17
	9015 R	-9.91	14.21	-626.78	-6.39	6.74	-423.64	-10.72	15.96	-354.37	-8.21	10.98	-662.78	-3.77	-2.98	-460.40	-11.21	16.78	-505.36	-1.62	-6.45	-484.91	-12.36	20.58	-505.15
9021.0	9021 L	17.77	7.37	226.86	12.60	10.62	144.05	12.29	14.06	66.51	17.16	7.05	390.32	13.96	7.05	193.79	18.17	9.68	182.82	11.67	14.92	120.98	24.42	-4.51	306.85
	9021 R	16.15	13.80	144.05	21.83	9.90	220.48	21.41	8.61	374.86	15.81	18.77	61.82	21.96	12.11	182.82	17.91	9.95	188.91	29.76	-4.99	306.76	15.29	19.38	78.34
9035.0	9035 L	26.09	-2.47	-309.11	21.40	-2.93	-311.16	25.08	-6.24	-478.73	21.72	6.98	-171.54	22.62	-1.19	-297.42	25.71	-3.72	-294.94	20.69	8.25	-208.48	32.57	-8.26	-407.43
	9035 R	17.27	-2.46	-311.15	21.58	-2.36	-315.50	17.61	4.73	-176.24	20.19	-2.72	-493.51	21.42	-3.63	-294.94	18.54	-1.21	-309.02	26.87	-6.99	-404.29	16.54	6.19	-251.34
9041.0	9041 L	5.59	-7.28	360.21	4.39	-9.54	433.02	3.42	-4.66	222.20	3.46	-6.50	559.63	2.53	-2.97	409.40	14.91	-16.23	348.28	1.00	0.70	404.23	16.46	-18.89	374.67
	9041 R	4.50	-11.77	368.90	10.63	-9.61	356.89	4.36	-9.65	535.81	3.38	-5.20	216.38	18.13	-20.53	346.93	2.45	-3.34	399.34	20.36	-24.30	374.74	0.96	0.89	355.59
9051.0	9051 L	4.38	-1.21	-258.67	4.01	-7.05	-318.04	4.35	-5.36	-459.38	1.49	3.26	-148.13	1.36	4.35	-320.90	9.04	-14.33	-283.14	-0.81	8.98	-239.30	19.11	-21.55	-322.50
	9051 R	3.68	-6.49	-323.34	4.02	-1.06	-261.76	1.64	1.77	-153.18	3.17	-3.23	-484.19	8.63	-13.29	-284.67	1.12	4.14	-330.77	17.64	-19.73	-322.73	-1.08	8.37	-285.76
9057.0	9057 L	18.67	2.92	285.41	13.22	4.36	247.44	13.40	8.43	148.98	17.52	3.31	465.32	15.08	2.08	274.18	18.36	4.61	266.76	12.34	10.15	219.36	20.19	-6.34	373.39
	9057 R	13.87	4.64	247.44	19.38	3.16	280.53	18.54	2.92	449.93	13.90	9.31	144.10	19.07	4.70	266.76	15.74	2.48	264.71	20.89	-6.38	373.39	13.01	10.66	176.62
9071.0	9071 L	18.53	5.57	-241.96	13.52	6.77	-220.00	17.14	4.95	-414.58	13.79	12.09	-104.53	15.33	5.19	-229.51	17.99	7.14	-223.73	12.48	13.06	-142.87	19.99	-4.67	-330.45
	9071 R	12.84	6.47	-220.00	17.79	5.25	-246.84	13.26	11.14	-109.32	16.08	5.29	-429.98	17.25	6.98	-223.73	14.63	4.72	-237.38	19.26	-4.74	-330.40	11.78	12.49	-185.65
9077.0	9077 L	-6.86	8.37	325.52	-7.31	3.79	392.86	-8.57	9.21	194.96	-7.51	6.29	542.44	-9.91	12.55	386.09	3.73	-5.19	317.34	-10.72	16.35	392.47	8.07	-11.33	341.33
	9077 R	-6.41	3.03	341.09	-5.90	6.59	318.73	-5.90	3.88	518.60	-7.79	7.75	186.20	-3.43	-3.43	312.87	-8.99	10.10	372.17	7.51	-9.07	337.17	-9.68	12.88	343.67
9089.0	9089 L	2.35	1.46	-375.28	4.34	-7.20	-455.97	2.91	-2.89	-590.11	0.95	2.65	-254.00	0.97	3.89	-454.45	7.01	-9.35	-380.10	-1.77	7.83	-401.73	8.38	-13.63	-419.76
	9089 R	4.13	-7.75	-462.74	2.17	1.62	-378.66	1.03	2.35	-259.70	2.31	-2.13	-608.73	6.84	-10.05	-381.12	0.87	4.12	-464.41	8.17	-14.82	-419.87	-1.91	8.52	-447.03
9095.0	9095 L	19.01	2.56	243.73	15.25	2.76	226.73	15.04	7.41	113.49	18.33	1.57	435.97	17.68	1.47	246.33	19.41	3.59	227.54	13.83	9.12	189.86	26.14	-6.11	339.75
	9095 R	15.45	3.34	226.73	19.27	3.34	238.85	19.73	-2.69	421.21	15.18	8.48	108.65	19.61	4.27	227.54	18.05	2.33	238.46	26.23	-4.94	339.76	14.15	9.78	147.11
9109.0	9109 L	21.48	1.15	-284.37	15.51	2.17	-229.44	20.24	-1.31	-435.08	15.74	7.36	-123.30	18.97	1.71	-249.63	21.30	3.16	-247.42	14.96	8.72	-160.90	22.51	-5.56	-352.58
	9109 R	15.29	1.51	-229.44	21.26	-1.80	-289.25	15.62	6.24	-128.21	19.69	-1.54	-450.54	21.10	2.38	-247.42	18.67	-0.94	-254.51	22.37	-6.48	-352.55	14.65	7.99	-203.66
9115.0	9115 L	3.80	-5.16	353.49	0.66	-4.33	454.62	-0.92	2.47	250.95	0.70	-3.72	591.28	-2.24	2.73	421.76	11.62	-12.08	385.69	-3.01	6.83	390.60	15.88	-18.28	419.76
	9115 R	0.24	-4.47	448.36	8.46	-5.94	349.71	1.12	-5.34	572.00	-1.68	3.30	244.15	13.76	-13.19	383.61	-2.78	2.99	412.28	19.11	-20.08	419.17	-3.64	7.41	344.89
9127.0	9127 L	1.70	0.22	-286.24	-1.21	0.15	-388.84	0.95	-1.94	-528.45	-2.75	6.52	-169.85	-1.76	3.54	-401.68	2.32	-3.48	-283.78	-4.21	10.11	-268.62	4.77	-9.61	-369.50
	9127 R	-1.31	0.29	-395.79	1.65	0.25	-289.88	-2.58	6.98	-174.89	0.47	-1.11	-548.25	2.29	-3.97	-285.09	-1.81	4.02	-408.29	4.74	-11.16	-370.12	-4.28	11.73	-314.16
9133.0	9133 L	15.82	2.61	229.78	10.58	2.71	214.32	11.89	6.90	116.69	14.84	0.88	444.85	13.92	2.96	303.41	14.97	4.16	206.69	10.16	8.02	191.32	17.20	-2.86	334.85
	9133 R	13.38	3.47	214.32	19.18	3.20	224.91	18.21	0.16	428.25	14.73	9.17	112.61	18.18	4.84	206.69	16.90	3.31	273.19	26.46	-4.43	334.84	13.07	10.40	148.59
9147.0	9147 L	21.37	-0.11	-270.23	15.23	2.57	-228.48	19.70	-1.55	-432.01	14.95	8.88	-120.09	19.48	-1.52	-294.93	18.93	4.44	-193.53	13.88	10.29	-149.16	22.51	-6.19	-341.88
	9147 R	12.09	2.10	-228.48	17.68	0.25	-275.11	12.05	6.71	-124.31	15.95	-0.54	-448.56	15.61	3.90	-193.53	16.02	1.38	-315.69	18.84	-4.47	-341.95	10.66	7.82	-191.80
9153.0	9153 L	8.22	-4.80	282.03	-4.15	1.26	421.73	-3.15	6.40	149.33	-1.11	-4.98	490.54	-3.37	-0.73	351.17	7.47	-5.36	275.05	-5.26	10.58	260.28	15.60	-18.27	363.24
	9153 R	-4.65	1.48	380.72	8.63	-5.18	276.60	-0.77	-7.15	471.13	-3.88	7.66	141.76	7.81	-5.76	270.83	-3.84	0.84	346.69	16.81	-20.09	362.44	-5.78	11.63	213.97
9163.0	9163 L	3.55	0.66	-205.26	-0.99	-0.25	-392.70	1.59	-1.76	-448.61	-0.41	4.28	-111.12	-1.21	4.96	-327.29	4.99	-7.75	-243.48	-2.19	11.14	-195.64	6.18	-13.81	-326.36
	9163 R	-1.02	-0.24	-413.06	3.33	0.62	-210.76	-0.24	3.43	-116.89	0.74	-0.08	-469.89	4.70	-7.11	-245.55	-1.22	4.56	-333.86	5.84	-12.66	-326.58	-2.16	10.22	-242.42
9169.0	9169 L	16.02	1.65	279.52	10.92	2.09	232.92	11.31	7.35	134.66	14.26	0.33	451.08	13.77	1.52	321.47	14.75	4.13	211.68	10.27	8.26	200.17	16.63	-3.31	344.97
	9169 R	13.78	2.56	232.92	19.39	1.62	274.64	17.74	-1.13	434.55	14.16	9.93	130.58	17.95	4.69	211.68	16.59	1.16	303.64	19.90	-5.30	345.26	13.26	10.91	157.36
9183.0	9183 L	18.76	4.46	-238.86	13.64	4.28	-214.43	17.98	1.51	-424.58	14.43	9.84	-118.63	15.62	3.72	-266.69	18.27	4.06	-222.33	12.93	11.07	-153.90	20.24	-3.88	-326.54
	9183 R	10.68	3.38	-214.43	15.29	3.76	-243.74	11.47	7.32	-122.68	14.34	1.98	-441.12	14.97	3.73	-222.33	12.85	3.37	-294.48	16.79	-2.32	-326.60	9.88	8.37	-196.56
9189.0	9189 L	-3.72	3.33	264.64	-6.49	2.37	342.58	-7.34	8.01	133.38	-5.15	1.81	473.61	-8.25	9.25	320.74	5.61	-6.04	264.41	-9.09	13.21	264.78	9.39	-11.31	312.05
	9189 R	-6.06	2.32	300.52	-3.58	3.32	260.16	-4.38	0.47	448.97	-6.95	8.44	128.05	5.27	-5.90	262.24	-7.55	9.04	314.02	8.85	-11.19	310.97	-8.30	13.02	218.89
9199.0	9199 L	3.55	0.44	-301.88	1.70	-3.62	-386.24	3.28	-5.84	-525.34	0.72	4.65	-143.67	-0.90	5.64	-364.47	5.90	-9.10	-320.80	-1.66	11.34	-266.94	7.17	-15.85	-362.42
	9199 R	1.51	-2.87	-404.60	3.47	0.37	-307.06	0.94	3.37	-151.55	1.54	-1.38	-548.18	5.73	-7.88	-323.16	-0.85	4.88	-372.91	6.98	-13.64	-363.43	-1.60	9.73	-325.72
9205.0	9205 L	17.48	4.64	263.94	12.63	2.90	245.28	13.44	8.42	126.07	17.11	-2.61	503.46	14.24	1.72	312.20	17.67	4.05	259.57	12.41	9.36	215.46	18.97	-4.83	401.11
	9205 R	14.25	3.79	245.28	19.34	5.87	257.62	19.09	-3.27	490.30	15.41	10.48	120.53	19.47	4.85	259.57	15.95	2.68	275.20	20.74	-5.34	401.40	14.14	11.54	160.24
9219.0	9219 L	20.80	3.41	-305.14	15.40	5.44	-233.36	20.54	-3.63	-475.63	14.84	12.91	-100.27	16.98	4.66	-251.94	19.49	5.96	-238.49	14.04	13.83	-139.65	22.08	-5.86	-383.29
	9219 R	13.69	4.45	-237.00	18.84	2.60	-315.10	13.20	10.12	-110.06	18.41	-2.96	-492.31	17.62	5.08	-242.13	15.14	3.42	-310.57	20.17	-5.32	-386.89	12.24	11.32	-198.24

Section Properties

Ref. Delta Frame Desig

Splice Node	Splice Side	pacity (ksi) BF	FY (kip)	MAX MZ Flange Stress (ksi) TF	MAX MZ Flange Stress (ksi) BF	MAX MZ Flange Capacity (ksi) TF	MAX MZ Flange Capacity (ksi) BF	MAX MZ FY (kip)	MIN MZ Flange Stress (ksi) TF	MIN MZ Flange Stress (ksi) BF	MIN MZ Flange Capacity (ksi) TF	MIN MZ Flange Capacity (ksi) BF	MIN MZ FY (kip)	ϕvVn (kip)
9225.0	9225 L	47.34	426.49	-10.05	18.56	50.00	50.00	442.42	22.01	-26.17	50.00	47.34	485.15	1375.39
	9225 R	50.00	446.41	19.47	-24.03	50.00	47.40	484.44	-8.81	17.16	50.00	50.00	359.47	1375.39
9232.0	9232 L	47.43	-189.26	-14.74	25.91	50.00	50.00	-171.26	9.41	-12.66	50.00	47.37	-217.00	1375.39
	9232 R	50.00	-282.82	8.75	-11.67	50.00	49.33	-216.99	-13.52	24.01	50.00	50.00	-248.19	1375.39
9242.0	9242 L	68.49	335.84	10.47	18.93	48.92	68.49	322.20	22.84	-5.71	48.92	66.70	518.53	3306.90
	9242 R	50.00	370.27	22.33	5.07	50.00	50.00	518.66	9.98	18.64	50.00	50.00	245.16	2686.30
9253.0	9253 L	50.00	-510.68	7.72	11.71	50.00	50.00	-347.64	21.71	-4.30	50.00	50.00	-629.88	2686.30
	9253 R	68.49	-522.83	21.73	-4.96	48.92	66.72	-629.88	7.75	11.83	48.92	68.49	-423.08	3306.90
9261.0	9261 L	49.36	162.84	-7.80	16.10	50.00	50.00	117.17	18.65	-22.44	50.00	49.35	185.98	1375.39
	9261 R	50.00	139.73	20.01	-22.12	50.00	48.92	185.34	-8.40	15.83	50.00	50.00	39.35	1375.39
9269.0	9269 L	48.95	-465.30	6.34	-5.30	50.00	48.99	-537.06	37.44	-40.84	50.00	48.93	-554.11	1375.39
	9269 R	65.95	-616.40	30.80	-36.29	68.34	65.99	-554.11	5.24	-4.60	68.34	66.10	-617.95	2686.30
9277.0	9277 L	68.64	501.01	21.82	12.29	68.64	68.64	479.64	34.08	-11.36	68.64	67.75	712.86	3935.48
	9277 R	68.96	549.05	38.50	-11.89	68.96	67.77	713.18	24.84	14.34	68.96	68.96	403.27	1375.39
9287.0	9287 L	68.96	-404.72	14.01	19.54	68.96	68.96	-169.37	29.82	4.47	68.96	68.96	-512.36	1375.39
	9287 R	68.64	-248.96	26.03	3.42	68.64	68.64	-512.40	11.51	17.06	68.64	68.64	-245.22	3935.48
9295.0	9295 L	68.22	748.47	-23.67	33.90	68.22	68.22	851.74	-2.03	1.22	68.22	68.22	777.32	2262.15
	9295 R	68.45	874.40	-1.10	0.64	68.45	68.45	777.33	-18.90	25.67	68.45	68.45	775.48	3908.99
9305.0	9305 L	68.45	-224.43	-31.85	39.91	68.45	68.45	-333.77	-22.08	22.52	68.45	68.45	-136.67	3908.99
	9305 R	68.45	-298.14	-22.08	22.52	68.45	68.45	-196.65	-31.85	39.92	68.45	68.45	-496.52	3908.99
9402.0	9402 L	59.60	-520.48	-38.86	6.81	63.56	68.99	-574.53	-24.81	-19.21	63.56	59.60	-403.99	2088.00
	9402 R	63.86	-340.59	-25.82	-20.31	63.86	63.86	-289.08	-40.21	4.59	63.86	69.39	-472.86	1392.00
9407.0	9407 L	63.86	104.84	-22.52	-22.84	63.86	63.86	239.70	-11.10	-29.89	63.86	63.86	5.11	1392.00
	9407 R	63.76	193.62	-10.35	-28.82	63.76	63.76	97.26	-21.49	-21.81	63.76	63.76	340.44	1740.00
9411.0	9411 L	63.76	-214.95	-19.84	-21.03	63.76	63.76	-352.27	-9.50	-29.48	63.76	63.76	-131.93	1740.00
	9411 R	63.86	-136.32	-10.22	-30.55	63.86	63.86	-40.77	-20.84	-22.05	63.86	63.86	-254.01	1392.00
9416.0	9416 L	63.86	346.78	-34.01	-4.17	63.86	63.86	443.06	-20.32	-19.91	63.86	63.86	274.38	1392.00
	9416 R	59.60	436.89	-19.24	-18.82	63.56	59.60	389.50	-32.72	-2.35	63.56	59.60	549.94	2088.00
9422.0	9422 L	50.00	-467.95	-35.69	4.92	50.00	50.00	-542.51	-22.60	-13.92	50.00	50.00	-391.12	1914.00
	9422 R	68.13	-336.09	-26.29	-16.47	68.13	68.13	-289.58	-41.04	4.88	68.18	69.30	-452.15	1392.00
9427.0	9427 L	68.13	58.22	-19.51	-23.95	68.13	68.13	175.89	-7.97	-32.71	68.13	68.13	-35.38	1392.00
	9427 R	67.81	139.77	-7.24	-31.48	67.81	67.81	43.92	-18.43	-22.78	67.81	67.81	262.82	1740.00
9431.0	9431 L	67.81	-119.95	-17.40	-21.42	67.81	67.81	-257.33	-6.14	-30.09	67.81	67.81	-36.85	1740.00
	9431 R	68.13	-57.75	-6.87	-31.31	68.13	68.13	41.83	-18.48	-22.59	68.13	68.13	-170.23	1392.00
9436.0	9436 L	68.13	372.71	-42.40	6.17	68.20	69.30	457.92	-28.46	-16.36	68.13	68.13	293.72	1392.00
	9436 R	50.00	432.00	-24.53	-13.85	50.00	50.00	397.35	-36.83	6.01	50.00	50.00	551.14	1914.00
9442.0	9442 L	50.00	-438.96	-32.86	-3.39	50.00	50.00	-519.43	-19.09	-20.38	50.00	50.00	-362.84	1914.00
	9442 R	67.05	-297.58	-22.68	-24.17	67.05	67.05	-248.18	-38.45	-4.66	67.05	67.05	-415.42	1392.00
9447.0	9447 L	67.05	151.21	-25.66	-21.52	67.05	67.05	280.65	-14.54	-31.64	67.05	67.05	61.34	1392.00
	9447 R	66.71	248.48	-13.60	-30.36	66.71	66.71	153.84	-24.34	-20.28	66.71	66.71	382.22	1740.00
9451.0	9451 L	66.71	-230.87	-24.50	-20.63	66.71	66.71	-385.83	-13.02	-29.81	66.71	66.71	-154.01	1740.00
	9451 R	67.05	-165.89	-14.01	-31.14	67.05	67.05	-65.04	-25.83	-21.89	67.05	67.05	-287.80	1392.00
9456.0	9456 L	67.05	333.74	-38.50	-5.83	67.05	67.05	410.98	-21.58	-24.70	67.05	67.05	243.33	1392.00
	9456 R	50.00	394.78	-18.15	-20.87	50.00	50.00	356.49	-32.86	-4.36	50.00	50.00	512.89	1914.00
9462.0	9462 L	49.25	-443.10	-33.12	6.12	50.00	50.00	-509.90	-19.60	-15.67	50.00	49.25	-331.50	1914.00
	9462 R	67.05	-279.61	-23.13	-18.89	67.05	67.05	-236.25	-39.71	4.96	67.10	69.29	-423.32	1392.00
9467.0	9467 L	67.05	82.69	-19.94	-17.68	67.05	67.05	200.85	-5.73	-29.65	67.05	67.05	-23.37	1392.00
	9467 R	66.71	148.89	-5.07	-28.50	66.71	66.71	51.55	-18.91	-16.69	66.71	66.71	279.42	1740.00
9471.0	9471 L	66.71	-145.13	-18.36	-16.55	66.71	66.71	-286.81	-5.38	-27.98	66.71	66.71	-53.98	1740.00
	9471 R	67.05	-88.94	-6.11	-29.18	67.05	67.05	19.53	-19.39	-17.54	67.05	67.05	-209.50	1392.00
9476.0	9476 L	67.05	356.55	-39.61	5.82	67.12	69.29	414.16	-19.81	-19.10	67.05	67.05	225.08	1392.00
	9476 R	49.25	346.61	-16.79	-16.13	50.00	49.25	320.64	-33.10	6.82	50.00	50.00	498.34	1914.00
9482.0	9482 L	49.18	-456.92	-33.68	10.13	50.00	50.00	-503.26	-19.46	-11.45	50.00	49.18	-348.26	1914.00
	9482 R	67.05	-282.44	-22.42	-13.82	67.05	67.05	-255.05	-39.51	7.87	67.15	69.29	-421.17	1392.00
9487.0	9487 L	67.05	40.32	-15.59	-18.91	67.05	67.05	142.76	-3.65	-29.18	67.05	67.05	-61.57	1392.00
	9487 R	66.71	102.98	-3.01	-28.02	66.71	66.71	4.82	-14.71	-17.96	66.71	66.71	212.75	1740.00
9491.0	9491 L	66.71	-97.11	-15.57	-17.22	66.71	66.71	-211.11	-3.40	-29.48	66.71	66.71	-2.01	1740.00
	9491 R	67.05	-35.55	-4.03	-30.65	67.05	67.05	67.70	-16.44	-18.13	67.05	67.05	-141.39	1392.00
9496.0	9496 L	67.05	371.83	-40.02	7.65	67.15	69.29	434.72	-23.13	-13.25	67.05	67.05	248.85	1392.00
	9496 R	49.18	361.48	-20.08	-10.83	50.00	49.18	332.46	-34.13	10.03	50.00	50.00	512.01	1914.00
9502.0	9502 L	50.00	-509.15	-33.76	6.91	50.00	50.00	-581.27	-21.54	-14.12	50.00	50.00	-409.49	1914.00
	9502 R	68.37	-366.23	-23.79	-15.96	68.37	68.37	-300.86	-37.22	6.06	68.43	69.42	-491.10	1392.00
9507.0	9507 L	68.37	47.63	-18.52	-21.83	68.37	68.37	195.19	-5.13	-30.48	68.37	68.37	-78.75	1392.00
	9507 R	68.10	135.84	-4.62	-29.56	68.10	68.10	3.50	-17.63	-20.89	68.10	68.10	292.66	1740.00
9511.0	9511 L	68.10	-117.30	-17.43	-20.91	68.10	68.10	-293.99	-4.89	-29.49	68.10	68.10	1.45	1740.00
	9511 R	68.37	-56.93	-5.40	-30.42	68.37	68.37	82.88	-18.31	-21.85	68.37	68.37	-199.69	1392.00
9516.0	9516 L	68.37	426.17	-38.63	8.03	68.45	69.42	495.63	-23.76	-16.91	68.37	68.37	301.04	1392.00
	9516 R	50.00	452.57	-21.50	-15.00	50.00	50.00	412.14	-35.06	8.72	50.00	50.00	584.16	1914.00
9522.0	9522 L	49.59	-583.96	-35.27	17.00	69.43	49.59	-616.78	-29.09	-6.58	69.43	49.59	-473.49	1914.00
	9522 R	69.53	-403.80	-31.18	-6.62	67.97	67.97	-387.06	-37.41	18.30	67.97	69.53	-550.30	1392.00
9527.0	9527 L	67.97	-149.53	-6.58	-19.75	67.97	67.97	-24.34	5.12	-25.93	69.53	67.97	-280.09	1392.00
	9527 R	67.87	-82.76	5.25	-25.28	69.42	67.87	-219.21	-6.19	-19.19	67.87	67.87	51.28	1740.00
9531.0	9531 L	67.87	66.32	-6.26	-20.03	67.87	67.87	-69.03	5.38	-25.55	69.42	67.87	202.76	1740.00
	9531 R	67.97	136.37	5.14	-26.10	69.53	67.97	264.67	-6.69	-20.65	67.97	67.97	6.89	1392.00
9536.0	9536 L	69.53	439.94	-36.30	17.06	67.97	69.53	553.91	-27.01	-5.37	67.97	67.97	384.86	1392.00
	9536 R	49.59	464.47	-25.15	-5.18	69.43	49.59	471.55	-34.25	15.88	69.43	49.59	620.94	1914.00
9542.0	9542 L	69.35	-598.56	-31.99	-6.59	68.43	69.35	-648.94	-23.97	-21.37	68.43	69.35	-477.54	2088.00
	9542 R	69.57	-386.15	-26.02	-23.72	69.57	69.57	-344.97	-34.80	-8.30	69.57	69.57	-528.44	1392.00
9547.0	9547 L	69.57	167.68	-17.31	-20.49	69.57	69.57	263.85	-8.59	-26.87	69.57	69.57	23.50	1392.00
	9547 R	69.47	293.18	-8.10	-26.16	69.47	69.47	127.33	-16.65	-19.80	69.47	69.47	377.42	1740.00
9551.0	9551 L	69.47	-297.20	-17.86	-21.54	69.47	69.47	-402.73	-8.77	-26.50	69.47	69.47	-132.59	1740.00
	9551 R	69.57	-169.35	-9.23	-27.18	69.57	69.57	-12.39	-18.52	-22.25	69.57	69.57	-270.57	1392.00
9556.0	9556 L	69.57	504.78	-34.86	3.14	69.57	69.57	624.80	-22.71	-13.57	69.57	69.57	432.20	1392.00
	9556 R	69.35	648.12	-20.60	-11.96	68.43	69.35	585.18	-31.88	4.02	68.43	69.35	759.92	2088.00

SERVICE II

Splice Node	Splice Side	MAX FX Flange Stress (ksi) TF	MAX FX BF	MAX FX FY (kip)	MIN FX Flange Stress (ksi) TF	MIN FX BF	MIN FX FY (kip)	MAX FY Flange Stress (ksi) TF	MAX FY BF	MAX FY FY (kip)	MIN FY Flange Stress (ksi) TF	MIN FY BF	MIN FY FY (kip)
9225.0	9225 L	-2.86	5.16	254.96	-3.02	-3.34	406.26	-4.45	5.76	112.21	-1.14	-5.24	520.07
	9225 R	-2.39	-3.10	345.65	-2.22	4.70	250.16	-0.18	-5.99	499.49	-3.96	5.89	103.46
9232.0	9232 L	-6.61	10.09	-155.82	-8.27	6.78	-140.87	-5.89	4.44	-349.66	-8.76	10.91	51.61
	9232 R	-7.58	6.18	-179.19	-5.98	9.28	-158.12	-7.94	9.81	49.01	-6.67	6.90	-366.40
9242.0	9242 L	12.79	8.06	289.11	8.02	8.36	254.73	9.19	12.75	131.66	11.53	5.76	488.08
	9242 R	7.65	8.23	254.74	12.39	8.13	283.43	11.44	5.28	471.39	8.74	12.76	128.99
9253.0	9253 L	11.44	2.55	-370.27	6.41	3.82	-309.58	10.70	-0.87	-560.16	7.61	7.70	-201.05
	9253 R	6.45	3.79	-309.58	11.48	2.33	-374.90	7.80	7.32	-208.57	10.66	-0.95	-565.73
9261.0	9261 L	-0.68	2.01	58.31	-2.45	-1.33	132.93	-3.39	3.62	-87.71	-1.26	-1.08	297.18
	9261 R	-2.89	-1.19	117.04	-1.04	2.00	55.75	-1.27	-1.91	275.93	-3.94	3.87	-90.25
9269.0	9269 L	15.75	-12.94	-377.46	14.79	-19.13	-435.12	13.60	-14.78	-582.96	7.53	-11.58	-207.43
	9269 R	11.91	-16.63	-473.57	13.06	-11.58	-383.39	6.98	-10.90	-215.26	6.97	-11.40	-597.41
9277.0	9277 L	21.72	5.51	371.30	16.46	-5.28	411.05	16.90	7.58	249.26	21.75	-5.56	629.06
	9277 R	20.43	-5.79	411.05	24.64	6.86	366.23	25.24	-6.30	616.29	19.01	9.10	245.33
9287.0	9287 L	17.63	6.59	-307.75	10.78	9.72	-176.54	15.95	7.29	-460.70	11.09	13.02	-82.07
	9287 R	8.97	8.41	-176.54	15.37	5.57	-312.70	9.31	10.95	-89.18	13.64	6.54	-469.01
9295.0	9295 L	-12.67	16.81	528.72	-10.79	11.14	676.27	-15.12	19.93	423.02	-12.59	15.98	778.15
	9295 R	-8.11	8.25	669.42	-9.74	12.59	528.72	-9.36	11.44	759.86	-11.99	15.20	420.39
9305.0	9305 L	-19.29	22.79	-202.27	-20.24	22.64	-217.95	-22.46	26.66	-338.53	-18.23	20.44	-55.65
	9305 R	-20.24	22.64	-277.43	-19.29	22.79	-260.16	-17.79	19.76	-105.80	-23.03	27.81	-407.83
9402.0	9402 L	-22.29	2.50	-318.59	-23.63	-8.37	-385.00	-27.43	1.07	-438.20	-18.95	-12.86	-285.12
	9402 R	-24.64	-9.65	-292.87	-23.02	-2.72	-256.36	-19.11	-14.04	-206.04	-28.57	-0.33	-355.64
9407.0	9407 L	-8.02	-16.17	27.08	-15.44	-19.72	141.78	-8.25	-20.80	-6.76	-16.14	-16.97	178.35
	9407 R	-14.10	-19.33	210.00	-7.54	-15.54	82.09	-16.14	-16.94	253.20	-7.78	-19.43	54.20
9411.0	9411 L	-8.17	-17.61	-108.03	-13.91	-19.65	-233.91	-15.59	-17.12	-271.00	-7.48	-20.19	-85.98
	9411 R	-14.67	-20.52	-155.22	-8.63	-18.24	-53.46	-7.80	-21.56	-25.21	-16.33	-17.80	-195.65
9416.0	9416 L	-19.36	-7.71	223.03	-21.21	-12.86	267.95	-14.78	-13.09	192.78	-25.28	-4.87	324.44
	9416 R	-20.28	-11.78	361.66	-18.79	-6.94	286.26	-24.32	-4.82	407.60	-14.75	-10.79	269.88
9422.0	9422 L	-19.75	2.41	-282.96	-21.76	-6.71	-361.99	-25.84	0.71	-402.83	-17.83	-7.16	-270.60
	9422 R	-25.21	-8.17	-279.88	-22.71	2.33	-232.00	-19.81	-10.39	-205.25	-29.68	1.72	-331.37
9427.0	9427 L	-4.94	-16.96	-4.63	-13.94	-21.18	114.01	-4.58	-21.08	-30.80	-14.66	-18.55	138.22
	9427 R	-13.11	-20.20	185.02	-4.46	-16.24	40.97	-13.85	-17.76	205.98	-3.90	-19.33	20.84
9431.0	9431 L	-4.42	-16.04	-37.45	-12.72	-20.66	-164.44	-14.01	-17.62	-200.44	-4.02	-19.29	-16.10
	9431 R	-13.54	-21.65	-93.66	-4.89	-16.75	7.97	-4.72	-21.06	35.53	-14.82	-18.40	-132.97
9436.0	9436 L	-24.71	4.48	236.20	-26.27	-7.34	284.68	-21.77	-11.10	208.79	-31.18	3.10	335.57
	9436 R	-22.67	-5.96	368.83	-21.53	4.32	288.26	-26.81	1.81	409.37	-19.43	-7.78	276.23
9442.0	9442 L	-17.60	-5.51	-265.55	-21.05	-12.98	-344.70	-24.17	-5.02	-385.68	-14.73	-11.97	-249.57
	9442 R	-24.92	-15.67	-252.35	-20.76	-6.90	-205.60	-16.71	-16.14	-173.74	-28.18	-4.64	-304.97
9447.0	9447 L	-11.11	-17.87	63.29	-18.26	-20.33	175.78	-10.54	-21.80	37.73	-19.99	-17.46	214.63
	9447 R	-17.24	-19.27	257.70	-10.51	-17.13	117.85	-18.99	-16.62	293.06	-9.85	-20.14	98.76
9451.0	9451 L	-10.23	-16.88	-117.72	-18.10	-19.06	-273.30	-19.12	-16.89	-294.05	-9.45	-19.75	-98.14
	9451 R	-19.13	-20.11	-194.43	-10.85	-17.64	-65.25	-10.11	-21.38	-39.72	-20.13	-17.74	-218.43
9456.0	9456 L	-18.81	-5.42	204.37	-22.88	-15.13	246.86	-16.35	-16.96	170.89	-27.94	-5.37	301.42
	9456 R	-19.38	-12.62	338.00	-16.04	-4.35	263.06	-23.72	-5.35	380.58	-14.07	-12.42	245.77
9462.0	9462 L	-15.62	1.29	-233.03	-22.10	-9.45	-350.73	-25.38	-2.81	-395.11	-13.43	-6.40	-205.34
	9462 R	-26.24	-12.18	-268.20	-18.68	-0.95	-187.81	-15.20	-9.38	-148.33	-30.00	-2.78	-321.31
9467.0	9467 L	-5.57	-13.63	7.04	-13.23	-19.90	129.69	-4.03	-18.87	-25.19	-14.77	-15.98	159.63
	9467 R	-12.40	-18.93	201.21	-5.18	-13.07	45.88	-13.63	-16.04	226.00	-3.76	-17.06	21.52
9471.0	9471 L	-5.33	-13.16	-49.92	-11.45	-18.69	-184.40	-13.45	-14.48	-228.92	-3.89	-17.18	-20.75
	9471 R	-12.24	-19.63	-117.22	-5.77	-13.75	-10.83	-4.44	-18.66	25.24	-13.88	-15.03	-166.92
9476.0	9476 L	-17.89	-0.13	189.46	-24.16	-11.19	256.30	-14.90	-10.17	148.82	-28.90	-3.23	309.27
	9476 R	-20.35	-8.73	336.12	-14.93	0.83	234.20	-24.19	-1.89	380.61	-12.72	-7.41	206.93
9482.0	9482 L	-16.52	4.06	-238.38	-21.44	-5.50	-344.15	-24.72	3.21	-382.33	-15.27	-3.46	-223.98
	9482 R	-24.85	-7.81	-265.92	-19.35	2.92	-195.75	-17.21	-6.91	-169.57	-28.83	2.46	-311.99
9487.0	9487 L	-3.15	-14.25	-21.70	-10.31	-19.26	79.89	-1.95	-18.90	-53.38	-12.10	-15.52	121.26
	9487 R	-9.57	-18.36	141.67	-2.81	-13.68	12.39	-11.39	-14.84	178.69	-1.59	-17.21	-11.95
9491.0	9491 L	-3.68	-13.81	-16.22	-9.42	-19.50	-137.66	-11.65	-15.39	-177.52	-1.86	-18.69	13.03
	9491 R	-10.14	-20.43	-73.20	-4.03	-14.37	19.12	-2.23	-19.59	56.75	-12.36	-16.07	-118.25
9496.0	9496 L	-19.47	2.72	197.02	-26.34	-7.53	277.47	-16.55	-6.66	160.05	-30.32	3.17	328.61
	9496 R	-22.74	-5.10	350.03	-16.63	3.84	237.03	-26.05	4.47	394.26	-14.52	-4.30	209.91
9502.0	9502 L	-17.58	2.35	-292.76	-22.09	-7.92	-383.77	-24.59	2.01	-434.19	-15.11	-5.18	-278.57
	9502 R	-24.31	-9.35	-296.08	-19.38	1.93	-242.23	-16.19	-8.90	-210.12	-27.49	3.16	-361.95
9507.0	9507 L	-5.11	-17.41	-26.97	-12.64	-19.96	103.39	-4.18	-21.84	-66.08	-13.73	-16.74	147.96
	9507 R	-11.96	-19.16	181.64	-4.80	-16.89	19.62	-13.12	-16.31	221.19	-3.81	-21.03	-9.74
9511.0	9511 L	-4.81	-16.40	-14.44	-11.67	-19.01	-197.68	-13.22	-16.67	-229.51	-4.00	-20.01	18.26
	9511 R	-12.35	-19.82	-120.66	-5.12	-16.91	30.83	-4.25	-21.58	72.74	-13.89	-17.20	-156.88
9516.0	9516 L	-20.60	3.61	244.67	-22.56	-9.20	294.30	-17.85	-10.74	209.59	-27.88	2.91	367.32
	9516 R	-20.42	-7.85	383.98	-18.75	3.92	293.84	-25.52	2.46	442.03	-16.97	-6.39	278.16
9522.0	9522 L	-21.96	13.12	-321.70	-23.70	4.66	-425.87	-26.79	9.37	-479.61	-22.20	11.85	-317.48
	9522 R	-25.39	4.72	-354.15	-23.26	13.86	-288.98	-23.26	8.42	-272.16	-28.48	11.40	-417.20
9527.0	9527 L	3.29	-13.95	-175.59	-4.77	-17.88	-46.99	4.58	-18.79	-212.20	-5.83	-16.14	-15.36
	9527 R	-4.47	-17.41	14.77	3.34	-13.60	-144.40	-5.63	-16.15	42.19	4.59	-17.20	-172.20
9531.0	9531 L	3.81	-14.08	138.96	-5.08	-18.66	-40.93	-5.85	-17.13	-62.55	4.58	-17.08	165.22
	9531 R	-5.39	-19.15	22.02	3.75	-14.41	170.45	4.57	-18.62	205.13	-5.97	-17.09	-3.75
9536.0	9536 L	-19.94	10.48	292.94	-24.23	3.51	355.51	-19.12	4.06	272.01	-27.86	11.01	419.82
	9536 R	-22.59	3.54	427.29	-18.84	9.78	325.91	-25.92	8.41	481.60	-18.37	7.66	319.61
9542.0	9542 L	-18.97	-9.79	-325.01	-19.78	-11.33	-444.98	-22.92	-6.83	-495.42	-19.04	-11.31	-321.05
	9542 R	-21.61	-12.87	-337.39	-20.48	-11.19	-254.18	-20.15	-16.40	-239.77	-25.02	-7.40	-394.85
9547.0	9547 L	-9.91	-18.03	50.92	-12.41	-18.50	165.42	-7.19	-19.93	9.89	-12.41	-15.47	202.08
	9547 R	-11.90	-17.91	256.66	-9.60	-17.62	112.77	-11.76	-14.90	288.29	-7.01	-18.83	81.13
9551.0	9551 L	-6.88	-14.67	-113.94	-13.12	-19.71	-271.15	-15.02	-18.66	-309.10	-5.25	-16.12	-82.69
	9551 R	-13.61	-20.28	-165.98	-7.19	-15.08	-40.54	-5.89	-18.11	-0.56	-15.51	-19.10	-208.91
9556.0	9556 L	-19.57	-1.28	342.79	-20.75	-8.23	389.72	-16.73	-7.99	305.53	-25.15	-1.60	466.98
	9556 R	-18.86	-7.02	510.73	-17.89	0.91	424.75	-22.72	-1.97	579.00	-15.81	-4.56	403.80

Splice Node	Splice Side	MAX MY Flange Stress (ksi) TF	MAX MY BF	MAX MY FY (kip)	MIN MY Flange Stress (ksi) TF	MIN MY BF	MIN MY FY (kip)	MAX MZ Flange Stress (ksi) TF	MAX MZ BF	MAX MZ FY (kip)	MIN MZ Flange Stress (ksi) TF	MIN MZ BF	MIN MZ FY (kip)
9225.0	9225 L	-6.07	8.54	338.57	11.06	-12.96	307.27	-7.34	13.64	318.52	15.73	-19.09	356.26
	9225 R	9.86	-11.91	306.20	-5.21	7.84	329.18	13.91	-17.54	356.05	-6.41	12.61	259.46
9232.0	9232 L	-8.44	11.74	-204.77	-4.98	-2.33	-135.50	-10.51	18.56	-130.58	-2.96	-7.35	-155.09
	9232 R	-4.57	-2.16	-136.02	-7.63	10.73	-209.62	-2.62	-6.80	-154.95	-9.62	17.19	-185.15
9242.0	9242 L	8.76	8.53	322.01	11.86	10.06	247.84	7.89	13.75	238.21	13.53	-4.02	377.46
	9242 R	11.46	10.10	247.84	8.39	8.40	272.71	13.13	3.95	377.54	7.52	13.54	183.77
9253.0	9253 L	9.47	5.77	-335.80	9.44	1.88	-373.95	5.88	8.37	-259.12	12.48	-2.97	-458.17
	9253 R	9.32	1.58	-373.95	9.52	5.65	-382.89	12.53	-3.39	-458.17	5.91	8.46	-312.41
9261.0	9261 L	-4.66	7.25	106.77	12.20	-13.94	117.98	-5.72	11.24	84.86	13.57	-15.92	134.33
	9261 R	12.95	-13.69	117.14	-5.03	7.12	100.95	14.54	-15.69	133.61	-6.18	11.05	30.03
9269.0	9269 L	6.23	-9.85	-444.28	20.28	-20.45	-342.66	4.76	-3.82	-393.36	26.42	-28.38	-405.47
	9269 R	16.81	-18.22	-345.22	5.45	-8.70	-450.09	21.74	-25.22	-406.08	4.12	-3.32	-450.15
9277.0	9277 L	18.14	1.94	410.80	22.33	5.87	368.11	16.14	8.37	353.02	25.01	-8.07	521.47
	9277 R	25.07	6.94	368.11	20.87	3.01	405.73	28.28	-8.44	521.69	18.30	9.71	299.06
9287.0	9287 L	11.86	8.41	-180.28	17.55	8.35	-293.70	10.68	14.37	-127.42	18.24	3.32	-371.33
	9287 R	15.42	7.34	-293.70	9.84	7.05	-185.23	16.02	2.70	-371.36	8.79	12.54	-181.01
9295.0	9295 L	-16.84	22.64	670.19	-5.80	3.80	551.29	-17.15	24.73	624.26	-5.71	2.11	568.99
	9295 R	-4.19	2.94	551.29	-13.43	17.21	637.57	-3.68	1.28	569.00	-13.64	18.70	570.38
9305.0	9305 L	-19.02	21.98	-210.50	-19.90	22.35	-128.25	-23.30	29.30	-241.64	-16.50	16.57	-104.80
	9305 R	-19.90	22.35	-217.81	-19.03	21.98	-256.64	-16.50	16.58	-148.16	-23.30	29.30	-357.34
9402.0	9402 L	-24.67	-12.87	-326.74	-25.65	-5.62	-379.47	-28.14	4.58	-417.65	-18.28	-14.08	-295.21
	9402 R	-26.49	-6.83	-297.64	-25.25	-13.65	-247.47	-19.02	-14.89	-211.08	-29.12	2.97	-343.01
9407.0	9407 L	-15.51	-18.65	126.82	-13.39	-20.61	74.62	-17.01	-17.31	173.86	-9.15	-22.71	5.76
	9407 R	-12.79	-19.88	141.16	-14.83	-17.91	196.60	-8.60	-21.92	73.36	-16.26	-16.55	247.52
9411.0	9411 L	-14.03	-16.97	-221.48	-9.73	-19.87	-133.40	-15.07	-16.04	-256.59	-8.00	-22.41	-99.44
	9411 R	-10.26	-20.56	-72.01	-14.70	-17.72	-152.61	-8.52	-23.20	-32.57	-15.80	-16.79	-184.70
9416.0	9416 L	-23.36	-15.07	240.94	-23.17	-14.17	251.08	-24.76	-3.52	320.35	-14.86	-14.58	199.93
	9416 R	-22.51	-13.36	335.17	-22.86	-14.42	318.90	-14.07	-13.78	284.23	-23.83	-2.21	398.77
9422.0	9422 L	-23.08	-9.27	-312.25	-24.58	-7.07	-340.80	-25.79	3.24	-393.09	-16.58	-10.06	-286.52
	9422 R	-28.25	-8.44	-269.33	-26.54	-10.87	-244.87	-19.29	-11.90	-212.28	-29.66	3.16	-326.87
9427.0	9427 L	-13.80	-20.02	96.73	-10.23	-21.99	29.14	-14.64	-18.09	125.81	-6.81	-24.63	-22.79
	9427 R	-9.64	-21.21	83.78	-13.07	-19.14	158.79	-6.27	-23.73	35.47	-13.85	-17.23	189.25
9431.0	9431 L	-13.31	-18.34	-154.75	-8.23	-20.69	-61.17	-13.48	-16.63	-186.14	-4.33	-21.56	-29.27
	9431 R	-8.76	-21.45	-9.50	-14.04	-19.20	-93.17	-4.91	-22.49	28.33	-14.27	-17.48	-122.38
9436.0	9436 L	-28.58	-11.79	246.51	-28.04	-6.99	270.97	-30.82	4.29	331.17	-21.01	-11.93	215.46
	9436 R	-24.48	-5.69	345.13	-24.90	-10.09	315.81	-18.12	-10.10	291.33	-26.77	4.20	399.45
9442.0	9442 L	-19.64	-13.02	-292.59	-22.15	-12.33	-320.18	-23.88	-2.59	-377.03	-13.94	-14.99	-264.95
	9442 R	-26.35	-15.09	-238.47	-23.44	-15.83	-215.66	-16.57	-17.77	-180.76	-27.94	-3.54	-301.11
9447.0	9447 L	-18.12	-17.73	175.69	-14.13	-21.13	91.08	-19.27	-16.23	205.81	-11.35	-23.74	45.08
	9447 R	-13.37	-20.32	154.92	-17.24	-16.77	248.42	-10.66	-22.80	112.66	-18.30	-15.32	280.34
9451.0	9451 L	-17.48	-17.49	-246.01	-12.93	-19.49	-151.54	-18.43	-15.58	-282.69	-10.24	-22.42	-113.25
	9451 R	-13.64	-20.35	-91.62	-18.39	-18.40	-176.62	-10.96	-23.39	-48.25	-19.41	-16.50	-210.75
9456.0	9456 L	-22.33	-16.70	210.44	-26.33	-13.52	242.90	-27.88	-4.42	297.47	-15.83	-18.16	177.41
	9456 R	-22.18	-10.99	321.02	-18.69	-13.80	287.52	-13.31	-15.34	260.47	-23.79	-3.34	371.90
9462.0	9462 L	-18.17	-6.66	-271.24	-22.74	-7.84	-316.31	-23.82	4.29	-363.51	-14.56	-11.58	-249.03
	9462 R	-26.95	-10.60	-246.47	-21.53	-8.83	-208.85	-17.18	-13.96	-178.21	-28.56	3.45	-300.95
9467.0	9467 L	-11.56	-17.24	108.47	-9.50	-17.66	57.05	-14.43	-12.56	143.79	-4.46	-22.16	-12.32
	9467 R	-8.86	-16.97	109.78	-10.86	-16.36	170.42	-3.96	-21.31	43.79	-13.69	-11.86	200.31
9471.0	9471 L	-10.48	-17.12	-166.77	-8.34	-15.78	-102.63	-13.59	-12.09	-206.58	-3.94	-20.35	-43.61
	9471 R	-8.78	-16.63	-49.99	-11.27	-17.87	-108.36	-4.48	-21.23	10.27	-14.33	-12.81	-150.24
9476.0	9476 L	-19.32	-10.31	191.07	-26.93	-8.00	256.34	-28.71	4.13	297.04	-14.50	-14.02	165.39
	9476 R	-22.70	-5.55	323.44	-16.31	-8.15	253.79	-12.29	-11.84	235.45	-24.00	4.85	358.29
9482.0	9482 L	-18.57	-4.62	-263.83	-23.03	-3.02	-330.90	-24.35	7.12	-362.48	-14.15	-8.32	-254.13
	9482 R	-26.69	-5.49	-264.07	-21.45	-6.72	-204.56	-16.31	-10.04	-186.13	-28.56	5.47	-302.58
9487.0	9487 L	-9.00	-17.78	80.06	-6.76	-16.77	10.99	-11.62	-13.85	102.68	-2.62	-21.15	-42.34
	9487 R	-6.33	-16.04	56.30	-8.33	-17.04	134.58	-2.15	-20.31	6.00	-10.97	-13.16	153.81
9491.0	9491 L	-7.60	-16.10	-117.51	-7.02	-17.01	-71.07	-11.20	-12.30	-149.64	-2.76	-21.92	-7.93
	9491 R	-7.44	-17.83	-21.46	-8.24	-16.87	-63.25	-3.23	-22.79	44.21	-11.83	-12.95	-99.67
9496.0	9496 L	-21.55	-5.56	206.30	-27.54	-6.05	273.39	-28.66	5.33	309.64	-17.27	-10.01	186.50
	9496 R	-23.80	-3.48	337.23	-18.61	-3.52	258.99	-15.00	-8.19	248.69	-24.44	7.06	365.34
9502.0	9502 L	-21.26	-6.40	-335.76	-24.16	-6.46	-369.01	-24.48	4.90	-421.19	-15.80	-10.38	-298.60
	9502 R	-26.35	-8.00	-290.82	-23.33	-7.78	-267.24	-17.45	-11.73	-219.07	-27.05	4.33	-355.46
9507.0	9507 L	-12.96	-18.20	99.33	-7.58	-20.32	-3.36	-14.13	-16.55	142.18	-4.59	-23.08	-57.66
	9507 R	-7.18	-19.74	50.90	-12.38	-17.50	167.50	-4.22	-22.40	2.25	-13.47	-15.86	213.54
9511.0	9511 L	-12.30	-17.63	-172.80	-8.52	-20.27	-65.28	-13.29	-15.85	-215.10	-4.37	-22.28	2.42
	9511 R	-8.96	-20.86	-7.94	-12.88	-18.34	-105.94	-4.74	-22.96	61.66	-13.94	-16.54	-145.99
9516.0	9516 L	-23.31	-10.21	256.54	-26.86	-4.81	310.11	-27.98	5.75	359.19	-17.46	-12.53	219.11
	9516 R	-24.48	-3.53	385.09	-21.28	-8.69	329.15	-15.80	-11.12	300.59	-25.39	6.25	423.51
9522.0	9522 L	-24.68	11.35	-347.75	-22.72	6.81	-425.81	-25.72	12.33	-449.00	-21.65	5.15	-347.89
	9522 R	-24.21	7.35	-367.11	-26.30	11.56	-296.40	-23.20	5.03	-284.58	-27.29	13.28	-400.25
9527.0	9527 L	-5.69	-18.94	-89.64	3.59	-18.67	-108.55	-5.71	-15.60	-22.59	4.35	-19.62	-203.65
	9527 R	3.82	-18.33	-64.76	-5.42	-18.47	-37.84	4.44	-19.14	-158.98	-5.43	-15.19	32.72
9531.0	9531 L	-5.06	-18.81	19.10	-5.10	-20.24	41.29	-5.05	-15.38	-44.14	4.79	-19.71	144.54
	9531 R	-5.31	-20.65	92.38	-5.31	-19.26	69.38	4.62	-20.11	190.34	-5.37	-15.84	11.07
9536.0	9536 L	-19.74	6.78	301.62	-22.95	6.27	322.71	-26.37	12.23	402.00	-20.09	-3.92	283.80
	9536 R	-21.58	6.21	382.30	-18.47	6.29	345.36	-18.71	-3.81	347.07	-24.88	11.39	451.27
9542.0	9542 L	-21.83	-13.88	-367.67	-18.43	-7.02	-436.22	-23.63	-5.44	-470.35	-17.50	-15.48	-350.72
	9542 R	-20.21	-8.22	-337.93	-23.55	-15.66	-281.47	-19.01	-17.19	-253.50	-25.68	-6.75	-382.00
9547.0	9547 L	-14.31	-20.17	138.35	-14.47	-21.02	130.17	-12.25	-14.72	192.24	-7.35	-20.62	17.48
	9547 R	-14.05	-20.54	207.04	-13.84	-19.62	223.33	-7.00	-20.10	93.44	-11.76	-14.20	275.64
9551.0	9551 L	-13.11	-19.33	-228.45	-15.82	-22.22	-225.89	-12.38	-15.15	-291.21	-7.50	-20.42	-100.73
	9551 R	-16.26	-22.73	-132.13	-13.57	-19.88	-134.04	-7.84	-20.92	-12.28	-12.86	-15.66	-194.50
9556.0	9556 L	-21.35	-4.38	376.44	-20.08	-6.68	371.07	-25.39	2.10	455.87	-16.79	-9.93	316.16
	9556 R	-18.32	-5.55	484.06	-19.43	-3.48	472.71	-15.24	-8.74	428.24	-23.22	2.76	555.09

Field Splice

Type A

Field Splice - Node 1007

Node 1007

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	154

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1007 L	94.50	69.06	6526.07	144.00	69.06	9944.49	96.00	50.00	4800.00
1007 R	94.50	69.06	6526.07	144.00	69.06	9944.49	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 1007 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	48.00	3.00	---	144.00	99.38	101.62	70	85
Splice Plates	TF Outside	42.00	1.125	56.50	47.25	32.91	---	70	85
	TF Inside	19.50	1.250	56.50	48.75	32.81	---	70	85
	BF Inside	22.50	1.500	68.50	67.50	45.19	---	70	85
	BF Outside	48.00	1.375	68.50	66.00	45.55	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-35.33	28.64	-44.78	43.31	-36.18	29.91	-44.38	42.64	-36.57	30.10	-37.01	30.74	-46.18	45.83	-32.53	23.67
ϕf Fnc (ksi)	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06
f / ϕf Fnc	0.51	0.41	0.65	0.63	0.52	0.43	0.64	0.62	0.53	0.44	0.54	0.45	0.67	0.66	0.47	0.34
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-35.33		-44.78		-36.18		-44.38		-36.57		-37.01		-46.18		-32.53	
Fcf (ksi)	-52.44		-57.22		-52.87		-57.02		-53.06		-53.28		-57.93		-51.79	
Fcf (kip)	-4955.34		-5407.75		-4996.02		-5388.66		-5014.28		-5035.42		-5474.67		-4894.55	
fncf (ksi)		28.64		43.31		29.91		42.64		30.10		30.74		45.83		23.67
Rcf		1.48		1.28		1.46		1.28		1.45		1.44		1.25		1.59
Fncf (ksi)		51.79		56.10		51.79		55.53		51.79		51.79		58.28		51.79
Fncf (kip)		5263.15		5700.91		5263.15		5642.92		5263.15		5263.15		5922.30		5263.15

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.33	21.30	-33.01	31.36	-26.93	22.19	-32.73	30.89	-25.36	19.09	-31.77	29.79	-33.99	33.45	-24.36	17.49
Fs (ksi)	-26.33	21.30	-33.01	31.36	-26.93	22.19	-32.73	30.89	-25.36	19.09	-31.77	29.79	-33.99	33.45	-24.36	17.49
Fs (kip)	-2488.47	3067.73	-3119.86	4516.44	-2544.76	3196.06	-3093.25	4448.11	-2396.54	2748.72	-3002.06	4289.06	-3212.44	4816.23	-2301.93	2518.09

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5922.30	0.00	4816.23
Comp	5474.67	0.00	3212.44	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	71.94	214.89	38.22	310.53	101.61	97.31	224.20	10.36	52.81	156.12	25.02	223.69	27.87	155.37	160.38	11.61
Vuw (kip)	107.91	322.34	57.33	465.79	152.42	145.97	336.29	15.54	---	---	---	---	---	---	---	---
Mv (k*ft)	60.70	181.32	32.25	262.01	85.73	82.11	189.17	8.74	29.71	87.82	14.07	125.82	15.68	87.40	90.22	6.53
Huw (kip)	-442.71	-53.16	-405.68	-70.62	-416.08	-398.64	16.47	-643.72	-241.41	-79.21	-227.23	-88.47	-301.05	-95.17	-26.31	-329.87
Muw (k*ft)	6031.48	7155.43	6135.21	7106.64	6145.76	6197.26	7337.70	5682.25	3048.75	4120.23	3143.91	4071.84	2844.70	3939.38	4316.17	2678.13
Mu (k*ft)	6092.17	7336.74	6167.46	7368.65	6231.49	6279.37	7526.87	5690.99	3078.45	4208.05	3157.98	4197.66	2860.38	4026.78	4406.39	2684.66

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.82	0.46	3.50	0.61	3.59	3.44	0.14	5.55	2.08	0.68	1.96	0.76	2.60	0.82	0.23	2.84
PY1 (Vuw)	0.93	2.78	0.49	4.02	1.31	1.26	2.90	0.13	0.46	1.35	0.22	1.93	0.24	1.34	1.38	0.10
PX2 (Mu)	41.28	49.71	41.79	49.93	42.22	42.55	51.00	38.56	20.86	28.51	21.40	28.44	19.38	27.28	29.86	18.19
PY2 (Mu)	4.42	5.33	4.48	5.35	4.52	4.56	5.46	4.13	2.23	3.05	2.29	3.05	2.08	2.92	3.20	1.95
Pu (kip)	45.41	50.82	45.56	51.40	46.18	46.35	51.82	44.31	23.10	29.52	23.49	29.63	22.10	28.43	30.43	21.13

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3142.13	2237.63	58.50	38.18	28.48	3442.21	2237.63	OK
TF Inside	0.00	3241.88	2231.25	130.00	84.84	24.22	4993.11	2231.25	OK
BF Inside	2994.42	4488.75	3072.75	192.00	125.06	34.88	7303.97	3072.75	OK
BF Outside	2927.88	4389.00	3097.19	88.00	57.32	40.13	4989.74	3097.19	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2694.56	2976.75	OK
TF Inside	2780.11	3071.25	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4158.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.23	44.86	40.41	45.18	40.88	41.04	45.74	39.31
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	465.79
Rr (kip)	2632.40
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2780.11	25.74	OK	1631.32	15.10	OK
BF	2994.42	19.44	OK	2435.17	15.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.82	25.91	OK	30.43	15.21	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2694.56	24.95	1.47	134.83	OK
TF	5474.67	50.69	1.47	269.66	OK
TF Inside	2780.11	25.74	1.47	149.81	OK
BF Inside	2994.42	19.44	1.47	179.78	OK
BF	5922.30	38.46	1.47	359.55	OK
BF Outside	2927.88	19.01	1.47	164.79	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.82	1.47	91.65	OK
Web SPL	25.91	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	1.03	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.41	1.11	5.32
Web	1.40	1.11	1.77
BF	1.86	1.06	8.67

Plate	Shear	Flexure
Web	5.65	1.09

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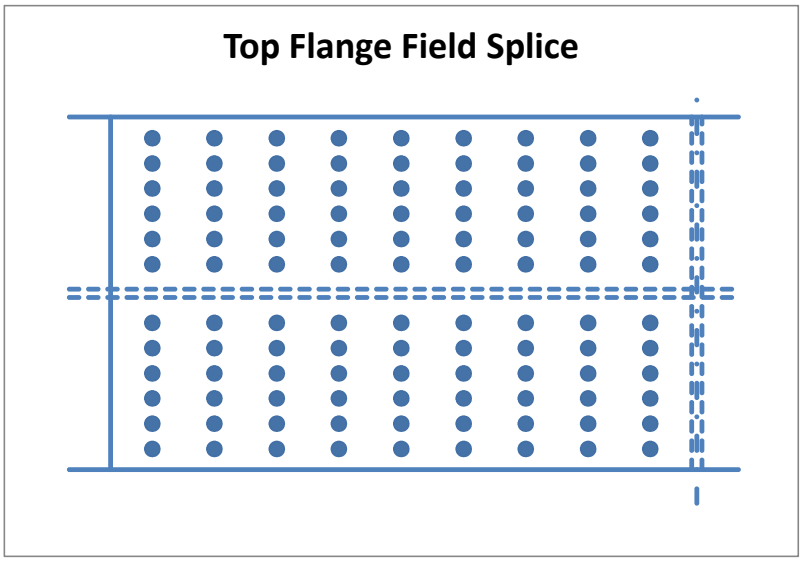
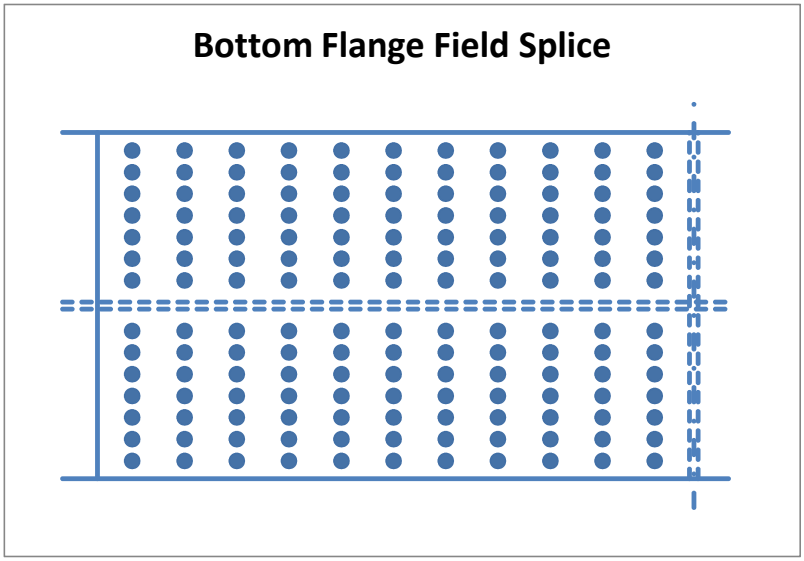
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1007

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	15	0	15
0	22	0	18
0	25	0	25
0	28	0	28
0	31	0	31
0	34	0	34
0	37	0	37
3	0	0	40
3	3	0	43
3	6	3	0
3	9	3	3
3	12	3	6
3	15	3	9
3	22	3	12
3	25	3	15
3	28	3	18
3	31	3	25
3	34	3	28
3	37	3	31
6	0	3	34
6	3	3	37
6	6	3	40
6	9	3	43
6	12	6	0
6	15	6	3
6	22	6	6
6	25	6	9
6	28	6	12
6	31	6	15
6	34	6	18
6	37	6	25
9	0	6	28
9	3	6	31
9	6	6	34
9	9	6	37
9	12	6	40
9	15	6	43
9	22	9	0
9	25	9	3
9	28	9	6
9	31	9	9
9	34	9	12
9	37	9	15
12	0	9	18
12	3	9	25
12	6	9	28
12	9	9	31
12	12	9	34
12	15	9	37
12	22	9	40
12	25	9	43
12	28	12	0
12	31	12	3
12	34	12	6

	Top Flange		Bottom Flange	
No. Bolts =	108.0		154.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		10.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	5.0		6.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





Flange Bolt Pattern Cont. - Node 1007

12	37	12	9
15	0	12	12
15	3	12	15
15	6	12	18
15	9	12	25
15	12	12	28
15	15	12	31
15	22	12	34
15	25	12	37
15	28	12	40
15	31	12	43
15	34	15	0
15	37	15	3
18	0	15	6
18	3	15	9
18	6	15	12
18	9	15	15
18	12	15	18
18	15	15	25
18	22	15	28
18	25	15	31
18	28	15	34
18	31	15	37
18	34	15	40
18	37	15	43
21	0	18	0
21	3	18	3
21	6	18	6
21	9	18	9
21	12	18	12
21	15	18	15
21	22	18	18
21	25	18	25
21	28	18	28
21	31	18	31
21	34	18	34
21	37	18	37
24	0	18	40
24	3	18	43
24	6	21	0
24	9	21	3
24	12	21	6
24	15	21	9
24	22	21	12
24	25	21	15
24	28	21	18
24	31	21	25
24	34	21	28
24	37	21	31
		21	34
		21	37
		21	40
		21	43
		24	0
		24	3
		24	6
		24	9
		24	12
		24	15
		24	18
		24	25
		24	28
		24	31
		24	34
		24	37
		24	40

		24	43
		27	0
		27	3
		27	6
		27	9
		27	12
		27	15
		27	18
		27	25
		27	28
		27	31
		27	34
		27	37
		27	40
		27	43
		30	0
		30	3
		30	6
		30	9
		30	12
		30	15
		30	18
		30	25
		30	28
		30	31
		30	34
		30	37
		30	40
		30	43

Flange Bolt Pattern Cont. - Node 1007

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
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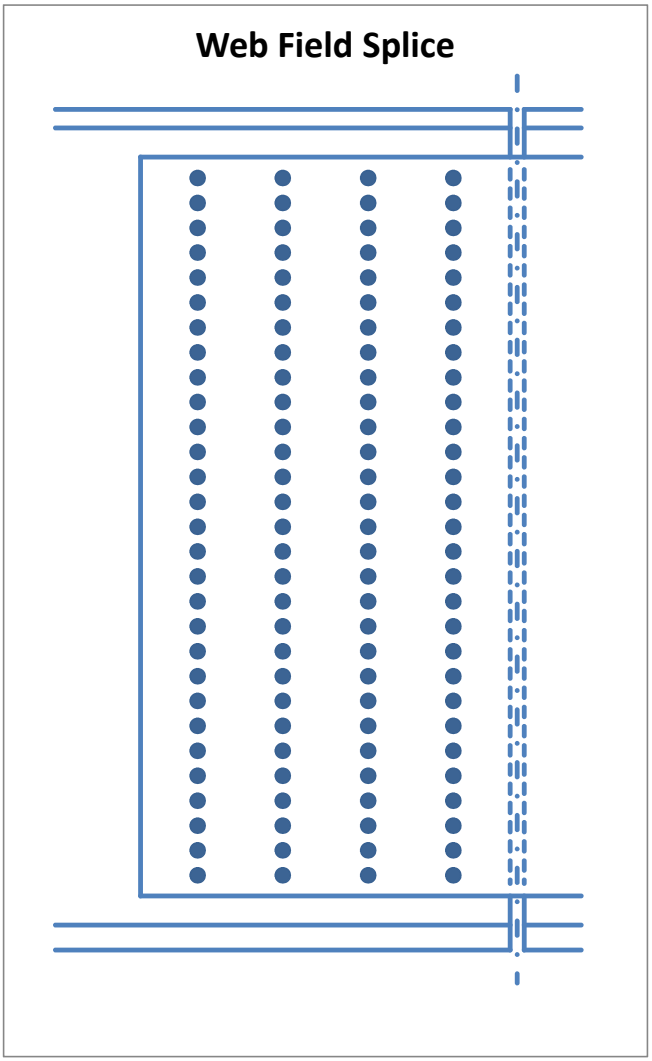
Web Bolt Pattern - Node 1007

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 1007

Web Bolt Pattern Cont. - Node 1007

522	4872	1305	73080

Field Splice - Node 3007

Node 3007

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	154

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3007 L	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00
3007 R	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 3007 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	48.00	3.00	---	144.00	99.38	101.62	70	85
Splice Plates	TF Outside	42.00	1.125	56.50	47.25	32.91	---	70	85
	TF Inside	19.50	1.250	56.50	48.75	32.81	---	70	85
	BF Inside	22.50	1.500	68.50	67.50	45.19	---	70	85
	BF Outside	48.00	1.375	68.50	66.00	45.55	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-37.97	30.71	-45.80	43.52	-37.99	30.54	-46.73	45.26	-39.29	32.36	-39.65	32.94	-47.97	47.59	-35.69	26.45
ϕf Fnc (ksi)	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04
f / ϕf Fnc	0.55	0.44	0.66	0.63	0.55	0.44	0.68	0.66	0.57	0.47	0.57	0.48	0.69	0.69	0.52	0.38
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-37.97		-45.80		-37.99		-46.73		-39.29		-39.65		-47.97		-35.69	
Fcf (ksi)	-53.77		-57.74		-53.78		-58.21		-54.44		-54.62		-58.84		-52.61	
Fcf (kip)	-5081.34		-5456.27		-5082.03		-5500.72		-5144.54		-5161.52		-5560.28		-4971.96	
fncf (ksi)		30.71		43.52		30.54		45.26		32.36		32.94		47.59		26.45
Rcf		1.42		1.26		1.42		1.25		1.39		1.38		1.23		1.47
Fncf (ksi)		51.78		55.62		51.78		57.16		51.78		51.78		59.19		51.78
Fncf (kip)		5261.82		5652.37		5261.82		5808.49		5261.82		5261.82		6014.30		5261.82

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.20	22.66	-33.75	31.52	-28.21	22.54	-34.41	32.75	-27.75	21.36	-33.35	31.13	-35.26	34.59	-26.61	19.46
Fs (ksi)	-28.20	22.66	-33.75	31.52	-28.21	22.54	-34.41	32.75	-27.75	21.36	-33.35	31.13	-35.26	34.59	-26.61	19.46
Fs (kip)	-2664.63	3263.51	-3189.35	4539.52	-2665.81	3246.40	-3251.30	4716.47	-2622.33	3075.73	-3151.24	4482.01	-3332.35	4981.39	-2514.37	2802.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	6014.30	0.00	4981.39
Comp	5560.28	0.00	3332.35	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	68.40	166.60	51.70	336.65	107.37	103.85	248.51	20.26	50.25	122.07	34.60	242.21	41.55	160.14	177.50	18.68
Vuw (kip)	102.60	249.90	77.54	504.97	161.06	155.77	372.76	30.39	---	---	---	---	---	---	---	---
Mv (k*ft)	57.71	140.57	43.62	284.04	90.59	87.62	209.68	17.09	28.26	68.66	19.46	136.24	23.37	90.08	99.84	10.51
Huw (kip)	-458.21	-100.07	-470.75	-49.61	-425.02	-407.42	16.44	-619.36	-265.62	-106.81	-271.93	-79.30	-306.74	-106.63	-32.16	-342.87
Muw (k*ft)	6177.48	7155.88	6161.67	7282.55	6306.17	6352.31	7450.19	5816.49	3255.07	4177.54	3248.26	4298.15	3142.96	4126.18	4470.78	2948.54
Mu (k*ft)	6235.19	7296.45	6205.29	7566.60	6396.76	6439.93	7659.87	5833.59	3283.33	4246.21	3267.72	4434.39	3166.34	4216.25	4570.62	2959.05

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3007	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.95	0.86	4.06	0.43	3.66	3.51	0.14	5.34	2.29	0.92	2.34	0.68	2.64	0.92	0.28	2.96
PY1 (Vuw)	0.88	2.15	0.67	4.35	1.39	1.34	3.21	0.26	0.43	1.05	0.30	2.09	0.36	1.38	1.53	0.16
PX2 (Mu)	42.25	49.44	42.04	51.27	43.34	43.63	51.90	39.53	22.25	28.77	22.14	30.05	21.45	28.57	30.97	20.05
PY2 (Mu)	4.53	5.30	4.50	5.49	4.64	4.68	5.56	4.23	2.38	3.08	2.37	3.22	2.30	3.06	3.32	2.15
Pu (kip)	46.51	50.85	46.39	52.62	47.39	47.53	52.78	45.09	24.70	29.98	24.63	31.18	24.24	29.82	31.62	23.12

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3142.13	2237.63	58.50	38.18	28.48	3442.21	2237.63	OK
TF Inside	0.00	3241.88	2231.25	130.00	84.84	24.22	4993.11	2231.25	OK
BF Inside	3040.94	4488.75	3072.75	192.00	125.06	34.88	7303.97	3072.75	OK
BF Outside	2973.36	4389.00	3097.19	88.00	57.32	40.13	4989.74	3097.19	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2736.70	2976.75	OK
TF Inside	2823.58	3071.25	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4158.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.22	44.96	41.13	46.22	41.95	42.08	46.54	39.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	504.97
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2823.58	26.14	OK	1692.21	15.67	OK
BF	3040.94	19.75	OK	2518.68	16.36	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2736.70	25.34	1.47	134.83	OK
TF	5560.28	51.48	1.47	269.66	OK
TF Inside	2823.58	26.14	1.47	149.81	OK
BF Inside	3040.94	19.75	1.47	179.78	OK
BF	6014.30	39.05	1.47	359.55	OK
BF Outside	2973.36	19.31	1.47	164.79	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.78	26.39	OK	31.62	15.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.78	1.47	91.65	OK
Web SPL	26.39	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.09
TF Inside	NA	1.09
BF Inside	1.01	NA
BF Outside	1.04	NA

Bolt	Shear	Slip	Bearing
TF	1.38	1.07	5.24
Web	1.37	1.06	1.74
BF	1.83	1.03	8.54

Plate	Shear	Flexure
Web	5.21	1.07

Field Splice - Node 5007

Node 5007

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	154

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5007 L	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00
5007 R	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 5007 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	48.00	3.00	---	144.00	99.38	101.62	70	85
Splice Plates	TF Outside	42.00	1.125	56.50	47.25	32.91	---	70	85
	TF Inside	19.50	1.250	56.50	48.75	32.81	---	70	85
	BF Inside	22.50	1.500	68.50	67.50	45.19	---	70	85
	BF Outside	48.00	1.375	68.50	66.00	45.55	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-39.21	32.36	-45.26	42.71	-38.52	31.07	-46.13	44.28	-39.53	32.60	-39.75	32.86	-47.49	46.64	-36.41	27.43
ϕf Fnc (ksi)	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04
f / ϕf Fnc	0.57	0.47	0.66	0.62	0.56	0.45	0.67	0.64	0.57	0.47	0.58	0.48	0.69	0.68	0.53	0.40
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-39.21		-45.26		-38.52		-46.13		-39.53		-39.75		-47.49		-36.41	
Fcf (ksi)	-54.40		-57.47		-54.05		-57.90		-54.56		-54.67		-58.60		-52.98	
Fcf (kip)	-5140.57		-5430.45		-5107.62		-5472.00		-5156.12		-5166.49		-5537.47		-5006.26	
fncf (ksi)		32.36		42.71		31.07		44.28		32.60		32.86		46.64		27.43
Rcf		1.39		1.27		1.40		1.26		1.38		1.38		1.23		1.46
Fncf (ksi)		51.78		54.98		51.78		56.35		51.78		51.78		58.34		51.78
Fncf (kip)		5261.82		5587.28		5261.82		5726.22		5261.82		5261.82		5928.35		5261.82

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.05	23.72	-33.32	31.01	-28.56	22.78	-33.94	32.14	-29.46	24.33	-31.80	28.19	-34.90	33.81	-27.07	20.22
Fs (ksi)	-29.05	23.72	-33.32	31.01	-28.56	22.78	-33.94	32.14	-29.46	24.33	-31.80	28.19	-34.90	33.81	-27.07	20.22
Fs (kip)	-2744.95	3416.05	-3148.90	4466.00	-2698.98	3280.95	-3206.86	4628.61	-2783.66	3503.55	-3004.72	4059.37	-3298.11	4869.02	-2557.72	2911.53

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5928.35	0.00	4869.02
Comp	5537.47	0.00	3298.11	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	113.38	166.16	26.54	345.37	121.02	120.09	259.00	41.04	83.40	120.25	15.90	247.30	90.43	153.65	186.29	31.85
Vuw (kip)	170.07	249.25	39.81	518.05	181.53	180.14	388.51	61.57	---	---	---	---	---	---	---	---
Mv (k*ft)	95.66	140.20	22.39	291.40	102.11	101.33	218.54	34.63	46.91	67.64	8.94	139.11	50.86	86.43	104.79	17.92
Huw (kip)	-420.56	-117.46	-466.64	-73.55	-423.45	-418.94	-12.18	-591.82	-255.58	-110.77	-277.26	-86.01	-246.07	-173.08	-52.22	-328.65
Muw (k*ft)	6306.81	7098.20	6201.35	7212.27	6323.73	6343.60	7381.56	5899.03	3377.26	4117.47	3286.08	4229.00	3442.36	3839.11	4397.65	3026.22
Mu (k*ft)	6402.48	7238.40	6223.74	7503.67	6425.84	6444.93	7600.10	5933.66	3424.17	4185.12	3295.02	4368.11	3493.23	3925.53	4502.44	3044.14

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.63	1.01	4.02	0.63	3.65	3.61	0.10	5.10	2.20	0.95	2.39	0.74	2.12	1.49	0.45	2.83
PY1 (Vuw)	1.47	2.15	0.34	4.47	1.56	1.55	3.35	0.53	0.72	1.04	0.14	2.13	0.78	1.32	1.61	0.27
PX2 (Mu)	43.38	49.04	42.17	50.84	43.54	43.67	51.49	40.20	23.20	28.36	22.33	29.60	23.67	26.60	30.51	20.63
PY2 (Mu)	4.65	5.25	4.52	5.45	4.66	4.68	5.52	4.31	2.49	3.04	2.39	3.17	2.54	2.85	3.27	2.21
Pu (kip)	47.40	50.60	46.45	52.42	47.60	47.69	52.36	45.56	25.61	29.59	24.84	30.80	26.00	28.40	31.34	23.59

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3142.13	2237.63	58.50	38.18	28.48	3442.21	2237.63	OK
TF Inside	0.00	3241.88	2231.25	130.00	84.84	24.22	4993.11	2231.25	OK
BF Inside	2997.48	4488.75	3072.75	192.00	125.06	34.88	7303.97	3072.75	OK
BF Outside	2930.87	4389.00	3097.19	88.00	57.32	40.13	4989.74	3097.19	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2725.48	2976.75	OK
TF Inside	2812.00	3071.25	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4158.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.95	44.74	41.21	46.02	42.11	42.19	46.15	40.39
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	518.05
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2812.00	26.04	OK	1674.82	15.51	OK
BF	2997.48	19.46	OK	2461.87	15.99	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2725.48	25.24	1.47	134.83	OK
TF	5537.47	51.27	1.47	269.66	OK
TF Inside	2812.00	26.04	1.47	149.81	OK
BF Inside	2997.48	19.46	1.47	179.78	OK
BF	5928.35	38.50	1.47	359.55	OK
BF Outside	2930.87	19.03	1.47	164.79	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.42	26.21	OK	31.34	15.67	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.42	1.47	91.65	OK
Web SPL	26.21	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.09
TF Inside	NA	1.09
BF Inside	1.03	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.39	1.09	5.26
Web	1.38	1.07	1.75
BF	1.86	1.05	8.66

Plate	Shear	Flexure
Web	5.08	1.08

Field Splice - Node 7007

Node 7007

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	154

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7007 L	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00
7007 R	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 7007 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	48.00	3.00	---	144.00	99.38	101.62	70	85
Splice Plates	TF Outside	42.00	1.125	56.50	47.25	32.91	---	70	85
	TF Inside	19.50	1.250	56.50	48.75	32.81	---	70	85
	BF Inside	22.50	1.500	68.50	67.50	45.19	---	70	85
	BF Outside	48.00	1.375	68.50	66.00	45.55	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-35.61	28.99	-42.16	39.91	-35.29	28.46	-43.29	42.06	-36.68	30.47	-36.75	30.40	-44.41	44.18	-33.28	24.76
ϕf Fnc (ksi)	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04	69.04
f / ϕf Fnc	0.52	0.42	0.61	0.58	0.51	0.41	0.63	0.61	0.53	0.44	0.53	0.44	0.64	0.64	0.48	0.36
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-35.61		-42.16		-35.29		-43.29		-36.68		-36.75		-44.41		-33.28	
Fcf (ksi)	-52.57		-55.90		-52.41		-56.46		-53.11		-53.15		-57.03		-51.78	
Fcf (kip)	-4968.07		-5282.13		-4952.84		-5335.94		-5019.18		-5022.56		-5389.48		-4893.32	
fncf (ksi)		28.99		39.91		28.46		42.06		30.47		30.40		44.18		24.76
Rcf		1.48		1.33		1.49		1.30		1.45		1.45		1.28		1.56
Fncf (ksi)		51.78		53.64		51.78		55.62		51.78		51.78		57.52		51.78
Fncf (kip)		5261.82		5450.77		5261.82		5652.06		5261.82		5261.82		5845.37		5261.82

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.39	21.41	-31.03	28.88	-26.17	21.04	-31.84	30.42	-29.77	27.02	-27.07	22.03	-32.66	32.20	-24.80	18.22
Fs (ksi)	-26.39	21.41	-31.03	28.88	-26.17	21.04	-31.84	30.42	-29.77	27.02	-27.07	22.03	-32.66	32.20	-24.80	18.22
Fs (kip)	-2494.30	3082.73	-2932.41	4158.45	-2473.07	3029.35	-3009.21	4380.10	-2813.33	3891.46	-2558.32	3171.75	-3086.60	4636.71	-2343.35	2623.73

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5845.37	0.00	4636.71
Comp	5389.48	0.00	3086.60	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	92.12	222.06	34.12	354.19	121.22	121.44	270.59	35.38	68.05	160.34	21.14	253.69	141.48	84.29	194.15	28.44
Vuw (kip)	138.17	333.10	51.19	531.28	181.83	182.15	405.89	53.07	---	---	---	---	---	---	---	---
Mv (k*ft)	77.72	187.37	28.79	298.84	102.28	102.46	228.31	29.85	38.28	90.19	11.89	142.70	79.58	47.41	109.21	16.00
Huw (kip)	-434.76	-106.76	-452.37	-39.93	-396.71	-405.49	23.30	-602.65	-239.37	-103.33	-246.38	-68.45	-131.84	-242.22	-22.22	-315.70
Muw (k*ft)	6057.43	6914.33	6013.59	7075.32	6176.44	6169.25	7231.16	5733.71	3059.36	3834.17	3021.26	3984.69	3634.86	3142.29	4151.15	2753.13
Mu (k*ft)	6135.16	7101.70	6042.39	7374.16	6278.72	6271.71	7459.48	5763.56	3097.64	3924.36	3033.15	4127.39	3714.44	3189.70	4260.36	2769.13

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.75	0.92	3.90	0.34	3.42	3.50	0.20	5.20	2.06	0.89	2.12	0.59	1.14	2.09	0.19	2.72
PY1 (Vuw)	1.19	2.87	0.44	4.58	1.57	1.57	3.50	0.46	0.59	1.38	0.18	2.19	1.22	0.73	1.67	0.25
PX2 (Mu)	41.57	48.12	40.94	49.96	42.54	42.49	50.54	39.05	20.99	26.59	20.55	27.97	25.17	21.61	28.87	18.76
PY2 (Mu)	4.45	5.16	4.39	5.35	4.56	4.55	5.42	4.18	2.25	2.85	2.20	3.00	2.70	2.32	3.09	2.01
Pu (kip)	45.67	49.69	45.10	51.28	46.37	46.40	51.52	44.49	23.23	27.80	22.80	29.02	26.59	23.89	29.45	21.60

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3142.13	2237.63	58.50	38.18	28.48	3442.21	2237.63	OK
TF Inside	0.00	3241.88	2231.25	130.00	84.84	24.22	4993.11	2231.25	OK
BF Inside	2955.52	4488.75	3072.75	192.00	125.06	34.88	7303.97	3072.75	OK
BF Outside	2889.85	4389.00	3097.19	88.00	57.32	40.13	4989.74	3097.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2652.64	2976.75	OK
TF Inside	2736.85	3071.25	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4158.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.43	43.83	40.00	44.99	41.02	41.04	45.38	39.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	531.28
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2736.85	25.34	OK	1567.41	14.51	OK
BF	2955.52	19.19	OK	2344.41	15.22	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2652.64	24.56	1.47	134.83	OK
TF	5389.48	49.90	1.47	269.66	OK
TF Inside	2736.85	25.34	1.47	149.81	OK
BF Inside	2955.52	19.19	1.47	179.78	OK
BF	5845.37	37.96	1.47	359.55	OK
BF Outside	2889.85	18.77	1.47	164.79	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.52	25.76	OK	29.45	14.72	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.52	1.47	91.65	OK
Web SPL	25.76	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.04	NA
BF Outside	1.07	NA

Bolt	Shear	Slip	Bearing
TF	1.43	1.16	5.40
Web	1.40	1.14	1.78
BF	1.89	1.11	8.78

Plate	Shear	Flexure
Web	4.95	1.10

Field Splice - Node 9007

Node 9007

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	154

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9007 L	94.50	69.06	6526.07	144.00	69.06	9944.49	96.00	50.00	4800.00
9007 R	94.50	69.06	6526.07	144.00	69.06	9944.49	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 9007 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	48.00	3.00	---	144.00	99.38	101.62	70	85
Splice Plates	TF Outside	42.00	1.125	56.50	47.25	32.91	---	70	85
	TF Inside	19.50	1.250	56.50	48.75	32.81	---	70	85
	BF Inside	22.50	1.500	68.50	67.50	45.19	---	70	85
	BF Outside	48.00	1.375	68.50	66.00	45.55	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.07	23.30	-37.31	36.27	-29.17	23.33	-37.67	36.82	-30.80	25.70	-30.91	25.55	-39.04	39.32	-27.08	19.61
ϕf Fnc (ksi)	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06	69.06
f / ϕf Fnc	0.42	0.34	0.54	0.53	0.42	0.34	0.55	0.53	0.45	0.37	0.45	0.37	0.57	0.57	0.39	0.28
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.07		-37.31		-29.17		-37.67		-30.80		-30.91			39.32	-27.08	
Fcf (ksi)	-51.79		-53.44		-51.79		-53.62		-51.79		-51.79			54.46	-51.79	
Fcf (kip)	-4894.55		-5050.19		-4894.55		-5067.27		-4894.55		-4894.55			5533.64	-4894.55	
fncf (ksi)		23.30		36.27		23.33		36.82		25.70		25.55	-39.04			19.61
Rcf		1.78		1.43		1.78		1.42		1.68		1.68	1.39			1.91
Fncf (ksi)		51.79		52.65		51.79		53.12		51.79		51.79	-54.81			51.79
Fncf (kip)		5263.15		5350.02		5263.15		5398.10		5263.15		5263.15	-5179.90			5263.15

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.68	17.45	-27.47	26.23	-21.75	17.48	-27.72	26.62	-26.09	24.41	-21.84	16.97	-28.78	28.84	-20.28	14.51
Fs (ksi)	-21.68	17.45	-27.47	26.23	-21.75	17.48	-27.72	26.62	-26.09	24.41	-21.84	16.97	-28.78	28.84	-20.28	14.51
Fs (kip)	-2048.37	2512.99	-2595.63	3776.57	-2055.29	2516.67	-2619.43	3832.64	-2465.18	3514.85	-2063.61	2443.90	-2720.03	4152.95	-1916.72	2089.69

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5533.64	0.00	4152.95
Comp	5179.90	0.00	2720.03	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	94.09	294.67	7.84	344.76	124.19	125.73	265.30	34.95	69.64	212.25	2.38	247.64	169.46	57.14	190.60	28.76
Vuw (kip)	141.13	442.00	11.77	517.14	186.29	188.59	397.95	52.43	---	---	---	---	---	---	---	---
Mv (k*ft)	79.39	248.63	6.62	290.89	104.79	106.08	223.85	29.49	39.17	119.39	1.34	139.30	95.32	32.14	107.21	16.17
Huw (kip)	-460.29	-37.51	-464.29	-23.66	-378.61	-398.01	-16.94	-652.19	-202.78	-59.56	-205.07	-52.96	-80.54	-233.55	2.72	-277.01
Muw (k*ft)	5926.81	6698.50	5921.49	6739.79	6035.72	6009.85	6899.26	5670.95	2504.14	3436.36	2510.46	3477.40	3231.70	2483.75	3687.89	2226.85
Mu (k*ft)	6006.20	6947.13	5928.11	7030.68	6140.51	6115.93	7123.11	5700.45	2543.31	3555.75	2511.80	3616.70	3327.02	2515.90	3795.10	2243.02

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.97	0.32	4.00	0.20	3.26	3.43	0.15	5.62	1.75	0.51	1.77	0.46	0.69	2.01	0.02	2.39
PY1 (Vuw)	1.22	3.81	0.10	4.46	1.61	1.63	3.43	0.45	0.60	1.83	0.02	2.13	1.46	0.49	1.64	0.25
PX2 (Mu)	40.70	47.07	40.17	47.64	41.61	41.44	48.26	38.62	17.23	24.09	17.02	24.51	22.54	17.05	25.71	15.20
PY2 (Mu)	4.36	5.04	4.30	5.10	4.46	4.44	5.17	4.14	1.85	2.58	1.82	2.63	2.42	1.83	2.76	1.63
Pu (kip)	45.01	48.21	44.39	48.79	45.28	45.28	49.17	44.48	19.14	25.00	18.88	25.41	23.56	19.20	26.11	17.69

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3142.13	2237.63	58.50	38.18	28.48	3442.21	2237.63	OK
TF Inside	0.00	3241.88	2231.25	130.00	84.84	24.22	4993.11	2231.25	OK
BF Inside	2797.91	4488.75	3072.75	192.00	125.06	34.88	7303.97	3072.75	OK
BF Outside	2735.73	4389.00	3097.19	88.00	57.32	40.13	4989.74	3097.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2549.48	2976.75	OK
TF Inside	2630.42	3071.25	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4158.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.84	42.38	39.40	42.78	40.05	40.04	43.29	39.43
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	517.14
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9007**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2630.42	24.36	OK	1381.26	12.79	OK
BF	2797.91	18.17	OK	2099.80	13.64	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2549.48	23.61	1.47	134.83	OK
TF	5179.90	47.96	1.47	269.66	OK
TF Inside	2630.42	24.36	1.47	149.81	OK
BF Inside	2797.91	18.17	1.47	179.78	OK
BF	5533.64	35.93	1.47	359.55	OK
BF Outside	2735.73	17.76	1.47	164.79	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.17	24.58	OK	26.11	13.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.17	1.47	91.65	OK
Web SPL	24.58	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.17
TF Inside	NA	1.17
BF Inside	1.10	NA
BF Outside	1.13	NA

Bolt	Shear	Slip	Bearing
TF	1.49	1.32	5.62
Web	1.47	1.29	1.86
BF	1.99	1.23	9.28

Plate	Shear	Flexure
Web	5.09	1.15

Field Splice

Type B

Field Splice - Node 1015

Node 1015

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	96
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1015 L	94.50	69.06	6526.07	144.00	69.06	9944.49	96.00	50.00	4800.00
1015 R	84.00	68.08	5718.49	84.00	68.08	5718.49	120.00	50.00	6000.00

Rh = 0.97

Controlling Section = 1015 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.00	---	84.00	58.50	59.82	70	85
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	TF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	Web	89.00	0.875	26.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.46	23.65	-6.88	7.14	-16.38	24.22	-12.49	15.89	-18.95	28.21	4.71	-6.03	7.64	-9.46	-19.97	31.38
ϕf Fnc (ksi)	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	59.12	68.08	59.12	68.08	68.08
f / ϕf Fnc	0.24	0.35	0.10	0.10	0.24	0.36	0.18	0.23	0.28	0.41	0.07	0.10	0.11	0.16	0.29	0.46
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.84	0.97	0.84	0.97	0.97
fcf (ksi)		23.65		7.14		24.22		15.89		28.21		-6.03		-9.46		31.38
Fcf (ksi)		51.06		51.06		51.06		51.06		51.06		-44.34		-44.34		51.06
Fcf (kip)		3054.26		3054.26		3054.26		3054.26		3054.26		-3724.47		-3724.47		3054.26
fncf (ksi)	-16.46		-6.88		-16.38		-12.49		-18.95		4.71		7.64		-19.97	
Rcf	2.16		7.15		2.11		3.21		1.81		7.35		4.69		1.63	
Fncf (ksi)	-51.06		-51.06		-51.06		-51.06		-51.06		51.06		51.06		-51.06	
Fncf (kip)	-4288.87		-4288.87		-4288.87		-4288.87		-4288.87		3054.26		3054.26		-4288.87	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.10	16.99	-5.61	4.83	-12.04	17.39	-9.14	11.63	-13.85	20.21	-2.95	-2.64	-1.33	-4.73	-14.58	22.45
Fs (ksi)	-12.10	16.99	-5.61	4.83	-12.04	17.39	-9.14	11.63	-13.85	20.21	-2.95	-2.64	-1.33	-4.73	-14.58	22.45
Fs (kip)	-1016.12	1427.38	-471.60	406.10	-1011.23	1460.72	-768.08	976.96	-1163.72	1697.98	-247.51	-221.98	-111.68	-396.98	-1224.74	1885.93

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3054.26	3054.26	0.00	1885.93
Comp	4288.87	3724.47	1224.74	396.98

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	927.64	649.91	542.48	981.07	758.81	690.15	715.66	764.44	672.62	483.59	400.49	713.32	553.33	507.78	525.80	557.31
Vuw (kip)	1391.46	974.87	813.72	1471.60	1138.21	1035.23	1073.49	1146.65	---	---	---	---	---	---	---	---
Mv (k*ft)	782.70	548.36	457.72	827.78	640.25	582.31	603.84	644.99	378.35	272.02	225.28	401.24	311.25	285.62	295.76	313.49
Huw (kip)	847.69	24.79	907.55	571.48	922.13	-510.42	-438.83	1029.36	293.76	-46.79	321.06	149.20	381.62	-335.35	-363.33	472.28
Muw (k*ft)	6814.62	7911.82	6734.81	7182.91	6715.37	6218.81	6314.26	6572.40	2327.14	835.90	2354.24	1661.94	2725.42	24.31	271.71	2962.54
Mu (k*ft)	7597.32	8460.18	7192.52	8010.69	7355.62	6801.12	6918.09	7217.39	2705.49	1107.92	2579.52	2063.18	3036.67	309.93	567.47	3276.03

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	7.31	0.21	7.82	4.93	7.95	4.40	3.78	8.87	2.53	0.40	2.77	1.29	3.29	2.89	3.13	4.07
PY1 (Vuw)	12.00	8.40	7.01	12.69	9.81	8.92	9.25	9.88	5.80	4.17	3.45	6.15	4.77	4.38	4.53	4.80
PX2 (Mu)	51.48	57.32	48.73	54.28	49.84	46.08	46.87	48.90	18.33	7.51	17.48	13.98	20.58	2.10	3.84	22.20
PY2 (Mu)	5.52	6.14	5.22	5.82	5.34	4.94	5.02	5.24	1.96	0.80	1.87	1.50	2.20	0.22	0.41	2.38
Pu (kip)	61.34	59.35	57.87	62.03	59.74	52.35	52.63	59.72	22.26	9.34	20.93	17.07	24.86	6.79	8.55	27.23

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1583.69	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK
TF Inside	1470.57	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Inside	1470.57	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Outside	1583.69	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2223.86	2315.25	OK
TF Inside	2065.01	2149.88	OK
BF Inside	1793.26	2149.88	OK
BF Outside	1931.21	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.90	44.10	43.19	45.28	44.13	38.60	38.75	44.10
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1471.60
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.89	1.0	32.06
Web	0.13	1.00	1.0	36.19
BF	1.00	0.73	1.0	26.38

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2223.86	23.17	OK	635.05	6.62	OK
BF	1931.21	20.12	OK	977.89	10.19	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2223.86	23.17	1.47	104.87	OK
TF	4288.87	44.68	1.47	239.70	OK
TF Inside	2065.01	21.51	1.47	104.87	OK
BF Inside	1793.26	18.68	1.47	104.87	OK
BF	3724.47	38.80	1.47	239.70	OK
BF Outside	1931.21	20.12	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
62.03	31.01	OK	27.23	13.62	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	62.03	1.47	114.56	OK
Web SPL	31.01	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.10	1.04
TF Inside	1.06	1.04
BF Inside	1.06	1.20
BF Outside	1.10	1.20

Bolt	Shear	Slip	Bearing
TF	1.38	2.54	4.53
Web	1.17	1.24	1.85
BF	1.31	1.65	5.21

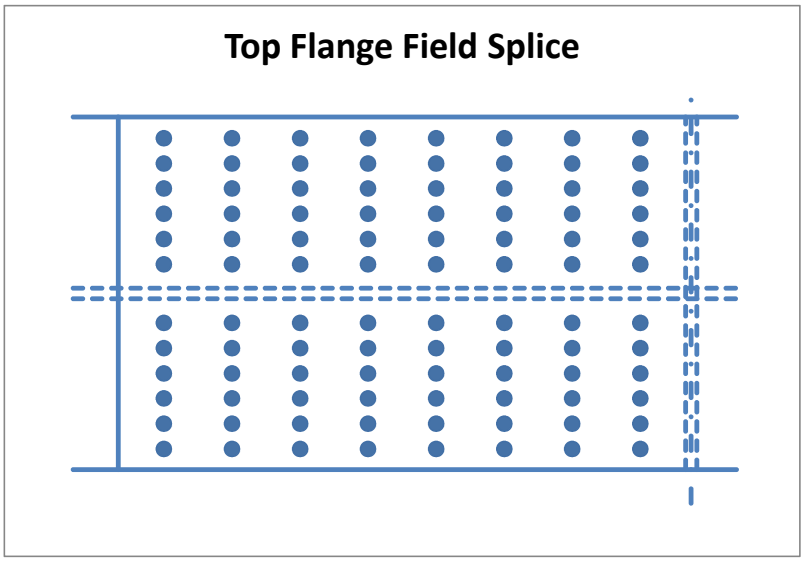
Plate	Shear	Flexure
Web	2.09	1.10

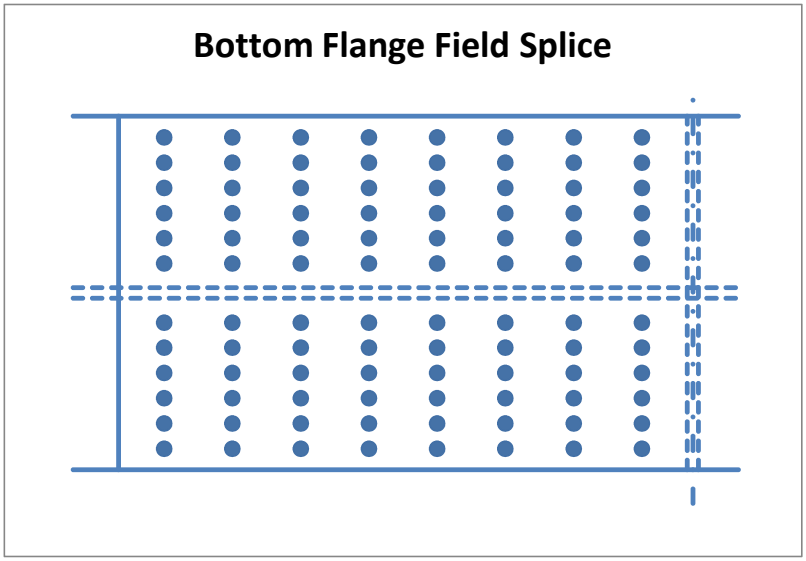
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1015	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1015

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	15	0	15
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
0	34	0	34
0	37	0	37
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	15	3	15
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
3	34	3	34
3	37	3	37
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	15	6	15
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
6	34	6	34
6	37	6	37
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	15	9	15
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
9	34	9	34
9	37	9	37
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	15	12	15
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
12	34	12	34

	Top Flange		Bottom Flange	
No. Bolts =	96.0		96.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	7.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	37	12	37
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	15	15	15
15	22	15	22
15	25	15	25
15	28	15	28
15	31	15	31
15	34	15	34
15	37	15	37
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	15	18	15
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
18	34	18	34
18	37	18	37
21	0	21	0
21	3	21	3
21	6	21	6
21	9	21	9
21	12	21	12
21	15	21	15
21	22	21	22
21	25	21	25
21	28	21	28
21	31	21	31
21	34	21	34
21	37	21	37

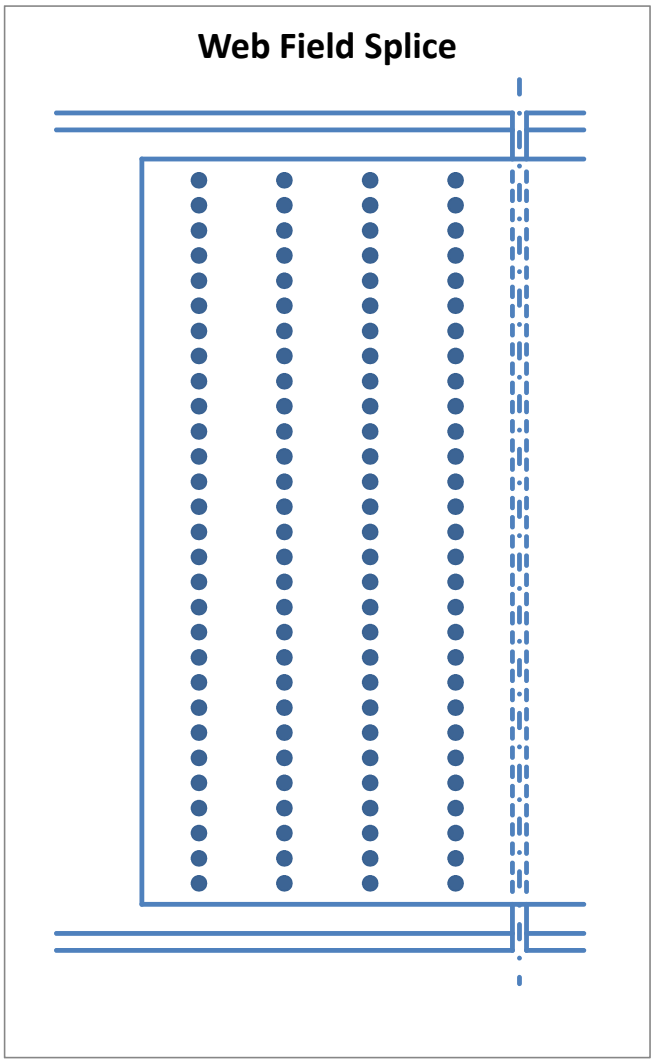
Flange Bolt Pattern Cont. - Node 1015

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1015	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1015

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 1015

Web Bolt Pattern Cont. - Node 1015

522	4872	1305	73080

Field Splice - Node 3015

Node 3015

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	96
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3015 L	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00
3015 R	84.00	68.06	5716.78	84.00	68.06	5716.78	120.00	50.00	6000.00

Rh = 0.97

Controlling Section = 3015 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.00	---	84.00	58.50	59.82	70	85
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	TF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	Web	89.00	0.875	26.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.10	21.17	-4.14	3.82	-14.94	21.82	-11.81	14.46	-16.88	24.55	1.04	-2.07	6.75	-8.66	-18.74	30.11
ϕf Fnc (ksi)	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	59.11	68.06	59.11	68.06	68.06
f / ϕf Fnc	0.22	0.31	0.06	0.06	0.22	0.32	0.17	0.21	0.25	0.36	0.02	0.04	0.10	0.15	0.28	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.84	0.97	0.84	0.97	0.97
fcf (ksi)		21.17	-4.14			21.82		14.46		24.55		-2.07		-8.66		30.11
Fcf (ksi)		51.04	-51.04			51.04		51.04		51.04		-44.33		-44.33		51.04
Fcf (kip)		3053.35	-4287.59			3053.35		3053.35		3053.35		-3723.79		-3723.79		3053.35
fncf (ksi)	-15.10			3.82	-14.94		-11.81		-16.88		1.04		6.75		-18.74	
Rcf	2.41			12.32	2.34		3.53		2.08		21.42		5.12		1.69	
Fncf (ksi)	-51.04			51.04	-51.04		-51.04		-51.04		51.04		51.04		-51.04	
Fncf (kip)	-4287.59			3053.35	-4287.59		-4287.59		-4287.59		3053.35		3053.35		-4287.59	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.11	15.27	-4.97	3.42	-11.00	15.73	-8.64	10.55	-12.37	17.66	-4.04	0.67	-1.95	-4.33	-13.68	21.59
Fs (ksi)	-11.11	15.27	-4.97	3.42	-11.00	15.73	-8.64	10.55	-12.37	17.66	-4.04	0.67	-1.95	-4.33	-13.68	21.59
Fs (kip)	-933.00	1282.80	-417.20	287.44	-923.78	1321.53	-725.90	885.94	-1038.80	1483.66	-339.76	55.86	-163.56	-363.64	-1149.35	1813.61

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3053.35	3053.35	0.00	1813.61
Comp	4287.59	3723.79	1149.35	363.64

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	984.65	747.35	606.77	1041.54	835.76	761.98	777.60	891.31	712.12	546.30	445.13	754.15	606.93	556.63	567.67	646.17
Vuw (kip)	1476.98	1121.03	910.15	1562.31	1253.65	1142.96	1166.41	1336.97	---	---	---	---	---	---	---	---
Mv (k*ft)	830.80	630.58	511.96	878.80	705.18	642.92	656.10	752.04	400.57	307.29	250.39	424.21	341.40	313.10	319.32	363.47
Huw (kip)	793.53	-157.08	880.64	476.58	872.20	-1247.69	-512.31	1071.47	249.86	-92.69	284.11	114.31	317.75	-202.78	-376.57	474.48
Muw (k*ft)	6882.09	7730.70	6765.94	7304.69	6777.21	5232.46	6212.97	6511.51	2110.28	671.08	2138.39	1535.09	2402.34	376.78	190.55	2821.87
Mu (k*ft)	7712.89	8361.28	7277.90	8183.50	7482.38	5875.37	6869.07	7263.56	2510.85	978.38	2388.78	1959.29	2743.74	689.89	509.87	3185.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	6.84	1.35	7.59	4.11	7.52	10.76	4.42	9.24	2.15	0.80	2.45	0.99	2.74	1.75	3.25	4.09
PY1 (Vuw)	12.73	9.66	7.85	13.47	10.81	9.85	10.06	11.53	6.14	4.71	3.84	6.50	5.23	4.80	4.89	5.57
PX2 (Mu)	52.26	56.65	49.31	55.45	50.70	39.81	46.54	49.21	17.01	6.63	16.19	13.28	18.59	4.67	3.45	21.58
PY2 (Mu)	5.60	6.07	5.28	5.94	5.43	4.27	4.99	5.27	1.82	0.71	1.73	1.42	1.99	0.50	0.37	2.31
Pu (kip)	61.88	60.10	58.40	62.64	60.44	52.50	53.13	60.82	20.75	9.20	19.45	16.31	22.52	8.33	8.52	26.86

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1583.22	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK
TF Inside	1470.13	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Inside	1470.13	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Outside	1583.22	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2223.19	2315.25	OK
TF Inside	2064.39	2149.88	OK
BF Inside	1792.94	2149.88	OK
BF Outside	1930.85	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.16	44.44	43.46	45.57	44.46	38.53	38.97	44.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1562.31
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.89	1.0	32.06
Web	0.13	1.00	1.0	36.19
BF	1.00	0.73	1.0	26.38

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2223.19	23.16	OK	595.96	6.21	OK
BF	1930.85	20.11	OK	940.39	9.80	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2223.19	23.16	1.47	104.87	OK
TF	4287.59	44.66	1.47	239.70	OK
TF Inside	2064.39	21.50	1.47	104.87	OK
BF Inside	1792.94	18.68	1.47	104.87	OK
BF	3723.79	38.79	1.47	239.70	OK
BF Outside	1930.85	20.11	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
62.64	31.32	OK	26.86	13.43	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	62.64	1.47	114.56	OK
Web SPL	31.32	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.10	1.04
TF Inside	1.06	1.04
BF Inside	1.06	1.20
BF Outside	1.10	1.20

Bolt	Shear	Slip	Bearing
TF	1.38	2.71	4.53
Web	1.16	1.25	1.83
BF	1.31	1.72	5.21

Plate	Shear	Flexure
Web	1.97	1.10

Field Splice - Node 5015

Node 5015

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	96
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5015 L	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00
5015 R	84.00	68.06	5716.78	84.00	68.06	5716.78	120.00	50.00	6000.00

Rh = 0.97

Controlling Section = 5015 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.00	---	84.00	58.50	59.82	70	85
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	TF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	Web	89.00	0.875	26.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.70	17.50	-9.71	10.26	-14.17	21.14	-10.53	11.83	-12.89	15.98	-8.49	7.98	6.52	-8.42	-17.21	27.96
ϕf Fnc (ksi)	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	59.11	68.06	68.06
f / ϕf Fnc	0.19	0.26	0.14	0.15	0.21	0.31	0.15	0.17	0.19	0.23	0.12	0.12	0.10	0.14	0.25	0.41
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.84	0.97	0.97
fcf (ksi)		17.50		10.26		21.14		11.83		15.98	-8.49			-8.42		27.96
Fcf (ksi)		51.04		51.04		51.04		51.04		51.04	-51.04			-44.33		51.04
Fcf (kip)		3053.35		3053.35		3053.35		3053.35		3053.35	-4287.59			-3723.79		3053.35
fncf (ksi)	-12.70		-9.71		-14.17		-10.53		-12.89			7.98	6.52		-17.21	
Rcf	2.92		4.97		2.41		4.32		3.19			6.01	5.27		1.83	
Fncf (ksi)	-51.04		-51.04		-51.04		-51.04		-51.04			51.04	51.04		-51.04	
Fncf (kip)	-4287.59		-4287.59		-4287.59		-4287.59		-4287.59			3053.35	3053.35		-4287.59	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.29	12.62	-7.11	7.45	-10.41	15.35	-7.76	8.61	-9.51	11.71	-6.29	5.86	-2.63	-4.35	-12.56	20.17
Fs (ksi)	-9.29	12.62	-7.11	7.45	-10.41	15.35	-7.76	8.61	-9.51	11.71	-6.29	5.86	-2.63	-4.35	-12.56	20.17
Fs (kip)	-780.34	1059.68	-597.32	625.96	-874.52	1289.71	-651.56	723.20	-798.52	983.73	-528.00	492.06	-220.91	-365.78	-1055.05	1694.37

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3053.35	3053.35	0.00	1694.37
Comp	4287.59	3723.79	1055.05	365.78

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	1007.63	732.21	635.49	1072.27	859.23	802.48	801.10	922.33	729.29	536.81	465.63	774.95	623.70	584.34	583.37	668.28
Vuw (kip)	1511.45	1098.31	953.24	1608.40	1288.85	1203.72	1201.65	1383.49	---	---	---	---	---	---	---	---
Mv (k*ft)	850.19	617.80	536.20	904.72	724.98	677.09	675.93	778.21	410.22	301.96	261.91	435.91	350.83	328.69	328.14	375.91
Huw (kip)	755.45	79.75	924.18	252.18	507.20	-99.02	-525.16	1091.76	199.53	20.45	296.57	51.17	132.30	-25.67	-419.07	456.66
Muw (k*ft)	6932.86	7833.81	6707.90	7603.89	7263.87	7808.10	6195.83	6484.46	1752.41	1165.03	2061.18	1309.29	1697.38	971.49	137.97	2618.49
Mu (k*ft)	7783.05	8451.61	7244.10	8508.62	7988.85	8485.20	6871.75	7262.67	2162.63	1466.98	2323.09	1745.20	2048.21	1300.18	466.11	2994.40

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	6.51	0.69	7.97	2.17	4.37	0.85	4.53	9.41	1.72	0.18	2.56	0.44	1.14	0.22	3.61	3.94
PY1 (Vuw)	13.03	9.47	8.22	13.87	11.11	10.38	10.36	11.93	6.29	4.63	4.01	6.68	5.38	5.04	5.03	5.76
PX2 (Mu)	52.73	57.26	49.08	57.65	54.13	57.49	46.56	49.21	14.65	9.94	15.74	11.82	13.88	8.81	3.16	20.29
PY2 (Mu)	5.65	6.14	5.26	6.18	5.80	6.16	4.99	5.27	1.57	1.06	1.69	1.27	1.49	0.94	0.34	2.17
Pu (kip)	62.12	60.02	58.62	63.09	60.90	60.64	53.34	61.09	18.16	11.61	19.16	14.62	16.51	10.83	8.64	25.49

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1583.22	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK
TF Inside	1470.13	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Inside	1470.13	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Outside	1583.22	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2223.19	2315.25	OK
TF Inside	2064.39	2149.88	OK
BF Inside	1792.94	2149.88	OK
BF Outside	1930.85	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.28	44.41	43.56	45.81	44.75	44.71	39.06	44.73
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1608.40
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.89	1.0	32.06
Web	0.13	1.00	1.0	36.19
BF	1.00	0.73	1.0	26.38

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2223.19	23.16	OK	547.06	5.70	OK
BF	1930.85	20.11	OK	878.56	9.15	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2223.19	23.16	1.47	104.87	OK
TF	4287.59	44.66	1.47	239.70	OK
TF Inside	2064.39	21.50	1.47	104.87	OK
BF Inside	1792.94	18.68	1.47	104.87	OK
BF	3723.79	38.79	1.47	239.70	OK
BF Outside	1930.85	20.11	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
63.09	31.55	OK	25.49	12.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	63.09	1.47	114.56	OK
Web SPL	31.55	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.10	1.04
TF Inside	1.06	1.04
BF Inside	1.06	1.20
BF Outside	1.10	1.20

Bolt	Shear	Slip	Bearing
TF	1.38	2.95	4.53
Web	1.15	1.32	1.82
BF	1.31	1.84	5.21

Plate	Shear	Flexure
Web	1.91	1.09

Field Splice - Node 7015

Node 7015

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	96
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7015 L	94.50	69.04	6524.43	144.00	69.04	9941.99	96.00	50.00	4800.00
7015 R	84.00	68.06	5716.78	84.00	68.06	5716.78	120.00	50.00	6000.00

Rh = 0.97

Controlling Section = 7015 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.00	---	84.00	58.50	59.82	70	85
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	TF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	Web	89.00	0.875	26.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.80	18.13	-6.95	6.97	-13.94	20.72	-10.33	13.06	-4.65	4.22	-14.12	20.64	7.53	-9.57	-17.22	28.66
ϕf Fnc (ksi)	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	68.06	59.11	68.06	68.06
f / ϕf Fnc	0.19	0.27	0.10	0.10	0.20	0.30	0.15	0.19	0.07	0.06	0.21	0.30	0.11	0.16	0.25	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.84	0.97	0.97
fcf (ksi)		18.13		6.97		20.72		13.06	-4.65			20.64		-9.57		28.66
Fcf (ksi)		51.04		51.04		51.04		51.04	-51.04			51.04		-44.33		51.04
Fcf (kip)		3053.35		3053.35		3053.35		3053.35	-4287.59			3053.35		-3723.79		3053.35
fncf (ksi)	-12.80		-6.95		-13.94		-10.33			4.22	-14.12		7.53		-17.22	
Rcf	2.82		7.32		2.46		3.91			10.99	2.47		4.63		1.78	
Fncf (ksi)	-51.04		-52.36		-51.04		-51.04			51.04	-51.04		51.04		-51.04	
Fncf (kip)	-4287.59		-4398.25		-4287.59		-4287.59			3053.35	-4287.59		3053.35		-4287.59	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.34	12.94	-6.38	5.70	-10.19	14.81	-7.66	9.76	-5.85	4.04	-10.27	14.71	-2.25	-5.16	-12.53	20.79
Fs (ksi)	-9.34	12.94	-6.38	5.70	-10.19	14.81	-7.66	9.76	-5.85	4.04	-10.27	14.71	-2.25	-5.16	-12.53	20.79
Fs (kip)	-784.59	1086.70	-535.66	479.00	-856.11	1244.15	-643.53	820.22	-491.76	339.77	-862.67	1235.43	-189.34	-433.07	-1052.56	1746.19

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3053.35	3053.35	0.00	1746.19
Comp	4398.25	3723.79	1052.56	433.07

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	947.08	717.09	584.81	1014.46	729.02	815.93	760.66	863.66	685.93	523.54	429.97	733.64	531.97	593.27	554.22	627.09
Vuw (kip)	1420.62	1075.63	877.21	1521.70	1093.53	1223.90	1140.99	1295.49	---	---	---	---	---	---	---	---
Mv (k*ft)	799.10	605.04	493.43	855.95	615.11	688.45	641.81	728.71	385.84	294.49	241.86	412.67	299.23	333.71	311.75	352.74
Huw (kip)	815.28	-76.85	916.79	554.35	-194.22	882.62	-493.37	1137.06	215.79	-40.47	277.17	126.21	-108.56	266.26	-444.58	495.45
Muw (k*ft)	6853.09	8042.61	6717.75	7201.00	7681.18	6763.31	6238.22	6424.06	1782.18	966.34	2000.25	1394.05	791.93	1998.19	232.13	2665.48
Mu (k*ft)	7652.19	8647.65	7211.18	8056.96	8296.29	7451.76	6880.02	7152.77	2168.02	1260.83	2242.11	1806.73	1091.16	2331.91	543.88	3018.22

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	7.03	0.66	7.90	4.78	1.67	7.61	4.25	9.80	1.86	0.35	2.39	1.09	0.94	2.30	3.83	4.27
PY1 (Vuw)	12.25	9.27	7.56	13.12	9.43	10.55	9.84	11.17	5.91	4.51	3.71	6.32	4.59	5.11	4.78	5.41
PX2 (Mu)	51.85	58.59	48.86	54.59	56.21	50.49	46.62	48.46	14.69	8.54	15.19	12.24	7.39	15.80	3.69	20.45
PY2 (Mu)	5.56	6.28	5.23	5.85	6.02	5.41	4.99	5.19	1.57	0.92	1.63	1.31	0.79	1.69	0.39	2.19
Pu (kip)	61.51	61.26	58.19	62.33	59.91	60.25	52.99	60.52	18.16	10.42	18.37	15.36	9.91	19.33	9.13	25.86

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1583.22	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK
TF Inside	1470.13	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Inside	1470.13	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Outside	1583.22	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2280.58	2315.25	OK
TF Inside	2117.68	2149.88	OK
BF Inside	1792.94	2149.88	OK
BF Outside	1930.85	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.98	45.41	43.34	45.41	44.34	44.37	38.90	44.45
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1521.70
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.89	1.0	32.06
Web	0.13	1.00	1.0	36.19
BF	1.00	0.73	1.0	26.38

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2280.58	23.76	OK	545.77	5.69	OK
BF	1930.85	20.11	OK	905.43	9.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2280.58	23.76	1.47	104.87	OK
TF	4398.25	45.82	1.47	239.70	OK
TF Inside	2117.68	22.06	1.47	104.87	OK
BF Inside	1792.94	18.68	1.47	104.87	OK
BF	3723.79	38.79	1.47	239.70	OK
BF Outside	1930.85	20.11	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
62.33	31.16	OK	25.86	12.93	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	62.33	1.47	114.56	OK
Web SPL	31.16	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.10	1.02
TF Inside	1.06	1.02
BF Inside	1.06	1.20
BF Outside	1.10	1.20

Bolt	Shear	Slip	Bearing
TF	1.35	2.96	4.41
Web	1.16	1.30	1.84
BF	1.31	1.78	5.21

Plate	Shear	Flexure
Web	2.02	1.10

Field Splice - Node 9015

Node 9015

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	96
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9015 L	94.50	69.06	6526.07	144.00	69.06	9944.49	96.00	50.00	4800.00
9015 R	84.00	68.08	5718.49	84.00	68.08	5718.49	120.00	50.00	6000.00

Rh = 0.97

Controlling Section = 9015 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.00	---	84.00	58.50	59.82	70	85
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	TF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Inside	19.50	0.875	50.50	34.13	22.97	---	70	85
	BF Outside	42.00	0.875	50.50	36.75	25.59	---	70	85
	Web	89.00	0.875	26.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.64	17.70	-8.54	8.68	-14.69	22.40	-11.11	14.68	5.42	-6.42	-15.46	23.64	9.43	-11.44	-16.98	28.26
ϕf Fnc (ksi)	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	68.08	59.12	68.08	68.08	68.08	59.12	68.08	68.08
f / ϕf Fnc	0.19	0.26	0.13	0.13	0.22	0.33	0.16	0.22	0.08	0.11	0.23	0.35	0.14	0.19	0.25	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.84	0.97	0.97	0.97	0.84	0.97	0.97
fcf (ksi)		17.70		8.68		22.40		14.68		-6.42		23.64		-11.44		28.26
Fcf (ksi)		51.06		51.06		51.06		51.06		-44.34		51.06		-44.34		51.06
Fcf (kip)		3054.26		3054.26		3054.26		3054.26		-3724.47		3054.26		-3724.47		3054.26
fncf (ksi)	-12.64		-8.54		-14.69		-11.11		5.42		-15.46		9.43		-16.98	
Rcf	2.89		5.89		2.28		3.48		6.90		2.16		3.87		1.81	
Fncf (ksi)	-51.06		-51.65		-51.06		-51.06		51.06		-51.06		51.06		-51.06	
Fncf (kip)	-4288.87		-4338.84		-4288.87		-4288.87		3054.26		-4288.87		3054.26		-4288.87	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.91	14.21	-6.39	6.74	-10.72	15.96	-8.21	10.98	-3.77	-2.98	-11.21	16.78	-1.62	-6.45	-12.36	20.58
Fs (ksi)	-9.91	14.21	-6.39	6.74	-10.72	15.96	-8.21	10.98	-3.77	-2.98	-11.21	16.78	-1.62	-6.45	-12.36	20.58
Fs (kip)	-832.66	1193.90	-536.96	566.17	-900.10	1340.80	-689.76	922.74	-316.75	-250.38	-941.59	1409.43	-136.10	-541.95	-1038.21	1728.65

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3054.26	3054.26	0.00	1728.65
Comp	4338.84	3724.47	1038.21	541.95

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	797.09	573.27	477.90	911.74	625.30	691.61	662.67	688.64	626.78	423.64	354.37	662.78	460.40	505.36	484.91	505.15
Vuw (kip)	1195.63	859.91	716.85	1367.61	937.96	1037.41	994.01	1032.96	---	---	---	---	---	---	---	---
Mv (k*ft)	672.54	483.70	403.23	769.28	527.60	583.55	559.13	581.04	352.56	238.30	199.33	372.81	258.98	284.26	272.76	284.15
Huw (kip)	791.06	-34.71	970.89	661.37	-343.21	975.17	-395.52	1138.67	258.02	20.86	314.79	166.41	-405.10	334.17	-484.32	493.17
Muw (k*ft)	6890.13	7991.16	6650.36	7063.05	6441.76	6644.65	6372.00	6426.66	1930.05	1050.60	2134.20	1535.71	63.21	2239.06	386.52	2635.10
Mu (k*ft)	7562.67	8474.86	7053.59	7832.33	6969.36	7228.19	6931.13	7007.70	2282.62	1288.90	2333.53	1908.53	322.18	2523.32	659.29	2919.25

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	6.82	0.30	8.37	5.70	2.96	8.41	3.41	9.82	2.22	0.18	2.71	1.43	3.49	2.88	4.18	4.25
PY1 (Vuw)	10.31	7.41	6.18	11.79	8.09	8.94	8.57	8.90	5.40	3.65	3.05	5.71	3.97	4.36	4.18	4.35
PX2 (Mu)	51.24	57.42	47.79	53.07	47.22	48.98	46.96	47.48	15.47	8.73	15.81	12.93	2.18	17.10	4.47	19.78
PY2 (Mu)	5.49	6.15	5.12	5.69	5.06	5.25	5.03	5.09	1.66	0.94	1.69	1.39	0.23	1.83	0.48	2.12
Pu (kip)	60.17	59.29	57.29	61.31	51.87	59.11	52.18	58.98	19.05	10.02	19.12	16.02	7.06	20.91	9.82	24.89

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1583.69	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK
TF Inside	1470.57	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Inside	1470.57	2269.31	1561.88	80.50	52.61	16.95	3227.73	1561.88	OK
BF Outside	1583.69	2443.88	1740.38	40.25	26.30	22.15	2543.55	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2249.77	2315.25	OK
TF Inside	2089.07	2149.88	OK
BF Inside	1793.26	2149.88	OK
BF Outside	1931.21	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.36	44.24	42.87	44.93	38.40	43.81	38.54	43.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1367.61
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9015**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.89	1.0	32.06
Web	0.13	1.00	1.0	36.19
BF	1.00	0.73	1.0	26.38

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2249.77	23.44	OK	538.33	5.61	OK
BF	1931.21	20.12	OK	896.34	9.34	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2249.77	23.44	1.47	104.87	OK
TF	4338.84	45.20	1.47	239.70	OK
TF Inside	2089.07	21.76	1.47	104.87	OK
BF Inside	1793.26	18.68	1.47	104.87	OK
BF	3724.47	38.80	1.47	239.70	OK
BF Outside	1931.21	20.12	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
61.31	30.66	OK	24.89	12.44	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	61.31	1.47	114.56	OK
Web SPL	30.66	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.10	1.03
TF Inside	1.06	1.03
BF Inside	1.06	1.20
BF Outside	1.10	1.20

Bolt	Shear	Slip	Bearing
TF	1.37	3.00	4.47
Web	1.18	1.35	1.87
BF	1.31	1.80	5.21

Plate	Shear	Flexure
Web	2.25	1.11

Field Splice

Type C

Field Splice - Node 1021

Node 1021

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1021 L	84.00	68.04	5715.34	94.50	68.04	6429.76	144.00	50.00	7200.00
1021 R	76.00	68.21	5184.02	76.00	68.21	5184.02	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 1021 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.99	14.85	30.72	12.52	29.13	7.08	18.75	22.27	26.64	15.82	27.07	8.96	37.06	-2.42	17.07	22.53
ϕf Fnc (ksi)	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	62.45	68.21	68.21
f / ϕf Fnc	0.26	0.22	0.45	0.18	0.43	0.10	0.27	0.33	0.39	0.23	0.40	0.13	0.54	0.04	0.25	0.33
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.89	0.97	0.97
fcf (ksi)	17.99		30.72		29.13			22.27	26.64		27.07		37.06			22.53
Fcf (ksi)	51.16		51.16		51.16			51.16	51.16		51.16		53.12			51.16
Fcf (kip)	2864.09		2864.09		2864.09			2864.09	2864.09		2864.09		2974.01			2864.09
fncf (ksi)		14.85		12.52		7.08	18.75			15.82		8.96		-2.42	17.07	
Rcf		2.84		1.67		1.76	2.30			1.92		1.89		1.43	2.27	
Fncf (ksi)		51.16		51.16		51.16	51.16			51.16		51.16		-46.84	51.16	
Fncf (kip)		2864.09		2864.09		2864.09	2864.09			2864.09		2864.09		-3559.74	2864.09	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	13.47	10.81	19.66	8.23	18.14	4.97	14.19	16.16	18.58	10.72	17.37	5.98	27.16	-1.54	12.82	16.24
Fs (ksi)	13.47	10.81	19.66	8.23	18.14	4.97	14.19	16.16	18.58	10.72	17.37	5.98	27.16	-1.54	12.82	16.24
Fs (kip)	1024.00	821.49	1494.37	625.57	1378.26	377.53	1078.80	1228.15	1412.25	814.65	1320.11	454.41	2064.44	-116.98	974.28	1234.01

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2974.01	2864.09	2064.44	1234.01
Comp	0.00	3559.74	0.00	116.98

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	184.55	267.07	508.46	70.59	242.12	242.99	409.73	96.82	138.56	195.94	367.41	57.11	179.23	178.92	296.72	76.57
Vuw (kip)	276.82	400.61	762.69	105.88	363.18	364.48	614.59	145.23	---	---	---	---	---	---	---	---
Mv (k*ft)	190.31	275.42	524.35	72.79	249.68	250.58	422.53	99.84	95.26	134.71	252.59	39.27	123.22	123.01	204.00	52.64
Huw (kip)	4419.23	3393.60	2989.46	4459.79	3851.42	3205.58	2318.05	4252.96	1165.57	1338.91	1108.92	1457.02	1406.47	1120.75	1229.98	1394.71
Muw (k*ft)	488.57	1856.07	2394.92	434.49	1245.64	2106.77	3535.05	710.26	170.53	731.62	842.72	125.77	503.24	729.01	1836.98	218.72
Mu (k*ft)	678.88	2131.49	2919.27	507.28	1495.33	2357.35	3957.58	810.10	265.79	866.33	1095.31	165.03	626.46	852.02	2040.98	271.36

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.48	23.40	20.62	30.76	26.56	22.11	15.99	29.33	8.04	9.23	7.65	10.05	9.70	7.73	8.48	9.62
PY1 (Vuw)	1.91	2.76	5.26	0.73	2.50	2.51	4.24	1.00	0.96	1.35	2.53	0.39	1.24	1.23	2.05	0.53
PX2 (Mu)	3.64	11.43	15.66	2.72	8.02	12.64	21.23	4.35	1.43	4.65	5.88	0.89	3.36	4.57	10.95	1.46
PY2 (Mu)	0.52	1.63	2.24	0.39	1.15	1.81	3.03	0.62	0.20	0.66	0.84	0.13	0.48	0.65	1.56	0.21
Pu (kip)	34.21	35.11	37.04	33.50	34.77	35.02	37.92	33.72	9.53	14.03	13.94	10.95	13.17	12.44	19.76	11.10

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1548.12	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1425.90	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1373.19	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.89	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.72	1929.38	OK
BF Outside	1853.02	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.22	38.34	40.08	36.48	37.91	38.30	41.35	36.77
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	762.69
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1548.12	15.48	OK	1074.64	10.75	OK
BF	1853.02	23.16	OK	642.36	8.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1548.12	15.48	1.47	134.83	OK
TF	2974.01	29.74	1.47	239.70	OK
TF Inside	1425.90	14.26	1.47	134.83	OK
BF Inside	1706.72	21.33	1.47	104.87	OK
BF	3559.74	44.50	1.47	239.70	OK
BF Outside	1853.02	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.92	18.96	OK	19.76	9.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.92	1.47	91.65	OK
Web SPL	18.96	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.35	NA
TF Inside	1.31	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.34	1.57	8.06
Web	1.61	1.70	2.42
BF	1.38	2.10	4.53

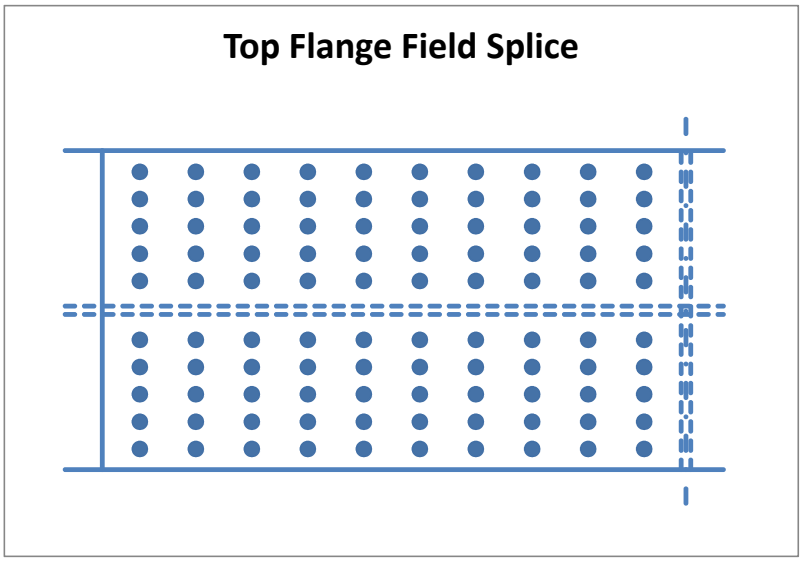
Plate	Shear	Flexure
Web	3.45	1.21

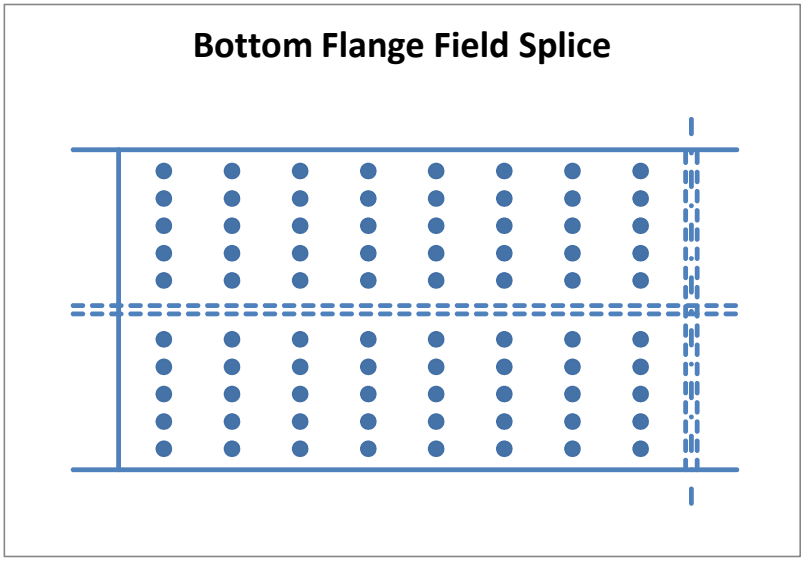
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1021	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1021

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.25	0	3.25
0	6.5	0	6.5
0	9.75	0	9.75
0	13	0	13
0	20	0	20
0	23.25	0	23.25
0	26.5	0	26.5
0	29.75	0	29.75
0	33	0	33
3	0	3	0
3	3.25	3	3.25
3	6.5	3	6.5
3	9.75	3	9.75
3	13	3	13
3	20	3	20
3	23.25	3	23.25
3	26.5	3	26.5
3	29.75	3	29.75
3	33	3	33
6	0	6	0
6	3.25	6	3.25
6	6.5	6	6.5
6	9.75	6	9.75
6	13	6	13
6	20	6	20
6	23.25	6	23.25
6	26.5	6	26.5
6	29.75	6	29.75
6	33	6	33
9	0	9	0
9	3.25	9	3.25
9	6.5	9	6.5
9	9.75	9	9.75
9	13	9	13
9	20	9	20
9	23.25	9	23.25
9	26.5	9	26.5
9	29.75	9	29.75
9	33	9	33
12	0	12	0
12	3.25	12	3.25
12	6.5	12	6.5
12	9.75	12	9.75
12	13	12	13
12	20	12	20
12	23.25	12	23.25
12	26.5	12	26.5
12	29.75	12	29.75
12	33	12	33
15	0	15	0
15	3.25	15	3.25
15	6.5	15	6.5
15	9.75	15	9.75
15	13	15	13
15	20	15	20
15	23.25	15	23.25
15	26.5	15	26.5
15	29.75	15	29.75

	Top Flange		Bottom Flange	
No. Bolts =	100.0		80.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.250	OK	3.250	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





15	33	15	33
18	0	18	0
18	3.25	18	3.25
18	6.5	18	6.5
18	9.75	18	9.75
18	13	18	13
18	20	18	20
18	23.25	18	23.25
18	26.5	18	26.5
18	29.75	18	29.75
18	33	18	33
21	0	21	0
21	3.25	21	3.25
21	6.5	21	6.5
21	9.75	21	9.75
21	13	21	13
21	20	21	20
21	23.25	21	23.25
21	26.5	21	26.5
21	29.75	21	29.75
21	33	21	33
24	0		
24	3.25		
24	6.5		
24	9.75		
24	13		
24	20		
24	23.25		
24	26.5		
24	29.75		
24	33		
27	0		
27	3.25		
27	6.5		
27	9.75		
27	13		
27	20		
27	23.25		
27	26.5		
27	29.75		
27	33		

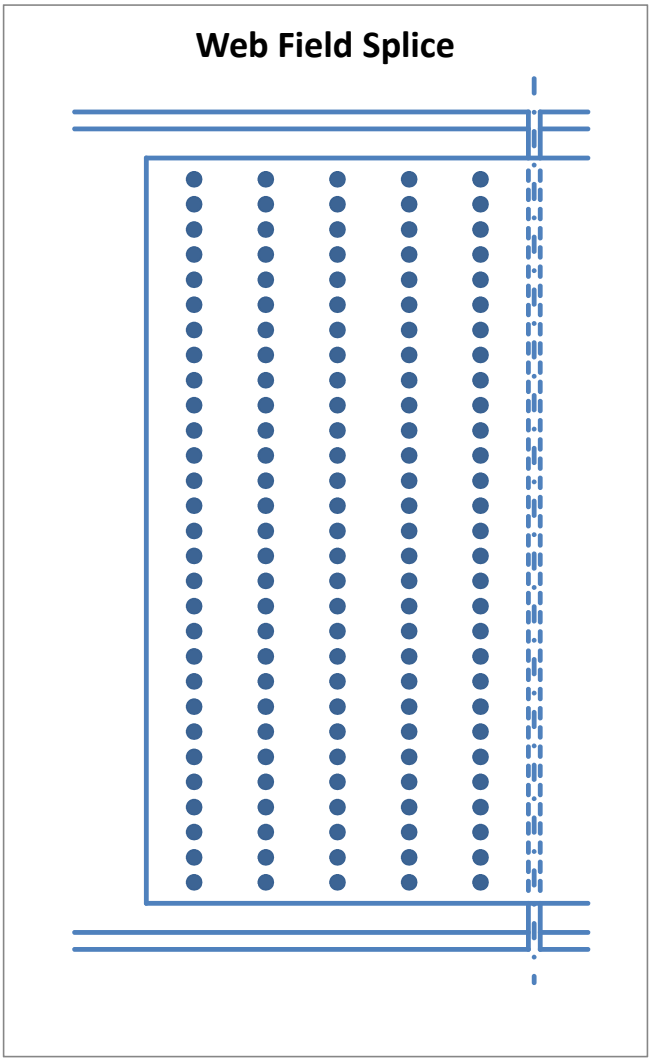
Flange Bolt Pattern Cont. - Node 1021

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1021	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1021

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	1764
0	3	36	1521
0	6	36	1296
0	9	36	1089
0	12	36	900
0	15	36	729
0	18	36	576
0	21	36	441
0	24	36	324
0	27	36	225
0	30	36	144
0	33	36	81
0	36	36	36
0	39	36	9
0	42	36	0
0	45	36	9
0	48	36	36
0	51	36	81
0	54	36	144
0	57	36	225
0	60	36	324
0	63	36	441
0	66	36	576
0	69	36	729
0	72	36	900
0	75	36	1089
0	78	36	1296
0	81	36	1521
0	84	36	1764
3	0	9	1764
3	3	9	1521
3	6	9	1296
3	9	9	1089
3	12	9	900
3	15	9	729
3	18	9	576
3	21	9	441
3	24	9	324
3	27	9	225
3	30	9	144
3	33	9	81
3	36	9	36
3	39	9	9
3	42	9	0
3	45	9	9
3	48	9	36
3	51	9	81
3	54	9	144
3	57	9	225
3	60	9	324
3	63	9	441
3	66	9	576
3	69	9	729
3	72	9	900
3	75	9	1089
3	78	9	1296
3	81	9	1521
3	84	9	1764
6	0	0	1764

No. Bolts =	145.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2610	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	91350	
Σd^2 (in^2) =	93960	



6	3	0	1521
6	6	0	1296
6	9	0	1089
6	12	0	900
6	15	0	729
6	18	0	576
6	21	0	441
6	24	0	324
6	27	0	225
6	30	0	144
6	33	0	81
6	36	0	36
6	39	0	9
6	42	0	0
6	45	0	9
6	48	0	36
6	51	0	81
6	54	0	144
6	57	0	225
6	60	0	324
6	63	0	441
6	66	0	576
6	69	0	729
6	72	0	900
6	75	0	1089
6	78	0	1296
6	81	0	1521
6	84	0	1764
9	0	9	1764
9	3	9	1521
9	6	9	1296
9	9	9	1089
9	12	9	900
9	15	9	729
9	18	9	576
9	21	9	441
9	24	9	324
9	27	9	225
9	30	9	144
9	33	9	81
9	36	9	36
9	39	9	9
9	42	9	0
9	45	9	9
9	48	9	36
9	51	9	81
9	54	9	144
9	57	9	225
9	60	9	324
9	63	9	441
9	66	9	576
9	69	9	729
9	72	9	900
9	75	9	1089
9	78	9	1296
9	81	9	1521
9	84	9	1764
12	0	36	1764
12	3	36	1521
12	6	36	1296
12	9	36	1089
12	12	36	900
12	15	36	729
12	18	36	576
12	21	36	441
12	24	36	324

Web Bolt Pattern Cont. - Node 1021

12	27	36	225
12	30	36	144
12	33	36	81
12	36	36	36
12	39	36	9
12	42	36	0
12	45	36	9
12	48	36	36
12	51	36	81
12	54	36	144
12	57	36	225
12	60	36	324
12	63	36	441
12	66	36	576
12	69	36	729
12	72	36	900
12	75	36	1089
12	78	36	1296
12	81	36	1521
12	84	36	1764
870	6090	2610	91350

Web Bolt Pattern Cont. - Node 1021

Field Splice - Node 3021

Node 3021

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3021 L	84.00	68.02	5713.57	94.50	68.02	6427.76	144.00	50.00	7200.00
3021 R	76.00	68.19	5182.53	76.00	68.19	5182.53	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 3021 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.96	13.95	38.35	8.89	38.51	3.35	24.57	20.13	33.54	14.84	30.94	7.40	41.88	-3.63	23.77	20.65
ϕf Fnc (ksi)	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	62.44	68.19	68.19
f / ϕf Fnc	0.34	0.20	0.56	0.13	0.56	0.05	0.36	0.30	0.49	0.22	0.45	0.11	0.61	0.06	0.35	0.30
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.89	0.97	0.97
fcf (ksi)	22.96		38.35		38.51		24.57		33.54		30.94		41.88		23.77	
Fcf (ksi)	51.14		53.78		53.86		51.14		51.31		51.14		55.59		51.14	
Fcf (kip)	2863.26		3010.86		3015.48		2863.26		2872.55		2863.26		3112.30		2863.26	
fncf (ksi)		13.95		8.89		3.35		20.13		14.84		7.40		-3.63		20.65
Rcf		2.23		1.40		1.40		2.08		1.53		1.65		1.33		2.15
Fncf (ksi)		51.14		51.14		51.14		51.14		51.14		51.14		-46.83		51.14
Fncf (kip)		2863.26		2863.26		2863.26		2863.26		2863.26		2863.26		-3558.95		2863.26

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.25	9.90	23.90	5.87	23.37	2.67	18.24	14.65	22.95	10.08	20.10	4.83	30.59	-2.45	17.67	15.01
Fs (ksi)	18.25	9.90	23.90	5.87	23.37	2.67	18.24	14.65	22.95	10.08	20.10	4.83	30.59	-2.45	17.67	15.01
Fs (kip)	1387.02	752.36	1816.72	446.09	1776.13	203.20	1386.32	1113.02	1744.16	765.95	1527.74	367.22	2325.04	-186.51	1343.26	1141.10

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3112.30	2863.26	2325.04	1141.10
Comp	0.00	3558.95	0.00	186.51

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	296.45	399.41	637.14	184.09	341.85	363.90	507.89	216.14	215.88	289.00	456.95	136.49	247.95	263.91	365.64	159.13
Vuw (kip)	444.68	599.12	955.71	276.13	512.77	545.86	761.84	324.21	---	---	---	---	---	---	---	---
Mv (k*ft)	305.72	411.89	657.05	189.84	352.53	375.28	523.77	222.89	148.41	198.68	314.16	93.84	170.46	181.44	251.38	109.40
Huw (kip)	3883.32	3113.12	2743.22	4402.67	3489.26	2978.79	2368.16	4524.54	1351.19	1429.14	1250.10	1578.53	1585.33	1196.81	1350.65	1569.07
Muw (k*ft)	1199.43	2555.11	3058.60	506.96	1745.53	2405.47	3774.32	344.46	534.45	1154.22	1324.58	230.14	823.75	977.28	2114.98	170.23
Mu (k*ft)	1505.15	2967.00	3715.65	696.81	2098.06	2780.75	4298.08	567.36	682.87	1352.90	1638.73	323.98	994.22	1158.72	2366.36	279.64

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.78	21.47	18.92	30.36	24.06	20.54	16.33	31.20	9.32	9.86	8.62	10.89	10.93	8.25	9.31	10.82
PY1 (Vuw)	3.07	4.13	6.59	1.90	3.54	3.76	5.25	2.24	1.49	1.99	3.15	0.94	1.71	1.82	2.52	1.10
PX2 (Mu)	8.07	15.91	19.93	3.74	11.25	14.92	23.05	3.04	3.66	7.26	8.79	1.74	5.33	6.22	12.69	1.50
PY2 (Mu)	1.15	2.27	2.85	0.53	1.61	2.13	3.29	0.43	0.52	1.04	1.26	0.25	0.76	0.89	1.81	0.21
Pu (kip)	35.11	37.93	39.98	34.19	35.69	35.95	40.30	34.35	13.14	17.38	17.96	12.68	16.45	14.72	22.43	12.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1620.10	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1492.20	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1372.80	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.46	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.35	1929.38	OK
BF Outside	1852.61	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.21	41.30	43.06	37.20	38.85	39.16	43.78	37.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	955.71
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1620.10	16.20	OK	1210.29	12.10	OK
BF	1852.61	23.16	OK	594.00	7.42	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1620.10	16.20	1.47	134.83	OK
TF	3112.30	31.12	1.47	239.70	OK
TF Inside	1492.20	14.92	1.47	134.83	OK
BF Inside	1706.35	21.33	1.47	104.87	OK
BF	3558.95	44.49	1.47	239.70	OK
BF Outside	1852.61	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
40.30	20.15	OK	22.43	11.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	40.30	1.47	91.65	OK
Web SPL	20.15	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.25	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.23	1.39	7.70
Web	1.51	1.50	2.27
BF	1.38	2.27	4.53

Plate	Shear	Flexure
Web	2.75	1.14

Field Splice - Node 5021

Node 5021

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5021 L	84.00	68.02	5713.57	94.50	68.02	6427.76	144.00	50.00	7200.00
5021 R	76.00	68.19	5182.53	76.00	68.19	5182.53	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 5021 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 5021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	24.99	15.28	41.76	9.53	41.54	6.26	26.44	20.08	37.34	15.23	32.08	9.94	44.65	-5.35	25.90	20.91
ϕf Fnc (ksi)	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	62.44	68.19	68.19
f / ϕf Fnc	0.37	0.22	0.61	0.14	0.61	0.09	0.39	0.29	0.55	0.22	0.47	0.15	0.65	0.09	0.38	0.31
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.89	0.97	0.97
fcf (ksi)	24.99		41.76		41.54		26.44		37.34		32.08		44.65		25.90	
Fcf (ksi)	51.14		55.53		55.42		51.14		53.26		51.14		57.01		51.14	
Fcf (kip)	2863.26		3108.89		3102.41		2863.26		2981.79		2863.26		3191.94		2863.26	
fncf (ksi)		15.28		9.53		6.26		20.08		15.23		9.94		-5.35		20.91
Rcf		2.05		1.33		1.33		1.93		1.43		1.59		1.28		1.97
Fncf (ksi)		51.14		51.14		51.14		51.14		51.14		51.14		-46.83		51.14
Fncf (kip)		2863.26		2863.26		2863.26		2863.26		2863.26		2863.26		-3558.95		2863.26

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.82	10.87	26.01	6.41	25.64	4.62	19.67	14.70	25.21	10.48	21.64	6.75	32.53	-3.77	19.29	15.29
Fs (ksi)	19.82	10.87	26.01	6.41	25.64	4.62	19.67	14.70	25.21	10.48	21.64	6.75	32.53	-3.77	19.29	15.29
Fs (kip)	1506.07	826.23	1976.68	487.39	1948.72	351.33	1494.93	1117.54	1915.95	796.64	1644.85	513.32	2472.36	-286.66	1465.73	1162.28

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3191.94	2863.26	2472.36	1162.28
Comp	0.00	3558.95	0.00	286.66

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	292.58	415.60	632.05	197.03	366.58	330.84	505.42	246.09	212.93	300.61	453.54	145.42	265.22	240.73	364.07	180.09
Vuw (kip)	438.86	623.40	948.07	295.54	549.87	496.26	758.13	369.14	---	---	---	---	---	---	---	---
Mv (k*ft)	301.72	428.58	651.80	203.18	378.04	341.18	521.22	253.78	146.39	206.67	311.81	99.98	182.34	165.50	250.30	123.81
Huw (kip)	3892.34	3205.08	2992.06	4255.77	3533.44	3151.86	2338.29	4373.90	1473.03	1556.26	1452.67	1649.98	1713.21	1363.06	1380.44	1659.80
Muw (k*ft)	1187.41	2650.82	2920.42	702.83	1929.94	2174.72	3991.52	545.32	572.49	1254.14	1345.17	317.80	942.58	952.87	2323.39	255.54
Mu (k*ft)	1489.13	3079.40	3572.22	906.02	2307.98	2515.90	4512.74	799.10	718.88	1460.80	1656.97	417.78	1124.91	1118.37	2573.69	379.35

Note: Mu = Muw + Mv

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.84	22.10	20.63	29.35	24.37	21.74	16.13	30.16	10.16	10.73	10.02	11.38	11.82	9.40	9.52	11.45
PY1 (Vuw)	3.03	4.30	6.54	2.04	3.79	3.42	5.23	2.55	1.47	2.07	3.13	1.00	1.83	1.66	2.51	1.24
PX2 (Mu)	7.99	16.52	19.16	4.86	12.38	13.50	24.21	4.29	3.86	7.84	8.89	2.24	6.03	6.00	13.81	2.03
PY2 (Mu)	1.14	2.36	2.74	0.69	1.77	1.93	3.46	0.61	0.55	1.12	1.27	0.32	0.86	0.86	1.97	0.29
Pu (kip)	35.08	39.19	40.86	34.32	37.17	35.64	41.26	34.60	14.16	18.84	19.41	13.68	18.05	15.60	23.75	13.57

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1661.56	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1530.38	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1372.80	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.46	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.35	1929.38	OK
BF Outside	1852.61	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.18	42.67	44.06	37.37	40.45	38.86	44.86	37.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	948.07
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1661.56	16.62	OK	1286.98	12.87	OK
BF	1852.61	23.16	OK	605.02	7.56	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1661.56	16.62	1.47	134.83	OK
TF	3191.94	31.92	1.47	239.70	OK
TF Inside	1530.38	15.30	1.47	134.83	OK
BF Inside	1706.35	21.33	1.47	104.87	OK
BF	3558.95	44.49	1.47	239.70	OK
BF Outside	1852.61	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.26	20.63	OK	23.75	11.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.26	1.47	91.65	OK
Web SPL	20.63	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.26	NA
TF Inside	1.22	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.18	1.31	7.51
Web	1.48	1.42	2.22
BF	1.38	2.23	4.53

Plate	Shear	Flexure
Web	2.78	1.11

Field Splice - Node 7021

Node 7021

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7021 L	84.00	68.02	5713.57	94.50	68.02	6427.76	144.00	50.00	7200.00
7021 R	76.00	68.19	5182.53	76.00	68.19	5182.53	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 7021 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.45	16.00	41.62	10.36	41.45	6.38	26.78	22.16	37.63	15.83	31.99	11.68	44.84	-6.96	26.31	22.96
ϕf Fnc (ksi)	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	68.19	62.44	68.19	68.19
f / ϕf Fnc	0.37	0.23	0.61	0.15	0.61	0.09	0.39	0.32	0.55	0.23	0.47	0.17	0.66	0.11	0.39	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.89	0.97	0.97
fcf (ksi)	25.45		41.62		41.45		26.78		37.63		31.99		44.84		26.31	
Fcf (ksi)	51.14		55.46		55.37		51.14		53.41		51.14		57.11		51.14	
Fcf (kip)	2863.26		3104.75		3099.81		2863.26		2990.06		2863.26		3197.38		2863.26	
fncf (ksi)		16.00		10.36		6.38		22.16		15.83		11.68		-6.96		22.96
Rcf		2.01		1.33		1.34		1.91		1.42		1.60		1.27		1.94
Fncf (ksi)		51.14		51.14		51.14		51.14		51.14		51.14		-46.83		51.14
Fncf (kip)		2863.26		2863.26		2863.26		2863.26		2863.26		2863.26		-3558.95		2863.26

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.09	11.31	25.95	7.16	25.47	4.74	19.98	16.25	25.46	11.09	21.70	7.85	32.63	-5.01	19.65	16.82
Fs (ksi)	20.09	11.31	25.95	7.16	25.47	4.74	19.98	16.25	25.46	11.09	21.70	7.85	32.63	-5.01	19.65	16.82
Fs (kip)	1527.19	859.93	1972.33	544.10	1935.82	360.42	1518.59	1235.12	1935.29	842.55	1648.92	596.97	2480.03	-380.69	1493.22	1278.24

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3197.38	2863.26	2480.03	1278.24
Comp	0.00	3558.95	0.00	380.69

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	309.81	427.76	646.85	200.10	365.30	362.45	518.40	231.01	226.51	308.52	464.64	147.66	264.38	263.70	373.89	169.50
Vuw (kip)	464.71	641.65	970.27	300.15	547.95	543.68	777.60	346.51	---	---	---	---	---	---	---	---
Mv (k*ft)	319.49	441.13	667.06	206.35	376.72	373.78	534.60	238.23	155.72	212.10	319.44	101.52	181.76	181.30	257.05	116.53
Huw (kip)	3934.27	3255.85	2998.04	4422.56	3575.92	3288.02	2244.97	4533.98	1507.65	1589.33	1450.26	1739.18	1754.42	1418.46	1325.90	1750.40
Muw (k*ft)	1131.49	2573.91	2906.65	480.44	1891.70	1993.17	4128.07	331.88	561.90	1202.71	1326.65	238.71	920.20	885.85	2409.03	181.03
Mu (k*ft)	1450.98	3015.05	3573.71	686.79	2268.42	2366.95	4662.67	570.11	717.62	1414.82	1646.09	340.23	1101.97	1067.15	2666.07	297.57

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.13	22.45	20.68	30.50	24.66	22.68	15.48	31.27	10.40	10.96	10.00	11.99	12.10	9.78	9.14	12.07
PY1 (Vuw)	3.20	4.43	6.69	2.07	3.78	3.75	5.36	2.39	1.56	2.13	3.20	1.02	1.82	1.82	2.58	1.17
PX2 (Mu)	7.78	16.17	19.17	3.68	12.17	12.70	25.01	3.06	3.85	7.59	8.83	1.83	5.91	5.72	14.30	1.60
PY2 (Mu)	1.11	2.31	2.74	0.53	1.74	1.81	3.57	0.44	0.55	1.08	1.26	0.26	0.84	0.82	2.04	0.23
Pu (kip)	35.18	39.21	40.95	34.28	37.24	35.81	41.47	34.44	14.40	18.83	19.35	13.88	18.21	15.73	23.90	13.74

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1664.39	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1532.99	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1372.80	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.46	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.35	1929.38	OK
BF Outside	1852.61	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.26	42.66	44.11	37.29	40.53	38.97	45.07	37.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	970.27
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1664.39	16.64	OK	1290.98	12.91	OK
BF	1852.61	23.16	OK	665.39	8.32	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1664.39	16.64	1.47	134.83	OK
TF	3197.38	31.97	1.47	239.70	OK
TF Inside	1532.99	15.33	1.47	134.83	OK
BF Inside	1706.35	21.33	1.47	104.87	OK
BF	3558.95	44.49	1.47	239.70	OK
BF Outside	1852.61	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.47	20.73	OK	23.90	11.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.47	1.47	91.65	OK
Web SPL	20.73	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.26	NA
TF Inside	1.22	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.17	1.30	7.50
Web	1.47	1.41	2.21
BF	1.38	2.02	4.53

Plate	Shear	Flexure
Web	2.71	1.11

Field Splice - Node 9021

Node 9021

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9021 L	84.00	68.04	5715.34	94.50	68.04	6429.76	144.00	50.00	7200.00
9021 R	76.00	68.21	5184.02	76.00	68.21	5184.02	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 9021 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.56	19.07	34.27	14.42	33.51	12.27	20.95	25.66	32.45	17.00	25.72	14.75	40.83	-6.85	20.21	26.52
ϕf Fnc (ksi)	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	62.45	68.21	68.21
f / ϕf Fnc	0.32	0.28	0.50	0.21	0.49	0.18	0.31	0.38	0.48	0.25	0.38	0.22	0.60	0.11	0.30	0.39
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.89	0.97	0.97
fcf (ksi)	21.56		34.27		33.51			25.66	32.45		25.72		40.83			26.52
Fcf (ksi)	51.16		51.69		51.30			51.16	51.16		51.16		55.06			51.16
Fcf (kip)	2864.09		2893.92		2871.94			2864.09	2864.09		2864.09		3082.30			2864.09
fncf (ksi)		19.07		14.42		12.27	20.95			17.00		14.75		-6.85	20.21	
Rcf		2.37		1.51		1.53	1.99			1.58		1.99		1.35	1.93	
Fncf (ksi)		51.16		51.16		51.16	51.16			51.16		51.16		-46.84	51.16	
Fncf (kip)		2864.09		2864.09		2864.09	2864.09			2864.09		2864.09		-3559.74	2864.09	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.15	13.80	21.83	9.90	21.41	8.61	15.81	18.77	21.96	12.11	17.91	9.95	29.76	-4.99	15.29	19.38
Fs (ksi)	16.15	13.80	21.83	9.90	21.41	8.61	15.81	18.77	21.96	12.11	17.91	9.95	29.76	-4.99	15.29	19.38
Fs (kip)	1227.32	1049.12	1658.96	752.74	1627.27	654.47	1201.34	1426.35	1668.66	920.53	1360.83	756.53	2261.91	-379.31	1161.71	1472.80

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3082.30	2864.09	2261.91	1472.80
Comp	0.00	3559.74	0.00	379.31

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	191.27	302.34	517.96	77.79	249.04	254.76	421.56	101.16	144.05	220.48	374.86	61.82	182.82	188.91	306.76	78.34
Vuw (kip)	286.90	453.51	776.93	116.68	373.56	382.14	632.35	151.75	---	---	---	---	---	---	---	---
Mv (k*ft)	197.24	311.79	534.14	80.22	256.82	262.72	434.74	104.33	99.03	151.58	257.72	42.50	125.69	129.87	210.90	53.86
Huw (kip)	4565.02	3462.03	3300.91	4397.50	3679.69	3801.17	2132.02	4263.78	1437.75	1523.18	1441.10	1659.59	1635.28	1337.28	1189.01	1663.90
Muw (k*ft)	294.18	1831.30	1997.15	517.54	1474.62	1312.64	4024.32	695.83	150.06	763.13	819.20	189.49	630.01	508.89	2224.18	261.97
Mu (k*ft)	491.42	2143.09	2531.29	597.76	1731.44	1575.36	4459.06	800.15	249.10	914.71	1076.92	231.99	755.69	638.76	2435.08	315.83

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.48	23.88	22.76	30.33	25.38	26.21	14.70	29.41	9.92	10.50	9.94	11.45	11.28	9.22	8.20	11.48
PY1 (Vuw)	1.98	3.13	5.36	0.80	2.58	2.64	4.36	1.05	0.99	1.52	2.59	0.43	1.26	1.30	2.12	0.54
PX2 (Mu)	2.64	11.50	13.58	3.21	9.29	8.45	23.92	4.29	1.34	4.91	5.78	1.24	4.05	3.43	13.06	1.69
PY2 (Mu)	0.38	1.64	1.94	0.46	1.33	1.21	3.42	0.61	0.19	0.70	0.83	0.18	0.58	0.49	1.87	0.24
Pu (kip)	34.20	35.69	37.07	33.56	34.88	34.88	39.40	33.74	11.31	15.57	16.08	12.70	15.44	12.78	21.63	13.19

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1604.48	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1477.81	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1373.19	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.89	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.72	1929.38	OK
BF Outside	1853.02	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.17	38.92	40.07	36.56	38.06	38.02	42.99	36.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	776.93
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9021**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1604.48	16.04	OK	1177.43	11.77	OK
BF	1853.02	23.16	OK	766.66	9.58	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.48	16.04	1.47	134.83	OK
TF	3082.30	30.82	1.47	239.70	OK
TF Inside	1477.81	14.78	1.47	134.83	OK
BF Inside	1706.72	21.33	1.47	104.87	OK
BF	3559.74	44.50	1.47	239.70	OK
BF Outside	1853.02	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.40	19.70	OK	21.63	10.82	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.40	1.47	91.65	OK
Web SPL	19.70	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.31	NA
TF Inside	1.26	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.26	1.43	7.78
Web	1.55	1.56	2.33
BF	1.38	1.76	4.53

Plate	Shear	Flexure
Web	3.39	1.16

Field Splice - Node 1035

Node 1035

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1035 L	76.00	68.21	5184.02	76.00	62.45	4746.32	96.00	50.00	4800.00
1035 R	84.00	68.04	5715.34	94.50	62.87	5941.28	144.00	50.00	7200.00

Rh = 0.97

Controlling Section = 1035 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	43.31	-5.07	31.16	-5.00	41.40	-10.21	28.67	9.09	39.39	-5.42	35.82	-2.41	25.23	11.07	46.51	-13.02
ϕf Fnc (ksi)	68.21	62.45	68.21	62.45	68.21	62.45	68.21	68.21	68.21	62.45	68.21	62.45	68.21	68.21	68.21	62.45
f / ϕf Fnc	0.63	0.08	0.46	0.08	0.61	0.16	0.42	0.13	0.58	0.09	0.53	0.04	0.37	0.16	0.68	0.21
α	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89
fcf (ksi)	43.31		31.16		41.40		28.67		39.39		35.82		25.23		46.51	
Fcf (ksi)	56.33		51.16		55.35		51.16		54.32		52.49		51.16		57.97	
Fcf (kip)	3153.46		2864.09		3098.75		2864.09		3040.83		2938.38		2864.09		3245.39	
fncf (ksi)		-5.07		-5.00		-10.21		9.09		-5.42		-2.41		11.07		-13.02
Rcf		1.30		1.64		1.34		1.78		1.38		1.47		2.03		1.25
Fncf (ksi)		-46.84		-46.84		-46.84		51.16		-46.84		-46.84		51.16		-46.84
Fncf (kip)		-3559.74		-3559.74		-3559.74		2864.09		-3559.74		-3559.74		2864.09		-3559.74

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.59	-4.42	22.18	-3.39	26.20	-7.09	22.13	5.01	26.35	-4.43	24.14	-2.21	21.11	6.54	34.10	-9.28
Fs (ksi)	27.59	-4.42	22.18	-3.39	26.20	-7.09	22.13	5.01	26.35	-4.43	24.14	-2.21	21.11	6.54	34.10	-9.28
Fs (kip)	2097.04	-335.55	1685.61	-257.90	1991.48	-539.19	1682.06	380.42	2002.78	-336.75	1834.40	-168.32	1604.30	497.27	2591.90	-705.29

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3245.39	2864.09	2591.90	497.27
Comp	0.00	3559.74	0.00	705.29

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	450.71	433.08	668.56	236.14	414.32	402.81	290.77	563.39	330.62	317.04	484.54	177.90	303.79	296.78	216.50	410.24
Vuw (kip)	676.06	649.62	1002.84	354.22	621.49	604.21	436.16	845.09	---	---	---	---	---	---	---	---
Mv (k*ft)	464.79	446.62	689.45	243.52	427.27	415.40	299.86	581.00	227.30	217.97	333.12	122.31	208.86	204.04	148.84	282.04
Huw (kip)	2318.15	1998.78	1933.82	3171.54	2181.57	2285.08	3470.35	1932.30	1112.52	901.71	917.23	1302.62	1052.23	1052.27	1327.30	1191.54
Muw (k*ft)	3934.70	3715.83	4325.24	2152.15	3865.87	3499.61	1753.74	4653.98	2048.50	1636.64	2131.09	1096.11	1970.13	1686.50	932.23	2776.58
Mu (k*ft)	4399.50	4162.45	5014.70	2395.67	4293.14	3915.01	2053.60	5234.98	2275.80	1854.61	2464.21	1218.42	2178.99	1890.54	1081.08	3058.62

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.99	13.78	13.34	21.87	15.05	15.76	23.93	13.33	7.67	6.22	6.33	8.98	7.26	7.26	9.15	8.22
PY1 (Vuw)	4.66	4.48	6.92	2.44	4.29	4.17	3.01	5.83	2.28	2.19	3.34	1.23	2.10	2.05	1.49	2.83
PX2 (Mu)	23.60	22.33	26.90	12.85	23.03	21.00	11.02	28.08	12.21	9.95	13.22	6.54	11.69	10.14	5.80	16.41
PY2 (Mu)	3.37	3.19	3.84	1.84	3.29	3.00	1.57	4.01	1.74	1.42	1.89	0.93	1.67	1.45	0.83	2.34
Pu (kip)	40.39	36.92	41.65	34.99	38.82	37.45	35.25	42.56	20.28	16.56	20.23	15.67	19.32	17.75	15.13	25.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1689.38	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1556.01	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1373.19	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.89	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.72	1929.38	OK
BF Outside	1853.02	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.02	40.20	44.87	38.27	42.36	40.84	38.44	46.20
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1002.84
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1689.38	16.89	OK	1349.21	13.49	OK
BF	1853.02	23.16	OK	367.14	4.59	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1689.38	16.89	1.47	134.83	OK
TF	3245.39	32.45	1.47	239.70	OK
TF Inside	1556.01	15.56	1.47	134.83	OK
BF Inside	1706.72	21.33	1.47	104.87	OK
BF	3559.74	44.50	1.47	239.70	OK
BF Outside	1853.02	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.56	21.28	OK	25.16	12.58	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.56	1.47	91.65	OK
Web SPL	21.28	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.24	NA
TF Inside	1.20	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.14	1.25	7.39
Web	1.43	1.34	2.15
BF	1.38	3.67	4.53

Plate	Shear	Flexure
Web	2.62	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3035	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3035

Node 3035

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3035 L	76.00	68.19	5182.53	76.00	62.44	4745.27	96.00	50.00	4800.00
3035 R	84.00	68.02	5713.57	94.50	62.86	5939.82	144.00	50.00	7200.00

Rh = 0.97

Controlling Section = 3035 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	44.07	-2.33	34.18	-3.53	43.77	-8.06	33.69	7.34	40.85	-3.00	42.93	-5.10	29.76	7.84	48.82	-10.73
ϕf Fnc (ksi)	68.19	62.44	68.19	62.44	68.19	62.44	68.19	68.19	68.19	62.44	68.19	62.44	68.19	68.19	68.19	62.44
f / ϕf Fnc	0.65	0.04	0.50	0.06	0.64	0.13	0.49	0.11	0.60	0.05	0.63	0.08	0.44	0.11	0.72	0.17
α	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89
fcf (ksi)	44.07		34.18		43.77		33.69		40.85		42.93		29.76		48.82	
Fcf (ksi)	56.72		51.64		56.56		51.39		55.06		56.13		51.14		59.15	
Fcf (kip)	3175.22		2890.96		3166.53		2876.83		3082.68		3142.36		2863.26		3311.60	
fncf (ksi)		-2.33		-3.53		-8.06		7.34		-3.00		-5.10		7.84		-10.73
Rcf		1.29		1.51		1.29		1.53		1.35		1.31		1.72		1.21
Fncf (ksi)		-46.83		-46.83		-46.83		51.14		-46.83		-46.83		51.14		-46.83
Fncf (kip)		-3558.95		-3558.95		-3558.95		2863.26		-3558.95		-3558.95		2863.26		-3558.95

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.63	-2.73	24.68	-2.60	28.08	-5.87	25.32	3.92	27.27	-2.72	28.91	-4.33	23.73	4.41	35.77	-7.74
Fs (ksi)	28.63	-2.73	24.68	-2.60	28.08	-5.87	25.32	3.92	27.27	-2.72	28.91	-4.33	23.73	4.41	35.77	-7.74
Fs (kip)	2175.89	-207.29	1875.80	-197.42	2133.92	-445.97	1924.00	298.04	2072.86	-206.74	2196.83	-329.25	1803.86	334.96	2718.62	-587.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3311.60	2863.26	2718.62	334.96
Comp	0.00	3558.95	0.00	587.98

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	512.41	498.14	789.02	336.27	521.18	495.62	392.76	651.32	373.47	362.76	568.90	248.39	379.04	361.61	288.30	471.61
Vuw (kip)	768.62	747.21	1082.20	504.41	781.77	743.44	589.14	976.98	---	---	---	---	---	---	---	---
Mv (k*ft)	528.43	513.71	744.01	346.78	537.47	511.11	405.03	671.67	256.76	249.39	391.12	170.77	260.59	248.61	198.21	324.23
Huw (kip)	2507.80	2158.89	2144.78	2939.84	2380.84	2304.45	3038.02	2141.58	1243.33	1060.03	1066.08	1403.39	1178.60	1179.52	1350.83	1345.67
Muw (k*ft)	3728.27	3560.37	4192.96	2487.62	3691.43	3926.22	2326.50	4520.31	2006.88	1745.87	2172.54	1369.23	1919.66	2127.23	1236.97	2784.50
Mu (k*ft)	4256.69	4074.08	4936.97	2834.40	4228.90	4437.34	2731.53	5191.99	2263.64	1995.26	2563.66	1540.00	2180.25	2375.83	1435.18	3108.74

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.30	14.89	14.79	20.27	16.42	15.89	20.95	14.77	8.57	7.31	7.35	9.68	8.13	8.13	9.32	9.28
PY1 (Vuw)	5.30	5.15	7.46	3.48	5.39	5.13	4.06	6.74	2.58	2.50	3.92	1.71	2.61	2.49	1.99	3.25
PX2 (Mu)	22.83	21.85	26.48	15.20	22.68	23.80	14.65	27.85	12.14	10.70	13.75	8.26	11.69	12.74	7.70	16.68
PY2 (Mu)	3.26	3.12	3.78	2.17	3.24	3.40	2.09	3.98	1.73	1.53	1.96	1.18	1.67	1.82	1.10	2.38
Pu (kip)	41.03	37.66	42.78	35.93	40.04	40.60	36.13	43.95	21.16	18.46	21.91	18.17	20.28	21.32	17.29	26.56

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1723.84	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1587.75	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1372.80	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.46	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.35	1929.38	OK
BF Outside	1852.61	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.58	40.86	45.98	39.20	43.46	44.15	39.31	47.50
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1082.20
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1723.84	17.24	OK	1415.17	14.15	OK
BF	1852.61	23.16	OK	306.07	3.83	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1723.84	17.24	1.47	134.83	OK
TF	3311.60	33.12	1.47	239.70	OK
TF Inside	1587.75	15.88	1.47	134.83	OK
BF Inside	1706.35	21.33	1.47	104.87	OK
BF	3558.95	44.49	1.47	239.70	OK
BF Outside	1852.61	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.95	21.97	OK	26.56	13.28	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.95	1.47	91.65	OK
Web SPL	21.97	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.21	NA
TF Inside	1.17	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.10	1.19	7.24
Web	1.39	1.27	2.09
BF	1.38	4.40	4.53

Plate	Shear	Flexure
Web	2.43	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5035	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5035

Node 5035

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5035 L	76.00	68.19	5182.53	76.00	68.19	5182.53	96.00	50.00	4800.00
5035 R	84.00	68.02	5713.57	94.50	62.86	5939.82	144.00	50.00	7200.00

Rh = 0.97

Controlling Section = 5035 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	43.81	1.56	35.49	-3.61	43.94	-7.45	34.50	7.86	39.58	0.40	43.58	-5.22	30.87	8.89	48.88	-10.01
ϕf Fnc (ksi)	68.19	68.19	68.19	62.44	68.19	62.44	68.19	68.19	68.19	68.19	68.19	62.44	68.19	68.19	68.19	62.44
f / ϕf Fnc	0.64	0.02	0.52	0.06	0.64	0.12	0.51	0.12	0.58	0.01	0.64	0.08	0.45	0.13	0.72	0.16
α	0.97	0.97	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.97	0.97	0.89	0.97	0.97	0.97	0.89
fcf (ksi)	43.81		35.49		43.94		34.50		39.58		43.58		30.87		48.88	
Fcf (ksi)	56.58		52.31		56.65		51.80		54.41		56.46		51.14		59.18	
Fcf (kip)	3167.82		2928.72		3171.38		2900.29		3046.23		3161.04		2863.26		3313.32	
fncf (ksi)		1.56		-3.61		-7.45		7.86		0.40		-5.22		8.89		-10.01
Rcf		1.29		1.47		1.29		1.50		1.37		1.30		1.66		1.21
Fncf (ksi)		51.14		-46.83		-46.83		51.14		51.14		-46.83		51.14		-46.83
Fncf (kip)		2863.26		-3558.95		-3558.95		2863.26		2863.26		-3558.95		2863.26		-3558.95

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.78	-1.98	25.45	-2.62	28.52	-5.50	25.68	4.42	26.57	-0.82	29.25	-4.36	24.35	5.27	35.72	-7.25
Fs (ksi)	28.78	-1.98	25.45	-2.62	28.52	-5.50	25.68	4.42	26.57	-0.82	29.25	-4.36	24.35	5.27	35.72	-7.25
Fs (kip)	2187.32	-150.68	1934.54	-199.39	2167.61	-417.95	1951.32	335.60	2019.06	-62.46	2222.74	-331.60	1850.35	400.17	2714.65	-551.25

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3313.32	2863.26	2714.65	400.17
Comp	0.00	3558.95	0.00	551.25

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	482.82	487.44	762.96	332.75	465.65	502.72	407.16	610.41	351.95	355.13	549.87	245.84	339.73	366.01	298.41	442.09
Vuw (kip)	724.23	731.16	1069.17	499.13	698.47	754.08	610.74	915.61	---	---	---	---	---	---	---	---
Mv (k*ft)	497.91	502.67	735.05	343.15	480.20	518.43	419.88	629.48	241.96	244.15	378.03	169.01	233.57	251.63	205.16	303.93
Huw (kip)	2742.70	2190.74	2187.58	2988.72	2570.34	2315.42	3098.40	2185.72	1286.30	1095.88	1105.04	1444.37	1235.75	1194.40	1421.38	1366.36
Muw (k*ft)	3398.58	3601.99	4146.69	2474.71	3357.59	3953.20	2245.99	4465.28	1968.84	1797.00	2177.32	1360.60	1752.86	2151.03	1221.21	2750.23
Mu (k*ft)	3896.49	4104.66	4881.74	2817.86	3837.79	4471.63	2665.87	5094.76	2210.81	2041.15	2555.35	1529.62	1986.42	2402.66	1426.37	3054.16

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.92	15.11	15.09	20.61	17.73	15.97	21.37	15.07	8.87	7.56	7.62	9.96	8.52	8.24	9.80	9.42
PY1 (Vuw)	4.99	5.04	7.37	3.44	4.82	5.20	4.21	6.31	2.43	2.45	3.79	1.70	2.34	2.52	2.06	3.05
PX2 (Mu)	20.90	22.02	26.19	15.11	20.59	23.99	14.30	27.33	11.86	10.95	13.71	8.20	10.66	12.89	7.65	16.38
PY2 (Mu)	2.99	3.15	3.74	2.16	2.94	3.43	2.04	3.90	1.69	1.56	1.96	1.17	1.52	1.84	1.09	2.34
Pu (kip)	40.61	38.02	42.74	36.16	39.09	40.87	36.21	43.62	21.14	18.94	22.09	18.39	19.56	21.57	17.74	26.36

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1724.74	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1588.58	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1372.80	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.46	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.35	1929.38	OK
BF Outside	1852.61	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.16	41.28	45.97	39.46	42.51	44.44	39.36	47.25
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1069.17
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1724.74	17.25	OK	1413.11	14.13	OK
BF	1852.61	23.16	OK	286.95	3.59	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1724.74	17.25	1.47	134.83	OK
TF	3313.32	33.13	1.47	239.70	OK
TF Inside	1588.58	15.89	1.47	134.83	OK
BF Inside	1706.35	21.33	1.47	104.87	OK
BF	3558.95	44.49	1.47	239.70	OK
BF Outside	1852.61	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.62	21.81	OK	26.36	13.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.62	1.47	91.65	OK
Web SPL	21.81	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.21	NA
TF Inside	1.17	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.10	1.19	7.23
Web	1.40	1.28	2.10
BF	1.38	4.69	4.53

Plate	Shear	Flexure
Web	2.46	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7035	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7035

Node 7035

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7035 L	76.00	68.19	5182.53	76.00	68.19	5182.53	96.00	50.00	4800.00
7035 R	84.00	68.02	5713.57	94.50	62.86	5939.82	144.00	50.00	7200.00

Rh = 0.97

Controlling Section = 7035 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	43.06	2.32	33.76	-3.38	43.27	-7.91	33.42	8.85	38.67	-1.29	42.31	-4.54	30.30	10.23	47.83	-10.34
ϕf Fnc (ksi)	68.19	68.19	68.19	62.44	68.19	62.44	68.19	68.19	68.19	62.44	68.19	62.44	68.19	68.19	68.19	62.44
f / ϕf Fnc	0.63	0.03	0.50	0.05	0.63	0.13	0.49	0.13	0.57	0.02	0.62	0.07	0.44	0.15	0.70	0.17
α	0.97	0.97	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89
fcf (ksi)	43.06		33.76		43.27		33.42		38.67		42.31		30.30		47.83	
Fcf (ksi)	56.20		51.42		56.30		51.25		53.94		55.81		51.14		58.65	
Fcf (kip)	3146.21		2878.94		3152.07		2869.18		3020.02		3124.73		2863.26		3283.36	
fncf (ksi)		2.32		-3.38		-7.91		8.85		-1.29		-4.54		10.23		-10.34
Rcf		1.31		1.52		1.30		1.53		1.39		1.32		1.69		1.23
Fncf (ksi)		51.14		-46.83		-46.83		51.14		-46.83		-46.83		51.14		-46.83
Fncf (kip)		2863.26		-3558.95		-3558.95		2863.26		-3558.95		-3558.95		2863.26		-3558.95

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.33	-2.16	24.42	-2.53	27.81	-5.70	25.10	5.01	25.79	-1.39	28.54	-4.03	24.14	6.17	34.88	-7.52
Fs (ksi)	28.33	-2.16	24.42	-2.53	27.81	-5.70	25.10	5.01	25.79	-1.39	28.54	-4.03	24.14	6.17	34.88	-7.52
Fs (kip)	2153.25	-164.50	1855.92	-191.98	2113.25	-432.94	1907.64	380.40	1960.14	-105.66	2168.92	-306.01	1834.71	468.55	2651.02	-571.18

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3283.36	2863.26	2651.02	468.55
Comp	0.00	3558.95	0.00	571.18

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	489.47	491.95	778.97	334.04	493.27	505.46	390.59	640.96	356.99	358.43	561.53	246.87	359.68	367.98	287.13	463.71
Vuw (kip)	734.20	737.93	1077.18	501.06	739.90	758.19	585.88	961.45	---	---	---	---	---	---	---	---
Mv (k*ft)	504.76	507.33	740.56	344.48	508.68	521.26	402.79	660.99	245.43	246.42	386.05	169.72	247.28	252.98	197.40	318.80
Huw (kip)	2773.18	2157.24	2138.67	3047.87	2435.81	2322.53	3220.05	2133.51	1256.05	1050.91	1061.25	1445.08	1171.25	1176.58	1454.69	1313.58
Muw (k*ft)	3309.82	3535.80	4168.88	2326.55	3478.59	3862.84	2083.79	4468.17	1951.80	1724.54	2144.16	1286.10	1739.61	2084.15	1150.45	2713.44
Mu (k*ft)	3814.58	4043.12	4909.44	2671.03	3987.27	4384.10	2486.58	5129.16	2197.23	1970.97	2530.21	1455.82	1986.89	2337.14	1347.86	3032.24

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.13	14.88	14.75	21.02	16.80	16.02	22.21	14.71	8.66	7.25	7.32	9.97	8.08	8.11	10.03	9.06
PY1 (Vuw)	5.06	5.09	7.43	3.46	5.10	5.23	4.04	6.63	2.46	2.47	3.87	1.70	2.48	2.54	1.98	3.20
PX2 (Mu)	20.46	21.69	26.33	14.33	21.39	23.52	13.34	27.51	11.79	10.57	13.57	7.81	10.66	12.54	7.23	16.26
PY2 (Mu)	2.92	3.10	3.76	2.05	3.06	3.36	1.91	3.93	1.68	1.51	1.94	1.12	1.52	1.79	1.03	2.32
Pu (kip)	40.38	37.47	42.58	35.77	39.05	40.46	36.04	43.53	20.86	18.26	21.68	18.00	19.16	21.10	17.52	25.92

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1709.15	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1574.21	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1372.80	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.46	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.35	1929.38	OK
BF Outside	1852.61	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.89	40.66	45.77	39.02	42.41	43.96	39.19	47.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1077.18
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7035**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1709.15	17.09	OK	1379.99	13.80	OK
BF	1852.61	23.16	OK	297.33	3.72	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1709.15	17.09	1.47	134.83	OK
TF	3283.36	32.83	1.47	239.70	OK
TF Inside	1574.21	15.74	1.47	134.83	OK
BF Inside	1706.35	21.33	1.47	104.87	OK
BF	3558.95	44.49	1.47	239.70	OK
BF Outside	1852.61	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.53	21.76	OK	25.92	12.96	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.53	1.47	91.65	OK
Web SPL	21.76	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.23	NA
TF Inside	1.18	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.12	1.22	7.30
Web	1.40	1.30	2.11
BF	1.38	4.53	4.53

Plate	Shear	Flexure
Web	2.44	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 9035

Node 9035

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9035 L	76.00	68.21	5184.02	76.00	68.21	5184.02	96.00	50.00	4800.00
9035 R	84.00	68.04	5715.34	94.50	62.87	5941.28	144.00	50.00	7200.00

Rh = 0.97

Controlling Section = 9035 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	38.00	2.00	---	76.00	54.75	55.98	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	38.00	2.00	---	76.00	54.75	55.98	70	85
Splice Plates	TF Outside	38.00	1.125	62.50	42.75	30.80	---	70	85
	TF Inside	17.50	1.125	62.50	39.38	27.42	---	70	85
	BF Inside	17.50	0.875	50.50	30.63	21.33	---	70	85
	BF Outside	38.00	0.875	50.50	33.25	23.95	---	70	85
	Web	89.00	0.750	32.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	40.06	3.15	29.88	-4.25	39.50	-9.01	27.86	11.80	33.38	-1.00	38.23	4.47	24.56	13.38	44.32	-11.61
ϕf Fnc (ksi)	68.21	68.21	68.21	62.45	68.21	62.45	68.21	68.21	68.21	62.45	68.21	68.21	68.21	68.21	68.21	62.45
f / ϕf Fnc	0.59	0.05	0.44	0.07	0.58	0.14	0.41	0.17	0.49	0.02	0.56	0.07	0.36	0.20	0.65	0.19
α	0.97	0.97	0.97	0.89	0.97	0.89	0.97	0.97	0.97	0.89	0.97	0.97	0.97	0.97	0.97	0.89
fcf (ksi)	40.06		29.88		39.50		27.86		33.38		38.23		24.56		44.32	
Fcf (ksi)	54.66		51.16		54.37		51.16		51.23		53.72		51.16		56.85	
Fcf (kip)	3060.15		2864.09		3044.12		2864.09		2868.19		3007.48		2864.09		3182.61	
fncf (ksi)		3.15		-4.25		-9.01		11.80		-1.00		4.47		13.38		-11.61
Rcf		1.36		1.71		1.38		1.84		1.53		1.41		2.08		1.28
Fncf (ksi)		51.16		-46.84		-46.84		51.16		-46.84		51.16		51.16		-46.84
Fncf (kip)		2864.09		-3559.74		-3559.74		2864.09		-3559.74		2864.09		2864.09		-3559.74

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	26.09	-2.47	21.40	-2.93	25.08	-6.24	21.72	6.98	22.62	-1.19	25.71	-3.72	20.69	8.25	32.57	-8.26
Fs (ksi)	26.09	-2.47	21.40	-2.93	25.08	-6.24	21.72	6.98	22.62	-1.19	25.71	-3.72	20.69	8.25	32.57	-8.26
Fs (kip)	1982.96	-187.94	1626.40	-222.45	1905.80	-474.35	1650.46	530.74	1718.98	-90.19	1954.02	-282.89	1572.12	627.31	2475.08	-627.87

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3182.61	2864.09	2475.08	627.31
Comp	0.00	3559.74	0.00	627.87

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	419.88	425.21	659.95	227.60	403.32	402.26	279.88	559.04	309.11	311.16	478.73	171.54	297.42	294.94	208.48	407.43
Vuw (kip)	629.82	637.81	989.93	341.40	604.98	603.39	419.83	838.55	---	---	---	---	---	---	---	---
Mv (k*ft)	433.00	438.50	680.58	234.71	415.93	414.83	288.63	576.51	212.51	213.92	329.13	117.94	204.47	202.77	143.33	280.11
Huw (kip)	2762.79	2043.18	1947.94	3432.91	2322.21	2814.34	3730.12	1944.19	1133.69	886.71	904.07	1377.60	1028.71	1055.45	1389.11	1166.66
Muw (k*ft)	3133.96	3656.63	4184.72	1803.66	3293.72	2947.88	1407.37	4498.26	1828.13	1556.93	2004.34	942.92	1523.51	1883.71	795.63	2613.01
Mu (k*ft)	3566.96	4095.13	4865.30	2038.38	3709.65	3362.71	1696.00	5074.76	2040.64	1770.85	2333.47	1060.86	1727.98	2086.49	938.96	2893.12

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.05	14.09	13.43	23.68	16.02	19.41	25.72	13.41	7.82	6.12	6.23	9.50	7.09	7.28	9.58	8.05
PY1 (Vuw)	4.34	4.40	6.83	2.35	4.17	4.16	2.90	5.78	2.13	2.15	3.30	1.18	2.05	2.03	1.44	2.81
PX2 (Mu)	19.13	21.97	26.10	10.93	19.90	18.04	9.10	27.22	10.95	9.50	12.52	5.69	9.27	11.19	5.04	15.52
PY2 (Mu)	2.73	3.14	3.73	1.56	2.84	2.58	1.30	3.89	1.56	1.36	1.79	0.81	1.32	1.60	0.72	2.22
Pu (kip)	38.84	36.84	40.92	34.83	36.59	38.05	35.07	41.76	19.12	16.00	19.43	15.32	16.71	18.82	14.78	24.09

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1656.70	2842.88	2094.19	65.25	42.54	26.37	3470.71	2094.19	OK
TF Inside	1525.91	2618.44	1864.69	130.50	85.08	19.69	4694.23	1864.69	OK
BF Inside	1373.19	2036.56	1450.31	80.50	52.61	15.31	3116.16	1450.31	OK
BF Outside	1490.89	2211.13	1628.81	40.25	26.30	20.51	2431.99	1628.81	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	OK
TF Inside	0.00	2480.63	OK
BF Inside	1706.72	1929.38	OK
BF Outside	1853.02	2094.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.31	40.12	44.07	38.07	39.87	41.46	38.22	45.32
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	989.93
Rr (kip)	2632.40
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.25	0.89	1.0	32.04

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1656.70	16.57	OK	1288.40	12.88	OK
BF	1853.02	23.16	OK	326.84	4.09	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1656.70	16.57	1.47	134.83	OK
TF	3182.61	31.83	1.47	239.70	OK
TF Inside	1525.91	15.26	1.47	134.83	OK
BF Inside	1706.72	21.33	1.47	104.87	OK
BF	3559.74	44.50	1.47	239.70	OK
BF Outside	1853.02	23.16	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.76	20.88	OK	24.09	12.05	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.76	1.47	91.65	OK
Web SPL	20.88	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.26	NA
TF Inside	1.22	NA
BF Inside	1.06	1.13
BF Outside	1.09	1.13

Bolt	Shear	Slip	Bearing
TF	2.18	1.31	7.53
Web	1.46	1.40	2.19
BF	1.38	4.12	4.53

Plate	Shear	Flexure
Web	2.66	1.10

Field Splice

Type D

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 1041

Node 1041

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	56
Web	116
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1041 L	84.00	68.08	5718.49	84.00	59.12	4965.96	120.00	50.00	6000.00
1041 R	64.00	67.93	4347.77	64.00	62.33	3988.96	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 1041 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	48.06	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	48.06	70	85
Splice Plates	TF Outside	32.00	0.875	44.50	28.00	20.56	---	70	85
	TF Inside	14.50	1.000	44.50	29.00	20.50	---	70	85
	BF Inside	14.50	1.000	50.50	29.00	20.50	---	70	85
	BF Outside	32.00	0.875	50.50	28.00	20.56	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.36	-21.79	19.37	-19.06	16.87	-20.84	10.17	-12.05	6.74	-9.03	31.96	-36.17	34.17	-40.62	2.53	-2.34
ϕf Fnc (ksi)	67.93	62.33	67.93	62.56	67.93	62.41	67.93	62.44	67.93	62.36	67.93	62.47	67.93	62.44	67.93	62.60
f / ϕf Fnc	0.23	0.35	0.29	0.30	0.25	0.33	0.15	0.19	0.10	0.14	0.47	0.58	0.50	0.65	0.04	0.04
α	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89
fcf (ksi)		-21.79		-19.06		-20.84		-12.05		-9.03		-36.17		-40.62		-2.34
Fcf (ksi)		-46.75		-46.92		-46.81		-46.83		-46.77		-49.87		-52.15		-46.95
Fcf (kip)		-2991.72		-3002.72		-2995.81		-2997.05		-2993.37		-3191.63		-3337.46		-3004.58
fncf (ksi)	15.36		19.37		16.87		10.17		6.74		31.96		34.17		2.53	
Rcf	2.15		2.46		2.25		3.89		5.18		1.38		1.28		20.04	
Fncf (ksi)	50.95		50.95		50.95		50.95		50.95		50.95		50.95		52.22	
Fncf (kip)	2448.69		2448.69		2448.69		2448.69		2448.69		2448.69		2448.69		2509.79	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	6.05	-13.39	13.53	-13.11	11.79	-14.38	4.69	-7.63	4.33	-5.84	22.02	-25.21	23.99	-28.34	2.78	-1.75
Fs (ksi)	6.05	-13.39	13.53	-13.11	11.79	-14.38	4.69	-7.63	4.33	-5.84	22.02	-25.21	23.99	-28.34	2.78	-1.75
Fs (kip)	387.51	-856.72	866.15	-838.80	754.29	-920.63	300.31	-488.08	276.95	-373.99	1409.26	-1613.75	1535.59	-1813.93	178.22	-112.13

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2509.79	0.00	1535.59	0.00
Comp	0.00	3337.46	0.00	1813.93

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	533.20	521.89	778.18	311.21	602.45	481.74	551.71	503.89	388.07	383.51	564.59	231.23	440.43	351.71	404.59	367.36
Vuw (kip)	799.80	782.83	1076.78	466.82	903.67	722.61	827.57	755.83	---	---	---	---	---	---	---	---
Mv (k*ft)	449.89	440.34	605.69	262.58	508.31	406.47	465.51	425.16	218.29	215.73	317.58	130.06	247.74	197.84	227.58	206.64
Huw (kip)	-595.49	103.05	-362.06	-285.24	-504.45	-208.29	-323.61	245.74	-351.91	20.51	-124.76	-140.83	-72.78	-153.37	-208.76	49.57
Muw (k*ft)	5012.85	5965.59	5332.03	5436.87	5137.43	5917.14	6046.43	6159.45	1244.23	1704.95	1674.92	788.39	650.95	3023.02	3349.52	290.35
Mu (k*ft)	5462.74	6405.93	5937.72	5699.45	5645.75	6323.61	6511.93	6584.60	1462.52	1920.68	1992.50	918.45	898.69	3220.86	3577.10	496.99

Note: Mu = Muw + Mv

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.13	0.89	3.12	2.46	4.35	1.80	2.79	2.12	3.03	0.18	1.08	1.21	0.63	1.32	1.80	0.43
PY1 (Vuw)	6.89	6.75	9.28	4.02	7.79	6.23	7.13	6.52	3.35	3.31	4.87	1.99	3.80	3.03	3.49	3.17
PX2 (Mu)	37.01	43.40	40.23	38.62	38.25	42.85	44.12	44.61	9.91	13.01	13.50	6.22	6.09	21.82	24.24	3.37
PY2 (Mu)	3.97	4.65	4.31	4.14	4.10	4.59	4.73	4.78	1.06	1.39	1.45	0.67	0.65	2.34	2.60	0.36
Pu (kip)	43.52	45.74	45.43	41.88	44.23	45.93	48.39	48.08	13.67	14.00	15.88	7.90	8.06	23.76	26.74	5.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1232.88	1862.00	1398.25	35.00	22.91	17.99	2127.20	1398.25	OK
TF Inside	1276.91	1928.50	1394.00	80.00	52.38	14.63	3060.17	1394.00	OK
BF Inside	0.00	1928.50	1394.00	92.00	60.13	14.63	3365.83	1394.00	OK
BF Outside	0.00	1862.00	1398.25	40.25	26.30	17.99	2260.93	1398.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1764.00	OK
TF Inside	0.00	1827.00	OK
BF Inside	1698.01	1827.00	OK
BF Outside	1639.45	1764.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.56	39.59	38.69	36.67	37.99	39.88	41.89	41.74
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1076.78
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1276.91	22.80	OK	781.27	13.95	OK
BF	1698.01	26.53	OK	922.88	14.42	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1232.88	22.02	1.47	104.87	OK
TF	2509.79	44.82	1.47	239.70	OK
TF Inside	1276.91	22.80	1.47	119.85	OK
BF Inside	1698.01	26.53	1.47	119.85	OK
BF	3337.46	52.15	1.47	239.70	OK
BF Outside	1639.45	25.62	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.39	24.19	OK	26.74	13.37	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.39	1.47	91.65	OK
Web SPL	24.19	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.13	NA
TF Inside	1.09	NA
BF Inside	NA	1.08
BF Outside	NA	1.08

Bolt	Shear	Slip	Bearing
TF	1.59	1.21	4.76
Web	1.50	1.26	1.89
BF	1.36	1.17	4.09

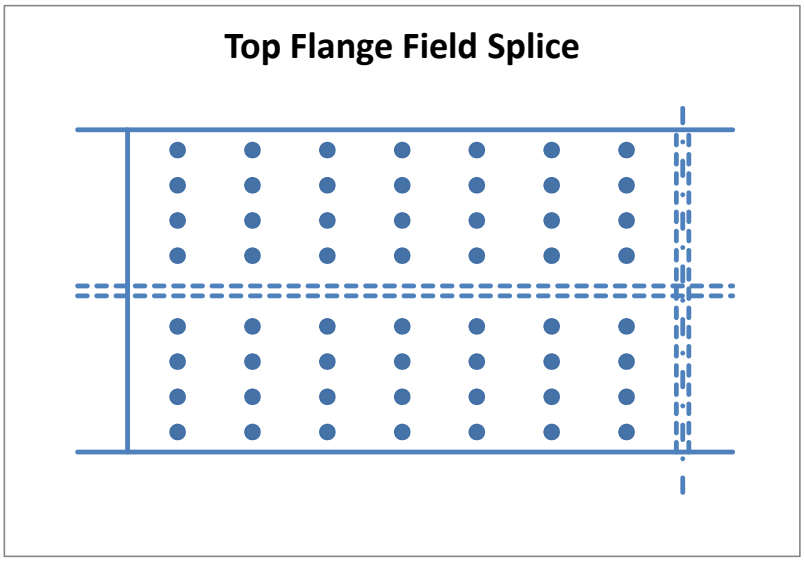
Plate	Shear	Flexure
Web	2.44	1.19

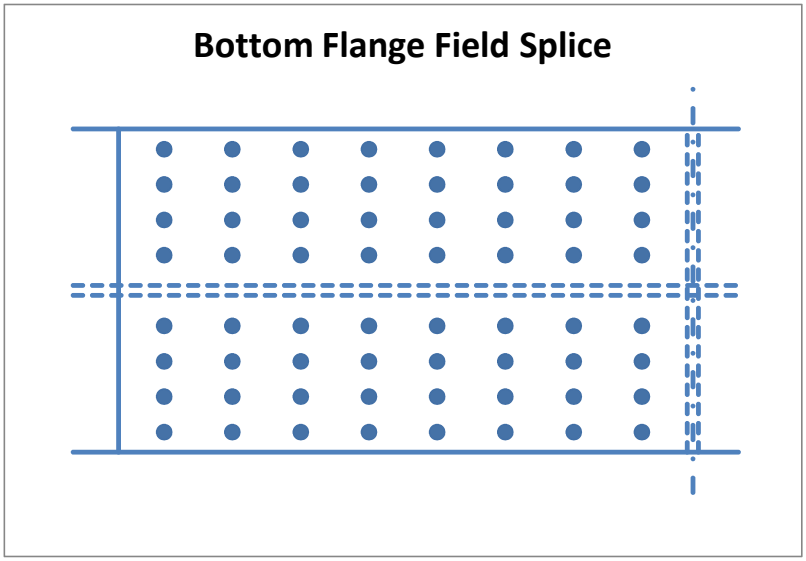
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1041	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1041

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
		21	0
		21	3.5
		21	7

	Top Flange		Bottom Flange	
No. Bolts =	56.0		64.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	6.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





		21	10.5
		21	17.5
		21	21
		21	24.5
		21	28

Flange Bolt Pattern Cont. - Node 1041

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
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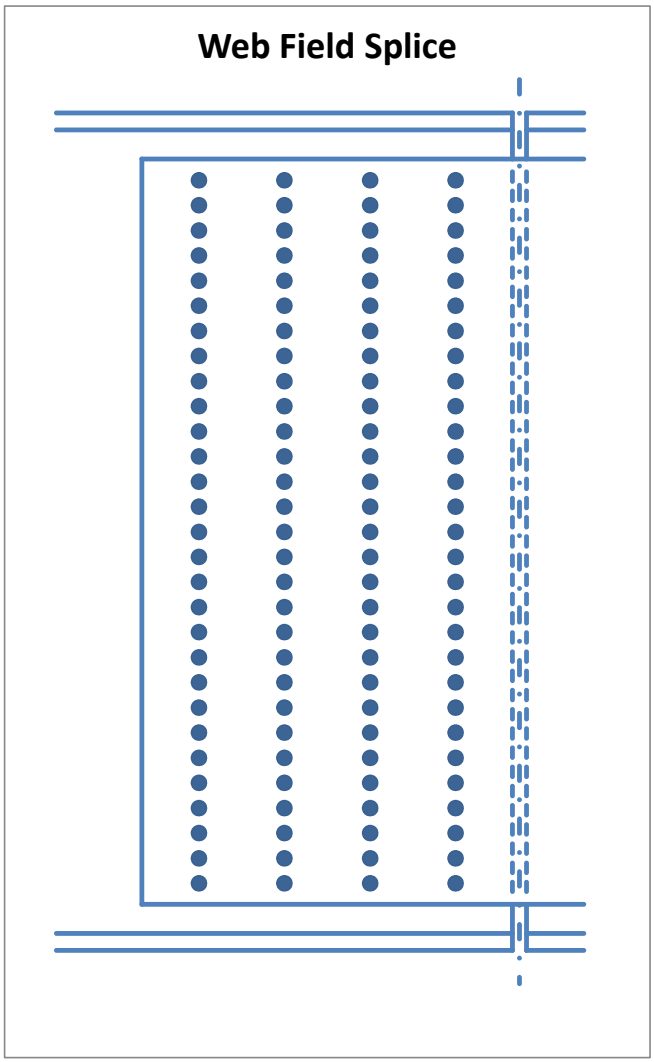
Web Bolt Pattern - Node 1041

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 1041

Web Bolt Pattern Cont. - Node 1041

522	4872	1305	73080

Field Splice - Node 3041

Node 3041

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	56
Web	116
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3041 L	84.00	68.06	5716.78	84.00	59.11	4965.05	120.00	50.00	6000.00
3041 R	64.00	67.91	4346.38	64.00	62.17	3978.98	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 3041 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	48.06	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	48.06	70	85
Splice Plates	TF Outside	32.00	0.875	44.50	28.00	20.56	---	70	85
	TF Inside	14.50	1.000	44.50	29.00	20.50	---	70	85
	BF Inside	14.50	1.000	50.50	29.00	20.50	---	70	85
	BF Outside	32.00	0.875	50.50	28.00	20.56	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 3041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	10.33	-15.95	22.76	-26.13	14.65	-19.26	10.39	-14.06	7.34	-11.71	27.69	-32.47	31.67	-38.49	1.54	-3.58
ϕf Fnc (ksi)	67.91	62.17	67.91	62.44	67.91	62.36	67.91	62.34	67.91	62.05	67.91	62.43	67.91	62.41	67.91	60.60
f / ϕf Fnc	0.15	0.26	0.34	0.42	0.22	0.31	0.15	0.23	0.11	0.19	0.41	0.52	0.47	0.62	0.02	0.06
α	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.87
fcf (ksi)		-15.95		-26.13		-19.26		-14.06		-11.71		-32.47		-38.49		-3.58
Fcf (ksi)		-46.63		-46.83		-46.77		-46.76		-46.54		-47.95		-51.04		-45.45
Fcf (kip)		-2984.23		-2997.28		-2993.22		-2992.37		-2978.54		-3068.69		-3266.68		-2908.97
fncf (ksi)	10.33		22.76		14.65		10.39		7.34		27.69		31.67		1.54	
Rcf	2.92		1.79		2.43		3.32		3.98		1.48		1.33		12.71	
Fncf (ksi)	50.93		50.93		50.93		50.93		50.93		50.93		50.93		50.93	
Fncf (kip)	2447.90		2447.90		2447.90		2447.90		2447.90		2447.90		2447.90		2447.90	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.35	-9.88	15.85	-18.09	5.69	-12.07	4.26	-8.81	3.92	-7.42	19.09	-22.57	22.17	-26.85	2.00	-2.42
Fs (ksi)	4.35	-9.88	15.85	-18.09	5.69	-12.07	4.26	-8.81	3.92	-7.42	19.09	-22.57	22.17	-26.85	2.00	-2.42
Fs (kip)	278.27	-632.38	1014.52	-1157.93	364.45	-772.20	272.63	-564.05	250.86	-474.88	1221.86	-1444.56	1418.82	-1718.51	128.01	-155.01

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2447.90	0.00	1418.82	0.00
Comp	0.00	3266.68	0.00	1718.51

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	571.48	591.93	823.29	353.45	625.95	562.37	585.07	597.27	414.31	431.48	594.94	260.28	455.52	407.88	426.64	432.54
Vuw (kip)	857.21	887.90	1099.34	530.18	938.93	843.55	877.61	895.90	---	---	---	---	---	---	---	---
Mv (k*ft)	482.18	499.44	618.38	298.23	528.15	474.50	493.65	503.94	233.05	242.71	334.66	146.41	256.23	229.43	239.98	243.30
Huw (kip)	-722.01	-222.91	-470.38	-518.58	-765.70	-270.25	-361.41	-1180.10	-265.58	-107.56	-305.81	-218.56	-168.01	-167.02	-224.77	-20.25
Muw (k*ft)	4827.77	5518.55	5180.70	5114.79	4758.48	5594.00	5856.62	4070.94	910.65	2172.45	1136.64	836.68	725.74	2666.42	3137.32	283.02
Mu (k*ft)	5309.95	6017.99	5799.08	5413.02	5286.62	6068.50	6350.27	4574.89	1143.70	2415.16	1471.30	983.09	981.97	2895.85	3377.31	526.32

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	6.22	1.92	4.06	4.47	6.60	2.33	3.12	10.17	2.29	0.93	2.64	1.88	1.45	1.44	1.94	0.17
PY1 (Vuw)	7.39	7.65	9.48	4.57	8.09	7.27	7.57	7.72	3.57	3.72	5.13	2.24	3.93	3.52	3.68	3.73
PX2 (Mu)	35.98	40.78	39.29	36.68	35.82	41.12	43.03	31.00	7.75	16.36	9.97	6.66	6.65	19.62	22.88	3.57
PY2 (Mu)	3.85	4.37	4.21	3.93	3.84	4.41	4.61	3.32	0.83	1.75	1.07	0.71	0.71	2.10	2.45	0.38
Pu (kip)	43.67	44.36	45.46	42.02	44.07	44.99	47.72	42.63	10.96	18.14	14.05	9.04	9.34	21.80	25.57	5.56

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1202.48	1862.00	1398.25	35.00	22.91	17.99	2127.20	1398.25	OK
TF Inside	1245.42	1928.50	1394.00	80.00	52.38	14.63	3060.17	1394.00	OK
BF Inside	0.00	1928.50	1394.00	92.00	60.13	14.63	3365.83	1394.00	OK
BF Outside	0.00	1862.00	1398.25	40.25	26.30	17.99	2260.93	1398.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1764.00	OK
TF Inside	0.00	1827.00	OK
BF Inside	1661.99	1827.00	OK
BF Outside	1604.68	1764.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.59	38.14	38.66	36.69	37.77	38.80	41.19	36.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1099.34
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1245.42	22.24	OK	721.85	12.89	OK
BF	1661.99	25.97	OK	874.33	13.66	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1202.48	21.47	1.47	104.87	OK
TF	2447.90	43.71	1.47	239.70	OK
TF Inside	1245.42	22.24	1.47	119.85	OK
BF Inside	1661.99	25.97	1.47	119.85	OK
BF	3266.68	51.04	1.47	239.70	OK
BF Outside	1604.68	25.07	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.72	23.86	OK	25.57	12.78	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.72	1.47	91.65	OK
Web SPL	23.86	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.16	NA
TF Inside	1.12	NA
BF Inside	NA	1.10
BF Outside	NA	1.10

Bolt	Shear	Slip	Bearing
TF	1.63	1.31	4.88
Web	1.52	1.32	1.92
BF	1.39	1.23	4.18

Plate	Shear	Flexure
Web	2.39	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5041	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5041

Node 5041

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	56
Web	116
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5041 L	84.00	68.06	5716.78	84.00	59.11	4965.05	120.00	50.00	6000.00
5041 R	64.00	67.91	4346.38	64.00	61.65	3945.38	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 5041 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	48.06	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	48.06	70	85
Splice Plates	TF Outside	32.00	0.875	44.50	28.00	20.56	---	70	85
	TF Inside	14.50	1.000	44.50	29.00	20.50	---	70	85
	BF Inside	14.50	1.000	50.50	29.00	20.50	---	70	85
	BF Outside	32.00	0.875	50.50	28.00	20.56	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	7.26	-12.88	25.19	-28.97	14.78	-20.42	10.41	-14.12	13.14	-18.60	20.07	-23.90	29.80	-36.45	1.59	-3.91
ϕf Fnc (ksi)	67.91	61.65	67.91	62.44	67.91	62.33	67.91	62.34	67.91	62.31	67.91	62.42	67.91	62.40	67.91	60.39
f / ϕf Fnc	0.11	0.21	0.37	0.46	0.22	0.33	0.15	0.23	0.19	0.30	0.30	0.38	0.44	0.58	0.02	0.06
α	0.97	0.88	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.86
fcf (ksi)		-12.88		-28.97		-20.42		-14.12		-18.60		-23.90		-36.45		-3.91
Fcf (ksi)		-46.23		-46.83		-46.75		-46.75		-46.74		-46.82		-49.99		-45.29
Fcf (kip)		-2959.03		-2997.23		-2991.75		-2992.30		-2991.04		-2996.16		-3199.08		-2898.55
fncf (ksi)	7.26		25.19		14.78		10.41		13.14		20.07		29.80		1.59	
Rcf	3.59		1.62		2.29		3.31		2.51		1.96		1.37		11.57	
Fncf (ksi)	50.93		50.93		50.93		50.93		50.93		50.93		50.93		50.93	
Fncf (kip)	2447.90		2447.90		2447.90		2447.90		2447.90		2447.90		2447.90		2447.90	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.29	-7.99	17.45	-20.05	5.36	-12.69	4.21	-8.84	5.24	-11.63	13.83	-16.48	20.77	-25.43	1.78	-2.57
Fs (ksi)	3.29	-7.99	17.45	-20.05	5.36	-12.69	4.21	-8.84	5.24	-11.63	13.83	-16.48	20.77	-25.43	1.78	-2.57
Fs (kip)	210.87	-511.63	1116.48	-1283.49	342.91	-812.19	269.49	-565.80	335.07	-744.11	884.90	-1054.56	1329.23	-1627.33	114.12	-164.53

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2447.90	0.00	1329.23	0.00
Comp	0.00	3199.08	0.00	1627.33

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	687.61	582.08	844.91	384.53	662.65	608.99	598.64	626.58	498.40	421.90	609.53	282.32	480.76	440.91	435.54	453.33
Vuw (kip)	1031.42	873.13	1110.15	576.79	993.97	913.49	897.97	939.87	---	---	---	---	---	---	---	---
Mv (k*ft)	580.17	491.13	624.46	324.45	559.11	513.84	505.11	528.68	280.35	237.32	342.86	158.80	270.43	248.01	244.99	255.00
Huw (kip)	-902.24	-226.10	-552.75	-522.34	-591.48	-293.59	-365.77	-1227.79	-225.58	-125.25	-351.96	-222.23	-306.78	-127.24	-223.58	-37.81
Muw (k*ft)	4538.57	5514.19	5068.04	5109.65	5015.03	5422.14	5719.63	3987.14	722.50	2399.97	1155.10	835.29	1079.18	1939.46	2956.56	278.65
Mu (k*ft)	5118.74	6005.33	5692.50	5434.09	5574.14	5935.98	6224.74	4515.82	1002.85	2637.29	1497.96	994.09	1349.61	2187.47	3201.55	533.65

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	Cleveland InnerBelt : Field Splice - Node 5041	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	7.78	1.95	4.77	4.50	5.10	2.53	3.15	10.58	1.94	1.08	3.03	1.92	2.64	1.10	1.93	0.33
PY1 (Vuw)	8.89	7.53	9.57	4.97	8.57	7.87	7.74	8.10	4.30	3.64	5.25	2.43	4.14	3.80	3.75	3.91
PX2 (Mu)	34.68	40.69	38.57	36.82	37.77	40.22	42.18	30.60	6.79	17.87	10.15	6.74	9.14	14.82	21.69	3.62
PY2 (Mu)	3.72	4.36	4.13	3.94	4.05	4.31	4.52	3.28	0.73	1.91	1.09	0.72	0.98	1.59	2.32	0.39
Pu (kip)	44.29	44.26	45.45	42.27	44.68	44.45	46.96	42.73	10.08	19.75	14.63	9.21	12.85	16.81	24.39	5.83

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1202.48	1862.00	1398.25	35.00	22.91	17.99	2127.20	1398.25	OK
TF Inside	1245.42	1928.50	1394.00	80.00	52.38	14.63	3060.17	1394.00	OK
BF Inside	0.00	1928.50	1394.00	92.00	60.13	14.63	3365.83	1394.00	OK
BF Outside	0.00	1862.00	1398.25	40.25	26.30	17.99	2260.93	1398.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1764.00	OK
TF Inside	0.00	1827.00	OK
BF Inside	1627.60	1827.00	OK
BF Outside	1571.48	1764.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.78	38.08	38.64	36.84	38.21	38.17	40.46	36.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1110.15
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1245.42	22.24	OK	676.27	12.08	OK
BF	1627.60	25.43	OK	827.94	12.94	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1202.48	21.47	1.47	104.87	OK
TF	2447.90	43.71	1.47	239.70	OK
TF Inside	1245.42	22.24	1.47	119.85	OK
BF Inside	1627.60	25.43	1.47	119.85	OK
BF	3199.08	49.99	1.47	239.70	OK
BF Outside	1571.48	24.55	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.96	23.48	OK	24.39	12.19	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.96	1.47	91.65	OK
Web SPL	23.48	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.16	NA
TF Inside	1.12	NA
BF Inside	NA	1.12
BF Outside	NA	1.12

Bolt	Shear	Slip	Bearing
TF	1.63	1.39	4.88
Web	1.54	1.38	1.95
BF	1.42	1.30	4.27

Plate	Shear	Flexure
Web	2.37	1.24

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7041	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7041

Node 7041

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	56
Web	116
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7041 L	84.00	68.06	5716.78	84.00	59.11	4965.05	120.00	50.00	6000.00
7041 R	64.00	67.91	4346.38	64.00	62.10	3974.27	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 7041 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	48.06	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	48.06	70	85
Splice Plates	TF Outside	32.00	0.875	44.50	28.00	20.56	---	70	85
	TF Inside	14.50	1.000	44.50	29.00	20.50	---	70	85
	BF Inside	14.50	1.000	50.50	29.00	20.50	---	70	85
	BF Outside	32.00	0.875	50.50	28.00	20.56	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	9.64	-15.18	20.46	-23.28	12.19	-16.63	8.85	-11.89	21.85	-25.80	7.42	-11.66	29.27	-35.63	-0.31	-1.69
ϕf Fnc (ksi)	67.91	62.10	67.91	62.45	67.91	62.34	67.91	62.35	67.91	62.43	67.91	62.11	67.91	62.41	67.91	54.70
f / ϕf Fnc	0.14	0.24	0.30	0.37	0.18	0.27	0.13	0.19	0.32	0.41	0.11	0.19	0.43	0.57	0.00	0.03
α	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.78
fcf (ksi)		-15.18		-23.28		-16.63		-11.89		-25.80		-11.66		-35.63		-1.69
Fcf (ksi)		-46.57		-46.84		-46.75		-46.76		-46.82		-46.58		-49.57		-41.03
Fcf (kip)		-2980.70		-2997.55		-2992.11		-2992.57		-2996.43		-2981.11		-3172.37		-2625.67
fncf (ksi)	9.64		20.46		12.19		8.85		21.85		7.42		29.27		-0.31	
Rcf	3.07		2.01		2.81		3.93		1.81		3.99		1.39		24.28	
Fncf (ksi)	50.93		50.93		50.93		50.93		50.93		50.93		50.93		-50.93	
Fncf (kip)	2447.90		2447.90		2447.90		2447.90		2447.90		2447.90		2447.90		-3259.78	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.57	-9.31	14.27	-16.05	4.29	-10.30	3.67	-7.44	15.10	-17.96	3.36	-7.21	20.50	-24.79	1.17	-1.25
Fs (ksi)	3.57	-9.31	14.27	-16.05	4.29	-10.30	3.67	-7.44	15.10	-17.96	3.36	-7.21	20.50	-24.79	1.17	-1.25
Fs (kip)	228.34	-595.61	913.47	-1027.51	274.61	-658.93	234.80	-476.00	966.48	-1149.41	215.35	-461.36	1311.87	-1586.26	74.72	-80.10

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2447.90	0.00	1311.87	0.00
Comp	3259.78	3172.37	0.00	1586.26

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	568.60	576.88	811.21	346.08	554.52	618.78	574.23	589.36	413.98	418.94	585.39	255.88	404.03	448.54	417.07	428.65
Vuw (kip)	852.90	865.32	1093.30	519.12	831.78	928.16	861.35	884.04	---	---	---	---	---	---	---	---
Mv (k*ft)	479.76	486.74	614.98	292.01	467.88	522.09	484.51	497.27	232.86	235.65	329.28	143.93	227.27	252.30	234.60	241.11
Huw (kip)	-749.34	-205.34	-532.79	-507.26	-276.67	-746.23	-354.11	-2273.03	-275.45	-85.53	-288.24	-180.91	-137.19	-184.51	-205.79	-4.04
Muw (k*ft)	4784.47	5542.50	5095.34	5130.28	5445.23	4789.41	5683.35	2064.00	823.95	1940.98	933.54	710.80	2115.89	676.71	2898.12	154.82
Mu (k*ft)	5264.23	6029.24	5710.32	5422.28	5913.11	5311.50	6167.86	2561.27	1056.81	2176.64	1262.83	854.73	2343.16	929.01	3132.73	395.94

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	6.46	1.77	4.59	4.37	2.39	6.43	3.05	19.60	2.37	0.74	2.48	1.56	1.18	1.59	1.77	0.03
PY1 (Vuw)	7.35	7.46	9.42	4.48	7.17	8.00	7.43	7.62	3.57	3.61	5.05	2.21	3.48	3.87	3.60	3.70
PX2 (Mu)	35.67	40.85	38.69	36.74	40.06	35.99	41.79	17.35	7.16	14.75	8.56	5.79	15.88	6.29	21.23	2.68
PY2 (Mu)	3.82	4.38	4.15	3.94	4.29	3.86	4.48	1.86	0.77	1.58	0.92	0.62	1.70	0.67	2.27	0.29
Pu (kip)	43.58	44.23	45.36	41.96	43.97	44.05	46.40	38.15	10.47	16.33	12.55	7.88	17.83	9.10	23.74	4.82

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1202.48	1862.00	1398.25	35.00	22.91	17.99	2127.20	1398.25	OK
TF Inside	1245.42	1928.50	1394.00	80.00	52.38	14.63	3060.17	1394.00	OK
BF Inside	0.00	1928.50	1394.00	92.00	60.13	14.63	3365.83	1394.00	OK
BF Outside	0.00	1862.00	1398.25	40.25	26.30	17.99	2260.93	1398.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1601.30	1764.00	OK
TF Inside	1658.49	1827.00	OK
BF Inside	1614.01	1827.00	OK
BF Outside	1558.36	1764.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.51	38.07	38.59	36.66	37.90	37.78	40.03	32.55
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1093.30
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1658.49	29.62	OK	667.44	11.92	OK
BF	1614.01	25.22	OK	807.04	12.61	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1601.30	28.59	1.47	104.87	OK
TF	3259.78	58.21	1.47	239.70	OK
TF Inside	1658.49	29.62	1.47	119.85	OK
BF Inside	1614.01	25.22	1.47	119.85	OK
BF	3172.37	49.57	1.47	239.70	OK
BF Outside	1558.36	24.35	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.40	23.20	OK	23.74	11.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.40	1.47	91.65	OK
Web SPL	23.20	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.16	1.10
TF Inside	1.12	1.10
BF Inside	NA	1.13
BF Outside	NA	1.13

Bolt	Shear	Slip	Bearing
TF	1.22	1.41	3.67
Web	1.56	1.42	1.98
BF	1.44	1.33	4.31

Plate	Shear	Flexure
Web	2.41	1.25

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9041	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9041

Node 9041

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	56
Web	116
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9041 L	84.00	68.08	5718.49	84.00	59.12	4965.96	120.00	50.00	6000.00
9041 R	64.00	67.93	4347.77	64.00	62.30	3987.05	96.00	50.00	4800.00

Rh = 0.97

Controlling Section = 9041 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	48.06	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	48.06	70	85
Splice Plates	TF Outside	32.00	0.875	44.50	28.00	20.56	---	70	85
	TF Inside	14.50	1.000	44.50	29.00	20.50	---	70	85
	BF Inside	14.50	1.000	50.50	29.00	20.50	---	70	85
	BF Outside	32.00	0.875	50.50	28.00	20.56	---	70	85
	Web	89.00	0.750	26.50	133.50	87.28	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	13.03	-19.41	15.14	-14.12	11.98	-15.70	7.19	-8.29	26.19	-29.37	3.37	-5.36	28.91	-34.91	-1.05	1.76
ϕf Fnc (ksi)	67.93	62.30	67.93	62.59	67.93	62.38	67.93	62.46	67.93	62.47	67.93	62.07	67.93	62.43	67.93	67.93
f / ϕf Fnc	0.19	0.31	0.22	0.23	0.18	0.25	0.11	0.13	0.39	0.47	0.05	0.09	0.43	0.56	0.02	0.03
α	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.89	0.97	0.97
fcf (ksi)		-19.41		-14.12		-15.70		-8.29		-29.37		-5.36		-34.91		1.76
Fcf (ksi)		-46.72		-46.94		-46.78		-46.84		-46.86		-46.56		-49.20		50.95
Fcf (kip)		-2990.29		-3004.37		-2994.04		-2997.88		-2998.73		-2979.54		-3148.89		2448.69
fncf (ksi)	13.03		15.14		11.98		7.19		26.19		3.37		28.91		-1.05	
Rcf	2.41		3.33		2.98		5.65		1.60		8.69		1.41		28.94	
Fncf (ksi)	50.95		51.86		50.95		50.95		50.95		50.95		50.95		-50.95	
Fncf (kip)	2448.69		2492.61		2448.69		2448.69		2448.69		2448.69		2448.69		-3260.83	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.50	-11.77	10.63	-9.61	4.36	-9.65	3.38	-5.20	18.13	-20.53	2.45	-3.34	20.36	-24.30	0.96	0.89
Fs (ksi)	4.50	-11.77	10.63	-9.61	4.36	-9.65	3.38	-5.20	18.13	-20.53	2.45	-3.34	20.36	-24.30	0.96	0.89
Fs (kip)	287.83	-753.23	680.63	-614.85	279.20	-617.73	216.28	-332.66	1160.60	-1313.90	156.62	-213.60	1303.23	-1555.21	61.73	57.02

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2492.61	2448.69	1303.23	57.02
Comp	3260.83	3148.89	0.00	1555.21

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	503.76	487.71	740.00	288.84	472.66	547.80	512.98	484.93	368.90	356.89	535.81	216.38	346.93	399.34	374.74	355.59
Vuw (kip)	755.64	731.56	1057.69	433.26	709.00	821.70	769.46	727.39	---	---	---	---	---	---	---	---
Mv (k*ft)	425.05	411.50	594.95	243.71	398.81	462.20	432.82	409.16	207.51	200.75	301.39	121.72	195.15	224.63	210.79	200.02
Huw (kip)	-671.37	229.24	-466.42	-232.41	-177.16	-764.59	-336.68	921.40	-349.05	49.34	-253.89	-87.29	-114.97	-42.73	-188.99	89.06
Muw (k*ft)	4908.90	6137.05	5189.44	5508.92	5584.23	4763.74	5663.01	5100.64	1041.05	1295.47	896.93	548.95	2474.50	370.21	2858.44	4.71
Mu (k*ft)	5333.94	6548.55	5784.39	5752.63	5983.04	5225.95	6095.83	5509.80	1248.56	1496.22	1198.32	670.66	2669.64	594.84	3069.23	204.73

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9041**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.79	1.98	4.02	2.00	1.53	6.59	2.90	7.94	3.01	0.43	2.19	0.75	0.99	0.37	1.63	0.77
PY1 (Vuw)	6.51	6.31	9.12	3.73	6.11	7.08	6.63	6.27	3.18	3.08	4.62	1.87	2.99	3.44	3.23	3.07
PX2 (Mu)	36.14	44.37	39.19	38.98	40.54	35.41	41.30	37.33	8.46	10.14	8.12	4.54	18.09	4.03	20.80	1.39
PY2 (Mu)	3.87	4.75	4.20	4.18	4.34	3.79	4.43	4.00	0.91	1.09	0.87	0.49	1.94	0.43	2.23	0.15
Pu (kip)	43.20	47.65	45.22	41.74	43.35	43.39	45.57	46.43	12.18	11.35	11.68	5.80	19.71	5.86	23.08	3.87

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1224.44	1862.00	1398.25	35.00	22.91	17.99	2127.20	1398.25	OK
TF Inside	1268.17	1928.50	1394.00	80.00	52.38	14.63	3060.17	1394.00	OK
BF Inside	1245.82	1928.50	1394.00	92.00	60.13	14.63	3365.83	1394.00	OK
BF Outside	1202.86	1862.00	1398.25	40.25	26.30	17.99	2260.93	1398.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1601.81	1764.00	OK
TF Inside	1659.02	1827.00	OK
BF Inside	1602.07	1827.00	OK
BF Outside	1546.83	1764.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.35	41.40	38.55	36.60	37.58	37.40	39.46	40.29
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1980.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1057.69
Rr (kip)	2632.40
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1659.02	29.63	OK	663.05	11.84	OK
BF	1602.07	25.03	OK	791.25	12.36	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1601.81	28.60	1.47	104.87	OK
TF	3260.83	58.23	1.47	239.70	OK
TF Inside	1659.02	29.63	1.47	119.85	OK
BF Inside	1602.07	25.03	1.47	119.85	OK
BF	3148.89	49.20	1.47	239.70	OK
BF Outside	1546.83	24.17	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.65	23.82	OK	23.08	11.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.65	1.47	91.65	OK
Web SPL	23.82	1.47	68.74	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.14	1.10
TF Inside	1.10	1.10
BF Inside	1.12	1.14
BF Outside	1.16	1.14

Bolt	Shear	Slip	Bearing
TF	1.22	1.42	3.67
Web	1.52	1.46	1.92
BF	1.45	1.36	4.34

Plate	Shear	Flexure
Web	2.49	1.21

Field Splice

Type E

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1051	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1051

Node 1051

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1051 L	64.00	67.93	4347.77	64.00	63.26	4048.90	96.00	50.00	4800.00
1051 R	72.00	50.00	3600.00	72.00	47.20	3398.08	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1051 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	7.79	-11.03	5.61	-1.58	3.47	1.64	6.09	-6.82	2.74	6.77	23.49	-24.88	26.66	-30.24	-0.77	11.94
ϕf Fnc (ksi)	50.00	47.20	50.00	47.77	50.00	50.00	50.00	47.28	50.00	50.00	50.00	47.31	50.00	47.28	50.00	50.00
f / ϕf Fnc	0.16	0.23	0.11	0.03	0.07	0.03	0.12	0.14	0.05	0.14	0.47	0.53	0.53	0.64	0.02	0.24
α	1.00	0.94	1.00	0.96	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-11.03	5.61		3.47			-6.82		6.77		-24.88		-30.24		11.94
Fcf (ksi)		-35.40	37.50		37.50			-35.46		37.50		-36.09		-38.76		37.50
Fcf (kip)		-2548.56	2170.66		2170.66			-2553.35		2170.66		-2598.66		-2790.65		2170.66
fncf (ksi)	7.79			-1.58		1.64	6.09		2.74		23.49		26.66		-0.77	
Rcf	3.21			6.68		10.81	5.20		5.54		1.45		1.28		3.14	
Fncf (ksi)	37.50			-35.83		37.50	37.50		37.50		37.50		37.50		-37.50	
Fncf (kip)	2170.66			-2579.72		2170.66	2170.66		2170.66		2170.66		2170.66		-2700.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.54	-7.10	4.31	-1.14	2.14	1.75	4.02	-4.75	1.64	4.87	9.70	-15.48	18.55	-21.34	-0.85	9.03
Fs (ksi)	4.54	-7.10	4.31	-1.14	2.14	1.75	4.02	-4.75	1.64	4.87	9.70	-15.48	18.55	-21.34	-0.85	9.03
Fs (kip)	326.58	-511.33	310.40	-81.96	153.96	125.99	289.14	-341.92	118.29	350.67	698.35	-1114.89	1335.27	-1536.14	-61.06	650.01

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	1335.27	650.01
Comp	2700.00	2790.65	61.06	1536.14

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	450.37	349.42	193.63	674.89	457.11	383.78	434.81	391.21	329.72	255.43	145.36	488.35	334.49	279.71	318.73	284.95
Vuw (kip)	675.55	524.13	290.45	1012.33	685.67	575.67	652.21	586.81	---	---	---	---	---	---	---	---
Mv (k*ft)	295.55	229.31	127.07	442.89	299.98	251.86	285.34	256.73	144.25	111.75	63.60	213.65	146.34	122.37	139.45	124.67
Huw (kip)	-499.50	1292.60	2649.43	-181.77	2527.40	-96.87	-220.20	1683.22	-123.16	152.29	186.63	-35.18	312.64	-277.69	-133.91	392.63
Muw (k*ft)	3864.77	3076.54	1267.43	4296.92	1430.14	4490.68	4667.56	2555.71	744.81	348.76	24.86	560.94	206.56	1611.76	2552.36	632.07
Mu (k*ft)	4160.33	3305.84	1394.50	4739.81	1730.12	4742.53	4952.90	2812.44	889.06	460.51	88.46	774.60	352.90	1734.13	2691.80	756.73

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.74	14.86	30.45	2.09	29.05	1.11	2.53	19.35	1.42	1.75	2.15	0.40	3.59	3.19	1.54	4.51
PY1 (Vuw)	7.76	6.02	3.34	11.64	7.88	6.62	7.50	6.74	3.79	2.94	1.67	5.61	3.84	3.22	3.66	3.28
PX2 (Mu)	37.89	30.11	12.70	43.17	15.76	43.20	45.11	25.62	8.10	4.19	0.81	7.06	3.21	15.80	24.52	6.89
PY2 (Mu)	2.71	2.15	0.91	3.08	1.13	3.09	3.22	1.83	0.58	0.30	0.06	0.50	0.23	1.13	1.75	0.49
Pu (kip)	44.88	45.71	43.36	47.60	45.71	45.36	48.84	45.78	10.47	6.77	3.42	9.65	7.93	19.48	26.61	12.01

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1400.15	1631.25	OK
BF Outside	1390.50	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.74	35.66	33.96	36.10	35.30	35.36	38.00	35.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1012.33
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	668.68	10.45	OK
BF	1400.15	21.88	OK	770.73	12.04	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1400.15	21.88	1.47	114.56	OK
BF	2790.65	43.60	1.47	206.21	OK
BF Outside	1390.50	21.73	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.84	24.42	OK	26.61	13.31	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.84	1.47	91.65	OK
Web SPL	24.42	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.17
BF Outside	1.27	1.17

Bolt	Shear	Slip	Bearing
TF	1.56	1.61	4.89
Web	1.48	1.26	1.88
BF	1.50	1.40	4.73

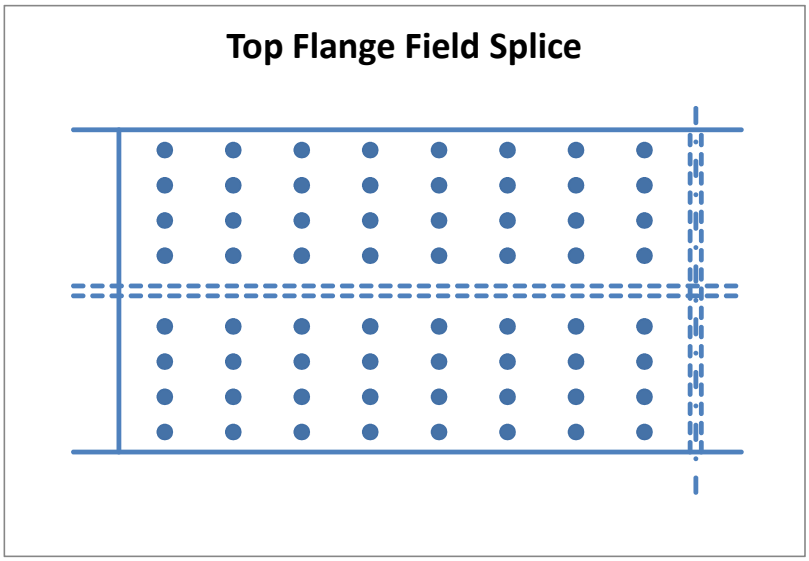
Plate	Shear	Flexure
Web	2.17	1.32

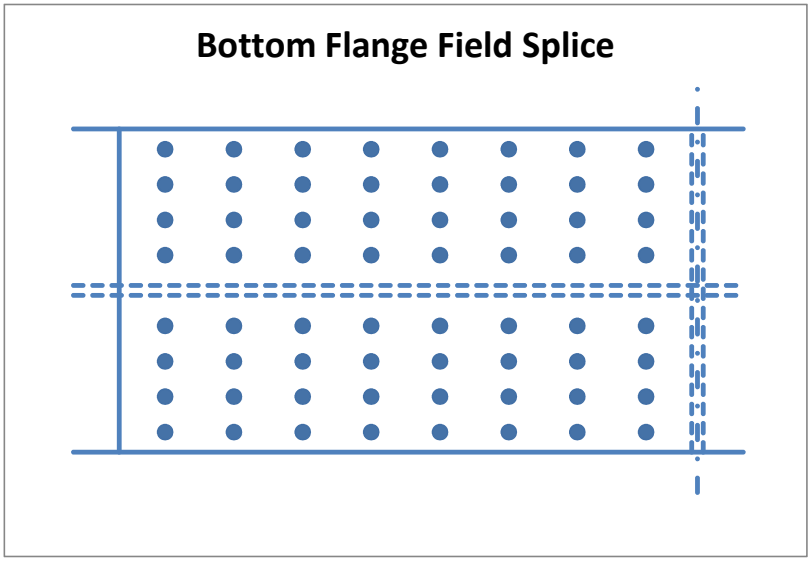
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1051	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1051

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0	21	0
21	3.5	21	3.5
21	7	21	7

	Top Flange		Bottom Flange	
No. Bolts =	64.0		64.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	7.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5	21	10.5
21	17.5	21	17.5
21	21	21	21
21	24.5	21	24.5
21	28	21	28

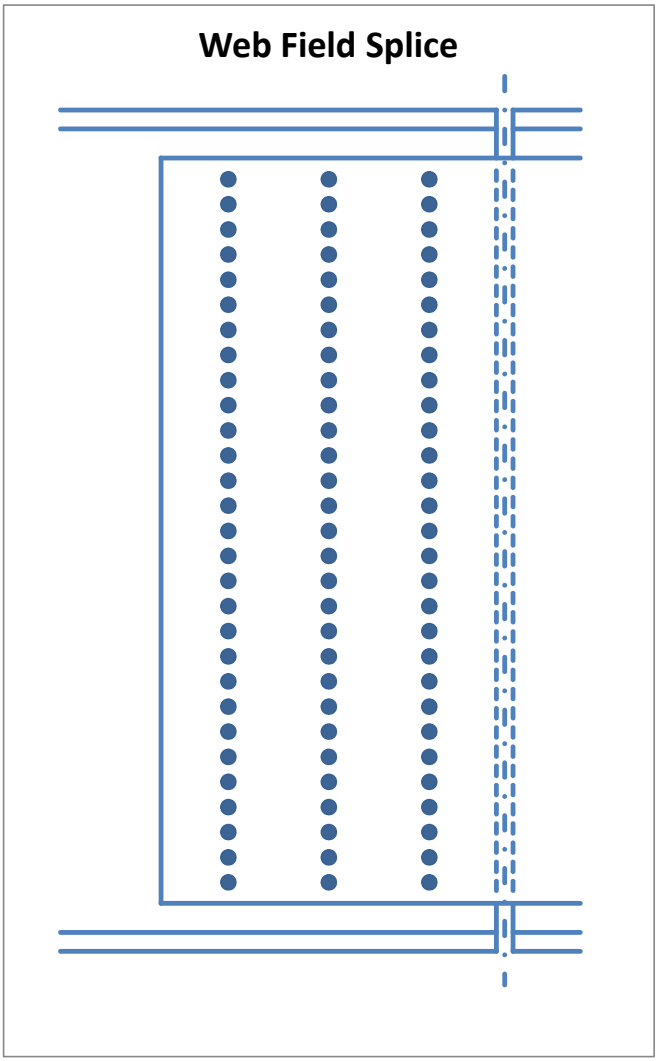
Flange Bolt Pattern Cont. - Node 1051

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1051	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1051

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	9	1764
0	3	9	1521
0	6	9	1296
0	9	9	1089
0	12	9	900
0	15	9	729
0	18	9	576
0	21	9	441
0	24	9	324
0	27	9	225
0	30	9	144
0	33	9	81
0	36	9	36
0	39	9	9
0	42	9	0
0	45	9	9
0	48	9	36
0	51	9	81
0	54	9	144
0	57	9	225
0	60	9	324
0	63	9	441
0	66	9	576
0	69	9	729
0	72	9	900
0	75	9	1089
0	78	9	1296
0	81	9	1521
0	84	9	1764
3	0	0	1764
3	3	0	1521
3	6	0	1296
3	9	0	1089
3	12	0	900
3	15	0	729
3	18	0	576
3	21	0	441
3	24	0	324
3	27	0	225
3	30	0	144
3	33	0	81
3	36	0	36
3	39	0	9
3	42	0	0
3	45	0	9
3	48	0	36
3	51	0	81
3	54	0	144
3	57	0	225
3	60	0	324
3	63	0	441
3	66	0	576
3	69	0	729
3	72	0	900
3	75	0	1089
3	78	0	1296
3	81	0	1521
3	84	0	1764
6	0	9	1764

No. Bolts =	87.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	2.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	3	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	522	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	54810	
Σd^2 (in^2) =	55332	



6	3	9	1521
6	6	9	1296
6	9	9	1089
6	12	9	900
6	15	9	729
6	18	9	576
6	21	9	441
6	24	9	324
6	27	9	225
6	30	9	144
6	33	9	81
6	36	9	36
6	39	9	9
6	42	9	0
6	45	9	9
6	48	9	36
6	51	9	81
6	54	9	144
6	57	9	225
6	60	9	324
6	63	9	441
6	66	9	576
6	69	9	729
6	72	9	900
6	75	9	1089
6	78	9	1296
6	81	9	1521
6	84	9	1764

Web Bolt Pattern Cont. - Node 1051

Web Bolt Pattern Cont. - Node 1051

261	3654	522	54810

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3051	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3051

Node 3051

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3051 L	64.00	67.91	4346.38	64.00	62.63	4008.15	96.00	50.00	4800.00
3051 R	72.00	50.00	3600.00	72.00	47.35	3408.95	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3051 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.90	-3.72	7.48	-6.40	3.46	-0.41	6.76	-8.43	2.94	3.43	18.89	-20.54	24.24	-27.82	-1.30	10.29
ϕf Fnc (ksi)	50.00	47.35	50.00	47.39	50.00	47.96	50.00	47.24	50.00	50.00	50.00	47.30	50.00	47.27	50.00	50.00
f / ϕf Fnc	0.08	0.08	0.15	0.14	0.07	0.01	0.14	0.18	0.06	0.07	0.38	0.43	0.48	0.59	0.03	0.21
α	1.00	0.95	1.00	0.95	1.00	0.96	1.00	0.94	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-3.72	7.48		3.46			-8.43		3.43		-20.54		-27.82		10.29
Fcf (ksi)		-35.51	37.50		37.50			-35.43		37.50		-35.47		-37.55		37.50
Fcf (kip)		-2556.71	2170.66		2170.66			-2551.13		2170.66		-2553.95		-2703.28		2170.66
fncf (ksi)	3.90			-6.40		-0.41	6.76		2.94		18.89		24.24		-1.30	
Rcf	9.55			5.01		10.83	4.20		10.94		1.73		1.35		3.64	
Fncf (ksi)	37.50			-35.54		-35.97	37.50		37.50		37.50		37.50		-37.50	
Fncf (kip)	2170.66			-2558.94		-2589.87	2170.66		2170.66		2170.66		2170.66		-2700.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.51	-2.52	4.37	-4.12	2.13	0.38	4.19	-5.63	1.83	2.55	7.91	-12.88	16.88	-19.56	-1.22	7.80
Fs (ksi)	2.51	-2.52	4.37	-4.12	2.13	0.38	4.19	-5.63	1.83	2.55	7.91	-12.88	16.88	-19.56	-1.22	7.80
Fs (kip)	180.76	-181.35	314.34	-296.39	153.60	27.52	301.90	-405.67	131.73	183.56	569.77	-927.03	1215.58	-1408.34	-87.62	561.72

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	1215.58	561.72
Comp	2700.00	2703.28	87.62	1408.34

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	583.42	394.61	241.46	725.73	569.14	446.72	468.71	508.54	422.47	286.47	178.27	523.01	412.38	323.29	341.43	366.97
Vuw (kip)	875.14	591.91	362.18	1050.56	853.71	670.09	703.07	762.82	---	---	---	---	---	---	---	---
Mv (k*ft)	382.87	258.96	158.45	459.62	373.50	293.16	307.59	333.73	184.83	125.33	77.99	228.82	180.42	141.44	149.38	160.55
Huw (kip)	85.24	259.47	1585.83	-336.90	3344.07	-137.08	-231.83	1573.46	-0.39	11.96	120.74	-69.18	210.20	-238.18	-128.50	316.07
Muw (k*ft)	4658.91	4454.05	2685.56	4086.14	341.24	4357.57	4496.72	2702.05	321.87	542.87	112.07	628.95	46.07	1330.48	2332.37	577.19
Mu (k*ft)	5041.79	4713.01	2844.01	4545.76	714.74	4650.73	4804.32	3035.78	506.70	668.20	190.06	857.76	226.48	1471.92	2481.75	737.74

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.98	2.98	18.23	3.87	38.44	1.58	2.66	18.09	0.00	0.14	1.39	0.80	2.42	2.74	1.48	3.63
PY1 (Vuw)	10.06	6.80	4.16	12.08	9.81	7.70	8.08	8.77	4.86	3.29	2.05	6.01	4.74	3.72	3.92	4.22
PX2 (Mu)	45.92	42.93	25.91	41.41	6.51	42.36	43.76	27.65	4.62	6.09	1.73	7.81	2.06	13.41	22.61	6.72
PY2 (Mu)	3.28	3.07	1.85	2.96	0.47	3.03	3.13	1.98	0.33	0.43	0.12	0.56	0.15	0.96	1.61	0.48
Pu (kip)	48.76	46.96	44.54	47.71	46.11	45.23	47.76	46.98	6.95	7.25	3.80	10.83	6.63	16.81	24.71	11.37

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1356.32	1631.25	OK
BF Outside	1346.96	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.43	36.60	34.94	36.08	35.26	35.05	37.02	36.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1050.56
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	608.74	9.51	OK
BF	1356.32	21.19	OK	706.61	11.04	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1356.32	21.19	1.47	114.56	OK
BF	2703.28	42.24	1.47	206.21	OK
BF Outside	1346.96	21.05	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.76	24.38	OK	24.71	12.36	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.76	1.47	91.65	OK
Web SPL	24.38	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.20
BF Outside	1.27	1.20

Bolt	Shear	Slip	Bearing
TF	1.56	1.77	4.89
Web	1.48	1.36	1.88
BF	1.55	1.52	4.88

Plate	Shear	Flexure
Web	2.09	1.34

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5051	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5051

Node 5051

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5051 L	64.00	67.91	4346.38	64.00	62.58	4005.15	96.00	50.00	4800.00
5051 R	72.00	50.00	3600.00	72.00	47.30	3405.43	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5051 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.63	-3.92	9.56	-8.78	3.70	-1.31	7.69	-10.31	6.79	-9.01	8.79	-8.87	23.03	-26.68	-0.59	8.75
ϕf Fnc (ksi)	50.00	47.30	50.00	47.36	50.00	47.71	50.00	47.22	50.00	47.22	50.00	47.32	50.00	47.27	50.00	50.00
f / ϕf Fnc	0.07	0.08	0.19	0.19	0.07	0.03	0.15	0.22	0.14	0.19	0.18	0.19	0.46	0.56	0.01	0.17
α	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.94	1.00	0.94	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-3.92	9.56		3.70			-10.31		-9.01		-8.87		-26.68		8.75
Fcf (ksi)		-35.47	37.50		37.50			-35.41		-35.41		-35.49		-36.97		37.50
Fcf (kip)		-2554.08	2170.66		2170.66			-2549.65		-2549.86		-2555.49		-2662.09		2170.66
fncf (ksi)	3.63			-8.78		-1.31	7.69		6.79		8.79		23.03		-0.59	
Rcf	9.05			3.92		10.13	3.44		3.93		4.00		1.39		4.29	
Fncf (ksi)	37.50			-35.52		-35.78	37.50		37.50		37.50		37.50		-37.50	
Fncf (kip)	2170.66			-2557.47		-2576.13	2170.66		2170.66		2170.66		2170.66		-2700.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.23	-2.29	5.03	-5.96	2.29	-0.45	4.34	-6.68	4.45	-5.96	4.86	-5.70	8.86	-16.91	-0.76	6.66
Fs (ksi)	2.23	-2.29	5.03	-5.96	2.29	-0.45	4.34	-6.68	4.45	-5.96	4.86	-5.70	8.86	-16.91	-0.76	6.66
Fs (kip)	160.77	-165.21	361.96	-429.22	164.57	-32.14	312.18	-480.70	320.28	-428.88	350.04	-410.14	637.62	-1217.58	-54.65	479.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	637.62	479.81
Comp	2700.00	2662.09	54.65	1217.58

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	615.81	378.09	276.95	751.52	591.42	455.50	497.44	530.05	442.89	277.00	203.48	540.83	427.72	329.63	361.32	382.30
Vuw (kip)	923.71	567.14	415.43	1063.45	887.13	683.25	746.16	795.08	---	---	---	---	---	---	---	---
Mv (k*ft)	404.12	248.12	181.75	465.26	388.12	298.92	326.44	347.85	193.76	121.19	89.02	236.61	187.13	144.21	158.08	167.26
Huw (kip)	-127.28	146.61	1165.30	-432.62	-419.40	-16.10	-242.77	1677.87	-2.96	-44.84	88.28	-112.34	-72.40	-40.07	-386.64	283.44
Muw (k*ft)	4370.88	4604.52	3246.26	3955.89	3973.89	4521.64	4408.91	2562.84	289.77	703.26	174.85	704.78	665.92	675.72	1649.07	475.08
Mu (k*ft)	4775.00	4852.64	3428.01	4421.15	4362.01	4820.56	4735.35	2910.68	483.53	824.45	263.87	941.40	853.04	819.93	1807.14	642.33

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.46	1.69	13.39	4.97	4.82	0.19	2.79	19.29	0.03	0.52	1.01	1.29	0.83	0.46	4.44	3.26
PY1 (Vuw)	10.62	6.52	4.78	12.22	10.20	7.85	8.58	9.14	5.09	3.18	2.34	6.22	4.92	3.79	4.15	4.39
PX2 (Mu)	43.49	44.20	31.22	40.27	39.73	43.91	43.13	26.51	4.40	7.51	2.40	8.57	7.77	7.47	16.46	5.85
PY2 (Mu)	3.11	3.16	2.23	2.88	2.84	3.14	3.08	1.89	0.31	0.54	0.17	0.61	0.56	0.53	1.18	0.42
Pu (kip)	47.00	46.90	45.17	47.70	46.42	45.44	47.38	47.11	6.99	8.85	4.24	12.00	10.19	9.03	21.57	10.30

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1335.65	1631.25	OK
BF Outside	1326.44	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.87	36.61	35.40	36.04	35.49	35.20	36.62	36.25
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1063.45
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	319.31	4.99	OK
BF	1335.65	20.87	OK	610.90	9.55	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1335.65	20.87	1.47	114.56	OK
BF	2662.09	41.60	1.47	206.21	OK
BF Outside	1326.44	20.73	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.70	23.85	OK	21.57	10.79	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.70	1.47	91.65	OK
Web SPL	23.85	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.22
BF Outside	1.27	1.22

Bolt	Shear	Slip	Bearing
TF	1.56	3.37	4.89
Web	1.52	1.56	1.92
BF	1.58	1.76	4.96

Plate	Shear	Flexure
Web	2.06	1.37

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7051	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7051

Node 7051

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7051 L	64.00	67.91	4346.38	64.00	62.63	4008.57	96.00	50.00	4800.00
7051 R	72.00	50.00	3600.00	72.00	47.32	3407.14	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7051 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.19	-3.24	7.56	-6.40	3.19	-0.38	5.87	-7.22	16.72	-18.11	2.68	2.00	23.78	-27.03	-1.25	9.91
ϕf Fnc (ksi)	50.00	47.32	50.00	47.39	50.00	47.96	50.00	47.25	50.00	47.30	50.00	50.00	50.00	47.28	50.00	50.00
f / ϕf Fnc	0.06	0.07	0.15	0.14	0.06	0.01	0.12	0.15	0.33	0.38	0.05	0.04	0.48	0.57	0.03	0.20
α	1.00	0.95	1.00	0.95	1.00	0.96	1.00	0.94	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)		-3.24	7.56		3.19			-7.22		-18.11	2.68			-27.03		9.91
Fcf (ksi)		-35.49	37.50		37.50			-35.44		-35.47	37.50			-37.15		37.50
Fcf (kip)		-2555.35	2170.66		2170.66			-2551.42		-2554.04	2170.66			-2675.01		2170.66
fncf (ksi)	3.19			-6.40		-0.38	5.87		16.72			2.00	23.78		-1.25	
Rcf	10.95			4.96		11.76	4.91		1.96			13.98	1.37		3.79	
Fncf (ksi)	37.50			-35.54		-35.97	37.50		37.50			37.50	37.50		-37.50	
Fncf (kip)	2170.66			-2559.17		-2589.87	2170.66		2170.66			2170.66	2170.66		-2700.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	1.92	-1.89	4.53	-4.40	1.92	0.54	3.62	-4.62	7.43	-11.64	1.54	1.81	16.70	-18.82	-1.24	7.42
Fs (ksi)	1.92	-1.89	4.53	-4.40	1.92	0.54	3.62	-4.62	7.43	-11.64	1.54	1.81	16.70	-18.82	-1.24	7.42
Fs (kip)	138.27	-136.14	326.39	-316.59	138.14	38.68	260.55	-332.88	534.92	-837.96	110.87	130.60	1202.71	-1355.39	-89.35	534.26

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	1202.71	534.26
Comp	2700.00	2675.01	89.35	1355.39

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	580.91	403.64	249.71	727.06	450.82	523.24	474.58	511.58	418.72	294.90	184.72	523.40	328.23	377.98	345.02	369.74
Vuw (kip)	871.37	605.47	374.57	1051.22	676.23	784.86	711.87	767.37	---	---	---	---	---	---	---	---
Mv (k*ft)	381.22	264.89	163.87	459.91	295.85	343.38	311.44	335.72	183.19	129.02	80.82	228.99	143.60	165.36	150.94	161.76
Huw (kip)	-27.50	276.38	1585.91	-317.59	-130.12	3143.16	-214.40	1572.09	1.42	6.53	117.88	-48.22	-202.02	160.98	-101.79	296.60
Muw (k*ft)	4506.18	4431.50	2685.45	4112.39	4367.02	609.12	4469.71	2703.88	243.92	571.54	88.41	527.49	1220.34	17.53	2273.87	554.32
Mu (k*ft)	4887.41	4696.39	2849.32	4572.30	4662.87	952.50	4781.15	3039.61	427.11	700.56	169.23	756.48	1363.94	182.90	2424.81	716.08

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.32	3.18	18.23	3.65	1.50	36.13	2.46	18.07	0.02	0.08	1.35	0.55	2.32	1.85	1.17	3.41
PY1 (Vuw)	10.02	6.96	4.31	12.08	7.77	9.02	8.18	8.82	4.81	3.39	2.12	6.02	3.77	4.34	3.97	4.25
PX2 (Mu)	44.52	42.78	25.95	41.65	42.47	8.68	43.55	27.69	3.89	6.38	1.54	6.89	12.42	1.67	22.09	6.52
PY2 (Mu)	3.18	3.06	1.85	2.97	3.03	0.62	3.11	1.98	0.28	0.46	0.11	0.49	0.89	0.12	1.58	0.47
Pu (kip)	46.74	47.03	44.61	47.74	45.28	45.83	47.38	47.01	6.42	7.51	3.66	9.89	15.46	5.68	23.91	10.99

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1342.13	1631.25	OK
BF Outside	1332.88	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.79	36.64	34.98	36.10	35.08	35.18	36.69	36.23
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1051.22
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	602.29	9.41	OK
BF	1342.13	20.97	OK	680.04	10.63	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1342.13	20.97	1.47	114.56	OK
BF	2675.01	41.80	1.47	206.21	OK
BF Outside	1332.88	20.83	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.74	23.87	OK	23.91	11.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.74	1.47	91.65	OK
Web SPL	23.87	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.22
BF Outside	1.27	1.22

Bolt	Shear	Slip	Bearing
TF	1.56	1.79	4.89
Web	1.52	1.41	1.92
BF	1.57	1.58	4.93

Plate	Shear	Flexure
Web	2.09	1.36

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9051	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9051

Node 9051

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9051 L	64.00	67.93	4347.77	64.00	63.39	4056.91	96.00	50.00	4800.00
9051 R	72.00	50.00	3600.00	72.00	47.17	3396.52	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9051 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	7.15	-10.75	5.09	-1.10	2.82	1.95	4.18	-5.26	20.13	-20.97	2.12	5.33	25.09	-28.45	-1.02	11.32
ϕf Fnc (ksi)	50.00	47.17	50.00	47.84	50.00	50.00	50.00	47.24	50.00	47.31	50.00	50.00	50.00	47.28	50.00	50.00
f / ϕf Fnc	0.14	0.23	0.10	0.02	0.06	0.04	0.08	0.11	0.40	0.44	0.04	0.11	0.50	0.60	0.02	0.23
α	1.00	0.94	1.00	0.96	1.00	1.00	1.00	0.94	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)		-10.75	5.09		2.82			-5.26		-20.97		5.33		-28.45		11.32
Fcf (ksi)		-35.38	37.50		37.50			-35.43		-35.48		37.50		-37.86		37.50
Fcf (kip)		-2547.39	2170.66		2170.66			-2550.96		-2554.84		2170.66		-2726.20		2170.66
fncf (ksi)	7.15			-1.10		1.95	4.18		20.13		2.12		25.09		-1.02	
Rcf	3.29			7.36		13.28	6.73		1.69		7.04		1.33		3.31	
Fncf (ksi)	37.50			-35.88		37.50	37.50		37.50		37.50		37.50		-37.50	
Fncf (kip)	2170.66			-2583.52		2170.66	2170.66		2170.66		2170.66		2170.66		-2700.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.68	-6.49	4.02	-1.06	1.64	1.77	3.17	-3.23	8.63	-13.29	1.12	4.14	17.64	-19.73	-1.08	8.37
Fs (ksi)	3.68	-6.49	4.02	-1.06	1.64	1.77	3.17	-3.23	8.63	-13.29	1.12	4.14	17.64	-19.73	-1.08	8.37
Fs (kip)	264.91	-466.94	289.61	-76.35	117.83	127.65	228.15	-232.20	621.57	-957.07	80.76	298.31	1270.36	-1420.47	-77.59	602.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	1270.36	602.98
Comp	2700.00	2726.20	77.59	1420.47

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	444.28	355.40	203.44	670.23	387.83	454.80	441.71	391.10	323.34	261.76	153.18	484.19	284.67	330.77	322.73	285.76
Vuw (kip)	666.43	533.10	305.15	1005.34	581.75	682.19	662.56	586.64	---	---	---	---	---	---	---	---
Mv (k*ft)	291.56	233.23	133.50	439.84	254.51	298.46	289.87	256.66	141.46	114.52	67.01	211.83	124.54	144.71	141.19	125.02
Huw (kip)	-568.22	1412.77	3043.83	-348.13	-68.40	2515.60	-214.36	1638.10	-134.69	142.17	163.65	-2.71	-223.67	252.71	-100.07	350.26
Muw (k*ft)	3771.07	2916.30	741.56	4070.87	4450.73	1445.86	4560.77	2615.87	650.54	325.30	8.73	409.20	1403.24	193.38	2391.85	604.95
Mu (k*ft)	4062.63	3149.54	875.06	4510.70	4705.25	1744.32	4850.64	2872.53	792.00	439.81	75.74	621.03	1527.78	338.09	2533.05	729.97

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	6.53	16.24	34.99	4.00	0.79	28.91	2.46	18.83	1.55	1.63	1.88	0.03	2.57	2.90	1.15	4.03
PY1 (Vuw)	7.66	6.13	3.51	11.56	6.69	7.84	7.62	6.74	3.72	3.01	1.76	5.57	3.27	3.80	3.71	3.28
PX2 (Mu)	37.01	28.69	7.97	41.09	42.86	15.89	44.18	26.16	7.21	4.01	0.69	5.66	13.92	3.08	23.07	6.65
PY2 (Mu)	2.64	2.05	0.57	2.93	3.06	1.13	3.16	1.87	0.52	0.29	0.05	0.40	0.99	0.22	1.65	0.47
Pu (kip)	44.74	45.66	43.15	47.36	44.72	45.69	47.87	45.81	9.73	6.53	3.14	8.25	17.03	7.21	24.81	11.32

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1367.82	1631.25	OK
BF Outside	1358.38	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.65	35.60	33.72	35.93	34.83	35.30	37.20	35.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1005.34
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9051**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	636.17	9.94	OK
BF	1367.82	21.37	OK	712.69	11.14	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1367.82	21.37	1.47	114.56	OK
BF	2726.20	42.60	1.47	206.21	OK
BF Outside	1358.38	21.22	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.87	23.94	OK	24.81	12.40	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.87	1.47	91.65	OK
Web SPL	23.94	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.19
BF Outside	1.27	1.19

Bolt	Shear	Slip	Bearing
TF	1.56	1.69	4.89
Web	1.51	1.36	1.91
BF	1.54	1.51	4.84

Plate	Shear	Flexure
Web	2.18	1.34

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1077	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1077

Node 1077

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1077 L	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00
1077 R	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1077 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.11	13.31	-8.54	4.53	-13.92	14.62	-10.86	8.88	8.65	-11.18	-16.40	21.24	-17.01	25.36	11.05	-15.58
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.23	50.00	50.00	50.00	50.00	50.00	47.20
f / ϕf Fnc	0.20	0.27	0.17	0.09	0.28	0.29	0.22	0.18	0.17	0.24	0.33	0.42	0.34	0.51	0.22	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)		13.31	-8.54			14.62	-10.86			-11.18		21.24		25.36		-15.58
Fcf (ksi)		37.50	-37.50			37.50	-37.50			-35.42		37.50		37.68		-35.40
Fcf (kip)		2170.66	-2700.00			2170.66	-2700.00			-2550.40		2170.66		2180.95		-2548.66
fncf (ksi)	-10.11			4.53	-13.92			8.88	8.65		-16.40		-17.01		11.05	
Rcf	2.82			4.39	2.56			3.45	3.17		1.77		1.49		2.27	
Fncf (ksi)	-37.50			37.50	-37.50			37.50	37.50		-37.50		-37.50		37.50	
Fncf (kip)	-2700.00			2170.66	-2700.00			2170.66	2170.66		-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.79	9.25	-8.07	4.10	-9.14	10.26	-8.67	6.69	5.78	-7.92	-11.98	15.26	-12.41	18.17	7.48	-11.03
Fs (ksi)	-7.79	9.25	-8.07	4.10	-9.14	10.26	-8.67	6.69	5.78	-7.92	-11.98	15.26	-12.41	18.17	7.48	-11.03
Fs (kip)	-561.07	666.32	-581.39	294.90	-657.94	739.07	-624.58	482.01	416.12	-570.21	-862.62	1098.87	-893.60	1308.39	538.35	-793.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2180.95	538.35	1308.39
Comp	2700.00	2550.40	893.60	793.81

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	453.49	558.89	270.53	767.57	451.85	552.44	549.49	482.00	331.33	408.92	202.07	556.36	333.29	401.25	399.16	354.59
Vuw (kip)	680.23	838.34	405.79	1071.48	677.77	828.66	824.24	722.99	---	---	---	---	---	---	---	---
Mv (k*ft)	297.60	366.77	177.53	468.77	296.52	362.54	360.61	316.31	144.96	178.90	88.40	243.41	145.81	175.55	174.63	155.13
Huw (kip)	432.57	-844.62	86.58	-327.13	-384.91	410.17	595.51	-493.50	70.17	-190.99	54.08	-95.04	-102.72	157.50	276.53	-170.31
Muw (k*ft)	4223.24	3673.84	4684.56	4363.83	4020.83	4253.11	4028.73	3872.96	1091.01	778.92	1241.79	983.64	876.74	1743.55	1957.33	1184.14
Mu (k*ft)	4520.84	4040.61	4862.09	4832.60	4317.35	4615.65	4389.34	4189.27	1235.97	957.83	1330.19	1227.04	1022.55	1919.09	2131.96	1339.28

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.97	9.71	1.00	3.76	4.42	4.71	6.84	5.67	0.81	2.20	0.62	1.09	1.18	1.81	3.18	1.96
PY1 (Vuw)	7.82	9.64	4.66	12.32	7.79	9.52	9.47	8.31	3.81	4.70	2.32	6.39	3.83	4.61	4.59	4.08
PX2 (Mu)	41.18	36.80	44.29	44.02	39.33	42.04	39.98	38.16	11.26	8.72	12.12	11.18	9.31	17.48	19.42	12.20
PY2 (Mu)	2.94	2.63	3.16	3.14	2.81	3.00	2.86	2.73	0.80	0.62	0.87	0.80	0.67	1.25	1.39	0.87
Pu (kip)	47.39	48.10	45.95	50.22	45.02	48.41	48.42	45.20	12.92	12.15	13.13	14.22	11.42	20.16	23.37	15.00

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1094.25	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1086.70	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1279.61	1631.25	OK
BF Outside	1270.79	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.76	36.97	36.13	38.08	34.85	37.25	37.27	34.90
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1071.48
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	447.50	6.99	OK
BF	1279.61	19.99	OK	656.46	10.26	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1279.61	19.99	1.47	114.56	OK
BF	2550.40	39.85	1.47	206.21	OK
BF Outside	1270.79	19.86	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.22	25.11	OK	23.37	11.69	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.22	1.47	91.65	OK
Web SPL	25.11	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.27
BF Outside	1.27	1.27

Bolt	Shear	Slip	Bearing
TF	1.56	2.41	4.89
Web	1.44	1.44	1.83
BF	1.53	1.64	5.17

Plate	Shear	Flexure
Web	2.05	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3077	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3077

Node 3077

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3077 L	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00
3077 R	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3077 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.34	7.21	-12.16	8.77	-12.64	11.57	-11.02	8.82	4.46	-7.65	-15.24	16.79	-16.71	23.02	9.23	-14.20
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.13	50.00	50.00	50.00	50.00	50.00	47.17
f / ϕf Fnc	0.15	0.14	0.24	0.18	0.25	0.23	0.22	0.18	0.09	0.16	0.30	0.34	0.33	0.46	0.18	0.30
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	-7.34		-12.16		-12.64		-11.02			-7.65		16.79		23.02		-14.20
Fcf (ksi)	-37.50		-37.50		-37.50		-37.50			-35.34		37.50		37.50		-35.37
Fcf (kip)	-2700.00		-2700.00		-2700.00		-2700.00			-2544.82		2170.66		2170.66		-2546.93
fncf (ksi)		7.21		8.77		11.57		8.82	4.46		-15.24		-16.71		9.23	
Rcf		5.11		3.08		2.97		3.40	4.62		2.23		1.63		2.49	
Fncf (ksi)		37.50		37.50		37.50		37.50	37.50		-37.50		-37.50		37.50	
Fncf (kip)		2170.66		2170.66		2170.66		2170.66	2170.66		-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.28	5.48	-9.11	6.64	-8.97	8.31	-8.73	6.59	2.87	-5.36	-11.19	12.08	-12.23	16.48	6.23	-9.97
Fs (ksi)	-7.28	5.48	-9.11	6.64	-8.97	8.31	-8.73	6.59	2.87	-5.36	-11.19	12.08	-12.23	16.48	6.23	-9.97
Fs (kip)	-523.89	394.65	-656.05	477.94	-645.84	598.23	-628.46	474.15	206.81	-385.90	-805.66	869.62	-880.36	1186.38	448.69	-718.19

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	448.69	1186.38
Comp	2700.00	2546.93	880.36	718.19

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	500.31	654.76	310.75	814.67	514.16	601.43	612.67	516.79	363.02	475.69	229.09	588.67	376.36	434.46	442.40	378.22
Vuw (kip)	750.47	982.14	466.12	1095.03	771.23	902.14	919.00	775.19	---	---	---	---	---	---	---	---
Mv (k*ft)	328.33	429.69	203.93	479.07	337.41	394.69	402.06	339.14	158.82	208.12	100.22	257.54	164.66	190.07	193.55	165.47
Huw (kip)	-32.02	-502.28	-152.26	-359.21	-708.14	165.82	493.05	-594.27	-86.16	-118.74	-31.74	-102.88	-119.39	42.64	204.01	-179.66
Muw (k*ft)	4757.30	4130.29	4596.99	4321.05	3579.95	4578.91	4142.60	3735.52	816.48	1007.99	1105.84	980.10	526.85	1489.13	1837.10	1037.23
Mu (k*ft)	5085.63	4559.98	4800.91	4800.13	3917.36	4973.60	4544.66	4074.67	975.30	1216.11	1206.07	1237.64	691.51	1679.21	2030.65	1202.70

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.37	5.77	1.75	4.13	8.14	1.91	5.67	6.83	0.99	1.36	0.36	1.18	1.37	0.49	2.34	2.07
PY1 (Vuw)	8.63	11.29	5.36	12.59	8.86	10.37	10.56	8.91	4.17	5.47	2.63	6.77	4.33	4.99	5.09	4.35
PX2 (Mu)	46.32	41.54	43.73	43.72	35.68	45.30	41.40	37.11	8.88	11.08	10.99	11.27	6.30	15.30	18.50	10.95
PY2 (Mu)	3.31	2.97	3.12	3.12	2.55	3.24	2.96	2.65	0.63	0.79	0.78	0.81	0.45	1.09	1.32	0.78
Pu (kip)	48.19	49.41	46.26	50.36	45.28	49.13	48.97	45.44	10.98	13.93	11.85	14.58	9.04	16.92	21.80	13.99

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1277.87	1631.25	OK
BF Outside	1269.06	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.27	37.67	36.28	38.13	34.85	37.66	37.48	34.97
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1095.03
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	440.87	6.89	OK
BF	1277.87	19.97	OK	595.24	9.30	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1277.87	19.97	1.47	114.56	OK
BF	2546.93	39.80	1.47	206.21	OK
BF Outside	1269.06	19.83	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.36	25.18	OK	21.80	10.90	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.36	1.47	91.65	OK
Web SPL	25.18	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.28
BF Outside	1.27	1.28

Bolt	Shear	Slip	Bearing
TF	1.56	2.44	4.89
Web	1.44	1.54	1.82
BF	1.53	1.81	5.18

Plate	Shear	Flexure
Web	2.00	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5077	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5077

Node 5077

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5077 L	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00
5077 R	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5077 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.62	2.78	-14.32	10.89	-11.65	10.14	-9.08	6.03	-4.15	1.89	-9.49	6.43	-15.59	20.71	8.88	-13.69
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.16
f / ϕf Fnc	0.07	0.06	0.29	0.22	0.23	0.20	0.18	0.12	0.08	0.04	0.19	0.13	0.31	0.41	0.18	0.29
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	-3.62		-14.32		-11.65		-9.08		-4.15		-9.49			20.71		-13.69
Fcf (ksi)	-37.50		-37.50		-37.50		-37.50		-37.50		-37.50			37.50		-35.37
Fcf (kip)	-2700.00		-2700.00		-2700.00		-2700.00		-2700.00		-2700.00			2170.66		-2546.89
fncf (ksi)		2.78		10.89		10.14		6.03		1.89		6.43	-15.59		8.88	
Rcf		10.35		2.62		3.22		4.13		9.03		3.95	1.81		2.58	
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50	-37.50		37.50	
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66		2170.66	-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.04	2.63	-9.58	7.97	-8.56	7.34	-7.97	4.88	-6.47	2.21	-8.47	5.20	-11.44	14.80	6.07	-9.57
Fs (ksi)	-6.04	2.63	-9.58	7.97	-8.56	7.34	-7.97	4.88	-6.47	2.21	-8.47	5.20	-11.44	14.80	6.07	-9.57
Fs (kip)	-434.89	189.46	-689.67	574.15	-616.25	528.23	-573.76	351.41	-465.81	159.21	-609.73	374.45	-823.42	1065.93	436.74	-689.13

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	436.74	1065.93
Comp	2700.00	2546.89	823.42	689.13

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	488.72	735.38	342.43	833.94	552.79	665.73	638.56	533.80	358.21	528.71	251.08	602.11	403.48	479.50	464.07	386.28
Vuw (kip)	733.09	1055.38	513.65	1104.66	829.19	998.59	957.84	800.69	---	---	---	---	---	---	---	---
Mv (k*ft)	320.73	461.73	224.72	483.29	362.77	436.88	419.05	350.30	156.72	231.31	109.85	263.42	176.52	209.78	203.03	169.00
Huw (kip)	-418.39	-430.91	-233.74	-603.34	-979.32	-580.61	444.71	-596.30	-163.62	-77.02	-58.68	-148.23	-204.40	-156.85	161.67	-168.26
Muw (k*ft)	4242.15	4225.45	4488.35	3995.55	3494.25	4025.86	4207.05	3732.74	554.98	1123.40	1017.32	822.37	555.58	874.83	1679.43	1000.77
Mu (k*ft)	4562.88	4687.18	4713.07	4478.84	3857.02	4462.74	4626.11	4083.04	711.70	1354.71	1127.17	1085.80	732.10	1084.61	1882.46	1169.77

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5077	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.81	4.95	2.69	6.93	11.26	6.67	5.11	6.85	1.88	0.89	0.67	1.70	2.35	1.80	1.86	1.93
PY1 (Vuw)	8.43	12.13	5.90	12.70	9.53	11.48	11.01	9.20	4.12	6.08	2.89	6.92	4.64	5.51	5.33	4.44
PX2 (Mu)	41.56	42.69	42.93	40.80	35.13	40.65	42.14	37.19	6.48	12.34	10.27	9.89	6.67	9.88	17.15	10.66
PY2 (Mu)	2.97	3.05	3.07	2.91	2.51	2.90	3.01	2.66	0.46	0.88	0.73	0.71	0.48	0.71	1.22	0.76
Pu (kip)	47.75	50.01	46.49	50.22	47.93	49.46	49.29	45.61	9.54	14.94	11.52	13.88	10.37	13.23	20.10	13.62

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1277.85	1631.25	OK
BF Outside	1269.04	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.94	37.96	36.37	37.99	36.85	37.67	37.64	35.05
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1104.66
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	412.36	6.44	OK
BF	1277.85	19.97	OK	534.81	8.36	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1277.85	19.97	1.47	114.56	OK
BF	2546.89	39.80	1.47	206.21	OK
BF Outside	1269.04	19.83	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.22	25.11	OK	20.10	10.05	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.22	1.47	91.65	OK
Web SPL	25.11	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.28
BF Outside	1.27	1.28

Bolt	Shear	Slip	Bearing
TF	1.56	2.61	4.89
Web	1.44	1.67	1.82
BF	1.53	2.01	5.18

Plate	Shear	Flexure
Web	1.99	1.32

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7077	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7077

Node 7077

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7077 L	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00
7077 R	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7077 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.63	4.19	-11.52	8.19	-12.11	10.97	-9.88	7.89	-14.38	12.85	-2.11	-2.82	-15.62	21.68	9.79	-14.54
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	43.22	50.00	50.00	50.00	47.18
f / ϕf Fnc	0.09	0.08	0.23	0.16	0.24	0.22	0.20	0.16	0.29	0.26	0.04	0.07	0.31	0.43	0.20	0.31
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	1.00	1.00	1.00	0.94
fcf (ksi)	-4.63		-11.52		-12.11		-9.88		-14.38			-2.82		21.68		-14.54
Fcf (ksi)	-37.50		-37.50		-37.50		-37.50		-37.50			-32.41		37.50		-35.38
Fcf (kip)	-2700.00		-2700.00		-2700.00		-2700.00		-2700.00			-2333.81		2170.66		-2547.62
fncf (ksi)		4.19		8.19		10.97		7.89		12.85	-2.11		-15.62		9.79	
Rcf		8.11		3.26		3.10		3.80		2.61	11.50		1.73		2.43	
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50	-37.50		-37.50		37.50	
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66	-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.30	3.58	-8.59	6.24	-8.63	7.82	-7.85	6.01	-9.36	9.13	-6.13	1.00	-11.41	15.54	6.68	-10.24
Fs (ksi)	-6.30	3.58	-8.59	6.24	-8.63	7.82	-7.85	6.01	-9.36	9.13	-6.13	1.00	-11.41	15.54	6.68	-10.24
Fs (kip)	-453.52	257.83	-618.70	449.42	-621.50	563.27	-565.42	432.64	-674.04	657.15	-441.41	72.31	-821.67	1118.81	481.19	-737.10

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	481.19	1118.81
Comp	2700.00	2547.62	821.67	737.10

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	504.61	647.85	310.08	809.41	571.63	501.32	609.30	514.12	369.98	466.94	228.30	585.33	417.33	363.42	443.94	372.46
Vuw (kip)	756.92	971.77	465.12	1092.40	857.44	751.99	913.94	771.18	---	---	---	---	---	---	---	---
Mv (k*ft)	331.15	425.15	203.49	477.92	375.13	328.99	399.85	337.39	161.87	204.29	99.88	256.08	182.58	158.99	194.22	162.95
Huw (kip)	-170.02	-519.75	-169.81	-362.73	-191.39	-2719.02	503.23	-555.20	-130.46	-112.85	-38.82	-88.52	-11.26	-246.07	198.09	-170.61
Muw (k*ft)	4573.30	4107.00	4573.58	4316.37	4544.81	523.64	4129.02	3788.82	632.32	949.45	1053.13	887.17	1183.28	456.64	1724.87	1082.92
Mu (k*ft)	4904.45	4532.15	4777.07	4794.29	4919.94	852.64	4528.87	4126.21	794.18	1153.73	1153.01	1143.25	1365.86	615.63	1919.09	1245.87

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.95	5.97	1.95	4.17	2.20	31.25	5.78	6.38	1.50	1.30	0.45	1.02	0.13	2.83	2.28	1.96
PY1 (Vuw)	8.70	11.17	5.35	12.56	9.86	8.64	10.51	8.86	4.25	5.37	2.62	6.73	4.80	4.18	5.10	4.28
PX2 (Mu)	44.67	41.28	43.51	43.67	44.81	7.77	41.25	37.58	7.23	10.51	10.50	10.41	12.44	5.61	17.48	11.35
PY2 (Mu)	3.19	2.95	3.11	3.12	3.20	0.55	2.95	2.68	0.52	0.75	0.75	0.74	0.89	0.40	1.25	0.81
Pu (kip)	48.12	49.32	46.24	50.34	48.79	40.09	48.92	45.46	9.95	13.30	11.46	13.66	13.80	9.60	20.75	14.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1278.22	1631.25	OK
BF Outside	1269.40	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.19	37.63	36.26	38.12	37.50	30.64	37.46	35.00
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1092.40
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	411.48	6.43	OK
BF	1278.22	19.97	OK	561.34	8.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1278.22	19.97	1.47	114.56	OK
BF	2547.62	39.81	1.47	206.21	OK
BF Outside	1269.40	19.83	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.34	25.17	OK	20.75	10.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.34	1.47	91.65	OK
Web SPL	25.17	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.28
BF Outside	1.27	1.28

Bolt	Shear	Slip	Bearing
TF	1.56	2.62	4.89
Web	1.44	1.62	1.82
BF	1.53	1.92	5.18

Plate	Shear	Flexure
Web	2.01	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9077	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9077

Node 9077

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9077 L	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00
9077 R	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9077 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.74	12.01	-7.94	4.15	-12.89	13.23	-9.82	8.15	-13.60	17.41	5.63	-7.33	-14.71	22.76	11.77	-16.02
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.23	50.00	50.00	50.00	47.21
f / ϕf Fnc	0.17	0.24	0.16	0.08	0.26	0.26	0.20	0.16	0.27	0.35	0.11	0.16	0.29	0.46	0.24	0.34
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94
fcf (ksi)		12.01	-7.94			13.23	-9.82			17.41		-7.33		22.76		-16.02
Fcf (ksi)		37.50	-37.50			37.50	-37.50			37.50		-35.42		37.50		-35.41
Fcf (kip)		2170.66	-2700.00			2170.66	-2700.00			2170.66		-2550.25		2170.66		-2549.36
fncf (ksi)	-8.74			4.15	-12.89			8.15	-13.60		5.63		-14.71		11.77	
Rcf	3.12			4.73	2.83			3.82	2.15		4.83		1.65		2.21	
Fncf (ksi)	-37.50			37.50	-37.50			37.50	-37.50		37.50		-37.50		37.50	
Fncf (kip)	-2700.00			2170.66	-2700.00			2170.66	-2700.00		2170.66		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.86	8.37	-7.31	3.79	-8.57	9.21	-7.51	6.29	-9.91	12.55	3.73	-5.19	-10.72	16.35	8.07	-11.33
Fs (ksi)	-6.86	8.37	-7.31	3.79	-8.57	9.21	-7.51	6.29	-9.91	12.55	3.73	-5.19	-10.72	16.35	8.07	-11.33
Fs (kip)	-493.93	602.46	-526.14	272.53	-617.22	663.38	-540.73	452.91	-713.82	903.80	268.36	-373.94	-771.85	1177.11	580.77	-816.05

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2170.66	580.77	1177.11
Comp	2700.00	2550.25	771.85	816.05

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	440.33	541.20	261.10	747.36	526.06	434.32	535.09	468.26	325.52	392.86	194.96	542.44	386.09	317.34	392.47	341.33
Vuw (kip)	660.49	811.81	391.65	1061.37	789.08	651.47	802.63	702.40	---	---	---	---	---	---	---	---
Mv (k*ft)	288.96	355.16	171.35	464.35	345.22	285.02	351.15	307.30	142.41	171.88	85.30	237.32	168.91	138.84	171.71	149.33
Huw (kip)	490.75	-858.98	47.06	-305.14	394.21	-394.67	636.33	-450.98	72.35	-169.07	30.77	-58.55	126.65	-70.39	270.18	-156.86
Muw (k*ft)	4145.66	3654.70	4737.25	4393.15	4274.38	4007.55	3951.56	3930.88	974.57	709.93	1138.30	883.23	1437.88	570.94	1732.41	1241.62
Mu (k*ft)	4434.63	4009.86	4908.60	4857.50	4619.61	4292.57	4302.71	4238.18	1116.99	881.80	1223.60	1120.55	1606.80	709.77	1904.12	1390.95

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.64	9.87	0.54	3.51	4.53	4.54	7.31	5.18	0.83	1.94	0.35	0.67	1.46	0.81	3.11	1.80
PY1 (Vuw)	7.59	9.33	4.50	12.20	9.07	7.49	9.23	8.07	3.74	4.52	2.24	6.23	4.44	3.65	4.51	3.92
PX2 (Mu)	40.39	36.52	44.71	44.25	42.08	39.10	39.19	38.60	10.17	8.03	11.15	10.21	14.64	6.47	17.34	12.67
PY2 (Mu)	2.89	2.61	3.19	3.16	3.01	2.79	2.80	2.76	0.73	0.57	0.80	0.73	1.05	0.46	1.24	0.90
Pu (kip)	47.21	47.91	45.90	50.16	48.15	44.83	48.04	45.11	11.88	11.20	11.89	12.92	17.00	8.35	21.24	15.26

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1279.54	1631.25	OK
BF Outside	1270.71	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.66	36.88	36.12	38.07	37.14	34.76	37.01	34.87
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1061.37
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9077**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.00	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	386.53	6.04	OK
BF	1279.54	19.99	OK	590.59	9.23	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1279.54	19.99	1.47	114.56	OK
BF	2550.25	39.85	1.47	206.21	OK
BF Outside	1270.71	19.85	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.16	25.08	OK	21.24	10.62	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.16	1.47	91.65	OK
Web SPL	25.08	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.22	1.27
BF Outside	1.27	1.27

Bolt	Shear	Slip	Bearing
TF	1.56	2.79	4.89
Web	1.44	1.58	1.83
BF	1.53	1.82	5.18

Plate	Shear	Flexure
Web	2.07	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 1133

Node 1133

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1133 L	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00
1133 R	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1133 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.60	7.37	29.92	9.16	28.81	3.65	19.04	17.31	25.68	5.13	25.00	11.74	35.75	-6.09	19.21	17.05
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.90	50.00	50.00
f / ϕf Fnc	0.39	0.15	0.60	0.18	0.58	0.07	0.38	0.35	0.51	0.10	0.50	0.23	0.71	0.13	0.38	0.34
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	19.60		29.92		28.81		19.04		25.68		25.00		35.75		19.21	
Fcf (ksi)	37.50		39.96		39.40		37.50		37.84		37.50		42.87		37.50	
Fcf (kip)	2170.66		2313.18		2280.92		2170.66		2190.40		2170.66		2481.72		2170.66	
fncf (ksi)		7.37		9.16		3.65		17.31		5.13		11.74		-6.09		17.05
Rcf		1.91		1.34		1.37		1.97		1.47		1.50		1.20		1.95
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-35.92		37.50
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66		2170.66		-2586.33		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	14.46	5.75	19.81	4.92	18.87	1.91	15.80	11.42	17.54	2.76	17.88	8.08	21.10	-4.63	14.19	12.59
Fs (ksi)	14.46	5.75	19.81	4.92	18.87	1.91	15.80	11.42	17.54	2.76	17.88	8.08	21.10	-4.63	14.19	12.59
Fs (kip)	1041.37	414.11	1426.25	354.39	1358.57	137.71	1137.28	822.46	1263.05	198.42	1287.10	581.70	1519.53	-333.18	1021.54	906.24

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2481.72	2170.66	1519.53	906.24
Comp	0.00	2586.33	0.00	333.18

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	288.49	280.26	568.71	141.51	344.61	245.60	439.58	190.80	205.83	217.59	421.38	101.98	263.05	175.53	330.16	136.81
Vuw (kip)	432.73	420.39	853.06	212.27	516.91	368.40	659.38	286.20	---	---	---	---	---	---	---	---
Mv (k*ft)	189.32	183.92	373.21	92.87	226.15	161.18	288.48	125.21	90.05	95.20	184.36	44.62	115.09	76.79	144.44	59.85
Huw (kip)	2477.00	2505.19	2130.84	3436.10	2179.07	2645.31	1707.36	3397.23	970.32	1187.09	997.52	1306.50	974.32	1245.86	790.90	1285.19
Muw (k*ft)	1497.33	1774.90	2202.69	218.53	1938.22	1272.93	3211.37	270.36	557.57	952.76	1085.22	279.84	946.34	627.02	1646.86	102.49
Mu (k*ft)	1686.65	1958.82	2575.91	311.39	2164.36	1434.10	3499.84	395.57	647.62	1047.96	1269.57	324.45	1061.43	703.81	1791.30	162.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.47	28.80	24.49	39.50	25.05	30.41	19.62	39.05	11.15	13.64	11.47	15.02	11.20	14.32	9.09	14.77
PY1 (Vuw)	4.97	4.83	9.81	2.44	5.94	4.23	7.58	3.29	2.37	2.50	4.84	1.17	3.02	2.02	3.79	1.57
PX2 (Mu)	15.36	17.84	23.46	2.84	19.71	13.06	31.88	3.60	5.90	9.55	11.56	2.96	9.67	6.41	16.32	1.48
PY2 (Mu)	1.10	1.27	1.68	0.20	1.41	0.93	2.28	0.26	0.42	0.68	0.83	0.21	0.69	0.46	1.17	0.11
Pu (kip)	44.25	47.04	49.31	42.41	45.36	43.77	52.44	42.80	17.28	23.41	23.72	18.03	21.20	20.88	25.89	16.34

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1242.80	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1238.92	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1800.00	OK
TF Inside	0.00	1794.38	OK
BF Inside	1297.64	1631.25	OK
BF Outside	1288.69	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.53	36.76	37.89	33.15	35.33	34.21	40.80	33.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	853.06
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1242.80	19.42	OK	760.95	11.89	OK
BF	1297.64	20.28	OK	454.69	7.10	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1242.80	19.42	1.47	114.56	OK
TF	2481.72	38.78	1.47	206.21	OK
TF Inside	1238.92	19.36	1.47	126.02	OK
BF Inside	1297.64	20.28	1.47	114.56	OK
BF	2586.33	40.41	1.47	206.21	OK
BF Outside	1288.69	20.14	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.44	26.22	OK	25.89	12.94	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.44	1.47	91.65	OK
Web SPL	26.22	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.23	NA
TF Inside	1.18	NA
BF Inside	1.22	1.26
BF Outside	1.27	1.26

Bolt	Shear	Slip	Bearing
TF	1.69	1.42	5.32
Web	1.38	1.30	1.75
BF	1.51	2.37	5.10

Plate	Shear	Flexure
Web	2.57	1.23

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3133	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3133

Node 3133

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3133 L	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00
3133 R	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3133 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.36	6.48	33.87	6.20	30.29	1.87	23.89	12.84	26.72	5.79	30.41	6.88	37.13	-3.96	21.04	13.73
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.98	50.00	50.00
f / ϕf Fnc	0.43	0.13	0.68	0.12	0.61	0.04	0.48	0.26	0.53	0.12	0.61	0.14	0.74	0.08	0.42	0.27
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	21.36		33.87		30.29		23.89		26.72		30.41		37.13		21.04	
Fcf (ksi)	37.50		41.94		40.14		37.50		38.36		40.21		43.57		37.50	
Fcf (kip)	2170.66		2427.45		2323.70		2170.66		2220.55		2327.32		2521.86		2170.66	
fncf (ksi)		6.48		6.20		1.87		12.84		5.79		6.88		-3.96		13.73
Rcf		1.76		1.24		1.33		1.57		1.44		1.32		1.17		1.78
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-35.98		37.50
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66		2170.66		-2590.78		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.66	5.15	21.80	3.00	19.98	0.83	17.83	8.46	18.45	4.25	20.79	3.93	22.32	-3.29	15.44	10.27
Fs (ksi)	15.66	5.15	21.80	3.00	19.98	0.83	17.83	8.46	18.45	4.25	20.79	3.93	22.32	-3.29	15.44	10.27
Fs (kip)	1127.39	370.63	1569.60	215.82	1438.76	60.02	1283.66	608.88	1328.30	306.19	1496.99	282.72	1607.29	-237.16	1111.47	739.65

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2521.86	2170.66	1607.29	739.65
Comp	0.00	2590.78	0.00	237.16

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	350.22	380.11	639.67	236.31	352.08	400.67	493.92	298.78	248.52	284.99	468.38	168.04	251.61	299.52	365.40	212.18
Vuw (kip)	525.33	570.17	959.51	354.46	528.13	601.00	740.87	448.17	---	---	---	---	---	---	---	---
Mv (k*ft)	229.83	249.45	419.78	155.08	231.05	262.94	324.13	196.07	108.73	124.68	204.92	73.52	110.08	131.04	159.86	92.83
Huw (kip)	2345.76	2381.23	2045.96	2767.66	2240.16	2366.49	1868.37	2974.40	998.68	1190.28	999.18	1261.69	1089.66	1186.47	913.42	1234.08
Muw (k*ft)	1672.32	2192.87	2410.47	1109.79	1923.45	1991.10	3085.47	834.14	672.67	1203.36	1225.55	599.80	908.54	1079.35	1639.51	330.51
Mu (k*ft)	1902.16	2442.32	2830.26	1264.86	2154.51	2254.04	3409.60	1030.21	781.40	1328.04	1430.46	673.32	1018.62	1210.39	1799.37	423.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.96	27.37	23.52	31.81	25.75	27.20	21.48	34.19	11.48	13.68	11.48	14.50	12.52	13.64	10.50	14.18
PY1 (Vuw)	6.04	6.55	11.03	4.07	6.07	6.91	8.52	5.15	2.86	3.28	5.38	1.93	2.89	3.44	4.20	2.44
PX2 (Mu)	17.33	22.25	25.78	11.52	19.62	20.53	31.06	9.38	7.12	12.10	13.03	6.13	9.28	11.03	16.39	3.86
PY2 (Mu)	1.24	1.59	1.84	0.82	1.40	1.47	2.22	0.67	0.51	0.86	0.93	0.44	0.66	0.79	1.17	0.28
Pu (kip)	44.88	50.28	50.95	43.61	45.98	48.46	53.62	43.96	18.90	26.11	25.31	20.77	22.09	25.02	27.42	18.24

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1262.91	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1258.96	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1800.00	OK
TF Inside	0.00	1794.38	OK
BF Inside	1299.87	1631.25	OK
BF Outside	1290.91	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.92	39.16	38.97	34.08	35.80	37.66	41.59	34.23
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	959.51
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1262.91	19.73	OK	804.90	12.58	OK
BF	1299.87	20.31	OK	371.11	5.80	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1262.91	19.73	1.47	114.56	OK
TF	2521.86	39.40	1.47	206.21	OK
TF Inside	1258.96	19.67	1.47	126.02	OK
BF Inside	1299.87	20.31	1.47	114.56	OK
BF	2590.78	40.48	1.47	206.21	OK
BF Outside	1290.91	20.17	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.62	26.81	OK	27.42	13.71	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.62	1.47	91.65	OK
Web SPL	26.81	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.21	NA
TF Inside	1.16	NA
BF Inside	1.22	1.25
BF Outside	1.27	1.25

Bolt	Shear	Slip	Bearing
TF	1.67	1.34	5.23
Web	1.35	1.23	1.71
BF	1.51	2.90	5.09

Plate	Shear	Flexure
Web	2.29	1.20

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5133	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5133

Node 5133

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5133 L	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00
5133 R	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5133 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.52	6.16	34.50	5.54	30.69	1.54	25.85	11.71	26.95	5.21	28.98	6.62	37.76	-5.11	22.14	12.84
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.94	50.00	50.00
f / ϕf Fnc	0.43	0.12	0.69	0.11	0.61	0.03	0.52	0.23	0.54	0.10	0.58	0.13	0.76	0.11	0.44	0.26
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	21.52		34.50		30.69		25.85		26.95		28.98		37.76		22.14	
Fcf (ksi)	37.50		42.25		40.34		37.93		38.47		39.49		43.88		37.50	
Fcf (kip)	2170.66		2445.47		2335.31		2195.28		2227.06		2285.83		2539.98		2170.66	
fncf (ksi)		6.16		5.54		1.54		11.71		5.21		6.62		-5.11		12.84
Rcf		1.74		1.22		1.31		1.47		1.43		1.36		1.16		1.69
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-35.95		37.50
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66		2170.66		-2588.71		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.61	4.96	22.32	2.59	20.45	-1.26	18.80	7.73	18.73	3.86	20.67	4.02	22.84	-4.15	16.23	9.67
Fs (ksi)	16.61	4.96	22.32	2.59	20.45	-1.26	18.80	7.73	18.73	3.86	20.67	4.02	22.84	-4.15	16.23	9.67
Fs (kip)	1195.72	357.13	1607.37	186.59	1472.39	-90.84	1353.41	556.22	1348.57	277.67	1488.48	289.43	1644.34	-298.55	1168.43	695.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2539.98	2170.66	1644.34	695.98
Comp	0.00	2588.71	0.00	298.55

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	364.58	396.71	655.94	251.83	384.82	368.03	515.62	317.97	258.55	298.65	481.80	178.89	279.38	277.98	382.66	225.62
Vuw (kip)	546.86	595.07	983.90	377.74	577.23	552.04	773.43	476.95	---	---	---	---	---	---	---	---
Mv (k*ft)	239.25	260.34	430.46	165.26	252.54	241.52	338.37	208.67	113.12	130.66	210.79	78.26	122.23	121.62	167.41	98.71
Huw (kip)	2314.89	2353.37	2033.58	2645.23	2203.90	2328.34	1821.30	2844.05	1035.23	1195.98	921.03	1273.08	1084.16	1185.27	897.19	1242.94
Muw (k*ft)	1713.48	2269.87	2452.65	1327.46	1986.20	1950.24	3188.29	1007.93	745.41	1262.92	1389.55	708.61	951.92	1065.82	1727.02	419.95
Mu (k*ft)	1952.74	2530.21	2883.11	1492.72	2238.74	2191.76	3526.67	1216.60	858.53	1393.58	1600.33	786.88	1074.15	1187.43	1894.43	518.66

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.61	27.05	23.37	30.40	25.33	26.76	20.93	32.69	11.90	13.75	10.59	14.63	12.46	13.62	10.31	14.29
PY1 (Vuw)	6.29	6.84	11.31	4.34	6.63	6.35	8.89	5.48	2.97	3.43	5.54	2.06	3.21	3.20	4.40	2.59
PX2 (Mu)	17.79	23.05	26.26	13.60	20.39	19.96	32.12	11.08	7.82	12.69	14.58	7.17	9.78	10.82	17.26	4.72
PY2 (Mu)	1.27	1.65	1.88	0.97	1.46	1.43	2.29	0.79	0.56	0.91	1.04	0.51	0.70	0.77	1.23	0.34
Pu (kip)	45.03	50.81	51.36	44.32	46.43	47.37	54.22	44.22	20.03	26.79	26.01	21.95	22.59	24.76	28.14	19.24

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1271.98	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1268.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1800.00	OK
TF Inside	0.00	1794.38	OK
BF Inside	1298.83	1631.25	OK
BF Outside	1289.88	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.01	39.55	39.24	34.63	36.09	36.87	42.02	34.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	983.90
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1271.98	19.87	OK	823.46	12.87	OK
BF	1298.83	20.29	OK	349.20	5.46	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1271.98	19.87	1.47	114.56	OK
TF	2539.98	39.69	1.47	206.21	OK
TF Inside	1268.00	19.81	1.47	126.02	OK
BF Inside	1298.83	20.29	1.47	114.56	OK
BF	2588.71	40.45	1.47	206.21	OK
BF Outside	1289.88	20.15	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.22	27.11	OK	28.14	14.07	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.22	1.47	91.65	OK
Web SPL	27.11	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.20	NA
TF Inside	1.16	NA
BF Inside	1.22	1.26
BF Outside	1.27	1.26

Bolt	Shear	Slip	Bearing
TF	1.66	1.31	5.20
Web	1.33	1.20	1.69
BF	1.51	3.08	5.10

Plate	Shear	Flexure
Web	2.23	1.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7133	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7133

Node 7133

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7133 L	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00
7133 R	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7133 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.33	5.94	33.12	5.36	30.40	1.26	22.58	11.90	27.01	6.07	29.41	5.94	36.89	-3.80	20.59	12.85
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.98	50.00	50.00
f / ϕf Fnc	0.43	0.12	0.66	0.11	0.61	0.03	0.45	0.24	0.54	0.12	0.59	0.12	0.74	0.08	0.41	0.26
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	21.33		33.12		30.40		22.58		27.01		29.41		36.89		20.59	
Fcf (ksi)	37.50		41.56		40.20		37.50		38.50		39.70		43.45		37.50	
Fcf (kip)	2170.66		2405.62		2326.83		2170.66		2228.74		2298.18		2514.78		2170.66	
fncf (ksi)		5.94		5.36		1.26		11.90		6.07		5.94		-3.80		12.85
Rcf		1.76		1.25		1.32		1.66		1.43		1.35		1.18		1.82
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-35.99		37.50
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66		2170.66		-2591.04		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.62	4.77	21.38	2.47	20.01	-0.48	17.04	7.81	18.62	4.24	20.61	3.51	22.21	-3.16	15.09	9.65
Fs (ksi)	15.62	4.77	21.38	2.47	20.01	-0.48	17.04	7.81	18.62	4.24	20.61	3.51	22.21	-3.16	15.09	9.65
Fs (kip)	1124.46	343.18	1539.34	177.71	1441.00	-34.83	1226.70	562.50	1340.47	305.59	1483.95	252.99	1599.48	-227.41	1086.77	694.70

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2514.78	2170.66	1599.48	694.70
Comp	0.00	2591.04	0.00	227.41

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	347.96	380.41	639.96	234.44	371.37	367.51	494.89	295.50	245.54	286.82	470.20	165.34	269.59	279.43	367.70	208.47
Vuw (kip)	521.94	570.62	959.94	351.66	557.05	551.26	742.33	443.25	---	---	---	---	---	---	---	---
Mv (k*ft)	228.35	249.64	419.98	153.85	243.71	241.18	324.77	193.92	107.42	125.48	205.71	72.33	117.94	122.25	160.87	91.21
Huw (kip)	2301.35	2317.86	2009.24	2748.64	2263.70	2290.93	1870.46	2923.57	978.42	1144.70	937.45	1192.80	1097.37	1157.96	914.71	1187.65
Muw (k*ft)	1731.54	2229.09	2466.35	1135.14	1910.17	2027.43	3067.02	901.90	694.47	1210.34	1311.85	590.41	919.90	1094.19	1623.90	348.51
Mu (k*ft)	1959.89	2478.74	2886.33	1288.99	2153.88	2268.60	3391.79	1095.82	801.89	1335.82	1517.56	662.74	1037.84	1216.44	1784.77	439.72

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.45	26.64	23.09	31.59	26.02	26.33	21.50	33.60	11.25	13.16	10.78	13.71	12.61	13.31	10.51	13.65
PY1 (Vuw)	6.00	6.56	11.03	4.04	6.40	6.34	8.53	5.09	2.82	3.30	5.40	1.90	3.10	3.21	4.23	2.40
PX2 (Mu)	17.85	22.58	26.29	11.74	19.62	20.66	30.89	9.98	7.30	12.17	13.82	6.04	9.45	11.08	16.26	4.01
PY2 (Mu)	1.28	1.61	1.88	0.84	1.40	1.48	2.21	0.71	0.52	0.87	0.99	0.43	0.68	0.79	1.16	0.29
Pu (kip)	44.90	49.89	51.05	43.61	46.30	47.64	53.48	43.97	18.85	25.67	25.42	19.88	22.39	24.72	27.31	17.86

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1259.36	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1255.42	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1800.00	OK
TF Inside	0.00	1794.38	OK
BF Inside	1300.00	1631.25	OK
BF Outside	1291.04	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.94	38.86	39.05	34.08	36.01	37.09	41.48	34.25
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	959.94
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1259.36	19.68	OK	800.99	12.52	OK
BF	1300.00	20.31	OK	348.55	5.45	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1259.36	19.68	1.47	114.56	OK
TF	2514.78	39.29	1.47	206.21	OK
TF Inside	1255.42	19.62	1.47	126.02	OK
BF Inside	1300.00	20.31	1.47	114.56	OK
BF	2591.04	40.48	1.47	206.21	OK
BF Outside	1291.04	20.17	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.48	26.74	OK	27.31	13.65	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.48	1.47	91.65	OK
Web SPL	26.74	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.21	NA
TF Inside	1.17	NA
BF Inside	1.22	1.25
BF Outside	1.27	1.25

Bolt	Shear	Slip	Bearing
TF	1.67	1.34	5.25
Web	1.35	1.23	1.71
BF	1.51	3.09	5.09

Plate	Shear	Flexure
Web	2.29	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 9133

Node 9133

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9133 L	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00
9133 R	72.00	50.00	3600.00	72.00	50.00	3600.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9133 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.39	4.44	28.92	6.75	27.78	1.22	18.05	14.37	25.17	8.63	25.32	4.58	34.94	-5.57	17.96	14.25
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.91	50.00	50.00
f / ϕf Fnc	0.37	0.09	0.58	0.14	0.56	0.02	0.36	0.29	0.50	0.17	0.51	0.09	0.70	0.12	0.36	0.29
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	18.39		28.92		27.78		18.05		25.17		25.32		34.94		17.96	
Fcf (ksi)	37.50		39.46		38.89		37.50		37.59		37.66		42.47		37.50	
Fcf (kip)	2170.66		2284.15		2251.12		2170.66		2175.66		2179.80		2458.24		2170.66	
fncf (ksi)		4.44		6.75		1.22		14.37		8.63		4.58		-5.57		14.25
Rcf		2.04		1.36		1.40		2.08		1.49		1.49		1.22		2.09
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-35.93		37.50
Fncf (kip)		2170.66		2170.66		2170.66		2170.66		2170.66		2170.66		-2587.06		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	13.38	3.47	19.18	3.20	18.21	0.16	14.73	9.17	18.18	4.84	16.90	3.31	26.46	-4.43	13.07	10.40
Fs (ksi)	13.38	3.47	19.18	3.20	18.21	0.16	14.73	9.17	18.18	4.84	16.90	3.31	26.46	-4.43	13.07	10.40
Fs (kip)	963.08	249.57	1381.21	230.36	1311.40	11.62	1060.71	660.30	1308.88	348.54	1216.58	238.30	1905.39	-318.79	940.95	748.70

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2458.24	2170.66	1905.39	748.70
Comp	0.00	2587.06	0.00	318.79

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	300.35	290.12	577.93	156.38	264.34	383.66	445.72	207.30	214.32	224.91	428.25	112.61	206.69	273.19	334.84	148.59
Vuw (kip)	450.52	435.18	866.89	234.57	396.51	575.49	668.58	310.96	---	---	---	---	---	---	---	---
Mv (k*ft)	197.10	190.39	379.27	102.63	173.47	251.78	292.51	136.04	93.77	98.40	187.36	49.27	90.43	119.52	146.49	65.01
Huw (kip)	2234.82	2336.51	1948.68	3232.76	2422.44	2134.92	1713.68	3228.94	808.44	1074.38	882.02	1147.34	1104.95	969.92	1057.73	1126.43
Muw (k*ft)	1820.23	1935.63	2379.68	489.66	1581.14	1973.67	3151.02	494.74	634.23	1022.98	1155.36	355.91	853.64	869.58	1977.04	170.89
Mu (k*ft)	2017.34	2126.02	2758.95	592.29	1754.61	2225.45	3443.52	630.79	728.00	1121.37	1342.72	405.18	944.06	989.10	2123.54	235.90

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 9133**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.69	26.86	22.40	37.16	27.84	24.54	19.70	37.11	9.29	12.35	10.14	13.19	12.70	11.15	12.16	12.95
PY1 (Vuw)	5.18	5.00	9.96	2.70	4.56	6.61	7.68	3.57	2.46	2.59	4.92	1.29	2.38	3.14	3.85	1.71
PX2 (Mu)	18.38	19.37	25.13	5.39	15.98	20.27	31.37	5.75	6.63	10.21	12.23	3.69	8.60	9.01	19.34	2.15
PY2 (Mu)	1.31	1.38	1.80	0.39	1.14	1.45	2.24	0.41	0.47	0.73	0.87	0.26	0.61	0.64	1.38	0.15
Pu (kip)	44.54	46.66	48.96	42.66	44.20	45.53	52.02	43.04	16.19	22.81	23.11	16.95	21.51	20.51	31.93	15.21

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1231.04	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1227.20	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1089.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1081.57	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1800.00	OK
TF Inside	0.00	1794.38	OK
BF Inside	1298.01	1631.25	OK
BF Outside	1289.06	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.76	36.46	37.58	33.37	34.53	35.37	40.44	33.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	866.89
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1231.04	19.24	OK	954.18	14.91	OK
BF	1298.01	20.28	OK	375.64	5.87	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1231.04	19.24	1.47	114.56	OK
TF	2458.24	38.41	1.47	206.21	OK
TF Inside	1227.20	19.17	1.47	126.02	OK
BF Inside	1298.01	20.28	1.47	114.56	OK
BF	2587.06	40.42	1.47	206.21	OK
BF Outside	1289.06	20.14	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.02	26.01	OK	31.93	15.97	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.02	1.47	91.65	OK
Web SPL	26.01	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.24	NA
TF Inside	1.19	NA
BF Inside	1.22	1.26
BF Outside	1.27	1.26

Bolt	Shear	Slip	Bearing
TF	1.71	1.13	5.37
Web	1.39	1.05	1.76
BF	1.51	2.87	5.10

Plate	Shear	Flexure
Web	2.53	1.24

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1199	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1199

Node 1199

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1199 L	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00
1199 R	72.00	50.00	3600.00	80.00	47.23	3778.44	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1199 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	5.78	0.26	2.88	-5.27	9.95	-12.50	0.59	8.12	23.55	-24.93	-2.71	11.89	-2.78	18.10	25.41	-31.18
ϕf Fnc (ksi)	50.00	50.00	50.00	46.99	50.00	47.14	50.00	50.00	50.00	47.21	50.00	50.00	50.00	50.00	50.00	47.15
f / ϕf Fnc	0.12	0.01	0.06	0.11	0.20	0.27	0.01	0.16	0.47	0.53	0.05	0.24	0.06	0.36	0.51	0.66
α	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	5.78			-5.27		-12.50		8.12		-24.93		11.89		18.10		-31.18
Fcf (ksi)	37.50			-35.24		-35.35		37.50		-36.07		37.50		37.50		-39.17
Fcf (kip)	2170.66			-2255.36		-2262.57		1929.47		-2308.62		1929.47		1929.47		-2506.60
fncf (ksi)		0.26	2.88		9.95		0.59		23.55		-2.71		-2.78		25.41	
Rcf		6.49	6.69		2.83		4.62		1.45		3.15		2.07		1.26	
Fncf (ksi)		37.50	37.50		37.50		37.50		37.50		-37.50		-37.50		37.50	
Fncf (kip)		1929.47	2170.66		2170.66		2170.66		2170.66		-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.94	-0.60	2.03	-3.98	4.58	-7.84	0.41	5.44	8.55	-16.10	-1.78	8.44	-1.82	12.83	17.98	-22.41
Fs (ksi)	3.94	-0.60	2.03	-3.98	4.58	-7.84	0.41	5.44	8.55	-16.10	-1.78	8.44	-1.82	12.83	17.98	-22.41
Fs (kip)	283.53	-38.18	146.32	-254.81	329.54	-501.94	29.81	347.89	615.61	-1030.48	-127.99	540.44	-131.10	821.00	1294.35	-1434.41

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	1929.47	1294.35	821.00
Comp	2700.00	2506.60	131.10	1434.41

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	441.15	524.63	740.45	197.18	458.97	513.47	374.24	514.99	328.76	374.03	540.23	142.68	327.64	379.86	281.50	367.21
Vuw (kip)	661.72	786.95	1057.92	295.77	688.46	770.21	561.37	772.48	---	---	---	---	---	---	---	---
Mv (k*ft)	289.50	344.29	462.84	129.40	301.20	336.97	245.60	337.96	143.83	163.64	236.35	62.42	143.34	166.19	123.15	160.66
Huw (kip)	1879.65	-765.97	-346.59	1931.54	-95.83	1389.23	1523.95	-348.08	160.38	-93.56	-156.76	280.79	-362.45	320.00	528.34	-212.91
Muw (k*ft)	2293.80	3489.42	4063.02	2224.61	4489.46	2947.70	2768.06	4549.10	290.21	384.87	794.87	321.39	1577.69	654.21	937.53	2584.94
Mu (k*ft)	2583.30	3833.71	4525.86	2354.01	4790.66	3284.66	3013.66	4887.06	434.05	548.51	1031.22	383.81	1721.03	820.40	1060.69	2745.59

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.61	8.80	3.98	22.20	1.10	15.97	17.52	4.00	1.84	1.08	1.80	3.23	4.17	3.68	6.07	2.45
PY1 (Vuw)	7.61	9.05	12.16	3.40	7.91	8.85	6.45	8.88	3.78	4.30	6.21	1.64	3.77	4.37	3.24	4.22
PX2 (Mu)	23.53	34.92	41.22	21.44	43.64	29.92	27.45	44.51	3.95	5.00	9.39	3.50	15.68	7.47	9.66	25.01
PY2 (Mu)	1.68	2.49	2.94	1.53	3.12	2.14	1.96	3.18	0.28	0.36	0.67	0.25	1.12	0.53	0.69	1.79
Pu (kip)	46.08	45.22	47.66	43.92	46.08	47.18	45.75	49.99	7.08	7.65	13.14	6.98	20.44	12.18	16.22	28.11

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	968.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	961.40	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1257.64	1631.25	OK
BF Outside	1248.97	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.68	34.76	36.03	34.48	35.70	36.37	35.61	38.67
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1057.92
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.16

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	648.19	10.13	OK
BF	1257.64	19.65	OK	719.68	11.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1257.64	19.65	1.47	114.56	OK
BF	2506.60	39.17	1.47	183.30	OK
BF Outside	1248.97	19.52	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.99	25.00	OK	28.11	14.05	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.99	1.47	91.65	OK
Web SPL	25.00	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.38	1.30
BF Outside	1.43	1.30

Bolt	Shear	Slip	Bearing
TF	1.71	1.66	4.89
Web	1.45	1.20	1.83
BF	1.53	1.50	4.68

Plate	Shear	Flexure
Web	2.07	1.29

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 3199

Node 3199

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3199 L	72.00	50.00	3600.00	64.00	47.26	3024.65	96.00	50.00	4800.00
3199 R	72.00	50.00	3600.00	80.00	47.33	3786.68	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3199 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	8.71	-8.19	0.80	-0.93	4.56	-7.88	0.30	4.01	17.26	-20.19	-2.18	6.49	-3.28	14.71	21.80	-28.27
ϕf Fnc (ksi)	50.00	47.26	50.00	47.17	50.00	47.01	50.00	50.00	50.00	47.17	50.00	50.00	50.00	50.00	50.00	47.12
f / ϕf Fnc	0.17	0.17	0.02	0.02	0.09	0.17	0.01	0.08	0.35	0.43	0.04	0.13	0.07	0.29	0.44	0.60
α	1.00	0.95	1.00	0.94	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	8.71			-0.93		-7.88		4.01		-20.19		6.49		14.71		-28.27
Fcf (ksi)	37.50			-35.38		-35.26		37.50		-35.38		37.50		37.50		-37.69
Fcf (kip)	2170.66			-2264.19		-2256.37		1929.47		-2264.02		1929.47		1929.47		-2412.47
fncf (ksi)		-8.19	0.80		4.56		0.30		17.26		-2.18		-3.28		21.80	
Rcf		4.30	37.93		4.47		9.36		1.75		5.78		2.55		1.33	
Fncf (ksi)		-35.45	37.50		37.50		37.50		37.50		-37.50		-37.50		37.50	
Fncf (kip)		-2268.49	2170.66		2170.66		2170.66		2170.66		-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.97	-5.64	0.60	-0.92	2.61	-5.10	0.24	2.52	6.22	-13.20	-1.46	4.60	-2.24	10.41	6.82	-17.88
Fs (ksi)	3.97	-5.64	0.60	-0.92	2.61	-5.10	0.24	2.52	6.22	-13.20	-1.46	4.60	-2.24	10.41	6.82	-17.88
Fs (kip)	286.05	-360.80	43.44	-58.99	187.64	-326.22	17.55	161.53	447.71	-845.00	-105.15	294.41	-161.20	666.15	491.21	-1144.14

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	1929.47	491.21	666.15
Comp	2700.00	2412.47	161.20	1144.14

$\phi v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	504.50	656.04	839.00	242.94	524.18	575.65	470.35	559.68	372.12	466.48	608.45	174.61	373.31	422.39	347.99	398.39
Vuw (kip)	756.76	984.07	1107.19	364.41	786.26	863.47	705.52	839.51	---	---	---	---	---	---	---	---
Mv (k*ft)	331.08	430.53	484.40	159.43	343.99	377.77	308.67	367.29	162.80	204.08	266.20	76.39	163.32	184.79	152.25	174.30
Huw (kip)	107.43	-233.82	-714.00	1932.67	-245.94	1194.61	1398.15	-413.68	-79.90	-15.28	-119.57	132.85	-335.28	150.70	392.15	-530.64
Muw (k*ft)	4656.75	4216.62	3560.74	2223.11	4200.13	3207.18	2935.80	4273.37	615.06	97.60	493.02	145.93	1242.97	387.88	809.44	1580.77
Mu (k*ft)	4987.84	4647.15	4045.14	2382.54	4544.12	3584.95	3244.46	4640.66	777.87	301.68	759.21	222.32	1406.29	572.67	961.68	1755.07

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.23	2.69	8.21	22.21	2.83	13.73	16.07	4.75	0.92	0.18	1.37	1.53	3.85	1.73	4.51	6.10
PY1 (Vuw)	8.70	11.31	12.73	4.19	9.04	9.92	8.11	9.65	4.28	5.36	6.99	2.01	4.29	4.86	4.00	4.58
PX2 (Mu)	45.43	42.33	36.85	21.70	41.39	32.65	29.55	42.27	7.09	2.75	6.92	2.03	12.81	5.22	8.76	15.99
PY2 (Mu)	3.25	3.02	2.63	1.55	2.96	2.33	2.11	3.02	0.51	0.20	0.49	0.14	0.91	0.37	0.63	1.14
Pu (kip)	48.17	47.24	47.60	44.29	45.82	47.98	46.75	48.70	9.32	6.28	11.17	4.15	17.46	8.70	14.05	22.81

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	968.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	961.40	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1210.41	1631.25	OK
BF Outside	1202.06	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.24	35.89	35.83	34.70	35.25	36.81	36.16	37.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1107.19
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.16

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	245.99	3.84	OK
BF	1210.41	18.91	OK	574.05	8.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1210.41	18.91	1.47	114.56	OK
BF	2412.47	37.69	1.47	183.30	OK
BF Outside	1202.06	18.78	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.70	24.35	OK	22.81	11.41	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.70	1.47	91.65	OK
Web SPL	24.35	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.38	1.35
BF Outside	1.43	1.35

Bolt	Shear	Slip	Bearing
TF	1.71	4.38	4.89
Web	1.49	1.48	1.88
BF	1.59	1.88	4.86

Plate	Shear	Flexure
Web	1.98	1.33

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 5199

Node 5199

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5199 L	72.00	50.00	3600.00	64.00	47.22	3022.06	96.00	50.00	4800.00
5199 R	72.00	50.00	3600.00	80.00	50.00	4000.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5199 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	10.83	-11.19	-0.45	1.12	4.23	-8.67	0.44	3.43	10.32	-12.82	1.71	-1.19	-2.85	13.18	20.21	-26.33
ϕf Fnc (ksi)	50.00	47.22	50.00	50.00	50.00	46.94	50.00	50.00	50.00	47.14	50.00	47.39	50.00	50.00	50.00	47.12
f / ϕf Fnc	0.22	0.24	0.01	0.02	0.08	0.18	0.01	0.07	0.21	0.27	0.03	0.03	0.06	0.26	0.40	0.56
α	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94	1.00	0.95	1.00	1.00	1.00	0.94
fcf (ksi)		-11.19		1.12		-8.67		3.43		-12.82	1.71			13.18		-26.33
Fcf (ksi)		-35.41		37.50		-35.21		37.50		-35.36	37.50			37.50		-36.73
Fcf (kip)		-2266.55		1929.47		-2253.32		1929.47		-2262.79	2170.66			1929.47		-2350.43
fncf (ksi)	10.83		-0.45		4.23		0.44		10.32			-1.19	-2.85		20.21	
Rcf	3.17		33.37		4.06		10.92		2.76			21.90	2.85		1.39	
Fncf (ksi)	37.50		-37.50		37.50		37.50		37.50			-35.54	-37.50		37.50	
Fncf (kip)	2170.66		-2700.00		2170.66		2170.66		2170.66			-2274.72	-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.44	-7.71	-0.30	0.81	2.21	-5.49	0.46	2.20	4.45	-8.59	1.27	-0.86	-1.99	9.32	6.42	-16.65
Fs (ksi)	4.44	-7.71	-0.30	0.81	2.21	-5.49	0.46	2.20	4.45	-8.59	1.27	-0.86	-1.99	9.32	6.42	-16.65
Fs (kip)	319.47	-493.42	-21.34	51.61	159.33	-351.13	33.02	140.98	320.76	-549.50	91.56	-55.34	-143.12	596.61	462.60	-1065.65

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	1929.47	462.60	596.61
Comp	2700.00	2350.43	143.12	1065.65

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	474.84	764.30	884.89	271.27	564.44	584.19	502.61	589.07	338.75	555.01	640.20	194.92	402.05	427.76	370.11	419.45
Vuw (kip)	712.26	1069.84	1130.14	406.90	846.65	876.29	753.91	883.60	---	---	---	---	---	---	---	---
Mv (k*ft)	311.61	468.06	494.43	178.02	370.41	383.38	329.83	386.57	148.20	242.82	280.09	85.28	175.90	187.14	161.92	183.51
Huw (kip)	-54.77	1073.08	-864.81	2030.38	-331.96	550.93	1410.97	-409.90	-157.09	24.48	-157.13	127.75	-198.29	19.53	352.04	-490.84
Muw (k*ft)	4460.07	3369.23	3353.57	2092.83	4082.96	4065.43	2918.71	4154.32	777.39	70.59	492.76	111.62	834.62	136.73	723.83	1476.85
Mu (k*ft)	4771.68	3837.29	3848.00	2270.85	4453.37	4448.80	3248.55	4540.89	925.60	313.40	772.85	196.90	1010.52	323.87	885.75	1660.36

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.63	12.33	9.94	23.34	3.82	6.33	16.22	4.71	1.81	0.28	1.81	1.47	2.28	0.22	4.05	5.64
PY1 (Vuw)	8.19	12.30	12.99	4.68	9.73	10.07	8.67	10.16	3.89	6.38	7.36	2.24	4.62	4.92	4.25	4.82
PX2 (Mu)	43.46	34.95	35.05	20.68	40.56	40.52	29.59	41.36	8.43	2.85	7.04	1.79	9.20	2.95	8.07	15.12
PY2 (Mu)	3.10	2.50	2.50	1.48	2.90	2.89	2.11	2.95	0.60	0.20	0.50	0.13	0.66	0.21	0.58	1.08
Pu (kip)	45.52	49.55	47.58	44.45	46.14	48.62	47.06	47.90	11.18	7.29	11.83	4.03	12.64	6.03	13.04	21.59

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	968.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	961.40	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1179.28	1631.25	OK
BF Outside	1171.15	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.19	37.55	35.76	34.76	35.37	37.30	36.31	36.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1130.14
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.16

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	231.66	3.62	OK
BF	1179.28	18.43	OK	534.67	8.35	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1179.28	18.43	1.47	114.56	OK
BF	2350.43	36.73	1.47	183.30	OK
BF Outside	1171.15	18.30	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.55	24.77	OK	21.59	10.79	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.55	1.47	91.65	OK
Web SPL	24.77	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.38	1.38
BF Outside	1.43	1.38

Bolt	Shear	Slip	Bearing
TF	1.71	4.65	4.89
Web	1.46	1.56	1.85
BF	1.64	2.01	4.99

Plate	Shear	Flexure
Web	1.94	1.33

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 7199

Node 7199

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7199 L	72.00	50.00	3600.00	64.00	47.29	3026.43	96.00	50.00	4800.00
7199 R	72.00	50.00	3600.00	80.00	47.15	3771.89	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7199 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	7.42	-6.54	0.93	-2.01	4.07	-7.54	0.18	4.38	1.61	-1.38	8.79	-9.67	-2.95	13.74	19.61	-25.54
ϕf Fnc (ksi)	50.00	47.29	50.00	46.93	50.00	46.98	50.00	50.00	50.00	47.30	50.00	47.19	50.00	50.00	50.00	47.12
f / ϕf Fnc	0.15	0.14	0.02	0.04	0.08	0.16	0.00	0.09	0.03	0.03	0.18	0.20	0.06	0.27	0.39	0.54
α	1.00	0.95	1.00	0.94	1.00	0.94	1.00	1.00	1.00	0.95	1.00	0.94	1.00	1.00	1.00	0.94
fcf (ksi)	7.42			-2.01		-7.54		4.38	1.61			-9.67		13.74		-25.54
Fcf (ksi)	37.50			-35.19		-35.24		37.50	37.50			-35.39		37.50		-36.33
Fcf (kip)	2170.66			-2252.46		-2255.14		1929.47	2170.66			-2265.26		1929.47		-2325.32
fncf (ksi)		-6.54	0.93		4.07		0.18			-1.38	8.79		-2.95		19.61	
Rcf		5.05	17.52		4.67		8.57			23.32	3.66		2.73		1.42	
Fncf (ksi)		-35.47	37.50		37.50		37.50			-35.47	37.50		-37.50		37.50	
Fncf (kip)		-2269.82	2170.66		2170.66		2170.66			-2270.30	2170.66		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.57	-4.82	0.63	-1.43	2.18	-4.84	0.32	2.89	1.34	-1.20	3.87	-6.52	-2.07	9.65	6.22	-16.10
Fs (ksi)	3.57	-4.82	0.63	-1.43	2.18	-4.84	0.32	2.89	1.34	-1.20	3.87	-6.52	-2.07	9.65	6.22	-16.10
Fs (kip)	257.20	-308.34	45.03	-91.61	156.97	-309.98	23.25	185.08	96.13	-76.88	278.92	-417.14	-149.12	617.50	447.83	-1030.46

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	1929.47	447.83	617.50
Comp	2700.00	2325.32	149.12	1030.46

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	483.77	669.56	834.50	241.74	555.96	500.78	445.36	572.02	345.77	487.75	604.28	174.77	396.77	368.50	329.35	408.12
Vuw (kip)	725.66	1004.34	1104.94	362.61	833.94	751.17	668.03	858.03	---	---	---	---	---	---	---	---
Mv (k*ft)	317.47	439.40	483.41	158.64	364.85	328.64	292.27	375.39	151.27	213.39	264.37	76.46	173.59	161.22	144.09	178.55
Huw (kip)	213.48	-904.49	-777.19	1872.12	250.15	-154.60	1413.76	-404.97	-59.79	-38.69	-127.83	154.30	6.43	-126.91	363.72	-474.29
Muw (k*ft)	4515.36	3298.93	3474.02	2303.84	4466.47	4324.40	2914.99	4110.68	536.97	131.63	449.50	164.41	162.33	665.07	750.05	1428.54
Mu (k*ft)	4832.83	3738.33	3957.43	2462.48	4831.31	4653.04	3207.26	4486.07	688.24	345.02	713.88	240.87	335.92	826.29	894.14	1607.09

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	2.45	10.40	8.93	21.52	2.88	1.78	16.25	4.65	0.69	0.44	1.47	1.77	0.07	1.46	4.18	5.45
PY1 (Vuw)	8.34	11.54	12.70	4.17	9.59	8.63	7.68	9.86	3.97	5.61	6.95	2.01	4.56	4.24	3.79	4.69
PX2 (Mu)	44.02	34.05	36.05	22.43	44.01	42.38	29.21	40.86	6.27	3.14	6.50	2.19	3.06	7.53	8.14	14.64
PY2 (Mu)	3.14	2.43	2.57	1.60	3.14	3.03	2.09	2.92	0.45	0.22	0.46	0.16	0.22	0.54	0.58	1.05
Pu (kip)	47.87	46.59	47.50	44.33	48.58	45.67	46.50	47.28	8.24	6.85	10.88	4.52	5.71	10.17	13.08	20.89

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	968.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	961.40	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1166.68	1631.25	OK
BF Outside	1158.64	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.06	35.31	35.76	34.73	37.38	35.23	36.03	36.26
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1104.94
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.16

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	224.27	3.50	OK
BF	1166.68	18.23	OK	517.01	8.08	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1166.68	18.23	1.47	114.56	OK
BF	2325.32	36.33	1.47	183.30	OK
BF Outside	1158.64	18.10	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.58	24.29	OK	20.89	10.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.58	1.47	91.65	OK
Web SPL	24.29	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.38	1.40
BF Outside	1.43	1.40

Bolt	Shear	Slip	Bearing
TF	1.71	4.80	4.89
Web	1.49	1.61	1.89
BF	1.65	2.08	5.04

Plate	Shear	Flexure
Web	1.99	1.34

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9199	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9199

Node 9199

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9199 L	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00
9199 R	72.00	50.00	3600.00	80.00	47.20	3776.11	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9199 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.72	2.12	2.49	-5.10	7.15	-9.30	0.65	6.77	-1.61	8.17	14.77	-13.92	-2.33	16.14	21.05	-25.42
ϕf Fnc (ksi)	50.00	50.00	50.00	46.94	50.00	47.12	50.00	50.00	50.00	50.00	50.00	47.26	50.00	50.00	50.00	47.15
f / ϕf Fnc	0.09	0.04	0.05	0.11	0.14	0.20	0.01	0.14	0.03	0.16	0.30	0.29	0.05	0.32	0.42	0.54
α	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.94
fcf (ksi)	4.72			-5.10		-9.30		6.77		8.17	14.77			16.14		-25.42
Fcf (ksi)	37.50			-35.21		-35.34		37.50		37.50	37.50			37.50		-36.29
Fcf (kip)	2170.66			-2253.30		-2261.87		1929.47		1929.47	2170.66			1929.47		-2322.43
fncf (ksi)		2.12	2.49		7.15		0.65		-1.61			-13.92	-2.33		21.05	
Rcf		7.94	6.90		3.80		5.54		4.59			2.54	2.32		1.43	
Fncf (ksi)		37.50	37.50		37.50		37.50		-37.50			-35.44	-37.50		37.50	
Fncf (kip)		1929.47	2170.66		2170.66		2170.66		-2700.00			-2268.43	-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.55	0.44	1.70	-3.62	3.28	-5.84	0.72	4.65	-0.90	5.64	5.90	-9.10	-1.66	11.34	7.17	-15.85
Fs (ksi)	3.55	0.44	1.70	-3.62	3.28	-5.84	0.72	4.65	-0.90	5.64	5.90	-9.10	-1.66	11.34	7.17	-15.85
Fs (kip)	255.62	28.19	122.37	-231.97	236.25	-373.55	52.16	297.35	-64.62	360.74	425.12	-582.12	-119.16	725.52	516.24	-1014.62

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	1929.47	516.24	725.52
Comp	2700.00	2322.43	119.16	1014.62

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	419.86	525.15	722.04	195.94	508.46	432.52	356.30	505.54	301.88	386.24	525.34	143.67	364.47	320.80	266.94	362.42
Vuw (kip)	629.79	787.72	1048.71	293.91	762.69	648.79	534.45	758.32	---	---	---	---	---	---	---	---
Mv (k*ft)	275.53	344.63	458.81	128.59	333.67	283.84	233.82	331.76	132.07	168.98	229.84	62.86	159.46	140.35	116.79	158.56
Huw (kip)	2607.79	-865.64	-392.64	1973.97	1445.41	102.91	1540.03	-299.36	191.55	-92.39	-122.66	257.79	227.47	-153.18	464.70	-416.80
Muw (k*ft)	1322.94	3352.42	4000.22	2168.04	2872.78	4662.78	2746.63	4245.70	199.03	340.74	583.55	250.99	418.18	960.00	831.45	1473.50
Mu (k*ft)	1598.48	3697.05	4459.03	2296.62	3206.46	4946.63	2980.45	4577.47	331.10	509.72	813.39	313.85	577.64	1100.35	948.23	1632.06

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.97	9.95	4.51	22.69	16.61	1.18	17.70	3.44	2.20	1.06	1.41	2.96	2.61	1.76	5.34	4.79
PY1 (Vuw)	7.24	9.05	12.05	3.38	8.77	7.46	6.14	8.72	3.47	4.44	6.04	1.65	4.19	3.69	3.07	4.17
PX2 (Mu)	14.56	33.68	40.62	20.92	29.21	45.06	27.15	41.69	3.02	4.64	7.41	2.86	5.26	10.02	8.64	14.87
PY2 (Mu)	1.04	2.41	2.90	1.49	2.09	3.22	1.94	2.98	0.22	0.33	0.53	0.20	0.38	0.72	0.62	1.06
Pu (kip)	45.30	45.11	47.54	43.88	47.09	47.46	45.57	46.63	6.39	7.44	11.00	6.11	9.10	12.58	14.46	20.34

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	968.08	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	961.40	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1165.23	1631.25	OK
BF Outside	1157.19	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.06	34.67	35.95	34.44	36.31	36.90	35.52	35.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1048.71
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9199**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.16

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	258.52	4.04	OK
BF	1165.23	18.21	OK	509.06	7.95	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1165.23	18.21	1.47	114.56	OK
BF	2322.43	36.29	1.47	183.30	OK
BF Outside	1157.19	18.08	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.54	23.77	OK	20.34	10.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.54	1.47	91.65	OK
Web SPL	23.77	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.38	1.40
BF Outside	1.43	1.40

Bolt	Shear	Slip	Bearing
TF	1.71	4.17	4.89
Web	1.52	1.65	1.93
BF	1.66	2.12	5.05

Plate	Shear	Flexure
Web	2.09	1.36

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1225	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1225

Node 1225

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1225 L	72.00	50.00	3600.00	80.00	50.00	4000.00	96.00	50.00	4800.00
1225 R	88.00	50.00	4400.00	88.00	45.49	4002.84	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1225 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.41	8.40	1.23	-7.55	-8.39	7.33	-3.45	1.18	17.05	-20.53	-10.29	14.73	-11.75	19.57	21.29	-25.53
ϕf Fnc (ksi)	50.00	50.00	50.00	45.24	50.00	50.00	50.00	50.00	50.00	47.34	50.00	50.00	50.00	50.00	50.00	47.34
f / ϕf Fnc	0.09	0.17	0.02	0.17	0.17	0.15	0.07	0.02	0.34	0.43	0.21	0.29	0.23	0.39	0.43	0.54
α	1.00	1.00	1.00	0.90	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		8.40		-7.55	-8.39		-3.45			-20.53		14.73		19.57		-25.53
Fcf (ksi)		37.50		-33.93	-37.50		-37.50			-35.50		37.50		37.50		-36.44
Fcf (kip)		2411.84		-2714.59	-2700.00		-2700.00			-2840.32		2411.84		2411.84		-2914.81
fncf (ksi)	-4.41		1.23			7.33		1.18	17.05		-10.29		-11.75		21.29	
Rcf	4.46		4.50			4.47		10.87	1.73		2.55		1.92		1.43	
Fncf (ksi)	-37.50		37.50			37.50		37.50	37.50		-37.50		-37.50		37.50	
Fncf (kip)	-2700.00		2170.66			2411.84		2411.84	2170.66		-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.69	5.18	-3.57	-3.68	-5.49	5.18	-4.00	1.23	12.39	-14.70	-7.74	10.51	-8.78	13.94	15.38	-18.23
Fs (ksi)	-3.69	5.18	-3.57	-3.68	-5.49	5.18	-4.00	1.23	12.39	-14.70	-7.74	10.51	-8.78	13.94	15.38	-18.23
Fs (kip)	-265.77	414.49	-257.36	-294.56	-395.28	414.46	-288.31	98.03	891.82	-1175.71	-557.55	841.08	-631.89	1114.86	1107.41	-1458.51

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2411.84	1107.41	1114.86
Comp	2700.00	2914.81	631.89	1458.51

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	435.19	598.41	232.52	808.91	474.60	580.92	566.36	525.04	321.29	432.83	174.32	585.33	349.14	420.47	410.18	384.78
Vuw (kip)	652.78	897.61	348.78	1092.15	711.90	871.38	849.54	787.56	---	---	---	---	---	---	---	---
Mv (k*ft)	285.59	392.71	152.59	477.81	311.45	381.23	371.67	344.56	140.57	189.36	76.27	256.08	152.75	183.96	179.46	168.34
Huw (kip)	854.32	-1363.15	-226.44	-1186.89	-288.32	542.74	719.52	-290.32	71.52	-348.31	-14.85	-133.39	-110.88	132.95	247.65	-136.83
Muw (k*ft)	3660.90	2525.82	4498.08	3217.48	4160.09	4076.35	3840.64	4276.60	567.83	6.89	682.93	334.70	1733.29	1168.47	1453.57	2151.17
Mu (k*ft)	3946.49	2918.52	4650.67	3695.30	4471.54	4457.58	4212.31	4621.16	708.40	196.25	759.19	590.78	1886.04	1352.43	1633.03	2319.51

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	9.82	15.67	2.60	13.64	3.31	6.24	8.27	3.34	0.82	4.00	0.17	1.53	1.27	1.53	2.85	1.57
PY1 (Vuw)	7.50	10.32	4.01	12.55	8.18	10.02	9.76	9.05	3.69	4.98	2.00	6.73	4.01	4.83	4.71	4.42
PX2 (Mu)	35.95	26.58	42.36	33.66	40.73	40.60	38.37	42.09	6.45	1.79	6.92	5.38	17.18	12.32	14.87	21.13
PY2 (Mu)	2.57	1.90	3.03	2.40	2.91	2.90	2.74	3.01	0.46	0.13	0.49	0.38	1.23	0.88	1.06	1.51
Pu (kip)	46.86	43.98	45.51	49.61	45.42	48.59	48.29	47.00	8.38	7.72	7.51	9.92	19.18	14.98	18.64	23.46

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1210.09	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1201.75	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1462.45	1631.25	OK
BF Outside	1452.36	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.38	33.48	35.85	37.54	35.11	37.29	37.10	36.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1092.15
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.85	1.0	30.62
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.91

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	554.57	8.67	OK
BF	1462.45	22.85	OK	731.78	11.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1462.45	22.85	1.47	114.56	OK
BF	2914.81	45.54	1.47	229.13	OK
BF Outside	1452.36	22.69	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.61	24.81	OK	23.46	11.73	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.61	1.47	91.65	OK
Web SPL	24.81	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.10	1.12
BF Outside	1.14	1.12

Bolt	Shear	Slip	Bearing
TF	1.45	1.94	4.89
Web	1.46	1.43	1.85
BF	1.44	1.47	4.54

Plate	Shear	Flexure
Web	2.01	1.33

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3225	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3225

Node 3225

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3225 L	72.00	50.00	3600.00	80.00	47.23	3778.66	96.00	50.00	4800.00
3225 R	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3225 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	1.02	-1.68	-7.62	1.76	-8.89	6.09	-1.92	-3.99	9.81	-14.04	-11.27	11.67	-12.99	19.00	17.76	-23.55
ϕf Fnc (ksi)	50.00	47.23	50.00	50.00	50.00	50.00	50.00	43.56	50.00	47.28	50.00	50.00	50.00	50.00	50.00	47.31
f / ϕf Fnc	0.02	0.04	0.15	0.04	0.18	0.12	0.04	0.09	0.20	0.30	0.23	0.23	0.26	0.38	0.36	0.50
α	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.87	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		-1.68	-7.62		-8.89			-3.99		-14.04		11.67		19.00		-23.55
Fcf (ksi)		-35.42	-37.50		-37.50			-32.67		-35.46		37.50		37.50		-35.48
Fcf (kip)		-2834.00	-2700.00		-2700.00			-2613.53		-2836.78		2411.84		2411.84		-2838.32
fncf (ksi)	1.02			1.76		6.09	-1.92		9.81		-11.27		-12.99		17.76	
Rcf	21.12			4.92		4.22	8.20		2.53		3.21		1.97		1.51	
Fncf (ksi)	37.50			37.50		37.50	-37.50		37.50		-37.50		-37.50		37.50	
Fncf (kip)	2170.66			2411.84		2411.84	-2700.00		2170.66		-2700.00		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.51	-0.93	-6.48	2.19	-6.44	4.57	-4.65	-2.06	7.21	-10.21	-8.44	8.46	-9.66	13.64	12.80	-16.91
Fs (ksi)	-3.51	-0.93	-6.48	2.19	-6.44	4.57	-4.65	-2.06	7.21	-10.21	-8.44	8.46	-9.66	13.64	12.80	-16.91
Fs (kip)	-252.41	-74.28	-466.79	175.06	-463.53	365.84	-335.07	-165.05	519.20	-816.64	-607.94	676.92	-695.81	1091.05	921.65	-1352.60

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2411.84	921.65	1091.05
Comp	2700.00	2838.32	695.81	1352.60

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	496.05	752.20	265.68	897.05	511.81	699.57	614.72	564.99	363.17	539.67	195.93	646.49	374.31	502.48	442.54	411.88
Vuw (kip)	744.07	1063.79	398.52	1136.22	767.72	1037.48	922.09	847.49	---	---	---	---	---	---	---	---
Mv (k*ft)	325.53	465.41	174.35	497.10	335.88	453.90	403.41	370.78	158.89	236.10	85.72	282.84	163.76	219.84	193.61	180.20
Huw (kip)	-668.05	-1385.26	-567.78	-2324.92	-512.61	62.60	568.93	-419.25	-212.84	-206.16	-89.52	-322.41	-143.85	0.86	190.76	-197.13
Muw (k*ft)	3643.67	2952.98	4042.96	1081.75	3855.38	4716.54	4041.42	3982.32	164.95	554.97	704.69	165.80	1114.82	1081.93	1491.35	1901.32
Mu (k*ft)	3969.20	3418.39	4217.32	1578.85	4191.26	5170.43	4444.83	4353.09	323.83	791.08	790.41	448.64	1278.58	1301.77	1684.95	2081.52

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	7.68	15.92	6.53	26.72	5.89	0.72	6.54	4.82	2.45	2.37	1.03	3.71	1.65	0.01	2.19	2.27
PY1 (Vuw)	8.55	12.23	4.58	13.06	8.82	11.93	10.60	9.74	4.17	6.20	2.25	7.43	4.30	5.78	5.09	4.73
PX2 (Mu)	36.15	31.14	38.41	14.38	38.18	47.10	40.49	39.65	2.95	7.21	7.20	4.09	11.65	11.86	15.35	18.96
PY2 (Mu)	2.58	2.22	2.74	1.03	2.73	3.36	2.89	2.83	0.21	0.51	0.51	0.29	0.83	0.85	1.10	1.35
Pu (kip)	45.22	49.23	45.53	43.45	45.56	50.20	48.92	46.21	6.95	11.70	8.68	10.97	14.26	13.59	18.60	22.08

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1210.09	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1201.75	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1424.07	1631.25	OK
BF Outside	1414.25	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.87	37.31	35.77	32.38	35.09	38.16	37.44	35.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1136.22
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.85	1.0	30.62
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.91

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	461.54	7.21	OK
BF	1424.07	22.25	OK	678.64	10.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1424.07	22.25	1.47	114.56	OK
BF	2838.32	44.35	1.47	229.13	OK
BF Outside	1414.25	22.10	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.20	25.10	OK	22.08	11.04	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.20	1.47	91.65	OK
Web SPL	25.10	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.10	1.15
BF Outside	1.14	1.15

Bolt	Shear	Slip	Bearing
TF	1.45	2.33	4.89
Web	1.44	1.52	1.83
BF	1.48	1.59	4.67

Plate	Shear	Flexure
Web	1.93	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5225	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5225

Node 5225

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5225 L	72.00	50.00	3600.00	80.00	47.29	3783.19	96.00	50.00	4800.00
5225 R	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5225 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.18	-3.02	-9.62	4.06	-8.44	6.44	-4.25	-1.37	4.37	-7.76	-6.40	2.29	-12.79	18.68	17.12	-22.86
ϕf Fnc (ksi)	50.00	47.29	50.00	50.00	50.00	50.00	50.00	43.56	50.00	47.21	50.00	50.00	50.00	50.00	50.00	47.30
f / ϕf Fnc	0.04	0.06	0.19	0.08	0.17	0.13	0.08	0.03	0.09	0.16	0.13	0.05	0.26	0.37	0.34	0.48
α	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.87	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		-3.02	-9.62		-8.44		-4.25			-7.76	-6.40			18.68		-22.86
Fcf (ksi)		-35.47	-37.50		-37.50		-37.50			-35.41	-37.50			37.50		-35.48
Fcf (kip)		-2837.39	-2700.00		-2700.00		-2700.00			-2832.54	-2700.00			2411.84		-2838.19
fncf (ksi)	2.18			4.06		6.44		-1.37	4.37			2.29	-12.79		17.12	
Rcf	11.74			3.90		4.44		8.83	4.56			5.86	2.01		1.55	
Fncf (ksi)	37.50			37.50		37.50		-32.67	37.50			37.50	-37.50		37.50	
Fncf (kip)	2170.66			2411.84		2411.84		-2613.53	2170.66			2411.84	-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.69	-1.22	-6.61	3.04	-6.26	4.86	-5.26	-0.45	-3.28	-4.58	-6.35	2.56	-9.47	13.56	12.30	-16.54
Fs (ksi)	-3.69	-1.22	-6.61	3.04	-6.26	4.86	-5.26	-0.45	-3.28	-4.58	-6.35	2.56	-9.47	13.56	12.30	-16.54
Fs (kip)	-265.52	-97.53	-475.85	243.02	-450.63	389.00	-378.49	-36.09	-236.40	-366.46	-457.47	204.81	-682.02	1084.56	885.75	-1323.35

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2411.84	885.75	1084.56
Comp	2700.00	2838.19	682.02	1323.35

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	461.61	779.55	269.64	908.30	562.40	688.27	622.15	576.35	333.45	563.71	197.82	654.67	410.29	493.59	446.88	420.15
Vuw (kip)	692.42	1077.47	404.45	1141.84	843.60	1031.83	933.22	864.53	---	---	---	---	---	---	---	---
Mv (k*ft)	302.93	471.39	176.95	499.56	369.07	451.42	408.28	378.23	145.89	246.62	86.55	286.42	179.50	215.95	195.51	183.81
Huw (kip)	-476.40	-1041.17	-425.91	-2382.36	-743.00	-1156.65	567.70	-427.56	-235.53	-171.42	-67.02	-273.98	-377.47	-182.09	196.06	-203.51
Muw (k*ft)	3904.63	3411.77	4232.12	1623.52	3541.40	3257.80	4043.07	3971.03	157.99	617.39	711.76	307.56	83.03	570.49	1473.89	1846.01
Mu (k*ft)	4207.56	3883.17	4409.06	2123.08	3910.47	3709.22	4451.35	4349.26	303.87	864.01	798.31	593.98	262.53	786.43	1669.40	2029.83

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.48	11.97	4.90	27.38	8.54	13.29	6.53	4.91	2.71	1.97	0.77	3.15	4.34	2.09	2.25	2.34
PY1 (Vuw)	7.96	12.38	4.65	13.12	9.70	11.86	10.73	9.94	3.83	6.48	2.27	7.52	4.72	5.67	5.14	4.83
PX2 (Mu)	38.33	35.37	40.16	19.34	35.62	33.79	40.55	39.62	2.77	7.87	7.27	5.41	2.39	7.16	15.21	18.49
PY2 (Mu)	2.74	2.53	2.87	1.38	2.54	2.41	2.90	2.83	0.20	0.56	0.52	0.39	0.17	0.51	1.09	1.32
Pu (kip)	45.09	49.63	45.68	48.92	45.82	49.20	49.00	46.32	6.80	12.10	8.51	11.66	8.32	11.13	18.54	21.72

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1210.09	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1201.75	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1424.00	1631.25	OK
BF Outside	1414.18	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.88	37.60	35.89	36.85	35.11	37.37	37.47	35.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1141.84
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.85	1.0	30.62
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.91

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	443.57	6.93	OK
BF	1424.00	22.25	OK	663.96	10.37	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1424.00	22.25	1.47	114.56	OK
BF	2838.19	44.35	1.47	229.13	OK
BF Outside	1414.18	22.10	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.63	24.82	OK	21.72	10.86	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.63	1.47	91.65	OK
Web SPL	24.82	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.10	1.15
BF Outside	1.14	1.15

Bolt	Shear	Slip	Bearing
TF	1.45	2.43	4.89
Web	1.46	1.55	1.85
BF	1.48	1.62	4.67

Plate	Shear	Flexure
Web	1.92	1.33

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	Cleveland InnerBelt : Field Splice - Node 7225	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7225

Node 7225

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7225 L	72.00	50.00	3600.00	80.00	47.36	3788.83	96.00	50.00	4800.00
7225 R	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7225 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	1.65	-1.86	-7.83	2.21	-8.08	6.22	-1.61	-3.25	-10.58	7.31	6.50	-9.56	-12.30	18.52	18.10	-23.46
ϕf Fnc (ksi)	50.00	47.36	50.00	50.00	50.00	50.00	50.00	43.56	50.00	50.00	50.00	47.27	50.00	50.00	50.00	47.31
f / ϕf Fnc	0.03	0.04	0.16	0.04	0.16	0.12	0.03	0.07	0.21	0.15	0.13	0.20	0.25	0.37	0.36	0.50
α	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.87	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95
fcf (ksi)		-1.86	-7.83		-8.08			-3.25	-10.58			-9.56		18.52		-23.46
Fcf (ksi)		-35.52	-37.50		-37.50			-32.67	-37.50			-35.45		37.50		-35.48
Fcf (kip)		-2841.63	-2700.00		-2700.00			-2613.53	-2700.00			-2836.24		2411.84		-2838.79
fncf (ksi)	1.65			2.21		6.22	-1.61			7.31	6.50		-12.30		18.10	
Rcf	19.09			4.79		4.64	10.07			3.54	3.71		2.02		1.51	
Fncf (ksi)	37.50			37.50		37.50	-37.50			37.50	37.50		-37.50		37.50	
Fncf (kip)	2170.66			2411.84		2411.84	-2700.00			2411.84	2170.66		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.56	-0.46	-5.95	1.77	-5.94	4.82	-4.30	-1.74	-6.74	4.78	-3.30	-5.04	-9.07	13.57	12.96	-17.11
Fs (ksi)	-3.56	-0.46	-5.95	1.77	-5.94	4.82	-4.30	-1.74	-6.74	4.78	-3.30	-5.04	-9.07	13.57	12.96	-17.11
Fs (kip)	-256.11	-36.76	-428.73	141.25	-427.65	385.66	-309.93	-138.90	-485.54	382.60	-237.77	-403.19	-652.76	1085.90	933.30	-1368.76

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2411.84	933.30	1085.90
Comp	2700.00	2841.63	652.76	1368.76

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	443.70	725.36	228.98	859.09	591.93	485.01	567.27	546.29	319.83	525.39	168.13	619.87	431.12	349.02	407.14	398.87
Vuw (kip)	665.54	1050.37	343.47	1117.24	887.90	727.51	850.90	819.43	---	---	---	---	---	---	---	---
Mv (k*ft)	291.18	459.54	150.27	488.79	388.45	318.29	372.27	358.50	139.93	229.86	73.56	271.19	188.61	152.70	178.12	174.51
Huw (kip)	-197.23	-1291.59	-413.04	-2348.20	-556.08	-544.51	604.71	-389.38	-192.80	-201.07	-53.70	-289.96	-94.13	-400.43	216.37	-199.06
Muw (k*ft)	4283.62	3077.88	4249.29	1050.71	4058.56	3811.97	3993.72	4022.89	198.25	494.10	688.67	164.37	737.67	111.20	1448.95	1924.61
Mu (k*ft)	4574.80	3537.41	4399.55	1539.50	4447.02	4130.25	4365.98	4381.39	338.18	723.95	762.22	435.57	926.29	263.89	1627.08	2099.11

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7225**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	2.27	14.85	4.75	26.99	6.39	6.26	6.95	4.48	2.22	2.31	0.62	3.33	1.08	4.60	2.49	2.29
PY1 (Vuw)	7.65	12.07	3.95	12.84	10.21	8.36	9.78	9.42	3.68	6.04	1.93	7.12	4.96	4.01	4.68	4.58
PX2 (Mu)	41.67	32.22	40.07	14.02	40.51	37.62	39.77	39.91	3.08	6.59	6.94	3.97	8.44	2.40	14.82	19.12
PY2 (Mu)	2.98	2.30	2.86	1.00	2.89	2.69	2.84	2.85	0.22	0.47	0.50	0.28	0.60	0.17	1.06	1.37
Pu (kip)	45.20	49.21	45.34	43.29	48.69	45.25	48.39	46.05	6.58	11.03	7.94	10.40	11.02	8.16	18.23	22.22

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1210.09	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1201.75	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1425.73	1631.25	OK
BF Outside	1415.90	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.04	37.33	35.71	32.30	37.34	34.93	37.18	35.36
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1117.24
Rr (kip)	2193.67
Check	OK

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.85	1.0	30.62
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.91

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	467.38	7.30	OK
BF	1425.73	22.28	OK	686.75	10.73	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1425.73	22.28	1.47	114.56	OK
BF	2841.63	44.40	1.47	229.13	OK
BF Outside	1415.90	22.12	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.21	24.61	OK	22.22	11.11	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.21	1.47	91.65	OK
Web SPL	24.61	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.10	1.14
BF Outside	1.14	1.14

Bolt	Shear	Slip	Bearing
TF	1.45	2.30	4.89
Web	1.47	1.51	1.86
BF	1.48	1.57	4.66

Plate	Shear	Flexure
Web	1.96	1.34

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Field Splice - Node 9225

Node 9225

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9225 L	72.00	50.00	3600.00	80.00	50.00	4000.00	96.00	50.00	4800.00
9225 R	88.00	50.00	4400.00	88.00	44.19	3889.06	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9225 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	TF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Inside	14.50	1.250	50.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	50.50	36.00	26.44	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.00	7.45	0.34	-5.92	-7.05	7.85	5.75	-8.60	-8.33	12.73	16.02	-19.23	-10.05	18.56	22.01	-26.17
ϕf Fnc (ksi)	50.00	50.00	50.00	44.02	50.00	50.00	50.00	47.26	50.00	50.00	50.00	47.34	50.00	50.00	50.00	47.34
f / ϕf Fnc	0.06	0.15	0.01	0.13	0.14	0.16	0.11	0.18	0.17	0.25	0.32	0.41	0.20	0.37	0.44	0.55
α	1.00	1.00	1.00	0.88	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95
fcf (ksi)		7.45		-5.92		7.85		-8.60		12.73		-19.23		18.56		-26.17
Fcf (ksi)		37.50		-33.02		37.50		-35.45		37.50		-35.50		37.50		-36.75
Fcf (kip)		2411.84		-2641.47		2411.84		-2835.88		2411.84		-2840.39		2411.84		-2940.33
fncf (ksi)	-3.00		0.34		-7.05		5.75		-8.33		16.02		-10.05		22.01	
Rcf	5.04		5.58		4.77		4.12		2.95		1.85		2.02		1.40	
Fncf (ksi)	-37.50		37.50		-37.50		37.50		-37.50		37.50		-37.50		37.50	
Fncf (kip)	-2700.00		2170.66		-2700.00		2170.66		-2700.00		2170.66		-2700.00		2170.66	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.86	5.16	-3.02	-3.34	-4.45	5.76	-1.14	-5.24	-6.07	8.54	11.06	-12.96	-7.34	13.64	15.73	-19.09
Fs (ksi)	-2.86	5.16	-3.02	-3.34	-4.45	5.76	-1.14	-5.24	-6.07	8.54	11.06	-12.96	-7.34	13.64	15.73	-19.09
Fs (kip)	-205.85	412.42	-217.59	-266.83	-320.61	460.97	-81.95	-418.87	-437.17	683.16	796.46	-1036.98	-528.13	1091.48	1132.23	-1527.44

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2170.66	2411.84	1132.23	1091.48
Comp	2700.00	2940.33	528.13	1527.44

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	352.46	555.92	150.41	717.01	460.11	426.49	442.42	485.15	254.96	406.26	112.21	520.07	338.57	307.27	318.52	356.26
Vuw (kip)	528.69	833.88	225.62	1046.20	690.17	639.74	663.62	727.73	---	---	---	---	---	---	---	---
Mv (k*ft)	231.30	364.82	98.71	457.71	301.95	279.89	290.34	318.38	111.55	177.74	49.09	227.53	148.12	134.43	139.35	155.86
Huw (kip)	1074.53	-1495.08	184.69	-564.98	621.90	-284.14	825.20	-280.02	110.22	-305.16	62.85	-305.96	118.45	-91.22	302.80	-161.64
Muw (k*ft)	3367.29	2232.91	4553.75	3784.09	3970.80	4165.76	3699.73	4331.17	512.92	20.05	653.77	262.25	935.13	1537.55	1342.64	2228.38
Mu (k*ft)	3598.59	2597.73	4652.46	4241.81	4272.75	4445.65	3990.06	4649.55	624.46	197.79	702.86	489.78	1083.25	1671.98	1481.99	2384.25

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	12.35	17.18	2.12	6.49	7.15	3.27	9.49	3.22	1.27	3.51	0.72	3.52	1.36	1.05	3.48	1.86
PY1 (Vuw)	6.08	9.58	2.59	12.03	7.93	7.35	7.63	8.36	2.93	4.67	1.29	5.98	3.89	3.53	3.66	4.09
PX2 (Mu)	32.78	23.66	42.38	38.64	38.92	40.49	36.34	42.35	5.69	1.80	6.40	4.46	9.87	15.23	13.50	21.72
PY2 (Mu)	2.34	1.69	3.03	2.76	2.78	2.89	2.60	3.03	0.41	0.13	0.46	0.32	0.70	1.09	0.96	1.55
Pu (kip)	45.91	42.37	44.85	47.49	47.30	44.94	46.96	46.97	7.71	7.16	7.34	10.16	12.13	16.92	17.60	24.24

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK
TF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Inside	1210.09	1721.88	1332.50	115.00	75.16	18.28	3217.34	1332.50	OK
BF Outside	1201.75	1710.00	1374.75	51.75	33.82	23.13	2222.93	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1352.11	1800.00	OK
TF Inside	1347.89	1794.38	OK
BF Inside	1475.25	1631.25	OK
BF Outside	1465.08	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.83	32.33	35.49	35.92	36.66	34.88	36.43	36.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1046.20
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.85	1.0	30.62
Web	0.00	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.91

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1352.11	21.13	OK	567.00	8.86	OK
BF	1475.25	23.05	OK	766.36	11.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1352.11	21.13	1.47	114.56	OK
TF	2700.00	42.19	1.47	206.21	OK
TF Inside	1347.89	21.06	1.47	126.02	OK
BF Inside	1475.25	23.05	1.47	114.56	OK
BF	2940.33	45.94	1.47	229.13	OK
BF Outside	1465.08	22.89	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.49	23.75	OK	24.24	12.12	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.49	1.47	91.65	OK
Web SPL	23.75	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.41	1.33
TF Inside	1.35	1.33
BF Inside	1.10	1.11
BF Outside	1.14	1.11

Bolt	Shear	Slip	Bearing
TF	1.45	1.90	4.89
Web	1.52	1.39	1.93
BF	1.43	1.41	4.50

Plate	Shear	Flexure
Web	2.10	1.36

Field Splice

Type F

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 1057

Node 1057

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1057 L	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00
1057 R	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 1057 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.68	3.96	27.32	1.32	28.54	-4.50	17.21	10.99	24.05	4.62	25.41	2.70	32.53	-7.64	14.89	12.11
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.91	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.82	50.00	50.00
f / ϕf Fnc	0.33	0.08	0.55	0.03	0.57	0.09	0.34	0.22	0.48	0.09	0.51	0.05	0.65	0.16	0.30	0.24
α	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	16.68		27.32		28.54		17.21		24.05		25.41		32.53		14.89	
Fcf (ksi)	37.50		38.66		39.27		37.50		37.50		37.71		41.27		37.50	
Fcf (kip)	2653.03		2734.98		2778.08		2653.03		2653.03		2667.54		2919.48		2653.03	
fncf (ksi)		3.96		1.32		-4.50		10.99		4.62		2.70		-7.64		12.11
Rcf		2.25		1.42		1.38		2.18		1.56		1.48		1.27		2.52
Fncf (ksi)		37.50		37.50		-35.93		37.50		37.50		37.50		-35.87		37.50
Fncf (kip)		2653.03		2653.03		-3162.21		2653.03		2653.03		2653.03		-3156.13		2653.03

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	12.58	2.73	17.43	0.62	17.52	-3.21	12.94	7.92	16.73	2.89	16.90	1.69	18.91	-5.24	11.30	8.71
Fs (ksi)	12.58	2.73	17.43	0.62	17.52	-3.21	12.94	7.92	16.73	2.89	16.90	1.69	18.91	-5.24	11.30	8.71
Fs (kip)	1106.80	239.97	1533.84	54.93	1541.84	-282.83	1138.81	696.61	1472.21	254.12	1487.39	149.12	1664.15	-460.97	994.35	766.15

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2919.48	2653.03	1664.15	766.15
Comp	0.00	3162.21	0.00	460.97

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	338.20	381.75	626.01	188.76	358.05	366.80	515.20	236.49	251.04	280.50	454.39	144.15	265.07	269.93	376.10	177.87
Vuw (kip)	507.30	572.62	939.02	283.14	537.08	550.20	772.80	354.74	---	---	---	---	---	---	---	---
Mv (k*ft)	348.77	393.68	645.57	194.66	369.24	378.26	531.30	243.88	172.59	192.84	312.39	99.10	182.23	185.58	258.57	122.29
Huw (kip)	2784.52	2431.55	1984.15	3686.69	2682.46	2502.26	1894.49	4079.91	918.25	1083.25	858.42	1251.42	1177.05	1115.80	820.35	1200.34
Muw (k*ft)	2287.30	2943.29	3637.28	1084.41	2423.39	2696.49	4076.62	560.13	788.03	1344.46	1658.79	402.00	1107.36	1216.61	1931.93	207.45
Mu (k*ft)	2636.07	3336.96	4282.86	1279.07	2792.63	3074.75	4607.92	804.01	960.62	1537.30	1971.18	501.10	1289.59	1402.19	2190.50	329.74

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.20	16.77	13.68	25.43	18.50	17.26	13.07	28.14	6.33	7.47	5.92	8.63	8.12	7.70	5.66	8.28
PY1 (Vuw)	3.50	3.95	6.48	1.95	3.70	3.79	5.33	2.45	1.73	1.93	3.13	0.99	1.83	1.86	2.59	1.23
PX2 (Mu)	14.14	17.90	22.97	6.86	14.98	16.49	24.72	4.31	5.15	8.25	10.57	2.69	6.92	7.52	11.75	1.77
PY2 (Mu)	2.02	2.56	3.28	0.98	2.14	2.36	3.53	0.62	0.74	1.18	1.51	0.38	0.99	1.07	1.68	0.25
Pu (kip)	33.80	35.27	37.93	32.42	33.99	34.31	38.81	32.59	11.75	16.02	17.13	11.40	15.30	15.50	17.92	10.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1419.09	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1500.39	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1578.63	1794.38	OK
BF Outside	1583.58	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.57	32.94	34.99	30.31	31.73	32.04	36.10	30.37
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	939.02
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1500.39	17.05	OK	855.25	9.72	OK
BF	1583.58	24.74	OK	383.67	5.99	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1419.09	16.13	1.47	137.48	OK
TF	2919.48	33.18	1.47	252.04	OK
TF Inside	1500.39	17.05	1.47	160.39	OK
BF Inside	1578.63	24.67	1.47	126.02	OK
BF	3162.21	49.41	1.47	252.04	OK
BF Outside	1583.58	24.74	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.81	19.40	OK	17.92	8.96	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.81	1.47	114.56	OK
Web SPL	19.40	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.24	NA
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	2.12	1.73	7.60
Web	1.87	1.88	2.95
BF	1.34	2.81	4.63

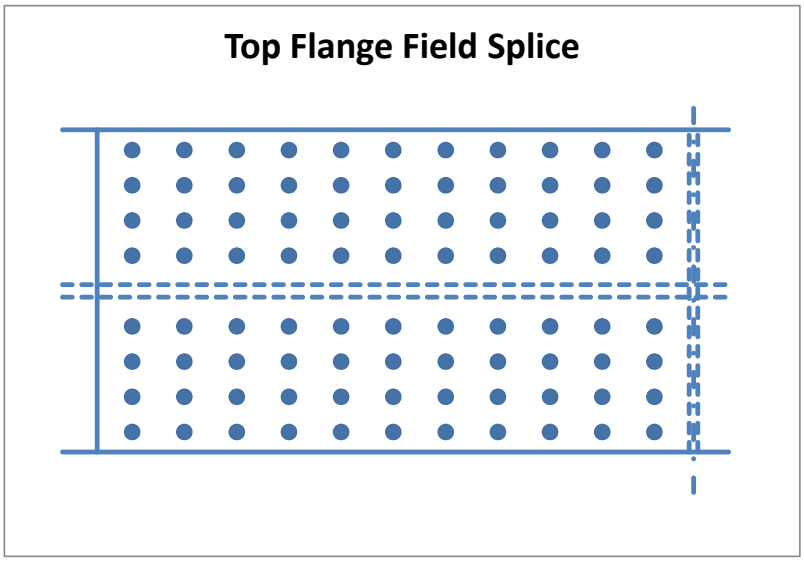
Plate	Shear	Flexure
Web	3.27	1.39

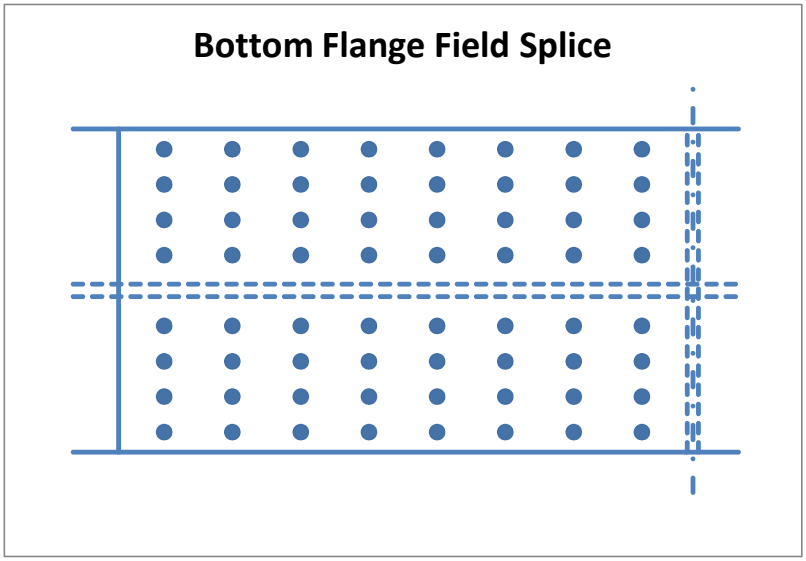
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1057	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1057

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0	21	0
21	3.5	21	3.5
21	7	21	7

	Top Flange		Bottom Flange	
No. Bolts =	88.0		64.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	10.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5	21	10.5
21	17.5	21	17.5
21	21	21	21
21	24.5	21	24.5
21	28	21	28
24	0		
24	3.5		
24	7		
24	10.5		
24	17.5		
24	21		
24	24.5		
24	28		
27	0		
27	3.5		
27	7		
27	10.5		
27	17.5		
27	21		
27	24.5		
27	28		
30	0		
30	3.5		
30	7		
30	10.5		
30	17.5		
30	21		
30	24.5		
30	28		

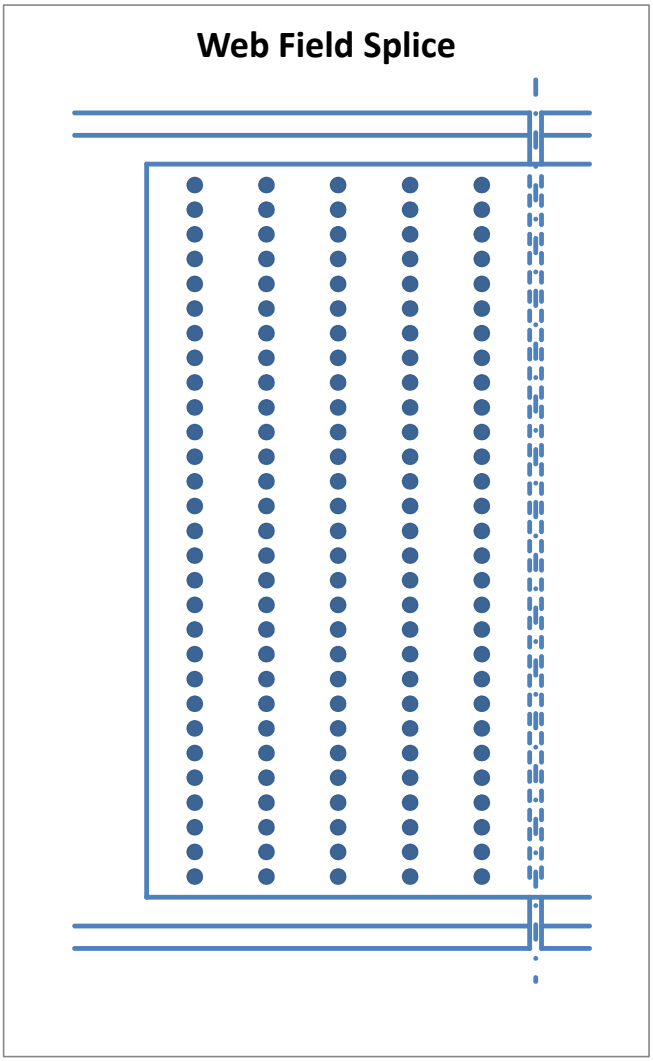
Flange Bolt Pattern Cont. - Node 1057

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1057	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1057

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	1764
0	3	36	1521
0	6	36	1296
0	9	36	1089
0	12	36	900
0	15	36	729
0	18	36	576
0	21	36	441
0	24	36	324
0	27	36	225
0	30	36	144
0	33	36	81
0	36	36	36
0	39	36	9
0	42	36	0
0	45	36	9
0	48	36	36
0	51	36	81
0	54	36	144
0	57	36	225
0	60	36	324
0	63	36	441
0	66	36	576
0	69	36	729
0	72	36	900
0	75	36	1089
0	78	36	1296
0	81	36	1521
0	84	36	1764
3	0	9	1764
3	3	9	1521
3	6	9	1296
3	9	9	1089
3	12	9	900
3	15	9	729
3	18	9	576
3	21	9	441
3	24	9	324
3	27	9	225
3	30	9	144
3	33	9	81
3	36	9	36
3	39	9	9
3	42	9	0
3	45	9	9
3	48	9	36
3	51	9	81
3	54	9	144
3	57	9	225
3	60	9	324
3	63	9	441
3	66	9	576
3	69	9	729
3	72	9	900
3	75	9	1089
3	78	9	1296
3	81	9	1521
3	84	9	1764
6	0	0	1764

No. Bolts =	145.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2610	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	91350	
Σd^2 (in^2) =	93960	



Web Bolt Pattern Cont. - Node 1057

6	3	0	1521
6	6	0	1296
6	9	0	1089
6	12	0	900
6	15	0	729
6	18	0	576
6	21	0	441
6	24	0	324
6	27	0	225
6	30	0	144
6	33	0	81
6	36	0	36
6	39	0	9
6	42	0	0
6	45	0	9
6	48	0	36
6	51	0	81
6	54	0	144
6	57	0	225
6	60	0	324
6	63	0	441
6	66	0	576
6	69	0	729
6	72	0	900
6	75	0	1089
6	78	0	1296
6	81	0	1521
6	84	0	1764
9	0	9	1764
9	3	9	1521
9	6	9	1296
9	9	9	1089
9	12	9	900
9	15	9	729
9	18	9	576
9	21	9	441
9	24	9	324
9	27	9	225
9	30	9	144
9	33	9	81
9	36	9	36
9	39	9	9
9	42	9	0
9	45	9	9
9	48	9	36
9	51	9	81
9	54	9	144
9	57	9	225
9	60	9	324
9	63	9	441
9	66	9	576
9	69	9	729
9	72	9	900
9	75	9	1089
9	78	9	1296
9	81	9	1521
9	84	9	1764
12	0	36	1764
12	3	36	1521
12	6	36	1296
12	9	36	1089
12	12	36	900
12	15	36	729
12	18	36	576
12	21	36	441
12	24	36	324

12	27	36	225
12	30	36	144
12	33	36	81
12	36	36	36
12	39	36	9
12	42	36	0
12	45	36	9
12	48	36	36
12	51	36	81
12	54	36	144
12	57	36	225
12	60	36	324
12	63	36	441
12	66	36	576
12	69	36	729
12	72	36	900
12	75	36	1089
12	78	36	1296
12	81	36	1521
12	84	36	1764
870	6090	2610	91350

Web Bolt Pattern Cont. - Node 1057

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3057	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3057

Node 3057

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3057 L	88.00	50.00	4400.00	90.00	48.87	4397.99	132.00	50.00	6600.00
3057 R	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 3057 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	30.72	-1.81	19.88	3.75	20.42	8.01	29.83	-4.34	26.93	1.60	27.57	4.02	18.42	9.75	34.44	-7.97
ϕf Fnc (ksi)	50.00	48.87	50.00	50.00	50.00	50.00	50.00	48.75	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.65
f / ϕf Fnc	0.61	0.04	0.40	0.08	0.41	0.16	0.60	0.09	0.54	0.03	0.55	0.08	0.37	0.20	0.69	0.16
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	30.72		19.88		20.42		29.83		26.93		27.57		18.42		34.44	
Fcf (ksi)	40.36		37.50		37.50		39.92		38.46		38.78		37.50		42.22	
Fcf (kip)	2855.29		2653.03		2653.03		2824.02		2721.21		2743.89		2653.03		2986.87	
fncf (ksi)		-1.81		3.75		8.01		-4.34		1.60		4.02		9.75		-7.97
Rcf		1.31		1.89		1.84		1.34		1.43		1.41		2.04		1.23
Fncf (ksi)		-36.65		37.50		37.50		-36.56		37.50		37.50		37.50		-36.49
Fncf (kip)		-3298.49		2822.37		2822.37		-3290.53		2822.37		2822.37		2822.37		-3283.83

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.50	-1.62	14.88	2.66	15.20	5.81	18.94	-3.18	17.99	0.87	18.95	2.56	13.79	7.04	20.57	-5.52
Fs (ksi)	19.50	-1.62	14.88	2.66	15.20	5.81	18.94	-3.18	17.99	0.87	18.95	2.56	13.79	7.04	20.57	-5.52
Fs (kip)	1715.59	-146.13	1309.18	239.70	1337.97	522.75	1666.31	-286.22	1583.09	78.23	1667.37	230.57	1213.40	633.30	1809.93	-496.45

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2986.87	2822.37	1809.93	633.30
Comp	0.00	3298.49	0.00	496.45

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	495.72	415.42	296.71	765.75	471.62	454.28	441.38	594.32	360.28	304.19	219.67	551.70	343.25	331.64	321.88	430.58
Vuw (kip)	743.58	623.13	445.06	1148.63	707.43	681.42	662.07	891.48	---	---	---	---	---	---	---	---
Mv (k*ft)	511.21	428.40	305.98	789.68	486.36	468.48	455.17	612.89	247.69	209.13	151.02	379.30	235.98	228.00	221.29	296.03
Huw (kip)	2506.83	2941.91	3446.37	2251.64	2689.36	2933.41	3785.71	2141.77	1179.53	1157.66	1386.83	1039.83	1244.69	1419.61	1374.46	993.38
Muw (k*ft)	3760.74	2677.45	2004.84	4023.20	3183.80	2914.82	1552.38	4574.81	1858.47	1074.80	826.84	1946.17	1506.60	1441.93	594.17	2295.34
Mu (k*ft)	4271.95	3105.86	2310.82	4812.88	3670.16	3383.30	2007.56	5187.71	2106.16	1283.93	977.86	2325.47	1742.58	1669.93	815.47	2591.37

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.29	20.29	23.77	15.53	18.55	20.23	26.11	14.77	8.13	7.98	9.56	7.17	8.58	9.79	9.48	6.85
PY1 (Vuw)	5.13	4.30	3.07	7.92	4.88	4.70	4.57	6.15	2.48	2.10	1.51	3.80	2.37	2.29	2.22	2.97
PX2 (Mu)	22.91	16.66	12.40	25.82	19.69	18.15	10.77	27.83	11.30	6.89	5.25	12.47	9.35	8.96	4.37	13.90
PY2 (Mu)	3.27	2.38	1.77	3.69	2.81	2.59	1.54	3.98	1.61	0.98	0.75	1.78	1.34	1.28	0.62	1.99
Pu (kip)	41.07	37.55	36.49	42.94	39.00	39.07	37.38	43.78	19.86	15.19	14.98	20.42	18.31	19.08	14.14	21.33

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1451.85	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1535.02	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1408.98	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1413.39	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1646.66	1794.38	OK
BF Outside	1651.83	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.28	35.02	34.13	39.46	36.33	36.41	34.73	40.70
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1148.63
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1535.02	17.44	OK	930.16	10.57	OK
BF	1651.83	25.81	OK	317.14	4.96	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1451.85	16.50	1.47	137.48	OK
TF	2986.87	33.94	1.47	252.04	OK
TF Inside	1535.02	17.44	1.47	160.39	OK
BF Inside	1646.66	25.73	1.47	126.02	OK
BF	3298.49	51.54	1.47	229.13	OK
BF Outside	1651.83	25.81	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.78	21.89	OK	21.33	10.67	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.78	1.47	126.02	OK
Web SPL	21.89	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.26	NA
TF Inside	1.22	NA
BF Inside	1.04	1.09
BF Outside	1.08	1.09

Bolt	Shear	Slip	Bearing
TF	2.07	1.59	7.43
Web	1.65	1.58	2.88
BF	1.29	3.40	4.44

Plate	Shear	Flexure
Web	2.67	1.23

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5057	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5057

Node 5057

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5057 L	88.00	50.00	4400.00	90.00	48.83	4394.48	132.00	50.00	6600.00
5057 R	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 5057 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	31.95	-2.74	20.13	4.82	19.38	9.49	31.29	-5.22	25.36	1.19	29.64	4.59	19.53	9.90	35.59	-8.73
ϕf Fnc (ksi)	50.00	48.83	50.00	50.00	50.00	50.00	50.00	48.72	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.63
f / ϕf Fnc	0.64	0.06	0.40	0.10	0.39	0.19	0.63	0.11	0.51	0.02	0.59	0.09	0.39	0.20	0.71	0.18
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	31.95		20.13		19.38		31.29		25.36		29.64		19.53		35.59	
Fcf (ksi)	40.98		37.50		37.50		40.65		37.68		39.82		37.50		42.79	
Fcf (kip)	2898.92		2653.03		2653.03		2875.62		2665.64		2817.16		2653.03		3027.46	
fncf (ksi)		-2.74		4.82		9.49		-5.22		1.19		4.59		9.90		-8.73
Rcf		1.28		1.86		1.94		1.30		1.49		1.34		1.92		1.20
Fncf (ksi)		-36.62		37.50		37.50		-36.54		37.50		37.50		37.50		-36.48
Fncf (kip)		-3295.86		2822.37		2822.37		-3288.76		2822.37		2822.37		2822.37		-3282.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.52	-2.43	15.72	3.44	15.73	6.05	20.15	-3.82	17.21	0.62	20.16	3.08	14.57	7.14	21.65	-6.06
Fs (ksi)	20.52	-2.43	15.72	3.44	15.73	6.05	20.15	-3.82	17.21	0.62	20.16	3.08	14.57	7.14	21.65	-6.06
Fs (kip)	1805.67	-218.66	1383.03	309.74	1384.38	544.88	1773.23	-343.81	1514.18	55.41	1773.72	277.60	1281.92	642.64	1905.40	-545.85

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3027.46	2822.37	1905.40	642.64
Comp	0.00	3295.86	0.00	545.85

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	487.06	408.03	301.60	748.71	420.11	474.25	443.24	570.16	354.47	298.19	223.00	539.33	306.72	345.42	323.06	413.18
Vuw (kip)	730.59	612.04	452.41	1123.07	630.17	711.38	664.86	855.24	---	---	---	---	---	---	---	---
Mv (k*ft)	502.28	420.78	311.03	772.11	433.24	489.07	457.09	587.98	243.70	205.00	153.31	370.79	210.87	237.48	222.11	284.06
Huw (kip)	2472.26	3067.65	3686.46	2235.41	2603.78	3034.77	3729.80	2131.77	1193.90	1264.41	1437.86	1077.79	1176.27	1533.86	1432.71	1028.76
Muw (k*ft)	3915.37	2509.80	1684.72	4173.20	3159.67	2961.95	1626.93	4689.12	2019.46	1080.17	851.61	2109.40	1460.00	1502.29	653.56	2439.12
Mu (k*ft)	4417.65	2930.58	1995.75	4945.31	3592.91	3451.02	2084.02	5277.10	2263.16	1285.18	1004.92	2480.19	1670.87	1739.77	875.67	2723.18

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.05	21.16	25.42	15.42	17.96	20.93	25.72	14.70	8.23	8.72	9.92	7.43	8.11	10.58	9.88	7.09
PY1 (Vuw)	5.04	4.22	3.12	7.75	4.35	4.91	4.59	5.90	2.44	2.06	1.54	3.72	2.12	2.38	2.23	2.85
PX2 (Mu)	23.70	15.72	10.71	26.53	19.27	18.51	11.18	28.31	12.14	6.89	5.39	13.30	8.96	9.33	4.70	14.61
PY2 (Mu)	3.39	2.25	1.53	3.79	2.75	2.64	1.60	4.04	1.73	0.98	0.77	1.90	1.28	1.33	0.67	2.09
Pu (kip)	41.61	37.44	36.43	43.50	37.90	40.16	37.42	44.14	20.80	15.91	15.48	21.48	17.41	20.25	14.86	22.26

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1471.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1555.88	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1408.98	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1413.39	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1645.35	1794.38	OK
BF Outside	1650.51	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.82	34.92	34.04	40.04	35.38	37.41	34.77	41.10
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1123.07
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1555.88	17.68	OK	979.23	11.13	OK
BF	1650.51	25.79	OK	321.82	5.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1471.57	16.72	1.47	137.48	OK
TF	3027.46	34.40	1.47	252.04	OK
TF Inside	1555.88	17.68	1.47	160.39	OK
BF Inside	1645.35	25.71	1.47	126.02	OK
BF	3295.86	51.50	1.47	229.13	OK
BF Outside	1650.51	25.79	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.14	22.07	OK	22.26	11.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.14	1.47	126.02	OK
Web SPL	22.07	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.25	NA
TF Inside	1.20	NA
BF Inside	1.04	1.09
BF Outside	1.08	1.09

Bolt	Shear	Slip	Bearing
TF	2.05	1.51	7.33
Web	1.64	1.51	2.85
BF	1.29	3.35	4.44

Plate	Shear	Flexure
Web	2.73	1.22

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7057	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7057

Node 7057

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7057 L	88.00	50.00	4400.00	90.00	48.81	4392.50	132.00	50.00	6600.00
7057 R	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 7057 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7057**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.21	-3.28	20.70	4.97	19.62	10.47	31.24	-5.59	25.45	1.43	29.48	5.63	19.75	11.31	35.73	-9.14
ϕf Fnc (ksi)	50.00	48.81	50.00	50.00	50.00	50.00	50.00	48.71	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.62
f / ϕf Fnc	0.64	0.07	0.41	0.10	0.39	0.21	0.62	0.11	0.51	0.03	0.59	0.11	0.40	0.23	0.71	0.19
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	32.21		20.70		19.62		31.24		25.45		29.48		19.75		35.73	
Fcf (ksi)	41.10		37.50		37.50		40.62		37.73		39.74		37.50		42.86	
Fcf (kip)	2908.03		2653.03		2653.03		2873.88		2668.95		2811.67		2653.03		3032.54	
fncf (ksi)		-3.28		4.97		10.47		-5.59		1.43		5.63		11.31		-9.14
Rcf		1.28		1.81		1.91		1.30		1.48		1.35		1.90		1.20
Fncf (ksi)		-36.60		37.50		37.50		-36.53		37.50		37.50		37.50		-36.47
Fncf (kip)		-3294.38		2822.37		2822.37		-3287.78		2822.37		2822.37		2822.37		-3282.10

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.65	-2.78	15.37	3.63	15.89	6.69	20.03	-4.03	17.24	0.83	20.18	3.83	14.70	8.10	21.63	-6.31
Fs (ksi)	20.65	-2.78	15.37	3.63	15.89	6.69	20.03	-4.03	17.24	0.83	20.18	3.83	14.70	8.10	21.63	-6.31
Fs (kip)	1817.27	-250.01	1352.26	326.34	1398.50	602.28	1762.98	-362.38	1516.70	74.80	1776.17	344.44	1293.62	729.36	1903.03	-567.92

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3032.54	2822.37	1903.03	729.36
Comp	0.00	3294.38	0.00	567.92

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	497.37	416.80	302.40	762.95	458.53	465.95	445.80	591.47	361.82	304.68	223.85	549.46	334.16	339.62	325.17	428.30
Vuw (kip)	746.06	625.20	453.60	1144.43	687.79	698.92	668.70	887.20	---	---	---	---	---	---	---	---
Mv (k*ft)	512.92	429.83	311.85	786.80	472.86	480.51	459.73	609.95	248.75	209.47	153.90	377.75	229.74	233.49	223.55	294.46
Huw (kip)	2437.02	3069.01	3795.07	2201.21	2629.35	3123.56	3891.50	2105.11	1179.61	1253.51	1490.55	1056.49	1192.38	1584.71	1505.08	1010.80
Muw (k*ft)	3985.02	2507.99	1539.90	4214.47	3133.83	2829.92	1411.33	4737.30	2061.72	1033.17	809.60	2117.31	1443.56	1439.38	580.46	2458.33
Mu (k*ft)	4497.94	2937.81	1851.75	5001.26	3606.69	3310.43	1871.06	5347.25	2310.47	1242.64	963.50	2495.06	1673.29	1672.87	804.02	2752.79

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.81	21.17	26.17	15.18	18.13	21.54	26.84	14.52	8.14	8.64	10.28	7.29	8.22	10.93	10.38	6.97
PY1 (Vuw)	5.15	4.31	3.13	7.89	4.74	4.82	4.61	6.12	2.50	2.10	1.54	3.79	2.30	2.34	2.24	2.95
PX2 (Mu)	24.13	15.76	9.93	26.83	19.35	17.76	10.04	28.68	12.39	6.67	5.17	13.38	8.98	8.97	4.31	14.77
PY2 (Mu)	3.45	2.25	1.42	3.83	2.76	2.54	1.43	4.10	1.77	0.95	0.74	1.91	1.28	1.28	0.62	2.11
Pu (kip)	41.83	37.50	36.39	43.61	38.22	39.98	37.37	44.39	20.97	15.61	15.62	21.44	17.57	20.23	14.97	22.32

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1474.04	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1558.49	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1408.98	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1413.39	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1644.61	1794.38	OK
BF Outside	1649.77	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.01	34.96	33.98	40.11	35.62	37.25	34.70	41.29
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1144.43
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1558.49	17.71	OK	978.02	11.11	OK
BF	1649.77	25.78	OK	365.25	5.71	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1474.04	16.75	1.47	137.48	OK
TF	3032.54	34.46	1.47	252.04	OK
TF Inside	1558.49	17.71	1.47	160.39	OK
BF Inside	1644.61	25.70	1.47	126.02	OK
BF	3294.38	51.47	1.47	229.13	OK
BF Outside	1649.77	25.78	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.39	22.20	OK	22.32	11.16	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.39	1.47	126.02	OK
Web SPL	22.20	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.24	NA
TF Inside	1.20	NA
BF Inside	1.04	1.09
BF Outside	1.08	1.09

Bolt	Shear	Slip	Bearing
TF	2.04	1.51	7.31
Web	1.63	1.51	2.84
BF	1.29	2.95	4.44

Plate	Shear	Flexure
Web	2.68	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 9057

Node 9057

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9057 L	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00
9057 R	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 9057 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.59	6.44	29.85	4.92	27.88	4.17	18.63	13.05	27.93	6.79	22.91	3.82	35.04	-9.41	17.37	14.96
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.78	50.00	50.00
f / ϕf Fnc	0.37	0.13	0.60	0.10	0.56	0.08	0.37	0.26	0.56	0.14	0.46	0.08	0.70	0.20	0.35	0.30
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00
fcf (ksi)	18.59		29.85		27.88		18.63		27.93		22.91		35.04		17.37	
Fcf (ksi)	37.50		39.93		38.94		37.50		38.96		37.50		42.52		37.50	
Fcf (kip)	2653.03		2824.62		2755.00		2653.03		2756.60		2653.03		3008.33		2653.03	
fncf (ksi)		6.44		4.92		4.17		13.05		6.79		3.82		-9.41		14.96
Rcf		2.02		1.34		1.40		2.01		1.40		1.64		1.21		2.16
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-35.84		37.50
Fncf (kip)		2653.03		2653.03		2653.03		2653.03		2653.03		2653.03		-3153.73		2653.03

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	13.87	4.64	19.38	3.16	18.54	2.92	13.90	9.31	19.07	4.70	15.74	2.48	20.89	-6.38	13.01	10.66
Fs (ksi)	13.87	4.64	19.38	3.16	18.54	2.92	13.90	9.31	19.07	4.70	15.74	2.48	20.89	-6.38	13.01	10.66
Fs (kip)	1220.46	408.61	1705.21	278.09	1631.92	257.26	1222.82	819.25	1678.32	413.67	1385.14	218.07	1838.03	-561.84	1144.46	938.44

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3008.33	2653.03	1838.03	938.44
Comp	0.00	3153.73	0.00	561.84

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	334.35	381.07	620.84	188.09	361.59	358.79	512.51	234.11	247.44	280.53	449.93	144.10	266.76	264.71	373.39	176.62
Vuw (kip)	501.53	571.61	931.26	282.13	542.38	538.18	768.76	351.17	---	---	---	---	---	---	---	---
Mv (k*ft)	344.80	392.98	640.24	193.97	372.89	370.00	528.52	241.43	170.12	192.86	309.33	99.07	183.40	181.98	256.71	121.43
Huw (kip)	3029.54	2790.23	2686.32	3825.67	2905.97	2625.31	1866.24	4188.33	1110.73	1352.25	1288.07	1392.32	1426.36	1093.09	870.13	1420.16
Muw (k*ft)	1960.62	2667.77	2648.85	899.11	2359.61	2499.59	4315.22	415.56	738.04	1297.38	1249.69	366.88	1149.68	1060.97	2181.70	187.29
Mu (k*ft)	2305.42	3060.75	3289.10	1093.07	2732.50	2869.59	4843.74	656.99	908.16	1490.24	1559.02	465.95	1333.08	1242.96	2438.40	308.72

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.89	19.24	18.53	26.38	20.04	18.11	12.87	28.89	7.66	9.33	8.88	9.60	9.84	7.54	6.00	9.79
PY1 (Vuw)	3.46	3.94	6.42	1.95	3.74	3.71	5.30	2.42	1.71	1.93	3.10	0.99	1.84	1.83	2.58	1.22
PX2 (Mu)	12.37	16.42	17.64	5.86	14.66	15.39	25.98	3.52	4.87	7.99	8.36	2.50	7.15	6.67	13.08	1.66
PY2 (Mu)	1.77	2.35	2.52	0.84	2.09	2.20	3.71	0.50	0.70	1.14	1.19	0.36	1.02	0.95	1.87	0.24
Pu (kip)	33.67	36.21	37.26	32.37	35.19	34.02	39.88	32.54	12.76	17.59	17.77	12.18	17.23	14.47	19.59	11.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1462.28	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1546.05	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1574.40	1794.38	OK
BF Outside	1579.33	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.43	33.81	34.33	30.24	32.85	31.76	37.14	30.30
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	931.26
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1546.05	17.57	OK	944.61	10.73	OK
BF	1579.33	24.68	OK	469.95	7.34	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1462.28	16.62	1.47	137.48	OK
TF	3008.33	34.19	1.47	252.04	OK
TF Inside	1546.05	17.57	1.47	160.39	OK
BF Inside	1574.40	24.60	1.47	126.02	OK
BF	3153.73	49.28	1.47	252.04	OK
BF Outside	1579.33	24.68	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.88	19.94	OK	19.59	9.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.88	1.47	114.56	OK
Web SPL	19.94	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.25	NA
TF Inside	1.21	NA
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	2.06	1.57	7.37
Web	1.81	1.72	2.87
BF	1.34	2.29	4.64

Plate	Shear	Flexure
Web	3.30	1.35

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1071	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1071

Node 1071

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1071 L	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00
1071 R	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 1071 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.90	5.38	16.22	6.99	22.51	3.66	16.92	14.76	21.57	4.43	22.41	8.84	14.54	15.76	30.53	-5.34
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.89
f / ϕf Fnc	0.52	0.11	0.32	0.14	0.45	0.07	0.34	0.30	0.43	0.09	0.45	0.18	0.29	0.32	0.61	0.11
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	25.90		16.22		22.51		16.92		21.57		22.41			15.76	30.53	
Fcf (ksi)	37.95		37.50		37.50		37.50		37.50		37.50			37.50	40.27	
Fcf (kip)	2684.95		2653.03		2653.03		2653.03		2653.03		2653.03			2653.03	2848.67	
fncf (ksi)		5.38		6.99		3.66		14.76		4.43		8.84	14.54			-5.34
Rcf		1.47		2.31		1.67		2.22		1.74		1.67	2.38			1.32
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50	37.50			-35.92
Fncf (kip)		2653.03		2653.03		2653.03		2653.03		2653.03		2653.03	2653.03			-3160.80

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.01	3.44	12.16	5.06	15.36	2.60	12.65	10.55	14.64	2.70	16.19	6.00	11.07	11.37	18.13	-3.60
Fs (ksi)	17.01	3.44	12.16	5.06	15.36	2.60	12.65	10.55	14.64	2.70	16.19	6.00	11.07	11.37	18.13	-3.60
Fs (kip)	1496.96	302.99	1070.19	445.31	1351.45	228.95	1113.49	928.74	1288.10	237.95	1424.59	528.05	974.50	1000.59	1595.62	-316.78

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2848.67	2653.03	1595.62	1000.59
Comp	0.00	3160.80	0.00	316.78

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	328.59	299.24	575.43	133.93	309.40	305.71	190.84	454.13	242.19	219.82	416.59	103.03	227.00	226.02	144.87	329.26
Vuw (kip)	492.89	448.85	863.15	200.89	464.10	458.56	286.26	681.20	---	---	---	---	---	---	---	---
Mv (k*ft)	338.86	308.59	593.42	138.11	319.07	315.26	196.80	468.32	166.51	151.13	286.41	70.83	156.06	155.39	99.60	226.36
Huw (kip)	2750.37	3219.00	2615.51	4213.10	2712.11	3136.95	4326.20	1993.54	1227.24	1033.29	1077.54	1392.43	1040.48	1331.34	1346.65	871.93
Muw (k*ft)	2405.03	1708.00	2512.65	382.54	2383.85	1817.40	231.73	3784.41	1085.43	568.08	1020.46	167.95	954.68	815.04	23.71	1738.54
Mu (k*ft)	2743.90	2016.59	3106.07	520.65	2702.92	2132.66	428.54	4252.73	1251.93	719.20	1306.87	238.78	1110.74	970.43	123.31	1964.91

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.97	22.20	18.04	29.06	18.70	21.63	29.84	13.75	8.46	7.13	7.43	9.60	7.18	9.18	9.29	6.01
PY1 (Vuw)	3.40	3.10	5.95	1.39	3.20	3.16	1.97	4.70	1.67	1.52	2.87	0.71	1.57	1.56	1.00	2.27
PX2 (Mu)	14.72	10.82	16.66	2.79	14.50	11.44	2.30	22.81	6.72	3.86	7.01	1.28	5.96	5.21	0.66	10.54
PY2 (Mu)	2.10	1.55	2.38	0.40	2.07	1.63	0.33	3.26	0.96	0.55	1.00	0.18	0.85	0.74	0.09	1.51
Pu (kip)	34.13	33.34	35.69	31.90	33.62	33.42	32.22	37.42	15.41	11.18	14.95	10.92	13.35	14.57	10.01	16.98

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1384.67	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1464.00	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1577.92	1794.38	OK
BF Outside	1582.87	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.91	31.14	32.93	29.75	31.45	31.22	30.00	34.89
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	863.15
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1464.00	16.64	OK	820.03	9.32	OK
BF	1582.87	24.73	OK	501.08	7.83	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1384.67	15.73	1.47	137.48	OK
TF	2848.67	32.37	1.47	252.04	OK
TF Inside	1464.00	16.64	1.47	160.39	OK
BF Inside	1577.92	24.66	1.47	126.02	OK
BF	3160.80	49.39	1.47	252.04	OK
BF Outside	1582.87	24.73	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.42	18.71	OK	16.98	8.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.42	1.47	114.56	OK
Web SPL	18.71	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.32	NA
TF Inside	1.27	NA
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	2.18	1.81	7.79
Web	1.93	1.98	3.06
BF	1.34	2.15	4.63

Plate	Shear	Flexure
Web	3.56	1.43

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 3071

Node 3071

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3071 L	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00
3071 R	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 3071 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	29.45	4.89	19.81	7.04	28.47	-2.54	20.63	13.15	23.58	3.86	26.39	8.67	18.53	14.36	33.09	-5.36
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.01	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.91
f / ϕf Fnc	0.59	0.10	0.40	0.14	0.57	0.05	0.41	0.26	0.47	0.08	0.53	0.17	0.37	0.29	0.66	0.11
α	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	29.45		19.81		28.47		20.63		23.58		26.39		18.53		33.09	
Fcf (ksi)	39.73		37.50		39.23		37.50		37.50		38.19		37.50		41.55	
Fcf (kip)	2810.52		2653.03		2775.68		2653.03		2653.03		2702.09		2653.03		2939.21	
fncf (ksi)		4.89		7.04		-2.54		13.15		3.86		8.67		14.36		-5.36
Rcf		1.35		1.89		1.38		1.82		1.59		1.45		2.02		1.26
Fncf (ksi)		37.50		37.50		-36.00		37.50		37.50		37.50		37.50		-35.93
Fncf (kip)		2653.03		2653.03		-3168.43		2653.03		2653.03		2653.03		2653.03		-3161.87

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.29	3.12	14.77	5.17	18.56	-1.80	15.35	9.48	16.35	2.48	18.74	5.87	13.91	10.41	20.21	-3.73
Fs (ksi)	19.29	3.12	14.77	5.17	18.56	-1.80	15.35	9.48	16.35	2.48	18.74	5.87	13.91	10.41	20.21	-3.73
Fs (kip)	1697.70	274.75	1299.70	454.55	1632.91	-158.10	1350.63	834.23	1438.65	218.25	1649.09	516.47	1224.07	915.71	1778.78	-328.54

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2939.21	2653.03	1778.78	915.71
Comp	0.00	3168.43	0.00	328.54

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	421.40	374.93	682.69	226.25	409.86	387.17	297.66	528.64	306.74	272.36	491.35	167.31	297.04	282.56	219.32	380.95
Vuw (kip)	632.10	562.40	1024.03	339.38	614.80	580.76	446.49	792.96	---	---	---	---	---	---	---	---
Mv (k*ft)	434.57	386.65	704.02	233.32	422.67	399.27	306.96	545.16	210.88	187.25	337.80	115.03	204.21	194.26	150.78	261.91
Huw (kip)	2779.34	3050.05	2144.07	3684.47	2618.29	3044.82	3993.42	2089.06	1344.85	1196.08	1005.55	1489.68	1129.71	1476.52	1458.94	988.80
Muw (k*ft)	2650.40	1933.27	3418.62	1087.38	2508.94	2051.20	675.44	3861.83	1293.59	768.33	1628.19	469.45	1109.45	1029.65	280.32	1915.75
Mu (k*ft)	3084.97	2319.92	4122.65	1320.70	2931.62	2450.47	982.41	4406.98	1504.47	955.57	1965.99	584.48	1313.67	1223.91	431.10	2177.66

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.17	21.03	14.79	25.41	18.06	21.00	27.54	14.41	9.27	8.25	6.93	10.27	7.79	10.18	10.06	6.82
PY1 (Vuw)	4.36	3.88	7.06	2.34	4.24	4.01	3.08	5.47	2.12	1.88	3.39	1.15	2.05	1.95	1.51	2.63
PX2 (Mu)	16.55	12.44	22.11	7.08	15.73	13.14	5.27	23.64	8.07	5.13	10.55	3.14	7.05	6.57	2.31	11.68
PY2 (Mu)	2.36	1.78	3.16	1.01	2.25	1.88	0.75	3.38	1.15	0.73	1.51	0.45	1.01	0.94	0.33	1.67
Pu (kip)	36.34	33.95	38.29	32.67	34.40	34.65	33.03	39.06	17.65	13.63	18.15	13.50	15.15	16.99	12.51	18.99

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1428.68	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1510.53	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1581.74	1794.38	OK
BF Outside	1586.69	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.87	31.63	35.18	30.52	32.04	32.28	30.74	36.30
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1024.03
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1510.53	17.17	OK	914.16	10.39	OK
BF	1586.69	24.79	OK	458.57	7.17	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1428.68	16.24	1.47	137.48	OK
TF	2939.21	33.40	1.47	252.04	OK
TF Inside	1510.53	17.17	1.47	160.39	OK
BF Inside	1581.74	24.71	1.47	126.02	OK
BF	3168.43	49.51	1.47	252.04	OK
BF Outside	1586.69	24.79	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.06	19.53	OK	18.99	9.50	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.06	1.47	114.56	OK
Web SPL	19.53	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.23	NA
BF Inside	1.11	1.13
BF Outside	1.15	1.13

Bolt	Shear	Slip	Bearing
TF	2.11	1.62	7.55
Web	1.85	1.77	2.93
BF	1.34	2.35	4.62

Plate	Shear	Flexure
Web	3.00	1.38

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5071	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5071

Node 5071

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5071 L	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00
5071 R	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 5071 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	30.43	6.28	21.03	7.81	29.83	3.30	21.09	13.21	23.94	5.77	28.44	8.75	19.44	14.27	34.16	-5.58
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.91
f / ϕf Fnc	0.61	0.13	0.42	0.16	0.60	0.07	0.42	0.26	0.48	0.12	0.57	0.17	0.39	0.29	0.68	0.12
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	30.43		21.03		29.83		21.09		23.94		28.44		19.44		34.16	
Fcf (ksi)	40.21		37.50		39.92		37.50		37.50		39.22		37.50		42.08	
Fcf (kip)	2845.06		2653.03		2823.88		2653.03		2653.03		2774.82		2653.03		2977.03	
fncf (ksi)		6.28		7.81		3.30		13.21		5.77		8.75		14.27		-5.58
Rcf		1.32		1.78		1.34		1.78		1.57		1.38		1.93		1.23
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-35.93
Fncf (kip)		2653.03		2653.03		2653.03		2653.03		2653.03		2653.03		2653.03		-3161.75

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.09	4.09	15.67	5.78	19.62	2.51	15.73	9.58	16.97	3.85	19.81	5.99	14.54	10.35	21.22	-3.94
Fs (ksi)	20.09	4.09	15.67	5.78	19.62	2.51	15.73	9.58	16.97	3.85	19.81	5.99	14.54	10.35	21.22	-3.94
Fs (kip)	1768.07	359.72	1378.62	508.66	1726.97	221.01	1384.12	843.16	1493.44	339.03	1742.91	526.78	1279.33	910.60	1867.10	-346.33

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2977.03	2653.03	1867.10	910.60
Comp	0.00	3161.75	0.00	346.33

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	412.06	368.68	667.37	232.99	366.49	402.63	304.44	517.86	298.57	269.21	480.23	172.05	266.37	293.19	223.81	373.32
Vuw (kip)	618.10	553.02	1001.05	349.48	549.73	603.94	456.65	776.79	---	---	---	---	---	---	---	---
Mv (k*ft)	424.94	380.20	688.22	240.27	377.94	415.21	313.95	534.05	205.27	185.08	330.16	118.28	183.13	201.57	153.87	256.66
Huw (kip)	2910.66	3085.03	2659.71	3659.08	2792.81	3076.97	3902.05	2112.30	1450.76	1286.78	1328.17	1518.60	1249.41	1547.52	1493.14	1036.89
Muw (k*ft)	2553.41	1886.63	2840.12	1121.22	2276.26	2172.82	797.27	3916.35	1280.32	790.87	1369.05	491.79	1049.47	1105.57	335.21	2012.21
Mu (k*ft)	2978.35	2266.83	3528.35	1361.49	2654.20	2588.03	1111.22	4450.39	1485.59	975.95	1699.21	610.07	1232.60	1307.13	489.08	2268.87

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.07	21.28	18.34	25.24	19.26	21.22	26.91	14.57	10.01	8.87	9.16	10.47	8.62	10.67	10.30	7.15
PY1 (Vuw)	4.26	3.81	6.90	2.41	3.79	4.17	3.15	5.36	2.06	1.86	3.31	1.19	1.84	2.02	1.54	2.57
PX2 (Mu)	15.98	12.16	18.93	7.30	14.24	13.88	5.96	23.87	7.97	5.23	9.11	3.27	6.61	7.01	2.62	12.17
PY2 (Mu)	2.28	1.74	2.70	1.04	2.03	1.98	0.85	3.41	1.14	0.75	1.30	0.47	0.94	1.00	0.37	1.74
Pu (kip)	36.64	33.89	38.49	32.72	34.00	35.64	33.11	39.43	18.26	14.35	18.85	13.84	15.48	17.94	13.06	19.80

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1447.06	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1529.96	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1578.40	1794.38	OK
BF Outside	1583.35	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.16	31.58	35.40	30.57	31.72	33.20	30.83	36.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1001.05
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1529.96	17.39	OK	959.55	10.90	OK
BF	1583.35	24.74	OK	456.01	7.13	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1447.06	16.44	1.47	137.48	OK
TF	2977.03	33.83	1.47	252.04	OK
TF Inside	1529.96	17.39	1.47	160.39	OK
BF Inside	1578.40	24.66	1.47	126.02	OK
BF	3161.75	49.40	1.47	252.04	OK
BF Outside	1583.35	24.74	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.43	19.71	OK	19.80	9.90	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.43	1.47	114.56	OK
Web SPL	19.71	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.22	NA
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	2.08	1.54	7.45
Web	1.84	1.70	2.91
BF	1.34	2.36	4.63

Plate	Shear	Flexure
Web	3.07	1.36

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7071	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7071

Node 7071

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7071 L	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00
7071 R	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 7071 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	31.05	6.75	21.20	8.41	29.94	-3.84	21.76	14.13	24.50	6.21	28.43	9.63	19.86	15.48	34.56	-6.48
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.95	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.88
f / ϕf Fnc	0.62	0.13	0.42	0.17	0.60	0.08	0.44	0.28	0.49	0.12	0.57	0.19	0.40	0.31	0.69	0.14
α	1.00	1.00	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	31.05		21.20		29.94		21.76		24.50		28.43		19.86		34.56	
Fcf (ksi)	40.53		37.50		39.97		37.50		37.50		39.21		37.50		42.28	
Fcf (kip)	2867.21		2653.03		2827.82		2653.03		2653.03		2774.30		2653.03		2991.31	
fncf (ksi)		6.75		8.41		-3.84		14.13		6.21		9.63		15.48		-6.48
Rcf		1.31		1.77		1.33		1.72		1.53		1.38		1.89		1.22
Fncf (ksi)		37.50		37.50		-35.96		37.50		37.50		37.50		37.50		-35.91
Fncf (kip)		2653.03		2653.03		-3164.78		2653.03		2653.03		2653.03		2653.03		-3159.77

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.47	4.44	15.77	6.18	19.58	-2.81	16.25	10.27	17.30	4.17	19.90	6.57	14.83	11.19	21.37	-4.52
Fs (ksi)	20.47	4.44	15.77	6.18	19.58	-2.81	16.25	10.27	17.30	4.17	19.90	6.57	14.83	11.19	21.37	-4.52
Fs (kip)	1801.71	390.98	1388.06	544.25	1723.33	-247.01	1430.37	903.96	1522.82	366.96	1751.56	578.43	1304.68	984.29	1880.78	-397.86

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2991.31	2653.03	1880.78	984.29
Comp	0.00	3164.78	0.00	397.86

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	424.69	380.59	683.98	236.13	395.25	406.35	305.38	532.16	307.96	277.93	492.29	174.73	287.15	296.13	224.80	383.88
Vuw (kip)	637.04	570.88	1025.97	354.19	592.87	609.52	458.08	798.24	---	---	---	---	---	---	---	---
Mv (k*ft)	437.97	392.48	705.36	243.51	407.60	419.05	314.93	548.79	211.72	191.08	338.45	120.13	197.42	203.59	154.55	263.92
Huw (kip)	2959.96	3142.07	2090.51	3711.30	2820.00	3149.88	4004.03	2061.39	1495.01	1317.48	1006.58	1591.59	1288.49	1588.63	1560.66	1011.08
Muw (k*ft)	2537.77	1810.57	3607.96	1051.61	2240.00	2074.44	661.29	4016.53	1282.48	767.09	1791.22	478.55	1050.79	1066.48	291.26	2071.49
Mu (k*ft)	2975.73	2203.06	4313.32	1295.11	2647.60	2493.49	976.22	4565.32	1494.20	958.17	2129.66	598.68	1248.20	1270.08	445.81	2335.41

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.41	21.67	14.42	25.60	19.45	21.72	27.61	14.22	10.31	9.09	6.94	10.98	8.89	10.96	10.76	6.97
PY1 (Vuw)	4.39	3.94	7.08	2.44	4.09	4.20	3.16	5.51	2.12	1.92	3.40	1.21	1.98	2.04	1.55	2.65
PX2 (Mu)	15.96	11.82	23.14	6.95	14.20	13.38	5.24	24.49	8.01	5.14	11.42	3.21	6.70	6.81	2.39	12.53
PY2 (Mu)	2.28	1.69	3.31	0.99	2.03	1.91	0.75	3.50	1.14	0.73	1.63	0.46	0.96	0.97	0.34	1.79
Pu (kip)	36.98	33.96	38.96	32.72	34.20	35.63	33.08	39.74	18.61	14.47	19.04	14.29	15.86	18.02	13.29	20.00

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1454.00	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1537.31	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1579.92	1794.38	OK
BF Outside	1584.87	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.46	31.62	35.83	30.56	31.86	33.18	30.78	36.95
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1025.97
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1537.31	17.47	OK	966.58	10.98	OK
BF	1584.87	24.76	OK	492.91	7.70	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1454.00	16.52	1.47	137.48	OK
TF	2991.31	33.99	1.47	252.04	OK
TF Inside	1537.31	17.47	1.47	160.39	OK
BF Inside	1579.92	24.69	1.47	126.02	OK
BF	3164.78	49.45	1.47	252.04	OK
BF Outside	1584.87	24.76	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.74	19.87	OK	20.00	10.00	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.74	1.47	114.56	OK
Web SPL	19.87	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.26	NA
TF Inside	1.21	NA
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	2.07	1.53	7.41
Web	1.82	1.68	2.88
BF	1.34	2.19	4.63

Plate	Shear	Flexure
Web	2.99	1.35

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9071	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9071

Node 9071

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9071 L	88.00	50.00	4400.00	88.00	50.00	4400.00	120.00	50.00	6000.00
9071 R	88.00	50.00	4400.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 9071 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.96	8.37	18.10	9.28	25.16	6.99	18.27	16.69	21.43	7.60	25.78	10.35	16.63	18.17	32.89	-6.89
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.85
f / ϕf Fnc	0.56	0.17	0.36	0.19	0.50	0.14	0.37	0.33	0.43	0.15	0.52	0.21	0.33	0.36	0.66	0.14
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	27.96		18.10		25.16		18.27		21.43		25.78			18.17	32.89	
Fcf (ksi)	38.98		37.50		37.58		37.50		37.50		37.89			37.50	41.45	
Fcf (kip)	2757.64		2653.03		2658.54		2653.03		2653.03		2680.57			2653.03	2932.17	
fncf (ksi)		8.37		9.28		6.99		16.69		7.60		10.35	16.63			-6.89
Rcf		1.39		2.07		1.49		2.05		1.75		1.47	2.06			1.26
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50	37.50			-35.89
Fncf (kip)		2653.03		2653.03		2653.03		2653.03		2653.03		2653.03	2653.03			-3158.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.53	5.57	13.52	6.77	17.14	4.95	13.79	12.09	15.33	5.19	17.99	7.14	12.48	13.06	19.99	-4.67
Fs (ksi)	18.53	5.57	13.52	6.77	17.14	4.95	13.79	12.09	15.33	5.19	17.99	7.14	12.48	13.06	19.99	-4.67
Fs (kip)	1630.35	490.48	1190.12	596.07	1508.23	435.94	1213.55	1063.60	1349.28	456.30	1582.95	628.12	1098.66	1149.05	1758.69	-411.30

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2932.17	2653.03	1758.69	1149.05
Comp	0.00	3158.05	0.00	411.30

$\phi v Vn$ (kip) = 2686.30

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	329.33	297.71	573.11	134.81	311.70	302.99	188.54	454.57	241.96	220.00	414.58	104.53	229.51	223.73	142.87	330.45
Vuw (kip)	493.99	446.56	859.66	202.22	467.55	454.49	282.81	681.86	---	---	---	---	---	---	---	---
Mv (k*ft)	339.62	307.01	591.02	139.02	321.44	312.46	194.43	468.78	166.35	151.25	285.02	71.86	157.79	153.82	98.22	227.18
Huw (kip)	3038.54	3403.29	2881.21	4305.86	3047.68	3186.40	4309.16	1965.93	1446.02	1217.85	1325.57	1552.60	1231.08	1507.55	1532.53	918.67
Muw (k*ft)	2185.20	1462.28	2170.86	258.86	1936.43	1813.76	254.45	4010.06	1036.24	540.05	974.81	136.32	811.80	868.02	45.81	1972.72
Mu (k*ft)	2524.82	1769.29	2761.88	397.88	2257.87	2126.22	448.88	4478.83	1202.59	691.29	1259.83	208.19	969.58	1021.84	144.03	2199.90

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9071**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.96	23.47	19.87	29.70	21.02	21.98	29.72	13.56	9.97	8.40	9.14	10.71	8.49	10.40	10.57	6.34
PY1 (Vuw)	3.41	3.08	5.93	1.39	3.22	3.13	1.95	4.70	1.67	1.52	2.86	0.72	1.58	1.54	0.99	2.28
PX2 (Mu)	13.54	9.49	14.81	2.13	12.11	11.40	2.41	24.02	6.45	3.71	6.76	1.12	5.20	5.48	0.77	11.80
PY2 (Mu)	1.93	1.36	2.12	0.30	1.73	1.63	0.34	3.43	0.92	0.53	0.97	0.16	0.74	0.78	0.11	1.69
Pu (kip)	34.91	33.26	35.61	31.88	33.50	33.72	32.21	38.45	16.63	12.28	16.35	11.86	13.89	16.05	11.39	18.56

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1425.26	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1506.91	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1576.55	1794.38	OK
BF Outside	1581.49	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.62	31.04	32.84	29.71	31.30	31.50	30.00	35.89
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	859.66
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1506.91	17.12	OK	903.83	10.27	OK
BF	1581.49	24.71	OK	575.42	8.99	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1425.26	16.20	1.47	137.48	OK
TF	2932.17	33.32	1.47	252.04	OK
TF Inside	1506.91	17.12	1.47	160.39	OK
BF Inside	1576.55	24.63	1.47	126.02	OK
BF	3158.05	49.34	1.47	252.04	OK
BF Outside	1581.49	24.71	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.45	19.23	OK	18.56	9.28	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.45	1.47	114.56	OK
Web SPL	19.23	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.24	NA
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	2.11	1.64	7.56
Web	1.88	1.81	2.98
BF	1.34	1.87	4.64

Plate	Shear	Flexure
Web	3.57	1.39

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1089	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1089

Node 1089

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1089 L	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00
1089 R	88.00	50.00	4400.00	88.00	47.36	4167.65	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1089 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	8.44	-11.66	3.52	1.63	1.22	2.69	3.58	-2.97	-2.13	8.47	18.12	-19.62	20.85	-23.23	-3.15	12.01
ϕf Fnc (ksi)	50.00	47.36	50.00	50.00	50.00	50.00	50.00	47.52	50.00	50.00	50.00	47.44	50.00	47.43	50.00	50.00
f / ϕf Fnc	0.17	0.25	0.07	0.03	0.02	0.05	0.07	0.06	0.04	0.17	0.36	0.41	0.42	0.49	0.06	0.24
α	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-11.66	3.52			2.69	3.58			8.47		-19.62		-23.23		12.01
Fcf (ksi)		-35.52	37.50			37.50	37.50			37.50		-35.58		-35.57		37.50
Fcf (kip)		-3125.74	2653.03			2653.03	2653.03			2653.03		-3130.85		-3130.25		2653.03
fncf (ksi)	8.44			1.63	1.22			-2.97	-2.13		18.12		20.85		-3.15	
Rcf	3.05			10.67	13.95			10.49	4.42		1.81		1.53		3.12	
Fncf (ksi)	37.50			37.50	37.50			-35.64	-37.50		37.50		37.50		-37.50	
Fncf (kip)	2653.03			2653.03	2653.03			-3136.54	-3300.00		2653.03		2653.03		-3300.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.92	-7.29	2.73	0.90	0.75	2.06	2.77	-2.34	-1.62	6.15	8.07	-12.99	15.10	-16.66	-2.34	8.65
Fs (ksi)	3.92	-7.29	2.73	0.90	0.75	2.06	2.77	-2.34	-1.62	6.15	8.07	-12.99	15.10	-16.66	-2.34	8.65
Fs (kip)	344.69	-641.29	239.93	79.45	65.72	181.65	243.68	-205.61	-142.80	541.09	710.37	-1143.10	1328.84	-1466.32	-205.91	761.04

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	1328.84	761.04
Comp	3300.00	3136.54	205.91	1466.32

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	647.43	548.20	368.13	871.93	669.86	539.48	589.45	646.35	470.48	404.21	273.15	632.93	486.33	398.05	433.35	469.72
Vuw (kip)	971.14	822.30	552.20	1123.66	1004.79	809.22	884.18	969.53	---	---	---	---	---	---	---	---
Mv (k*ft)	667.66	565.33	379.64	772.52	690.79	556.34	607.87	666.55	323.46	277.89	187.79	435.14	334.35	273.66	297.93	322.93
Huw (kip)	-470.63	2634.84	2619.37	305.45	1347.53	-130.92	-174.46	1328.68	-161.78	174.21	134.93	20.77	217.25	-236.03	-74.98	302.80
Muw (k*ft)	3919.02	1286.88	1307.51	4392.73	3003.30	4379.39	4320.48	3028.43	717.08	116.72	84.31	326.76	497.38	1347.98	2032.84	703.24
Mu (k*ft)	4586.68	1852.21	1687.15	5165.25	3694.09	4935.73	4928.35	3694.97	1040.54	394.61	272.11	761.90	831.73	1621.64	2330.77	1026.17

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1089	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.25	18.17	18.06	2.11	9.29	0.90	1.20	9.16	1.12	1.20	0.93	0.14	1.50	1.63	0.52	2.09
PY1 (Vuw)	6.70	5.67	3.81	7.75	6.93	5.58	6.10	6.69	3.24	2.79	1.88	4.37	3.35	2.75	2.99	3.24
PX2 (Mu)	24.60	9.94	9.05	27.71	19.82	26.48	26.44	19.82	5.58	2.12	1.46	4.09	4.46	8.70	12.50	5.50
PY2 (Mu)	3.51	1.42	1.29	3.96	2.83	3.78	3.78	2.83	0.80	0.30	0.21	0.58	0.64	1.24	1.79	0.79
Pu (kip)	29.66	28.99	27.59	32.03	30.70	28.93	29.35	30.51	7.82	4.53	3.18	6.51	7.17	11.07	13.87	8.59

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1565.82	1794.38	OK
BF Outside	1570.72	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.85	26.54	25.58	28.79	27.84	26.48	26.72	27.72
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1123.66
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.41
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	682.92	7.76	OK
BF	1570.72	24.54	OK	734.31	11.47	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1565.82	24.47	1.47	126.02	OK
BF	3136.54	49.01	1.47	252.04	OK
BF Outside	1570.72	24.54	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.03	16.01	OK	13.87	6.93	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.03	1.47	91.65	OK
Web SPL	16.01	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.73	2.17	6.72
Web	2.26	2.43	2.86
BF	1.47	1.47	4.67

Plate	Shear	Flexure
Web	2.73	1.74

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 3089

Node 3089

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3089 L	80.00	50.00	4000.00	99.00	48.51	4802.76	96.00	50.00	4800.00
3089 R	88.00	50.00	4400.00	88.00	47.35	4166.37	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3089 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.21	-3.20	4.13	-3.18	1.39	0.65	3.23	-3.23	-1.59	5.22	14.58	-16.40	19.10	-21.83	-3.22	10.43
ϕf Fnc (ksi)	50.00	47.35	50.00	47.55	50.00	50.00	50.00	47.46	50.00	50.00	50.00	47.42	50.00	47.42	50.00	50.00
f / ϕf Fnc	0.04	0.07	0.08	0.07	0.03	0.01	0.06	0.07	0.03	0.10	0.29	0.35	0.38	0.46	0.06	0.21
α	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-3.20	4.13		1.39			-3.23		5.22		-16.40		-21.83		10.43
Fcf (ksi)		-35.51	37.50		37.50			-35.60		37.50		-35.57		-35.56		37.50
Fcf (kip)		-3124.78	2653.03		2653.03			-3132.59		2653.03		-3130.03		-3129.71		2653.03
fncf (ksi)	2.21			-3.18		0.65	3.23		-1.59		14.58		19.10		-3.22	
Rcf	11.11			9.08		27.02	11.04		7.18		2.17		1.63		3.59	
Fncf (ksi)	37.50			-35.66		37.50	37.50		-37.50		37.50		37.50		-37.50	
Fncf (kip)	2653.03			-3138.14		2653.03	2653.03		-3300.00		2653.03		2653.03		-3300.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	1.48	-2.05	3.08	-2.69	0.90	0.67	2.50	-2.54	-1.21	3.90	6.63	-11.00	7.74	-14.35	-2.36	7.58
Fs (ksi)	1.48	-2.05	3.08	-2.69	0.90	0.67	2.50	-2.54	-1.21	3.90	6.63	-11.00	7.74	-14.35	-2.36	7.58
Fs (kip)	129.81	-180.25	270.84	-236.41	78.80	59.07	219.79	-223.85	-106.27	343.16	583.41	-968.29	681.36	-1263.23	-207.69	667.29

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	681.36	667.29
Comp	3300.00	3138.14	207.69	1263.23

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	775.99	595.49	407.89	916.39	724.71	608.05	616.75	712.20	560.22	436.43	300.14	663.15	523.98	445.30	451.45	515.14
Vuw (kip)	1075.69	893.24	611.84	1145.89	1050.05	912.07	925.12	1043.79	---	---	---	---	---	---	---	---
Mv (k*ft)	739.54	614.10	420.64	787.80	721.91	627.05	636.02	717.61	385.15	300.05	206.35	455.91	360.24	306.15	310.37	354.16
Huw (kip)	-526.79	413.12	2644.73	2.61	1252.81	-190.01	-213.19	1244.79	-27.51	18.78	75.20	-2.22	129.21	-209.94	-317.38	250.69
Muw (k*ft)	3842.74	4249.17	1273.70	4559.97	3129.59	4299.43	4268.04	3140.28	225.50	368.91	14.35	322.65	326.85	1128.50	1414.25	636.35
Mu (k*ft)	4582.28	4863.27	1694.34	5347.76	3851.50	4926.48	4904.06	3857.88	610.65	668.96	220.70	778.57	687.09	1434.65	1724.62	990.51

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.63	2.85	18.24	0.02	8.64	1.31	1.47	8.58	0.19	0.13	0.52	0.02	0.89	1.45	2.19	1.73
PY1 (Vuw)	7.42	6.16	4.22	7.90	7.24	6.29	6.38	7.20	3.86	3.01	2.07	4.57	3.61	3.07	3.11	3.55
PX2 (Mu)	24.58	26.09	9.09	28.69	20.66	26.43	26.31	20.69	3.28	3.59	1.18	4.18	3.69	7.70	9.25	5.31
PY2 (Mu)	3.51	3.73	1.30	4.10	2.95	3.78	3.76	2.96	0.47	0.51	0.17	0.60	0.53	1.10	1.32	0.76
Pu (kip)	30.26	30.58	27.88	31.11	31.02	29.51	29.57	30.99	5.55	5.12	2.81	6.66	6.17	10.05	12.27	8.26

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1566.61	1794.38	OK
BF Outside	1571.52	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	27.18	27.91	25.78	27.79	28.05	26.81	26.84	28.03
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1145.89
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.41
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	350.17	3.98	OK
BF	1571.52	24.56	OK	632.60	9.88	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1566.61	24.48	1.47	126.02	OK
BF	3138.14	49.03	1.47	252.04	OK
BF Outside	1571.52	24.56	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.11	15.56	OK	12.27	6.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.11	1.47	91.65	OK
Web SPL	15.56	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.73	4.23	6.72
Web	2.33	2.74	2.95
BF	1.47	1.70	4.67

Plate	Shear	Flexure
Web	2.68	1.78

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5089	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5089

Node 5089

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5089 L	80.00	50.00	4000.00	99.00	48.46	4797.72	96.00	50.00	4800.00
5089 R	88.00	50.00	4400.00	88.00	47.76	4202.86	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5089 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	0.84	-0.32	6.88	-6.49	1.68	-0.26	3.45	-5.12	4.16	-5.80	8.26	-9.17	18.19	-21.18	-2.46	9.05
ϕf Fnc (ksi)	50.00	47.76	50.00	47.48	50.00	47.95	50.00	47.34	50.00	47.36	50.00	47.43	50.00	47.41	50.00	50.00
f / ϕf Fnc	0.02	0.01	0.14	0.14	0.03	0.01	0.07	0.11	0.08	0.12	0.17	0.19	0.36	0.45	0.05	0.18
α	1.00	0.96	1.00	0.95	1.00	0.96	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)	0.84		6.88		1.68			-5.12		-5.80		-9.17		-21.18		9.05
Fcf (ksi)	37.50		37.50		37.50			-35.50		-35.52		-35.57		-35.56		37.50
Fcf (kip)	2653.03		2653.03		2653.03			-3124.27		-3125.53		-3130.33		-3129.32		2653.03
fncf (ksi)		-0.32		-6.49		-0.26	3.45		4.16		8.26		18.19		-2.46	
Rcf		44.85		5.45		22.30	6.93		6.12		3.88		1.68		4.14	
Fncf (ksi)		-35.82		-35.61		-35.96	37.50		37.50		37.50		37.50		-37.50	
Fncf (kip)		-3152.14		-3133.82		-3164.79	2653.03		2653.03		2653.03		2653.03		-3300.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	0.78	-0.52	3.63	-4.24	1.15	0.21	2.67	-3.81	3.04	-3.75	4.57	-6.49	7.46	-13.99	-1.78	6.66
Fs (ksi)	0.78	-0.52	3.63	-4.24	1.15	0.21	2.67	-3.81	3.04	-3.75	4.57	-6.49	7.46	-13.99	-1.78	6.66
Fs (kip)	68.98	-46.11	319.12	-373.08	100.87	18.35	235.31	-335.06	267.25	-329.80	402.16	-571.43	656.57	-1230.85	-156.68	585.89

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	656.57	585.89
Comp	3300.00	3164.79	156.68	1230.85

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	838.07	580.32	435.12	929.91	749.97	650.71	639.22	721.76	607.30	421.64	319.05	672.19	541.50	474.93	466.81	521.57
Vuw (kip)	1106.73	870.48	652.68	1152.65	1062.68	976.07	958.83	1048.57	---	---	---	---	---	---	---	---
Mv (k*ft)	760.87	598.46	448.72	792.45	730.59	671.05	659.19	720.90	417.52	289.87	219.35	462.13	372.28	326.51	320.93	358.58
Huw (kip)	1115.13	103.57	1518.39	-555.87	-483.07	-168.76	-240.35	1310.72	12.47	-29.43	65.03	-54.41	-34.11	-92.33	-313.24	234.11
Muw (k*ft)	3313.16	4661.91	2775.47	3803.23	3902.13	4328.20	4231.27	3052.37	83.70	503.42	60.01	414.82	434.22	708.06	1372.67	540.05
Mu (k*ft)	4074.04	5260.36	3224.19	4595.67	4632.72	4999.24	4890.46	3773.27	501.22	793.29	279.36	876.95	806.50	1034.58	1693.60	898.63

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	7.69	0.71	10.47	3.83	3.33	1.16	1.66	9.04	0.09	0.20	0.45	0.38	0.24	0.64	2.16	1.61
PY1 (Vuw)	7.63	6.00	4.50	7.95	7.33	6.73	6.61	7.23	4.19	2.91	2.20	4.64	3.73	3.28	3.22	3.60
PX2 (Mu)	21.85	28.22	17.29	24.65	24.85	26.82	26.23	20.24	2.69	4.26	1.50	4.70	4.33	5.55	9.08	4.82
PY2 (Mu)	3.12	4.03	2.47	3.52	3.55	3.83	3.75	2.89	0.38	0.61	0.21	0.67	0.62	0.79	1.30	0.69
Pu (kip)	31.44	30.62	28.63	30.71	30.21	29.91	29.75	30.98	5.35	5.68	3.10	7.35	6.30	7.40	12.12	7.73

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1579.92	1794.38	OK
BF Outside	1584.87	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.32	27.99	26.50	27.44	27.16	27.05	26.94	28.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1152.65
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.41
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	337.43	3.83	OK
BF	1584.87	24.76	OK	616.39	9.63	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1579.92	24.69	1.47	126.02	OK
BF	3164.79	49.45	1.47	252.04	OK
BF Outside	1584.87	24.76	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.44	15.72	OK	12.12	6.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.44	1.47	91.65	OK
Web SPL	15.72	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.14
BF Outside	1.15	1.14

Bolt	Shear	Slip	Bearing
TF	1.73	4.39	6.72
Web	2.30	2.78	2.92
BF	1.46	1.75	4.63

Plate	Shear	Flexure
Web	2.66	1.77

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 7089

Node 7089

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7089 L	80.00	50.00	4000.00	99.00	48.49	4800.84	96.00	50.00	4800.00
7089 R	88.00	50.00	4400.00	88.00	47.34	4165.94	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7089 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 7089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.49	-3.66	5.12	-4.26	1.52	0.78	2.92	-3.08	10.44	-11.62	1.86	2.31	18.90	-21.63	-2.75	9.90
ϕf Fnc (ksi)	50.00	47.34	50.00	47.52	50.00	50.00	50.00	47.45	50.00	47.43	50.00	50.00	50.00	47.42	50.00	50.00
f / ϕf Fnc	0.05	0.08	0.10	0.09	0.03	0.02	0.06	0.06	0.21	0.25	0.04	0.05	0.38	0.46	0.05	0.20
α	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)		-3.66	5.12		1.52			-3.08		-11.62		2.31		-21.63		9.90
Fcf (ksi)		-35.51	37.50		37.50			-35.58		-35.57		37.50		-35.56		37.50
Fcf (kip)		-3124.45	2653.03		2653.03			-3131.38		-3130.26		2653.03		-3129.67		2653.03
fncf (ksi)	2.49			-4.26		0.78	2.92		10.44		1.86		18.90		-2.75	
Rcf	9.71			7.32		24.74	11.55		3.06		16.21		1.64		3.79	
Fncf (ksi)	37.50			-35.64		37.50	37.50		37.50		37.50		37.50		-37.50	
Fncf (kip)	2653.03			-3136.52		2653.03	2653.03		2653.03		2653.03		2653.03		-3300.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	1.93	-2.92	3.16	-2.79	1.06	0.88	2.22	-2.50	5.15	-7.42	1.47	1.30	7.65	-14.29	-1.95	7.31
Fs (ksi)	1.93	-2.92	3.16	-2.79	1.06	0.88	2.22	-2.50	5.15	-7.42	1.47	1.30	7.65	-14.29	-1.95	7.31
Fs (kip)	169.61	-256.75	277.87	-245.49	93.71	77.47	195.45	-220.08	452.90	-653.24	129.56	114.35	673.34	-1257.79	-171.48	642.88

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	673.34	642.88
Comp	3300.00	3136.52	171.48	1257.79

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	771.92	581.00	402.85	905.99	593.93	717.11	612.31	701.50	560.77	422.34	296.47	655.49	431.47	522.05	448.00	507.47
Vuw (kip)	1073.65	871.50	604.27	1140.69	890.89	1046.25	918.47	1038.44	---	---	---	---	---	---	---	---
Mv (k*ft)	738.14	599.16	415.44	784.22	612.49	719.30	631.45	713.93	385.53	290.36	203.82	450.65	296.64	358.91	308.00	348.89
Huw (kip)	-545.38	304.03	2720.68	-91.13	-173.90	3245.59	-215.58	1300.20	-47.53	17.66	93.37	-13.43	-109.28	133.04	-318.79	257.12
Muw (k*ft)	3817.49	4394.63	1172.42	4433.23	4321.24	472.54	4264.81	3066.40	310.08	380.63	11.81	302.21	804.47	11.06	1404.46	592.26
Mu (k*ft)	4555.63	4993.79	1587.86	5217.45	4933.73	1191.84	4896.26	3780.32	695.61	670.98	215.63	752.86	1101.10	369.97	1712.46	941.15

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 7089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.76	2.10	18.76	0.63	1.20	22.38	1.49	8.97	0.33	0.12	0.64	0.09	0.75	0.92	2.20	1.77
PY1 (Vuw)	7.40	6.01	4.17	7.87	6.14	7.22	6.33	7.16	3.87	2.91	2.04	4.52	2.98	3.60	3.09	3.50
PX2 (Mu)	24.44	26.79	8.52	27.99	26.46	6.39	26.26	20.28	3.73	3.60	1.16	4.04	5.91	1.98	9.19	5.05
PY2 (Mu)	3.49	3.83	1.22	4.00	3.78	0.91	3.75	2.90	0.53	0.51	0.17	0.58	0.84	0.28	1.31	0.72
Pu (kip)	30.23	30.51	27.81	30.98	29.39	29.90	29.53	30.93	5.99	5.06	2.85	6.56	7.68	4.85	12.21	8.02

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1565.81	1794.38	OK
BF Outside	1570.71	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	27.16	27.89	25.72	27.69	26.74	27.03	26.82	27.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1140.69
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.41
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	346.04	3.93	OK
BF	1570.71	24.54	OK	629.88	9.84	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1565.81	24.47	1.47	126.02	OK
BF	3136.52	49.01	1.47	252.04	OK
BF Outside	1570.71	24.54	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
30.98	15.49	OK	12.21	6.10	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	30.98	1.47	91.65	OK
Web SPL	15.49	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.73	4.28	6.72
Web	2.34	2.76	2.96
BF	1.47	1.71	4.67

Plate	Shear	Flexure
Web	2.69	1.79

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9089	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9089

Node 9089

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9089 L	80.00	50.00	4000.00	99.00	50.00	4950.00	96.00	50.00	4800.00
9089 R	88.00	50.00	4400.00	88.00	47.36	4167.74	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9089 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	8.42	-11.59	3.09	1.78	1.44	2.79	3.08	-2.53	15.16	-15.92	-1.25	6.33	19.96	-22.54	-2.71	11.55
ϕf Fnc (ksi)	50.00	47.36	50.00	50.00	50.00	50.00	50.00	47.53	50.00	47.45	50.00	50.00	50.00	47.42	50.00	50.00
f / ϕf Fnc	0.17	0.24	0.06	0.04	0.03	0.06	0.06	0.05	0.30	0.34	0.03	0.13	0.40	0.48	0.05	0.23
α	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)		-11.59	3.09			2.79	3.08			-15.92		6.33		-22.54		11.55
Fcf (ksi)		-35.52	37.50			37.50	37.50			-35.59		37.50		-35.57		37.50
Fcf (kip)		-3125.80	2653.03			2653.03	2653.03			-3131.50		2653.03		-3129.95		2653.03
fncf (ksi)	8.42			1.78	1.44			-2.53	15.16		-1.25		19.96		-2.71	
Rcf	3.07			12.14	13.43			12.18	2.24		5.93		1.58		3.25	
Fncf (ksi)	37.50			37.50	37.50			-35.64	37.50		-37.50		37.50		-37.50	
Fncf (kip)	2653.03			2653.03	2653.03			-3136.72	2653.03		-3300.00		2653.03		-3300.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.13	-7.75	2.17	1.62	1.03	2.35	2.31	-2.13	6.84	-10.05	0.87	4.12	8.17	-14.82	-1.91	8.52
Fs (ksi)	4.13	-7.75	2.17	1.62	1.03	2.35	2.31	-2.13	6.84	-10.05	0.87	4.12	8.17	-14.82	-1.91	8.52
Fs (kip)	363.43	-682.04	191.26	142.42	90.32	207.07	203.20	-187.47	602.04	-884.45	76.73	362.75	718.87	-1304.34	-167.93	749.99

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	718.87	749.99
Comp	3300.00	3136.72	167.93	1304.34

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	632.26	517.88	349.50	838.89	521.36	634.62	571.58	614.64	462.74	378.66	259.70	608.73	381.12	464.41	419.87	447.03
Vuw (kip)	948.39	776.82	524.25	1107.14	782.03	951.93	857.37	921.96	---	---	---	---	---	---	---	---
Mv (k*ft)	652.02	534.06	360.42	761.16	537.65	654.45	589.44	633.84	318.14	260.33	178.54	418.50	262.02	319.28	288.66	307.33
Huw (kip)	-466.69	2836.60	2727.83	318.31	-81.89	1443.89	-195.89	1377.02	-173.79	182.00	162.21	8.58	-154.05	239.72	-319.35	317.48
Muw (k*ft)	3924.37	1017.87	1162.90	4375.59	4445.72	2874.81	4291.47	2963.98	760.34	35.52	84.91	284.12	1081.08	208.02	1471.42	667.58
Mu (k*ft)	4576.39	1551.93	1523.32	5136.75	4983.37	3529.27	4880.91	3597.82	1078.48	295.85	263.45	702.62	1343.10	527.30	1760.08	974.91

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	3.22	19.56	18.81	2.20	0.56	9.96	1.35	9.50	1.20	1.26	1.12	0.06	1.06	1.65	2.20	2.19
PY1 (Vuw)	6.54	5.36	3.62	7.64	5.39	6.57	5.91	6.36	3.19	2.61	1.79	4.20	2.63	3.20	2.90	3.08
PX2 (Mu)	24.55	8.32	8.17	27.55	26.73	18.93	26.18	19.30	5.78	1.59	1.41	3.77	7.20	2.83	9.44	5.23
PY2 (Mu)	3.51	1.19	1.17	3.94	3.82	2.70	3.74	2.76	0.83	0.23	0.20	0.54	1.03	0.40	1.35	0.75
Pu (kip)	29.53	28.65	27.40	31.92	28.81	30.34	29.18	30.20	8.06	4.02	3.22	6.09	9.04	5.75	12.39	8.35

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1565.91	1794.38	OK
BF Outside	1570.82	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.77	26.27	25.43	28.72	26.41	27.60	26.61	27.53
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1107.14
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9089**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.41
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	369.44	4.20	OK
BF	1570.82	24.54	OK	653.19	10.21	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1565.91	24.47	1.47	126.02	OK
BF	3136.72	49.01	1.47	252.04	OK
BF Outside	1570.82	24.54	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.92	15.96	OK	12.39	6.20	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.92	1.47	91.65	OK
Web SPL	15.96	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.73	4.01	6.72
Web	2.27	2.72	2.87
BF	1.47	1.65	4.67

Plate	Shear	Flexure
Web	2.77	1.74

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1147	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1147

Node 1147

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1147 L	72.00	50.00	3600.00	72.00	48.00	3456.07	96.00	50.00	4800.00
1147 R	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 1147 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	38.49	-3.45	22.23	5.51	32.09	-2.16	23.18	13.20	31.80	7.29	26.69	2.22	21.06	14.78	41.19	-9.60
ϕf Fnc (ksi)	50.00	48.00	50.00	50.00	50.00	48.03	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.82
f / ϕf Fnc	0.77	0.07	0.44	0.11	0.64	0.04	0.46	0.26	0.64	0.15	0.53	0.04	0.42	0.30	0.82	0.20
α	1.00	0.96	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	38.49		22.23		32.09		23.18		31.80		26.69		21.06		41.19	
Fcf (ksi)	44.24		37.50		41.04		37.50		40.90		38.34		37.50		45.59	
Fcf (kip)	2560.98		2170.66		2375.78		2170.66		2367.40		2219.43		2170.66		2639.16	
fncf (ksi)		-3.45		5.51		-2.16		13.20		7.29		2.22		14.78		-9.60
Rcf		1.15		1.69		1.28		1.62		1.29		1.44		1.78		1.11
Fncf (ksi)		-36.00		37.50		-36.03		37.50		37.50		37.50		37.50		-35.87
Fncf (kip)		-2592.05		2170.66		-2593.81		2170.66		2170.66		2170.66		2170.66		-2582.45

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	23.62	-2.52	16.79	3.51	21.24	-2.32	17.15	10.01	21.71	5.04	18.93	0.90	15.65	11.13	30.32	-7.37
Fs (ksi)	23.62	-2.52	16.79	3.51	21.24	-2.32	17.15	10.01	21.71	5.04	18.93	0.90	15.65	11.13	30.32	-7.37
Fs (kip)	1700.64	-181.58	1208.99	253.00	1529.44	-167.17	1235.03	720.93	1563.00	362.84	1362.62	64.60	1127.13	801.37	2183.33	-530.51

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2639.16	2170.66	2183.33	801.37
Comp	0.00	2593.81	0.00	530.51

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	395.84	307.72	596.01	183.80	294.52	376.36	225.90	467.48	279.44	233.96	437.64	129.62	207.85	282.45	159.37	346.83
Vuw (kip)	593.76	461.59	894.01	275.69	441.78	564.54	338.85	701.22	---	---	---	---	---	---	---	---
Mv (k*ft)	408.21	317.34	614.63	189.54	303.73	388.12	232.96	482.09	192.11	160.85	300.87	89.12	142.90	194.18	109.57	238.44
Huw (kip)	1933.27	2245.99	1837.69	2824.59	2413.07	1993.39	3062.94	1678.16	1012.71	974.66	908.18	1303.97	1283.89	951.48	1285.66	1101.88
Muw (k*ft)	3085.44	1805.35	2803.33	1033.88	2017.64	2250.00	716.07	3598.47	1673.09	849.78	1508.09	456.98	1066.80	1153.80	289.56	2412.31
Mu (k*ft)	3493.65	2122.69	3417.96	1223.42	2321.37	2638.12	949.04	4080.56	1865.20	1010.62	1808.96	546.10	1209.70	1347.98	399.13	2650.75

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.33	15.49	12.67	19.48	16.64	13.75	21.12	11.57	6.98	6.72	6.26	8.99	8.85	6.56	8.87	7.60
PY1 (Vuw)	4.09	3.18	6.17	1.90	3.05	3.89	2.34	4.84	1.93	1.61	3.02	0.89	1.43	1.95	1.10	2.39
PX2 (Mu)	18.74	11.39	18.33	6.56	12.45	14.15	5.09	21.89	10.00	5.42	9.70	2.93	6.49	7.23	2.14	14.22
PY2 (Mu)	2.68	1.63	2.62	0.94	1.78	2.02	0.73	3.13	1.43	0.77	1.39	0.42	0.93	1.03	0.31	2.03
Pu (kip)	32.78	27.30	32.23	26.20	29.49	28.52	26.39	34.40	17.32	12.38	16.56	11.99	15.52	14.11	11.10	22.26

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1282.83	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1356.33	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1294.88	1794.38	OK
BF Outside	1298.94	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.56	25.45	29.55	24.49	27.55	26.50	24.60	31.97
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	894.01
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1356.33	15.41	OK	1122.07	12.75	OK
BF	1298.94	20.30	OK	401.31	6.27	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1282.83	14.58	1.47	137.48	OK
TF	2639.16	29.99	1.47	206.21	OK
TF Inside	1356.33	15.41	1.47	160.39	OK
BF Inside	1294.88	20.23	1.47	126.02	OK
BF	2593.81	40.53	1.47	206.21	OK
BF Outside	1298.94	20.30	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.40	17.20	OK	22.26	11.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.40	1.47	91.65	OK
Web SPL	17.20	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.43	NA
TF Inside	1.38	NA
BF Inside	1.35	1.39
BF Outside	1.41	1.39

Bolt	Shear	Slip	Bearing
TF	2.13	1.32	6.88
Web	2.10	1.51	2.66
BF	1.51	2.68	5.09

Plate	Shear	Flexure
Web	3.44	1.56

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 3147

Node 3147

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3147 L	72.00	50.00	3600.00	72.00	48.03	3458.09	96.00	50.00	4800.00
3147 R	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 3147 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	40.52	-2.85	25.14	4.98	39.44	-5.49	25.19	11.45	34.76	6.05	30.44	2.02	23.97	12.43	43.51	-8.59
ϕf Fnc (ksi)	50.00	48.03	50.00	50.00	50.00	47.93	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.86
f / ϕf Fnc	0.81	0.06	0.50	0.10	0.79	0.11	0.50	0.23	0.70	0.12	0.61	0.04	0.48	0.25	0.87	0.18
α	1.00	0.96	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	40.52		25.14		39.44		25.19		34.76		30.44		23.97		43.51	
Fcf (ksi)	45.26		37.57		44.72		37.60		42.38		40.22		37.50		46.75	
Fcf (kip)	2619.83		2174.80		2588.54		2176.22		2453.11		2328.04		2170.66		2706.36	
fncf (ksi)		-2.85		4.98		-5.49		11.45		6.05		2.02		12.43		-8.59
Rcf		1.12		1.49		1.13		1.49		1.22		1.32		1.56		1.07
Fncf (ksi)		-36.02		37.50		-35.95		37.50		37.50		37.50		37.50		-35.90
Fncf (kip)		-2593.57		2170.66		-2588.44		2170.66		2170.66		2170.66		2170.66		-2584.61

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.16	-2.11	18.88	3.17	24.71	-4.54	18.64	8.83	23.68	4.27	21.24	0.61	17.77	9.52	26.12	-6.58
Fs (ksi)	25.16	-2.11	18.88	3.17	24.71	-4.54	18.64	8.83	23.68	4.27	21.24	0.61	17.77	9.52	26.12	-6.58
Fs (kip)	1811.53	-151.98	1359.29	228.40	1778.88	-326.71	1341.77	635.58	1704.82	307.22	1529.35	43.73	1279.46	685.49	1880.54	-473.72

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2706.36	2170.66	1880.54	685.49
Comp	0.00	2593.57	0.00	473.72

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	469.40	380.11	683.57	273.13	410.93	422.36	321.33	553.58	329.65	284.42	498.82	190.98	288.34	314.27	225.03	406.98
Vuw (kip)	704.10	570.16	1025.36	409.70	616.40	633.55	482.00	830.37	---	---	---	---	---	---	---	---
Mv (k*ft)	484.07	391.99	704.93	281.67	423.77	435.56	331.38	570.88	226.63	195.54	342.94	131.30	198.23	216.06	154.71	279.80
Huw (kip)	2019.87	2160.43	1847.75	2624.69	2388.18	2058.86	2733.47	1801.16	1106.37	1058.46	968.11	1318.24	1341.36	1048.72	1309.97	937.88
Muw (k*ft)	3100.11	1928.59	3260.41	1312.72	2240.36	2402.87	1155.38	3583.05	1745.34	1005.24	1871.64	627.72	1242.31	1320.55	527.97	2092.68
Mu (k*ft)	3584.18	2320.58	3965.34	1594.39	2664.13	2838.43	1486.75	4153.93	1971.98	1200.78	2214.58	759.02	1440.54	1536.61	682.68	2372.47

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.93	14.90	12.74	18.10	16.47	14.20	18.85	12.42	7.63	7.30	6.68	9.09	9.25	7.23	9.03	6.47
PY1 (Vuw)	4.86	3.93	7.07	2.83	4.25	4.37	3.32	5.73	2.27	1.96	3.44	1.32	1.99	2.17	1.55	2.81
PX2 (Mu)	19.23	12.45	21.27	8.55	14.29	15.23	7.97	22.28	10.58	6.44	11.88	4.07	7.73	8.24	3.66	12.73
PY2 (Mu)	2.75	1.78	3.04	1.22	2.04	2.18	1.14	3.18	1.51	0.92	1.70	0.58	1.10	1.18	0.52	1.82
Pu (kip)	34.02	27.94	35.48	26.96	31.40	30.14	27.20	35.83	18.60	14.04	19.25	13.30	17.26	15.83	12.86	19.74

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1315.50	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1390.86	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1294.75	1794.38	OK
BF Outside	1298.81	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.59	25.92	32.46	25.13	29.17	27.96	25.27	33.14
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1025.36
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1390.86	15.81	OK	966.46	10.98	OK
BF	1298.81	20.29	OK	343.28	5.36	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1315.50	14.95	1.47	137.48	OK
TF	2706.36	30.75	1.47	206.21	OK
TF Inside	1390.86	15.81	1.47	160.39	OK
BF Inside	1294.75	20.23	1.47	126.02	OK
BF	2593.57	40.52	1.47	206.21	OK
BF Outside	1298.81	20.29	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.83	17.91	OK	19.74	9.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.83	1.47	91.65	OK
Web SPL	17.91	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.39	NA
TF Inside	1.34	NA
BF Inside	1.35	1.39
BF Outside	1.41	1.39

Bolt	Shear	Slip	Bearing
TF	2.08	1.53	6.71
Web	2.02	1.70	2.56
BF	1.51	3.14	5.09

Plate	Shear	Flexure
Web	3.00	1.51

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5147	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5147

Node 5147

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5147 L	72.00	50.00	3600.00	72.00	48.06	3460.33	96.00	50.00	4800.00
5147 R	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 5147 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	39.01	-1.94	24.95	3.85	38.01	-4.75	25.41	9.59	33.49	3.59	29.11	3.20	23.73	10.99	41.68	-7.73
ϕf Fnc (ksi)	50.00	48.06	50.00	50.00	50.00	47.95	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.88
f / ϕf Fnc	0.78	0.04	0.50	0.08	0.76	0.10	0.51	0.19	0.67	0.07	0.58	0.06	0.47	0.22	0.83	0.16
α	1.00	0.96	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	39.01		24.95		38.01		25.41		33.49		29.11		23.73		41.68	
Fcf (ksi)	44.50		37.50		44.00		37.71		41.75		39.55		37.50		45.84	
Fcf (kip)	2576.09		2170.66		2547.14		2182.56		2416.41		2289.56		2170.66		2653.31	
fncf (ksi)		-1.94		3.85		-4.75		9.59		3.59		3.20		10.99		-7.73
Rcf		1.14		1.50		1.16		1.48		1.25		1.36		1.58		1.10
Fncf (ksi)		-36.05		37.50		-35.96		37.50		37.50		37.50		37.50		-35.91
Fncf (kip)		-2595.24		2170.66		-2589.44		2170.66		2170.66		2170.66		2170.66		-2585.35

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	24.26	-1.43	18.71	2.32	23.85	-4.03	18.78	7.49	23.06	-1.66	20.58	2.34	17.59	8.47	25.03	-5.96
Fs (ksi)	24.26	-1.43	18.71	2.32	23.85	-4.03	18.78	7.49	23.06	-1.66	20.58	2.34	17.59	8.47	25.03	-5.96
Fs (kip)	1746.91	-102.79	1347.03	167.31	1716.91	-289.93	1352.16	539.12	1660.09	-119.45	1481.81	168.55	1266.47	609.97	1801.95	-429.07

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.31	2170.66	1801.95	609.97
Comp	0.00	2595.24	0.00	429.07

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	465.67	379.74	679.87	277.71	415.36	401.96	328.53	542.43	326.85	284.42	496.47	194.05	309.59	281.84	229.96	399.37
Vuw (kip)	698.50	569.61	1019.80	416.57	623.03	602.95	492.80	813.65	---	---	---	---	---	---	---	---
Mv (k*ft)	480.22	391.60	701.12	286.39	428.34	414.53	338.80	559.38	224.71	195.54	341.32	133.41	212.84	193.76	158.09	274.57
Huw (kip)	2030.10	2077.63	1848.41	2493.25	2218.34	2107.09	2633.58	1791.94	1096.08	1009.56	951.32	1260.85	1027.10	1100.23	1250.96	915.25
Muw (k*ft)	2989.73	2029.82	3167.97	1501.98	2385.66	2253.47	1288.57	3478.05	1644.18	1048.64	1783.86	722.70	1581.81	1167.34	583.56	1983.14
Mu (k*ft)	3469.96	2421.42	3869.09	1788.37	2813.99	2668.00	1627.37	4037.43	1868.89	1244.18	2125.18	856.11	1794.65	1361.10	741.65	2257.70

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.00	14.33	12.75	17.19	15.30	14.53	18.16	12.36	7.56	6.96	6.56	8.70	7.08	7.59	8.63	6.31
PY1 (Vuw)	4.82	3.93	7.03	2.87	4.30	4.16	3.40	5.61	2.25	1.96	3.42	1.34	2.14	1.94	1.59	2.75
PX2 (Mu)	18.61	12.99	20.75	9.59	15.09	14.31	8.73	21.66	10.02	6.67	11.40	4.59	9.63	7.30	3.98	12.11
PY2 (Mu)	2.66	1.86	2.96	1.37	2.16	2.04	1.25	3.09	1.43	0.95	1.63	0.66	1.38	1.04	0.57	1.73
Pu (kip)	33.46	27.92	34.96	27.12	31.07	29.50	27.29	35.11	17.97	13.94	18.66	13.44	17.07	15.19	12.79	18.96

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.71	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.60	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1295.59	1794.38	OK
BF Outside	1299.65	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.06	25.92	31.96	25.30	28.86	27.39	25.36	32.48
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1019.80
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1363.60	15.50	OK	926.07	10.52	OK
BF	1299.65	20.31	OK	305.46	4.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1289.71	14.66	1.47	137.48	OK
TF	2653.31	30.15	1.47	206.21	OK
TF Inside	1363.60	15.50	1.47	160.39	OK
BF Inside	1295.59	20.24	1.47	126.02	OK
BF	2595.24	40.55	1.47	206.21	OK
BF Outside	1299.65	20.31	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.11	17.56	OK	18.96	9.48	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.11	1.47	91.65	OK
Web SPL	17.56	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	NA
TF Inside	1.37	NA
BF Inside	1.35	1.38
BF Outside	1.41	1.38

Bolt	Shear	Slip	Bearing
TF	2.12	1.60	6.84
Web	2.06	1.78	2.61
BF	1.51	3.53	5.09

Plate	Shear	Flexure
Web	3.01	1.54

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 7147

Node 7147

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7147 L	72.00	50.00	3600.00	72.00	48.08	3462.00	96.00	50.00	4800.00
7147 R	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 7147 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	38.93	-1.36	24.19	4.41	38.22	-4.62	23.76	10.56	32.56	3.79	31.25	4.22	22.94	11.86	41.78	-7.30
ϕf Fnc (ksi)	50.00	48.08	50.00	50.00	50.00	47.96	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.89
f / ϕf Fnc	0.78	0.03	0.48	0.09	0.76	0.10	0.48	0.21	0.65	0.08	0.62	0.08	0.46	0.24	0.84	0.15
α	1.00	0.96	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	38.93		24.19		38.22		23.76		32.56		31.25		22.94		41.78	
Fcf (ksi)	44.46		37.50		44.11		37.50		41.28		40.62		37.50		45.89	
Fcf (kip)	2573.80		2170.66		2553.35		2170.66		2389.36		2351.42		2170.66		2656.24	
fncf (ksi)		-1.36		4.41		-4.62		10.56		3.79		4.22		11.86		-7.30
Rcf		1.14		1.55		1.15		1.58		1.27		1.30		1.63		1.10
Fncf (ksi)		-36.06		37.50		-35.97		37.50		37.50		37.50		37.50		-35.92
Fncf (kip)		-2596.50		2170.66		-2589.74		2170.66		2170.66		2170.66		2170.66		-2586.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	24.13	-0.96	18.16	2.73	23.85	-4.00	17.66	8.28	22.49	1.82	21.39	2.94	17.08	9.20	24.94	-5.74
Fs (ksi)	24.13	-0.96	18.16	2.73	23.85	-4.00	17.66	8.28	22.49	1.82	21.39	2.94	17.08	9.20	24.94	-5.74
Fs (kip)	1737.10	-68.97	1307.69	196.62	1716.93	-287.87	1271.40	596.28	1619.12	130.81	1540.28	211.75	1229.80	662.08	1795.91	-413.25

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2656.24	2170.66	1795.91	662.08
Comp	0.00	2596.50	0.00	413.25

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	463.00	374.07	677.11	266.55	416.52	403.09	314.48	547.13	324.55	280.25	494.35	185.76	310.24	282.23	219.62	402.52
Vuw (kip)	694.49	561.10	1015.67	399.83	624.78	604.64	471.72	820.69	---	---	---	---	---	---	---	---
Mv (k*ft)	477.46	385.76	698.27	274.88	429.54	415.69	324.30	564.22	223.13	192.67	339.87	127.71	213.29	194.03	150.99	276.73
Huw (kip)	2059.94	2128.34	1861.63	2600.37	2212.02	2213.22	2730.41	1817.98	1112.09	1002.87	952.70	1245.12	1166.62	1168.02	1261.26	921.77
Muw (k*ft)	2944.88	1962.22	3164.07	1332.84	2334.26	2248.75	1159.46	3449.81	1605.39	987.62	1782.04	600.11	1322.94	1180.92	504.64	1963.69
Mu (k*ft)	3422.34	2347.97	3862.34	1607.72	2763.80	2664.44	1483.76	4014.03	1828.52	1180.28	2121.91	727.82	1536.23	1374.95	655.63	2240.42

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 7147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.21	14.68	12.84	17.93	15.26	15.26	18.83	12.54	7.67	6.92	6.57	8.59	8.05	8.06	8.70	6.36
PY1 (Vuw)	4.79	3.87	7.00	2.76	4.31	4.17	3.25	5.66	2.24	1.93	3.41	1.28	2.14	1.95	1.51	2.78
PX2 (Mu)	18.36	12.59	20.72	8.62	14.82	14.29	7.96	21.53	9.81	6.33	11.38	3.90	8.24	7.38	3.52	12.02
PY2 (Mu)	2.62	1.80	2.96	1.23	2.12	2.04	1.14	3.08	1.40	0.90	1.63	0.56	1.18	1.05	0.50	1.72
Pu (kip)	33.40	27.86	35.00	26.86	30.76	30.20	27.15	35.17	17.85	13.55	18.65	12.63	16.62	15.72	12.38	18.92

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1291.14	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1365.11	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1296.22	1794.38	OK
BF Outside	1300.28	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.00	25.86	32.01	25.05	28.56	28.05	25.24	32.52
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1015.67
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1365.11	15.51	OK	922.96	10.49	OK
BF	1300.28	20.32	OK	331.56	5.18	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1291.14	14.67	1.47	137.48	OK
TF	2656.24	30.18	1.47	206.21	OK
TF Inside	1365.11	15.51	1.47	160.39	OK
BF Inside	1296.22	20.25	1.47	126.02	OK
BF	2596.50	40.57	1.47	206.21	OK
BF Outside	1300.28	20.32	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.17	17.59	OK	18.92	9.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.17	1.47	91.65	OK
Web SPL	17.59	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	NA
TF Inside	1.37	NA
BF Inside	1.35	1.38
BF Outside	1.41	1.38

Bolt	Shear	Slip	Bearing
TF	2.12	1.60	6.83
Web	2.06	1.78	2.61
BF	1.51	3.25	5.08

Plate	Shear	Flexure
Web	3.02	1.54

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9147	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9147

Node 9147

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9147 L	72.00	50.00	3600.00	72.00	48.12	3464.97	96.00	50.00	4800.00
9147 R	80.00	50.00	4000.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 9147 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.25	---	72.00	52.88	57.88	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9147**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	35.03	-0.34	20.17	4.36	30.02	-0.87	20.07	11.42	28.34	2.70	27.12	6.38	18.45	13.31	38.66	-8.07
ϕf Fnc (ksi)	50.00	48.12	50.00	50.00	50.00	48.09	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.85
f / ϕf Fnc	0.70	0.01	0.40	0.09	0.60	0.02	0.40	0.23	0.57	0.05	0.54	0.13	0.37	0.27	0.77	0.17
α	1.00	0.96	1.00	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96
fcf (ksi)	35.03		20.17		30.02		20.07		28.34		27.12		18.45		38.66	
Fcf (ksi)	42.52		37.50		40.01		37.50		39.17		38.56		37.50		44.33	
Fcf (kip)	2460.96		2170.66		2315.96		2170.66		2267.22		2232.09		2170.66		2566.06	
fncf (ksi)		-0.34		4.36		-0.87		11.42		2.70		6.38		13.31		-8.07
Rcf		1.21		1.86		1.33		1.87		1.38		1.42		2.03		1.15
Fncf (ksi)		-36.09		37.50		-36.07		37.50		37.50		37.50		37.50		-35.89
Fncf (kip)		-2598.73		2170.66		-2597.01		2170.66		2170.66		2170.66		2170.66		-2583.90

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.37	-0.11	15.23	2.57	19.70	-1.55	14.95	8.88	19.48	-1.52	18.93	4.44	13.88	10.29	22.51	-6.19
Fs (ksi)	21.37	-0.11	15.23	2.57	19.70	-1.55	14.95	8.88	19.48	-1.52	18.93	4.44	13.88	10.29	22.51	-6.19
Fs (kip)	1538.49	-8.05	1096.55	185.19	1418.50	-111.86	1076.41	639.55	1402.38	-109.57	1362.79	319.87	999.23	741.00	1620.88	-446.00

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2566.06	2170.66	1620.88	741.00
Comp	0.00	2598.73	0.00	446.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	384.72	299.23	587.31	172.22	393.29	276.16	213.36	459.75	270.23	228.48	432.01	120.09	294.93	193.53	149.16	341.88
Vuw (kip)	577.09	448.85	880.96	258.32	589.94	414.25	320.04	689.62	---	---	---	---	---	---	---	---
Mv (k*ft)	396.75	308.58	605.66	177.60	405.58	284.79	220.03	474.11	185.79	157.08	297.01	82.56	202.77	133.05	102.55	235.05
Huw (kip)	2021.21	2189.04	1864.93	2824.15	2059.26	2286.66	3098.64	1683.61	1020.29	854.49	871.09	1143.97	861.87	1121.77	1160.15	783.25
Muw (k*ft)	2747.00	1881.28	2634.73	1034.46	2267.85	1886.98	668.48	3429.54	1374.70	810.09	1360.32	388.32	1343.96	927.04	229.53	1837.23
Mu (k*ft)	3143.74	2189.87	3240.40	1212.06	2673.43	2171.77	888.51	3903.65	1560.48	967.17	1657.33	470.89	1546.73	1060.10	332.08	2072.27

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.94	15.10	12.86	19.48	14.20	15.77	21.37	11.61	7.04	5.89	6.01	7.89	5.94	7.74	8.00	5.40
PY1 (Vuw)	3.98	3.10	6.08	1.78	4.07	2.86	2.21	4.76	1.86	1.58	2.98	0.83	2.03	1.33	1.03	2.36
PX2 (Mu)	16.86	11.75	17.38	6.50	14.34	11.65	4.77	20.94	8.37	5.19	8.89	2.53	8.30	5.69	1.78	11.12
PY2 (Mu)	2.41	1.68	2.48	0.93	2.05	1.66	0.68	2.99	1.20	0.74	1.27	0.36	1.19	0.81	0.25	1.59
Pu (kip)	31.46	27.26	31.43	26.12	29.19	27.79	26.29	33.46	15.71	11.32	15.49	10.48	14.60	13.59	9.87	16.98

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1247.30	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1318.76	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1083.63	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1087.03	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2160.00	OK
TF Inside	0.00	2283.75	OK
BF Inside	1297.33	1794.38	OK
BF Outside	1301.40	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.31	25.43	28.80	24.43	27.11	25.96	24.51	31.09
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	880.96
Rr (kip)	3071.14
Check	OK

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.19	1.00	1.0	36.19
BF	0.50	0.85	1.0	30.62

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1318.76	14.99	OK	833.01	9.47	OK
BF	1301.40	20.33	OK	371.08	5.80	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1247.30	14.17	1.47	137.48	OK
TF	2566.06	29.16	1.47	206.21	OK
TF Inside	1318.76	14.99	1.47	160.39	OK
BF Inside	1297.33	20.27	1.47	126.02	OK
BF	2598.73	40.61	1.47	206.21	OK
BF Outside	1301.40	20.33	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.46	16.73	OK	16.98	8.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.46	1.47	91.65	OK
Web SPL	16.73	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.47	NA
TF Inside	1.41	NA
BF Inside	1.35	1.38
BF Outside	1.41	1.38

Bolt	Shear	Slip	Bearing
TF	2.20	1.78	7.07
Web	2.16	1.98	2.74
BF	1.51	2.90	5.08

Plate	Shear	Flexure
Web	3.49	1.61

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1234	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1234

Node 1234

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1234 L	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00
1234 R	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1234 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1234**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.90	9.21	-5.04	2.93	-5.02	5.17	-7.29	13.77	12.98	-14.15	-9.34	18.16	-11.05	24.42	16.00	-19.20
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.43	50.00	50.00	50.00	50.00	50.00	47.40
f / ϕf Fnc	0.08	0.18	0.10	0.06	0.10	0.10	0.15	0.28	0.26	0.30	0.19	0.36	0.22	0.49	0.32	0.40
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		9.21	-5.04			5.17		13.77		-14.15		18.16		24.42		-19.20
Fcf (ksi)		37.50	-37.50			37.50		37.50		-35.58		37.50		37.50		-35.55
Fcf (kip)		2653.03	-3300.00			2653.03		2653.03		-3130.70		2653.03		2653.03		-3128.67
fncf (ksi)	-3.90			2.93	-5.02		-7.29		12.98		-9.34		-11.05		16.00	
Rcf	4.07			7.44	7.25		2.72		2.51		2.06		1.54		1.85	
Fncf (ksi)	-37.50			37.50	-37.50		-37.50		37.50		-37.50		-37.50		37.50	
Fncf (kip)	-3300.00			2653.03	-3300.00		-3300.00		2653.03		-3300.00		-3300.00		2653.03	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.41	5.90	-3.73	1.98	-3.72	3.57	-5.13	9.84	3.02	-8.82	-6.59	12.94	-7.97	17.16	4.17	-11.76
Fs (ksi)	-2.41	5.90	-3.73	1.98	-3.72	3.57	-5.13	9.84	3.02	-8.82	-6.59	12.94	-7.97	17.16	4.17	-11.76
Fs (kip)	-211.75	519.42	-328.12	174.37	-327.11	313.83	-451.76	865.69	265.65	-775.89	-579.65	1138.77	-701.59	1510.29	366.67	-1034.73

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	366.67	1510.29
Comp	3300.00	3130.70	701.59	1034.73

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	419.10	467.36	696.60	136.84	402.65	395.98	352.87	429.24	305.35	342.82	504.79	105.93	297.11	289.02	261.93	312.52
Vuw (kip)	628.64	701.04	1035.99	205.27	603.98	593.97	529.31	643.85	---	---	---	---	---	---	---	---
Mv (k*ft)	432.19	481.97	712.24	141.12	415.24	408.35	363.90	442.65	209.93	235.69	347.04	72.83	204.26	198.70	180.08	214.85
Huw (kip)	1036.86	-753.33	52.16	847.40	-142.03	873.91	985.63	-284.50	167.82	-83.86	-7.24	225.78	-278.31	304.97	441.11	-364.39
Muw (k*ft)	3417.53	3795.56	4730.46	3670.14	4364.37	3634.79	3485.82	4171.47	531.76	365.45	466.14	958.15	757.48	1249.76	1608.64	1019.20
Mu (k*ft)	3849.72	4277.53	5442.70	3811.26	4779.61	4043.14	3849.72	4614.12	741.69	601.14	813.18	1030.97	961.74	1448.46	1788.72	1234.05

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	7.15	5.20	0.36	5.84	0.98	6.03	6.80	1.96	1.16	0.58	0.05	1.56	1.92	2.10	3.04	2.51
PY1 (Vuw)	4.34	4.83	7.14	1.42	4.17	4.10	3.65	4.44	2.11	2.36	3.48	0.73	2.05	1.99	1.81	2.16
PX2 (Mu)	20.65	22.94	29.19	20.44	25.64	21.69	20.65	24.75	3.98	3.22	4.36	5.53	5.16	7.77	9.59	6.62
PY2 (Mu)	2.95	3.28	4.17	2.92	3.66	3.10	2.95	3.54	0.57	0.46	0.62	0.79	0.74	1.11	1.37	0.95
Pu (kip)	28.74	29.29	31.65	26.64	27.74	28.63	28.23	27.88	5.79	4.74	6.03	7.25	7.61	10.35	13.03	9.64

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1562.90	1794.38	OK
BF Outside	1567.80	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.65	27.05	28.61	25.24	25.74	26.61	26.32	25.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1035.99
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1234**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.87	1.0	31.37
Web	0.00	1.00	1.0	36.19
BF	0.50	0.86	1.0	31.02

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	360.56	4.10	OK
BF	1567.80	24.50	OK	756.33	11.82	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1562.90	24.42	1.47	126.02	OK
BF	3130.70	48.92	1.47	252.04	OK
BF Outside	1567.80	24.50	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.65	15.82	OK	13.03	6.52	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.65	1.47	91.65	OK
Web SPL	15.82	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.63	4.11	6.72
Web	2.29	2.58	2.90
BF	1.27	1.42	4.68

Plate	Shear	Flexure
Web	2.96	1.75

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3234	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3234

Node 3234

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3234 L	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00
3234 R	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3234 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3234**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.63	3.97	-7.88	7.85	-5.36	3.01	-7.93	11.88	7.62	-9.84	-10.28	15.73	-11.48	21.91	12.86	-17.11
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.38	50.00	50.00	50.00	50.00	50.00	47.37
f / ϕf Fnc	0.05	0.08	0.16	0.16	0.11	0.06	0.16	0.24	0.15	0.21	0.21	0.31	0.23	0.44	0.26	0.36
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		3.97	-7.88		-5.36			11.88		-9.84		15.73		21.91		-17.11
Fcf (ksi)		37.50	-37.50		-37.50			37.50		-35.54		37.50		37.50		-35.53
Fcf (kip)		2653.03	-3300.00		-3300.00			2653.03		-3127.14		2653.03		2653.03		-3126.51
fncf (ksi)	-2.63			7.85		3.01	-7.93		7.62		-10.28		-11.48		12.86	
Rcf	9.44			4.76		6.99	3.16		3.61		2.38		1.71		2.08	
Fncf (ksi)	-37.50			37.50		37.50	-37.50		37.50		-37.50		-37.50		37.50	
Fncf (kip)	-3300.00			2653.03		2653.03	-3300.00		2653.03		-3300.00		-3300.00		2653.03	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.90	2.82	-5.82	5.60	-4.20	2.48	-5.76	8.56	-0.57	-5.90	-7.43	11.29	-8.36	15.54	1.97	-10.31
Fs (ksi)	-2.90	2.82	-5.82	5.60	-4.20	2.48	-5.76	8.56	-0.57	-5.90	-7.43	11.29	-8.36	15.54	1.97	-10.31
Fs (kip)	-254.96	248.00	-511.82	492.69	-369.19	217.98	-507.05	753.71	-49.72	-519.29	-653.52	993.09	-735.89	1367.09	173.65	-907.68

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	173.65	1367.09
Comp	3300.00	3127.14	735.89	907.68

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	434.20	617.61	810.92	177.61	464.78	562.02	437.72	479.57	313.93	447.89	584.47	132.64	339.92	404.24	320.80	345.98
Vuw (kip)	651.30	926.41	1093.15	266.41	697.17	843.03	656.58	719.35	---	---	---	---	---	---	---	---
Mv (k*ft)	447.77	636.91	751.54	183.16	479.30	579.58	451.40	494.55	215.83	307.93	401.82	91.19	233.69	277.91	220.55	237.86
Huw (kip)	608.89	-7.87	-790.35	598.80	-384.23	623.24	856.49	-423.89	-3.80	-10.43	-82.48	134.54	-310.37	185.22	344.29	-400.38
Muw (k*ft)	3988.15	4789.51	3746.20	4001.60	4036.26	3969.01	3658.01	3982.46	365.79	730.55	427.03	916.91	341.50	1197.54	1529.44	786.42
Mu (k*ft)	4435.92	5426.42	4497.74	4184.76	4515.56	4548.59	4109.40	4477.02	581.61	1038.48	828.85	1008.10	575.19	1475.45	1749.98	1024.28

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3234**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.20	0.05	5.45	4.13	2.65	4.30	5.91	2.92	0.03	0.07	0.57	0.93	2.14	1.28	2.37	2.76
PY1 (Vuw)	4.49	6.39	7.54	1.84	4.81	5.81	4.53	4.96	2.17	3.09	4.03	0.91	2.34	2.79	2.21	2.39
PX2 (Mu)	23.79	29.11	24.13	22.45	24.22	24.40	22.04	24.01	3.12	5.57	4.45	5.41	3.09	7.91	9.39	5.49
PY2 (Mu)	3.40	4.16	3.45	3.21	3.46	3.49	3.15	3.43	0.45	0.80	0.64	0.77	0.44	1.13	1.34	0.78
Pu (kip)	29.08	31.01	31.55	27.05	28.11	30.17	28.98	28.21	4.09	6.85	6.85	6.56	5.92	9.99	12.29	8.84

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1561.12	1794.38	OK
BF Outside	1566.02	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.95	28.24	28.44	25.58	25.92	27.63	26.84	25.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1093.15
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3234**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.87	1.0	31.37
Web	0.00	1.00	1.0	36.19
BF	0.50	0.86	1.0	31.02

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	378.19	4.30	OK
BF	1566.02	24.47	OK	684.61	10.70	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1561.12	24.39	1.47	126.02	OK
BF	3127.14	48.86	1.47	252.04	OK
BF Outside	1566.02	24.47	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.55	15.78	OK	12.29	6.14	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.55	1.47	91.65	OK
Web SPL	15.78	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.63	3.92	6.72
Web	2.29	2.74	2.90
BF	1.27	1.57	4.68

Plate	Shear	Flexure
Web	2.81	1.76

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5233	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5233

Node 5233

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

Rh = 1.00

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5233 L	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00
5233 R	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00

Controlling Section = 5233 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5233**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.28	1.91	-9.64	10.61	-7.37	5.71	-8.76	11.49	1.79	-3.59	-9.11	10.25	-12.38	21.64	11.25	-15.20
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.25	50.00	50.00	50.00	50.00	50.00	47.37
f / ϕf Fnc	0.03	0.04	0.19	0.21	0.15	0.11	0.18	0.23	0.04	0.08	0.18	0.20	0.25	0.43	0.23	0.32
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		1.91		10.61	-7.37			11.49		-3.59		10.25		21.64		-15.20
Fcf (ksi)		37.50		37.50	-37.50			37.50		-35.44		37.50		37.50		-35.53
Fcf (kip)		2653.03		2653.03	-3300.00			2653.03		-3118.36		2653.03		2653.03		-3126.20
fncf (ksi)	-1.28		-9.64			5.71	-8.76		1.79		-9.11		-12.38		11.25	
Rcf	19.61		3.53			5.09	3.26		9.87		3.66		1.73		2.34	
Fncf (ksi)	-37.50		-37.50			37.50	-37.50		37.50		-37.50		-37.50		37.50	
Fncf (kip)	-3300.00		-3300.00			2653.03	-3300.00		2653.03		-3300.00		-3300.00		2653.03	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.42	1.70	-7.12	7.72	-5.48	4.24	-6.50	8.34	-2.83	-1.74	-6.75	7.46	-9.02	15.49	-0.95	-9.00
Fs (ksi)	-3.42	1.70	-7.12	7.72	-5.48	4.24	-6.50	8.34	-2.83	-1.74	-6.75	7.46	-9.02	15.49	-0.95	-9.00
Fs (kip)	-300.95	149.95	-626.66	679.09	-482.63	372.79	-572.15	733.96	-249.29	-153.40	-593.98	656.49	-793.71	1363.27	-83.56	-792.31

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	0.00	1363.27
Comp	3300.00	3126.20	793.71	792.31

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	432.06	624.19	828.47	180.78	490.47	616.83	475.13	487.42	317.07	447.11	597.14	133.83	358.34	441.91	347.50	350.48
Vuw (kip)	648.08	936.28	1101.93	271.17	735.71	925.24	712.70	731.13	---	---	---	---	---	---	---	---
Mv (k*ft)	445.56	643.69	757.58	186.43	505.80	636.10	489.98	502.65	217.98	307.39	410.54	92.01	246.36	303.81	238.91	240.96
Huw (kip)	595.38	165.06	-407.17	427.93	-855.00	199.39	770.33	-442.43	-82.36	28.60	-59.91	88.26	-219.65	34.10	310.67	-477.75
Muw (k*ft)	4006.16	4579.92	4257.11	4229.42	3395.80	4534.14	3772.89	3957.30	327.92	949.63	622.12	949.90	69.74	909.43	1568.71	515.45
Mu (k*ft)	4451.72	5223.62	5014.69	4415.85	3901.60	5170.25	4262.87	4459.96	545.91	1257.02	1032.66	1041.91	316.10	1213.24	1807.62	756.41

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5233**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.11	1.14	2.81	2.95	5.90	1.38	5.31	3.05	0.57	0.20	0.41	0.61	1.51	0.24	2.14	3.29
PY1 (Vuw)	4.47	6.46	7.60	1.87	5.07	6.38	4.92	5.04	2.19	3.08	4.12	0.92	2.47	3.05	2.40	2.42
PX2 (Mu)	23.88	28.02	26.90	23.69	20.93	27.73	22.87	23.92	2.93	6.74	5.54	5.59	1.70	6.51	9.70	4.06
PY2 (Mu)	3.41	4.00	3.84	3.38	2.99	3.96	3.27	3.42	0.42	0.96	0.79	0.80	0.24	0.93	1.39	0.58
Pu (kip)	29.07	30.98	31.83	27.15	28.01	30.89	29.34	28.27	4.36	8.03	7.72	6.43	4.20	7.83	12.43	7.94

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1560.66	1794.38	OK
BF Outside	1565.55	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.95	28.19	28.66	25.68	25.76	28.14	27.09	26.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1101.93
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5233**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.87	1.0	31.37
Web	0.00	1.00	1.0	36.19
BF	0.50	0.86	1.0	31.02

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	407.91	4.64	OK
BF	1565.55	24.46	OK	682.70	10.67	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1560.66	24.39	1.47	126.02	OK
BF	3126.20	48.85	1.47	252.04	OK
BF Outside	1565.55	24.46	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.83	15.92	OK	12.43	6.21	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.83	1.47	91.65	OK
Web SPL	15.92	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.63	3.63	6.72
Web	2.27	2.71	2.88
BF	1.27	1.58	4.68

Plate	Shear	Flexure
Web	2.79	1.74

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7233	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7233

Node 7233

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7233 L	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00
7233 R	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7233 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7233**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.83	4.88	-11.33	11.84	-9.34	8.57	-10.89	13.47	-9.21	8.94	-4.80	4.00	-14.33	23.73	8.87	-12.86
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.34
f / ϕf Fnc	0.08	0.10	0.23	0.24	0.19	0.17	0.22	0.27	0.18	0.18	0.10	0.08	0.29	0.47	0.18	0.27
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)		4.88		11.84	-9.34			13.47	-9.21		-4.80			23.73		-12.86
Fcf (ksi)		37.50		37.50	-37.50			37.50	-37.50		-37.50			37.50		-35.51
Fcf (kip)		2653.03		2653.03	-3300.00			2653.03	-3300.00		-3300.00			2653.03		-3124.75
fncf (ksi)	-3.83		-11.33			8.57	-10.89			8.94		4.00	-14.33		8.87	
Rcf	7.68		3.17			4.02	2.78			4.07		7.81	1.58		2.76	
Fncf (ksi)	-37.50		-37.50			37.50	-37.50			37.50		37.50	-37.50		37.50	
Fncf (kip)	-3300.00		-3300.00			2653.03	-3300.00			2653.03		2653.03	-3300.00		2653.03	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.14	3.84	-8.45	8.57	-6.90	6.38	-8.14	9.73	-6.81	6.64	-5.92	3.38	-10.43	17.09	-2.64	-7.36
Fs (ksi)	-5.14	3.84	-8.45	8.57	-6.90	6.38	-8.14	9.73	-6.81	6.64	-5.92	3.38	-10.43	17.09	-2.64	-7.36
Fs (kip)	-452.19	337.50	-743.54	754.49	-607.31	561.73	-716.07	856.15	-599.35	584.30	-520.70	297.32	-917.61	1503.94	-232.08	-647.57

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2653.03	0.00	1503.94
Comp	3300.00	3124.75	917.61	647.57

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	393.49	474.81	762.03	89.56	426.48	387.23	386.18	412.74	289.30	339.25	549.68	67.06	312.61	277.37	284.13	295.40
Vuw (kip)	590.23	712.22	1068.71	134.34	639.72	580.85	579.26	619.11	---	---	---	---	---	---	---	---
Mv (k*ft)	405.79	489.65	734.74	92.36	439.81	399.33	398.24	425.64	198.89	233.24	377.90	46.11	214.92	190.69	195.34	203.09
Huw (kip)	387.32	76.60	-147.40	344.80	-53.48	-300.95	712.99	-528.26	-62.56	5.97	-24.86	76.40	-8.21	-121.85	319.82	-479.81
Muw (k*ft)	4283.57	4697.87	4603.47	4340.27	4728.70	4398.74	3849.35	3840.75	574.32	1089.47	850.21	1143.43	860.83	594.92	1761.13	302.17
Mu (k*ft)	4689.36	5187.51	5338.20	4432.63	5168.50	4798.07	4247.59	4266.39	773.21	1322.71	1228.11	1189.54	1075.75	785.62	1956.47	505.26

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7233**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	2.67	0.53	1.02	2.38	0.37	2.08	4.92	3.64	0.43	0.04	0.17	0.53	0.06	0.84	2.21	3.31
PY1 (Vuw)	4.07	4.91	7.37	0.93	4.41	4.01	3.99	4.27	2.00	2.34	3.79	0.46	2.16	1.91	1.96	2.04
PX2 (Mu)	25.15	27.83	28.63	23.78	27.72	25.74	22.78	22.88	4.15	7.09	6.59	6.38	5.77	4.21	10.49	2.71
PY2 (Mu)	3.59	3.98	4.09	3.40	3.96	3.68	3.25	3.27	0.59	1.01	0.94	0.91	0.82	0.60	1.50	0.39
Pu (kip)	28.86	29.71	31.79	26.51	29.31	28.85	28.63	27.58	5.26	7.88	8.25	7.04	6.54	5.65	13.16	6.49

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1324.44	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1328.59	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1559.93	1794.38	OK
BF Outside	1564.82	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.84	27.44	28.67	25.24	27.19	26.85	26.64	25.55
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1068.71
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7233**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.87	1.0	31.37
Web	0.00	1.00	1.0	36.19
BF	0.50	0.86	1.0	31.02

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	471.58	5.36	OK
BF	1564.82	24.45	OK	753.15	11.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1559.93	24.37	1.47	126.02	OK
BF	3124.75	48.82	1.47	252.04	OK
BF Outside	1564.82	24.45	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.79	15.89	OK	13.16	6.58	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.79	1.47	91.65	OK
Web SPL	15.89	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.11	1.15
BF Outside	1.15	1.15

Bolt	Shear	Slip	Bearing
TF	1.63	3.14	6.72
Web	2.28	2.56	2.88
BF	1.27	1.43	4.69

Plate	Shear	Flexure
Web	2.87	1.74

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9232	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9232

Node 9232

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	88
Web	145
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9232 L	88.00	50.00	4400.00	88.00	50.00	4400.00	96.00	50.00	4800.00
9232 R	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9232 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.75	---	88.00	64.63	70.75	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.75	---	88.00	64.63	70.75	50	65
Splice Plates	TF Outside	32.00	1.500	68.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.750	68.50	50.75	35.88	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9232**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.66	14.99	-11.25	9.55	-5.90	5.31	-11.95	15.40	-11.81	16.26	3.85	-4.30	-14.74	25.91	9.41	-12.66
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.43	50.00	50.00	50.00	47.37
f / ϕf Fnc	0.19	0.30	0.22	0.19	0.12	0.11	0.24	0.31	0.24	0.33	0.08	0.09	0.29	0.52	0.19	0.27
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95
fcf (ksi)		14.99	-11.25		-5.90			15.40		16.26		-4.30		25.91		-12.66
Fcf (ksi)		37.50	-37.50		-37.50			37.50		37.50		-35.57		37.95		-35.53
Fcf (kip)		2653.03	-3300.00		-3300.00			2653.03		2653.03		-3130.21		2685.15		-3126.27
fncf (ksi)	-9.66			9.55		5.31	-11.95		-11.81		3.85		-14.74		9.41	
Rcf	2.50			3.33		6.35	2.44		2.31		8.28		1.46		2.81	
Fncf (ksi)	-37.50			37.50		37.50	-37.50		-37.50		37.50		-37.50		37.50	
Fncf (kip)	-3300.00			2653.03		2653.03	-3300.00		-3300.00		2653.03		-3300.00		2653.03	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.61	10.09	-8.27	6.78	-5.89	4.44	-8.76	10.91	-8.44	11.74	-4.98	-2.33	-10.51	18.56	-2.96	-7.35
Fs (ksi)	-6.61	10.09	-8.27	6.78	-5.89	4.44	-8.76	10.91	-8.44	11.74	-4.98	-2.33	-10.51	18.56	-2.96	-7.35
Fs (kip)	-581.45	887.78	-727.42	596.85	-518.74	390.74	-771.27	960.33	-742.37	1033.01	-437.81	-204.63	-924.59	1633.04	-260.74	-646.87

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2653.03	2685.15	0.00	1633.04
Comp	3300.00	3130.21	924.59	646.87

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	206.98	196.87	481.34	75.56	276.26	189.26	171.26	217.00	155.82	140.87	349.66	51.61	204.77	135.50	130.58	155.09
Vuw (kip)	310.46	295.30	722.01	113.34	414.39	283.89	256.89	325.49	---	---	---	---	---	---	---	---
Mv (k*ft)	213.44	203.02	496.38	77.92	284.89	195.18	176.61	223.78	107.12	96.85	240.39	35.48	140.78	93.15	89.77	106.63
Huw (kip)	640.07	-271.42	-180.66	402.72	492.87	-177.17	785.56	-438.18	167.09	-71.22	-69.82	103.13	158.53	-350.42	386.43	-495.06
Muw (k*ft)	3946.57	4438.11	4559.12	4263.04	4142.85	4316.81	3810.70	3963.07	1068.53	963.11	661.44	1259.34	1291.19	169.58	1860.10	280.82
Mu (k*ft)	4160.01	4641.13	5055.50	4340.96	4427.74	4511.98	3987.32	4186.84	1175.65	1059.96	901.83	1294.82	1431.96	262.74	1949.87	387.45

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.41	1.87	1.25	2.78	3.40	1.22	5.42	3.02	1.15	0.49	0.48	0.71	1.09	2.42	2.67	3.41
PY1 (Vuw)	2.14	2.04	4.98	0.78	2.86	1.96	1.77	2.24	1.07	0.97	2.41	0.36	1.41	0.93	0.90	1.07
PX2 (Mu)	22.31	24.89	27.12	23.28	23.75	24.20	21.39	22.46	6.31	5.69	4.84	6.95	7.68	1.41	10.46	2.08
PY2 (Mu)	3.19	3.56	3.87	3.33	3.39	3.46	3.06	3.21	0.90	0.81	0.69	0.99	1.10	0.20	1.49	0.30
Pu (kip)	27.25	27.34	29.71	26.38	27.86	25.99	27.24	26.06	7.72	6.43	6.16	7.77	9.13	3.99	13.34	5.66

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1289.57	2280.00	1833.00	96.00	62.53	30.84	3489.82	1833.00	OK
TF Inside	1363.45	2410.63	1865.50	224.00	145.91	25.59	5731.41	1865.50	OK
BF Inside	1340.47	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1344.67	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1604.05	2160.00	OK
TF Inside	1695.95	2283.75	OK
BF Inside	1562.66	1794.38	OK
BF Outside	1567.56	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	25.72	25.85	27.42	25.13	26.16	24.57	25.75	24.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	722.01
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.87	1.0	31.37
Web	0.00	1.00	1.0	36.19
BF	0.50	0.86	1.0	31.02

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1695.95	19.27	OK	475.17	5.40	OK
BF	1567.56	24.49	OK	817.80	12.78	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1604.05	18.23	1.47	137.48	OK
TF	3300.00	37.50	1.47	252.04	OK
TF Inside	1695.95	19.27	1.47	160.39	OK
BF Inside	1562.66	24.42	1.47	126.02	OK
BF	3130.21	48.91	1.47	252.04	OK
BF Outside	1567.56	24.49	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
29.71	14.86	OK	13.34	6.67	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	29.71	1.47	91.65	OK
Web SPL	14.86	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.42	1.35
TF Inside	1.37	1.35
BF Inside	1.09	1.15
BF Outside	1.14	1.15

Bolt	Shear	Slip	Bearing
TF	1.63	3.12	6.72
Web	2.44	2.52	3.08
BF	1.27	1.32	4.68

Plate	Shear	Flexure
Web	4.25	1.82

Field Splice

Type G

Field Splice - Node 1095

Node 1095

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1095 L	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00
1095 R	99.00	50.00	4950.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1095 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	29.47	2.93	19.50	3.20	18.43	10.43	27.12	2.10	29.33	3.80	26.31	2.88	18.27	11.69	36.34	-8.81
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.64
f / ϕf Fnc	0.59	0.06	0.39	0.06	0.37	0.21	0.54	0.04	0.59	0.08	0.53	0.06	0.37	0.23	0.73	0.18
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	29.47		19.50		18.43		27.12		29.33		26.31		18.27		36.34	
Fcf (ksi)	39.73		37.50		37.50		38.56		39.67		38.15		37.50		43.17	
Fcf (kip)	2759.38		2604.28		2604.28		2677.82		2754.64		2649.75		2604.28		2997.94	
fncf (ksi)		2.93		3.20		10.43		2.10		3.80		2.88		11.69		-8.81
Rcf		1.35		1.92		2.03		1.42		1.35		1.45		2.05		1.19
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-36.48
Fncf (kip)		2604.28		2604.28		2604.28		2604.28		2604.28		2604.28		2604.28		-3283.09

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.44	1.47	14.85	2.37	14.87	6.47	18.47	1.24	19.91	2.44	17.80	1.82	13.50	8.33	26.66	-6.30
Fs (ksi)	19.44	1.47	14.85	2.37	14.87	6.47	18.47	1.24	19.91	2.44	17.80	1.82	13.50	8.33	26.66	-6.30
Fs (kip)	1749.62	132.38	1336.58	213.69	1338.34	582.23	1661.87	111.50	1792.32	219.22	1602.17	163.95	1214.90	750.14	2399.82	-566.86

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2997.94	2604.28	2399.82	750.14
Comp	0.00	3283.09	0.00	566.86

$\phi v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	329.03	303.33	142.94	596.41	309.09	321.64	252.26	459.28	243.16	222.63	109.32	432.07	229.06	235.57	186.55	335.18
Vuw (kip)	493.55	454.99	214.41	894.62	463.63	482.46	378.39	688.92	---	---	---	---	---	---	---	---
Mv (k*ft)	339.32	312.81	147.41	615.05	318.75	331.69	260.14	473.63	167.17	153.06	75.15	297.05	157.48	161.96	128.26	230.44
Huw (kip)	2883.54	2880.75	3875.09	2741.87	2956.85	2793.44	4058.41	2158.27	1380.13	1136.87	1408.42	1300.47	1475.13	1295.16	1441.03	1344.17
Muw (k*ft)	3148.36	2759.00	1433.22	3130.54	3038.61	2990.66	1188.79	4719.95	1581.30	1097.94	739.31	1515.92	1538.14	1406.25	454.43	2900.76
Mu (k*ft)	3487.68	3071.81	1580.62	3745.59	3357.36	3322.35	1448.93	5193.58	1748.47	1251.00	814.47	1812.97	1695.63	1568.21	582.69	3131.19

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.89	19.87	26.72	18.91	20.39	19.27	27.99	14.88	9.52	7.84	9.71	8.97	10.17	8.93	9.94	9.27
PY1 (Vuw)	3.40	3.14	1.48	6.17	3.20	3.33	2.61	4.75	1.68	1.54	0.75	2.98	1.58	1.62	1.29	2.31
PX2 (Mu)	18.71	16.48	8.48	20.09	18.01	17.82	7.77	27.86	9.38	6.71	4.37	9.72	9.10	8.41	3.13	16.80
PY2 (Mu)	2.67	2.35	1.21	2.87	2.57	2.55	1.11	3.98	1.34	0.96	0.62	1.39	1.30	1.20	0.45	2.40
Pu (kip)	39.07	36.76	35.31	40.03	38.83	37.55	35.95	43.63	19.14	14.76	14.15	19.20	19.48	17.57	13.18	26.49

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1504.19	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1493.75	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1753.11	1856.25	OK
BF Outside	1529.98	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.63	34.45	33.09	37.06	36.42	35.19	33.58	40.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	894.62
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1504.19	15.04	OK	1204.09	12.04	OK
BF	1753.11	25.04	OK	400.56	5.72	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.19	15.04	1.47	137.48	OK
TF	2997.94	29.98	1.47	229.13	OK
TF Inside	1493.75	14.94	1.47	148.93	OK
BF Inside	1753.11	25.04	1.47	114.56	OK
BF	3283.09	46.90	1.47	229.13	OK
BF Outside	1529.98	21.86	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.63	21.81	OK	26.49	13.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.63	1.47	126.02	OK
Web SPL	21.81	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.32	NA
TF Inside	1.27	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.21	1.40	7.64
Web	1.66	1.27	2.89
BF	1.31	2.94	4.19

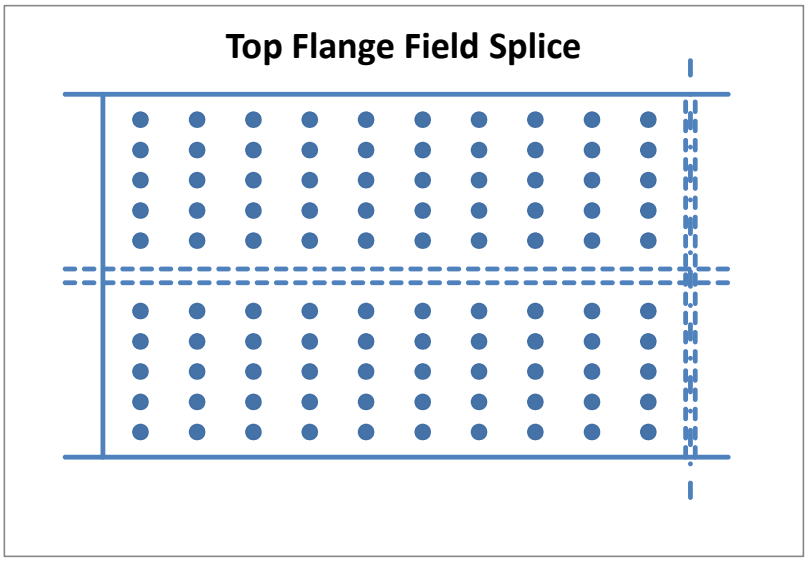
Plate	Shear	Flexure
Web	3.43	1.22

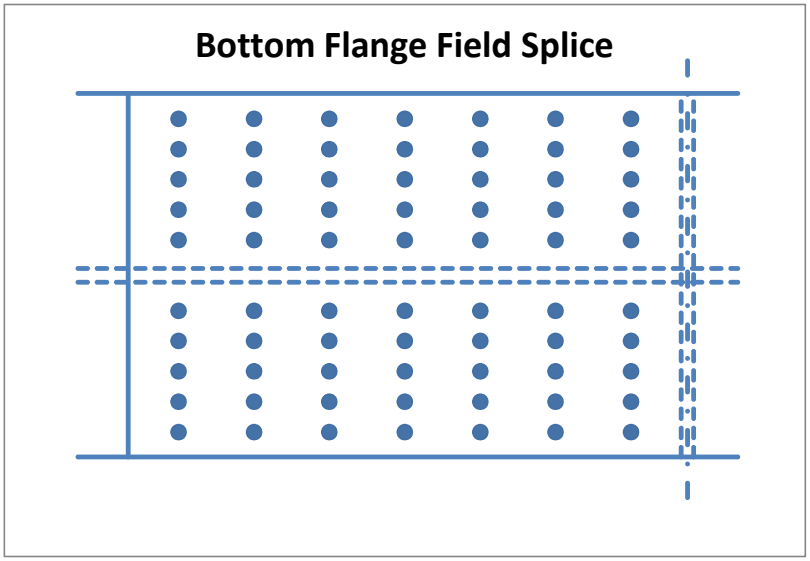
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1095	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1095

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	19	0	19
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	19	3	19
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	19	6	19
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	19	9	19
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	19	12	19
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	19	15	19
15	22	15	22
15	25	15	25
15	28	15	28

	Top Flange		Bottom Flange	
No. Bolts =	100.0		70.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





15	31	15	31
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	19	18	19
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
21	0		
21	3		
21	6		
21	9		
21	12		
21	19		
21	22		
21	25		
21	28		
21	31		
24	0		
24	3		
24	6		
24	9		
24	12		
24	19		
24	22		
24	25		
24	28		
24	31		
27	0		
27	3		
27	6		
27	9		
27	12		
27	19		
27	22		
27	25		
27	28		
27	31		

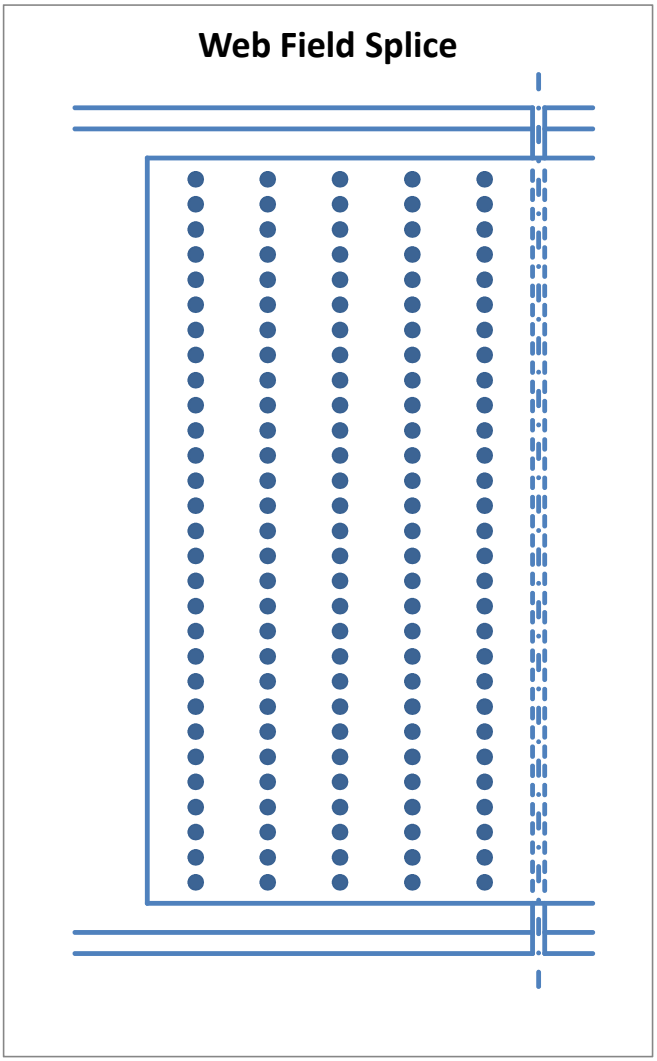
Flange Bolt Pattern Cont. - Node 1095

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1095	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1095

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	1764
0	3	36	1521
0	6	36	1296
0	9	36	1089
0	12	36	900
0	15	36	729
0	18	36	576
0	21	36	441
0	24	36	324
0	27	36	225
0	30	36	144
0	33	36	81
0	36	36	36
0	39	36	9
0	42	36	0
0	45	36	9
0	48	36	36
0	51	36	81
0	54	36	144
0	57	36	225
0	60	36	324
0	63	36	441
0	66	36	576
0	69	36	729
0	72	36	900
0	75	36	1089
0	78	36	1296
0	81	36	1521
0	84	36	1764
3	0	9	1764
3	3	9	1521
3	6	9	1296
3	9	9	1089
3	12	9	900
3	15	9	729
3	18	9	576
3	21	9	441
3	24	9	324
3	27	9	225
3	30	9	144
3	33	9	81
3	36	9	36
3	39	9	9
3	42	9	0
3	45	9	9
3	48	9	36
3	51	9	81
3	54	9	144
3	57	9	225
3	60	9	324
3	63	9	441
3	66	9	576
3	69	9	729
3	72	9	900
3	75	9	1089
3	78	9	1296
3	81	9	1521
3	84	9	1764
6	0	0	1764

No. Bolts =	145.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2610	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	91350	
Σd^2 (in^2) =	93960	



6	3	0	1521
6	6	0	1296
6	9	0	1089
6	12	0	900
6	15	0	729
6	18	0	576
6	21	0	441
6	24	0	324
6	27	0	225
6	30	0	144
6	33	0	81
6	36	0	36
6	39	0	9
6	42	0	0
6	45	0	9
6	48	0	36
6	51	0	81
6	54	0	144
6	57	0	225
6	60	0	324
6	63	0	441
6	66	0	576
6	69	0	729
6	72	0	900
6	75	0	1089
6	78	0	1296
6	81	0	1521
6	84	0	1764
9	0	9	1764
9	3	9	1521
9	6	9	1296
9	9	9	1089
9	12	9	900
9	15	9	729
9	18	9	576
9	21	9	441
9	24	9	324
9	27	9	225
9	30	9	144
9	33	9	81
9	36	9	36
9	39	9	9
9	42	9	0
9	45	9	9
9	48	9	36
9	51	9	81
9	54	9	144
9	57	9	225
9	60	9	324
9	63	9	441
9	66	9	576
9	69	9	729
9	72	9	900
9	75	9	1089
9	78	9	1296
9	81	9	1521
9	84	9	1764
12	0	36	1764
12	3	36	1521
12	6	36	1296
12	9	36	1089
12	12	36	900
12	15	36	729
12	18	36	576
12	21	36	441
12	24	36	324

Web Bolt Pattern Cont. - Node 1095

12	27	36	225
12	30	36	144
12	33	36	81
12	36	36	36
12	39	36	9
12	42	36	0
12	45	36	9
12	48	36	36
12	51	36	81
12	54	36	144
12	57	36	225
12	60	36	324
12	63	36	441
12	66	36	576
12	69	36	729
12	72	36	900
12	75	36	1089
12	78	36	1296
12	81	36	1521
12	84	36	1764
870	6090	2610	91350

Web Bolt Pattern Cont. - Node 1095

Field Splice - Node 3095

Node 3095

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3095 L	90.00	50.00	4500.00	90.00	48.92	4403.20	132.00	50.00	6600.00
3095 R	99.00	50.00	4950.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3095 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.69	-0.71	21.90	2.09	21.80	7.82	32.11	-4.43	31.65	-3.17	29.59	2.24	21.02	8.92	37.49	-8.09
ϕf Fnc (ksi)	50.00	48.92	50.00	50.00	50.00	50.00	50.00	48.76	50.00	48.81	50.00	50.00	50.00	50.00	50.00	48.67
f / ϕf Fnc	0.65	0.01	0.44	0.04	0.44	0.16	0.64	0.09	0.63	0.06	0.59	0.04	0.42	0.18	0.75	0.17
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	32.69		21.90		21.80		32.11		31.65		29.59		21.02		37.49	
Fcf (ksi)	41.34		37.50		37.50		41.06		40.82		39.79		37.50		43.75	
Fcf (kip)	2871.20		2604.28		2604.28		2851.27		2835.16		2763.59		2604.28		3038.10	
fncf (ksi)		-0.71		2.09		7.82		-4.43		-3.17		2.24		8.92		-8.09
Rcf		1.26		1.71		1.72		1.28		1.29		1.34		1.78		1.17
Fncf (ksi)		-36.69		37.50		37.50		-36.57		-36.61		37.50		37.50		-36.50
Fncf (kip)		-3302.40		2604.28		2604.28		-3291.20		-3294.54		2604.28		2604.28		-3285.02

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.13	-0.99	16.47	1.58	16.84	4.80	20.76	-3.12	21.46	-2.55	19.99	1.42	15.49	6.43	27.44	-5.80
Fs (ksi)	21.13	-0.99	16.47	1.58	16.84	4.80	20.76	-3.12	21.46	-2.55	19.99	1.42	15.49	6.43	27.44	-5.80
Fs (kip)	1901.42	-88.90	1482.09	141.86	1515.94	431.76	1868.47	-280.96	1931.11	-229.38	1799.08	127.68	1394.02	578.59	2469.80	-522.15

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3038.10	2604.28	2469.80	578.59
Comp	0.00	3302.40	0.00	522.15

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	425.58	381.82	242.63	713.67	416.09	402.50	395.48	535.03	310.83	276.93	178.59	514.36	304.12	291.54	286.58	388.16
Vuw (kip)	638.37	572.72	363.95	1070.50	624.14	603.75	593.21	802.55	---	---	---	---	---	---	---	---
Mv (k*ft)	438.88	393.75	250.22	735.97	429.10	415.08	407.83	551.75	213.69	190.39	122.78	353.62	209.08	200.44	197.02	266.86
Huw (kip)	2669.74	2710.95	3362.54	2336.34	2424.44	2825.06	3525.16	2264.51	1329.18	1190.90	1428.32	1164.17	1247.93	1412.96	1446.58	1428.28
Muw (k*ft)	3716.80	2985.39	2116.61	4110.84	3952.53	3236.99	1899.79	4680.08	1946.09	1310.45	1060.08	2101.66	2112.48	1634.26	797.31	2925.46
Mu (k*ft)	4155.69	3379.14	2366.83	4846.81	4381.63	3652.07	2307.63	5231.83	2159.78	1500.83	1182.87	2455.29	2321.56	1834.69	994.33	3192.32

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.41	18.70	23.19	16.11	16.72	19.48	24.31	15.62	9.17	8.21	9.85	8.03	8.61	9.74	9.98	9.85
PY1 (Vuw)	4.40	3.95	2.51	7.38	4.30	4.16	4.09	5.53	2.14	1.91	1.23	3.55	2.10	2.01	1.98	2.68
PX2 (Mu)	22.29	18.13	12.70	26.00	23.50	19.59	12.38	28.06	11.59	8.05	6.34	13.17	12.45	9.84	5.33	17.12
PY2 (Mu)	3.18	2.59	1.81	3.71	3.36	2.80	1.77	4.01	1.66	1.15	0.91	1.88	1.78	1.41	0.76	2.45
Pu (kip)	41.40	37.40	36.15	43.55	40.95	39.69	37.15	44.71	21.10	16.55	16.34	21.88	21.41	19.88	15.55	27.46

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1524.34	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1513.75	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1763.42	1856.25	OK
BF Outside	1538.98	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.73	34.96	33.88	40.18	38.33	37.11	34.62	41.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1070.50
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1524.34	15.24	OK	1239.20	12.39	OK
BF	1763.42	25.19	OK	308.96	4.41	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1524.34	15.24	1.47	137.48	OK
TF	3038.10	30.38	1.47	229.13	OK
TF Inside	1513.75	15.14	1.47	148.93	OK
BF Inside	1763.42	25.19	1.47	114.56	OK
BF	3302.40	47.18	1.47	229.13	OK
BF Outside	1538.98	21.99	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.71	22.36	OK	27.46	13.73	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.71	1.47	126.02	OK
Web SPL	22.36	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.30	NA
TF Inside	1.25	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.18	1.36	7.54
Web	1.62	1.23	2.82
BF	1.30	3.81	4.17

Plate	Shear	Flexure
Web	2.87	1.20

Field Splice - Node 5095

Node 5095

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5095 L	90.00	50.00	4500.00	90.00	48.90	4400.93	132.00	50.00	6600.00
5095 R	99.00	50.00	4950.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5095 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	33.27	-1.25	22.39	1.66	21.60	7.48	32.15	-3.97	30.40	2.31	30.87	3.11	21.03	8.15	36.91	-7.44
ϕf Fnc (ksi)	50.00	48.90	50.00	50.00	50.00	50.00	50.00	48.78	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.68
f / ϕf Fnc	0.67	0.03	0.45	0.03	0.43	0.15	0.64	0.08	0.61	0.05	0.62	0.06	0.42	0.16	0.74	0.15
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	33.27		22.39		21.60		32.15		30.40		30.87		21.03		36.91	
Fcf (ksi)	41.64		37.50		37.50		41.07		40.20		40.43		37.50		43.45	
Fcf (kip)	2891.53		2604.28		2604.28		2852.43		2791.63		2808.08		2604.28		3017.80	
fncf (ksi)		-1.25		1.66		7.48		-3.97		2.31		3.11		8.15		-7.44
Rcf		1.25		1.68		1.74		1.28		1.32		1.31		1.78		1.18
Fncf (ksi)		-36.67		37.50		37.50		-36.58		37.50		37.50		37.50		-36.51
Fncf (kip)		-3300.70		2604.28		2604.28		-3292.45		2604.28		2604.28		2604.28		-3286.08

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.41	-1.33	16.69	1.36	16.74	4.63	20.81	-2.84	20.66	-1.30	20.88	2.12	15.51	5.92	22.58	-5.10
Fs (ksi)	21.41	-1.33	16.69	1.36	16.74	4.63	20.81	-2.84	20.66	-1.30	20.88	2.12	15.51	5.92	22.58	-5.10
Fs (kip)	1926.81	-119.50	1502.25	122.26	1506.58	416.81	1873.22	-255.79	1859.41	-117.31	1879.41	190.53	1396.14	532.79	2031.84	-458.90

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3017.80	2604.28	2031.84	532.79
Comp	0.00	3300.70	0.00	458.90

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	431.20	378.50	249.76	700.55	376.54	412.60	396.76	517.57	314.60	274.35	183.39	504.90	275.98	298.44	287.25	375.61
Vuw (kip)	646.81	567.75	374.64	1050.83	564.82	618.91	595.14	776.35	---	---	---	---	---	---	---	---
Mv (k*ft)	444.68	390.33	257.57	722.45	388.31	425.50	409.16	533.74	216.28	188.61	126.08	347.12	189.73	205.18	197.48	258.23
Huw (kip)	2644.85	2658.69	3331.91	2376.24	2854.27	2937.65	3433.73	2290.19	1325.36	1191.30	1410.49	1186.11	1277.54	1517.95	1414.55	1153.49
Muw (k*ft)	3801.51	3055.08	2157.46	4060.57	3269.11	3199.63	2021.69	4594.41	2000.83	1349.32	1065.55	2081.69	1932.80	1651.34	844.17	2435.39
Mu (k*ft)	4246.19	3445.41	2415.03	4783.01	3657.42	3625.13	2430.85	5128.15	2217.11	1537.94	1191.63	2428.81	2122.53	1856.52	1041.65	2693.62

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.24	18.34	22.98	16.39	19.68	20.26	23.68	15.79	9.14	8.22	9.73	8.18	8.81	10.47	9.76	7.96
PY1 (Vuw)	4.46	3.92	2.58	7.25	3.90	4.27	4.10	5.35	2.17	1.89	1.26	3.48	1.90	2.06	1.98	2.59
PX2 (Mu)	22.78	18.48	12.95	25.66	19.62	19.45	13.04	27.51	11.89	8.25	6.39	13.03	11.39	9.96	5.59	14.45
PY2 (Mu)	3.25	2.64	1.85	3.67	2.80	2.78	1.86	3.93	1.70	1.18	0.91	1.86	1.63	1.42	0.80	2.06
Pu (kip)	41.74	37.40	36.21	43.44	39.87	40.33	37.20	44.29	21.39	16.75	16.27	21.87	20.50	20.72	15.59	22.88

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1514.16	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1503.64	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1762.51	1856.25	OK
BF Outside	1538.19	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.04	34.97	33.94	40.10	37.32	37.69	34.67	41.34
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1050.83
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1514.16	15.14	OK	1019.46	10.19	OK
BF	1762.51	25.18	OK	284.50	4.06	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1514.16	15.14	1.47	137.48	OK
TF	3017.80	30.18	1.47	229.13	OK
TF Inside	1503.64	15.04	1.47	148.93	OK
BF Inside	1762.51	25.18	1.47	114.56	OK
BF	3300.70	47.15	1.47	229.13	OK
BF Outside	1538.19	21.97	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.29	22.14	OK	22.88	11.44	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.29	1.47	126.02	OK
Web SPL	22.14	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.31	NA
TF Inside	1.26	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.19	1.65	7.59
Web	1.63	1.47	2.85
BF	1.30	4.14	4.17

Plate	Shear	Flexure
Web	2.92	1.21

Field Splice - Node 7095

Node 7095

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7095 L	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00
7095 R	99.00	50.00	4950.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7095 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.09	0.90	22.43	2.21	22.10	8.39	31.98	-4.28	29.55	1.70	31.02	3.75	21.36	9.44	37.15	-7.94
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.76	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.67
f / ϕf Fnc	0.64	0.02	0.45	0.04	0.44	0.17	0.64	0.09	0.59	0.03	0.62	0.07	0.43	0.19	0.74	0.16
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	32.09		22.43		22.10		31.98		29.55		31.02		21.36		37.15	
Fcf (ksi)	41.04		37.50		37.50		40.99		39.78		40.51		37.50		43.57	
Fcf (kip)	2850.46		2604.28		2604.28		2846.50		2762.30		2813.15		2604.28		3026.13	
fncf (ksi)		0.90		2.21		8.39		-4.28		1.70		3.75		9.44		-7.94
Rcf		1.28		1.67		1.70		1.28		1.35		1.31		1.76		1.17
Fncf (ksi)		37.50		37.50		37.50		-36.57		37.50		37.50		37.50		-36.50
Fncf (kip)		2604.28		2604.28		2604.28		-3291.54		2604.28		2604.28		2604.28		-3285.16

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.77	-0.49	16.92	1.45	17.15	5.32	20.64	-3.09	19.98	-0.97	21.06	2.62	15.83	6.91	27.14	-5.77
Fs (ksi)	20.77	-0.49	16.92	1.45	17.15	5.32	20.64	-3.09	19.98	-0.97	21.06	2.62	15.83	6.91	27.14	-5.77
Fs (kip)	1869.49	-43.89	1523.23	130.33	1543.07	479.01	1858.01	-278.53	1798.00	-87.24	1895.24	235.51	1424.65	621.68	2442.34	-519.38

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3026.13	2604.28	2442.34	621.68
Comp	0.00	3291.54	0.00	519.38

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	434.66	387.48	250.99	713.81	411.47	411.37	401.81	536.82	314.34	283.98	184.56	514.54	300.93	297.88	291.12	389.49
Vuw (kip)	652.00	581.22	376.48	1070.72	617.21	617.05	602.71	805.22	---	---	---	---	---	---	---	---
Mv (k*ft)	448.25	399.59	258.83	736.12	424.33	424.22	414.36	553.59	216.11	195.23	126.89	353.74	206.89	204.79	200.15	267.77
Huw (kip)	2784.92	2718.68	3414.66	2343.06	2775.77	2996.69	3568.59	2261.23	1338.77	1212.61	1482.85	1158.29	1254.56	1562.55	1500.64	1410.17
Muw (k*ft)	3510.67	2975.10	2047.12	4089.79	3299.45	3133.76	1841.88	4654.13	1870.85	1361.95	1040.41	2089.06	1843.35	1622.84	785.12	2895.90
Mu (k*ft)	3958.92	3374.68	2305.95	4825.91	3723.78	3557.98	2256.24	5207.72	2086.96	1557.18	1167.30	2442.80	2050.23	1827.64	985.27	3163.67

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.21	18.75	23.55	16.16	19.14	20.67	24.61	15.59	9.23	8.36	10.23	7.99	8.65	10.78	10.35	9.73
PY1 (Vuw)	4.50	4.01	2.60	7.38	4.26	4.26	4.16	5.55	2.17	1.96	1.27	3.55	2.08	2.05	2.01	2.69
PX2 (Mu)	21.24	18.10	12.37	25.89	19.97	19.08	12.10	27.93	11.19	8.35	6.26	13.10	11.00	9.80	5.28	16.97
PY2 (Mu)	3.03	2.59	1.77	3.70	2.85	2.73	1.73	3.99	1.60	1.19	0.89	1.87	1.57	1.40	0.75	2.42
Pu (kip)	41.14	37.44	36.18	43.48	39.76	40.36	37.18	44.56	20.77	17.01	16.63	21.78	19.99	20.87	15.88	27.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1518.34	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1507.79	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1757.62	1856.25	OK
BF Outside	1533.92	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.44	34.98	33.90	40.11	37.16	37.72	34.63	41.57
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1070.72
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1518.34	15.18	OK	1225.42	12.25	OK
BF	1757.62	25.11	OK	331.97	4.74	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1518.34	15.18	1.47	137.48	OK
TF	3026.13	30.26	1.47	229.13	OK
TF Inside	1507.79	15.08	1.47	148.93	OK
BF Inside	1757.62	25.11	1.47	114.56	OK
BF	3291.54	47.02	1.47	229.13	OK
BF Outside	1533.92	21.91	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.56	22.28	OK	27.18	13.59	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.56	1.47	126.02	OK
Web SPL	22.28	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.30	NA
TF Inside	1.25	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.18	1.37	7.57
Web	1.62	1.24	2.83
BF	1.31	3.55	4.18

Plate	Shear	Flexure
Web	2.87	1.20

Field Splice - Node 9095

Node 9095

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9095 L	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00
9095 R	99.00	50.00	4950.00	99.00	50.00	4950.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9095 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.87	4.08	19.80	4.02	18.37	11.54	27.10	2.63	26.07	2.73	28.54	5.04	18.52	12.54	35.77	-8.38
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.65
f / ϕf Fnc	0.58	0.08	0.40	0.08	0.37	0.23	0.54	0.05	0.52	0.05	0.57	0.10	0.37	0.25	0.72	0.17
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	28.87		19.80		18.37		27.10		26.07		28.54		18.52		35.77	
Fcf (ksi)	39.44		37.50		37.50		38.55		38.04		39.27		37.50		42.88	
Fcf (kip)	2738.73		2604.28		2604.28		2677.18		2641.45		2727.21		2604.28		2978.13	
fncf (ksi)		4.08		4.02		11.54		2.63		2.73		5.04		12.54		-8.38
Rcf		1.37		1.89		2.04		1.42		1.46		1.38		2.02		1.20
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-36.49
Fncf (kip)		2604.28		2604.28		2604.28		2604.28		2604.28		2604.28		2604.28		-3283.68

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.01	2.56	15.25	2.76	15.04	7.41	18.33	1.57	17.68	1.47	19.41	3.59	13.83	9.12	26.14	-6.11
Fs (ksi)	19.01	2.56	15.25	2.76	15.04	7.41	18.33	1.57	17.68	1.47	19.41	3.59	13.83	9.12	26.14	-6.11
Fs (kip)	1710.89	230.52	1372.41	248.11	1353.63	667.06	1649.86	141.70	1590.93	132.45	1746.49	323.13	1244.89	821.23	2352.90	-550.17

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2978.13	2604.28	2352.90	821.23
Comp	0.00	3283.68	0.00	550.17

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	333.27	305.41	148.94	601.57	333.16	310.36	257.02	465.38	243.73	226.73	113.49	435.97	246.33	227.54	189.86	339.75
Vuw (kip)	499.91	458.12	223.41	902.35	499.74	465.54	385.53	698.07	---	---	---	---	---	---	---	---
Mv (k*ft)	343.69	314.96	153.60	620.36	343.57	320.06	265.05	479.92	167.56	155.88	78.03	299.73	169.35	156.44	130.53	233.58
Huw (kip)	2970.59	2977.14	4029.30	2791.48	2772.94	3049.46	4151.10	2167.55	1423.70	1188.38	1481.84	1313.81	1263.82	1517.72	1515.16	1322.01
Muw (k*ft)	2979.95	2630.48	1227.60	3062.79	2996.95	2845.60	1065.21	4657.38	1447.47	1099.31	671.31	1474.65	1426.07	1391.73	414.25	2838.56
Mu (k*ft)	3323.64	2945.44	1381.20	3683.15	3340.52	3165.66	1330.26	5137.31	1615.04	1255.19	749.33	1774.38	1595.42	1548.16	544.77	3072.13

Note: Mu = Muw + Mv

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For	**Cleveland InnerBelt : Field Splice - Node 9095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.49	20.53	27.79	19.25	19.12	21.03	28.63	14.95	9.82	8.20	10.22	9.06	8.72	10.47	10.45	9.12
PY1 (Vuw)	3.45	3.16	1.54	6.22	3.45	3.21	2.66	4.81	1.68	1.56	0.78	3.01	1.70	1.57	1.31	2.34
PX2 (Mu)	17.83	15.80	7.41	19.76	17.92	16.98	7.14	27.56	8.66	6.73	4.02	9.52	8.56	8.30	2.92	16.48
PY2 (Mu)	2.55	2.26	1.06	2.82	2.56	2.43	1.02	3.94	1.24	0.96	0.57	1.36	1.22	1.19	0.42	2.35
Pu (kip)	38.78	36.73	35.29	40.04	37.53	38.43	35.95	43.40	18.71	15.14	14.30	19.08	17.52	18.97	13.48	26.02

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1494.25	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1483.88	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1753.42	1856.25	OK
BF Outside	1530.26	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.34	34.41	33.04	37.05	35.15	36.02	33.56	40.60
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	902.35
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9095**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1494.25	14.94	OK	1180.55	11.81	OK
BF	1753.42	25.05	OK	438.52	6.26	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1494.25	14.94	1.47	137.48	OK
TF	2978.13	29.78	1.47	229.13	OK
TF Inside	1483.88	14.84	1.47	148.93	OK
BF Inside	1753.42	25.05	1.47	114.56	OK
BF	3283.68	46.91	1.47	229.13	OK
BF Outside	1530.26	21.86	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.40	21.70	OK	26.02	13.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.40	1.47	126.02	OK
Web SPL	21.70	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.32	NA
TF Inside	1.27	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.22	1.43	7.69
Web	1.67	1.29	2.90
BF	1.31	2.69	4.19

Plate	Shear	Flexure
Web	3.40	1.23

Field Splice - Node 1109

Node 1109

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1109 L	99.00	50.00	4950.00	99.00	48.90	4841.15	96.00	50.00	4800.00
1109 R	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 1109 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1109**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.99	1.73	33.95	-3.16	21.37	7.95	30.23	-3.09	27.17	1.42	32.55	-4.55	38.60	-10.87	19.88	10.31
ϕf Fnc (ksi)	50.00	50.00	50.00	48.82	50.00	50.00	50.00	48.81	50.00	50.00	50.00	48.76	50.00	48.60	50.00	50.00
f / ϕf Fnc	0.42	0.03	0.68	0.06	0.43	0.16	0.60	0.06	0.54	0.03	0.65	0.09	0.77	0.22	0.40	0.21
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.97	1.00	1.00
fcf (ksi)	20.99		33.95		21.37		30.23		27.17		32.55		38.60		19.88	
Fcf (ksi)	37.50		41.98		37.50		40.11		38.59		41.28		44.30		37.50	
Fcf (kip)	2604.28		2915.13		2604.28		2785.83		2679.78		2866.58		3076.68		2604.28	
fncf (ksi)		1.73		-3.16		7.95		-3.09		1.42		-4.55		-10.87		10.31
Rcf		1.79		1.24		1.75		1.33		1.42		1.27		1.15		1.89
Fncf (ksi)		37.50		-36.61		37.50		-36.60		37.50		-36.57		-36.45		37.50
Fncf (kip)		2604.28		-3295.20		2604.28		-3294.35		2604.28		-3291.04		-3280.43		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.58	1.13	22.08	-2.67	16.06	5.61	20.19	-2.49	19.22	-1.17	21.80	-3.61	28.23	-7.70	14.80	7.19
Fs (ksi)	15.58	1.13	22.08	-2.67	16.06	5.61	20.19	-2.49	19.22	-1.17	21.80	-3.61	28.23	-7.70	14.80	7.19
Fs (kip)	1402.53	101.89	1987.47	-240.09	1445.78	504.70	1817.19	-224.21	1729.87	-105.75	1961.65	-325.06	2540.88	-692.58	1331.92	646.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3076.68	2604.28	2540.88	646.98
Comp	0.00	3295.20	0.00	692.58

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	311.64	393.45	169.88	623.68	343.30	341.89	488.64	273.90	231.81	287.55	129.59	452.28	252.12	253.19	354.80	205.15
Vuw (kip)	467.46	590.18	254.83	935.51	514.95	512.83	732.96	410.85	---	---	---	---	---	---	---	---
Mv (k*ft)	321.38	405.75	175.19	643.17	354.03	352.57	503.91	282.46	159.37	197.69	89.10	310.94	173.33	174.07	243.93	141.04
Huw (kip)	2679.29	2512.75	3396.16	2376.91	2680.10	2343.75	2100.74	3757.70	1103.25	1281.41	1430.36	1168.19	1191.02	1200.16	1355.42	1451.19
Muw (k*ft)	3027.61	4037.46	2071.79	3890.90	3217.89	4139.74	4996.21	1589.73	1271.73	2178.05	920.17	1996.04	1794.82	2235.89	3161.61	669.72
Mu (k*ft)	3348.98	4443.20	2246.98	4534.07	3571.92	4492.31	5500.12	1872.19	1431.11	2375.74	1009.26	2306.98	1968.15	2409.95	3405.54	810.76

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1109	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.48	17.33	23.42	16.39	18.48	16.16	14.49	25.92	7.61	8.84	9.86	8.06	8.21	8.28	9.35	10.01
PY1 (Vuw)	3.22	4.07	1.76	6.45	3.55	3.54	5.05	2.83	1.60	1.98	0.89	3.12	1.74	1.75	2.45	1.41
PX2 (Mu)	17.96	23.83	12.05	24.32	19.16	24.10	29.50	10.04	7.68	12.74	5.41	12.37	10.56	12.93	18.27	4.35
PY2 (Mu)	2.57	3.40	1.72	3.47	2.74	3.44	4.21	1.43	1.10	1.82	0.77	1.77	1.51	1.85	2.61	0.62
Pu (kip)	36.90	41.84	35.64	41.91	38.16	40.86	44.96	36.21	15.52	21.91	15.37	21.01	19.05	21.51	28.07	14.50

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1543.70	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1532.98	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1759.58	1856.25	OK
BF Outside	1535.63	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.60	39.21	33.48	38.81	35.76	38.38	42.06	33.85
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	935.51
Rr (kip)	3071.14
Check	OK

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For	**Cleveland InnerBelt : Field Splice - Node 1109**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1543.70	15.44	OK	1274.87	12.75	OK
BF	1759.58	25.14	OK	369.83	5.28	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1543.70	15.44	1.47	137.48	OK
TF	3076.68	30.77	1.47	229.13	OK
TF Inside	1532.98	15.33	1.47	148.93	OK
BF Inside	1759.58	25.14	1.47	114.56	OK
BF	3295.20	47.07	1.47	229.13	OK
BF Outside	1535.63	21.94	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.96	22.48	OK	28.07	14.04	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.96	1.47	126.02	OK
Web SPL	22.48	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.23	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.15	1.32	7.45
Web	1.61	1.20	2.80
BF	1.30	3.19	4.18

Plate	Shear	Flexure
Web	3.28	1.19

Field Splice - Node 3109

Node 3109

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3109 L	99.00	50.00	4950.00	99.00	48.87	4838.13	96.00	50.00	4800.00
3109 R	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 3109 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	23.03	0.98	36.41	-4.46	22.43	6.40	33.86	-5.86	30.85	-2.73	33.75	-4.45	39.03	-9.54	22.07	7.31
ϕf Fnc (ksi)	50.00	50.00	50.00	48.78	50.00	50.00	50.00	48.72	50.00	48.82	50.00	48.77	50.00	48.64	50.00	50.00
f / ϕf Fnc	0.46	0.02	0.73	0.09	0.45	0.13	0.68	0.12	0.62	0.06	0.67	0.09	0.78	0.20	0.44	0.15
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.97	1.00	1.00
fcf (ksi)	23.03		36.41		22.43		33.86		30.85		33.75		39.03		22.07	
Fcf (ksi)	37.50		43.20		37.50		41.93		40.42		41.87		44.52		37.50	
Fcf (kip)	2604.28		3000.34		2604.28		2912.06		2807.34		2907.96		3091.55		2604.28	
fncf (ksi)		0.98		-4.46		6.40		-5.86		-2.73		-4.45		-9.54		7.31
Rcf		1.63		1.19		1.67		1.24		1.31		1.24		1.14		1.70
Fncf (ksi)		37.50		-36.58		37.50		-36.54		-36.62		-36.57		-36.48		37.50
Fncf (kip)		2604.28		-3292.54		2604.28		-3288.29		-3295.62		-3291.71		-3282.96		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.07	0.64	23.45	-3.49	17.96	3.60	21.91	-4.15	21.53	-2.27	22.80	-3.52	23.99	-6.51	16.38	5.11
Fs (ksi)	17.07	0.64	23.45	-3.49	17.96	3.60	21.91	-4.15	21.53	-2.27	22.80	-3.52	23.99	-6.51	16.38	5.11
Fs (kip)	1536.21	57.48	2110.09	-314.37	1616.16	324.03	1971.95	-373.64	1937.46	-203.91	2052.09	-316.41	2159.52	-586.31	1474.45	459.56

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3091.55	2604.28	2159.52	459.56
Comp	0.00	3295.62	0.00	586.31

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	383.27	475.81	265.01	733.96	423.07	439.53	549.39	412.91	281.55	344.89	195.95	529.32	307.63	321.30	396.87	302.49
Vuw (kip)	574.90	713.72	397.51	1100.94	634.61	659.29	824.08	619.37	---	---	---	---	---	---	---	---
Mv (k*ft)	395.24	490.68	273.29	756.89	436.29	453.26	566.56	425.82	193.56	237.11	134.72	363.90	211.49	220.89	272.85	207.96
Huw (kip)	2580.10	2502.36	3181.19	2288.57	2431.71	2399.22	2220.16	3294.83	1168.71	1316.87	1422.81	1172.10	1271.28	1272.84	1153.69	1418.27
Muw (k*ft)	3159.87	4267.25	2358.41	4328.59	3872.35	4170.67	4874.67	2206.90	1445.87	2370.59	1263.41	2293.47	2093.78	2315.86	2684.82	992.33
Mu (k*ft)	3555.11	4757.93	2631.70	5085.48	4308.64	4623.94	5441.23	2632.71	1639.43	2607.70	1398.13	2657.37	2305.28	2536.76	2957.67	1200.29

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3109**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.79	17.26	21.94	15.78	16.77	16.55	15.31	22.72	8.06	9.08	9.81	8.08	8.77	8.78	7.96	9.78
PY1 (Vuw)	3.96	4.92	2.74	7.59	4.38	4.55	5.68	4.27	1.94	2.38	1.35	3.65	2.12	2.22	2.74	2.09
PX2 (Mu)	19.07	25.52	14.12	27.28	23.11	24.80	29.19	14.12	8.79	13.99	7.50	14.25	12.37	13.61	15.86	6.44
PY2 (Mu)	2.72	3.65	2.02	3.90	3.30	3.54	4.17	2.02	1.26	2.00	1.07	2.04	1.77	1.94	2.27	0.92
Pu (kip)	37.47	43.63	36.37	44.57	40.61	42.13	45.58	37.38	17.15	23.48	17.48	23.05	21.49	22.77	24.34	16.50

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1551.16	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1540.39	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1759.80	1856.25	OK
BF Outside	1535.82	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.03	40.78	34.09	41.11	37.99	39.42	42.52	34.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1100.94
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1551.16	15.51	OK	1083.52	10.84	OK
BF	1759.80	25.14	OK	313.08	4.47	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1551.16	15.51	1.47	137.48	OK
TF	3091.55	30.92	1.47	229.13	OK
TF Inside	1540.39	15.40	1.47	148.93	OK
BF Inside	1759.80	25.14	1.47	114.56	OK
BF	3295.62	47.08	1.47	229.13	OK
BF Outside	1535.82	21.94	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.58	22.79	OK	24.34	12.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.58	1.47	126.02	OK
Web SPL	22.79	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.23	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.14	1.55	7.41
Web	1.59	1.38	2.77
BF	1.30	3.76	4.18

Plate	Shear	Flexure
Web	2.79	1.18

Field Splice - Node 5109

Node 5109

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5109 L	99.00	50.00	4950.00	99.00	48.92	4842.99	96.00	50.00	4800.00
5109 R	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 5109 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.30	1.65	34.71	-2.57	22.56	6.30	33.76	-4.94	32.46	-3.35	31.86	-2.70	38.40	-8.57	22.34	6.86
ϕf Fnc (ksi)	50.00	50.00	50.00	48.84	50.00	50.00	50.00	48.75	50.00	48.80	50.00	48.83	50.00	48.66	50.00	50.00
f / ϕf Fnc	0.45	0.03	0.69	0.05	0.45	0.13	0.68	0.10	0.65	0.07	0.64	0.06	0.77	0.18	0.45	0.14
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.97	1.00	1.00
fcf (ksi)	22.30		34.71		22.56		33.76		32.46		31.86		38.40		22.34	
Fcf (ksi)	37.50		42.35		37.50		41.88		41.23		40.93		44.20		37.50	
Fcf (kip)	2604.28		2941.43		2604.28		2908.35		2863.20		2842.62		3069.69		2604.28	
fncf (ksi)		1.65		-2.57		6.30		-4.94		-3.35		-2.70		-8.57		6.86
Rcf		1.68		1.22		1.66		1.24		1.27		1.28		1.15		1.68
Fncf (ksi)		37.50		-36.63		37.50		-36.56		-36.60		-36.62		-36.49		37.50
Fncf (kip)		2604.28		-3297.02		2604.28		-3290.48		-3294.27		-3295.97		-3284.46		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.43	0.97	22.58	-2.23	18.00	3.59	22.00	-3.54	22.26	-2.70	21.98	-2.27	23.80	-5.91	16.60	4.83
Fs (ksi)	17.43	0.97	22.58	-2.23	18.00	3.59	22.00	-3.54	22.26	-2.70	21.98	-2.27	23.80	-5.91	16.60	4.83
Fs (kip)	1568.29	87.22	2031.78	-200.67	1620.25	322.78	1980.19	-318.56	2003.56	-243.20	1977.89	-204.10	2142.15	-531.48	1493.69	434.32

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3069.69	2604.28	2142.15	434.32
Comp	0.00	3297.02	0.00	531.48

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	373.44	454.48	269.53	719.18	436.50	391.34	534.12	414.78	274.49	329.57	198.90	518.76	319.05	284.96	385.84	303.70
Vuw (kip)	560.16	681.72	404.29	1078.77	654.76	587.01	801.19	622.17	---	---	---	---	---	---	---	---
Mv (k*ft)	385.11	468.68	277.95	741.65	450.15	403.57	550.82	427.74	188.71	226.58	136.74	356.65	219.34	195.91	265.26	208.79
Huw (kip)	2658.10	2588.73	3166.09	2359.62	2440.58	2472.26	2266.03	3235.09	1214.04	1342.82	1424.88	1218.53	1290.93	1300.78	1181.16	1413.87
Muw (k*ft)	3055.87	4002.81	2378.54	4224.44	4002.09	3907.68	4758.12	2286.54	1448.16	2182.83	1268.63	2247.66	2196.82	2133.51	2614.22	1035.83
Mu (k*ft)	3440.98	4471.49	2656.49	4966.09	4452.24	4311.24	5308.93	2714.29	1636.87	2409.41	1405.37	2604.31	2416.17	2329.42	2879.48	1244.62

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.33	17.85	21.84	16.27	16.83	17.05	15.63	22.31	8.37	9.26	9.83	8.40	8.90	8.97	8.15	9.75
PY1 (Vuw)	3.86	4.70	2.79	7.44	4.52	4.05	5.53	4.29	1.89	2.27	1.37	3.58	2.20	1.97	2.66	2.09
PX2 (Mu)	18.46	23.99	14.25	26.64	23.88	23.13	28.48	14.56	8.78	12.92	7.54	13.97	12.96	12.49	15.45	6.68
PY2 (Mu)	2.64	3.43	2.04	3.81	3.41	3.30	4.07	2.08	1.25	1.85	1.08	2.00	1.85	1.78	2.21	0.95
Pu (kip)	37.36	42.62	36.41	44.36	41.48	40.84	45.14	37.42	17.44	22.56	17.54	23.06	22.24	21.79	24.09	16.71

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1540.19	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1529.50	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1760.54	1856.25	OK
BF Outside	1536.48	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.94	39.85	34.13	40.94	38.80	38.27	42.12	34.87
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1078.77
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1540.19	15.40	OK	1074.81	10.75	OK
BF	1760.54	25.15	OK	283.80	4.05	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1540.19	15.40	1.47	137.48	OK
TF	3069.69	30.70	1.47	229.13	OK
TF Inside	1529.50	15.29	1.47	148.93	OK
BF Inside	1760.54	25.15	1.47	114.56	OK
BF	3297.02	47.10	1.47	229.13	OK
BF Outside	1536.48	21.95	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.14	22.57	OK	24.09	12.04	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.14	1.47	126.02	OK
Web SPL	22.57	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.24	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.15	1.57	7.46
Web	1.60	1.40	2.79
BF	1.30	4.15	4.18

Plate	Shear	Flexure
Web	2.85	1.19

Field Splice - Node 7109

Node 7109

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7109 L	99.00	50.00	4950.00	99.00	48.89	4839.96	96.00	50.00	4800.00
7109 R	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 7109 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	23.20	1.71	35.44	-3.69	22.67	7.15	33.33	-5.25	32.87	-3.71	30.64	-2.52	38.33	-8.99	22.28	8.08
ϕf Fnc (ksi)	50.00	50.00	50.00	48.80	50.00	50.00	50.00	48.73	50.00	48.79	50.00	48.83	50.00	48.65	50.00	50.00
f / ϕf Fnc	0.46	0.03	0.71	0.08	0.45	0.14	0.67	0.11	0.66	0.08	0.61	0.05	0.77	0.18	0.45	0.16
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.97	1.00	0.98	1.00	0.98	1.00	0.97	1.00	1.00
fcf (ksi)	23.20		35.44		22.67		33.33		32.87		30.64		38.33		22.28	
Fcf (ksi)	37.50		42.72		37.50		41.66		41.43		40.32		44.17		37.50	
Fcf (kip)	2604.28		2966.83		2604.28		2893.47		2877.46		2800.07		3067.25		2604.28	
fncf (ksi)		1.71		-3.69		7.15		-5.25		-3.71		-2.52		-8.99		8.08
Rcf		1.62		1.21		1.65		1.25		1.26		1.32		1.15		1.68
Fncf (ksi)		37.50		-36.60		37.50		-36.55		-36.59		-36.62		-36.49		37.50
Fncf (kip)		2604.28		-3294.18		2604.28		-3289.56		-3293.40		-3296.23		-3283.65		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.28	1.16	22.91	-2.97	18.03	4.13	21.68	-3.70	22.51	-2.98	21.10	-2.11	23.57	-6.20	16.60	5.74
Fs (ksi)	17.28	1.16	22.91	-2.97	18.03	4.13	21.68	-3.70	22.51	-2.98	21.10	-2.11	23.57	-6.20	16.60	5.74
Fs (kip)	1555.47	104.62	2061.57	-267.00	1622.88	371.58	1951.48	-332.60	2025.73	-268.38	1899.07	-189.51	2121.50	-557.90	1494.45	516.56

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3067.25	2604.28	2121.50	516.56
Comp	0.00	3296.23	0.00	557.90

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	381.44	480.58	269.00	730.30	430.21	427.95	553.93	415.68	278.22	350.33	198.78	526.76	314.74	311.08	400.09	304.48
Vuw (kip)	572.16	720.87	403.49	1095.46	645.32	641.92	830.90	623.52	---	---	---	---	---	---	---	---
Mv (k*ft)	393.36	495.60	277.40	753.13	443.66	441.32	571.24	428.67	191.28	240.85	136.66	362.15	216.38	213.87	275.06	209.33
Huw (kip)	2657.01	2526.13	3255.66	2317.06	2426.25	2442.44	2231.46	3372.07	1217.41	1316.02	1462.60	1187.19	1288.73	1253.68	1146.64	1474.74
Muw (k*ft)	3057.32	4150.66	2259.13	4243.49	4057.33	3839.62	4798.05	2103.91	1418.61	2276.82	1223.49	2233.32	2243.13	2042.17	2619.86	956.16
Mu (k*ft)	3450.68	4646.26	2536.53	4996.62	4500.99	4280.94	5369.29	2532.58	1609.89	2517.67	1360.15	2595.47	2459.52	2256.04	2894.92	1165.49

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.32	17.42	22.45	15.98	16.73	16.84	15.39	23.26	8.40	9.08	10.09	8.19	8.89	8.65	7.91	10.17
PY1 (Vuw)	3.95	4.97	2.78	7.55	4.45	4.43	5.73	4.30	1.92	2.42	1.37	3.63	2.17	2.15	2.76	2.10
PX2 (Mu)	18.51	24.92	13.61	26.80	24.14	22.96	28.80	13.58	8.64	13.50	7.30	13.92	13.19	12.10	15.53	6.25
PY2 (Mu)	2.64	3.56	1.94	3.83	3.45	3.28	4.11	1.94	1.23	1.93	1.04	1.99	1.88	1.73	2.22	0.89
Pu (kip)	37.42	43.19	36.37	44.27	41.63	40.55	45.27	37.37	17.32	22.99	17.55	22.81	22.45	21.11	23.96	16.69

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1538.97	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1528.28	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1760.12	1856.25	OK
BF Outside	1536.11	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.98	40.35	34.08	40.83	38.96	37.92	42.22	34.81
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1095.46
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1538.97	15.39	OK	1064.45	10.64	OK
BF	1760.12	25.14	OK	297.91	4.26	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1538.97	15.39	1.47	137.48	OK
TF	3067.25	30.67	1.47	229.13	OK
TF Inside	1528.28	15.28	1.47	148.93	OK
BF Inside	1760.12	25.14	1.47	114.56	OK
BF	3296.23	47.09	1.47	229.13	OK
BF Outside	1536.11	21.94	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.27	22.64	OK	23.96	11.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.27	1.47	126.02	OK
Web SPL	22.64	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.24	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.16	1.58	7.47
Web	1.60	1.40	2.78
BF	1.30	3.95	4.18

Plate	Shear	Flexure
Web	2.80	1.18

Field Splice - Node 9109

Node 9109

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9109 L	99.00	50.00	4950.00	99.00	50.00	4950.00	96.00	50.00	4800.00
9109 R	90.00	50.00	4500.00	90.00	50.00	4500.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 9109 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.38	---	132.00	89.63	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9109**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.44	2.22	32.72	-1.97	20.90	8.92	29.26	-1.87	31.01	3.82	26.79	1.69	37.02	-9.53	19.51	11.23
ϕf Fnc (ksi)	50.00	50.00	50.00	48.86	50.00	50.00	50.00	48.86	50.00	50.00	50.00	50.00	50.00	48.62	50.00	50.00
f / ϕf Fnc	0.41	0.04	0.65	0.04	0.42	0.18	0.59	0.04	0.62	0.08	0.54	0.03	0.74	0.20	0.39	0.22
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
fcf (ksi)	20.44		32.72		20.90		29.26		31.01		26.79		37.02		19.51	
Fcf (ksi)	37.50		41.36		37.50		39.63		40.50		38.40		43.51		37.50	
Fcf (kip)	2604.28		2872.31		2604.28		2752.25		2812.88		2666.53		3021.49		2604.28	
fncf (ksi)		2.22		-1.97		8.92		-1.87		3.82		1.69		-9.53		11.23
Rcf		1.83		1.26		1.79		1.35		1.31		1.43		1.18		1.92
Fncf (ksi)		37.50		-36.65		37.50		-36.64		37.50		37.50		-36.47		37.50
Fncf (kip)		2604.28		-3298.38		2604.28		-3297.99		2604.28		2604.28		-3282.04		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.29	1.51	21.26	-1.80	15.62	6.24	19.69	-1.54	21.10	2.38	18.67	-0.94	22.37	-6.48	14.65	7.99
Fs (ksi)	15.29	1.51	21.26	-1.80	15.62	6.24	19.69	-1.54	21.10	2.38	18.67	-0.94	22.37	-6.48	14.65	7.99
Fs (kip)	1376.52	135.66	1913.42	-161.89	1405.39	561.35	1772.50	-138.36	1898.95	214.46	1679.99	-84.24	2013.39	-582.80	1318.44	719.30

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3021.49	2604.28	2013.39	719.30
Comp	0.00	3298.38	0.00	582.80

$\phi_v V_n$ (kip) = 3306.90

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	311.27	392.81	167.99	621.10	333.60	346.75	485.52	271.67	229.44	289.25	128.21	450.54	247.42	254.51	352.55	203.66
Vuw (kip)	466.90	589.21	251.98	931.65	500.40	520.13	728.28	407.51	---	---	---	---	---	---	---	---
Mv (k*ft)	321.00	405.08	173.24	640.51	344.02	357.59	500.69	280.16	157.74	198.86	88.15	309.75	170.10	174.98	242.38	140.02
Huw (kip)	2744.36	2565.45	3531.44	2448.16	3002.63	2694.14	2131.86	3900.19	1108.93	1284.45	1442.28	1198.38	1549.84	1170.22	1049.10	1494.35
Muw (k*ft)	2940.85	3858.68	1891.42	3710.80	3125.16	3165.57	4814.85	1399.75	1213.29	2029.19	825.29	1868.40	1647.06	1725.02	2538.49	585.83
Mu (k*ft)	3261.84	4263.76	2064.66	4351.31	3469.19	3523.16	5315.54	1679.92	1371.03	2228.05	913.43	2178.14	1817.16	1900.00	2780.87	725.85

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.93	17.69	24.35	16.88	20.71	18.58	14.70	26.90	7.65	8.86	9.95	8.26	10.69	8.07	7.24	10.31
PY1 (Vuw)	3.22	4.06	1.74	6.43	3.45	3.59	5.02	2.81	1.58	1.99	0.88	3.11	1.71	1.76	2.43	1.40
PX2 (Mu)	17.50	22.87	11.07	23.34	18.61	18.90	28.51	9.01	7.35	11.95	4.90	11.68	9.75	10.19	14.92	3.89
PY2 (Mu)	2.50	3.27	1.58	3.33	2.66	2.70	4.07	1.29	1.05	1.71	0.70	1.67	1.39	1.46	2.13	0.56
Pu (kip)	36.87	41.22	35.58	41.39	39.79	38.00	44.16	36.14	15.23	21.14	14.93	20.51	20.67	18.54	22.62	14.33

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1516.01	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1505.48	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1761.27	1856.25	OK
BF Outside	1537.11	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.56	38.62	33.40	38.32	37.30	35.60	41.30	33.77
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	931.65
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1516.01	15.16	OK	1010.20	10.10	OK
BF	1761.27	25.16	OK	384.09	5.49	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1516.01	15.16	1.47	137.48	OK
TF	3021.49	30.21	1.47	229.13	OK
TF Inside	1505.48	15.05	1.47	148.93	OK
BF Inside	1761.27	25.16	1.47	114.56	OK
BF	3298.38	47.12	1.47	229.13	OK
BF Outside	1537.11	21.96	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.16	22.08	OK	22.62	11.31	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.16	1.47	126.02	OK
Web SPL	22.08	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.31	NA
TF Inside	1.26	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.19	1.67	7.58
Web	1.64	1.49	2.85
BF	1.30	3.07	4.17

Plate	Shear	Flexure
Web	3.30	1.21

Field Splice - Node 1205

Node 1205

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1205 L	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00
1205 R	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1205 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.14	4.67	31.95	3.96	31.82	-4.33	18.16	13.35	22.93	6.49	29.18	5.09	37.14	-7.39	16.42	15.02
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.80	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.75	50.00	50.00
f / ϕf Fnc	0.34	0.09	0.64	0.08	0.64	0.09	0.36	0.27	0.46	0.13	0.58	0.10	0.74	0.15	0.33	0.30
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
fcf (ksi)	17.14		31.95		31.82		18.16		22.93		29.18		37.14		16.42	
Fcf (ksi)	37.50		40.98		40.91		37.50		37.50		39.59		43.57		37.50	
Fcf (kip)	2604.28		2845.67		2841.21		2604.28		2604.28		2749.51		3025.80		2604.28	
fncf (ksi)		4.67		3.96		-4.33		13.35		6.49		5.09		-7.39		15.02
Rcf		2.19		1.28		1.29		2.07		1.64		1.36		1.17		2.28
Fncf (ksi)		37.50		37.50		-36.60		37.50		37.50		37.50		-36.56		37.50
Fncf (kip)		2604.28		2604.28		-3294.24		2604.28		2604.28		2604.28		-3290.51		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	12.67	3.31	19.48	1.88	18.42	-2.92	13.69	9.43	16.39	4.17	18.53	3.05	27.18	-5.11	12.16	10.62
Fs (ksi)	12.67	3.31	19.48	1.88	18.42	-2.92	13.69	9.43	16.39	4.17	18.53	3.05	27.18	-5.11	12.16	10.62
Fs (kip)	1140.73	298.08	1753.43	169.54	1658.19	-262.92	1231.95	849.06	1475.29	375.26	1667.67	274.45	2446.16	-460.31	1094.58	955.83

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3025.80	2604.28	2446.16	955.83
Comp	0.00	3294.24	0.00	460.31

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	318.01	402.22	670.80	142.01	333.79	352.14	536.20	200.05	235.00	294.41	484.25	110.57	246.07	259.11	389.07	151.66
Vuw (kip)	477.02	603.33	1006.20	213.02	500.69	528.20	804.30	300.08	---	---	---	---	---	---	---	---
Mv (k*ft)	327.95	414.79	691.76	146.45	344.22	363.14	552.95	206.30	161.56	202.41	332.92	76.02	169.17	178.14	267.49	104.27
Huw (kip)	2290.62	2210.72	1696.85	3123.28	2309.30	2231.94	1675.48	3446.56	767.36	1025.59	744.15	1109.87	986.96	1035.80	1059.12	1093.55
Muw (k*ft)	1745.84	2297.29	2974.24	635.63	1720.94	2091.76	3342.95	204.59	599.22	1126.32	1366.12	272.28	782.24	990.73	2066.82	98.67
Mu (k*ft)	2073.79	2712.07	3666.01	782.08	2065.16	2454.90	3895.90	410.89	760.78	1328.73	1699.05	348.30	951.41	1168.87	2334.31	202.94

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.80	15.25	11.70	21.54	15.93	15.39	11.56	23.77	5.29	7.07	5.13	7.65	6.81	7.14	7.30	7.54
PY1 (Vuw)	3.29	4.16	6.94	1.47	3.45	3.64	5.55	2.07	1.62	2.03	3.34	0.76	1.70	1.79	2.68	1.05
PX2 (Mu)	11.12	14.55	19.66	4.20	11.08	13.17	20.90	2.20	4.08	7.13	9.11	1.87	5.10	6.27	12.52	1.09
PY2 (Mu)	1.59	2.08	2.81	0.60	1.58	1.88	2.99	0.31	0.58	1.02	1.30	0.27	0.73	0.90	1.79	0.16
Pu (kip)	27.36	30.44	32.85	25.82	27.47	29.09	33.56	26.08	9.63	14.52	14.98	9.58	12.15	13.68	20.32	8.71

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1518.17	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1507.63	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1759.06	1856.25	OK
BF Outside	1535.18	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	25.48	28.28	29.94	24.12	25.55	27.08	30.99	24.26
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1006.20
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1518.17	15.18	OK	1227.34	12.27	OK
BF	1759.06	25.13	OK	510.39	7.29	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1518.17	15.18	1.47	137.48	OK
TF	3025.80	30.26	1.47	229.13	OK
TF Inside	1507.63	15.08	1.47	148.93	OK
BF Inside	1759.06	25.13	1.47	114.56	OK
BF	3294.24	47.06	1.47	229.13	OK
BF Outside	1535.18	21.93	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.56	16.78	OK	20.32	10.16	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.56	1.47	91.65	OK
Web SPL	16.78	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.30	NA
TF Inside	1.25	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.38	1.37	7.57
Web	2.16	1.66	2.73
BF	1.30	2.31	4.18

Plate	Shear	Flexure
Web	3.05	1.61

Field Splice - Node 3205

Node 3205

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3205 L	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00
3205 R	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3205 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.14	4.16	34.01	2.48	33.27	-3.40	19.37	12.81	29.44	4.45	30.52	4.54	38.62	-6.46	20.30	11.88
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.84	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.78	50.00	50.00
f / ϕf Fnc	0.40	0.08	0.68	0.05	0.67	0.07	0.39	0.26	0.59	0.09	0.61	0.09	0.77	0.13	0.41	0.24
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	20.14		34.01		33.27		19.37		29.44		30.52		38.62		20.30	
Fcf (ksi)	37.50		42.01		41.64		37.50		39.72		40.26		44.31		37.50	
Fcf (kip)	2604.28		2917.16		2891.50		2604.28		2758.54		2796.09		3077.17		2604.28	
fncf (ksi)		4.16		2.48		-3.40		12.81		4.45		4.54		-6.46		11.88
Rcf		1.86		1.24		1.25		1.94		1.35		1.32		1.15		1.85
Fncf (ksi)		37.50		37.50		-36.63		37.50		37.50		37.50		-36.58		37.50
Fncf (kip)		2604.28		2604.28		-3296.43		2604.28		2604.28		2604.28		-3292.33		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.84	3.04	20.81	0.73	19.87	-2.42	16.52	7.83	19.83	2.74	19.88	2.51	21.86	-4.57	15.04	8.42
Fs (ksi)	15.84	3.04	20.81	0.73	19.87	-2.42	16.52	7.83	19.83	2.74	19.88	2.51	21.86	-4.57	15.04	8.42
Fs (kip)	1425.89	273.88	1873.02	65.90	1788.03	-217.64	1486.78	704.97	1784.79	246.16	1788.83	225.92	1966.97	-411.67	1353.63	758.14

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3077.17	2604.28	1966.97	758.14
Comp	0.00	3296.43	0.00	411.67

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	428.54	496.17	839.57	270.87	466.13	480.45	662.12	352.00	313.17	359.54	603.57	200.36	338.32	349.85	476.79	259.09
Vuw (kip)	642.80	744.25	1107.48	406.30	699.20	720.67	993.19	527.99	---	---	---	---	---	---	---	---
Mv (k*ft)	441.93	511.67	761.39	279.33	480.70	495.46	682.82	363.00	215.30	247.18	414.95	137.75	232.59	240.52	327.79	178.13
Huw (kip)	2172.09	2163.03	1794.41	2990.50	2194.68	2219.71	1771.35	2853.40	906.54	1034.09	837.54	1168.93	1083.17	1074.54	829.49	1126.28
Muw (k*ft)	1903.88	2492.65	2936.84	812.67	2158.09	2193.93	3309.80	995.46	819.20	1285.06	1426.25	555.95	1094.13	1111.40	1691.48	423.46
Mu (k*ft)	2345.81	3004.32	3698.23	1092.00	2638.79	2689.39	3992.62	1358.46	1034.51	1532.24	1841.21	693.70	1326.73	1351.92	2019.28	601.59

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.98	14.92	12.38	20.62	15.14	15.31	12.22	19.68	6.25	7.13	5.78	8.06	7.47	7.41	5.72	7.77
PY1 (Vuw)	4.43	5.13	7.64	2.80	4.82	4.97	6.85	3.64	2.16	2.48	4.16	1.38	2.33	2.41	3.29	1.79
PX2 (Mu)	12.58	16.12	19.84	5.86	14.15	14.43	21.42	7.29	5.55	8.22	9.88	3.72	7.12	7.25	10.83	3.23
PY2 (Mu)	1.80	2.30	2.83	0.84	2.02	2.06	3.06	1.04	0.79	1.17	1.41	0.53	1.02	1.04	1.55	0.46
Pu (kip)	28.26	31.91	33.87	26.73	30.08	30.55	35.06	27.37	12.16	15.78	16.62	11.94	14.97	15.06	17.24	11.22

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1543.95	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1533.22	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1760.23	1856.25	OK
BF Outside	1536.20	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.13	29.49	30.73	24.87	27.80	28.22	32.11	25.38
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1107.48
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1543.95	15.44	OK	986.91	9.87	OK
BF	1760.23	25.15	OK	404.83	5.78	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1543.95	15.44	1.47	137.48	OK
TF	3077.17	30.77	1.47	229.13	OK
TF Inside	1533.22	15.33	1.47	148.93	OK
BF Inside	1760.23	25.15	1.47	114.56	OK
BF	3296.43	47.09	1.47	229.13	OK
BF Outside	1536.20	21.95	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.06	17.53	OK	17.24	8.62	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.06	1.47	91.65	OK
Web SPL	17.53	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.23	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.34	1.71	7.45
Web	2.06	1.95	2.61
BF	1.30	2.91	4.18

Plate	Shear	Flexure
Web	2.77	1.56

Field Splice - Node 5205

Node 5205

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5205 L	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00
5205 R	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5205 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.66	4.87	35.30	2.81	33.89	-2.62	21.63	12.50	31.04	6.32	30.13	3.12	39.35	-6.42	21.81	12.44
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.86	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.78	50.00	50.00
f / ϕf Fnc	0.43	0.10	0.71	0.06	0.68	0.05	0.43	0.25	0.62	0.13	0.60	0.06	0.79	0.13	0.44	0.25
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	21.66		35.30		33.89		21.63		31.04		30.13		39.35		21.81	
Fcf (ksi)	37.50		42.65		41.95		37.50		40.52		40.07		44.68		37.50	
Fcf (kip)	2604.28		2962.07		2913.05		2604.28		2813.90		2782.57		3102.68		2604.28	
fncf (ksi)		4.87		2.81		-2.62		12.50		6.32		3.12		-6.42		12.44
Rcf		1.73		1.21		1.24		1.73		1.31		1.33		1.14		1.72
Fncf (ksi)		37.50		37.50		-36.65		37.50		37.50		37.50		-36.58		37.50
Fncf (kip)		2604.28		2604.28		-3298.14		2604.28		2604.28		2604.28		-3292.58		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.81	3.54	21.68	1.15	20.69	-2.01	17.57	7.71	20.85	3.87	19.61	1.68	22.55	-4.62	16.20	8.86
Fs (ksi)	16.81	3.54	21.68	1.15	20.69	-2.01	17.57	7.71	20.85	3.87	19.61	1.68	22.55	-4.62	16.20	8.86
Fs (kip)	1512.46	318.99	1950.88	103.44	1862.17	-180.69	1581.63	693.47	1876.15	348.07	1765.30	151.61	2029.12	-415.63	1457.94	797.79

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3102.68	2604.28	2029.12	797.79
Comp	0.00	3298.14	0.00	415.63

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	425.97	502.44	833.06	278.44	469.82	459.56	634.40	366.36	311.87	363.39	599.49	205.14	340.35	335.60	456.63	269.76
Vuw (kip)	638.96	753.66	1104.22	417.66	704.73	689.34	951.60	549.55	---	---	---	---	---	---	---	---
Mv (k*ft)	439.28	518.14	759.15	287.14	484.50	473.92	654.23	377.81	214.41	249.83	412.15	141.03	233.99	230.72	313.93	185.46
Huw (kip)	2205.15	2210.22	1857.86	2840.42	2341.05	2122.14	1794.81	2826.57	976.77	1095.64	896.79	1213.38	1186.25	1022.35	860.53	1203.05
Muw (k*ft)	1859.79	2512.49	2891.96	1012.77	2064.95	2299.09	3325.54	1031.24	848.69	1313.73	1452.70	631.58	1086.63	1147.52	1738.49	469.44
Mu (k*ft)	2299.08	3030.63	3651.12	1299.91	2549.46	2773.01	3979.77	1409.06	1063.10	1563.57	1864.84	772.61	1320.62	1378.24	2052.42	654.90

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.21	15.24	12.81	19.59	16.15	14.64	12.38	19.49	6.74	7.56	6.18	8.37	8.18	7.05	5.93	8.30
PY1 (Vuw)	4.41	5.20	7.62	2.88	4.86	4.75	6.56	3.79	2.15	2.51	4.13	1.41	2.35	2.31	3.15	1.86
PX2 (Mu)	12.33	16.26	19.58	6.97	13.68	14.87	21.35	7.56	5.70	8.39	10.00	4.14	7.08	7.39	11.01	3.51
PY2 (Mu)	1.76	2.32	2.80	1.00	1.95	2.12	3.05	1.08	0.81	1.20	1.43	0.59	1.01	1.06	1.57	0.50
Pu (kip)	28.22	32.38	34.03	26.84	30.59	30.30	35.07	27.49	12.79	16.37	17.12	12.67	15.63	14.83	17.59	12.04

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1556.75	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1545.94	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1761.14	1856.25	OK
BF Outside	1537.00	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.10	29.93	30.89	24.99	28.27	28.03	32.20	25.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1104.22
Rr (kip)	3071.14
Check	OK

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1556.75	15.57	OK	1018.09	10.18	OK
BF	1761.14	25.16	OK	426.00	6.09	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1556.75	15.57	1.47	137.48	OK
TF	3102.68	31.03	1.47	229.13	OK
TF Inside	1545.94	15.46	1.47	148.93	OK
BF Inside	1761.14	25.16	1.47	114.56	OK
BF	3298.14	47.12	1.47	229.13	OK
BF Outside	1537.00	21.96	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.07	17.53	OK	17.59	8.79	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.07	1.47	91.65	OK
Web SPL	17.53	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.22	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.32	1.65	7.38
Web	2.06	1.91	2.61
BF	1.30	2.77	4.17

Plate	Shear	Flexure
Web	2.78	1.55

Field Splice - Node 7205

Node 7205

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7205 L	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00
7205 R	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7205 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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For	**Cleveland InnerBelt : Field Splice - Node 7205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.93	4.32	33.62	6.14	33.96	-4.22	21.60	13.73	31.45	7.07	28.96	1.50	39.01	-7.45	22.43	13.23
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.81	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.75	50.00	50.00
f / ϕf Fnc	0.44	0.09	0.67	0.12	0.68	0.09	0.43	0.27	0.63	0.14	0.58	0.03	0.78	0.15	0.45	0.26
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	21.93		33.62		33.96		21.60		31.45		28.96		39.01		22.43	
Fcf (ksi)	37.50		41.81		41.98		37.50		40.73		39.48		44.51		37.50	
Fcf (kip)	2604.28		2903.46		2915.24		2604.28		2828.41		2741.69		3090.78		2604.28	
fncf (ksi)		4.32		6.14		-4.22		13.73		7.07		1.50		-7.45		13.23
Rcf		1.71		1.24		1.24		1.74		1.29		1.36		1.14		1.67
Fncf (ksi)		37.50		37.50		-36.61		37.50		37.50		37.50		-36.57		37.50
Fncf (kip)		2604.28		2604.28		-3294.97		2604.28		2604.28		2604.28		-3290.95		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.95	3.23	21.47	3.28	20.79	-3.03	17.77	8.49	21.13	4.32	18.90	0.72	22.42	-5.34	16.72	9.46
Fs (ksi)	16.95	3.23	21.47	3.28	20.79	-3.03	17.77	8.49	21.13	4.32	18.90	0.72	22.42	-5.34	16.72	9.46
Fs (kip)	1525.49	290.32	1932.23	295.22	1871.16	-272.53	1598.96	764.00	1902.05	388.71	1701.04	64.75	2017.68	-480.22	1504.93	851.00

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3090.78	2604.28	2017.68	851.00
Comp	0.00	3294.97	0.00	480.22

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	446.45	486.93	845.99	286.99	477.86	494.91	668.41	368.85	323.90	355.78	609.47	211.24	346.09	361.42	480.72	272.36
Vuw (kip)	669.67	730.40	1110.69	430.48	716.79	742.36	1002.62	553.28	---	---	---	---	---	---	---	---
Mv (k*ft)	460.40	502.15	763.60	295.96	492.79	510.37	689.30	380.38	222.68	244.60	419.01	145.22	237.94	248.47	330.49	187.25
Huw (kip)	2154.45	2373.45	1764.49	2944.58	2394.08	1993.19	1728.30	2861.24	968.44	1187.97	852.60	1260.24	1221.74	941.75	819.98	1256.50
Muw (k*ft)	1927.40	2186.82	3020.50	873.89	2021.01	2395.68	3392.30	985.01	878.34	1164.10	1524.40	593.75	1076.16	1163.59	1776.29	465.01
Mu (k*ft)	2387.80	2688.97	3784.10	1169.85	2513.80	2906.06	4081.60	1365.39	1101.02	1408.70	1943.41	738.98	1314.09	1412.06	2106.78	652.26

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.86	16.37	12.17	20.31	16.51	13.75	11.92	19.73	6.68	8.19	5.88	8.69	8.43	6.49	5.66	8.67
PY1 (Vuw)	4.62	5.04	7.66	2.97	4.94	5.12	6.91	3.82	2.23	2.45	4.20	1.46	2.39	2.49	3.32	1.88
PX2 (Mu)	12.81	14.42	20.30	6.28	13.48	15.59	21.89	7.32	5.91	7.56	10.42	3.96	7.05	7.57	11.30	3.50
PY2 (Mu)	1.83	2.06	2.90	0.90	1.93	2.23	3.13	1.05	0.84	1.08	1.49	0.57	1.01	1.08	1.61	0.50
Pu (kip)	28.41	31.60	34.14	26.86	30.77	30.24	35.27	27.49	12.96	16.14	17.27	12.82	15.84	14.52	17.66	12.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1550.78	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1540.01	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1759.45	1856.25	OK
BF Outside	1535.52	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.24	29.21	30.98	24.98	28.43	27.89	32.30	25.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1110.69
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1550.78	15.51	OK	1012.36	10.12	OK
BF	1759.45	25.14	OK	454.42	6.49	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1550.78	15.51	1.47	137.48	OK
TF	3090.78	30.91	1.47	229.13	OK
TF Inside	1540.01	15.40	1.47	148.93	OK
BF Inside	1759.45	25.14	1.47	114.56	OK
BF	3294.97	47.07	1.47	229.13	OK
BF Outside	1535.52	21.94	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.27	17.64	OK	17.66	8.83	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.27	1.47	91.65	OK
Web SPL	17.64	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.23	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.33	1.66	7.41
Web	2.05	1.91	2.60
BF	1.30	2.59	4.18

Plate	Shear	Flexure
Web	2.77	1.55

Field Splice - Node 9205

Node 9205

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9205 L	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00
9205 R	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9205 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.03	5.23	29.24	9.97	31.64	-4.81	20.66	14.70	29.52	7.67	23.00	4.16	36.36	-7.82	18.88	16.19
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.79	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.74	50.00	50.00
f / ϕf Fnc	0.38	0.10	0.58	0.20	0.63	0.10	0.41	0.29	0.59	0.15	0.46	0.08	0.73	0.16	0.38	0.32
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	1.00
fcf (ksi)	19.03		29.24		31.64		20.66		29.52		23.00		36.36		18.88	
Fcf (ksi)	37.50		39.62		40.82		37.50		39.76		37.50		43.18		37.50	
Fcf (kip)	2604.28		2751.47		2834.91		2604.28		2761.35		2604.28		2998.80		2604.28	
fncf (ksi)		5.23		9.97		-4.81		14.70		7.67		4.16		-7.82		16.19
Rcf		1.97		1.36		1.29		1.81		1.35		1.63		1.19		1.99
Fncf (ksi)		37.50		37.50		-36.59		37.50		37.50		37.50		-36.55		37.50
Fncf (kip)		2604.28		2604.28		-3293.24		2604.28		2604.28		2604.28		-3289.62		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	14.25	3.79	19.34	5.87	19.09	-3.27	15.41	10.48	19.47	4.85	15.95	2.68	20.74	-5.34	14.14	11.54
Fs (ksi)	14.25	3.79	19.34	5.87	19.09	-3.27	15.41	10.48	19.47	4.85	15.95	2.68	20.74	-5.34	14.14	11.54
Fs (kip)	1282.55	340.99	1740.16	527.92	1718.03	-294.68	1386.52	943.10	1752.48	436.14	1435.47	241.11	1866.87	-480.18	1272.97	1038.36

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2998.80	2604.28	1866.87	1038.36
Comp	0.00	3293.24	0.00	480.18

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	334.86	345.98	675.31	158.29	355.09	370.85	549.47	214.50	245.28	257.62	490.30	120.53	259.57	275.20	401.40	160.24
Vuw (kip)	502.29	518.97	1012.97	237.44	532.63	556.28	824.21	321.74	---	---	---	---	---	---	---	---
Mv (k*ft)	345.32	356.79	696.42	163.24	366.18	382.44	566.64	221.20	168.63	177.11	337.08	82.86	178.45	189.20	275.96	110.16
Huw (kip)	2294.41	2550.41	1661.34	3080.20	2404.35	2125.38	1627.09	3344.17	865.89	1209.64	759.12	1242.47	1167.27	894.18	739.57	1232.71
Muw (k*ft)	1740.79	1670.74	3009.96	693.06	1883.71	1966.16	3357.72	341.11	669.56	862.03	1431.26	315.32	936.06	849.32	1669.02	166.83
Mu (k*ft)	2086.11	2027.53	3706.37	856.31	2249.89	2348.60	3924.36	562.31	838.19	1039.15	1768.34	398.18	1114.52	1038.51	1944.98	277.00

Note: Mu = Muw + Mv

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.82	17.59	11.46	21.24	16.58	14.66	11.22	23.06	5.97	8.34	5.24	8.57	8.05	6.17	5.10	8.50
PY1 (Vuw)	3.46	3.58	6.99	1.64	3.67	3.84	5.68	2.22	1.69	1.78	3.38	0.83	1.79	1.90	2.77	1.11
PX2 (Mu)	11.19	10.88	19.88	4.59	12.07	12.60	21.05	3.02	4.50	5.57	9.49	2.14	5.98	5.57	10.43	1.49
PY2 (Mu)	1.60	1.55	2.84	0.66	1.72	1.80	3.01	0.43	0.64	0.80	1.36	0.31	0.85	0.80	1.49	0.21
Pu (kip)	27.48	28.92	32.84	25.94	29.15	27.83	33.42	26.21	10.72	14.15	15.46	10.76	14.28	12.04	16.11	10.07

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1504.63	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1494.18	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1758.52	1856.25	OK
BF Outside	1534.71	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	25.57	26.91	29.92	24.22	27.12	25.85	30.83	24.39
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1012.97
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9205**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1504.63	15.05	OK	936.69	9.37	OK
BF	1758.52	25.12	OK	554.47	7.92	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.63	15.05	1.47	137.48	OK
TF	2998.80	29.99	1.47	229.13	OK
TF Inside	1494.18	14.94	1.47	148.93	OK
BF Inside	1758.52	25.12	1.47	114.56	OK
BF	3293.24	47.05	1.47	229.13	OK
BF Outside	1534.71	21.92	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.42	16.71	OK	16.11	8.05	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.42	1.47	91.65	OK
Web SPL	16.71	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.32	NA
TF Inside	1.27	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.41	1.80	7.64
Web	2.17	2.09	2.74
BF	1.30	2.12	4.18

Plate	Shear	Flexure
Web	3.03	1.62

Field Splice - Node 1219

Node 1219

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1219 L	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00
1219 R	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 1219 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1219**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	30.44	5.72	19.57	4.51	33.47	-4.41	19.63	13.61	29.17	4.74	25.71	6.07	18.00	15.26	38.42	-7.91
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.81	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.74
f / ϕf Fnc	0.61	0.11	0.39	0.09	0.67	0.09	0.39	0.27	0.58	0.09	0.51	0.12	0.36	0.31	0.77	0.16
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	30.44		19.57		33.47		19.63		29.17		25.71		18.00		38.42	
Fcf (ksi)	40.22		37.50		41.73		37.50		39.59		37.86		37.50		44.21	
Fcf (kip)	2793.31		2604.28		2898.38		2604.28		2749.22		2629.08		2604.28		3070.27	
fncf (ksi)		5.72		4.51		-4.41		13.61		4.74		6.07		15.26		-7.91
Rcf		1.32		1.92		1.25		1.91		1.36		1.47		2.08		1.15
Fncf (ksi)		37.50		37.50		-36.61		37.50		37.50		37.50		37.50		-36.56
Fncf (kip)		2604.28		2604.28		-3294.51		2604.28		2604.28		2604.28		2604.28		-3290.12

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.73	2.88	14.41	3.18	20.15	-3.11	14.45	9.61	19.63	2.91	17.81	3.67	13.30	10.77	28.18	-5.53
Fs (ksi)	19.73	2.88	14.41	3.18	20.15	-3.11	14.45	9.61	19.63	2.91	17.81	3.67	13.30	10.77	28.18	-5.53
Fs (kip)	1776.08	259.16	1296.95	286.02	1813.57	-279.65	1300.39	864.48	1767.04	261.99	1602.70	330.51	1197.18	969.56	2536.44	-497.86

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3070.27	2604.28	2536.44	969.56
Comp	0.00	3294.51	0.00	497.86

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	365.40	332.45	672.01	144.37	346.68	353.81	201.89	541.44	268.17	244.56	484.80	111.67	254.94	259.65	152.31	392.55
Vuw (kip)	548.10	498.68	1008.02	216.55	520.02	530.72	302.84	812.16	---	---	---	---	---	---	---	---
Mv (k*ft)	376.82	342.84	693.01	148.88	357.51	364.87	208.20	558.36	184.37	168.14	333.30	76.78	175.27	178.51	104.72	269.88
Huw (kip)	2293.59	2214.85	1739.60	3048.02	2208.58	2246.37	3325.76	1685.30	1085.46	844.25	818.09	1154.60	1082.15	1031.05	1155.59	1087.24
Muw (k*ft)	2090.30	1846.86	3022.61	735.97	2122.37	1850.56	365.65	3411.81	1078.70	718.89	1488.51	309.98	1070.26	904.66	161.87	2157.72
Mu (k*ft)	2467.12	2189.71	3715.62	884.85	2479.88	2215.43	573.85	3970.17	1263.07	887.02	1821.81	386.76	1245.53	1083.17	266.58	2427.60

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1219**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.82	15.27	12.00	21.02	15.23	15.49	22.94	11.62	7.49	5.82	5.64	7.96	7.46	7.11	7.97	7.50
PY1 (Vuw)	3.78	3.44	6.95	1.49	3.59	3.66	2.09	5.60	1.85	1.69	3.34	0.77	1.76	1.79	1.05	2.71
PX2 (Mu)	13.23	11.75	19.93	4.75	13.30	11.88	3.08	21.30	6.78	4.76	9.77	2.07	6.68	5.81	1.43	13.02
PY2 (Mu)	1.89	1.68	2.85	0.68	1.90	1.70	0.44	3.04	0.97	0.68	1.40	0.30	0.95	0.83	0.20	1.86
Pu (kip)	29.60	27.50	33.40	25.86	29.06	27.90	26.14	34.03	14.54	10.84	16.13	10.09	14.40	13.18	9.48	21.02

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1540.48	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1529.78	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1759.20	1856.25	OK
BF Outside	1535.30	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	27.54	25.59	30.47	24.17	27.06	25.93	24.33	31.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1008.02
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1219**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1540.48	15.40	OK	1272.64	12.73	OK
BF	1759.20	25.13	OK	517.72	7.40	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1540.48	15.40	1.47	137.48	OK
TF	3070.27	30.70	1.47	229.13	OK
TF Inside	1529.78	15.30	1.47	148.93	OK
BF Inside	1759.20	25.13	1.47	114.56	OK
BF	3294.51	47.06	1.47	229.13	OK
BF Outside	1535.30	21.93	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.03	17.02	OK	21.02	10.51	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.03	1.47	91.65	OK
Web SPL	17.02	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.24	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.35	1.32	7.46
Web	2.13	1.60	2.69
BF	1.30	2.28	4.18

Plate	Shear	Flexure
Web	3.05	1.59

Field Splice - Node 3219

Node 3219

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3219 L	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00
3219 R	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 3219 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3219**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	35.98	1.10	22.67	3.53	35.56	-3.84	22.39	11.79	31.26	4.83	30.91	4.77	21.50	12.84	40.16	-6.91
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.83	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.77
f / ϕf Fnc	0.72	0.02	0.45	0.07	0.71	0.08	0.45	0.24	0.63	0.10	0.62	0.10	0.43	0.26	0.80	0.14
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
fcf (ksi)	35.98		22.67		35.56		22.39		31.26		30.91		21.50		40.16	
Fcf (ksi)	42.99		37.50		42.78		37.50		40.63		40.46		37.50		45.08	
Fcf (kip)	2985.62		2604.28		2970.88		2604.28		2821.63		2809.53		2604.28		3130.51	
fncf (ksi)		1.10		3.53		-3.84		11.79		4.83		4.77		12.84		-6.91
Rcf		1.19		1.65		1.20		1.67		1.30		1.31		1.74		1.12
Fncf (ksi)		37.50		37.50		-36.62		37.50		37.50		37.50		37.50		-36.58
Fncf (kip)		2604.28		2604.28		-3296.04		2604.28		2604.28		2604.28		2604.28		-3292.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.23	-0.31	16.69	2.58	21.71	-2.92	16.52	8.44	21.30	2.68	20.84	2.80	15.87	9.16	23.14	-5.02
Fs (ksi)	22.23	-0.31	16.69	2.58	21.71	-2.92	16.52	8.44	21.30	2.68	20.84	2.80	15.87	9.16	23.14	-5.02
Fs (kip)	2001.06	-28.08	1501.94	231.91	1953.88	-262.67	1487.12	760.02	1916.76	241.00	1875.56	252.20	1427.89	824.26	2082.33	-451.48

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3130.51	2604.28	2082.33	824.26
Comp	0.00	3296.04	0.00	451.48

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	516.43	433.71	834.61	263.10	473.87	466.44	339.83	649.54	375.16	314.35	599.96	193.81	345.08	337.48	248.03	469.20
Vuw (kip)	774.65	650.56	1105.00	394.64	710.80	699.66	509.75	974.31	---	---	---	---	---	---	---	---
Mv (k*ft)	532.57	447.26	759.69	271.32	488.68	481.02	350.45	669.84	257.92	216.12	412.47	133.25	237.25	232.02	170.52	322.57
Huw (kip)	2126.55	2080.05	1831.82	2747.69	2251.68	2241.45	2875.06	1791.47	1052.25	924.72	901.98	1198.47	1150.80	1134.81	1201.15	869.79
Muw (k*ft)	2667.46	2026.60	3033.28	1136.42	2198.38	2189.70	966.59	3381.30	1442.94	903.13	1576.21	517.05	1191.65	1154.39	429.25	1801.82
Mu (k*ft)	3200.03	2473.86	3792.96	1407.73	2687.06	2670.72	1317.04	4051.14	1700.86	1119.25	1988.68	650.29	1428.90	1386.41	599.77	2124.40

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.67	14.35	12.63	18.95	15.53	15.46	19.83	12.35	7.26	6.38	6.22	8.27	7.94	7.83	8.28	6.00
PY1 (Vuw)	5.34	4.49	7.62	2.72	4.90	4.83	3.52	6.72	2.59	2.17	4.14	1.34	2.38	2.33	1.71	3.24
PX2 (Mu)	17.16	13.27	20.35	7.55	14.41	14.33	7.06	21.73	9.12	6.00	10.67	3.49	7.66	7.44	3.22	11.40
PY2 (Mu)	2.45	1.90	2.91	1.08	2.06	2.05	1.01	3.10	1.30	0.86	1.52	0.50	1.09	1.06	0.46	1.63
Pu (kip)	32.77	28.34	34.62	26.77	30.74	30.57	27.27	35.47	16.84	12.75	17.81	11.90	15.98	15.63	11.70	18.06

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1570.71	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1559.80	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1760.02	1856.25	OK
BF Outside	1536.02	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.28	26.20	31.46	24.95	28.41	28.26	25.30	32.54
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1105.00
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1570.71	15.71	OK	1044.79	10.45	OK
BF	1760.02	25.14	OK	440.14	6.29	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1570.71	15.71	1.47	137.48	OK
TF	3130.51	31.31	1.47	229.13	OK
TF Inside	1559.80	15.60	1.47	148.93	OK
BF Inside	1760.02	25.14	1.47	114.56	OK
BF	3296.04	47.09	1.47	229.13	OK
BF Outside	1536.02	21.94	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.47	17.74	OK	18.06	9.03	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.47	1.47	91.65	OK
Web SPL	17.74	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.26	NA
TF Inside	1.21	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.30	1.61	7.32
Web	2.04	1.86	2.58
BF	1.30	2.68	4.18

Plate	Shear	Flexure
Web	2.78	1.54

Field Splice - Node 5219

Node 5219

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5219 L	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00
5219 R	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 5219 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	35.49	3.30	22.82	4.83	34.92	-2.52	23.11	12.72	32.73	3.77	27.69	7.73	21.96	14.07	39.74	-5.76
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.87	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.80
f / ϕf Fnc	0.71	0.07	0.46	0.10	0.70	0.05	0.46	0.25	0.65	0.08	0.55	0.15	0.44	0.28	0.79	0.12
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
fcf (ksi)	35.49		22.82		34.92		23.11		32.73		27.69		21.96		39.74	
Fcf (ksi)	42.74		37.50		42.46		37.50		41.36		38.84		37.50		44.87	
Fcf (kip)	2968.46		2604.28		2948.57		2604.28		2872.59		2697.66		2604.28		3116.23	
fncf (ksi)		3.30		4.83		-2.52		12.72		3.77		7.73		14.07		-5.76
Rcf		1.20		1.64		1.22		1.62		1.26		1.40		1.71		1.13
Fncf (ksi)		37.50		37.50		-36.65		37.50		37.50		37.50		37.50		-36.60
Fncf (kip)		2604.28		2604.28		-3298.49		2604.28		2604.28		2604.28		2604.28		-3293.68

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.19	1.20	16.95	3.71	21.57	-2.09	17.15	9.28	21.38	1.87	19.97	5.10	16.34	10.23	23.04	-4.29
Fs (ksi)	22.19	1.20	16.95	3.71	21.57	-2.09	17.15	9.28	21.38	1.87	19.97	5.10	16.34	10.23	23.04	-4.29
Fs (kip)	1997.35	108.00	1525.23	333.75	1941.19	-187.71	1543.26	835.50	1924.02	167.96	1797.28	459.40	1470.41	921.13	2073.50	-386.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3116.23	2604.28	2073.50	921.13
Comp	0.00	3298.49	0.00	386.23

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	489.45	413.31	814.26	257.08	477.34	425.59	339.14	628.74	356.28	299.19	585.76	188.81	347.72	307.86	246.79	454.69
Vuw (kip)	734.17	619.96	1094.82	385.62	716.01	638.38	508.71	943.12	---	---	---	---	---	---	---	---
Mv (k*ft)	504.74	426.23	752.69	265.11	492.26	438.89	349.74	648.39	244.94	205.69	402.71	129.81	239.06	211.66	169.67	312.60
Huw (kip)	2242.77	2180.73	1890.87	2790.70	2214.12	2385.15	2952.74	1841.75	1122.85	991.46	935.19	1268.67	1115.72	1203.56	1275.49	899.88
Muw (k*ft)	2480.88	1892.36	2913.42	1079.07	2342.37	1791.91	863.02	3287.92	1343.54	847.27	1513.88	503.29	1248.76	951.38	390.60	1749.14
Mu (k*ft)	2985.62	2318.58	3666.11	1344.18	2834.63	2230.80	1212.75	3936.32	1588.48	1052.96	1916.59	633.10	1487.82	1163.04	560.27	2061.74

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.47	15.04	13.04	19.25	15.27	16.45	20.36	12.70	7.74	6.84	6.45	8.75	7.69	8.30	8.80	6.21
PY1 (Vuw)	5.06	4.28	7.55	2.66	4.94	4.40	3.51	6.50	2.46	2.06	4.04	1.30	2.40	2.12	1.70	3.14
PX2 (Mu)	16.01	12.44	19.66	7.21	15.20	11.97	6.51	21.11	8.52	5.65	10.28	3.40	7.98	6.24	3.01	11.06
PY2 (Mu)	2.29	1.78	2.81	1.03	2.17	1.71	0.93	3.02	1.22	0.81	1.47	0.49	1.14	0.89	0.43	1.58
Pu (kip)	32.33	28.14	34.31	26.71	31.29	29.07	27.23	35.13	16.67	12.81	17.61	12.28	16.07	14.85	11.99	17.90

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1563.54	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1552.68	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1761.33	1856.25	OK
BF Outside	1537.16	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.91	26.04	31.18	24.90	28.94	26.90	25.26	32.27
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1094.82
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1563.54	15.64	OK	1040.36	10.40	OK
BF	1761.33	25.16	OK	491.86	7.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1563.54	15.64	1.47	137.48	OK
TF	3116.23	31.16	1.47	229.13	OK
TF Inside	1552.68	15.53	1.47	148.93	OK
BF Inside	1761.33	25.16	1.47	114.56	OK
BF	3298.49	47.12	1.47	229.13	OK
BF Outside	1537.16	21.96	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.13	17.57	OK	17.90	8.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.13	1.47	91.65	OK
Web SPL	17.57	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.22	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.31	1.62	7.35
Web	2.06	1.88	2.61
BF	1.30	2.40	4.17

Plate	Shear	Flexure
Web	2.81	1.55

Field Splice - Node 7219

Node 7219

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7219 L	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00
7219 R	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 7219 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	36.09	1.64	22.72	5.43	35.16	-3.25	22.34	13.67	30.61	3.83	29.29	7.61	21.72	14.71	39.32	-6.23
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.85	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.78
f / ϕf Fnc	0.72	0.03	0.45	0.11	0.70	0.07	0.45	0.27	0.61	0.08	0.59	0.15	0.43	0.29	0.79	0.13
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
fcf (ksi)	36.09		22.72		35.16		22.34		30.61		29.29		21.72		39.32	
Fcf (ksi)	43.05		37.50		42.58		37.50		40.30		39.64		37.50		44.66	
Fcf (kip)	2989.42		2604.28		2956.98		2604.28		2798.93		2753.07		2604.28		3101.52	
fncf (ksi)		1.64		5.43		-3.25		13.67		3.83		7.61		14.71		-6.23
Rcf		1.19		1.65		1.21		1.68		1.32		1.35		1.73		1.14
Fncf (ksi)		37.50		37.50		-36.63		37.50		37.50		37.50		37.50		-36.59
Fncf (kip)		2604.28		2604.28		-3297.08		2604.28		2604.28		2604.28		2604.28		-3292.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.93	0.62	16.97	3.72	21.37	-2.65	16.63	10.04	20.20	1.85	20.44	5.00	16.19	10.77	22.61	-4.66
Fs (ksi)	21.93	0.62	16.97	3.72	21.37	-2.65	16.63	10.04	20.20	1.85	20.44	5.00	16.19	10.77	22.61	-4.66
Fs (kip)	1973.37	55.90	1527.39	334.97	1923.53	-238.88	1496.59	903.61	1818.08	166.90	1839.77	450.31	1456.85	969.73	2035.34	-419.25

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3101.52	2604.28	2035.34	969.73
Comp	0.00	3297.08	0.00	419.25

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	542.67	423.33	824.73	266.92	480.96	448.28	341.17	639.80	390.33	310.07	593.66	195.51	350.78	323.64	247.96	463.00
Vuw (kip)	814.00	635.00	1100.06	400.38	721.44	672.42	511.75	959.70	---	---	---	---	---	---	---	---
Mv (k*ft)	559.63	436.56	756.29	275.26	495.99	462.29	351.83	659.79	268.35	213.17	408.14	134.41	241.16	222.50	170.48	318.31
Huw (kip)	2159.81	2230.08	1854.84	2901.29	2176.86	2397.28	3019.17	1803.79	1082.27	993.26	898.48	1280.11	1058.66	1221.38	1294.17	861.92
Muw (k*ft)	2630.13	1826.56	2976.96	931.62	2256.29	1877.88	774.44	3311.43	1363.53	847.94	1537.71	421.67	1174.18	988.06	346.39	1745.49
Mu (k*ft)	3189.76	2263.12	3733.25	1206.88	2752.28	2340.17	1126.27	3971.22	1631.89	1061.11	1945.85	556.08	1415.34	1210.56	516.87	2063.80

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7219**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.90	15.38	12.79	20.01	15.01	16.53	20.82	12.44	7.46	6.85	6.20	8.83	7.30	8.42	8.93	5.94
PY1 (Vuw)	5.61	4.38	7.59	2.76	4.98	4.64	3.53	6.62	2.69	2.14	4.09	1.35	2.42	2.23	1.71	3.19
PX2 (Mu)	17.11	12.14	20.03	6.47	14.76	12.55	6.04	21.30	8.75	5.69	10.44	2.98	7.59	6.49	2.77	11.07
PY2 (Mu)	2.44	1.73	2.86	0.92	2.11	1.79	0.86	3.04	1.25	0.81	1.49	0.43	1.08	0.93	0.40	1.58
Pu (kip)	33.00	28.19	34.44	26.74	30.61	29.79	27.22	35.10	16.69	12.88	17.55	11.94	15.30	15.25	11.89	17.67

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1556.16	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1545.36	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1760.58	1856.25	OK
BF Outside	1536.50	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.44	26.07	31.30	24.90	28.27	27.55	25.23	32.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1100.06
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1556.16	15.56	OK	1021.22	10.21	OK
BF	1760.58	25.15	OK	517.82	7.40	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1556.16	15.56	1.47	137.48	OK
TF	3101.52	31.02	1.47	229.13	OK
TF Inside	1545.36	15.45	1.47	148.93	OK
BF Inside	1760.58	25.15	1.47	114.56	OK
BF	3297.08	47.10	1.47	229.13	OK
BF Outside	1536.50	21.95	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.10	17.55	OK	17.67	8.84	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.10	1.47	91.65	OK
Web SPL	17.55	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.22	NA
BF Inside	1.05	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.33	1.65	7.39
Web	2.06	1.90	2.61
BF	1.30	2.28	4.18

Plate	Shear	Flexure
Web	2.79	1.55

Field Splice - Node 9219

Node 9219

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	145
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9219 L	90.00	50.00	4500.00	90.00	50.00	4500.00	96.00	50.00	4800.00
9219 R	90.00	50.00	4500.00	107.25	50.00	5362.50	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 9219 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.500	62.50	54.00	38.06	---	50	65
	TF Inside	16.50	1.625	62.50	53.63	36.36	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.000	44.50	36.00	25.38	---	50	65
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	33.79	5.40	20.55	7.83	34.20	-4.66	19.80	17.53	24.07	7.90	28.53	8.38	18.67	18.83	38.73	-7.97
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	48.80	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	48.74
f / ϕf Fnc	0.68	0.11	0.41	0.16	0.68	0.10	0.40	0.35	0.48	0.16	0.57	0.17	0.37	0.38	0.77	0.16
α	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
fcf (ksi)	33.79		20.55		34.20		19.80		24.07		28.53			18.83	38.73	
Fcf (ksi)	41.90		37.50		42.10		37.50		37.50		39.27			37.50	44.37	
Fcf (kip)	2909.63		2604.28		2923.72		2604.28		2604.28		2726.90			2604.28	3081.15	
fncf (ksi)		5.40		7.83		-4.66		17.53		7.90		8.38	18.67			-7.97
Rcf		1.24		1.82		1.23		1.89		1.56		1.38	1.99			1.15
Fncf (ksi)		37.50		37.50		-36.60		37.50		37.50		37.50	37.50			-36.56
Fncf (kip)		2604.28		2604.28		-3294.21		2604.28		2604.28		2604.28	2604.28			-3290.12

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.80	3.41	15.40	5.44	20.54	-3.63	14.84	12.91	16.98	4.66	19.49	5.96	14.04	13.83	22.08	-5.86
Fs (ksi)	20.80	3.41	15.40	5.44	20.54	-3.63	14.84	12.91	16.98	4.66	19.49	5.96	14.04	13.83	22.08	-5.86
Fs (kip)	1871.67	306.94	1386.35	489.73	1848.42	-326.99	1335.25	1162.35	1528.06	419.41	1754.21	536.62	1263.52	1244.68	1987.41	-526.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3081.15	2604.28	1987.41	1244.68
Comp	0.00	3294.21	0.00	526.98

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	422.48	313.66	656.57	132.51	339.96	328.14	188.25	525.87	305.14	233.36	475.63	100.27	251.94	238.49	139.65	383.29
Vuw (kip)	633.72	470.49	984.86	198.76	509.94	492.21	282.38	788.81	---	---	---	---	---	---	---	---
Mv (k*ft)	435.68	323.47	677.09	136.65	350.58	338.40	194.13	542.31	209.78	160.44	327.00	68.93	173.21	163.96	96.01	263.51
Huw (kip)	2332.65	2485.94	1745.28	3393.71	2391.18	2438.38	3585.33	1691.30	1161.93	1000.57	811.43	1332.05	1038.65	1221.78	1337.71	778.90
Muw (k*ft)	2252.61	1485.42	3061.74	275.05	1611.76	1774.85	19.57	3423.87	1112.70	637.59	1546.96	122.96	788.37	865.85	13.40	1788.02
Mu (k*ft)	2688.29	1808.88	3738.83	411.71	1962.34	2113.25	213.70	3966.17	1322.48	798.03	1873.96	191.89	961.58	1029.81	109.41	2051.53

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.09	17.14	12.04	23.40	16.49	16.82	24.73	11.66	8.01	6.90	5.60	9.19	7.16	8.43	9.23	5.37
PY1 (Vuw)	4.37	3.24	6.79	1.37	3.52	3.39	1.95	5.44	2.10	1.61	3.28	0.69	1.74	1.64	0.96	2.64
PX2 (Mu)	14.42	9.70	20.06	2.21	10.53	11.34	1.15	21.27	7.09	4.28	10.05	1.03	5.16	5.52	0.59	11.00
PY2 (Mu)	2.06	1.39	2.87	0.32	1.50	1.62	0.16	3.04	1.01	0.61	1.44	0.15	0.74	0.79	0.08	1.57
Pu (kip)	31.18	27.24	33.51	25.67	27.48	28.59	25.96	34.01	15.43	11.40	16.34	10.25	12.57	14.16	9.87	16.91

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1545.94	2565.00	1979.25	87.00	56.72	32.16	3382.76	1979.25	OK
TF Inside	1535.20	2547.19	1890.69	188.50	122.89	25.19	5016.13	1890.69	OK
BF Inside	1390.63	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1213.64	1710.00	1319.50	40.00	26.19	21.44	1904.57	1319.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	2430.00	OK
TF Inside	0.00	2413.13	OK
BF Inside	1759.04	1856.25	OK
BF Outside	1535.17	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.94	25.36	30.63	23.93	25.55	26.63	24.13	31.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	984.86
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.77

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1545.94	15.46	OK	997.17	9.97	OK
BF	1759.04	25.13	OK	664.64	9.49	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1545.94	15.46	1.47	137.48	OK
TF	3081.15	30.81	1.47	229.13	OK
TF Inside	1535.20	15.35	1.47	148.93	OK
BF Inside	1759.04	25.13	1.47	114.56	OK
BF	3294.21	47.06	1.47	229.13	OK
BF Outside	1535.17	21.93	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.01	17.01	OK	16.91	8.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.01	1.47	91.65	OK
Web SPL	17.01	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	NA
TF Inside	1.23	NA
BF Inside	1.05	1.06
BF Outside	1.09	1.06

Bolt	Shear	Slip	Bearing
TF	2.34	1.69	7.44
Web	2.13	1.99	2.69
BF	1.30	1.77	4.18

Plate	Shear	Flexure
Web	3.12	1.59

Field Splice

Type H

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1115	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type H

Field Splice - Node 1115

Node 1115

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1115 L	88.00	50.00	4400.00	88.00	47.52	4181.36	96.00	50.00	4800.00
1115 R	64.00	50.00	3200.00	80.00	47.14	3771.35	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1115 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.000	50.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	50.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.69	-8.23	13.37	-10.53	9.15	-11.81	-2.69	2.57	-8.08	5.84	26.67	-26.27	29.05	-31.31	-5.28	10.30
ϕf Fnc (ksi)	50.00	47.14	50.00	47.49	50.00	47.32	50.00	50.00	50.00	50.00	50.00	47.41	50.00	47.38	50.00	50.00
f / ϕf Fnc	0.07	0.17	0.27	0.22	0.18	0.25	0.05	0.05	0.16	0.12	0.53	0.55	0.58	0.66	0.11	0.21
α	1.00	0.94	1.00	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-8.23	13.37			-11.81	-2.69		-8.08			-26.27		-31.31		10.30
Fcf (ksi)		-35.36	37.50			-35.49	-37.50		-37.50			-36.84		-39.35		37.50
Fcf (kip)		-2828.51	1929.47			-2839.00	-2400.00		-2400.00			-2947.27		-3147.70		2411.84
fncf (ksi)	3.69			-10.53	9.15			2.57		5.84	26.67		29.05		-5.28	
Rcf	4.30			2.80	3.00			13.94		4.64	1.40		1.26		3.64	
Fncf (ksi)	37.50			-35.62	37.50			37.50		37.50	37.50		37.50		-37.50	
Fncf (kip)	1929.47			-2849.35	1929.47			2411.84		2411.84	1929.47		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-0.94	-4.67	9.05	-6.86	2.06	-6.66	-1.50	1.80	-3.77	4.38	18.44	-18.38	20.13	-21.94	-3.93	7.79
Fs (ksi)	-0.94	-4.67	9.05	-6.86	2.06	-6.66	-1.50	1.80	-3.77	4.38	18.44	-18.38	20.13	-21.94	-3.93	7.79
Fs (kip)	-60.20	-373.82	579.26	-548.49	131.68	-533.10	-96.27	143.74	-241.06	350.61	1180.28	-1470.28	1288.04	-1755.29	-251.78	623.03

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	2411.84	1288.04	623.03
Comp	2400.00	3147.70	251.78	1755.29

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	650.47	512.43	812.89	355.50	606.31	550.31	604.53	487.54	468.69	380.41	592.69	260.29	446.74	397.92	436.23	362.82
Vuw (kip)	975.70	768.65	1094.14	533.25	909.46	825.47	906.80	731.30	---	---	---	---	---	---	---	---
Mv (k*ft)	426.87	336.28	478.69	233.30	397.89	361.14	396.72	319.95	205.05	166.43	259.30	113.88	195.45	174.09	190.85	158.73
Huw (kip)	-936.94	382.30	-383.66	-77.60	-500.38	26.72	-136.45	877.31	-269.44	105.35	-221.10	14.05	29.57	3.04	-87.14	184.98
Muw (k*ft)	3276.36	4290.27	4030.86	4696.54	4132.83	4751.26	4854.39	3630.26	238.86	1018.05	558.16	211.26	521.55	2356.51	2692.27	750.21
Mu (k*ft)	3703.23	4626.55	4509.54	4929.83	4530.72	5112.40	5251.12	3950.20	443.91	1184.48	817.47	325.13	717.00	2530.60	2883.12	908.94

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	10.77	4.39	4.41	0.89	5.75	0.31	1.57	10.08	3.10	1.21	2.54	0.16	0.34	0.03	1.00	2.13
PY1 (Vuw)	11.21	8.84	12.58	6.13	10.45	9.49	10.42	8.41	5.39	4.37	6.81	2.99	5.13	4.57	5.01	4.17
PX2 (Mu)	33.73	42.14	41.08	44.90	41.27	46.57	47.83	35.98	4.04	10.79	7.45	2.96	6.53	23.05	26.26	8.28
PY2 (Mu)	2.41	3.01	2.93	3.21	2.95	3.33	3.42	2.57	0.29	0.77	0.53	0.21	0.47	1.65	1.88	0.59
Pu (kip)	46.54	48.02	48.06	46.74	48.89	48.59	51.30	47.35	9.12	13.06	12.40	4.47	8.86	23.91	28.12	11.44

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	46.00	30.06	20.56	1975.94	1222.00	OK
TF Inside	974.07	1549.69	1199.25	103.50	67.64	16.45	2895.60	1199.25	OK
BF Inside	1204.03	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1207.81	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1571.39	1794.38	OK
BF Outside	1576.32	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.35	37.08	36.24	36.55	37.44	37.42	39.41	36.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1094.14
Rr (kip)	2193.67
Check	OK

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.75	0.79	1.0	28.44
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	18.93	OK	650.25	10.16	OK
BF	1576.32	24.63	OK	879.02	13.73	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	18.57	1.47	91.65	OK
TF	2400.00	37.50	1.47	183.30	OK
TF Inside	1211.61	18.93	1.47	103.11	OK
BF Inside	1571.39	24.55	1.47	126.02	OK
BF	3147.70	49.18	1.47	229.13	OK
BF Outside	1576.32	24.63	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.30	25.65	OK	28.12	14.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.30	1.47	91.65	OK
Web SPL	25.65	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.22	1.14
BF Outside	1.26	1.14

Bolt	Shear	Slip	Bearing
TF	1.50	1.66	4.89
Web	1.41	1.20	1.79
BF	1.35	1.23	4.65

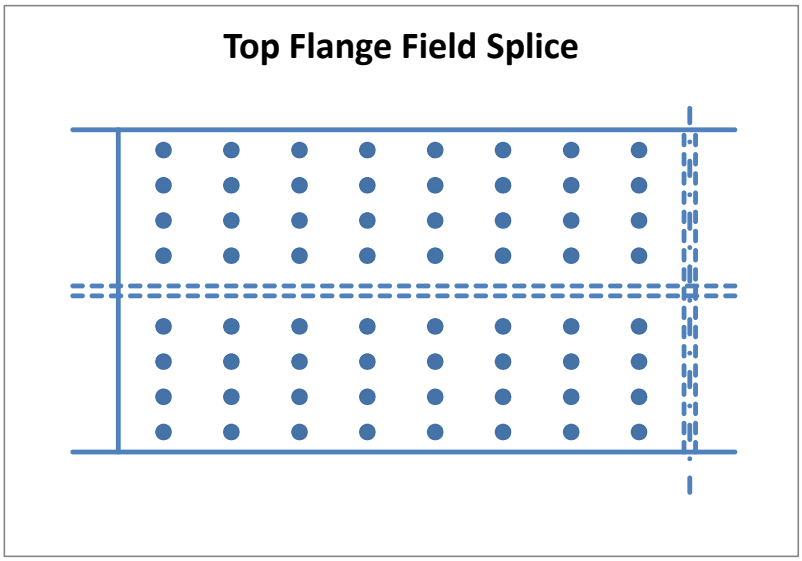
Plate	Shear	Flexure
Web	2.00	1.27

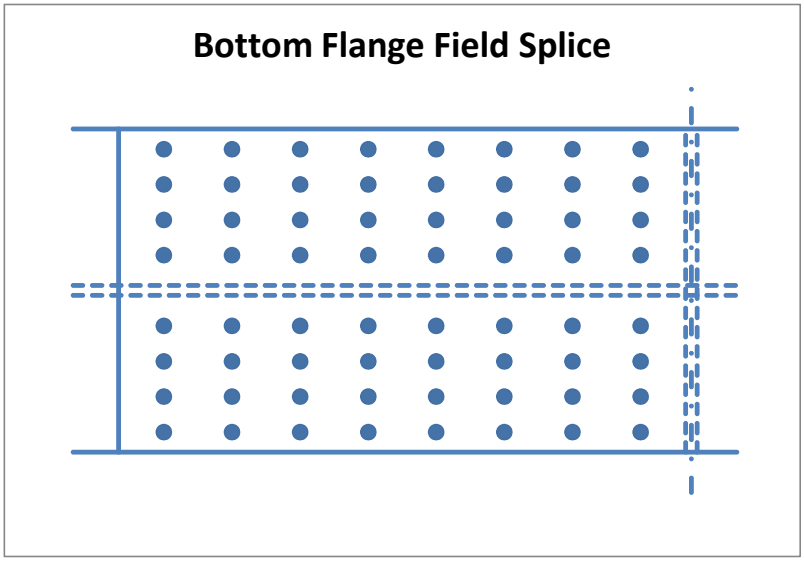
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1115	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1115

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0	21	0
21	3.5	21	3.5
21	7	21	7

	Top Flange		Bottom Flange	
No. Bolts =	64.0		64.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	7.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5	21	10.5
21	17.5	21	17.5
21	21	21	21
21	24.5	21	24.5
21	28	21	28

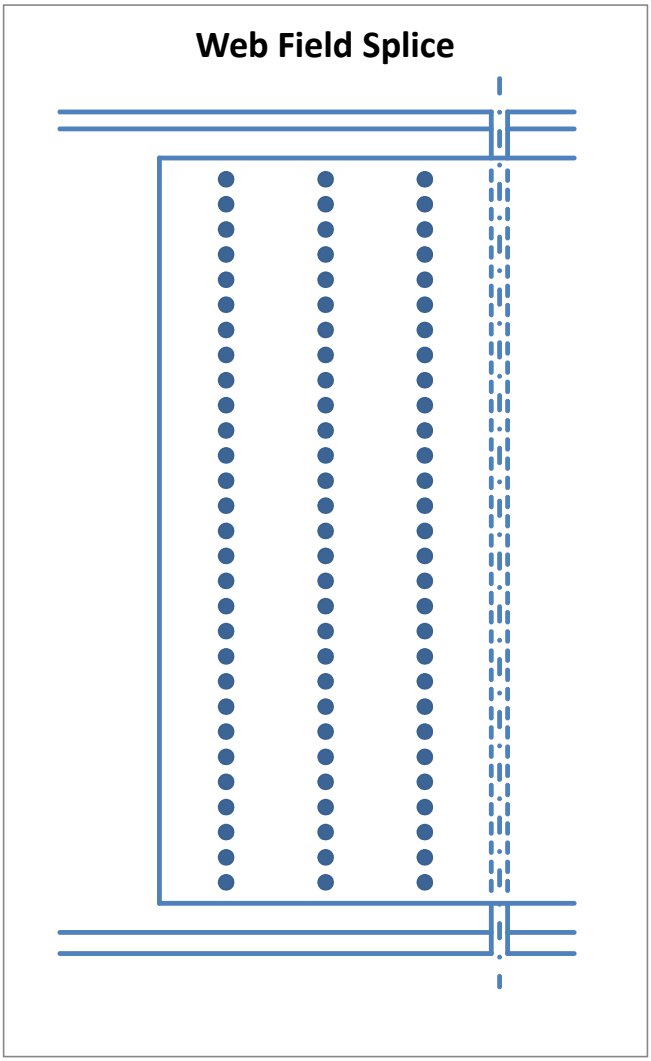
Flange Bolt Pattern Cont. - Node 1115

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1115	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1115

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	9	1764
0	3	9	1521
0	6	9	1296
0	9	9	1089
0	12	9	900
0	15	9	729
0	18	9	576
0	21	9	441
0	24	9	324
0	27	9	225
0	30	9	144
0	33	9	81
0	36	9	36
0	39	9	9
0	42	9	0
0	45	9	9
0	48	9	36
0	51	9	81
0	54	9	144
0	57	9	225
0	60	9	324
0	63	9	441
0	66	9	576
0	69	9	729
0	72	9	900
0	75	9	1089
0	78	9	1296
0	81	9	1521
0	84	9	1764
3	0	0	1764
3	3	0	1521
3	6	0	1296
3	9	0	1089
3	12	0	900
3	15	0	729
3	18	0	576
3	21	0	441
3	24	0	324
3	27	0	225
3	30	0	144
3	33	0	81
3	36	0	36
3	39	0	9
3	42	0	0
3	45	0	9
3	48	0	36
3	51	0	81
3	54	0	144
3	57	0	225
3	60	0	324
3	63	0	441
3	66	0	576
3	69	0	729
3	72	0	900
3	75	0	1089
3	78	0	1296
3	81	0	1521
3	84	0	1764
6	0	9	1764

No. Bolts =	87.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	2.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	3	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	522	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	54810	
Σd^2 (in^2) =	55332	



6	3	9	1521
6	6	9	1296
6	9	9	1089
6	12	9	900
6	15	9	729
6	18	9	576
6	21	9	441
6	24	9	324
6	27	9	225
6	30	9	144
6	33	9	81
6	36	9	36
6	39	9	9
6	42	9	0
6	45	9	9
6	48	9	36
6	51	9	81
6	54	9	144
6	57	9	225
6	60	9	324
6	63	9	441
6	66	9	576
6	69	9	729
6	72	9	900
6	75	9	1089
6	78	9	1296
6	81	9	1521
6	84	9	1764

Web Bolt Pattern Cont. - Node 1115

Web Bolt Pattern Cont. - Node 1115

261	3654	522	54810

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3115	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3115

Node 3115

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3115 L	88.00	50.00	4400.00	88.00	47.43	4173.56	96.00	50.00	4800.00
3115 R	64.00	50.00	3200.00	80.00	45.93	3674.35	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3115 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.000	50.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	50.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	1.38	-5.84	14.38	-14.82	8.06	-11.18	-2.35	0.47	-5.41	2.02	21.09	-22.70	26.12	-29.23	-5.74	8.31
ϕf Fnc (ksi)	50.00	45.93	50.00	47.39	50.00	47.29	50.00	50.00	50.00	50.00	50.00	47.38	50.00	47.37	50.00	50.00
f / ϕf Fnc	0.03	0.13	0.29	0.31	0.16	0.24	0.05	0.01	0.11	0.04	0.42	0.48	0.52	0.62	0.11	0.17
α	1.00	0.92	1.00	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-5.84		-14.82		-11.18	-2.35		-5.41			-22.70		-29.23		8.31
Fcf (ksi)		-34.45		-35.55		-35.47	-37.50		-37.50			-35.53		-38.30		37.50
Fcf (kip)		-2755.76		-2843.69		-2837.53	-2400.00		-2400.00			-2842.77		-3064.02		2411.84
fncf (ksi)	1.38		14.38		8.06			0.47		2.02	21.09		26.12		-5.74	
Rcf	5.90		2.40		3.17			15.93		6.93	1.57		1.31		4.51	
Fncf (ksi)	37.50		37.50		37.50			37.50		37.50	37.50		37.50		-37.50	
Fncf (kip)	1929.47		1929.47		1929.47			2411.84		2411.84	1929.47		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.61	-3.29	9.72	-9.92	1.52	-6.41	-1.75	0.54	-3.26	1.96	14.57	-15.80	18.13	-20.43	-4.29	6.36
Fs (ksi)	-1.61	-3.29	9.72	-9.92	1.52	-6.41	-1.75	0.54	-3.26	1.96	14.57	-15.80	18.13	-20.43	-4.29	6.36
Fs (kip)	-102.73	-263.05	622.05	-793.41	97.43	-512.70	-112.13	43.45	-208.63	156.51	932.35	-1263.74	1160.49	-1634.15	-274.83	508.97

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	2411.84	1160.49	508.97
Comp	2400.00	3064.02	274.83	1634.15

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	645.24	580.42	843.55	380.22	635.46	601.67	627.45	555.52	463.85	427.09	613.00	276.62	465.98	433.07	451.29	409.50
Vuw (kip)	967.85	870.64	1109.47	570.33	953.19	902.50	941.18	833.29	---	---	---	---	---	---	---	---
Mv (k*ft)	423.44	380.90	485.39	249.52	417.02	394.84	411.76	364.56	202.94	186.85	268.19	121.02	203.86	189.47	197.44	179.16
Huw (kip)	-1263.53	-50.07	-475.22	-1438.71	-1127.85	-120.62	-195.77	557.19	-234.87	-9.51	-234.55	-58.03	-62.57	-58.98	-110.12	99.26
Muw (k*ft)	2724.51	4483.15	3906.42	2881.72	3296.20	4387.61	4641.42	4057.07	107.71	1256.78	507.59	146.89	333.84	1943.34	2467.80	682.01
Mu (k*ft)	3147.95	4864.05	4391.81	3131.24	3713.22	4782.46	5053.18	4421.64	310.65	1443.63	775.78	267.91	537.70	2132.81	2665.24	861.17

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.52	0.58	5.46	16.54	12.96	1.39	2.25	6.40	2.70	0.11	2.70	0.67	0.72	0.68	1.27	1.14
PY1 (Vuw)	11.12	10.01	12.75	6.56	10.96	10.37	10.82	9.58	5.33	4.91	7.05	3.18	5.36	4.98	5.19	4.71
PX2 (Mu)	28.67	44.30	40.00	28.52	33.82	43.56	46.03	40.28	2.83	13.15	7.07	2.44	4.90	19.43	24.28	7.84
PY2 (Mu)	2.05	3.16	2.86	2.04	2.42	3.11	3.29	2.88	0.20	0.94	0.50	0.17	0.35	1.39	1.73	0.56
Pu (kip)	45.16	46.77	48.07	45.87	48.66	46.93	50.30	48.31	7.82	14.49	12.34	4.57	8.01	21.09	26.46	10.41

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	46.00	30.06	20.56	1975.94	1222.00	OK
TF Inside	974.07	1549.69	1199.25	103.50	67.64	16.45	2895.60	1199.25	OK
BF Inside	1204.03	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1207.81	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1529.61	1794.38	OK
BF Outside	1534.41	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.25	35.82	36.21	35.70	37.14	35.86	38.51	37.16
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1109.47
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.75	0.79	1.0	28.44
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	18.93	OK	585.85	9.15	OK
BF	1534.41	23.98	OK	818.35	12.79	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	18.57	1.47	91.65	OK
TF	2400.00	37.50	1.47	183.30	OK
TF Inside	1211.61	18.93	1.47	103.11	OK
BF Inside	1529.61	23.90	1.47	126.02	OK
BF	3064.02	47.88	1.47	229.13	OK
BF Outside	1534.41	23.98	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.30	25.15	OK	26.46	13.23	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.30	1.47	91.65	OK
Web SPL	25.15	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.22	1.17
BF Outside	1.26	1.17

Bolt	Shear	Slip	Bearing
TF	1.50	1.84	4.89
Web	1.44	1.27	1.82
BF	1.38	1.32	4.78

Plate	Shear	Flexure
Web	1.98	1.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 5115

Node 5115

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5115 L	88.00	50.00	4400.00	88.00	47.43	4173.43	96.00	50.00	4800.00
5115 R	64.00	50.00	3200.00	80.00	43.56	3484.70	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5115 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.000	50.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	50.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-0.53	-4.96	12.43	-12.85	10.16	-14.11	-1.52	-0.76	6.36	-9.57	12.32	-14.26	24.96	-28.24	-9.28	7.75
ϕf Fnc (ksi)	50.00	43.56	50.00	47.39	50.00	47.29	50.00	43.56	50.00	47.27	50.00	47.35	50.00	47.36	50.00	50.00
f / ϕf Fnc	0.01	0.11	0.25	0.27	0.20	0.30	0.03	0.02	0.13	0.20	0.25	0.30	0.50	0.60	0.19	0.16
α	1.00	0.87	1.00	0.95	1.00	0.95	1.00	0.87	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00
fcf (ksi)		-4.96		-12.85		-14.11	-1.52			-9.57		-14.26		-28.24	-9.28	
Fcf (ksi)		-32.67		-35.55		-35.47	-37.50			-35.45		-35.52		-37.80	-37.50	
Fcf (kip)		-2613.53		-2843.61		-2837.51	-2400.00			-2835.91		-2841.25		-3023.91	-2400.00	
fncf (ksi)	-0.53		12.43		10.16			-0.76	6.36		12.32		24.96			7.75
Rcf	6.58		2.77		2.51			24.72	3.70		2.49		1.34			4.04
Fncf (ksi)	-37.50		37.50		37.50			-32.67	37.50		37.50		37.50			37.50
Fncf (kip)	-2400.00		1929.47		1929.47			-2613.53	1929.47		1929.47		1929.47			2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.48	-2.51	8.53	-8.76	2.05	-8.20	-1.33	-0.26	1.42	-5.54	8.43	-9.74	17.39	-19.63	-3.54	5.18
Fs (ksi)	-1.48	-2.51	8.53	-8.76	2.05	-8.20	-1.33	-0.26	1.42	-5.54	8.43	-9.74	17.39	-19.63	-3.54	5.18
Fs (kip)	-94.89	-200.72	545.86	-701.16	130.95	-656.18	-84.83	-20.69	90.89	-442.82	539.56	-778.94	1112.71	-1570.63	-226.30	414.75

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	2411.84	1112.71	414.75
Comp	2400.00	3023.91	226.30	1570.63

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	723.42	550.79	864.82	407.61	676.15	623.86	641.90	582.47	527.85	396.64	627.74	295.48	494.45	448.26	461.01	428.26
Vuw (kip)	1049.40	826.18	1120.10	611.41	1014.23	935.78	962.85	873.70	---	---	---	---	---	---	---	---
Mv (k*ft)	459.11	361.45	490.04	267.49	443.72	409.41	421.25	382.24	230.93	173.53	274.64	129.27	216.32	196.11	201.69	187.36
Huw (kip)	-1734.15	-56.40	-476.77	-2706.93	-570.11	-232.00	-210.23	-296.68	-191.60	-11.30	-295.50	-76.04	-197.53	-62.69	-107.84	79.13
Muw (k*ft)	1869.44	4474.58	3904.32	1190.76	3777.31	4236.67	4557.96	4404.43	65.68	1106.79	655.90	68.27	445.14	1162.70	2369.22	558.10
Mu (k*ft)	2328.56	4836.03	4394.36	1458.25	4221.03	4646.07	4979.20	4786.67	296.61	1280.32	930.54	197.54	661.46	1358.82	2570.91	745.46

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.93	0.65	5.48	31.11	6.55	2.67	2.42	3.41	2.20	0.13	3.40	0.87	2.27	0.72	1.24	0.91
PY1 (Vuw)	12.06	9.50	12.87	7.03	11.66	10.76	11.07	10.04	6.07	4.56	7.22	3.40	5.68	5.15	5.30	4.92
PX2 (Mu)	21.21	44.05	40.03	13.28	38.45	42.32	45.35	43.60	2.70	11.66	8.48	1.80	6.03	12.38	23.42	6.79
PY2 (Mu)	1.52	3.15	2.86	0.95	2.75	3.02	3.24	3.11	0.19	0.83	0.61	0.13	0.43	0.88	1.67	0.49
Pu (kip)	43.33	46.45	48.15	45.11	47.25	47.05	49.87	48.82	7.95	12.97	14.22	4.42	10.30	14.42	25.62	9.41

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	46.00	30.06	20.56	1975.94	1222.00	OK
TF Inside	974.07	1549.69	1199.25	103.50	67.64	16.45	2895.60	1199.25	OK
BF Inside	1204.03	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1207.81	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1509.59	1794.38	OK
BF Outside	1514.32	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.52	35.67	36.24	34.94	35.82	35.87	38.10	37.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1120.10
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.75	0.79	1.0	28.44
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	18.93	OK	561.74	8.78	OK
BF	1514.32	23.66	OK	786.54	12.29	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	18.57	1.47	91.65	OK
TF	2400.00	37.50	1.47	183.30	OK
TF Inside	1211.61	18.93	1.47	103.11	OK
BF Inside	1509.59	23.59	1.47	126.02	OK
BF	3023.91	47.25	1.47	229.13	OK
BF Outside	1514.32	23.66	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.87	24.93	OK	25.62	12.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.87	1.47	91.65	OK
Web SPL	24.93	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.22	1.19
BF Outside	1.26	1.19

Bolt	Shear	Slip	Bearing
TF	1.50	1.92	4.89
Web	1.45	1.31	1.84
BF	1.40	1.37	4.84

Plate	Shear	Flexure
Web	1.96	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 7115

Node 7115

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7115 L	88.00	50.00	4400.00	88.00	47.43	4173.95	96.00	50.00	4800.00
7115 R	64.00	50.00	3200.00	80.00	43.56	3484.70	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7115 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.000	50.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	50.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-0.32	-4.60	13.82	-14.09	7.97	-11.30	-2.31	0.76	14.72	-15.97	-1.92	-3.33	25.51	-28.34	-5.36	7.96
ϕf Fnc (ksi)	50.00	43.56	50.00	47.40	50.00	47.28	50.00	50.00	50.00	47.38	50.00	43.56	50.00	47.37	50.00	50.00
f / ϕf Fnc	0.01	0.11	0.28	0.30	0.16	0.24	0.05	0.02	0.29	0.34	0.04	0.08	0.51	0.60	0.11	0.16
α	1.00	0.87	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	0.87	1.00	0.95	1.00	1.00
fcf (ksi)		-4.60		-14.09		-11.30	-2.31			-15.97		-3.33		-28.34		7.96
Fcf (ksi)		-32.67		-35.55		-35.46	-37.50			-35.53		-32.67		-37.85		37.50
Fcf (kip)		-2613.53		-2843.91		-2837.09	-2400.00			-2842.61		-2613.53		-3028.36		2411.84
fncf (ksi)	-0.32		13.82		7.97			0.76	14.72		-1.92		25.51		-5.36	
Rcf	7.10		2.52		3.14			16.24	2.23		9.82		1.34		4.71	
Fncf (ksi)	-37.50		37.50		37.50			37.50	37.50		-37.50		37.50		-37.50	
Fncf (kip)	-2400.00		1929.47		1929.47			2411.84	1929.47		-2400.00		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.40	-2.29	9.59	-9.61	1.22	-6.48	-1.55	0.78	9.93	-10.88	-1.90	-1.71	17.85	-19.68	-4.08	6.03
Fs (ksi)	-1.40	-2.29	9.59	-9.61	1.22	-6.48	-1.55	0.78	9.93	-10.88	-1.90	-1.71	17.85	-19.68	-4.08	6.03
Fs (kip)	-89.83	-183.43	613.62	-769.02	77.90	-518.32	-99.00	62.40	635.73	-870.32	-121.34	-136.99	1142.14	-1574.61	-261.03	482.20

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	2411.84	1142.14	482.20
Comp	2400.00	3028.36	261.03	1574.61

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	645.86	558.45	836.65	374.97	578.52	626.75	621.27	549.21	473.21	402.40	608.01	272.76	425.64	450.65	446.78	404.93
Vuw (kip)	968.79	837.68	1106.02	562.45	867.78	940.12	931.90	823.82	---	---	---	---	---	---	---	---
Mv (k*ft)	423.85	366.48	483.88	246.07	379.65	411.30	407.71	360.42	207.03	176.05	266.00	119.33	186.22	197.16	195.47	177.16
Huw (kip)	-1676.13	-32.24	-501.90	-1204.79	-133.11	-2474.84	-181.48	586.24	-177.43	-1.20	-252.57	-36.81	-45.40	-173.20	-88.17	93.55
Muw (k*ft)	1946.81	4507.27	3870.13	3193.61	4370.69	881.85	4603.40	4018.35	56.92	1228.84	492.56	148.92	1331.98	11.75	2401.83	646.79
Mu (k*ft)	2370.65	4873.76	4354.02	3439.68	4750.34	1293.16	5011.10	4378.77	263.95	1404.88	758.56	268.26	1518.20	208.91	2597.30	823.95

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.27	0.37	5.77	13.85	1.53	28.45	2.09	6.74	2.04	0.01	2.90	0.42	0.52	1.99	1.01	1.08
PY1 (Vuw)	11.14	9.63	12.71	6.46	9.97	10.81	10.71	9.47	5.44	4.63	6.99	3.14	4.89	5.18	5.14	4.65
PX2 (Mu)	21.59	44.39	39.66	31.33	43.27	11.78	45.64	39.88	2.40	12.80	6.91	2.44	13.83	1.90	23.66	7.51
PY2 (Mu)	1.54	3.17	2.83	2.24	3.09	0.84	3.26	2.85	0.17	0.91	0.49	0.17	0.99	0.14	1.69	0.54
Pu (kip)	42.78	46.56	48.01	46.01	46.67	41.88	49.73	48.22	7.16	13.96	12.34	4.38	15.51	6.59	25.60	10.03

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	46.00	30.06	20.56	1975.94	1222.00	OK
TF Inside	974.07	1549.69	1199.25	103.50	67.64	16.45	2895.60	1199.25	OK
BF Inside	1204.03	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1207.81	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1511.81	1794.38	OK
BF Outside	1516.55	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.31	35.73	36.17	35.84	35.74	31.65	38.07	37.11
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1106.02
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.75	0.79	1.0	28.44
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	18.93	OK	576.59	9.01	OK
BF	1516.55	23.70	OK	788.54	12.32	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	18.57	1.47	91.65	OK
TF	2400.00	37.50	1.47	183.30	OK
TF Inside	1211.61	18.93	1.47	103.11	OK
BF Inside	1511.81	23.62	1.47	126.02	OK
BF	3028.36	47.32	1.47	229.13	OK
BF Outside	1516.55	23.70	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.73	24.87	OK	25.60	12.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.73	1.47	91.65	OK
Web SPL	24.87	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.22	1.19
BF Outside	1.26	1.19

Bolt	Shear	Slip	Bearing
TF	1.50	1.87	4.89
Web	1.46	1.31	1.84
BF	1.40	1.37	4.83

Plate	Shear	Flexure
Web	1.98	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 9115

Node 9115

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	87
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9115 L	88.00	50.00	4400.00	88.00	47.54	4183.44	96.00	50.00	4800.00
9115 R	64.00	50.00	3200.00	80.00	47.17	3773.67	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9115 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.000	50.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	50.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	89.00	0.625	20.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	4.09	-8.28	12.13	-8.93	7.00	-9.55	-3.86	4.79	20.13	-19.14	-5.84	3.93	27.21	-28.94	-4.80	10.04
ϕf Fnc (ksi)	50.00	47.17	50.00	47.51	50.00	47.30	50.00	50.00	50.00	47.42	50.00	50.00	50.00	47.38	50.00	50.00
f / ϕf Fnc	0.08	0.18	0.24	0.19	0.14	0.20	0.08	0.10	0.40	0.40	0.12	0.08	0.54	0.61	0.10	0.20
α	1.00	0.94	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)		-8.28	12.13			-9.55		4.79		-19.14	-5.84			-28.94		10.04
Fcf (ksi)		-35.38	37.50			-35.47		37.50		-35.57	-37.50			-38.16		37.50
Fcf (kip)		-2830.25	1929.47			-2837.86		2411.84		-2845.38	-2400.00			-3053.10		2411.84
fncf (ksi)	4.09			-8.93	7.00		-3.86		20.13			3.93	27.21		-4.80	
Rcf	4.27			3.09	3.71		7.83		1.86			6.42	1.32		3.73	
Fncf (ksi)	37.50			-35.63	37.50		-37.50		37.50			37.50	37.50		-37.50	
Fncf (kip)	1929.47			-2850.76	1929.47		-2400.00		1929.47			2411.84	1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	0.24	-4.47	8.46	-5.94	1.12	-5.34	-1.68	3.30	13.76	-13.19	-2.78	2.99	19.11	-20.08	-3.64	7.41
Fs (ksi)	0.24	-4.47	8.46	-5.94	1.12	-5.34	-1.68	3.30	13.76	-13.19	-2.78	2.99	19.11	-20.08	-3.64	7.41
Fs (kip)	15.07	-357.75	541.20	-474.83	71.59	-427.46	-107.43	263.76	880.93	-1055.43	-177.63	239.06	1223.27	-1606.08	-232.64	593.02

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	2411.84	1223.27	593.02
Comp	2400.00	3053.10	232.64	1606.08

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	609.39	482.94	784.38	333.52	517.74	571.50	581.25	462.93	448.36	349.71	572.00	244.15	383.61	412.28	419.17	344.89
Vuw (kip)	914.08	724.40	1079.88	500.28	776.62	857.25	871.87	694.40	---	---	---	---	---	---	---	---
Mv (k*ft)	399.91	316.93	472.45	218.87	339.77	375.05	381.44	303.80	196.16	153.00	250.25	106.81	167.83	180.37	183.39	150.89
Huw (kip)	-859.34	474.76	-455.22	349.17	88.15	-589.60	-109.58	940.51	-203.35	121.00	-202.78	77.69	27.44	10.21	-46.20	181.33
Muw (k*ft)	3382.61	4166.98	3933.62	4334.45	4670.14	4013.87	4738.86	3545.99	301.27	921.07	413.56	318.44	1725.27	368.88	2508.14	707.06
Mu (k*ft)	3782.52	4483.91	4406.07	4553.32	5009.91	4388.92	5120.30	3849.78	497.43	1074.07	663.80	425.25	1893.10	549.26	2691.52	857.95

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	9.88	5.46	5.23	4.01	1.01	6.78	1.26	10.81	2.34	1.39	2.33	0.89	0.32	0.12	0.53	2.08
PY1 (Vuw)	10.51	8.33	12.41	5.75	8.93	9.85	10.02	7.98	5.15	4.02	6.57	2.81	4.41	4.74	4.82	3.96
PX2 (Mu)	34.45	40.84	40.13	41.47	45.63	39.98	46.64	35.07	4.53	9.78	6.05	3.87	17.24	5.00	24.52	7.81
PY2 (Mu)	2.46	2.92	2.87	2.96	3.26	2.86	3.33	2.50	0.32	0.70	0.43	0.28	1.23	0.36	1.75	0.56
Pu (kip)	46.19	47.65	47.87	46.31	48.21	48.45	49.72	47.06	8.78	12.13	10.92	5.68	18.44	7.22	25.89	10.88

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	46.00	30.06	20.56	1975.94	1222.00	OK
TF Inside	974.07	1549.69	1199.25	103.50	67.64	16.45	2895.60	1199.25	OK
BF Inside	1204.03	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	1207.81	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1524.16	1794.38	OK
BF Outside	1528.94	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.23	36.87	36.13	36.25	37.22	37.22	38.22	36.45
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1079.88
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9115**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.75	0.79	1.0	28.44
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.17

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	18.93	OK	617.55	9.65	OK
BF	1528.94	23.89	OK	804.30	12.57	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	18.57	1.47	91.65	OK
TF	2400.00	37.50	1.47	183.30	OK
TF Inside	1211.61	18.93	1.47	103.11	OK
BF Inside	1524.16	23.82	1.47	126.02	OK
BF	3053.10	47.70	1.47	229.13	OK
BF Outside	1528.94	23.89	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.72	24.86	OK	25.89	12.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.72	1.47	91.65	OK
Web SPL	24.86	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.22	1.18
BF Outside	1.26	1.18

Bolt	Shear	Slip	Bearing
TF	1.50	1.74	4.89
Web	1.46	1.30	1.84
BF	1.39	1.34	4.80

Plate	Shear	Flexure
Web	2.03	1.31

Field Splice

Type I

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1127	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type I

Field Splice - Node 1127

Node 1127

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1127 L	64.00	50.00	3200.00	80.00	50.00	4000.00	96.00	50.00	4800.00
1127 R	64.00	50.00	3200.00	64.00	42.82	2740.53	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1127 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.24	-1.45	0.95	4.90	-3.94	9.85	-0.87	-0.19	-4.06	8.85	9.50	-9.18	14.71	-16.81	-6.03	16.53
ϕf Fnc (ksi)	50.00	42.82	50.00	50.00	50.00	50.00	50.00	42.82	50.00	50.00	50.00	47.25	50.00	47.18	50.00	50.00
f / ϕf Fnc	0.02	0.03	0.02	0.10	0.08	0.20	0.02	0.00	0.08	0.18	0.19	0.19	0.29	0.36	0.12	0.33
α	1.00	0.86	1.00	1.00	1.00	1.00	1.00	0.86	1.00	1.00	1.00	0.95	1.00	0.94	1.00	1.00
fcf (ksi)		-1.45		4.90		9.85	-0.87			8.85		-9.18		-16.81		16.53
Fcf (ksi)		-32.12		37.50		37.50	-37.50			37.50		-35.44		-35.38		37.50
Fcf (kip)		-2055.40		1929.47		1929.47	-2400.00			1929.47		-2268.01		-2264.61		1929.47
fncf (ksi)	-1.24		0.95		-3.94			-0.19	-4.06		9.50		14.71		-6.03	
Rcf	22.13		7.65		3.81			42.89	4.24		3.86		2.11		2.27	
Fncf (ksi)	-37.50		37.50		-37.50			-32.12	-37.50		37.50		37.50		-37.50	
Fncf (kip)	-2400.00		1929.47		-2400.00			-2055.40	-2400.00		1929.47		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-0.48	-2.36	0.55	3.63	-3.02	7.75	-0.23	-1.47	-3.07	7.01	3.52	-7.04	4.66	-11.57	-4.50	12.47
Fs (ksi)	-0.48	-2.36	0.55	3.63	-3.02	7.75	-0.23	-1.47	-3.07	7.01	3.52	-7.04	4.66	-11.57	-4.50	12.47
Fs (kip)	-30.83	-150.89	35.50	232.53	-193.40	496.21	-14.43	-93.82	-196.27	448.57	225.31	-450.68	297.96	-740.66	-288.14	798.18

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	297.96	798.18
Comp	2400.00	2268.01	288.14	740.66

$\phi v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	594.60	379.71	239.52	767.75	568.64	400.09	505.39	433.66	436.72	276.01	176.96	559.05	409.49	299.30	373.69	314.13
Vuw (kip)	891.90	569.56	359.28	1071.57	852.95	600.13	758.08	650.49	---	---	---	---	---	---	---	---
Mv (k*ft)	390.21	249.18	157.19	468.81	373.17	262.56	331.66	284.59	191.07	120.75	77.42	244.59	179.15	130.94	163.49	137.43
Huw (kip)	-2855.75	2147.20	1080.83	-2188.91	975.54	57.86	-211.60	1143.22	-136.29	201.02	227.11	-81.19	189.23	-169.03	-332.03	382.53
Muw (k*ft)	303.13	1937.07	3358.90	1881.45	3499.28	4613.17	4247.08	3275.71	120.06	197.03	689.60	79.39	644.83	675.98	1038.62	1086.31
Mu (k*ft)	693.33	2186.25	3516.08	2350.26	3872.45	4875.73	4578.74	3560.30	311.13	317.79	767.02	323.98	823.98	806.92	1202.11	1223.74

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.82	24.68	12.42	25.16	11.21	0.67	2.43	13.14	1.57	2.31	2.61	0.93	2.18	1.94	3.82	4.40
PY1 (Vuw)	10.25	6.55	4.13	12.32	9.80	6.90	8.71	7.48	5.02	3.17	2.03	6.43	4.71	3.44	4.30	3.61
PX2 (Mu)	6.32	19.91	32.03	21.41	35.27	44.41	41.71	32.43	2.83	2.89	6.99	2.95	7.51	7.35	10.95	11.15
PY2 (Mu)	0.45	1.42	2.29	1.53	2.52	3.17	2.98	2.32	0.20	0.21	0.50	0.21	0.54	0.52	0.78	0.80
Pu (kip)	40.58	45.30	44.91	48.58	48.09	46.19	45.66	46.61	6.83	6.21	9.93	7.69	11.01	10.10	15.61	16.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1153.90	1305.00	OK
BF Outside	1114.11	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.39	44.00	44.10	45.96	46.16	44.97	44.00	45.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1071.57
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.82	1.0	29.68

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	150.42	3.13	OK
BF	1153.90	20.61	OK	406.09	7.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1153.90	20.61	1.47	91.65	OK
BF	2268.01	40.50	1.47	183.30	OK
BF Outside	1114.11	19.89	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.58	24.29	OK	16.16	8.08	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.58	1.47	91.65	OK
Web SPL	24.29	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.43	5.37	3.67
Web	1.49	2.08	1.89
BF	1.44	2.32	4.03

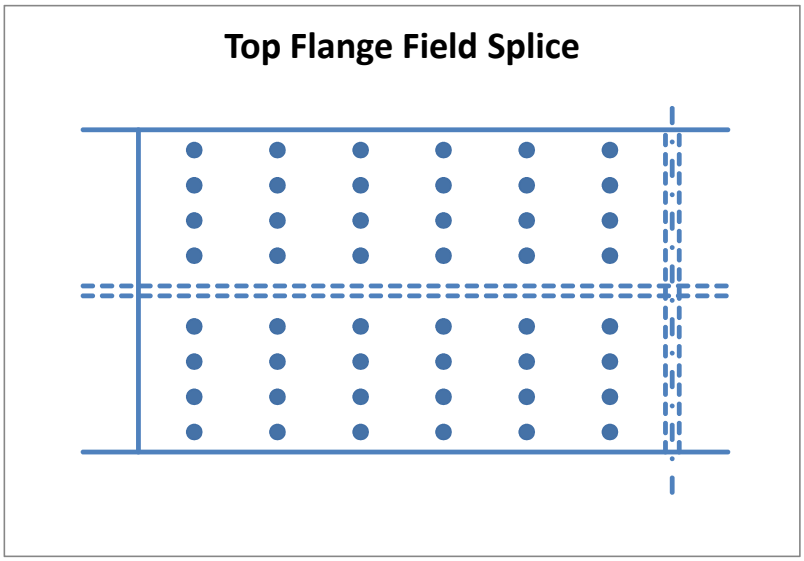
Plate	Shear	Flexure
Web	1.64	1.08

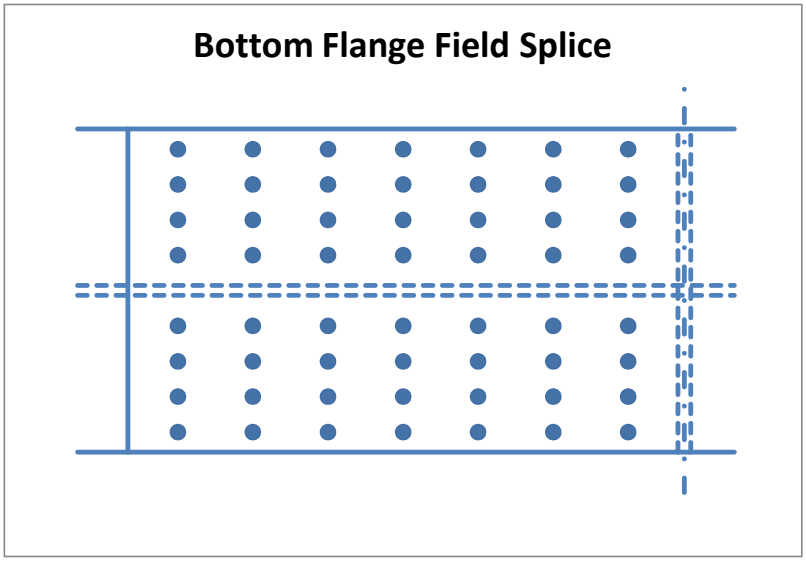
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1127	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1127

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
		18	0
		18	3.5
		18	7
		18	10.5
		18	17.5
		18	21
		18	24.5
		18	28

	Top Flange		Bottom Flange	
No. Bolts =	48.0		56.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	5.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





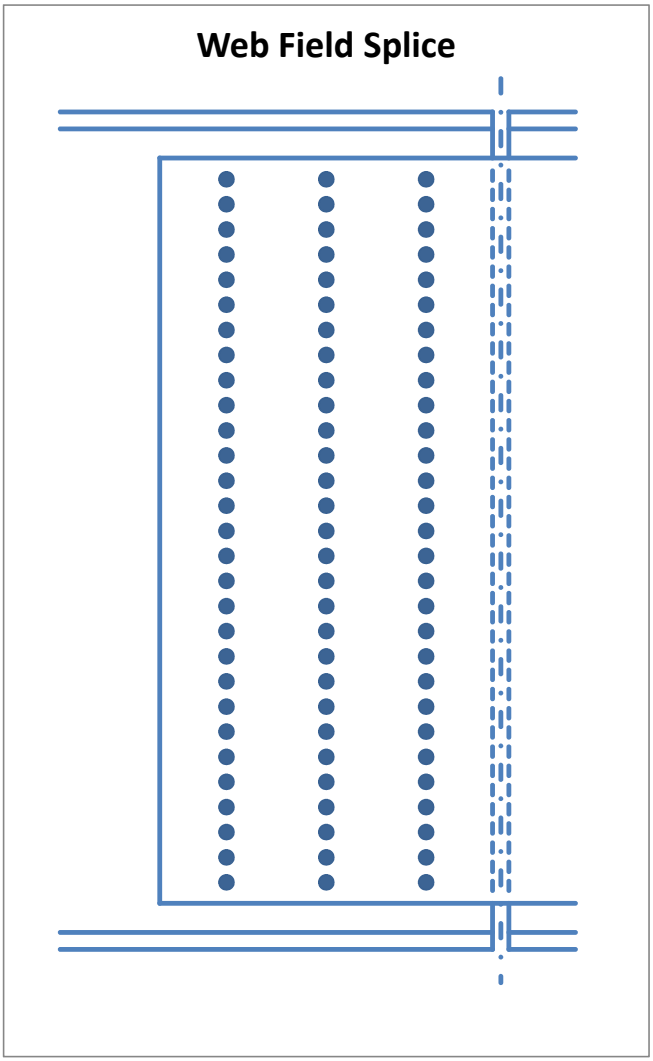
Flange Bolt Pattern Cont. - Node 1127

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1127	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1127

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	9	1764
0	3	9	1521
0	6	9	1296
0	9	9	1089
0	12	9	900
0	15	9	729
0	18	9	576
0	21	9	441
0	24	9	324
0	27	9	225
0	30	9	144
0	33	9	81
0	36	9	36
0	39	9	9
0	42	9	0
0	45	9	9
0	48	9	36
0	51	9	81
0	54	9	144
0	57	9	225
0	60	9	324
0	63	9	441
0	66	9	576
0	69	9	729
0	72	9	900
0	75	9	1089
0	78	9	1296
0	81	9	1521
0	84	9	1764
3	0	0	1764
3	3	0	1521
3	6	0	1296
3	9	0	1089
3	12	0	900
3	15	0	729
3	18	0	576
3	21	0	441
3	24	0	324
3	27	0	225
3	30	0	144
3	33	0	81
3	36	0	36
3	39	0	9
3	42	0	0
3	45	0	9
3	48	0	36
3	51	0	81
3	54	0	144
3	57	0	225
3	60	0	324
3	63	0	441
3	66	0	576
3	69	0	729
3	72	0	900
3	75	0	1089
3	78	0	1296
3	81	0	1521
3	84	0	1764
6	0	9	1764

No. Bolts =	87.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	2.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	3	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	522	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	54810	
Σd^2 (in^2) =	55332	



6	3	9	1521
6	6	9	1296
6	9	9	1089
6	12	9	900
6	15	9	729
6	18	9	576
6	21	9	441
6	24	9	324
6	27	9	225
6	30	9	144
6	33	9	81
6	36	9	36
6	39	9	9
6	42	9	0
6	45	9	9
6	48	9	36
6	51	9	81
6	54	9	144
6	57	9	225
6	60	9	324
6	63	9	441
6	66	9	576
6	69	9	729
6	72	9	900
6	75	9	1089
6	78	9	1296
6	81	9	1521
6	84	9	1764

Web Bolt Pattern Cont. - Node 1127

Web Bolt Pattern Cont. - Node 1127

261	3654	522	54810

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3127	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3127

Node 3127

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3127 L	64.00	50.00	3200.00	80.00	50.00	4000.00	96.00	50.00	4800.00
3127 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3127 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.55	1.88	1.49	0.37	-3.50	6.78	-0.82	-0.28	-4.07	6.60	6.58	-7.56	13.45	-16.34	-6.31	14.20
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	42.82	50.00	50.00	50.00	47.18	50.00	47.15	50.00	50.00
f / ϕf Fnc	0.05	0.04	0.03	0.01	0.07	0.14	0.02	0.01	0.08	0.13	0.13	0.16	0.27	0.35	0.13	0.28
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.86	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00
fcf (ksi)	-2.55		1.49			6.78	-0.82			6.60		-7.56		-16.34		14.20
Fcf (ksi)	-37.50		37.50			37.50	-37.50			37.50		-35.38		-35.37		37.50
Fcf (kip)	-2400.00		1929.47			1929.47	-2400.00			1929.47		-2264.48		-2263.36		1929.47
fncf (ksi)		1.88		0.37	-3.50			-0.28	-4.07		6.58		13.45		-6.31	
Rcf		14.68		25.21	5.53			45.80	5.68		4.68		2.16		2.64	
Fncf (ksi)		37.50		37.50	-37.50			-32.12	-37.50		37.50		37.50		-37.50	
Fncf (kip)		1929.47		1929.47	-2400.00			-2055.40	-2400.00		1929.47		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.35	0.06	0.28	0.81	-2.71	5.49	-0.13	-1.44	-3.09	5.35	2.43	-6.02	4.05	-11.31	-4.69	10.74
Fs (ksi)	-1.35	0.06	0.28	0.81	-2.71	5.49	-0.13	-1.44	-3.09	5.35	2.43	-6.02	4.05	-11.31	-4.69	10.74
Fs (kip)	-86.15	3.89	18.11	51.58	-173.27	351.67	-8.61	-92.48	-197.69	342.46	155.22	-385.59	259.38	-723.80	-300.21	687.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	259.38	687.27
Comp	2400.00	2264.48	300.21	723.80

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	662.22	439.99	280.85	813.27	605.03	465.07	546.75	539.86	483.25	317.84	205.41	589.97	434.44	343.96	401.67	388.40
Vuw (kip)	993.33	659.99	421.28	1094.33	907.54	697.61	820.12	809.79	---	---	---	---	---	---	---	---
Mv (k*ft)	434.58	288.74	184.31	478.77	397.05	305.20	358.80	354.28	211.42	139.06	89.87	258.11	190.07	150.48	175.73	169.93
Huw (kip)	-475.05	2252.83	871.03	-2422.27	691.59	-220.88	-300.27	1000.70	-61.69	52.27	133.80	-75.82	108.58	-172.78	-348.31	290.29
Muw (k*ft)	4166.60	1796.23	3638.62	1570.31	3877.89	4234.45	4126.36	3465.73	90.04	33.47	524.94	83.87	540.15	540.81	983.18	987.49
Mu (k*ft)	4601.18	2084.97	3822.93	2049.08	4274.93	4539.65	4485.17	3820.01	301.46	172.53	614.81	341.98	730.22	691.29	1158.90	1157.41

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.46	25.89	10.01	27.84	7.95	2.54	3.45	11.50	0.71	0.60	1.54	0.87	1.25	1.99	4.00	3.34
PY1 (Vuw)	11.42	7.59	4.84	12.58	10.43	8.02	9.43	9.31	5.55	3.65	2.36	6.78	4.99	3.95	4.62	4.46
PX2 (Mu)	41.91	18.99	34.82	18.66	38.94	41.35	40.85	34.80	2.75	1.57	5.60	3.11	6.65	6.30	10.56	10.54
PY2 (Mu)	2.99	1.36	2.49	1.33	2.78	2.95	2.92	2.49	0.20	0.11	0.40	0.22	0.48	0.45	0.75	0.75
Pu (kip)	49.51	45.77	45.43	48.54	48.71	45.24	45.99	47.78	6.71	4.35	7.65	8.06	9.61	9.38	15.52	14.83

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1152.10	1305.00	OK
BF Outside	1112.38	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.16	44.26	44.54	45.84	46.63	43.75	44.14	45.97
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1094.33
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.82	1.0	29.68

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	151.56	3.16	OK
BF	1152.10	20.57	OK	368.25	6.58	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1152.10	20.57	1.47	91.65	OK
BF	2264.48	40.44	1.47	183.30	OK
BF Outside	1112.38	19.86	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.51	24.76	OK	15.52	7.76	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.51	1.47	91.65	OK
Web SPL	24.76	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.43	5.33	3.67
Web	1.46	2.17	1.85
BF	1.44	2.56	4.04

Plate	Shear	Flexure
Web	1.60	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5127	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5127

Node 5127

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5127 L	64.00	50.00	3200.00	80.00	47.47	3797.96	96.00	50.00	4800.00
5127 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5127 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.79	4.79	6.36	-5.94	-3.21	5.75	-0.80	-1.34	0.74	-2.43	-1.62	1.40	13.08	-15.72	-6.22	13.23
ϕf Fnc (ksi)	50.00	50.00	50.00	47.27	50.00	50.00	50.00	42.82	50.00	46.11	50.00	50.00	50.00	47.16	50.00	50.00
f / ϕf Fnc	0.08	0.10	0.13	0.13	0.06	0.11	0.02	0.03	0.01	0.05	0.03	0.03	0.26	0.33	0.12	0.26
α	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.86	1.00	0.92	1.00	1.00	1.00	0.94	1.00	1.00
fcf (ksi)		4.79	6.36			5.75		-1.34		-2.43	-1.62			-15.72		13.23
Fcf (ksi)		37.50	37.50			37.50		-32.12		-34.58	-37.50			-35.37		37.50
Fcf (kip)		1929.47	1929.47			1929.47		-2055.40		-2213.13	-2400.00			-2263.59		1929.47
fncf (ksi)	-3.79			-5.94	-3.21		-0.80		0.74			1.40	13.08		-6.22	
Rcf	7.83			5.90	6.52		24.00		14.22			23.20	2.25		2.83	
Fncf (ksi)	-37.50			-35.45	-37.50		-37.50		37.50			37.50	37.50		-37.50	
Fncf (kip)	-2400.00			-2268.72	-2400.00		-2400.00		1929.47			1929.47	1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.93	4.06	2.50	-5.07	-2.53	4.73	0.35	-2.03	-0.55	-0.83	-0.67	-1.44	4.09	-10.90	-4.65	10.02
Fs (ksi)	-2.93	4.06	2.50	-5.07	-2.53	4.73	0.35	-2.03	-0.55	-0.83	-0.67	-1.44	4.09	-10.90	-4.65	10.02
Fs (kip)	-187.82	259.54	159.97	-324.43	-161.71	302.81	22.55	-129.91	-35.45	-53.43	-42.60	-91.98	261.53	-697.88	-297.70	641.26

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	261.53	641.26
Comp	2400.00	2268.72	297.70	697.88

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	703.90	471.09	305.08	817.86	586.65	498.79	559.79	551.17	503.70	347.77	221.93	592.77	420.86	367.34	410.44	395.79
Vuw (kip)	1039.65	706.63	457.62	1096.62	879.98	748.19	839.69	826.75	---	---	---	---	---	---	---	---
Mv (k*ft)	454.84	309.15	200.21	479.77	384.99	327.33	367.36	361.70	220.37	152.15	97.09	259.34	184.13	160.71	179.57	173.16
Huw (kip)	378.21	118.45	795.71	-2459.52	-1153.03	-245.95	-284.60	954.66	53.79	-123.34	105.83	-80.52	-66.66	-100.93	-327.27	257.67
Muw (k*ft)	4295.71	4642.07	3739.06	831.44	2888.88	4472.06	4147.70	3527.12	447.36	484.40	464.51	152.46	17.97	49.38	959.41	938.95
Mu (k*ft)	4750.56	4951.22	3939.27	1311.21	3273.87	4799.39	4515.06	3888.83	667.73	636.55	561.61	411.80	202.10	210.10	1138.98	1112.11

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.35	1.36	9.15	28.27	13.25	2.83	3.27	10.97	0.62	1.42	1.22	0.93	0.77	1.16	3.76	2.96
PY1 (Vuw)	11.95	8.12	5.26	12.60	10.11	8.60	9.65	9.50	5.79	4.00	2.55	6.81	4.84	4.22	4.72	4.55
PX2 (Mu)	43.27	45.10	35.88	11.94	29.82	43.72	41.13	35.42	6.08	5.80	5.12	3.75	1.84	1.91	10.37	10.13
PY2 (Mu)	3.09	3.22	2.56	0.85	2.13	3.12	2.94	2.53	0.43	0.41	0.37	0.27	0.13	0.14	0.74	0.72
Pu (kip)	49.94	47.83	45.70	42.41	44.78	48.00	46.15	47.93	9.15	8.46	6.97	8.49	5.61	5.33	15.15	14.11

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1154.26	1305.00	OK
BF Outside	1114.46	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.43	46.34	44.75	39.55	42.71	46.39	44.24	46.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1096.62
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.82	1.0	29.68

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	150.29	3.13	OK
BF	1154.26	20.61	OK	355.06	6.34	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1154.26	20.61	1.47	91.65	OK
BF	2268.72	40.51	1.47	183.30	OK
BF Outside	1114.46	19.90	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.94	24.97	OK	15.15	7.58	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.94	1.47	91.65	OK
Web SPL	24.97	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.43	5.38	3.67
Web	1.45	2.22	1.84
BF	1.44	2.65	4.03

Plate	Shear	Flexure
Web	1.60	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7127	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7127

Node 7127

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7127 L	64.00	50.00	3200.00	80.00	47.56	3804.45	96.00	50.00	4800.00
7127 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7127 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.21	3.42	3.21	-2.16	-3.29	6.34	-0.97	-0.80	5.96	-6.64	-3.31	4.44	13.70	-16.35	-6.21	13.84
ϕf Fnc (ksi)	50.00	50.00	50.00	47.40	50.00	50.00	50.00	42.82	50.00	47.19	50.00	50.00	50.00	47.16	50.00	50.00
f / ϕf Fnc	0.06	0.07	0.06	0.05	0.07	0.13	0.02	0.02	0.12	0.14	0.07	0.09	0.27	0.35	0.12	0.28
α	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.86	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00
fcf (ksi)		3.42	3.21			6.34	-0.97			-6.64		4.44		-16.35		13.84
Fcf (ksi)		37.50	37.50			37.50	-37.50			-35.39		37.50		-35.37		37.50
Fcf (kip)		1929.47	1929.47			1929.47	-2400.00			-2265.11		1929.47		-2263.72		1929.47
fncf (ksi)	-3.21			-2.16	-3.29			-0.80	5.96		-3.31		13.70		-6.21	
Rcf	10.98			11.69	5.91			38.85	5.33		8.45		2.16		2.71	
Fncf (ksi)	-37.50			-35.55	-37.50			-32.12	37.50		-37.50		37.50		-37.50	
Fncf (kip)	-2400.00			-2275.40	-2400.00			-2055.40	1929.47		-2400.00		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.55	3.04	1.50	-2.68	-2.61	5.11	0.43	-1.69	1.48	-3.57	-1.81	1.98	4.27	-11.25	-4.67	10.41
Fs (ksi)	-2.55	3.04	1.50	-2.68	-2.61	5.11	0.43	-1.69	1.48	-3.57	-1.81	1.98	4.27	-11.25	-4.67	10.41
Fs (kip)	-163.07	194.87	95.86	-171.84	-166.78	327.27	27.64	-108.34	94.68	-228.22	-116.06	126.71	273.06	-719.85	-299.05	666.29

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	273.06	666.29
Comp	2400.00	2275.40	299.05	719.85

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	652.45	447.58	282.98	808.75	472.22	601.09	547.09	536.77	467.47	332.25	206.43	587.43	340.14	440.71	402.56	385.74
Vuw (kip)	978.68	671.37	424.47	1092.07	708.34	901.64	820.63	805.16	---	---	---	---	---	---	---	---
Mv (k*ft)	428.17	293.72	185.71	477.78	309.90	394.47	359.03	352.26	204.52	145.36	90.31	257.00	148.81	192.81	176.12	168.76
Huw (kip)	109.87	586.97	866.68	-3285.03	-174.50	457.85	-275.06	991.82	23.85	-56.98	120.37	-60.52	-100.15	7.99	-335.09	275.43
Muw (k*ft)	4653.50	4017.38	3644.43	419.96	4297.55	4189.53	4160.70	3477.57	357.94	267.70	494.05	135.97	322.90	242.76	992.91	965.35
Mu (k*ft)	5081.67	4311.10	3830.14	897.74	4607.45	4584.00	4519.73	3829.83	562.46	413.06	584.36	392.97	471.71	435.57	1169.02	1134.11

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.26	6.75	9.96	37.76	2.01	5.26	3.16	11.40	0.27	0.65	1.38	0.70	1.15	0.09	3.85	3.17
PY1 (Vuw)	11.25	7.72	4.88	12.55	8.14	10.36	9.43	9.25	5.37	3.82	2.37	6.75	3.91	5.07	4.63	4.43
PX2 (Mu)	46.29	39.27	34.89	8.18	41.97	41.75	41.17	34.88	5.12	3.76	5.32	3.58	4.30	3.97	10.65	10.33
PY2 (Mu)	3.31	2.80	2.49	0.58	3.00	2.98	2.94	2.49	0.37	0.27	0.38	0.26	0.31	0.28	0.76	0.74
Pu (kip)	49.73	47.20	45.45	47.78	45.36	48.87	46.02	47.75	7.88	6.02	7.25	8.21	6.89	6.71	15.47	14.45

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1157.66	1305.00	OK
BF Outside	1117.74	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.43	45.78	44.55	45.07	43.84	46.81	44.17	45.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1092.07
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.82	1.0	29.68

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	150.97	3.15	OK
BF	1157.66	20.67	OK	366.24	6.54	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1157.66	20.67	1.47	91.65	OK
BF	2275.40	40.63	1.47	183.30	OK
BF Outside	1117.74	19.96	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.73	24.86	OK	15.47	7.73	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.73	1.47	91.65	OK
Web SPL	24.86	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.43	5.35	3.67
Web	1.46	2.18	1.84
BF	1.44	2.57	4.02

Plate	Shear	Flexure
Web	1.61	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9127	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9127

Node 9127

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9127 L	64.00	50.00	3200.00	80.00	50.00	4000.00	96.00	50.00	4800.00
9127 R	64.00	50.00	3200.00	64.00	42.82	2740.53	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9127 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.42	-0.95	2.33	2.62	-3.20	8.97	-0.62	0.49	8.00	-7.41	-3.39	7.30	14.64	-16.45	-5.62	15.70
ϕf Fnc (ksi)	50.00	42.82	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.27	50.00	50.00	50.00	47.19	50.00	50.00
f / ϕf Fnc	0.03	0.02	0.05	0.05	0.06	0.18	0.01	0.01	0.16	0.16	0.07	0.15	0.29	0.35	0.11	0.31
α	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.94	1.00	1.00
fcf (ksi)	-1.42			2.62		8.97	-0.62		8.00			7.30		-16.45		15.70
Fcf (ksi)	-37.50			37.50		37.50	-37.50		37.50			37.50		-35.39		37.50
Fcf (kip)	-2400.00			1929.47		1929.47	-2400.00		1929.47			1929.47		-2264.94		1929.47
fncf (ksi)		-0.95	2.33		-3.20			0.49		-7.41	-3.39		14.64		-5.62	
Rcf		26.37	14.29		4.18			60.52		4.69	5.14		2.15		2.39	
Fncf (ksi)		-32.12	37.50		-37.50			37.50		-35.45	-37.50		37.50		-37.50	
Fncf (kip)		-2055.40	1929.47		-2400.00			1929.47		-2268.91	-2400.00		1929.47		-2400.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.31	0.29	1.65	0.25	-2.58	6.98	0.47	-1.11	2.29	-3.97	-1.81	4.02	4.74	-11.16	-4.28	11.73
Fs (ksi)	-1.31	0.29	1.65	0.25	-2.58	6.98	0.47	-1.11	2.29	-3.97	-1.81	4.02	4.74	-11.16	-4.28	11.73
Fs (kip)	-83.96	18.86	105.85	15.69	-165.11	446.91	29.98	-71.13	146.25	-253.84	-115.72	257.34	303.62	-714.26	-273.70	750.64

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	303.62	750.64
Comp	2400.00	2268.91	273.70	714.26

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	550.56	385.29	237.90	750.99	393.89	552.89	498.86	435.03	395.79	289.88	174.89	548.25	285.09	408.29	370.12	314.16
Vuw (kip)	825.84	577.93	356.86	1063.19	590.83	829.33	748.29	652.54	---	---	---	---	---	---	---	---
Mv (k*ft)	361.31	252.85	156.12	465.14	258.49	362.83	327.38	285.49	173.16	126.82	76.51	239.86	124.73	178.63	161.93	137.44
Huw (kip)	-3002.49	3397.49	1157.49	-378.24	133.71	964.61	-187.06	1155.97	-48.83	91.15	211.35	-30.86	-80.69	106.22	-307.98	357.70
Muw (k*ft)	796.68	270.02	3256.68	4295.68	4621.72	3513.86	4280.47	3258.71	102.82	90.16	612.02	101.11	400.09	373.06	1017.88	1024.34
Mu (k*ft)	1157.98	522.86	3412.80	4760.82	4880.21	3876.69	4607.85	3544.19	275.98	216.98	688.54	340.97	524.82	551.69	1179.81	1161.79

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9127	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.51	39.05	13.30	4.35	1.54	11.09	2.15	13.29	0.56	1.05	2.43	0.35	0.93	1.22	3.54	4.11
PY1 (Vuw)	9.49	6.64	4.10	12.22	6.79	9.53	8.60	7.50	4.55	3.33	2.01	6.30	3.28	4.69	4.25	3.61
PX2 (Mu)	10.55	4.76	31.09	43.36	44.45	35.31	41.97	32.28	2.51	1.98	6.27	3.11	4.78	5.03	10.75	10.58
PY2 (Mu)	0.75	0.34	2.22	3.10	3.18	2.52	3.00	2.31	0.18	0.14	0.45	0.22	0.34	0.36	0.77	0.76
Pu (kip)	46.21	44.37	44.84	50.11	47.06	47.94	45.62	46.61	5.64	4.61	9.04	7.38	6.76	8.03	15.14	15.33

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1154.36	1305.00	OK
BF Outside	1114.55	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.26	42.93	44.03	47.52	45.86	46.08	43.99	45.20
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1063.19
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9127**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.50	0.82	1.0	29.68

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	153.28	3.19	OK
BF	1154.36	20.61	OK	381.90	6.82	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1154.36	20.61	1.47	91.65	OK
BF	2268.91	40.52	1.47	183.30	OK
BF Outside	1114.55	19.90	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.11	25.06	OK	15.33	7.66	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.11	1.47	91.65	OK
Web SPL	25.06	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.43	5.27	3.67
Web	1.44	2.20	1.83
BF	1.44	2.47	4.03

Plate	Shear	Flexure
Web	1.65	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1189	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1189

Node 1189

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1189 L	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00
1189 R	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1189 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.71	7.70	-8.24	3.87	-10.39	11.13	-5.04	2.34	5.91	-7.42	-10.90	11.02	-12.09	17.95	11.40	-14.79
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.14	50.00	50.00	50.00	50.00	50.00	47.13
f / ϕf Fnc	0.07	0.15	0.16	0.08	0.21	0.22	0.10	0.05	0.12	0.16	0.22	0.22	0.24	0.36	0.23	0.31
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)		7.70	-8.24			11.13	-5.04			-7.42		11.02		17.95		-14.79
Fcf (ksi)		37.50	-37.50			37.50	-37.50			-35.35		37.50		37.50		-35.34
Fcf (kip)		1929.47	-2400.00			1929.47	-2400.00			-2262.69		1929.47		1929.47		-2262.05
fncf (ksi)	-3.71			3.87	-10.39			2.34	5.91		-10.90		-12.09		11.40	
Rcf	4.87			4.55	3.37			7.45	4.76		3.40		2.09		2.39	
Fncf (ksi)	-37.50			37.50	-37.50			37.50	37.50		-37.50		-37.50		37.50	
Fncf (kip)	-2400.00			1929.47	-2400.00			1929.47	1929.47		-2400.00		-2400.00		1929.47	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.16	6.30	-6.62	2.26	-7.41	8.72	-5.57	1.18	3.32	-4.12	-7.28	6.42	-9.15	13.70	9.02	-12.07
Fs (ksi)	-5.16	6.30	-6.62	2.26	-7.41	8.72	-5.57	1.18	3.32	-4.12	-7.28	6.42	-9.15	13.70	9.02	-12.07
Fs (kip)	-330.40	403.19	-423.98	144.75	-474.22	557.99	-356.63	75.82	212.57	-263.57	-465.87	411.19	-585.42	876.78	577.25	-772.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	577.25	876.78
Comp	2400.00	2262.69	585.42	772.27

$\phi v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	335.97	555.22	163.31	653.38	321.56	473.54	361.89	415.72	240.76	409.30	118.77	478.65	230.58	351.59	259.07	310.74
Vuw (kip)	503.96	832.83	244.96	980.06	482.34	710.31	542.84	623.59	---	---	---	---	---	---	---	---
Mv (k*ft)	220.48	364.36	107.17	428.78	211.03	310.76	237.49	272.82	105.33	179.07	51.96	209.41	100.88	153.82	113.34	135.95
Huw (kip)	932.33	-956.15	119.81	-962.86	-346.28	20.31	587.50	-388.81	54.60	-209.42	62.83	-210.60	-38.25	-41.01	218.52	-146.26
Muw (k*ft)	3556.90	3525.13	4640.25	3516.19	4063.66	4772.92	4016.67	4005.68	733.59	568.74	1032.21	432.45	476.14	877.06	1462.20	1349.53
Mu (k*ft)	3777.38	3889.49	4747.42	3944.97	4274.69	5083.68	4254.16	4278.50	838.92	747.81	1084.18	641.86	577.02	1030.88	1575.54	1485.48

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	10.72	10.99	1.38	11.07	3.98	0.23	6.75	4.47	0.63	2.41	0.72	2.42	0.44	0.47	2.51	1.68
PY1 (Vuw)	5.79	9.57	2.82	11.27	5.54	8.16	6.24	7.17	2.77	4.70	1.37	5.50	2.65	4.04	2.98	3.57
PX2 (Mu)	34.41	35.43	43.24	35.93	38.94	46.31	38.75	38.97	7.64	6.81	9.88	5.85	5.26	9.39	14.35	13.53
PY2 (Mu)	2.46	2.53	3.09	2.57	2.78	3.31	2.77	2.78	0.55	0.49	0.71	0.42	0.38	0.67	1.03	0.97
Pu (kip)	45.87	47.97	45.01	48.99	43.72	47.93	46.39	44.57	8.91	10.58	10.80	10.17	6.45	10.93	17.33	15.87

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1151.19	1305.00	OK
BF Outside	1111.50	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.81	46.10	44.50	46.68	42.75	46.44	45.27	43.26
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	980.06
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.90	1.0	32.57
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	295.54	6.16	OK
BF	1151.19	20.56	OK	446.08	7.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1151.19	20.56	1.47	91.65	OK
BF	2262.69	40.41	1.47	183.30	OK
BF Outside	1111.50	19.85	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.99	24.50	OK	17.33	8.67	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.99	1.47	91.65	OK
Web SPL	24.50	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.29	2.73	3.67
Web	1.48	1.94	1.87
BF	1.76	2.11	4.04

Plate	Shear	Flexure
Web	1.79	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 3189

Node 3189

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3189 L	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00
3189 R	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3189 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.46	1.84	-9.28	3.97	-10.65	8.47	-4.71	0.86	2.54	-5.52	-11.38	7.86	-13.61	16.75	9.71	-14.95
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	46.93	50.00	50.00	50.00	50.00	50.00	47.06
f / ϕf Fnc	0.05	0.04	0.19	0.08	0.21	0.17	0.09	0.02	0.05	0.12	0.23	0.16	0.27	0.33	0.19	0.32
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	-2.46		-9.28		-10.65		-4.71			-5.52	-11.38			16.75		-14.95
Fcf (ksi)	-37.50		-37.50		-37.50		-37.50			-35.19	-37.50			37.50		-35.29
Fcf (kip)	-2400.00		-2400.00		-2400.00		-2400.00			-2252.45	-2400.00			1929.47		-2258.70
fncf (ksi)		1.84		3.97		8.47		0.86	2.54			7.86	-13.61		9.71	
Rcf		15.25		4.04		3.52		7.96	6.38			3.29	2.24		2.36	
Fncf (ksi)		37.50		37.50		37.50		37.50	37.50			37.50	-37.50		37.50	
Fncf (kip)		1929.47		1929.47		1929.47		1929.47	1929.47			1929.47	-2400.00		1929.47	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.71	2.71	-7.43	2.29	-8.12	6.97	-6.06	0.24	-5.15	-1.77	-8.08	4.61	-10.24	12.73	7.83	-12.07
Fs (ksi)	-5.71	2.71	-7.43	2.29	-8.12	6.97	-6.06	0.24	-5.15	-1.77	-8.08	4.61	-10.24	12.73	7.83	-12.07
Fs (kip)	-365.27	173.25	-475.54	146.87	-519.83	446.30	-387.70	15.44	-329.86	-113.30	-517.38	295.34	-655.56	814.73	501.38	-772.70

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	501.38	814.73
Comp	2400.00	2258.70	655.56	772.70

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	411.24	612.66	223.99	727.83	397.31	523.11	485.01	475.33	293.95	448.89	161.66	530.26	284.11	385.62	346.07	351.86
Vuw (kip)	616.85	918.99	335.99	1051.61	595.97	784.67	727.51	713.00	---	---	---	---	---	---	---	---
Mv (k*ft)	269.87	402.06	147.00	460.08	260.74	343.29	318.29	311.94	128.60	196.39	70.72	231.99	124.30	168.71	151.40	153.94
Huw (kip)	-455.89	-1030.87	-369.41	-1469.87	-911.29	-556.62	337.27	-593.51	-144.01	-246.51	-55.15	-279.20	-332.37	-166.53	119.37	-203.49
Muw (k*ft)	4192.14	3425.51	4307.45	2840.17	3289.84	4057.84	4350.31	3726.06	538.52	622.41	966.14	403.14	216.57	812.72	1470.29	1274.08
Mu (k*ft)	4462.01	3827.57	4454.45	3300.25	3550.58	4401.13	4668.60	4037.99	667.12	818.80	1036.86	635.13	340.86	981.43	1621.70	1428.02

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.24	11.85	4.25	16.90	10.47	6.40	3.88	6.82	1.66	2.83	0.63	3.21	3.82	1.91	1.37	2.34
PY1 (Vuw)	7.09	10.56	3.86	12.09	6.85	9.02	8.36	8.20	3.38	5.16	1.86	6.09	3.27	4.43	3.98	4.04
PX2 (Mu)	40.64	34.86	40.57	30.06	32.34	40.09	42.52	36.78	6.08	7.46	9.44	5.79	3.10	8.94	14.77	13.01
PY2 (Mu)	2.90	2.49	2.90	2.15	2.31	2.86	3.04	2.63	0.43	0.53	0.67	0.41	0.22	0.64	1.06	0.93
Pu (kip)	46.96	48.50	45.33	49.07	43.78	47.98	47.78	44.93	8.62	11.76	10.39	11.10	7.75	11.98	16.91	16.13

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1149.16	1305.00	OK
BF Outside	1109.54	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.68	46.37	44.64	46.51	42.51	46.26	46.23	43.37
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1051.61
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.90	1.0	32.57
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	330.95	6.89	OK
BF	1149.16	20.52	OK	414.51	7.40	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1149.16	20.52	1.47	91.65	OK
BF	2258.70	40.33	1.47	183.30	OK
BF Outside	1109.54	19.81	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.07	24.53	OK	16.91	8.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.07	1.47	91.65	OK
Web SPL	24.53	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.44	3.67
Web	1.48	1.99	1.87
BF	1.76	2.27	4.05

Plate	Shear	Flexure
Web	1.67	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 5189

Node 5189

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5189 L	64.00	50.00	3200.00	64.00	47.01	3008.62	96.00	50.00	4800.00
5189 R	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5189 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.06	-3.57	-12.80	8.00	-10.07	7.55	-4.06	-0.66	-4.41	2.20	-4.11	-1.66	-13.45	15.95	9.21	-14.29
ϕf Fnc (ksi)	50.00	47.01	50.00	50.00	50.00	50.00	50.00	42.82	50.00	50.00	50.00	42.82	50.00	50.00	50.00	47.05
f / ϕf Fnc	0.04	0.08	0.26	0.16	0.20	0.15	0.08	0.02	0.09	0.04	0.08	0.04	0.27	0.32	0.18	0.30
α	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.86	1.00	1.00	1.00	0.86	1.00	1.00	1.00	0.94
fcf (ksi)		-3.57	-12.80		-10.07		-4.06		-4.41		-4.11			15.95		-14.29
Fcf (ksi)		-35.26	-37.50		-37.50		-37.50		-37.50		-37.50			37.50		-35.29
Fcf (kip)		-2256.46	-2400.00		-2400.00		-2400.00		-2400.00		-2400.00			1929.47		-2258.54
fncf (ksi)	2.06			8.00		7.55		-0.66		2.20		-1.66	-13.45		9.21	
Rcf	9.87			2.93		3.72		9.25		8.50		9.12	2.35		2.47	
Fncf (ksi)	37.50			37.50		37.50		-32.12		37.50		-32.12	-37.50		37.50	
Fncf (kip)	1929.47			1929.47		1929.47		-2055.40		1929.47		-2055.40	-2400.00		1929.47	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.48	-3.84	-8.93	6.76	-7.99	6.30	-5.78	-0.59	-6.65	2.99	-6.02	-1.26	-10.17	12.09	7.54	-11.43
Fs (ksi)	2.48	-3.84	-8.93	6.76	-7.99	6.30	-5.78	-0.59	-6.65	2.99	-6.02	-1.26	-10.17	12.09	7.54	-11.43
Fs (kip)	158.43	-245.79	-571.76	432.48	-511.41	403.23	-370.03	-37.88	-425.58	191.52	-385.23	-80.48	-651.14	773.89	482.47	-731.55

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	482.47	773.89
Comp	2400.00	2258.54	651.14	731.55

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	418.17	653.20	260.96	745.88	435.64	524.30	523.56	483.02	310.47	465.32	188.19	542.00	311.61	385.45	373.73	356.29
Vuw (kip)	627.26	979.80	391.44	1060.63	653.45	786.44	785.34	724.53	---	---	---	---	---	---	---	---
Mv (k*ft)	274.43	428.66	171.25	464.03	285.89	344.07	343.59	316.98	135.83	203.58	82.33	237.13	136.33	168.63	163.51	155.88
Huw (kip)	-715.83	-675.64	-450.77	-2093.54	-902.07	-2528.68	282.11	-602.92	-65.52	-104.46	-81.14	-305.93	-175.55	-349.28	92.06	-186.81
Muw (k*ft)	3558.49	3899.15	4198.97	2008.62	3597.24	1428.43	4423.85	3713.18	404.22	1004.24	914.64	332.15	617.10	304.75	1425.04	1214.03
Mu (k*ft)	3832.92	4327.81	4370.22	2472.65	3883.12	1772.50	4767.44	4030.16	540.05	1207.82	996.98	569.27	753.43	473.39	1588.54	1369.91

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 5189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	8.23	7.77	5.18	24.06	10.37	29.07	3.24	6.93	0.75	1.20	0.93	3.52	2.02	4.01	1.06	2.15
PY1 (Vuw)	7.21	11.26	4.50	12.19	7.51	9.04	9.03	8.33	3.57	5.35	2.16	6.23	3.58	4.43	4.30	4.10
PX2 (Mu)	34.91	39.42	39.81	22.52	35.37	16.15	43.42	36.71	4.92	11.00	9.08	5.19	6.86	4.31	14.47	12.48
PY2 (Mu)	2.49	2.82	2.84	1.61	2.53	1.15	3.10	2.62	0.35	0.79	0.65	0.37	0.49	0.31	1.03	0.89
Pu (kip)	44.22	49.24	45.58	48.59	46.83	46.35	48.22	44.99	6.89	13.66	10.40	10.92	9.77	9.58	16.42	15.45

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1149.08	1305.00	OK
BF Outside	1109.46	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.88	46.93	44.79	46.00	45.43	44.52	46.50	43.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1060.63
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.90	1.0	32.57
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	328.72	6.85	OK
BF	1149.08	20.52	OK	393.73	7.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1149.08	20.52	1.47	91.65	OK
BF	2258.54	40.33	1.47	183.30	OK
BF Outside	1109.46	19.81	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.24	24.62	OK	16.42	8.21	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.24	1.47	91.65	OK
Web SPL	24.62	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.46	3.67
Web	1.47	2.05	1.86
BF	1.76	2.39	4.05

Plate	Shear	Flexure
Web	1.65	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7189	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7189

Node 7189

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7189 L	64.00	50.00	3200.00	64.00	42.82	2740.53	96.00	50.00	4800.00
7189 R	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7189 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-0.77	-0.09	-9.79	4.76	-10.56	8.05	-4.55	1.25	-11.85	8.75	2.34	-5.40	-13.56	16.57	9.86	-14.66
ϕf Fnc (ksi)	50.00	42.82	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	46.90	50.00	50.00	50.00	47.07
f / ϕf Fnc	0.02	0.00	0.20	0.10	0.21	0.16	0.09	0.03	0.24	0.18	0.05	0.12	0.27	0.33	0.20	0.31
α	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94
fcf (ksi)	-0.77		-9.79		-10.56		-4.55		-11.85			-5.40		16.57		-14.66
Fcf (ksi)	-37.50		-37.50		-37.50		-37.50		-37.50			-35.18		37.50		-35.30
Fcf (kip)	-2400.00		-2400.00		-2400.00		-2400.00		-2400.00			-2251.39		1929.47		-2259.37
fncf (ksi)		-0.09		4.76		8.05		1.25		8.75	2.34		-13.56		9.86	
Rcf		48.71		3.83		3.55		8.25		3.17	6.51		2.26		2.41	
Fncf (ksi)		-32.12		37.50		37.50		37.50		37.50	37.50		-37.50		37.50	
Fncf (kip)		-2055.40		1929.47		1929.47		1929.47		1929.47	1929.47		-2400.00		1929.47	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.44	-0.43	-8.18	4.71	-8.12	6.54	-5.79	0.64	-8.83	7.08	-4.39	-3.60	-10.28	12.44	8.05	-11.56
Fs (ksi)	-4.44	-0.43	-8.18	4.71	-8.12	6.54	-5.79	0.64	-8.83	7.08	-4.39	-3.60	-10.28	12.44	8.05	-11.56
Fs (kip)	-284.44	-27.67	-523.36	301.59	-519.95	418.50	-370.85	41.13	-565.37	453.35	-280.70	-230.50	-658.05	796.40	515.40	-739.56

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	515.40	796.40
Comp	2400.00	2259.37	658.05	739.56

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	429.39	600.69	237.47	722.79	500.65	427.54	493.89	473.81	318.62	428.58	171.95	525.91	357.89	317.31	353.12	350.00
Vuw (kip)	644.09	901.04	356.20	1049.09	750.98	641.30	740.83	710.71	---	---	---	---	---	---	---	---
Mv (k*ft)	281.79	394.21	155.84	458.98	328.55	280.57	324.11	310.93	139.40	187.50	75.23	230.09	156.58	138.82	154.49	153.12
Huw (kip)	-2005.65	-924.33	-427.48	-1304.68	-470.06	-957.91	326.66	-554.76	-234.08	-166.33	-76.09	-247.29	-84.02	-383.40	103.76	-168.12
Muw (k*ft)	2125.80	3567.56	4230.02	3060.43	4173.25	3225.58	4364.45	3779.05	256.78	824.95	938.45	411.98	1018.72	50.20	1454.46	1254.96
Mu (k*ft)	2407.59	3961.76	4385.86	3519.41	4501.81	3506.15	4688.56	4089.99	396.17	1012.45	1013.67	642.07	1175.30	189.02	1608.94	1408.08

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.05	10.62	4.91	15.00	5.40	11.01	3.75	6.38	2.69	1.91	0.87	2.84	0.97	4.41	1.19	1.93
PY1 (Vuw)	7.40	10.36	4.09	12.06	8.63	7.37	8.52	8.17	3.66	4.93	1.98	6.04	4.11	3.65	4.06	4.02
PX2 (Mu)	21.93	36.09	39.95	32.06	41.01	31.94	42.71	37.25	3.61	9.22	9.23	5.85	10.71	1.72	14.66	12.83
PY2 (Mu)	1.57	2.58	2.85	2.29	2.93	2.28	3.05	2.66	0.26	0.66	0.66	0.42	0.76	0.12	1.05	0.92
Pu (kip)	45.87	48.47	45.40	49.19	47.83	44.02	47.88	44.95	7.42	12.46	10.45	10.83	12.65	7.20	16.65	15.56

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1149.50	1305.00	OK
BF Outside	1109.87	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.42	46.40	44.67	46.65	46.20	42.63	46.29	43.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1049.09
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.90	1.0	32.57
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	332.21	6.92	OK
BF	1149.50	20.53	OK	405.19	7.24	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1149.50	20.53	1.47	91.65	OK
BF	2259.37	40.35	1.47	183.30	OK
BF Outside	1109.87	19.82	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.19	24.60	OK	16.65	8.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.19	1.47	91.65	OK
Web SPL	24.60	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.43	3.67
Web	1.47	2.02	1.86
BF	1.76	2.33	4.05

Plate	Shear	Flexure
Web	1.67	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9189	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9189

Node 9189

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9189 L	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00
9189 R	72.00	50.00	3600.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9189 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.00	---	64.00	47.00	51.45	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	2.00	---	64.00	47.00	51.45	50	65
Splice Plates	TF Outside	32.00	1.000	38.50	32.00	23.50	---	50	65
	TF Inside	14.50	1.125	38.50	32.63	23.06	---	50	65
	BF Inside	14.50	1.000	44.50	29.00	20.50	---	50	65
	BF Outside	32.00	0.875	44.50	28.00	20.56	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.94	6.05	-5.49	0.82	-10.15	10.54	-4.78	2.82	-12.12	12.40	6.33	-7.08	-11.86	17.68	11.69	-14.54
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.19	50.00	50.00	50.00	47.14
f / ϕf Fnc	0.04	0.12	0.11	0.02	0.20	0.21	0.10	0.06	0.24	0.25	0.13	0.15	0.24	0.35	0.23	0.31
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94
fcf (ksi)		6.05	-5.49			10.54	-4.78			12.40		-7.08		17.68		-14.54
Fcf (ksi)		37.50	-37.50			37.50	-37.50			37.50		-35.39		37.50		-35.36
Fcf (kip)		1929.47	-2400.00			1929.47	-2400.00			1929.47		-2265.06		1929.47		-2262.90
fncf (ksi)	-1.94			0.82	-10.15			2.82	-12.12		6.33		-11.86		11.69	
Rcf	6.20			6.83	3.56			7.85	3.03		5.00		2.12		2.43	
Fncf (ksi)	-37.50			37.50	-37.50			37.50	-37.50		37.50		-37.50		37.50	
Fncf (kip)	-2400.00			1929.47	-2400.00			1929.47	-2400.00		1929.47		-2400.00		1929.47	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.72	3.33	-6.49	2.37	-7.34	8.01	-5.15	1.81	-8.25	9.25	5.61	-6.04	-9.09	13.21	9.39	-11.31
Fs (ksi)	-3.72	3.33	-6.49	2.37	-7.34	8.01	-5.15	1.81	-8.25	9.25	5.61	-6.04	-9.09	13.21	9.39	-11.31
Fs (kip)	-238.14	213.13	-415.47	151.66	-469.85	512.71	-329.43	115.73	-528.18	591.90	358.73	-386.79	-582.06	845.14	601.03	-724.15

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1929.47	1929.47	601.03	845.14
Comp	2400.00	2265.06	582.06	724.15

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	352.25	478.30	182.19	648.02	447.38	351.93	368.18	419.36	264.64	342.58	133.38	473.61	320.74	264.41	264.78	312.05
Vuw (kip)	528.38	717.44	273.29	972.03	671.08	527.90	552.28	629.03	---	---	---	---	---	---	---	---
Mv (k*ft)	231.17	313.88	119.56	425.26	293.60	230.96	241.62	275.20	115.78	149.88	58.35	207.20	140.32	115.68	115.84	136.52
Huw (kip)	1223.78	-1530.12	66.18	-738.10	39.44	-177.92	592.37	-331.97	-18.76	-197.86	32.14	-160.27	47.79	-21.04	197.31	-92.34
Muw (k*ft)	3168.29	2759.84	4711.76	3815.87	4747.41	4292.90	4010.17	4083.17	451.27	567.12	982.55	445.15	1120.07	745.52	1427.20	1325.18
Mu (k*ft)	3399.46	3073.72	4831.32	4241.13	5041.01	4523.86	4251.79	4358.37	567.05	717.00	1040.90	652.36	1260.40	861.20	1543.05	1461.71

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9189**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.07	17.59	0.76	8.48	0.45	2.05	6.81	3.82	0.22	2.27	0.37	1.84	0.55	0.24	2.27	1.06
PY1 (Vuw)	6.07	8.25	3.14	11.17	7.71	6.07	6.35	7.23	3.04	3.94	1.53	5.44	3.69	3.04	3.04	3.59
PX2 (Mu)	30.96	28.00	44.01	38.63	45.92	41.21	38.73	39.70	5.17	6.53	9.48	5.94	11.48	7.84	14.06	13.31
PY2 (Mu)	2.21	2.00	3.14	2.76	3.28	2.94	2.77	2.84	0.37	0.47	0.68	0.42	0.82	0.56	1.00	0.95
Pu (kip)	45.79	46.72	45.21	49.13	47.66	44.18	46.44	44.66	6.37	9.85	10.10	9.75	12.85	8.85	16.82	15.07

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	955.41	1520.00	1222.00	34.00	22.31	20.56	1742.20	1222.00	OK
TF Inside	974.07	1549.69	1199.25	76.50	50.20	16.45	2369.69	1199.25	OK
BF Inside	981.66	1377.50	1066.00	80.00	52.38	14.63	2340.13	1066.00	OK
BF Outside	947.81	1330.00	1069.25	35.00	22.91	17.99	1626.68	1069.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1188.39	1440.00	OK
TF Inside	1211.61	1468.13	OK
BF Inside	1152.40	1305.00	OK
BF Outside	1112.66	1260.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.65	45.13	44.66	46.84	46.26	43.12	45.30	43.35
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	972.03
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.90	1.0	32.57
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1211.61	25.24	OK	303.42	6.32	OK
BF	1152.40	20.58	OK	429.98	7.68	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.39	24.76	1.47	91.65	OK
TF	2400.00	50.00	1.47	183.30	OK
TF Inside	1211.61	25.24	1.47	103.11	OK
BF Inside	1152.40	20.58	1.47	91.65	OK
BF	2265.06	40.45	1.47	183.30	OK
BF Outside	1112.66	19.87	1.47	80.19	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.13	24.57	OK	16.82	8.41	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.13	1.47	91.65	OK
Web SPL	24.57	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.09	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.29	2.66	3.67
Web	1.47	2.00	1.87
BF	1.76	2.19	4.04

Plate	Shear	Flexure
Web	1.81	1.07

Field Splice

Type J

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type J

Field Splice - Node 1153

Node 1153

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1153 L	64.00	50.00	3200.00	64.00	47.34	3029.76	96.00	50.00	4800.00
1153 R	56.00	50.00	2800.00	56.00	50.00	2800.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1153 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.15	2.03	14.62	-11.76	5.46	-9.50	-5.81	6.97	-7.70	5.24	19.60	-19.58	24.47	-27.75	-7.06	13.38
ϕf Fnc (ksi)	50.00	50.00	50.00	47.22	50.00	46.86	50.00	50.00	50.00	50.00	50.00	47.12	50.00	47.06	50.00	50.00
f / ϕf Fnc	0.14	0.04	0.29	0.25	0.11	0.20	0.12	0.14	0.15	0.10	0.39	0.42	0.49	0.59	0.14	0.27
α	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00
fcf (ksi)	-7.15		14.62			-9.50		6.97	-7.70			-19.58		-27.75		13.38
Fcf (ksi)	-37.50		37.50			-35.15		37.50	-37.50			-35.34		-37.40		37.50
Fcf (kip)	-2100.00		1688.29			-1968.30		1688.29	-2100.00			-1979.04		-2094.55		1688.29
fncf (ksi)		2.03		-11.76	5.46		-5.81			5.24	19.60		24.47		-7.06	
Rcf		5.24		2.57	3.70		5.38			4.87	1.81		1.35		2.80	
Fncf (ksi)		37.50		-35.42	37.50		-37.50			37.50	37.50		37.50		-37.50	
Fncf (kip)		1688.29		-1983.40	1688.29		-2100.00			1688.29	1688.29		1688.29		-2100.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.81	1.01	9.51	-7.15	-0.66	-4.24	-2.88	3.58	-4.45	4.78	14.64	-15.02	18.08	-20.79	-5.41	10.45
Fs (ksi)	-3.81	1.01	9.51	-7.15	-0.66	-4.24	-2.88	3.58	-4.45	4.78	14.64	-15.02	18.08	-20.79	-5.41	10.45
Fs (kip)	-213.53	56.62	532.40	-400.49	-37.20	-237.60	-161.13	200.38	-248.95	267.61	819.69	-841.06	1012.42	-1164.22	-302.85	585.46

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	1012.42	585.46
Comp	2100.00	2094.55	302.85	1164.22

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	532.12	389.07	664.33	191.32	478.53	402.94	510.82	295.54	385.85	285.83	480.30	145.07	349.04	294.59	370.80	219.75
Vuw (kip)	798.19	583.61	996.49	286.97	717.79	604.41	766.23	443.32	---	---	---	---	---	---	---	---
Mv (k*ft)	349.21	255.33	435.96	125.55	314.03	264.43	335.22	193.95	168.81	125.05	210.13	63.47	152.70	128.88	162.23	96.14
Huw (kip)	-1288.18	351.20	-717.69	298.79	-574.43	2.14	-211.69	851.01	-134.50	113.06	-235.54	33.64	16.00	-18.32	-130.11	242.24
Muw (k*ft)	3082.43	4331.73	3542.05	4401.61	4034.10	4526.38	4505.29	3665.32	308.74	1066.16	229.03	413.15	590.36	1898.00	2487.59	1015.21
Mu (k*ft)	3431.64	4587.06	3978.02	4527.16	4348.13	4790.82	4840.52	3859.28	477.55	1191.21	439.16	476.62	743.06	2026.88	2649.81	1111.35

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.81	4.04	8.25	3.43	6.60	0.02	2.43	9.78	1.55	1.30	2.71	0.39	0.18	0.21	1.50	2.78
PY1 (Vuw)	9.17	6.71	11.45	3.30	8.25	6.95	8.81	5.10	4.44	3.29	5.52	1.67	4.01	3.39	4.26	2.53
PX2 (Mu)	31.26	41.78	36.23	41.24	39.61	43.64	44.09	35.15	4.35	10.85	4.00	4.34	6.77	18.46	24.14	10.12
PY2 (Mu)	2.23	2.98	2.59	2.95	2.83	3.12	3.15	2.51	0.31	0.78	0.29	0.31	0.48	1.32	1.72	0.72
Pu (kip)	47.46	46.83	46.65	45.11	47.52	44.81	48.04	45.57	7.57	12.81	8.87	5.12	8.28	19.26	26.32	13.31

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1076.44	1141.88	OK
BF Outside	1018.11	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.67	45.64	44.22	44.51	45.98	43.57	46.38	44.64
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	996.49
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	520.31	10.84	OK
BF	1076.44	22.43	OK	598.32	12.46	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1076.44	22.43	1.47	80.19	OK
BF	2094.55	43.64	1.47	160.39	OK
BF Outside	1018.11	21.21	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.04	24.02	OK	26.32	13.16	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.04	1.47	91.65	OK
Web SPL	24.02	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.06
BF Outside	1.12	1.06

Bolt	Shear	Slip	Bearing
TF	1.41	1.55	3.23
Web	1.51	1.28	1.91
BF	1.42	1.35	3.24

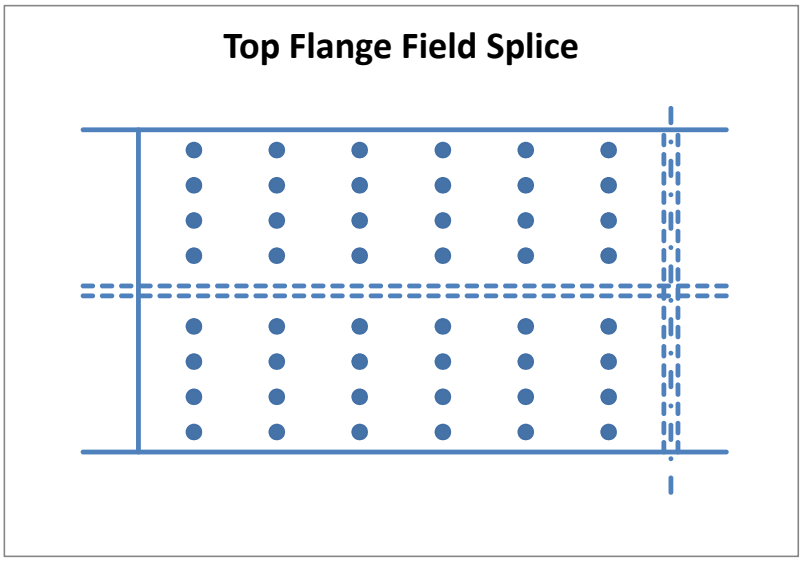
Plate	Shear	Flexure
Web	1.76	1.08

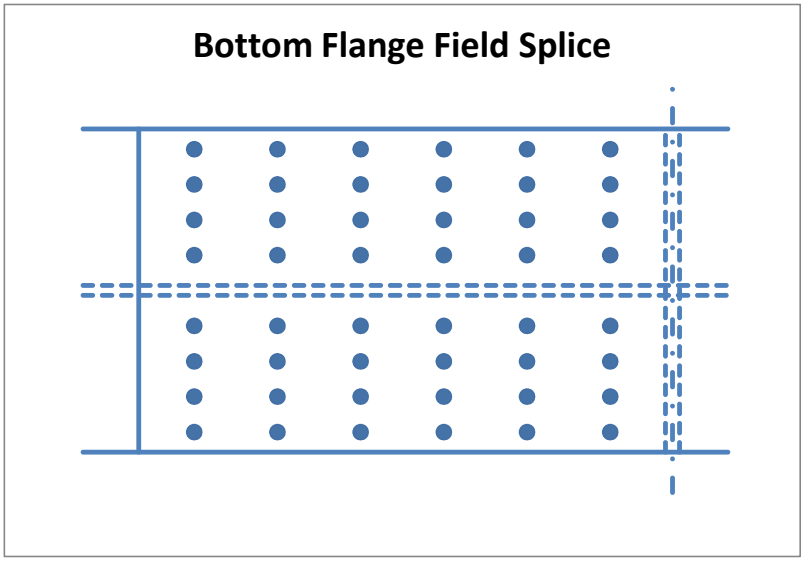
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1153	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1153

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28

	Top Flange		Bottom Flange	
No. Bolts =	48.0		48.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	5.0		5.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





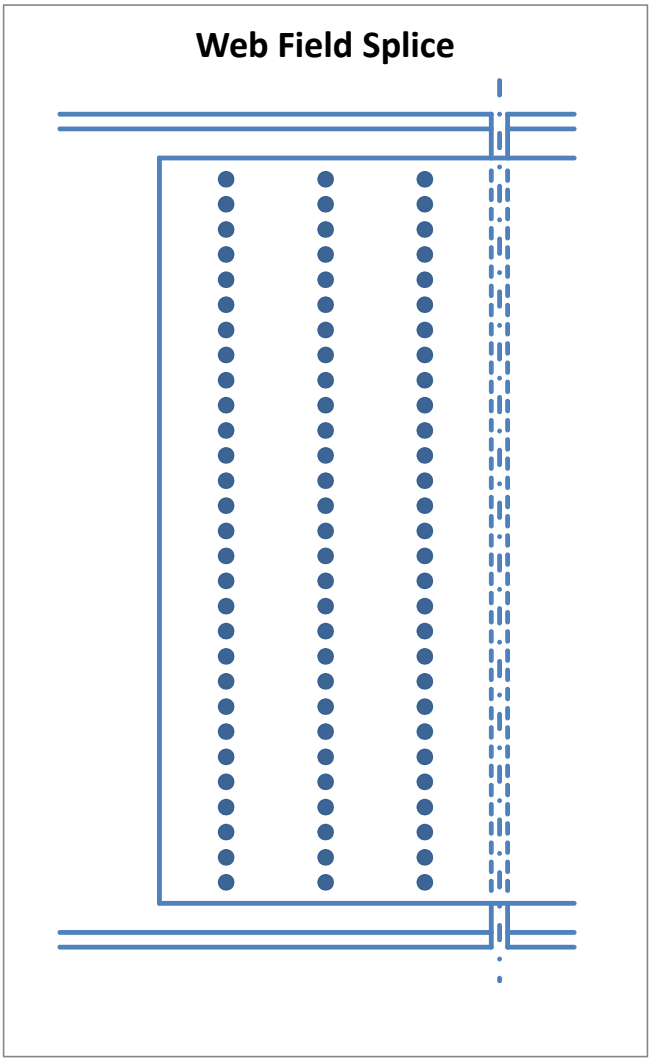
Flange Bolt Pattern Cont. - Node 1153

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1153	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1153

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	9	1764
0	3	9	1521
0	6	9	1296
0	9	9	1089
0	12	9	900
0	15	9	729
0	18	9	576
0	21	9	441
0	24	9	324
0	27	9	225
0	30	9	144
0	33	9	81
0	36	9	36
0	39	9	9
0	42	9	0
0	45	9	9
0	48	9	36
0	51	9	81
0	54	9	144
0	57	9	225
0	60	9	324
0	63	9	441
0	66	9	576
0	69	9	729
0	72	9	900
0	75	9	1089
0	78	9	1296
0	81	9	1521
0	84	9	1764
3	0	0	1764
3	3	0	1521
3	6	0	1296
3	9	0	1089
3	12	0	900
3	15	0	729
3	18	0	576
3	21	0	441
3	24	0	324
3	27	0	225
3	30	0	144
3	33	0	81
3	36	0	36
3	39	0	9
3	42	0	0
3	45	0	9
3	48	0	36
3	51	0	81
3	54	0	144
3	57	0	225
3	60	0	324
3	63	0	441
3	66	0	576
3	69	0	729
3	72	0	900
3	75	0	1089
3	78	0	1296
3	81	0	1521
3	84	0	1764
6	0	9	1764

No. Bolts =	87.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	2.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	3	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	522	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	54810	
Σd^2 (in^2) =	55332	



6	3	9	1521
6	6	9	1296
6	9	9	1089
6	12	9	900
6	15	9	729
6	18	9	576
6	21	9	441
6	24	9	324
6	27	9	225
6	30	9	144
6	33	9	81
6	36	9	36
6	39	9	9
6	42	9	0
6	45	9	9
6	48	9	36
6	51	9	81
6	54	9	144
6	57	9	225
6	60	9	324
6	63	9	441
6	66	9	576
6	69	9	729
6	72	9	900
6	75	9	1089
6	78	9	1296
6	81	9	1521
6	84	9	1764

Web Bolt Pattern Cont. - Node 1153

Web Bolt Pattern Cont. - Node 1153

261	3654	522	54810

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3153	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3153

Node 3153

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3153 L	64.00	50.00	3200.00	64.00	47.21	3021.65	96.00	50.00	4800.00
3153 R	56.00	50.00	2800.00	56.00	50.00	2800.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3153 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.62	3.41	16.28	-17.69	6.56	-13.20	-7.56	6.83	-8.04	3.15	15.86	-18.78	21.87	-27.35	-8.68	12.35
ϕf Fnc (ksi)	50.00	50.00	50.00	47.08	50.00	46.80	50.00	50.00	50.00	50.00	50.00	47.04	50.00	47.01	50.00	50.00
f / ϕf Fnc	0.19	0.07	0.33	0.38	0.13	0.28	0.15	0.14	0.16	0.06	0.32	0.40	0.44	0.58	0.17	0.25
α	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00
fcf (ksi)	-9.62			-17.69		-13.20	-7.56		-8.04			-18.78		-27.35		12.35
Fcf (ksi)	-37.50			-35.31		-35.10	-37.50		-37.50			-35.28		-37.18		37.50
Fcf (kip)	-2100.00			-1977.35		-1965.73	-2100.00		-2100.00			-1975.64		-2082.19		1688.29
fncf (ksi)		3.41	16.28		6.56			6.83		3.15	15.86		21.87		-8.68	
Rcf		3.90	2.00		2.66			4.96		4.66	1.88		1.36		3.04	
Fncf (ksi)		37.50	37.50		37.50			37.50		37.50	37.50		37.50		-37.50	
Fncf (kip)		1688.29	1688.29		1688.29			1688.29		1688.29	1688.29		1688.29		-2100.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.01	1.63	10.71	-11.17	-0.61	-8.56	-4.44	5.50	-5.07	3.59	11.95	-14.61	16.19	-20.67	-6.54	9.85
Fs (ksi)	-5.01	1.63	10.71	-11.17	-0.61	-8.56	-4.44	5.50	-5.07	3.59	11.95	-14.61	16.19	-20.67	-6.54	9.85
Fs (kip)	-280.77	91.24	599.99	-625.39	-34.37	-479.46	-248.54	307.78	-284.06	200.93	669.45	-818.28	906.91	-1157.32	-366.50	551.68

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	906.91	551.68
Comp	2100.00	2082.19	366.50	1157.32

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	575.27	456.53	721.79	228.00	499.40	475.60	560.60	360.65	416.34	331.81	519.86	170.35	362.09	345.92	405.97	264.07
Vuw (kip)	862.90	684.80	1048.59	342.00	749.10	713.40	840.90	540.98	---	---	---	---	---	---	---	---
Mv (k*ft)	377.52	299.60	458.76	149.63	327.73	312.11	367.89	236.68	182.15	145.17	227.44	74.53	158.42	151.34	177.61	115.53
Huw (kip)	-1162.58	-134.71	-847.73	-173.44	-1095.78	-263.02	-357.90	534.88	-162.45	-21.77	-440.43	50.78	-71.25	-127.56	-214.64	158.73
Muw (k*ft)	3249.90	4340.05	3362.79	4568.74	3338.96	4165.06	4282.08	4086.82	425.15	1400.43	508.68	635.79	554.28	1700.27	2359.12	1049.34
Mu (k*ft)	3627.42	4639.65	3821.55	4718.37	3666.69	4477.17	4649.97	4323.50	607.30	1545.59	736.12	710.31	712.69	1851.61	2536.73	1164.87

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.36	1.55	9.74	1.99	12.60	3.02	4.11	6.15	1.87	0.25	5.06	0.58	0.82	1.47	2.47	1.82
PY1 (Vuw)	9.92	7.87	12.05	3.93	8.61	8.20	9.67	6.22	4.79	3.81	5.98	1.96	4.16	3.98	4.67	3.04
PX2 (Mu)	33.04	42.26	34.81	42.98	33.40	40.78	42.36	39.38	5.53	14.08	6.71	6.47	6.49	16.87	23.11	10.61
PY2 (Mu)	2.36	3.02	2.49	3.07	2.39	2.91	3.03	2.81	0.40	1.01	0.48	0.46	0.46	1.20	1.65	0.76
Pu (kip)	48.00	45.14	46.87	45.51	47.29	45.19	48.17	46.42	9.03	15.12	13.42	7.46	8.65	19.05	26.34	13.00

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1070.09	1141.88	OK
BF Outside	1012.10	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.04	43.69	44.26	44.84	45.64	43.65	46.29	45.31
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1048.59
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	466.08	9.71	OK
BF	1070.09	22.29	OK	594.78	12.39	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1070.09	22.29	1.47	80.19	OK
BF	2082.19	43.38	1.47	160.39	OK
BF Outside	1012.10	21.09	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.17	24.09	OK	26.34	13.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.17	1.47	91.65	OK
Web SPL	24.09	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.07
BF Outside	1.12	1.07

Bolt	Shear	Slip	Bearing
TF	1.41	1.73	3.23
Web	1.50	1.28	1.90
BF	1.42	1.36	3.26

Plate	Shear	Flexure
Web	1.67	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5153	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5153

Node 5153

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5153 L	64.00	50.00	3200.00	64.00	47.23	3022.90	96.00	50.00	4800.00
5153 R	56.00	50.00	2800.00	56.00	50.00	2800.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5153 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.02	2.56	12.48	-13.00	7.05	-14.10	-6.78	6.26	1.96	-5.36	8.16	-11.50	20.33	-25.67	-8.60	12.02
ϕf Fnc (ksi)	50.00	50.00	50.00	47.10	50.00	46.81	50.00	50.00	50.00	46.38	50.00	46.96	50.00	47.01	50.00	50.00
f / ϕf Fnc	0.18	0.05	0.25	0.28	0.14	0.30	0.14	0.13	0.04	0.12	0.16	0.24	0.41	0.55	0.17	0.24
α	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00	1.00	0.93	1.00	0.94	1.00	0.94	1.00	1.00
fcf (ksi)	-9.02			-13.00		-14.10	-6.78			-5.36		-11.50		-25.67		12.02
Fcf (ksi)	-37.50			-35.32		-35.10	-37.50			-34.79		-35.22		-36.34		37.50
Fcf (kip)	-2100.00			-1978.20		-1965.83	-2100.00			-1948.15		-1972.24		-2035.08		1688.29
fncf (ksi)		2.56	12.48		7.05			6.26	1.96		8.16		20.33		-8.60	
Rcf		4.16	2.72		2.49			5.53	6.49		3.06		1.42		3.12	
Fncf (ksi)		37.50	37.50		37.50			37.50	37.50		37.50		37.50		-37.50	
Fncf (kip)		1688.29	1688.29		1688.29			1688.29	1688.29		1688.29		1688.29		-2100.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.96	1.13	8.06	-7.69	-0.62	-9.15	-4.20	5.26	-2.47	-1.73	-0.74	-7.92	15.09	-19.55	-6.45	9.73
Fs (ksi)	-4.96	1.13	8.06	-7.69	-0.62	-9.15	-4.20	5.26	-2.47	-1.73	-0.74	-7.92	15.09	-19.55	-6.45	9.73
Fs (kip)	-277.51	63.17	451.55	-430.58	-34.88	-512.24	-235.09	294.43	-138.32	-96.82	-41.30	-443.59	844.82	-1094.61	-360.95	545.13

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	844.82	545.13
Comp	2100.00	2035.08	360.95	1094.61

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	603.72	449.71	738.86	253.63	498.10	493.78	568.53	386.17	436.53	325.86	532.00	187.33	360.05	358.85	411.66	280.97
Vuw (kip)	905.59	674.56	1057.12	380.45	747.15	740.67	852.80	579.26	---	---	---	---	---	---	---	---
Mv (k*ft)	396.19	295.12	462.49	166.44	326.88	324.04	373.10	253.43	190.98	142.56	232.75	81.96	157.52	157.00	180.10	122.92
Huw (kip)	-1289.45	-67.71	-843.06	-137.77	-1059.75	-490.96	-362.98	511.95	-183.72	17.98	-468.96	50.86	-201.55	-415.62	-214.10	157.86
Muw (k*ft)	3080.73	4431.31	3369.25	4616.30	3039.91	3853.36	4167.63	4117.39	389.34	1008.16	545.55	605.16	47.43	459.76	2216.49	1035.52
Mu (k*ft)	3476.93	4726.43	3831.74	4782.75	3366.79	4177.41	4540.73	4370.82	580.32	1150.72	778.30	687.12	204.95	616.76	2396.60	1158.44

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.82	0.78	9.69	1.58	12.18	5.64	4.17	5.88	2.11	0.21	5.39	0.58	2.32	4.78	2.46	1.81
PY1 (Vuw)	10.41	7.75	12.15	4.37	8.59	8.51	9.80	6.66	5.02	3.75	6.11	2.15	4.14	4.12	4.73	3.23
PX2 (Mu)	31.67	43.05	34.90	43.56	30.67	38.05	41.36	39.81	5.29	10.48	7.09	6.26	1.87	5.62	21.83	10.55
PY2 (Mu)	2.26	3.08	2.49	3.11	2.19	2.72	2.95	2.84	0.38	0.75	0.51	0.45	0.13	0.40	1.56	0.75
Pu (kip)	48.19	45.15	46.94	45.76	44.18	45.11	47.29	46.67	9.16	11.59	14.13	7.32	5.98	11.34	25.09	12.99

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1045.88	1141.88	OK
BF Outside	989.20	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.09	43.72	44.30	45.02	42.51	43.49	45.35	45.48
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1057.12
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	434.17	9.05	OK
BF	1045.88	21.79	OK	562.55	11.72	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1045.88	21.79	1.47	80.19	OK
BF	2035.08	42.40	1.47	160.39	OK
BF Outside	989.20	20.61	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.19	24.09	OK	25.09	12.55	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.19	1.47	91.65	OK
Web SPL	24.09	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.09
BF Outside	1.12	1.09

Bolt	Shear	Slip	Bearing
TF	1.41	1.86	3.23
Web	1.50	1.34	1.90
BF	1.46	1.44	3.34

Plate	Shear	Flexure
Web	1.66	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 7153

Node 7153

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7153 L	64.00	50.00	3200.00	64.00	47.22	3022.25	96.00	50.00	4800.00
7153 R	56.00	50.00	2800.00	56.00	50.00	2800.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7153 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.15	3.85	15.30	-16.28	6.31	-13.00	-7.67	7.32	8.28	-9.85	-3.64	-3.92	20.79	-26.33	-8.98	12.92
ϕf Fnc (ksi)	50.00	50.00	50.00	47.09	50.00	46.79	50.00	50.00	50.00	47.04	50.00	42.35	50.00	47.01	50.00	50.00
f / ϕf Fnc	0.20	0.08	0.31	0.35	0.13	0.28	0.15	0.15	0.17	0.21	0.07	0.09	0.42	0.56	0.18	0.26
α	1.00	1.00	1.00	0.94	1.00	0.94	1.00	1.00	1.00	0.94	1.00	0.85	1.00	0.94	1.00	1.00
fcf (ksi)	-10.15			-16.28		-13.00	-7.67			-9.85		-3.92		-26.33		12.92
Fcf (ksi)	-37.50			-35.32		-35.10	-37.50			-35.28		-31.76		-36.67		37.50
Fcf (kip)	-2100.00			-1977.76		-1965.33	-2100.00			-1975.54		-1778.60		-2053.58		1688.29
fncf (ksi)		3.85	15.30		6.31			7.32	8.28		-3.64		20.79		-8.98	
Rcf		3.70	2.17		2.70			4.89	3.58		8.10		1.39		2.90	
Fncf (ksi)		37.50	37.50		37.50			37.50	37.50		-37.50		37.50		-37.50	
Fncf (kip)		1688.29	1688.29		1688.29			1688.29	1688.29		-2100.00		1688.29		-2100.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.47	1.88	10.10	-9.91	-1.20	-8.56	-4.44	5.96	-0.71	-4.59	-3.84	-3.06	15.35	-20.09	-6.68	10.43
Fs (ksi)	-5.47	1.88	10.10	-9.91	-1.20	-8.56	-4.44	5.96	-0.71	-4.59	-3.84	-3.06	15.35	-20.09	-6.68	10.43
Fs (kip)	-306.58	105.03	565.36	-555.12	-67.07	-479.42	-248.83	333.71	-39.97	-256.92	-214.80	-171.64	859.54	-1124.93	-373.91	584.03

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	859.54	584.03
Comp	2100.00	2053.58	373.91	1124.93

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	571.73	451.15	716.28	226.68	438.81	528.11	554.35	358.83	414.39	327.09	516.51	168.50	318.37	383.56	402.10	261.87
Vuw (kip)	857.60	676.73	1045.83	340.02	658.22	792.16	831.52	538.25	---	---	---	---	---	---	---	---
Mv (k*ft)	375.20	296.07	457.55	148.76	287.97	346.57	363.79	235.48	181.29	143.10	225.97	73.72	139.29	167.81	175.92	114.57
Huw (kip)	-1117.03	-102.73	-867.18	-83.87	-270.22	-2937.43	-370.31	548.99	-172.76	8.78	-468.42	72.75	-254.48	-331.23	-227.48	180.10
Muw (k*ft)	3310.63	4383.63	3335.94	4688.18	4155.24	148.80	4200.15	4068.02	470.41	1280.55	471.26	665.76	247.95	49.33	2267.97	1094.79
Mu (k*ft)	3685.83	4679.69	3793.49	4836.94	4443.21	495.37	4563.94	4303.50	651.70	1423.65	697.23	739.47	387.24	217.14	2443.89	1209.36

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	12.84	1.18	9.97	0.96	3.11	33.76	4.26	6.31	1.99	0.10	5.38	0.84	2.93	3.81	2.61	2.07
PY1 (Vuw)	9.86	7.78	12.02	3.91	7.57	9.11	9.56	6.19	4.76	3.76	5.94	1.94	3.66	4.41	4.62	3.01
PX2 (Mu)	33.57	42.63	34.55	44.06	40.47	4.51	41.57	39.20	5.94	12.97	6.35	6.74	3.53	1.98	22.26	11.02
PY2 (Mu)	2.40	3.04	2.47	3.15	2.89	0.32	2.97	2.80	0.42	0.93	0.45	0.48	0.25	0.14	1.59	0.79
Pu (kip)	48.00	45.12	46.82	45.57	44.81	39.42	47.51	46.39	9.47	13.88	13.36	7.95	7.55	7.36	25.64	13.63

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1055.38	1141.88	OK
BF Outside	998.20	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.05	43.69	44.23	44.91	43.42	37.51	45.65	45.29
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1045.83
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	441.74	9.20	OK
BF	1055.38	21.99	OK	578.13	12.04	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1055.38	21.99	1.47	80.19	OK
BF	2053.58	42.78	1.47	160.39	OK
BF Outside	998.20	20.80	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.00	24.00	OK	25.64	12.82	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.00	1.47	91.65	OK
Web SPL	24.00	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.08
BF Outside	1.12	1.08

Bolt	Shear	Slip	Bearing
TF	1.41	1.83	3.23
Web	1.51	1.31	1.91
BF	1.44	1.40	3.31

Plate	Shear	Flexure
Web	1.68	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9153	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9153

Node 9153

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9153 L	64.00	50.00	3200.00	64.00	47.38	3032.33	96.00	50.00	4800.00
9153 R	56.00	50.00	2800.00	56.00	50.00	2800.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9153 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.20	2.93	13.17	-9.66	6.01	-10.82	-7.56	9.95	12.01	-10.48	-5.35	2.09	22.88	-26.35	-7.76	14.54
ϕf Fnc (ksi)	50.00	50.00	50.00	47.27	50.00	46.85	50.00	50.00	50.00	47.18	50.00	50.00	50.00	47.05	50.00	50.00
f / ϕf Fnc	0.16	0.06	0.26	0.20	0.12	0.23	0.15	0.20	0.24	0.22	0.11	0.04	0.46	0.56	0.16	0.29
α	1.00	1.00	1.00	0.95	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00
fcf (ksi)	-8.20		13.17			-10.82		9.95	12.01		-5.35			-26.35		14.54
Fcf (ksi)	-37.50		37.50			-35.14		37.50	37.50		-37.50			-36.70		37.50
Fcf (kip)	-2100.00		1688.29			-1967.68		1688.29	1688.29		-2100.00			-2055.27		1688.29
fncf (ksi)		2.93		-9.66	6.01		-7.56			-10.48		2.09	22.88		-7.76	
Rcf		4.57		2.85	3.25		3.77			3.12		7.01	1.39		2.58	
Fncf (ksi)		37.50		-35.45	37.50		-37.50			-35.39		37.50	37.50		-37.50	
Fncf (kip)		1688.29		-1985.26	1688.29		-2100.00			-1981.76		1688.29	1688.29		-2100.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.65	1.48	8.63	-5.18	-0.77	-7.15	-3.88	7.66	7.81	-5.76	-3.84	0.84	16.81	-20.09	-5.78	11.63
Fs (ksi)	-4.65	1.48	8.63	-5.18	-0.77	-7.15	-3.88	7.66	7.81	-5.76	-3.84	0.84	16.81	-20.09	-5.78	11.63
Fs (kip)	-260.49	82.88	483.05	-289.90	-43.32	-400.27	-217.38	429.13	437.37	-322.54	-214.98	46.99	941.36	-1124.85	-323.94	651.28

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	941.36	651.28
Comp	2100.00	2055.27	323.94	1124.85

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	523.54	378.47	651.50	187.62	370.30	475.38	497.66	289.82	380.72	276.60	471.13	141.76	270.83	346.69	362.44	213.97
Vuw (kip)	785.31	567.71	977.25	281.43	555.46	713.07	746.50	434.72	---	---	---	---	---	---	---	---
Mv (k*ft)	343.57	248.37	427.55	123.12	243.01	311.97	326.59	190.19	166.56	121.01	206.12	62.02	118.49	151.68	158.57	93.61
Huw (kip)	-1157.79	479.62	-750.31	432.50	229.08	-1095.47	-231.71	839.69	-152.23	165.56	-380.22	181.50	98.43	-144.00	-157.28	280.58
Muw (k*ft)	3256.28	4160.51	3497.14	4223.34	4494.56	3339.37	4388.82	3680.42	392.43	883.37	407.94	738.87	868.47	299.40	2361.38	1114.53
Mu (k*ft)	3599.85	4408.88	3924.69	4346.46	4737.57	3651.34	4715.41	3870.61	558.99	1004.38	614.05	800.89	986.96	451.08	2519.94	1208.14

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9153**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.31	5.51	8.62	4.97	2.63	12.59	2.66	9.65	1.75	1.90	4.37	2.09	1.13	1.66	1.81	3.23
PY1 (Vuw)	9.03	6.53	11.23	3.23	6.38	8.20	8.58	5.00	4.38	3.18	5.42	1.63	3.11	3.98	4.17	2.46
PX2 (Mu)	32.79	40.16	35.75	39.59	43.15	33.26	42.95	35.26	5.09	9.15	5.59	7.30	8.99	4.11	22.95	11.00
PY2 (Mu)	2.34	2.87	2.55	2.83	3.08	2.38	3.07	2.52	0.36	0.65	0.40	0.52	0.64	0.29	1.64	0.79
Pu (kip)	47.48	46.63	46.47	44.97	46.75	47.05	47.08	45.53	8.32	11.70	11.54	9.62	10.80	7.18	25.43	14.59

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1056.25	1141.88	OK
BF Outside	999.02	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.73	45.46	44.10	44.37	45.64	45.50	45.47	44.62
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	977.25
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	483.79	10.08	OK
BF	1056.25	22.01	OK	578.09	12.04	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1056.25	22.01	1.47	80.19	OK
BF	2055.27	42.82	1.47	160.39	OK
BF Outside	999.02	20.81	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.48	23.74	OK	25.43	12.72	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.48	1.47	91.65	OK
Web SPL	23.74	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.08
BF Outside	1.12	1.08

Bolt	Shear	Slip	Bearing
TF	1.41	1.67	3.23
Web	1.52	1.32	1.93
BF	1.44	1.40	3.30

Plate	Shear	Flexure
Web	1.80	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1163	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1163

Node 1163

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1163 L	56.00	50.00	2800.00	56.00	47.99	2687.44	96.00	50.00	4800.00
1163 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1163 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	6.40	-0.48	-2.12	2.40	2.80	-5.10	-1.18	8.35	13.88	-10.64	-2.74	5.60	-4.13	15.27	19.35	-21.06
ϕf Fnc (ksi)	50.00	47.99	50.00	50.00	50.00	46.84	50.00	50.00	50.00	47.25	50.00	50.00	50.00	50.00	50.00	47.08
f / ϕf Fnc	0.13	0.01	0.04	0.05	0.06	0.11	0.02	0.17	0.28	0.23	0.05	0.11	0.08	0.31	0.39	0.45
α	1.00	0.96	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	6.40			2.40		-5.10		8.35	13.88			5.60		15.27		-21.06
Fcf (ksi)	37.50			37.50		-35.13		37.50	37.50			37.50		37.50		-35.31
Fcf (kip)	1688.29			1688.29		-1967.47		1688.29	1688.29			1688.29		1688.29		-1977.32
fncf (ksi)		-0.48	-2.12		2.80		-1.18			-10.64	-2.74		-4.13		19.35	
Rcf		5.86	15.65		6.89		4.49			2.70	6.70		2.46		1.68	
Fncf (ksi)		-35.99	-37.50		37.50		-37.50			-35.44	-37.50		-37.50		37.50	
Fncf (kip)		-2015.58	-2100.00		1688.29		-2100.00			-1984.38	-2100.00		-2100.00		1688.29	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	2.86	0.61	-1.20	0.80	1.15	-1.90	-0.54	5.01	4.83	-5.77	-1.64	3.06	-3.17	11.88	6.29	-13.76
Fs (ksi)	2.86	0.61	-1.20	0.80	1.15	-1.90	-0.54	5.01	4.83	-5.77	-1.64	3.06	-3.17	11.88	6.29	-13.76
Fs (kip)	159.91	34.39	-67.39	44.89	64.59	-106.18	-30.03	280.43	270.33	-323.20	-91.74	171.58	-177.45	665.54	352.41	-770.79

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	352.41	665.54
Comp	2100.00	2015.58	177.45	770.79

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	266.17	537.81	615.55	134.49	331.90	443.10	248.62	449.21	197.01	388.52	443.85	103.56	243.44	321.60	184.60	325.92
Vuw (kip)	399.25	806.72	923.32	201.73	497.84	664.65	372.93	673.82	---	---	---	---	---	---	---	---
Mv (k*ft)	174.67	352.94	403.95	88.26	217.81	290.79	163.15	294.80	86.19	169.98	194.18	45.31	106.51	140.70	80.76	142.59
Huw (kip)	1665.13	204.86	-761.47	1545.92	420.55	919.43	1313.03	-137.17	166.55	-19.28	-35.65	214.63	-45.32	68.43	418.36	-358.61
Muw (k*ft)	2579.82	4526.85	3481.77	2738.77	4239.27	3574.09	3049.30	4336.70	143.45	128.33	195.17	354.81	678.32	300.94	963.41	1283.66
Mu (k*ft)	2754.50	4879.79	3885.72	2827.03	4457.07	3864.88	3212.45	4631.50	229.64	298.30	389.35	400.12	784.83	441.64	1044.18	1426.25

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.14	2.35	8.75	17.77	4.83	10.57	15.09	1.58	1.91	0.22	0.41	2.47	0.52	0.79	4.81	4.12
PY1 (Vuw)	4.59	9.27	10.61	2.32	5.72	7.64	4.29	7.75	2.26	4.47	5.10	1.19	2.80	3.70	2.12	3.75
PX2 (Mu)	25.09	44.45	35.39	25.75	40.60	35.20	29.26	42.19	2.09	2.72	3.55	3.64	7.15	4.02	9.51	12.99
PY2 (Mu)	1.79	3.17	2.53	1.84	2.90	2.51	2.09	3.01	0.15	0.19	0.25	0.26	0.51	0.29	0.68	0.93
Pu (kip)	44.69	48.43	46.06	43.72	46.24	46.88	44.81	45.07	4.68	5.51	6.66	6.28	8.35	6.25	14.59	17.74

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1035.86	1141.88	OK
BF Outside	979.73	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.75	46.66	43.88	43.07	45.24	45.46	43.95	43.64
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	923.32
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	181.11	3.77	OK
BF	1035.86	21.58	OK	396.13	8.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1035.86	21.58	1.47	80.19	OK
BF	2015.58	41.99	1.47	160.39	OK
BF Outside	979.73	20.41	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.43	24.22	OK	17.74	8.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.43	1.47	91.65	OK
Web SPL	24.22	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.10
BF Outside	1.12	1.10

Bolt	Shear	Slip	Bearing
TF	1.41	4.46	3.23
Web	1.49	1.90	1.89
BF	1.47	2.04	3.37

Plate	Shear	Flexure
Web	1.90	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3163	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3163

Node 3163

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3163 L	56.00	50.00	2800.00	56.00	47.23	2645.03	96.00	50.00	4800.00
3163 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3163 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	8.67	-6.85	-3.02	2.71	4.80	-9.54	-2.03	7.67	10.70	-10.11	-2.66	2.11	-4.91	13.24	17.90	-21.48
ϕf Fnc (ksi)	50.00	47.23	50.00	50.00	50.00	46.81	50.00	50.00	50.00	47.15	50.00	50.00	50.00	50.00	50.00	47.03
f / ϕf Fnc	0.17	0.15	0.06	0.05	0.10	0.20	0.04	0.15	0.21	0.21	0.05	0.04	0.10	0.26	0.36	0.46
α	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94
fcf (ksi)	8.67		-3.02			-9.54		7.67		-10.11	-2.66			13.24		-21.48
Fcf (ksi)	37.50		-37.50			-35.11		37.50		-35.36	-37.50			37.50		-35.27
Fcf (kip)	1688.29		-2100.00			-1965.95		1688.29		-1980.17	-2100.00			1688.29		-1975.37
fncf (ksi)		-6.85		2.71	4.80		-2.03		10.70			2.11	-4.91		17.90	
Rcf		4.33		12.42	3.68		4.89		3.50			14.10	2.83		1.64	
Fncf (ksi)		-35.42		37.50	37.50		-37.50		37.50			37.50	-37.50		37.50	
Fncf (kip)		-1983.77		1688.29	1688.29		-2100.00		1688.29			1688.29	-2100.00		1688.29	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.00	-3.55	-1.89	0.92	1.85	-6.80	-1.60	6.55	3.59	-5.48	-1.64	-0.67	-3.64	10.48	5.36	-14.23
Fs (ksi)	3.00	-3.55	-1.89	0.92	1.85	-6.80	-1.60	6.55	3.59	-5.48	-1.64	-0.67	-3.64	10.48	5.36	-14.23
Fs (kip)	167.86	-198.60	-105.82	51.54	103.72	-380.67	-89.83	366.71	200.81	-307.00	-91.63	-37.56	-203.89	587.12	300.22	-797.15

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	300.22	587.12
Comp	2100.00	1983.77	203.89	797.15

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	335.47	561.56	683.27	176.22	406.07	489.97	320.68	509.90	245.03	404.97	490.96	132.51	294.91	354.39	234.58	368.48
Vuw (kip)	503.20	842.34	1024.91	264.33	609.11	734.96	481.02	764.86	---	---	---	---	---	---	---	---
Mv (k*ft)	220.15	368.52	448.40	115.64	266.48	321.54	210.45	334.62	107.20	177.17	214.80	57.97	129.02	155.05	102.63	161.21
Huw (kip)	378.08	-182.27	-837.49	1324.44	99.63	-371.49	1132.67	-282.84	-26.35	-46.53	-237.39	237.33	-91.02	-110.74	328.49	-425.94
Muw (k*ft)	4295.89	4556.97	3376.93	3034.08	4658.93	4304.68	3289.77	4138.00	418.81	179.84	553.59	521.76	580.36	61.80	904.01	1254.14
Mu (k*ft)	4516.05	4925.49	3825.33	3149.72	4925.42	4626.23	3500.21	4472.62	526.01	357.01	768.38	579.73	709.38	216.85	1006.64	1415.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.35	2.10	9.63	15.22	1.15	4.27	13.02	3.25	0.30	0.53	2.73	2.73	1.05	1.27	3.78	4.90
PY1 (Vuw)	5.78	9.68	11.78	3.04	7.00	8.45	5.53	8.79	2.82	4.65	5.64	1.52	3.39	4.07	2.70	4.24
PX2 (Mu)	41.14	44.86	34.84	28.69	44.86	42.14	31.88	40.74	4.79	3.25	7.00	5.28	6.46	1.98	9.17	12.89
PY2 (Mu)	2.94	3.20	2.49	2.05	3.20	3.01	2.28	2.91	0.34	0.23	0.50	0.38	0.46	0.14	0.65	0.92
Pu (kip)	46.31	48.70	46.70	44.21	47.13	47.80	45.58	45.52	5.99	6.18	11.50	8.23	8.44	5.32	13.37	18.52

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1019.51	1141.88	OK
BF Outside	964.27	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.30	46.82	44.18	43.51	45.89	46.23	44.54	43.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1024.91
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	154.29	3.21	OK
BF	1019.51	21.24	OK	409.67	8.53	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1019.51	21.24	1.47	80.19	OK
BF	1983.77	41.33	1.47	160.39	OK
BF Outside	964.27	20.09	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.70	24.35	OK	18.52	9.26	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.70	1.47	91.65	OK
Web SPL	24.35	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.12
BF Outside	1.12	1.12

Bolt	Shear	Slip	Bearing
TF	1.41	5.24	3.23
Web	1.49	1.82	1.88
BF	1.50	1.97	3.42

Plate	Shear	Flexure
Web	1.71	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5163	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5163

Node 5163

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5163 L	56.00	50.00	2800.00	56.00	47.26	2646.34	96.00	50.00	4800.00
5163 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5163 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	8.54	-6.43	-2.05	1.17	3.64	-7.43	-0.97	4.61	5.17	-5.13	1.22	-2.95	-4.06	11.84	17.45	-20.77
ϕf Fnc (ksi)	50.00	47.26	50.00	50.00	50.00	46.80	50.00	50.00	50.00	47.12	50.00	46.73	50.00	50.00	50.00	47.04
f / ϕf Fnc	0.17	0.14	0.04	0.02	0.07	0.16	0.02	0.09	0.10	0.11	0.02	0.06	0.08	0.24	0.35	0.44
α	1.00	0.95	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94	1.00	0.93	1.00	1.00	1.00	0.94
fcf (ksi)	8.54		-2.05			-7.43		4.61		-5.13		-2.95		11.84		-20.77
Fcf (ksi)	37.50		-37.50			-35.10		37.50		-35.34		-35.05		37.50		-35.28
Fcf (kip)	1688.29		-2100.00			-1965.51		1688.29		-1979.18		-1962.70		1688.29		-1975.54
fncf (ksi)		-6.43		1.17	3.64		-0.97		5.17		1.22		-4.06		17.45	
Rcf		4.39		18.29	4.72		8.13		6.89		11.89		3.17		1.70	
Fncf (ksi)		-35.44		37.50	37.50		-37.50		37.50		37.50		-37.50		37.50	
Fncf (kip)		-1984.76		1688.29	1688.29		-2100.00		1688.29		1688.29		-2100.00		1688.29	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.11	-3.27	-1.23	-0.31	1.27	-3.39	-0.47	2.25	2.25	-2.34	1.10	-3.11	-2.97	9.54	5.42	-13.86
Fs (ksi)	3.11	-3.27	-1.23	-0.31	1.27	-3.39	-0.47	2.25	2.25	-2.34	1.10	-3.11	-2.97	9.54	5.42	-13.86
Fs (kip)	174.28	-182.99	-69.10	-17.46	71.37	-189.69	-26.23	126.12	126.23	-131.22	61.35	-174.05	-166.18	534.13	303.72	-776.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	303.72	534.13
Comp	2100.00	1984.76	166.18	776.23

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	370.18	593.93	702.42	207.06	446.00	423.22	350.12	522.71	269.31	427.39	504.04	154.05	322.88	306.77	255.14	377.07
Vuw (kip)	555.27	890.90	1038.90	310.59	669.00	634.83	525.18	784.07	---	---	---	---	---	---	---	---
Mv (k*ft)	242.93	389.77	454.52	135.88	292.69	277.74	229.77	343.03	117.82	186.98	220.52	67.40	141.26	134.21	111.62	164.97
Huw (kip)	445.97	-773.70	-858.46	1422.63	13.85	-986.11	1183.46	-270.53	-7.46	-74.20	-101.42	85.63	-4.27	-96.60	315.38	-405.01
Muw (k*ft)	4205.37	3768.40	3347.98	2903.16	4542.31	3171.36	3222.06	4154.80	408.31	59.02	298.36	174.12	294.23	269.03	800.35	1234.22
Mu (k*ft)	4448.30	4158.17	3802.50	3039.05	4834.99	3449.10	3451.82	4497.84	526.13	246.00	518.88	241.52	435.48	403.25	911.97	1399.19

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.13	8.89	9.87	16.35	0.16	11.33	13.60	3.11	0.09	0.85	1.17	0.98	0.05	1.11	3.63	4.66
PY1 (Vuw)	6.38	10.24	11.94	3.57	7.69	7.30	6.04	9.01	3.10	4.91	5.79	1.77	3.71	3.53	2.93	4.33
PX2 (Mu)	40.52	37.88	34.64	27.68	44.04	31.42	31.44	40.97	4.79	2.24	4.73	2.20	3.97	3.67	8.31	12.74
PY2 (Mu)	2.89	2.71	2.47	1.98	3.15	2.24	2.25	2.93	0.34	0.16	0.34	0.16	0.28	0.26	0.59	0.91
Pu (kip)	46.58	48.53	46.78	44.38	45.51	43.80	45.80	45.67	5.97	5.94	8.50	3.72	5.66	6.10	12.44	18.17

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1020.01	1141.88	OK
BF Outside	964.74	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.44	46.49	44.21	43.61	44.10	42.43	44.67	43.92
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1038.90
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	156.09	3.25	OK
BF	1020.01	21.25	OK	398.92	8.31	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1020.01	21.25	1.47	80.19	OK
BF	1984.76	41.35	1.47	160.39	OK
BF Outside	964.74	20.10	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.53	24.26	OK	18.17	9.09	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.53	1.47	91.65	OK
Web SPL	24.26	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.12
BF Outside	1.12	1.12

Bolt	Shear	Slip	Bearing
TF	1.41	5.18	3.23
Web	1.49	1.85	1.89
BF	1.49	2.03	3.42

Plate	Shear	Flexure
Web	1.69	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7163	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7163

Node 7163

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7163 L	56.00	50.00	2800.00	56.00	47.25	2645.76	96.00	50.00	4800.00
7163 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7163 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	9.16	-7.04	-2.50	1.97	3.62	-7.05	-1.44	5.37	-1.94	2.80	8.82	-9.68	-4.29	12.57	17.90	-21.56
ϕf Fnc (ksi)	50.00	47.25	50.00	50.00	50.00	46.82	50.00	50.00	50.00	50.00	50.00	47.07	50.00	50.00	50.00	47.03
f / ϕf Fnc	0.18	0.15	0.05	0.04	0.07	0.15	0.03	0.11	0.04	0.06	0.18	0.21	0.09	0.25	0.36	0.46
α	1.00	0.94	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94
fcf (ksi)	9.16		-2.50			-7.05		5.37		2.80		-9.68		12.57		-21.56
Fcf (ksi)	37.50		-37.50			-35.11		37.50		37.50		-35.31		37.50		-35.27
Fcf (kip)	1688.29		-2100.00			-1966.29		1688.29		1688.29		-1977.15		1688.29		-1975.30
fncf (ksi)		-7.04		1.97	3.62		-1.44		-1.94		8.82		-4.29		17.90	
Rcf		4.10		15.00	4.98		6.98		13.37		3.65		2.98		1.64	
Fncf (ksi)		-35.43		37.50	37.50		-37.50		-37.50		37.50		-37.50		37.50	
Fncf (kip)		-1984.32		1688.29	1688.29		-2100.00		-2100.00		1688.29		-2100.00		1688.29	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.44	-3.68	-1.58	0.34	1.31	-3.18	-0.87	2.79	-1.41	3.14	3.47	-7.31	-3.09	10.05	5.44	-14.35
Fs (ksi)	3.44	-3.68	-1.58	0.34	1.31	-3.18	-0.87	2.79	-1.41	3.14	3.47	-7.31	-3.09	10.05	5.44	-14.35
Fs (kip)	192.45	-206.22	-88.53	19.01	73.33	-178.28	-48.83	156.07	-79.19	176.12	194.53	-409.18	-172.77	562.90	304.62	-803.52

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	304.62	562.90
Comp	2100.00	1984.32	172.77	803.52

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	341.46	565.24	686.09	183.49	481.84	408.20	328.75	510.67	250.24	407.02	493.73	137.30	349.42	296.07	241.26	368.46
Vuw (kip)	512.18	847.86	1029.14	275.24	722.76	612.31	493.13	766.01	---	---	---	---	---	---	---	---
Mv (k*ft)	224.08	370.94	450.25	120.42	316.21	267.88	215.75	335.13	109.48	178.07	216.01	60.07	152.87	129.53	105.55	161.20
Huw (kip)	415.86	-385.05	-820.72	1318.25	553.01	-150.67	1184.93	-287.43	-11.80	-59.59	-89.96	91.92	83.08	-183.99	334.40	-427.62
Muw (k*ft)	4245.52	4286.60	3400.08	3042.34	4062.65	4318.31	3220.10	4131.73	455.62	122.90	287.55	234.18	291.78	689.95	840.76	1266.45
Mu (k*ft)	4469.60	4657.54	3850.33	3162.75	4378.86	4586.19	3435.84	4466.86	565.10	300.97	503.56	294.25	444.66	819.48	946.31	1427.65

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	4.78	4.43	9.43	15.15	6.36	1.73	13.62	3.30	0.14	0.68	1.03	1.06	0.95	2.11	3.84	4.92
PY1 (Vuw)	5.89	9.75	11.83	3.16	8.31	7.04	5.67	8.80	2.88	4.68	5.68	1.58	4.02	3.40	2.77	4.24
PX2 (Mu)	40.71	42.42	35.07	28.81	39.89	41.77	31.30	40.69	5.15	2.74	4.59	2.68	4.05	7.46	8.62	13.00
PY2 (Mu)	2.91	3.03	2.51	2.06	2.85	2.98	2.24	2.91	0.37	0.20	0.33	0.19	0.29	0.53	0.62	0.93
Pu (kip)	46.33	48.56	46.76	44.27	47.57	44.65	45.61	45.52	6.20	5.96	8.22	4.13	6.60	10.36	12.92	18.65

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1019.79	1141.88	OK
BF Outside	964.53	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.30	46.66	44.22	43.56	46.02	43.38	44.54	43.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1029.14
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	156.55	3.26	OK
BF	1019.79	21.25	OK	412.95	8.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1019.79	21.25	1.47	80.19	OK
BF	1984.32	41.34	1.47	160.39	OK
BF Outside	964.53	20.09	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.56	24.28	OK	18.65	9.32	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.56	1.47	91.65	OK
Web SPL	24.28	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.12
BF Outside	1.12	1.12

Bolt	Shear	Slip	Bearing
TF	1.41	5.16	3.23
Web	1.49	1.80	1.89
BF	1.50	1.96	3.42

Plate	Shear	Flexure
Web	1.71	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9163	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9163

Node 9163

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	48
Web	87
BF	48

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9163 L	56.00	50.00	2800.00	56.00	47.93	2684.32	96.00	50.00	4800.00
9163 R	64.00	50.00	3200.00	64.00	50.00	3200.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9163 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	1.75	---	56.00	41.13	45.02	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	32.00	1.75	---	56.00	41.13	45.02	50	65
Splice Plates	TF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	TF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Inside	14.50	0.875	38.50	25.38	17.94	---	50	65
	BF Outside	32.00	0.750	38.50	24.00	17.63	---	50	65
	Web	89.00	0.500	20.50	89.00	58.19	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	7.14	-0.76	-1.62	1.66	3.12	-4.90	-0.76	7.39	-1.71	5.37	12.66	-10.57	-3.10	14.12	19.04	-21.01
ϕf Fnc (ksi)	50.00	47.93	50.00	50.00	50.00	46.91	50.00	50.00	50.00	50.00	50.00	47.21	50.00	50.00	50.00	47.07
f / ϕf Fnc	0.14	0.02	0.03	0.03	0.06	0.10	0.02	0.15	0.03	0.11	0.25	0.22	0.06	0.28	0.38	0.45
α	1.00	0.96	1.00	1.00	1.00	0.94	1.00	1.00	1.00	1.00	1.00	0.94	1.00	1.00	1.00	0.94
fcf (ksi)	7.14			1.66		-4.90		7.39		5.37	12.66			14.12		-21.01
Fcf (ksi)	37.50			37.50		-35.18		37.50		37.50	37.50			37.50		-35.30
Fcf (kip)	1688.29			1688.29		-1970.16		1688.29		1688.29	1688.29			1688.29		-1977.05
fncf (ksi)		-0.76	-1.62		3.12		-0.76		-1.71			-10.57	-3.10		19.04	
Rcf		5.25	22.61		7.18		5.08		6.98			2.96	2.66		1.68	
Fncf (ksi)		-35.95	-37.50		37.50		-37.50		-37.50			-35.40	-37.50		37.50	
Fncf (kip)		-2013.24	-2100.00		1688.29		-2100.00		-2100.00			-1982.66	-2100.00		1688.29	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	3.55	0.66	-0.99	-0.25	1.59	-1.76	-0.41	4.28	-1.21	4.96	4.99	-7.75	-2.19	11.14	6.18	-13.81
Fs (ksi)	3.55	0.66	-0.99	-0.25	1.59	-1.76	-0.41	4.28	-1.21	4.96	4.99	-7.75	-2.19	11.14	6.18	-13.81
Fs (kip)	198.66	36.75	-55.27	-14.03	89.26	-98.60	-23.19	239.87	-67.87	277.66	279.64	-433.94	-122.77	623.99	345.96	-773.40

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	1688.29	1688.29	345.96	623.99
Comp	2100.00	2013.24	122.77	773.40

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 5.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	275.46	545.06	619.90	146.51	448.19	333.84	261.84	451.16	205.26	392.70	448.61	111.12	327.29	243.48	195.64	326.36
Vuw (kip)	413.19	817.58	929.85	219.76	672.28	500.76	392.77	676.73	---	---	---	---	---	---	---	---
Mv (k*ft)	180.77	357.69	406.81	96.14	294.12	219.08	171.84	296.07	89.80	171.81	196.27	48.61	143.19	106.52	85.59	142.78
Huw (kip)	1609.24	40.43	-615.02	1613.66	1226.28	297.12	1405.02	-158.57	201.78	-59.40	-8.01	185.73	179.82	-132.25	429.62	-366.38
Muw (k*ft)	2654.35	4746.09	3683.20	2648.46	3164.97	4403.84	2926.64	4307.53	185.04	47.13	214.69	300.63	394.89	815.52	853.44	1279.27
Mu (k*ft)	2835.12	5103.78	4090.02	2744.60	3459.09	4622.92	3098.47	4603.60	274.84	218.94	410.96	349.25	538.08	922.04	939.03	1422.05

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9163**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.50	0.46	7.07	18.55	14.10	3.42	16.15	1.82	2.32	0.68	0.09	2.13	2.07	1.52	4.94	4.21
PY1 (Vuw)	4.75	9.40	10.69	2.53	7.73	5.76	4.51	7.78	2.36	4.51	5.16	1.28	3.76	2.80	2.25	3.75
PX2 (Mu)	25.82	46.49	37.25	25.00	31.51	42.11	28.22	41.93	2.50	1.99	3.74	3.18	4.90	8.40	8.55	12.95
PY2 (Mu)	1.84	3.32	2.66	1.79	2.25	3.01	2.02	3.00	0.18	0.14	0.27	0.23	0.35	0.60	0.61	0.93
Pu (kip)	44.81	48.65	46.29	43.76	46.68	46.36	44.85	45.06	5.45	5.37	6.64	5.52	8.09	10.48	13.79	17.79

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK
TF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Inside	867.65	1205.31	932.75	59.50	39.05	12.80	1843.09	932.75	OK
BF Outside	820.64	1140.00	916.50	25.50	16.73	15.42	1306.65	916.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1020.76	1080.00	OK
TF Inside	1079.24	1141.88	OK
BF Inside	1034.65	1141.88	OK
BF Outside	978.59	1080.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.85	46.85	44.09	43.08	45.22	45.36	43.95	43.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1320.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	929.85
Rr (kip)	1754.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.88	1.0	31.76
Web	0.00	1.00	1.0	36.19
BF	0.25	0.88	1.0	31.76

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1079.24	22.48	OK	177.80	3.70	OK
BF	1034.65	21.56	OK	397.47	8.28	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1020.76	21.27	1.47	68.74	OK
TF	2100.00	43.75	1.47	160.39	OK
TF Inside	1079.24	22.48	1.47	80.19	OK
BF Inside	1034.65	21.56	1.47	80.19	OK
BF	2013.24	41.94	1.47	160.39	OK
BF Outside	978.59	20.39	1.47	68.74	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.65	24.32	OK	17.79	8.89	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.65	1.47	91.65	OK
Web SPL	24.32	1.47	45.83	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.12	1.06
TF Inside	1.08	1.06
BF Inside	1.08	1.10
BF Outside	1.12	1.10

Bolt	Shear	Slip	Bearing
TF	1.41	4.54	3.23
Web	1.49	1.89	1.88
BF	1.47	2.03	3.37

Plate	Shear	Flexure
Web	1.89	1.07

Field Splice

Type K

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type K

Field Splice - Node 1169

Node 1169

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1169 L	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00
1169 R	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1169 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1169**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.87	4.63	31.44	2.16	28.26	-0.41	18.21	13.07	24.57	2.57	25.63	7.09	35.73	-7.21	16.77	14.54
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.63	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.34	50.00	50.00
f / ϕf Fnc	0.36	0.09	0.63	0.04	0.57	0.01	0.36	0.26	0.49	0.05	0.51	0.14	0.71	0.15	0.34	0.29
α	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)	17.87		31.44		28.26		18.21		24.57		25.63		35.73		16.77	
Fcf (ksi)	37.50		40.72		39.13		37.50		37.50		37.81		42.86		37.50	
Fcf (kip)	1985.92		2156.56		2072.18		1985.92		1985.92		2002.53		2269.95		1985.92	
fncf (ksi)		4.63		2.16		-0.41		13.07		2.57		7.09		-7.21		14.54
Rcf		2.10		1.30		1.38		2.06		1.53		1.48		1.20		2.24
Fncf (ksi)		37.50		37.50		-35.72		37.50		37.50		37.50		-35.50		37.50
Fncf (kip)		1985.92		1985.92		-2411.19		1985.92		1985.92		1985.92		-2396.34		1985.92

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	13.50	2.77	18.85	1.59	17.70	-0.90	13.43	9.95	16.62	1.19	17.27	4.98	26.34	-5.66	12.41	10.99
Fs (ksi)	13.50	2.77	18.85	1.59	17.70	-0.90	13.43	9.95	16.62	1.19	17.27	4.98	26.34	-5.66	12.41	10.99
Fs (kip)	911.46	187.14	1272.17	107.10	1194.72	-60.77	906.28	671.48	1121.80	80.18	1165.91	336.02	1777.64	-381.91	837.47	741.59

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2269.95	1985.92	1777.64	741.59
Comp	0.00	2411.19	0.00	381.91

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	308.15	383.57	593.01	182.05	412.81	288.81	464.34	220.54	234.92	268.93	436.18	126.54	308.86	201.97	345.27	153.74
Vuw (kip)	462.22	575.36	889.52	273.07	619.21	433.22	696.51	330.81	---	---	---	---	---	---	---	---
Mv (k*ft)	260.00	323.64	500.35	153.60	348.31	243.68	391.79	186.08	132.14	151.27	245.35	71.18	173.73	113.61	194.22	86.48
Huw (kip)	2266.55	2089.05	1850.64	3091.31	1988.36	2317.20	1642.11	3360.20	781.23	980.82	806.36	1121.96	854.74	1068.04	992.52	1122.88
Muw (k*ft)	1777.93	2427.04	2540.96	678.26	2148.85	1750.55	3297.03	319.73	686.76	1104.66	1190.39	222.63	987.62	786.86	2047.58	90.91
Mu (k*ft)	2037.93	2750.69	3041.32	831.86	2497.16	1994.23	3688.82	505.82	818.90	1255.93	1435.74	293.81	1161.35	900.47	2241.79	177.39

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.54	18.01	15.95	26.65	17.14	19.98	14.16	28.97	6.73	8.46	6.95	9.67	7.37	9.21	8.56	9.68
PY1 (Vuw)	3.98	4.96	7.67	2.35	5.34	3.73	6.00	2.85	2.03	2.32	3.76	1.09	2.66	1.74	2.98	1.33
PX2 (Mu)	13.81	18.64	20.61	5.64	16.92	13.51	24.99	3.43	5.55	8.51	9.73	1.99	7.87	6.10	15.19	1.20
PY2 (Mu)	1.48	2.00	2.21	0.60	1.81	1.45	2.68	0.37	0.59	0.91	1.04	0.21	0.84	0.65	1.63	0.13
Pu (kip)	33.79	37.30	37.87	32.42	34.80	33.89	40.10	32.55	12.56	17.27	17.36	11.74	15.64	15.49	24.19	10.98

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1145.39	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1124.56	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1213.08	1366.88	OK
BF Outside	1198.11	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.19	38.78	38.75	33.84	36.03	35.33	41.58	33.88
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	889.52
Rr (kip)	2193.67
Check	OK

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1145.39	17.90	OK	896.97	14.02	OK
BF	1213.08	21.66	OK	373.10	6.66	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1145.39	17.90	1.47	126.02	OK
TF	2269.95	35.47	1.47	206.21	OK
TF Inside	1124.56	17.57	1.47	137.48	OK
BF Inside	1213.08	21.66	1.47	103.11	OK
BF	2411.19	43.06	1.47	206.21	OK
BF Outside	1198.11	21.39	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
40.10	20.05	OK	24.19	12.09	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	40.10	1.47	91.65	OK
Web SPL	20.05	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.34	NA
TF Inside	1.28	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	2.02	1.20	5.81
Web	1.80	1.39	2.29
BF	1.39	2.53	4.28

Plate	Shear	Flexure
Web	2.47	1.20

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
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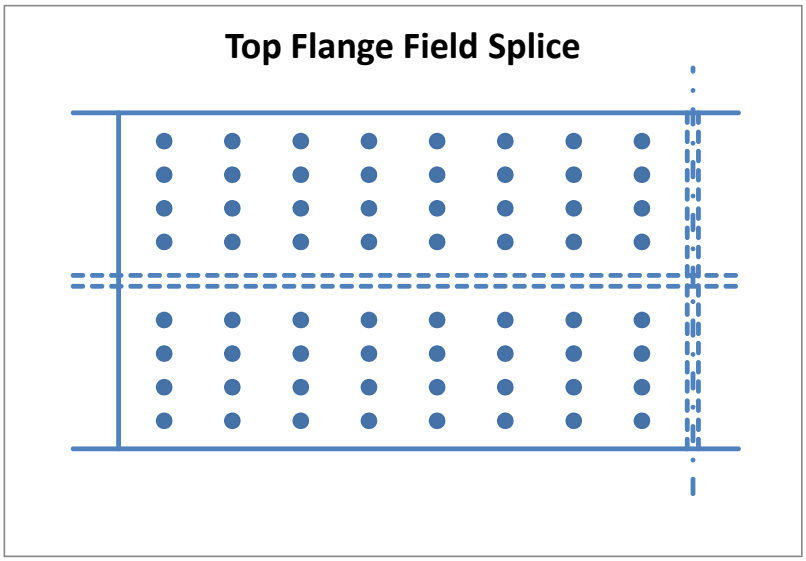
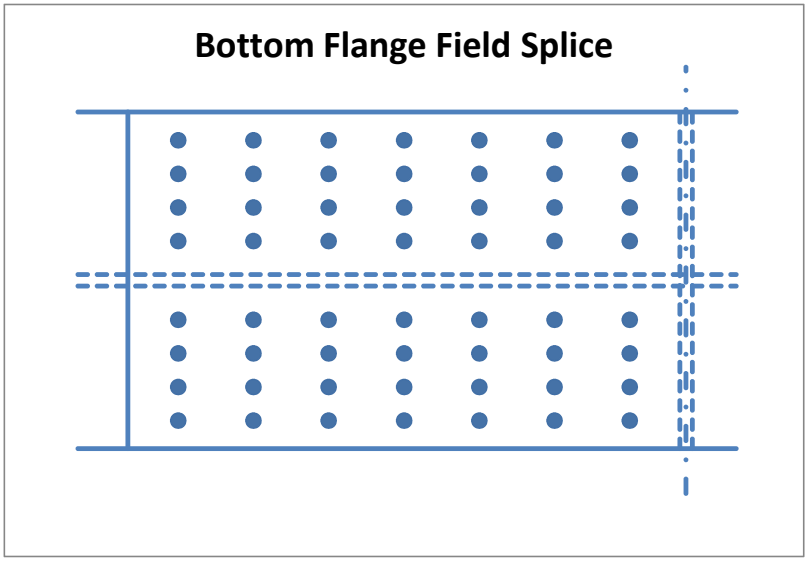
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1169

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	16	0	16
0	19	0	19
0	22	0	22
0	25	0	25
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	16	3	16
3	19	3	19
3	22	3	22
3	25	3	25
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	16	6	16
6	19	6	19
6	22	6	22
6	25	6	25
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	16	9	16
9	19	9	19
9	22	9	22
9	25	9	25
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	16	12	16
12	19	12	19
12	22	12	22
12	25	12	25
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	16	15	16
15	19	15	19
15	22	15	22
15	25	15	25
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	16	18	16
18	19	18	19
18	22	18	22
18	25	18	25
21	0		
21	3		
21	6		

	Top Flange		Bottom Flange	
No. Bolts =	64.0		56.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	7.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	9		
21	16		
21	19		
21	22		
21	25		

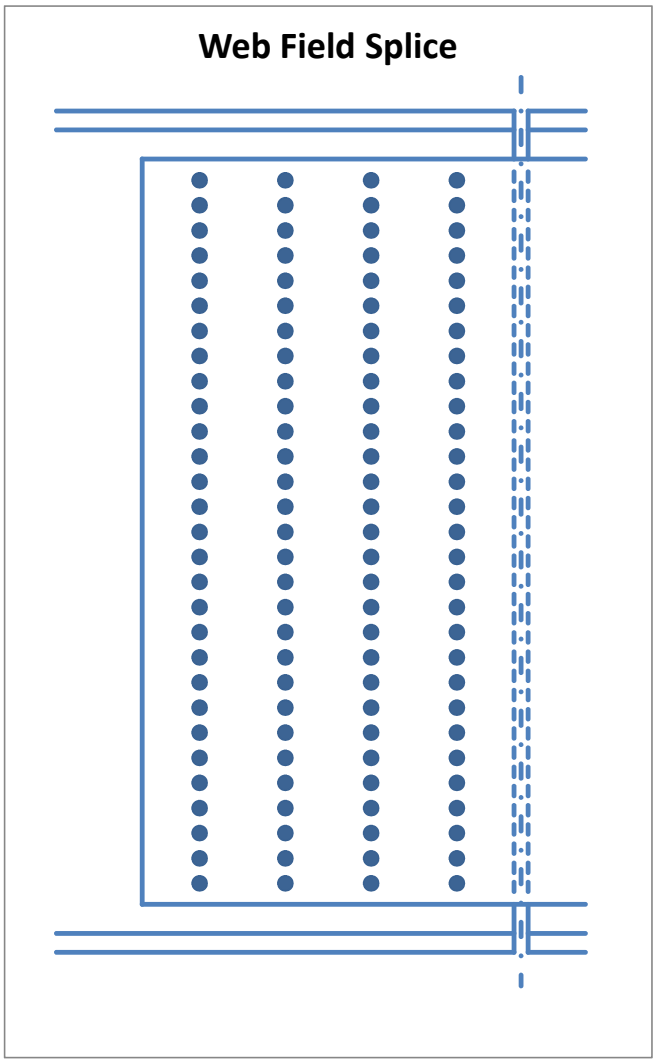
Flange Bolt Pattern Cont. - Node 1169

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1169	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1169

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 1169

Web Bolt Pattern Cont. - Node 1169

522	4872	1305	73080

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3169	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3169

Node 3169

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3169 L	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00
3169 R	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3169 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3169**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.53	5.16	35.81	1.81	35.79	-2.48	21.41	12.04	28.64	4.49	30.42	6.16	39.21	-5.29	20.61	13.02
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.53	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.43	50.00	50.00
f / ϕf Fnc	0.43	0.10	0.72	0.04	0.72	0.05	0.43	0.24	0.57	0.09	0.61	0.12	0.78	0.11	0.41	0.26
α	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)	21.53		35.81		35.79		21.41		28.64		30.42		39.21		20.61	
Fcf (ksi)	37.50		42.91		42.90		37.50		39.32		40.21		44.60		37.50	
Fcf (kip)	1985.92		2272.18		2271.69		1985.92		2082.25		2129.45		2362.07		1985.92	
fncf (ksi)		5.16		1.81		-2.48		12.04		4.49		6.16		-5.29		13.02
Rcf		1.74		1.20		1.20		1.75		1.37		1.32		1.14		1.82
Fncf (ksi)		37.50		37.50		-35.65		37.50		37.50		37.50		-35.57		37.50
Fncf (kip)		1985.92		1985.92		-2406.25		1985.92		1985.92		1985.92		-2401.03		1985.92

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.16	3.28	21.54	1.29	21.40	-2.21	15.81	9.25	19.52	2.40	20.16	4.35	22.46	-4.03	15.24	9.94
Fs (ksi)	16.16	3.28	21.54	1.29	21.40	-2.21	15.81	9.25	19.52	2.40	20.16	4.35	22.46	-4.03	15.24	9.94
Fs (kip)	1090.56	221.54	1454.19	87.20	1444.54	-149.25	1067.41	624.53	1317.72	161.81	1360.67	293.82	1516.25	-271.80	1029.00	671.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2362.07	1985.92	1516.25	671.23
Comp	0.00	2406.25	0.00	271.80

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	388.76	479.29	692.35	282.29	426.78	422.07	574.12	329.32	290.67	335.77	505.17	196.59	317.53	295.34	421.64	229.82
Vuw (kip)	583.14	718.93	1033.87	423.43	640.16	633.10	861.19	493.98	---	---	---	---	---	---	---	---
Mv (k*ft)	328.02	404.40	581.55	238.18	360.09	356.12	484.42	277.86	163.50	188.87	284.16	110.58	178.61	166.13	237.17	129.27
Huw (kip)	2231.18	2163.40	1916.16	2811.78	2183.02	2321.11	1852.01	2936.86	933.04	1096.10	921.09	1203.15	1052.11	1176.53	884.94	1209.05
Muw (k*ft)	1825.09	2607.35	2935.83	1050.96	2122.12	2052.10	3239.81	884.19	823.96	1296.11	1511.15	419.92	1095.97	1011.53	1695.34	339.21
Mu (k*ft)	2153.11	3011.75	3517.39	1289.14	2482.22	2408.22	3724.22	1162.05	987.46	1484.98	1795.31	530.50	1274.58	1177.66	1932.51	468.49

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3169**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.23	18.65	16.52	24.24	18.82	20.01	15.97	25.32	8.04	9.45	7.94	10.37	9.07	10.14	7.63	10.42
PY1 (Vuw)	5.03	6.20	8.91	3.65	5.52	5.46	7.42	4.26	2.51	2.89	4.35	1.69	2.74	2.55	3.63	1.98
PX2 (Mu)	14.59	20.41	23.83	8.73	16.82	16.32	25.23	7.87	6.69	10.06	12.16	3.59	8.64	7.98	13.09	3.17
PY2 (Mu)	1.56	2.19	2.55	0.94	1.80	1.75	2.70	0.84	0.72	1.08	1.30	0.39	0.93	0.85	1.40	0.34
Pu (kip)	34.46	39.95	41.95	33.29	36.38	37.03	42.43	33.58	15.08	19.91	20.89	14.12	18.08	18.44	21.33	13.79

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1191.87	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1170.20	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1210.60	1366.88	OK
BF Outside	1195.65	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.71	41.35	42.80	34.65	37.67	38.38	43.73	34.85
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1033.87
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3169**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1191.87	18.62	OK	765.08	11.95	OK
BF	1210.60	21.62	OK	337.70	6.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1191.87	18.62	1.47	126.02	OK
TF	2362.07	36.91	1.47	206.21	OK
TF Inside	1170.20	18.28	1.47	137.48	OK
BF Inside	1210.60	21.62	1.47	103.11	OK
BF	2406.25	42.97	1.47	206.21	OK
BF Outside	1195.65	21.35	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.43	21.21	OK	21.33	10.66	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.43	1.47	91.65	OK
Web SPL	21.21	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.23	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.94	1.41	5.59
Web	1.71	1.58	2.16
BF	1.40	2.79	4.29

Plate	Shear	Flexure
Web	2.12	1.14

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5169	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5169

Node 5169

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5169 L	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00
5169 R	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5169 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5169**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.87	4.79	35.89	0.77	35.39	-2.54	22.54	10.79	29.30	3.55	28.65	6.03	38.85	-5.61	21.20	11.99
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.53	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.41	50.00	50.00
f / ϕf Fnc	0.42	0.10	0.72	0.02	0.71	0.05	0.45	0.22	0.59	0.07	0.57	0.12	0.78	0.12	0.42	0.24
α	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)	20.87		35.89		35.39		22.54		29.30		28.65		38.85		21.20	
Fcf (ksi)	37.50		42.95		42.70		37.50		39.65		39.32		44.42		37.50	
Fcf (kip)	1985.92		2274.36		2261.17		1985.92		2099.72		2082.57		2352.60		1985.92	
fncf (ksi)		4.79		0.77		-2.54		10.79		3.55		6.03		-5.61		11.99
Rcf		1.80		1.20		1.21		1.66		1.35		1.37		1.14		1.77
Fncf (ksi)		37.50		37.50		-35.65		37.50		37.50		37.50		-35.56		37.50
Fncf (kip)		1985.92		1985.92		-2406.05		1985.92		1985.92		1985.92		-2400.33		1985.92

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.55	2.95	21.62	0.60	21.35	-2.28	16.66	8.34	19.79	1.78	19.62	4.30	22.37	-4.23	15.71	9.18
Fs (ksi)	16.55	2.95	21.62	0.60	21.35	-2.28	16.66	8.34	19.79	1.78	19.62	4.30	22.37	-4.23	15.71	9.18
Fs (kip)	1116.93	199.17	1459.31	40.29	1441.41	-153.88	1124.62	562.68	1335.78	120.30	1324.48	290.52	1510.27	-285.77	1060.60	619.92

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2352.60	1985.92	1510.27	619.92
Comp	0.00	2406.05	0.00	285.77

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	389.21	477.36	691.24	289.76	442.25	400.64	560.16	340.34	290.82	334.97	504.21	202.43	328.29	280.76	411.60	238.16
Vuw (kip)	583.82	716.04	1033.31	434.64	663.38	600.96	840.25	510.51	---	---	---	---	---	---	---	---
Mv (k*ft)	328.40	402.77	581.24	244.49	373.15	338.04	472.64	287.16	163.59	188.42	283.62	113.86	184.66	157.93	231.52	133.97
Huw (kip)	2213.31	2105.75	1902.42	2661.45	2133.78	2284.97	1824.51	2817.93	935.90	1066.38	915.57	1199.86	1035.44	1148.44	870.76	1195.04
Muw (k*ft)	1848.92	2689.50	2928.71	1251.41	2230.02	1986.97	3253.59	1042.76	870.17	1345.44	1512.57	532.80	1152.45	980.34	1702.91	417.83
Mu (k*ft)	2177.32	3092.27	3509.95	1495.89	2603.16	2325.01	3726.22	1329.92	1033.76	1533.86	1796.19	646.67	1337.12	1138.27	1934.43	551.79

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.08	18.15	16.40	22.94	18.39	19.70	15.73	24.29	8.07	9.19	7.89	10.34	8.93	9.90	7.51	10.30
PY1 (Vuw)	5.03	6.17	8.91	3.75	5.72	5.18	7.24	4.40	2.51	2.89	4.35	1.75	2.83	2.42	3.55	2.05
PX2 (Mu)	14.75	20.95	23.78	10.14	17.64	15.75	25.25	9.01	7.00	10.39	12.17	4.38	9.06	7.71	13.11	3.74
PY2 (Mu)	1.58	2.24	2.55	1.09	1.89	1.69	2.71	0.97	0.75	1.11	1.30	0.47	0.97	0.83	1.40	0.40
Pu (kip)	34.47	40.00	41.78	33.43	36.83	36.11	42.17	33.73	15.42	19.99	20.84	14.89	18.38	17.91	21.20	14.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1187.09	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1165.51	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1210.50	1366.88	OK
BF Outside	1195.55	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.73	41.41	42.62	34.80	38.11	37.45	43.50	35.00
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1033.31
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1187.09	18.55	OK	762.06	11.91	OK
BF	1210.50	21.62	OK	311.89	5.57	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1187.09	18.55	1.47	126.02	OK
TF	2352.60	36.76	1.47	206.21	OK
TF Inside	1165.51	18.21	1.47	137.48	OK
BF Inside	1210.50	21.62	1.47	103.11	OK
BF	2406.05	42.97	1.47	206.21	OK
BF Outside	1195.55	21.35	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.17	21.08	OK	21.20	10.60	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.17	1.47	91.65	OK
Web SPL	21.08	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.24	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.95	1.41	5.61
Web	1.72	1.59	2.17
BF	1.40	3.02	4.29

Plate	Shear	Flexure
Web	2.12	1.15

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 7169

Node 7169

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7169 L	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00
7169 R	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7169 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7169**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.62	5.12	35.82	1.58	35.76	-2.53	21.64	11.74	29.87	6.20	30.05	4.26	38.97	-5.17	20.91	12.80
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.53	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.43	50.00	50.00
f / ϕf Fnc	0.41	0.10	0.72	0.03	0.72	0.05	0.43	0.23	0.60	0.12	0.60	0.09	0.78	0.11	0.42	0.26
α	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)	20.62		35.82		35.76		21.64		29.87		30.05		38.97		20.91	
Fcf (ksi)	37.50		42.91		42.88		37.50		39.94		40.02		44.48		37.50	
Fcf (kip)	1985.92		2272.41		2270.82		1985.92		2114.98		2119.59		2355.83		1985.92	
fncf (ksi)		5.12		1.58		-2.53		11.74		6.20		4.26		-5.17		12.80
Rcf		1.82		1.20		1.20		1.73		1.34		1.33		1.14		1.79
Fncf (ksi)		37.50		37.50		-35.65		37.50		37.50		37.50		-35.57		37.50
Fncf (kip)		1985.92		1985.92		-2406.13		1985.92		1985.92		1985.92		-2401.20		1985.92

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.39	3.22	21.66	1.15	21.39	-2.30	16.12	9.09	20.06	4.37	20.07	2.21	22.33	-4.00	15.61	9.84
Fs (ksi)	16.39	3.22	21.66	1.15	21.39	-2.30	16.12	9.09	20.06	4.37	20.07	2.21	22.33	-4.00	15.61	9.84
Fs (kip)	1106.63	217.68	1462.26	77.56	1443.85	-155.37	1088.04	613.84	1353.86	294.71	1354.57	149.00	1507.40	-269.70	1053.42	664.13

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2355.83	1985.92	1507.40	664.13
Comp	0.00	2406.13	0.00	269.70

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	388.94	482.43	693.48	283.80	422.62	430.98	575.52	330.98	290.09	339.00	505.26	198.66	296.74	319.79	421.91	231.99
Vuw (kip)	583.41	723.65	1034.44	425.71	633.94	646.47	863.28	496.47	---	---	---	---	---	---	---	---
Mv (k*ft)	328.17	407.05	581.87	239.46	356.59	363.64	485.60	279.26	163.17	190.69	284.21	111.75	166.92	179.88	237.33	130.49
Huw (kip)	2246.72	2150.29	1912.35	2776.98	2314.92	2193.78	1851.99	2901.67	941.73	1094.98	916.25	1210.23	1172.32	1069.21	880.14	1221.37
Muw (k*ft)	1804.37	2625.39	2938.81	1097.35	2025.38	2198.05	3224.75	931.10	842.85	1312.90	1516.30	449.61	1004.23	1143.06	1684.95	369.10
Mu (k*ft)	2132.54	3032.44	3520.68	1336.81	2381.97	2561.69	3710.35	1210.37	1006.03	1503.59	1800.50	561.36	1171.15	1322.94	1922.28	499.60

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.37	18.54	16.49	23.94	19.96	18.91	15.97	25.01	8.12	9.44	7.90	10.43	10.11	9.22	7.59	10.53
PY1 (Vuw)	5.03	6.24	8.92	3.67	5.46	5.57	7.44	4.28	2.50	2.92	4.36	1.71	2.56	2.76	3.64	2.00
PX2 (Mu)	14.45	20.55	23.85	9.06	16.14	17.36	25.14	8.20	6.82	10.19	12.20	3.80	7.94	8.96	13.02	3.39
PY2 (Mu)	1.55	2.20	2.56	0.97	1.73	1.86	2.69	0.88	0.73	1.09	1.31	0.41	0.85	0.96	1.40	0.36
Pu (kip)	34.45	39.98	41.94	33.32	36.81	37.02	42.34	33.61	15.28	20.03	20.88	14.39	18.36	18.56	21.22	14.11

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1188.72	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1167.11	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1210.53	1366.88	OK
BF Outside	1195.59	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.70	41.38	42.79	34.68	38.13	38.35	43.63	34.88
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1034.44
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1188.72	18.57	OK	760.61	11.88	OK
BF	1210.53	21.62	OK	334.13	5.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1188.72	18.57	1.47	126.02	OK
TF	2355.83	36.81	1.47	206.21	OK
TF Inside	1167.11	18.24	1.47	137.48	OK
BF Inside	1210.53	21.62	1.47	103.11	OK
BF	2406.13	42.97	1.47	206.21	OK
BF Outside	1195.59	21.35	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.34	21.17	OK	21.22	10.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.34	1.47	91.65	OK
Web SPL	21.17	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.24	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.95	1.42	5.60
Web	1.71	1.59	2.16
BF	1.40	2.82	4.29

Plate	Shear	Flexure
Web	2.12	1.15

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Field Splice - Node 9169

Node 9169

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9169 L	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00
9169 R	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9169 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.48	4.36	31.93	2.23	28.50	-0.73	18.89	12.99	26.56	6.62	24.70	2.62	35.64	-7.32	17.61	14.37
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	47.61	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.33	50.00	50.00
f / ϕf Fnc	0.37	0.09	0.64	0.04	0.57	0.02	0.38	0.26	0.53	0.13	0.49	0.05	0.71	0.15	0.35	0.29
α	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
fcf (ksi)	18.48		31.93		28.50		18.89		26.56		24.70		35.64		17.61	
Fcf (ksi)	37.50		40.96		39.25		37.50		38.28		37.50		42.82		37.50	
Fcf (kip)	1985.92		2169.38		2078.59		1985.92		2027.14		1985.92		2267.53		1985.92	
fncf (ksi)		4.36		2.23		-0.73		12.99		6.62		2.62		-7.32		14.37
Rcf		2.03		1.28		1.38		1.99		1.44		1.52		1.20		2.13
Fncf (ksi)		37.50		37.50		-35.71		37.50		37.50		37.50		-35.50		37.50
Fncf (kip)		1985.92		1985.92		-2410.16		1985.92		1985.92		1985.92		-2396.11		1985.92

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	13.78	2.56	19.39	1.62	17.74	-1.13	14.16	9.93	17.95	4.69	16.59	1.16	19.90	-5.30	13.26	10.91
Fs (ksi)	13.78	2.56	19.39	1.62	17.74	-1.13	14.16	9.93	17.95	4.69	16.59	1.16	19.90	-5.30	13.26	10.91
Fs (kip)	930.08	172.89	1309.10	109.41	1197.60	-76.45	955.50	669.98	1211.94	316.61	1119.70	78.16	1343.31	-357.70	894.83	736.18

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2267.53	1985.92	1343.31	736.18
Comp	0.00	2410.16	0.00	357.70

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	307.55	388.54	592.93	184.65	299.42	407.66	466.56	222.54	232.92	274.64	434.55	130.58	211.68	303.64	345.26	157.36
Vuw (kip)	461.33	582.81	889.40	276.97	449.14	611.48	699.84	333.81	---	---	---	---	---	---	---	---
Mv (k*ft)	259.50	327.83	500.29	155.80	252.64	343.96	393.66	187.77	131.02	154.48	244.43	73.45	119.07	170.80	194.21	88.51
Huw (kip)	2224.42	2103.70	1835.83	3037.65	2295.16	1991.26	1633.21	3268.89	784.34	1008.72	797.26	1155.90	1086.97	851.80	700.88	1159.84
Muw (k*ft)	1834.11	2438.49	2576.21	749.80	1839.42	2144.99	3303.04	441.48	717.93	1137.48	1207.99	270.71	848.90	987.53	1612.80	150.42
Mu (k*ft)	2093.61	2766.31	3076.50	905.59	2092.06	2488.95	3696.70	629.25	848.95	1291.96	1452.42	344.16	967.97	1158.33	1807.01	238.94

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.18	18.14	15.83	26.19	19.79	17.17	14.08	28.18	6.76	8.70	6.87	9.96	9.37	7.34	6.04	10.00
PY1 (Vuw)	3.98	5.02	7.67	2.39	3.87	5.27	6.03	2.88	2.01	2.37	3.75	1.13	1.82	2.62	2.98	1.36
PX2 (Mu)	14.19	18.74	20.85	6.14	14.17	16.86	25.05	4.26	5.75	8.75	9.84	2.33	6.56	7.85	12.24	1.62
PY2 (Mu)	1.52	2.01	2.23	0.66	1.52	1.81	2.68	0.46	0.62	0.94	1.05	0.25	0.70	0.84	1.31	0.17
Pu (kip)	33.81	37.54	37.98	32.47	34.39	34.76	40.09	32.61	12.79	17.76	17.39	12.37	16.13	15.58	18.78	11.72

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1144.17	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1123.36	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1212.57	1366.88	OK
BF Outside	1197.60	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.22	39.03	38.87	33.89	35.84	36.00	41.56	33.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	889.40
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1144.17	17.88	OK	677.81	10.59	OK
BF	1212.57	21.65	OK	370.38	6.61	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1144.17	17.88	1.47	126.02	OK
TF	2267.53	35.43	1.47	206.21	OK
TF Inside	1123.36	17.55	1.47	137.48	OK
BF Inside	1212.57	21.65	1.47	103.11	OK
BF	2410.16	43.04	1.47	206.21	OK
BF Outside	1197.60	21.39	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
40.09	20.04	OK	18.78	9.39	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	40.09	1.47	91.65	OK
Web SPL	20.04	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.34	NA
TF Inside	1.28	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	2.02	1.59	5.82
Web	1.81	1.79	2.29
BF	1.39	2.54	4.29

Plate	Shear	Flexure
Web	2.47	1.20

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 1183

Node 1183

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1183 L	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00
1183 R	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 1183 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.05	7.50	17.97	5.81	25.93	2.39	19.48	13.24	23.42	8.22	24.41	4.27	17.15	15.10	33.46	-5.08
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.40
f / ϕf Fnc	0.54	0.15	0.36	0.12	0.52	0.05	0.39	0.26	0.47	0.16	0.49	0.09	0.34	0.30	0.67	0.11
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)	27.05		17.97		25.93		19.48		23.42		24.41		17.15		33.46	
Fcf (ksi)	38.53		37.50		37.97		37.50		37.50		37.50		37.50		41.73	
Fcf (kip)	2040.31		1985.92		2010.60		1985.92		1985.92		1985.92		1985.92		2209.86	
fncf (ksi)		7.50		5.81		2.39		13.24		8.22		4.27		15.10		-5.08
Rcf		1.42		2.09		1.46		1.92		1.60		1.54		2.19		1.25
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-35.55
Fncf (kip)		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		-2399.79

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.21	3.44	13.21	4.66	17.27	0.67	14.27	9.91	16.52	5.66	16.89	1.86	12.63	11.22	19.62	-4.12
Fs (ksi)	18.21	3.44	13.21	4.66	17.27	0.67	14.27	9.91	16.52	5.66	16.89	1.86	12.63	11.22	19.62	-4.12
Fs (kip)	1229.06	232.20	891.52	314.52	1165.93	44.98	963.43	668.77	1115.08	382.25	1140.18	125.34	852.22	757.39	1324.40	-277.92

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2209.86	1985.92	1324.40	757.39
Comp	0.00	2399.79	0.00	277.92

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	316.49	298.58	579.30	164.84	267.69	400.54	215.55	439.18	243.87	212.42	429.55	117.92	190.59	303.25	153.75	330.55
Vuw (kip)	474.74	447.88	868.94	247.25	401.54	600.81	323.33	658.77	---	---	---	---	---	---	---	---
Mv (k*ft)	267.04	251.93	488.78	139.08	225.87	337.95	181.87	370.56	137.18	119.49	241.62	66.33	107.21	170.58	86.49	185.93
Huw (kip)	2361.63	2382.12	1990.64	3023.40	2431.84	2115.22	3384.80	1698.85	1039.12	857.63	861.10	1160.68	1064.77	899.93	1144.61	744.16
Muw (k*ft)	1782.62	1623.84	2205.45	768.80	1557.54	1979.71	286.94	3076.12	945.17	547.08	1062.83	279.38	694.83	962.22	89.91	1519.24
Mu (k*ft)	2049.67	1875.77	2694.23	907.88	1783.41	2317.67	468.81	3446.67	1082.34	666.56	1304.45	345.71	802.03	1132.80	176.40	1705.18

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.36	20.54	17.16	26.06	20.96	18.23	29.18	14.65	8.96	7.39	7.42	10.01	9.18	7.76	9.87	6.42
PY1 (Vuw)	4.09	3.86	7.49	2.13	3.46	5.18	2.79	5.68	2.10	1.83	3.70	1.02	1.64	2.61	1.33	2.85
PX2 (Mu)	13.89	12.71	18.25	6.15	12.08	15.70	3.18	23.35	7.33	4.52	8.84	2.34	5.43	7.68	1.20	11.55
PY2 (Mu)	1.49	1.36	1.96	0.66	1.29	1.68	0.34	2.50	0.79	0.48	0.95	0.25	0.58	0.82	0.13	1.24
Pu (kip)	34.70	33.65	36.65	32.34	33.39	34.62	32.51	38.87	16.55	12.13	16.91	12.41	14.78	15.81	11.16	18.43

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1115.07	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1094.79	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1207.35	1366.88	OK
BF Outside	1192.44	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.13	35.05	37.49	33.78	34.83	35.87	33.83	40.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	868.94
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1183**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1115.07	17.42	OK	668.27	10.44	OK
BF	1207.35	21.56	OK	381.05	6.80	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1115.07	17.42	1.47	126.02	OK
TF	2209.86	34.53	1.47	206.21	OK
TF Inside	1094.79	17.11	1.47	137.48	OK
BF Inside	1207.35	21.56	1.47	103.11	OK
BF	2399.79	42.85	1.47	206.21	OK
BF Outside	1192.44	21.29	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.87	19.43	OK	18.43	9.21	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.87	1.47	91.65	OK
Web SPL	19.43	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.38	NA
TF Inside	1.32	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	2.08	1.61	5.97
Web	1.86	1.83	2.36
BF	1.40	2.47	4.30

Plate	Shear	Flexure
Web	2.52	1.24

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3183	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3183

Node 3183

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3183 L	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00
3183 R	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 3183 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3183**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.31	5.66	21.99	5.18	30.57	0.42	22.29	12.70	28.32	6.88	29.71	5.68	21.54	13.15	37.15	-3.85
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.48
f / ϕf Fnc	0.65	0.11	0.44	0.10	0.61	0.01	0.45	0.25	0.57	0.14	0.59	0.11	0.43	0.26	0.74	0.08
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)	32.31		21.99		30.57		22.29		28.32		29.71		21.54		37.15	
Fcf (ksi)	41.16		37.50		40.28		37.50		39.16		39.85		37.50		43.57	
Fcf (kip)	2179.59		1985.92		2133.34		1985.92		2073.78		2110.63		1985.92		2307.55	
fncf (ksi)		5.66		5.18		0.42		12.70		6.88		5.68		13.15		-3.85
Rcf		1.27		1.71		1.32		1.68		1.38		1.34		1.74		1.17
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-35.61
Fncf (kip)		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		-2403.43

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.27	2.19	16.14	4.25	20.19	-0.56	17.58	8.16	19.56	4.73	20.55	2.66	15.82	9.88	22.29	-3.37
Fs (ksi)	21.27	2.19	16.14	4.25	20.19	-0.56	17.58	8.16	19.56	4.73	20.55	2.66	15.82	9.88	22.29	-3.37
Fs (kip)	1435.67	147.52	1089.31	287.18	1363.13	-37.58	1186.51	550.79	1320.57	319.60	1387.26	179.67	1067.80	667.17	1504.89	-227.76

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2307.55	1985.92	1504.89	667.17
Comp	0.00	2403.43	0.00	227.76

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	424.18	386.82	679.95	268.90	404.77	416.62	328.85	551.42	318.61	274.02	499.32	190.71	286.70	313.26	233.07	408.51
Vuw (kip)	636.27	580.22	1019.93	403.35	607.15	624.93	493.28	827.14	---	---	---	---	---	---	---	---
Mv (k*ft)	357.90	326.38	573.71	226.89	341.52	351.52	277.47	465.26	179.22	154.13	280.86	107.27	161.27	176.21	131.10	229.79
Huw (kip)	2321.81	2223.97	1960.43	2826.07	2336.02	2278.49	2898.64	1874.52	1125.83	978.83	942.61	1235.41	1166.34	1114.26	1233.76	908.18
Muw (k*ft)	2172.35	1834.71	2542.39	1031.90	1897.66	2063.45	935.15	3078.01	1221.36	760.54	1328.08	602.76	949.07	1144.97	379.85	1642.81
Mu (k*ft)	2530.26	2161.09	3116.10	1258.79	2239.18	2414.97	1212.62	3543.28	1400.57	914.68	1608.94	710.03	1110.33	1321.18	510.95	1872.59

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3183**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.02	19.17	16.90	24.36	20.14	19.64	24.99	16.16	9.71	8.44	8.13	10.65	10.05	9.61	10.64	7.83
PY1 (Vuw)	5.49	5.00	8.79	3.48	5.23	5.39	4.25	7.13	2.75	2.36	4.30	1.64	2.47	2.70	2.01	3.52
PX2 (Mu)	17.14	14.64	21.11	8.53	15.17	16.36	8.22	24.01	9.49	6.20	10.90	4.81	7.52	8.95	3.46	12.69
PY2 (Mu)	1.84	1.57	2.26	0.91	1.63	1.75	0.88	2.57	1.02	0.66	1.17	0.52	0.81	0.96	0.37	1.36
Pu (kip)	37.87	34.45	39.59	33.18	35.97	36.71	33.60	41.32	19.56	14.95	19.80	15.61	17.88	18.91	14.30	21.09

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1164.36	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1143.19	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1209.18	1366.88	OK
BF Outside	1194.25	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.27	35.71	40.28	34.56	37.28	38.04	34.87	42.62
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1019.93
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3183**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1164.36	18.19	OK	759.35	11.86	OK
BF	1209.18	21.59	OK	335.66	5.99	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1164.36	18.19	1.47	126.02	OK
TF	2307.55	36.06	1.47	206.21	OK
TF Inside	1143.19	17.86	1.47	137.48	OK
BF Inside	1209.18	21.59	1.47	103.11	OK
BF	2403.43	42.92	1.47	206.21	OK
BF Outside	1194.25	21.33	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.32	20.66	OK	21.09	10.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.32	1.47	91.65	OK
Web SPL	20.66	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.32	NA
TF Inside	1.26	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.99	1.42	5.72
Web	1.75	1.60	2.22
BF	1.40	2.81	4.30

Plate	Shear	Flexure
Web	2.15	1.17

Field Splice - Node 5183

Node 5183

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5183 L	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00
5183 R	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 5183 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5183**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.76	5.09	22.67	4.60	30.67	0.60	23.77	11.10	26.75	6.94	29.66	4.54	22.08	12.09	37.51	-4.39
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.45
f / ϕf Fnc	0.66	0.10	0.45	0.09	0.61	0.01	0.48	0.22	0.53	0.14	0.59	0.09	0.44	0.24	0.75	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)	32.76		22.67		30.67		23.77		26.75		29.66		22.08		37.51	
Fcf (ksi)	41.38		37.50		40.34		37.50		38.37		39.83		37.50		43.76	
Fcf (kip)	2191.29		1985.92		2136.13		1985.92		2032.15		2109.29		1985.92		2317.25	
fncf (ksi)		5.09		4.60		0.60		11.10		6.94		4.54		12.09		-4.39
Rcf		1.26		1.65		1.32		1.58		1.43		1.34		1.70		1.17
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-35.59
Fncf (kip)		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		-2402.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.67	1.91	16.60	3.77	20.54	-0.86	18.09	7.00	19.05	4.71	20.71	2.11	16.19	9.08	22.73	-3.77
Fs (ksi)	21.67	1.91	16.60	3.77	20.54	-0.86	18.09	7.00	19.05	4.71	20.71	2.11	16.19	9.08	22.73	-3.77
Fs (kip)	1462.85	128.64	1120.26	254.71	1386.13	-57.76	1221.25	472.53	1286.13	317.80	1397.89	142.25	1093.04	612.70	1534.32	-254.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2317.25	1985.92	1534.32	612.70
Comp	0.00	2402.39	0.00	254.47

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	418.28	387.09	677.11	274.24	369.84	444.69	338.37	533.21	313.94	274.83	496.81	195.10	262.64	332.60	240.41	395.15
Vuw (kip)	627.42	580.63	1015.66	411.36	554.76	667.04	507.55	799.82	---	---	---	---	---	---	---	---
Mv (k*ft)	352.92	326.60	571.31	231.39	312.05	375.21	285.50	449.90	176.59	154.59	279.46	109.74	147.74	187.09	135.23	222.27
Huw (kip)	2294.78	2165.55	1974.30	2640.37	2319.86	2204.73	2785.49	1854.73	1131.72	977.75	944.62	1204.47	1140.58	1095.21	1212.97	910.12
Muw (k*ft)	2236.67	1912.60	2530.64	1279.51	1818.59	2158.53	1086.02	3127.86	1265.03	820.68	1369.02	709.90	918.12	1190.54	455.44	1696.04
Mu (k*ft)	2589.59	2239.21	3101.95	1510.89	2130.65	2533.74	1371.51	3577.76	1441.62	975.27	1648.48	819.64	1065.85	1377.63	590.66	1918.31

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.78	18.67	17.02	22.76	20.00	19.01	24.01	15.99	9.76	8.43	8.14	10.38	9.83	9.44	10.46	7.85
PY1 (Vuw)	5.41	5.01	8.76	3.55	4.78	5.75	4.38	6.89	2.71	2.37	4.28	1.68	2.26	2.87	2.07	3.41
PX2 (Mu)	17.55	15.17	21.02	10.24	14.44	17.17	9.29	24.24	9.77	6.61	11.17	5.55	7.22	9.33	4.00	13.00
PY2 (Mu)	1.88	1.63	2.25	1.10	1.55	1.84	1.00	2.60	1.05	0.71	1.20	0.60	0.77	1.00	0.43	1.39
Pu (kip)	38.03	34.48	39.60	33.32	35.01	36.96	33.74	41.34	19.88	15.35	20.07	16.10	17.32	19.17	14.67	21.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1169.26	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1148.00	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1208.66	1366.88	OK
BF Outside	1193.74	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.46	35.75	40.30	34.72	36.35	38.24	35.01	42.69
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1015.66
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0
Ks	0.33 (Class A)
Ns	1.0
Pt	51.0
Rr	16.83

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1169.26	18.27	OK	774.20	12.10	OK
BF	1208.66	21.58	OK	308.25	5.50	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1169.26	18.27	1.47	126.02	OK
TF	2317.25	36.21	1.47	206.21	OK
TF Inside	1148.00	17.94	1.47	137.48	OK
BF Inside	1208.66	21.58	1.47	103.11	OK
BF	2402.39	42.90	1.47	206.21	OK
BF Outside	1193.74	21.32	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.34	20.67	OK	21.39	10.69	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.34	1.47	91.65	OK
Web SPL	20.67	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.31	NA
TF Inside	1.26	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.98	1.39	5.70
Web	1.75	1.57	2.22
BF	1.40	3.06	4.30

Plate	Shear	Flexure
Web	2.16	1.17

Field Splice - Node 7183

Node 7183

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7183 L	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00
7183 R	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 7183 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.57	6.40	22.52	5.16	31.30	0.77	22.39	12.98	28.29	6.47	30.16	6.23	21.97	13.26	37.59	-3.87
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.48
f / ϕf Fnc	0.65	0.13	0.45	0.10	0.63	0.02	0.45	0.26	0.57	0.13	0.60	0.12	0.44	0.27	0.75	0.08
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)	32.57		22.52		31.30		22.39		28.29		30.16		21.97		37.59	
Fcf (ksi)	41.28		37.50		40.65		37.50		39.15		40.08		37.50		43.80	
Fcf (kip)	2186.31		1985.92		2152.66		1985.92		2073.09		2122.49		1985.92		2319.33	
fncf (ksi)		6.40		5.16		0.77		12.98		6.47		6.23		13.26		-3.87
Rcf		1.27		1.67		1.30		1.67		1.38		1.33		1.71		1.17
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-35.61
Fncf (kip)		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		-2403.49

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.68	2.85	16.44	4.10	20.69	-0.54	17.67	8.23	19.40	4.29	21.05	3.25	16.05	9.82	22.76	-3.31
Fs (ksi)	21.68	2.85	16.44	4.10	20.69	-0.54	17.67	8.23	19.40	4.29	21.05	3.25	16.05	9.82	22.76	-3.31
Fs (kip)	1463.21	192.46	1109.52	276.91	1396.72	-36.23	1192.87	555.34	1309.61	289.77	1421.01	219.55	1083.30	663.14	1536.09	-223.42

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2319.33	1985.92	1536.09	663.14
Comp	0.00	2403.49	0.00	223.42

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	422.20	387.65	679.47	268.74	401.41	419.32	328.97	550.94	316.19	275.36	497.96	191.35	285.09	314.15	233.90	407.15
Vuw (kip)	633.30	581.47	1019.21	403.11	602.12	628.98	493.45	826.41	---	---	---	---	---	---	---	---
Mv (k*ft)	356.23	327.08	573.30	226.75	338.69	353.80	277.57	464.86	177.86	154.89	280.10	107.63	160.36	176.71	131.57	229.02
Huw (kip)	2370.77	2212.58	1999.08	2843.26	2308.42	2321.49	2886.50	1885.70	1177.37	985.91	967.46	1243.17	1137.34	1166.62	1241.91	933.46
Muw (k*ft)	2123.32	1849.89	2537.58	1008.98	1932.80	2034.76	951.34	3091.58	1204.86	789.43	1358.65	604.47	966.96	1139.17	398.38	1668.28
Mu (k*ft)	2479.55	2176.97	3110.89	1235.73	2271.49	2388.56	1228.90	3556.44	1382.71	944.32	1638.75	712.11	1127.32	1315.88	529.94	1897.31

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.44	19.07	17.23	24.51	19.90	20.01	24.88	16.26	10.15	8.50	8.34	10.72	9.80	10.06	10.71	8.05
PY1 (Vuw)	5.46	5.01	8.79	3.48	5.19	5.42	4.25	7.12	2.73	2.37	4.29	1.65	2.46	2.71	2.02	3.51
PX2 (Mu)	16.80	14.75	21.08	8.37	15.39	16.18	8.33	24.10	9.37	6.40	11.10	4.82	7.64	8.92	3.59	12.86
PY2 (Mu)	1.80	1.58	2.26	0.90	1.65	1.73	0.89	2.58	1.00	0.69	1.19	0.52	0.82	0.96	0.38	1.38
Pu (kip)	37.94	34.46	39.87	33.17	35.95	36.90	33.61	41.50	19.87	15.21	20.20	15.69	17.75	19.32	14.50	21.47

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1170.30	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1149.02	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1209.21	1366.88	OK
BF Outside	1194.28	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.34	35.72	40.59	34.54	37.27	38.24	34.88	42.81
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1019.21
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1170.30	18.29	OK	775.09	12.11	OK
BF	1209.21	21.59	OK	333.63	5.96	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1170.30	18.29	1.47	126.02	OK
TF	2319.33	36.24	1.47	206.21	OK
TF Inside	1149.02	17.95	1.47	137.48	OK
BF Inside	1209.21	21.59	1.47	103.11	OK
BF	2403.49	42.92	1.47	206.21	OK
BF Outside	1194.28	21.33	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.50	20.75	OK	21.47	10.73	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.50	1.47	91.65	OK
Web SPL	20.75	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.31	NA
TF Inside	1.26	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	1.98	1.39	5.69
Web	1.74	1.57	2.21
BF	1.40	2.82	4.30

Plate	Shear	Flexure
Web	2.15	1.17

Field Splice - Node 9183

Node 9183

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	64
Web	116
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9183 L	67.50	50.00	3375.00	67.50	50.00	3375.00	96.00	50.00	4800.00
9183 R	72.00	50.00	3600.00	99.00	50.00	4950.00	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 9183 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	30.00	2.25	---	67.50	48.38	52.96	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	30.00	2.25	---	67.50	48.38	52.96	50	65
Splice Plates	TF Outside	30.00	1.375	50.50	41.25	29.56	---	50	65
	TF Inside	13.50	1.500	50.50	40.50	27.75	---	50	65
	BF Inside	13.50	1.125	44.50	30.38	20.81	---	50	65
	BF Outside	30.00	1.000	44.50	30.00	21.50	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.36	8.54	18.73	5.63	26.68	3.18	19.85	13.50	22.65	5.64	25.75	7.12	17.72	15.24	34.00	-5.06
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	47.41
f / ϕf Fnc	0.55	0.17	0.37	0.11	0.53	0.06	0.40	0.27	0.45	0.11	0.51	0.14	0.35	0.30	0.68	0.11
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95
fcf (ksi)	27.36		18.73		26.68		19.85		22.65		25.75		17.72		34.00	
Fcf (ksi)	38.68		37.50		38.34		37.50		37.50		37.87		37.50		42.00	
Fcf (kip)	2048.45		1985.92		2030.45		1985.92		1985.92		2005.66		1985.92		2224.22	
fncf (ksi)		8.54		5.63		3.18		13.50		5.64		7.12		15.24		-5.06
Rcf		1.41		2.00		1.44		1.89		1.66		1.47		2.12		1.24
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-35.56
Fncf (kip)		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		1985.92		-2400.01

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.76	4.46	13.64	4.28	17.98	1.51	14.43	9.84	15.62	3.72	18.27	4.06	12.93	11.07	20.24	-3.88
Fs (ksi)	18.76	4.46	13.64	4.28	17.98	1.51	14.43	9.84	15.62	3.72	18.27	4.06	12.93	11.07	20.24	-3.88
Fs (kip)	1266.62	300.72	920.57	288.78	1213.66	101.76	973.87	664.09	1054.67	251.36	1233.54	273.80	872.63	747.04	1366.36	-261.76

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2224.22	1985.92	1366.36	747.04
Comp	0.00	2400.01	0.00	261.76

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	312.58	299.13	575.45	163.54	373.11	289.18	213.46	436.68	238.86	214.43	424.58	118.63	266.69	222.33	153.90	326.54
Vuw (kip)	468.87	448.70	863.17	245.31	559.66	433.77	320.19	655.02	---	---	---	---	---	---	---	---
Mv (k*ft)	263.74	252.39	485.53	137.99	314.81	244.00	180.11	368.45	134.36	120.61	238.83	66.73	150.01	125.06	86.57	183.68
Huw (kip)	2436.36	2340.85	2059.93	3024.15	2247.96	2320.95	3347.40	1716.10	1114.55	859.98	935.41	1164.77	928.73	1071.89	1151.76	785.49
Muw (k*ft)	1702.64	1678.87	2161.06	767.80	1802.72	1753.10	336.80	3087.83	915.82	599.03	1054.24	293.72	761.66	909.97	119.08	1543.70
Mu (k*ft)	1966.38	1931.27	2646.60	905.79	2117.53	1997.10	516.90	3456.28	1050.18	719.65	1293.07	360.44	911.67	1035.03	205.65	1727.38

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9183**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.00	20.18	17.76	26.07	19.38	20.01	28.86	14.79	9.61	7.41	8.06	10.04	8.01	9.24	9.93	6.77
PY1 (Vuw)	4.04	3.87	7.44	2.11	4.82	3.74	2.76	5.65	2.06	1.85	3.66	1.02	2.30	1.92	1.33	2.81
PX2 (Mu)	13.32	13.09	17.93	6.14	14.35	13.53	3.50	23.42	7.12	4.88	8.76	2.44	6.18	7.01	1.39	11.70
PY2 (Mu)	1.43	1.40	1.92	0.66	1.54	1.45	0.38	2.51	0.76	0.52	0.94	0.26	0.66	0.75	0.15	1.25
Pu (kip)	34.76	33.68	36.90	32.33	34.32	33.94	32.51	39.07	16.96	12.52	17.44	12.55	14.49	16.47	11.42	18.92

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1122.31	1959.38	1537.25	63.25	41.34	24.15	2502.41	1537.25	OK
TF Inside	1101.91	1923.75	1443.00	138.00	90.19	17.44	3626.81	1443.00	OK
BF Inside	999.13	1442.81	1082.25	90.00	58.92	13.08	2457.15	1082.25	OK
BF Outside	986.79	1425.00	1118.00	40.00	26.19	17.56	1703.07	1118.00	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1856.25	OK
TF Inside	0.00	1822.50	OK
BF Inside	1207.46	1366.88	OK
BF Outside	1192.55	1350.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.20	35.09	37.76	33.77	35.60	35.38	33.85	40.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	863.17
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.50	0.83	1.0	30.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1122.31	17.54	OK	689.45	10.77	OK
BF	1207.46	21.56	OK	375.84	6.71	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1122.31	17.54	1.47	126.02	OK
TF	2224.22	34.75	1.47	206.21	OK
TF Inside	1101.91	17.22	1.47	137.48	OK
BF Inside	1207.46	21.56	1.47	103.11	OK
BF	2400.01	42.86	1.47	206.21	OK
BF Outside	1192.55	21.30	1.47	91.65	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.07	19.54	OK	18.92	9.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.07	1.47	91.65	OK
Web SPL	19.54	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.37	NA
TF Inside	1.31	NA
BF Inside	1.08	1.13
BF Outside	1.13	1.13

Bolt	Shear	Slip	Bearing
TF	2.06	1.56	5.93
Web	1.85	1.78	2.35
BF	1.40	2.51	4.30

Plate	Shear	Flexure
Web	2.54	1.23

Field Splice

Type L

Field Splice - Node 1242

Node 1242

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1242 L	135.00	48.92	6604.26	126.00	68.49	8629.57	132.00	50.00	6600.00
1242 R	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 1242 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	11.57	6.19	20.11	5.81	18.71	2.25	11.92	13.00	13.64	11.57	17.03	2.55	24.02	-3.68	10.74	13.39
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.23	0.12	0.40	0.12	0.37	0.05	0.24	0.26	0.27	0.23	0.34	0.05	0.48	0.07	0.21	0.27
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	11.57		20.11		18.71			13.00	13.64		17.03		24.02			13.39
Fcf (ksi)	37.50		37.50		37.50			37.50	37.50		37.50		37.50			37.50
Fcf (kip)	3971.84		3971.84		3971.84			3971.84	3971.84		3971.84		3971.84			3971.84
fncf (ksi)		6.19		5.81		2.25	11.92			11.57		2.55		-3.68	10.74	
Rcf		3.24		1.86		2.00	2.88			2.75		2.20		1.56	2.80	
Fncf (ksi)		37.50		37.50		37.50	37.50			37.50		37.50		-37.50	37.50	
Fncf (kip)		3971.84		3971.84		3971.84	3971.84			3971.84		3971.84		-5062.50	3971.84	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	8.65	4.48	12.85	3.76	11.94	1.77	9.95	8.53	10.86	7.84	10.86	1.72	13.86	-2.52	8.06	9.57
Fs (ksi)	8.65	4.48	12.85	3.76	11.94	1.77	9.95	8.53	10.86	7.84	10.86	1.72	13.86	-2.52	8.06	9.57
Fs (kip)	1167.62	604.58	1734.94	507.79	1611.39	239.12	1343.55	1151.42	1466.12	1057.90	1465.62	231.58	1871.26	-340.48	1088.47	1291.33

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3971.84	3971.84	1871.26	1291.33
Comp	0.00	5062.50	0.00	340.48

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	412.81	438.19	748.31	213.54	371.09	507.36	585.38	320.23	302.48	322.59	541.69	161.70	275.18	369.29	426.57	237.08
Vuw (kip)	619.21	657.29	1122.47	320.31	556.64	761.03	878.07	480.34	---	---	---	---	---	---	---	---
Mv (k*ft)	348.31	369.73	631.39	180.18	313.11	428.08	493.91	270.19	170.15	181.45	304.70	90.96	154.79	207.72	239.95	133.36
Huw (kip)	3454.05	2900.50	2520.63	4313.36	4158.52	2587.40	1904.99	4054.82	787.65	996.77	822.45	1108.88	1121.79	754.31	680.35	1057.69
Muw (k*ft)	1394.61	2132.66	2639.15	248.85	455.31	2550.14	3460.01	593.58	333.65	727.20	813.20	113.85	241.91	731.28	1310.66	120.21
Mu (k*ft)	1742.91	2502.39	3270.54	429.03	768.42	2978.22	3953.93	863.77	503.80	908.66	1117.90	204.81	396.69	939.00	1550.61	253.57

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1242**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.78	25.00	21.73	37.18	35.85	22.31	16.42	34.96	6.79	8.59	7.09	9.56	9.67	6.50	5.87	9.12
PY1 (Vuw)	5.34	5.67	9.68	2.76	4.80	6.56	7.57	4.14	2.61	2.78	4.67	1.39	2.37	3.18	3.68	2.04
PX2 (Mu)	11.81	16.96	22.16	2.91	5.21	20.18	26.79	5.85	3.41	6.16	7.57	1.39	2.69	6.36	10.51	1.72
PY2 (Mu)	1.27	1.82	2.37	0.31	0.56	2.16	2.87	0.63	0.37	0.66	0.81	0.15	0.29	0.68	1.13	0.18
Pu (kip)	42.11	42.62	45.51	40.21	41.40	43.37	44.46	41.09	10.63	15.15	15.66	11.06	12.64	13.43	17.06	11.06

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1974.95	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	1996.89	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.72	44.27	46.44	41.89	42.97	44.91	45.88	42.73
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1122.47
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1996.89	18.49	OK	940.80	8.71	OK
BF	2547.58	26.54	OK	649.83	6.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1974.95	18.29	1.47	137.48	OK
TF	3971.84	36.78	1.47	274.95	OK
TF Inside	1996.89	18.49	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.51	22.76	OK	17.06	8.53	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.51	1.47	114.56	OK
Web SPL	22.76	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.24	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.96	1.93	7.48
Web	1.59	1.97	2.52
BF	1.36	2.49	4.81

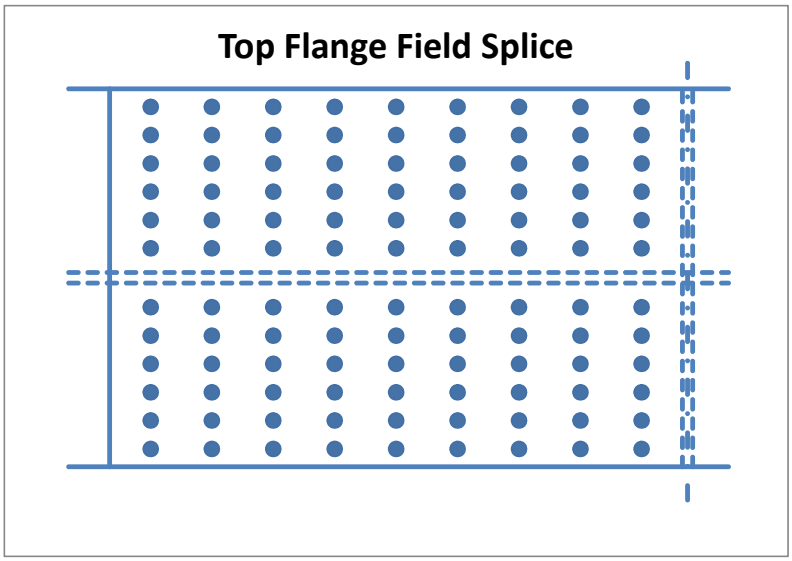
Plate	Shear	Flexure
Web	1.95	1.08

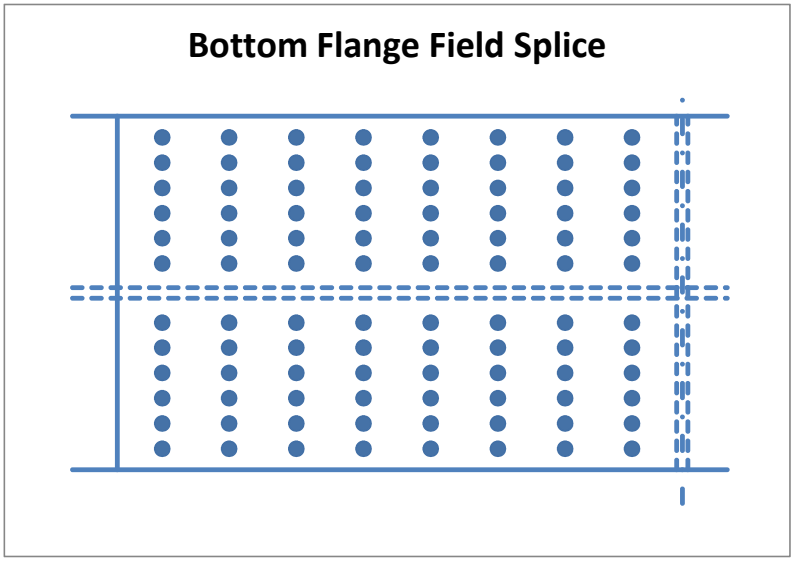
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1242	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1242

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3
0	6.75	0	6
0	10.125	0	9
0	13.5	0	12
0	16.875	0	15
0	23.875	0	22
0	27.25	0	25
0	30.625	0	28
0	34	0	31
0	37.375	0	34
0	40.75	0	37
3	0	3	0
3	3.375	3	3
3	6.75	3	6
3	10.125	3	9
3	13.5	3	12
3	16.875	3	15
3	23.875	3	22
3	27.25	3	25
3	30.625	3	28
3	34	3	31
3	37.375	3	34
3	40.75	3	37
6	0	6	0
6	3.375	6	3
6	6.75	6	6
6	10.125	6	9
6	13.5	6	12
6	16.875	6	15
6	23.875	6	22
6	27.25	6	25
6	30.625	6	28
6	34	6	31
6	37.375	6	34
6	40.75	6	37
9	0	9	0
9	3.375	9	3
9	6.75	9	6
9	10.125	9	9
9	13.5	9	12
9	16.875	9	15
9	23.875	9	22
9	27.25	9	25
9	30.625	9	28
9	34	9	31
9	37.375	9	34
9	40.75	9	37
12	0	12	0
12	3.375	12	3
12	6.75	12	6
12	10.125	12	9
12	13.5	12	12
12	16.875	12	15
12	23.875	12	22
12	27.25	12	25
12	30.625	12	28
12	34	12	31
12	37.375	12	34

	Top Flange		Bottom Flange	
No. Bolts =	108.0		96.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.500	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	40.75	12	37
15	0	15	0
15	3.375	15	3
15	6.75	15	6
15	10.125	15	9
15	13.5	15	12
15	16.875	15	15
15	23.875	15	22
15	27.25	15	25
15	30.625	15	28
15	34	15	31
15	37.375	15	34
15	40.75	15	37
18	0	18	0
18	3.375	18	3
18	6.75	18	6
18	10.125	18	9
18	13.5	18	12
18	16.875	18	15
18	23.875	18	22
18	27.25	18	25
18	30.625	18	28
18	34	18	31
18	37.375	18	34
18	40.75	18	37
21	0	21	0
21	3.375	21	3
21	6.75	21	6
21	10.125	21	9
21	13.5	21	12
21	16.875	21	15
21	23.875	21	22
21	27.25	21	25
21	30.625	21	28
21	34	21	31
21	37.375	21	34
21	40.75	21	37
24	0		
24	3.375		
24	6.75		
24	10.125		
24	13.5		
24	16.875		
24	23.875		
24	27.25		
24	30.625		
24	34		
24	37.375		
24	40.75		

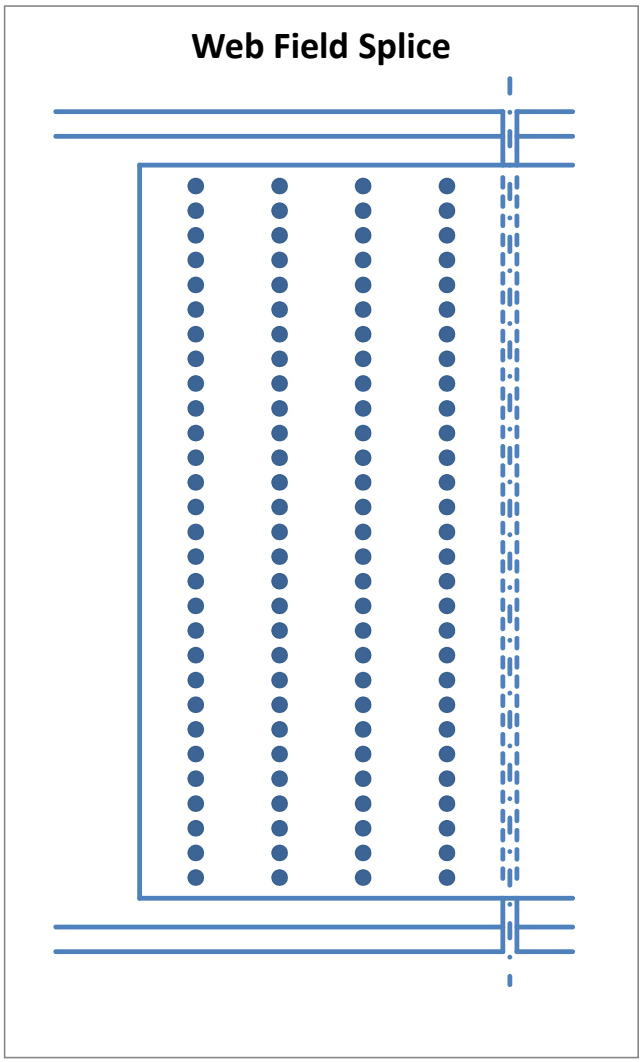
Flange Bolt Pattern Cont. - Node 1242

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1242	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1242

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 1242

Web Bolt Pattern Cont. - Node 1242

522	4872	1305	73080

Field Splice - Node 3242

Node 3242

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3242 L	135.00	48.89	6600.40	126.00	68.45	8624.53	132.00	50.00	6600.00
3242 R	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 3242 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3242**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	14.07	6.67	23.59	6.78	22.06	3.56	15.62	12.66	18.61	10.06	19.68	4.55	27.02	-3.81	13.98	14.03
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.28	0.13	0.47	0.14	0.44	0.07	0.31	0.25	0.37	0.20	0.39	0.09	0.54	0.08	0.28	0.28
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	14.07		23.59		22.06		15.62		18.61		19.68		27.02			14.03
Fcf (ksi)	37.50		37.50		37.50		37.50		37.50		37.50		38.51			37.50
Fcf (kip)	3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		4078.78			3971.84
fncf (ksi)		6.67		6.78		3.56		12.66		10.06		4.55		-3.81	13.98	
Rcf		2.66		1.59		1.70		2.40		2.01		1.91		1.43	2.67	
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-37.50	37.50	
Fncf (kip)		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		-5062.50	3971.84	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	11.06	4.93	15.00	4.32	14.06	2.58	11.60	9.10	13.50	6.80	12.86	3.01	15.74	-2.78	10.44	10.06
Fs (ksi)	11.06	4.93	15.00	4.32	14.06	2.58	11.60	9.10	13.50	6.80	12.86	3.01	15.74	-2.78	10.44	10.06
Fs (kip)	1492.65	665.58	2024.54	583.26	1898.74	348.14	1566.47	1228.03	1822.83	918.27	1736.29	406.45	2124.57	-375.46	1409.86	1358.73

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4078.78	3971.84	2124.57	1358.73
Comp	0.00	5062.50	0.00	375.46

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	569.97	600.92	941.83	348.51	529.78	665.21	752.14	463.48	415.06	438.69	679.55	258.58	388.42	482.34	545.53	339.82
Vuw (kip)	854.96	901.38	1412.75	522.76	794.67	997.81	1128.21	695.22	---	---	---	---	---	---	---	---
Mv (k*ft)	480.91	507.03	794.67	294.05	447.00	561.27	634.62	391.06	233.47	246.76	382.25	145.45	218.49	271.32	306.86	191.15
Huw (kip)	3316.41	2896.41	2613.17	4073.10	3465.68	2769.72	1984.34	4492.32	959.21	1159.02	998.61	1242.00	1218.27	952.33	777.38	1230.49
Muw (k*ft)	1578.12	2138.12	2515.77	569.20	1379.10	2307.04	3515.75	10.24	490.11	854.09	918.88	200.56	536.03	788.05	1481.50	30.30
Mu (k*ft)	2059.04	2645.14	3310.44	863.25	1826.10	2868.31	4150.37	401.30	723.58	1100.85	1301.12	346.01	754.52	1059.37	1788.36	221.45

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3242**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.59	24.97	22.53	35.11	29.88	23.88	17.11	38.73	8.27	9.99	8.61	10.71	10.50	8.21	6.70	10.61
PY1 (Vuw)	7.37	7.77	12.18	4.51	6.85	8.60	9.73	5.99	3.58	3.78	5.86	2.23	3.35	4.16	4.70	2.93
PX2 (Mu)	13.95	17.92	22.43	5.85	12.37	19.43	28.12	2.72	4.90	7.46	8.82	2.34	5.11	7.18	12.12	1.50
PY2 (Mu)	1.49	1.92	2.40	0.63	1.33	2.08	3.01	0.29	0.53	0.80	0.94	0.25	0.55	0.77	1.30	0.16
Pu (kip)	43.45	43.97	47.26	41.28	43.03	44.61	46.99	41.92	13.80	18.04	18.71	13.28	16.09	16.16	19.75	12.50

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2028.12	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2050.66	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.78	45.27	47.56	42.89	44.43	45.75	48.02	43.30
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1412.75
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3242**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2050.66	18.99	OK	1068.15	9.89	OK
BF	2547.58	26.54	OK	683.75	7.12	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2028.12	18.78	1.47	137.48	OK
TF	4078.78	37.77	1.47	274.95	OK
TF Inside	2050.66	18.99	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.26	23.63	OK	19.75	9.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.26	1.47	114.56	OK
Web SPL	23.63	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.24	NA
TF Inside	1.21	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.91	1.70	7.28
Web	1.53	1.70	2.42
BF	1.36	2.36	4.81

Plate	Shear	Flexure
Web	1.55	1.04

Field Splice - Node 5241

Node 5241

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5241 L	135.00	48.89	6600.40	126.00	68.45	8624.53	132.00	50.00	6600.00
5241 R	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 5241 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 5241**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.48	10.05	24.51	9.50	22.02	8.20	16.29	15.00	20.13	12.48	19.22	8.17	27.34	4.02	14.81	16.95
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.31	0.20	0.49	0.19	0.44	0.16	0.33	0.30	0.40	0.25	0.38	0.16	0.55	0.08	0.30	0.34
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	15.48		24.51		22.02		16.29		20.13		19.22		27.34			16.95
Fcf (ksi)	37.50		37.50		37.50		37.50		37.50		37.50		38.67			37.50
Fcf (kip)	3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		4095.55			3971.84
fncf (ksi)		10.05		9.50		8.20		15.00		12.48		8.17		4.02	14.81	
Rcf		2.42		1.53		1.70		2.30		1.86		1.95		1.41	2.21	
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50	37.50	
Fncf (kip)		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84	3971.84	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	11.61	7.43	15.56	6.35	14.45	5.80	12.17	10.93	14.34	8.66	13.05	5.74	16.24	-3.06	11.12	12.30
Fs (ksi)	11.61	7.43	15.56	6.35	14.45	5.80	12.17	10.93	14.34	8.66	13.05	5.74	16.24	-3.06	11.12	12.30
Fs (kip)	1566.84	1002.69	2100.19	856.88	1950.55	783.15	1642.77	1474.98	1935.90	1169.65	1761.42	774.98	2192.79	-413.18	1501.64	1660.86

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4095.55	3971.84	2192.79	1660.86
Comp	0.00	0.00	0.00	413.18

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	494.10	551.44	873.72	303.33	532.00	535.45	664.39	430.14	361.60	398.70	629.81	223.40	388.38	387.40	481.92	313.00
Vuw (kip)	741.14	827.16	1310.57	454.99	797.99	803.18	996.58	645.20	---	---	---	---	---	---	---	---
Mv (k*ft)	416.89	465.28	737.20	255.93	448.87	451.79	560.58	362.93	203.40	224.27	354.27	125.66	218.46	217.91	271.08	176.06
Huw (kip)	3710.22	3122.57	3087.87	4322.32	3645.16	3206.27	2661.37	4215.72	1142.02	1314.25	1214.98	1385.67	1380.24	1127.29	790.94	1405.56
Muw (k*ft)	1053.04	1836.57	1882.84	236.91	1139.79	1724.97	2638.39	379.03	334.31	736.78	691.79	99.43	454.07	584.56	1544.28	94.36
Mu (k*ft)	1469.93	2301.85	2620.03	492.84	1588.66	2176.76	3198.97	741.96	537.71	961.05	1046.06	225.09	672.54	802.47	1815.36	270.42

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.98	26.92	26.62	37.26	31.42	27.64	22.94	36.34	9.84	11.33	10.47	11.95	11.90	9.72	6.82	12.12
PY1 (Vuw)	6.39	7.13	11.30	3.92	6.88	6.92	8.59	5.56	3.12	3.44	5.43	1.93	3.35	3.34	4.15	2.70
PX2 (Mu)	9.96	15.60	17.75	3.34	10.76	14.75	21.67	5.03	3.64	6.51	7.09	1.53	4.56	5.44	12.30	1.83
PY2 (Mu)	1.07	1.67	1.90	0.36	1.15	1.58	2.32	0.54	0.39	0.70	0.76	0.16	0.49	0.58	1.32	0.20
Pu (kip)	42.60	43.42	46.29	40.83	42.95	43.23	45.93	41.82	13.94	18.31	18.62	13.63	16.90	15.65	19.89	14.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2036.46	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2059.09	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	0.00	2632.50	OK
BF Outside	0.00	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.04	44.81	46.81	42.44	44.32	44.65	47.18	43.29
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1310.57
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2059.09	19.07	OK	1102.45	10.21	OK
BF	1998.73	20.82	OK	835.79	8.71	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2036.46	18.86	1.47	137.48	OK
TF	4095.55	37.92	1.47	274.95	OK
TF Inside	2059.09	19.07	1.47	148.93	OK
BF Inside	1998.73	20.82	1.47	137.48	OK
BF	3971.84	41.37	1.47	274.95	OK
BF Outside	1973.11	20.55	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.29	23.15	OK	19.89	9.94	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.29	1.47	114.56	OK
Web SPL	23.15	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.24	NA
TF Inside	1.20	NA
BF Inside	1.02	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.90	1.65	7.25
Web	1.56	1.69	2.47
BF	1.74	1.93	6.13

Plate	Shear	Flexure
Web	1.67	1.06

Field Splice - Node 7241

Node 7241

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7241 L	135.00	48.89	6600.40	126.00	68.45	8624.53	132.00	50.00	6600.00
7241 R	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 7241 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

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For	**Cleveland InnerBelt : Field Splice - Node 7241**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.40	10.95	25.52	11.34	23.84	7.40	17.53	17.30	22.72	13.69	19.95	9.97	28.44	-6.44	16.17	18.51
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.33	0.22	0.51	0.23	0.48	0.15	0.35	0.35	0.45	0.27	0.40	0.20	0.57	0.13	0.32	0.37
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	16.40		25.52		23.84		17.53		22.72		19.95		28.44			18.51
Fcf (ksi)	37.50		37.76		37.50		37.50		37.50		37.50		39.22			37.50
Fcf (kip)	3971.84		3999.28		3971.84		3971.84		3971.84		3971.84		4154.21			3971.84
fncf (ksi)		10.95		11.34		7.40		17.30		13.69		9.97		-6.44	16.17	
Rcf		2.29		1.48		1.57		2.14		1.65		1.88		1.38	2.03	
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		-37.50	37.50	
Fncf (kip)		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		-5062.50	3971.84	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	12.28	8.14	16.54	7.74	15.32	5.50	13.17	12.65	15.76	9.52	13.87	7.09	17.04	-4.74	12.11	13.48
Fs (ksi)	12.28	8.14	16.54	7.74	15.32	5.50	13.17	12.65	15.76	9.52	13.87	7.09	17.04	-4.74	12.11	13.48
Fs (kip)	1657.22	1098.69	2232.94	1044.46	2067.70	743.15	1778.62	1707.82	2127.95	1285.31	1872.62	957.77	2301.02	-639.45	1635.04	1819.75

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4154.21	3971.84	2301.02	1819.75
Comp	0.00	5062.50	0.00	639.45

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	516.09	569.44	886.55	311.33	519.09	531.83	696.88	416.92	376.39	413.37	638.13	231.01	378.51	386.80	503.41	306.32
Vuw (kip)	774.14	854.16	1329.82	467.00	778.64	797.75	1045.32	625.38	---	---	---	---	---	---	---	---
Mv (k*ft)	435.45	480.47	748.03	262.69	437.99	448.73	587.99	351.78	211.72	232.52	358.95	129.94	212.91	217.58	283.17	172.31
Huw (kip)	3751.63	3272.00	2948.10	4470.61	3606.00	3375.13	1820.60	4215.83	1224.85	1456.62	1249.27	1549.53	1517.01	1257.95	738.48	1535.46
Muw (k*ft)	997.83	1678.78	2069.19	39.19	1192.00	1499.82	3848.03	378.90	330.98	704.28	784.92	41.96	499.34	542.13	1742.50	109.46
Mu (k*ft)	1433.28	2159.24	2817.22	301.87	1629.99	1948.56	4436.02	730.68	542.70	936.80	1143.87	171.90	712.25	759.71	2025.67	281.76

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.34	28.21	25.41	38.54	31.09	29.10	15.69	36.34	10.56	12.56	10.77	13.36	13.08	10.84	6.37	13.24
PY1 (Vuw)	6.67	7.36	11.46	4.03	6.71	6.88	9.01	5.39	3.24	3.56	5.50	1.99	3.26	3.33	4.34	2.64
PX2 (Mu)	9.71	14.63	19.09	2.05	11.04	13.20	30.06	4.95	3.68	6.35	7.75	1.16	4.83	5.15	13.73	1.91
PY2 (Mu)	1.04	1.57	2.05	0.22	1.18	1.41	3.22	0.53	0.39	0.68	0.83	0.12	0.52	0.55	1.47	0.20
Pu (kip)	42.75	43.76	46.51	40.81	42.86	43.10	47.36	41.72	14.69	19.37	19.57	14.68	18.30	16.46	20.91	15.41

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2065.63	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2088.58	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.15	45.11	46.99	42.38	44.27	44.51	48.62	43.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1329.82
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7241**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2088.58	19.34	OK	1156.86	10.71	OK
BF	2547.58	26.54	OK	915.74	9.54	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2065.63	19.13	1.47	137.48	OK
TF	4154.21	38.46	1.47	274.95	OK
TF Inside	2088.58	19.34	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.36	23.68	OK	20.91	10.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.36	1.47	114.56	OK
Web SPL	23.68	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.22	NA
TF Inside	1.18	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.87	1.57	7.15
Web	1.53	1.61	2.42
BF	1.36	1.76	4.81

Plate	Shear	Flexure
Web	1.65	1.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9242	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9242

Node 9242

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9242 L	135.00	48.92	6604.26	126.00	68.49	8629.57	132.00	50.00	6600.00
9242 R	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 9242 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9242**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	10.17	11.13	19.22	11.88	18.14	6.98	11.71	17.54	16.23	14.40	10.56	11.81	22.33	5.07	9.98	18.64
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.20	0.22	0.38	0.24	0.36	0.14	0.23	0.35	0.32	0.29	0.21	0.24	0.45	0.10	0.20	0.37
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)		11.13	19.22		18.14			17.54	16.23			11.81	22.33			18.64
Fcf (ksi)		37.50	37.50		37.50			37.50	37.50			37.50	37.50			37.50
Fcf (kip)		3971.84	3971.84		3971.84			3971.84	3971.84			3971.84	3971.84			3971.84
fncf (ksi)	10.17			11.88		6.98	11.71			14.40	10.56			5.07	9.98	
Rcf	3.37			1.95		2.07	2.14			2.31	3.18			1.68	2.01	
Fncf (ksi)	37.50			37.50		37.50	37.50			37.50	37.50			37.50	37.50	
Fncf (kip)	3971.84			3971.84		3971.84	3971.84			3971.84	3971.84			3971.84	3971.84	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	7.65	8.23	12.39	8.13	11.44	5.28	8.74	12.76	11.46	10.10	8.39	8.40	13.13	3.95	7.52	13.54
Fs (ksi)	7.65	8.23	12.39	8.13	11.44	5.28	8.74	12.76	11.46	10.10	8.39	8.40	13.13	3.95	7.52	13.54
Fs (kip)	1033.25	1111.00	1673.07	1098.10	1544.10	713.19	1179.56	1722.46	1547.55	1363.48	1133.16	1133.74	1772.52	532.58	1014.64	1827.75

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3971.84	3971.84	1772.52	1827.75
Comp	0.00	0.00	0.00	0.00

$\phi v Vn$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	345.60	385.44	651.49	167.62	335.84	370.27	518.66	245.16	254.74	283.43	471.39	128.99	247.84	272.71	377.54	183.77
Vuw (kip)	518.40	578.17	977.23	251.43	503.76	555.41	777.98	367.73	---	---	---	---	---	---	---	---
Mv (k*ft)	291.60	325.22	549.69	141.43	283.37	312.42	437.62	206.85	143.29	159.43	265.16	72.56	139.41	153.40	212.37	103.37
Huw (kip)	4306.57	3640.34	3115.32	3751.71	4246.42	4261.56	2760.33	3454.14	953.00	1231.63	1003.24	1289.78	1293.79	1007.51	1024.49	1263.28
Muw (k*ft)	257.91	1146.21	1846.25	997.72	338.11	317.92	2319.56	1394.48	46.07	340.73	492.39	321.72	109.08	0.35	734.78	481.84
Mu (k*ft)	549.51	1471.43	2395.94	1139.15	621.47	630.34	2757.18	1601.33	189.36	500.15	757.55	394.27	248.49	153.74	947.15	585.21

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.13	31.38	26.86	32.34	36.61	36.74	23.80	29.78	8.22	10.62	8.65	11.12	11.15	8.69	8.83	10.89
PY1 (Vuw)	4.47	4.98	8.42	2.17	4.34	4.79	6.71	3.17	2.20	2.44	4.06	1.11	2.14	2.35	3.25	1.58
PX2 (Mu)	3.72	9.97	16.23	7.72	4.21	4.27	18.68	10.85	1.28	3.39	5.13	2.67	1.68	1.04	6.42	3.97
PY2 (Mu)	0.40	1.07	1.74	0.83	0.45	0.46	2.00	1.16	0.14	0.36	0.55	0.29	0.18	0.11	0.69	0.42
Pu (kip)	41.14	41.79	44.27	40.17	41.10	41.34	43.36	40.86	9.78	14.28	14.53	13.86	13.04	10.03	15.75	14.99

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1974.95	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	1996.89	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	0.00	2632.50	OK
BF Outside	0.00	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.71	43.42	45.43	42.01	42.69	42.89	44.86	42.69
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	977.23
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9242**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1996.89	18.49	OK	891.16	8.25	OK
BF	1998.73	20.82	OK	919.77	9.58	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1974.95	18.29	1.47	137.48	OK
TF	3971.84	36.78	1.47	274.95	OK
TF Inside	1996.89	18.49	1.47	148.93	OK
BF Inside	1998.73	20.82	1.47	137.48	OK
BF	3971.84	41.37	1.47	274.95	OK
BF Outside	1973.11	20.55	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.27	22.14	OK	15.75	7.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.27	1.47	114.56	OK
Web SPL	22.14	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.24	NA
BF Inside	1.02	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.96	2.04	7.48
Web	1.63	2.14	2.59
BF	1.74	1.76	6.13

Plate	Shear	Flexure
Web	2.24	1.10

Field Splice - Node 1253

Node 1253

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1253 L	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00
1253 R	135.00	48.92	6604.26	126.00	68.49	8629.57	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 1253 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.57	7.14	16.96	9.52	27.16	-7.38	17.77	15.51	22.81	4.01	21.92	11.98	15.96	16.46	30.69	-10.38
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.55	0.14	0.34	0.19	0.54	0.15	0.36	0.31	0.46	0.08	0.44	0.24	0.32	0.33	0.61	0.21
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	27.57		16.96		27.16		17.77		22.81		21.92			16.46	30.69	
Fcf (ksi)	38.79		37.50		38.58		37.50		37.50		37.50			37.50	40.34	
Fcf (kip)	4108.06		3971.84		4086.36		3971.84		3971.84		3971.84			3971.84	4272.92	
fncf (ksi)		7.14		9.52		-7.38		15.51		4.01		11.98	15.96			-10.38
Rcf		1.41		2.21		1.42		2.11		1.64		1.71	2.28			1.31
Fncf (ksi)		37.50		37.50		-37.50		37.50		37.50		37.50	37.50			-37.50
Fncf (kip)		3971.84		3971.84		-5062.50		3971.84		3971.84		3971.84	3971.84			-5062.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.96	5.00	12.82	6.98	17.48	-5.75	13.38	11.44	15.29	3.14	16.23	8.24	12.10	12.11	18.65	-7.71
Fs (ksi)	17.96	5.00	12.82	6.98	17.48	-5.75	13.38	11.44	15.29	3.14	16.23	8.24	12.10	12.11	18.65	-7.71
Fs (kip)	2424.83	674.73	1730.39	942.93	2359.61	-776.63	1806.12	1544.56	2064.57	424.56	2191.01	1112.74	1633.54	1635.35	2517.18	-1040.21

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4272.92	3971.84	2517.18	1635.35
Comp	0.00	5062.50	0.00	1040.21

$\phi v Vn$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	486.44	401.78	741.48	242.22	469.27	411.86	311.11	609.88	355.88	298.53	538.53	183.33	343.75	305.65	232.01	445.55
Vuw (kip)	729.66	602.67	1112.22	363.32	703.90	617.79	466.67	914.82	---	---	---	---	---	---	---	---
Mv (k*ft)	410.44	339.00	625.62	204.37	395.94	347.50	262.50	514.59	200.18	167.92	302.92	103.12	193.36	171.93	130.50	250.62
Huw (kip)	2929.53	3512.86	1685.50	4214.21	2646.11	3479.65	4431.02	1601.61	1377.58	1188.14	703.55	1489.19	1106.28	1468.33	1452.84	656.43
Muw (k*ft)	2299.72	1316.18	3925.65	381.06	2471.86	1360.46	91.98	4319.33	1037.10	466.64	1858.51	155.00	971.86	638.97	1.07	2108.08
Mu (k*ft)	2710.16	1655.18	4551.27	585.43	2867.80	1707.97	354.48	4833.92	1237.28	634.56	2161.44	258.12	1165.22	810.90	131.57	2358.70

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1253	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.25	30.28	14.53	36.33	22.81	30.00	38.20	13.81	11.88	10.24	6.07	12.84	9.54	12.66	12.52	5.66
PY1 (Vuw)	6.29	5.20	9.59	3.13	6.07	5.33	4.02	7.89	3.07	2.57	4.64	1.58	2.96	2.63	2.00	3.84
PX2 (Mu)	18.36	11.21	30.84	3.97	19.43	11.57	2.40	32.75	8.38	4.30	14.64	1.75	7.90	5.49	0.89	15.98
PY2 (Mu)	1.97	1.20	3.30	0.42	2.08	1.24	0.26	3.51	0.90	0.46	1.57	0.19	0.85	0.59	0.10	1.71
Pu (kip)	44.39	41.99	47.16	40.45	43.02	42.08	40.83	47.93	20.64	14.86	21.62	14.69	17.84	18.44	13.58	22.34

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2124.65	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2148.26	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.04	43.61	48.25	42.14	44.64	43.70	42.41	49.55
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1112.22
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2148.26	19.89	OK	1265.54	11.72	OK
BF	2547.58	26.54	OK	822.95	8.57	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2124.65	19.67	1.47	137.48	OK
TF	4272.92	39.56	1.47	274.95	OK
TF Inside	2148.26	19.89	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.93	23.97	OK	22.34	11.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.93	1.47	114.56	OK
Web SPL	23.97	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.18	NA
TF Inside	1.15	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.82	1.44	6.95
Web	1.51	1.51	2.39
BF	1.36	1.96	4.81

Plate	Shear	Flexure
Web	1.97	1.01

Field Splice - Node 5253

Node 5253

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5253 L	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00
5253 R	135.00	48.89	6600.40	126.00	68.45	8624.53	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 5253 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.35	3.67	14.84	6.24	23.36	2.50	15.24	11.04	22.88	4.69	15.23	8.18	14.22	12.98	27.99	-4.70
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.51	0.07	0.30	0.12	0.47	0.05	0.30	0.22	0.46	0.09	0.30	0.16	0.28	0.26	0.56	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	25.35		14.84		23.36		15.24		22.88		15.23		14.22		27.99	
Fcf (ksi)	37.68		37.50		37.50		37.50		37.50		37.50		37.50		39.00	
Fcf (kip)	3990.56		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		4130.43	
fncf (ksi)		3.67		6.24		2.50		11.04		4.69		8.18		12.98		-4.70
Rcf		1.49		2.53		1.61		2.46		1.64		2.46		2.64		1.39
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-37.50
Fncf (kip)		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		-5062.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.92	1.96	11.09	4.53	14.98	1.41	11.37	7.92	15.11	2.99	12.01	5.10	10.65	9.30	16.50	-3.48
Fs (ksi)	15.92	1.96	11.09	4.53	14.98	1.41	11.37	7.92	15.11	2.99	12.01	5.10	10.65	9.30	16.50	-3.48
Fs (kip)	2149.45	264.80	1497.02	611.54	2021.96	190.62	1535.18	1069.42	2039.46	404.16	1621.34	687.93	1437.74	1254.86	2227.71	-469.80

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4130.43	3971.84	2227.71	1254.86
Comp	0.00	5062.50	0.00	469.80

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	649.18	530.48	950.03	357.94	635.78	605.92	469.54	753.90	472.66	387.80	685.22	265.90	462.20	442.10	344.75	546.65
Vuw (kip)	973.76	795.71	1425.05	536.92	953.67	908.89	704.31	1130.85	---	---	---	---	---	---	---	---
Mv (k*ft)	547.74	447.59	801.59	302.02	536.44	511.25	396.17	636.11	265.87	218.14	385.43	149.57	259.99	248.68	193.92	307.49
Huw (kip)	2587.92	3195.74	2490.93	3879.65	2710.97	3458.99	4304.41	1947.04	1073.00	937.14	983.37	1157.60	1086.05	1026.34	1196.71	781.29
Muw (k*ft)	2577.72	1739.01	2678.76	827.13	2385.37	1388.01	260.79	3643.52	1116.83	524.73	1085.24	276.00	969.07	553.13	108.37	1598.53
Mu (k*ft)	3125.47	2186.60	3480.35	1129.14	2921.81	1899.26	656.97	4279.62	1382.70	742.87	1470.67	425.57	1229.05	801.81	302.29	1906.02

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.31	27.55	21.47	33.45	23.37	29.82	37.11	16.78	9.25	8.08	8.48	9.98	9.36	8.85	10.32	6.74
PY1 (Vuw)	8.39	6.86	12.28	4.63	8.22	7.84	6.07	9.75	4.07	3.34	5.91	2.29	3.98	3.81	2.97	4.71
PX2 (Mu)	21.18	14.82	23.58	7.65	19.80	12.87	4.45	29.00	9.37	5.03	9.96	2.88	8.33	5.43	2.05	12.91
PY2 (Mu)	2.27	1.59	2.53	0.82	2.12	1.38	0.48	3.11	1.00	0.54	1.07	0.31	0.89	0.58	0.22	1.38
Pu (kip)	44.77	43.20	47.43	41.46	44.39	43.67	42.07	47.55	19.30	13.67	19.72	13.12	18.35	14.94	12.77	20.57

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2053.80	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2076.62	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.99	44.63	47.70	43.08	45.62	44.90	43.47	48.62
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1425.05
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2076.62	19.23	OK	1120.01	10.37	OK
BF	2547.58	26.54	OK	631.48	6.58	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2053.80	19.02	1.47	137.48	OK
TF	4130.43	38.24	1.47	274.95	OK
TF Inside	2076.62	19.23	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.55	23.78	OK	20.57	10.29	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.55	1.47	114.56	OK
Web SPL	23.78	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.22	NA
TF Inside	1.19	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.88	1.62	7.19
Web	1.52	1.64	2.41
BF	1.36	2.56	4.81

Plate	Shear	Flexure
Web	1.54	1.03

Field Splice - Node 7252

Node 7252

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7252 L	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00
7252 R	135.00	48.89	6600.40	126.00	68.45	8624.53	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 7252 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7252**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.68	4.40	13.04	6.06	22.12	2.02	13.44	10.91	20.53	5.53	16.76	4.64	12.28	12.24	26.39	-3.82
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.45	0.09	0.26	0.12	0.44	0.04	0.27	0.22	0.41	0.11	0.34	0.09	0.25	0.24	0.53	0.08
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	22.68		13.04		22.12		13.44		20.53		16.76		12.28		26.39	
Fcf (ksi)	37.50		37.50		37.50		37.50		37.50		37.50		37.50		38.19	
Fcf (kip)	3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		4045.24	
fncf (ksi)		4.40		6.06		2.02		10.91		5.53		4.64		12.24		-3.82
Rcf		1.65		2.88		1.70		2.79		1.83		2.24		3.05		1.45
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-37.50
Fncf (kip)		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		-5062.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	14.46	2.48	9.75	4.38	14.04	1.18	10.03	7.81	13.79	3.53	11.84	2.83	9.21	8.75	15.45	-2.81
Fs (ksi)	14.46	2.48	9.75	4.38	14.04	1.18	10.03	7.81	13.79	3.53	11.84	2.83	9.21	8.75	15.45	-2.81
Fs (kip)	1952.04	335.11	1316.37	590.85	1894.85	159.62	1354.65	1053.90	1861.14	476.44	1598.77	381.97	1243.68	1181.10	2085.91	-378.92

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4045.24	3971.84	2085.91	1181.10
Comp	0.00	5062.50	0.00	378.92

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	664.44	537.46	934.39	360.18	598.94	624.35	460.95	758.80	483.37	393.22	674.09	267.97	436.66	455.04	339.17	550.03
Vuw (kip)	996.66	806.19	1401.59	540.28	898.42	936.53	691.43	1138.20	---	---	---	---	---	---	---	---
Mv (k*ft)	560.62	453.48	788.39	303.91	505.36	526.80	388.93	640.24	271.89	221.19	379.18	150.73	245.62	255.96	190.78	309.39
Huw (kip)	2686.62	3294.83	2455.34	4076.26	2856.02	2872.42	4493.71	1959.46	1016.51	847.65	913.10	1070.47	1038.92	880.33	1077.68	758.66
Muw (k*ft)	2417.84	1606.89	2726.21	564.99	2191.98	2170.11	8.39	3498.26	958.18	429.94	1028.28	178.23	820.57	721.07	37.08	1460.64
Mu (k*ft)	2978.46	2060.37	3514.60	868.90	2697.33	2696.91	397.32	4138.49	1230.07	651.12	1407.46	328.96	1066.19	977.03	227.87	1770.04

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7252	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.16	28.40	21.17	35.14	24.62	24.76	38.74	16.89	8.76	7.31	7.87	9.23	8.96	7.59	9.29	6.54
PY1 (Vuw)	8.59	6.95	12.08	4.66	7.74	8.07	5.96	9.81	4.17	3.39	5.81	2.31	3.76	3.92	2.92	4.74
PX2 (Mu)	20.18	13.96	23.81	5.89	18.28	18.27	2.69	28.04	8.33	4.41	9.54	2.23	7.22	6.62	1.54	11.99
PY2 (Mu)	2.16	1.50	2.55	0.63	1.96	1.96	0.29	3.00	0.89	0.47	1.02	0.24	0.77	0.71	0.17	1.28
Pu (kip)	44.66	43.20	47.30	41.37	43.98	44.19	41.90	46.72	17.83	12.34	18.70	11.74	16.80	14.94	11.27	19.49

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2011.44	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2033.79	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.81	44.60	47.63	42.96	45.29	45.43	43.28	47.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1401.59
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2033.79	18.83	OK	1048.72	9.71	OK
BF	2547.58	26.54	OK	594.36	6.19	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2011.44	18.62	1.47	137.48	OK
TF	4045.24	37.46	1.47	274.95	OK
TF Inside	2033.79	18.83	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.30	23.65	OK	19.49	9.74	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.30	1.47	114.56	OK
Web SPL	23.65	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.25	NA
TF Inside	1.22	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.92	1.73	7.34
Web	1.53	1.73	2.42
BF	1.36	2.72	4.81

Plate	Shear	Flexure
Web	1.57	1.05

Field Splice - Node 9253

Node 9253

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9253 L	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00
9253 R	135.00	48.92	6604.26	126.00	68.49	8629.57	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 9253 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	19.50	1.500	50.50	58.50	39.38	---	50	65
	BF Outside	42.00	1.375	50.50	57.75	40.22	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.96	4.25	8.47	5.27	17.25	0.92	9.91	10.66	12.27	8.81	14.00	2.97	7.72	11.71	21.71	-4.30
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.36	0.08	0.17	0.11	0.34	0.02	0.20	0.21	0.25	0.18	0.28	0.06	0.15	0.23	0.43	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	17.96		8.47		17.25			10.66	12.27		14.00			11.71	21.71	
Fcf (ksi)	37.50		37.50		37.50			37.50	37.50		37.50			37.50	37.50	
Fcf (kip)	3971.84		3971.84		3971.84			3971.84	3971.84		3971.84			3971.84	3971.84	
fncf (ksi)		4.25		5.27		0.92	9.91			8.81		2.97	7.72			-4.30
Rcf		2.09		4.43		2.17	3.52			3.06		2.68	3.20			1.73
Fncf (ksi)		37.50		37.50		37.50	37.50			37.50		37.50	37.50			-37.50
Fncf (kip)		3971.84		3971.84		3971.84	3971.84			3971.84		3971.84	3971.84			-5062.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	11.44	2.55	6.41	3.82	10.70	-0.87	7.61	7.70	9.47	5.77	9.44	1.88	5.88	8.37	12.48	-2.97
Fs (ksi)	11.44	2.55	6.41	3.82	10.70	-0.87	7.61	7.70	9.47	5.77	9.44	1.88	5.88	8.37	12.48	-2.97
Fs (kip)	1544.67	344.59	865.51	515.90	1444.50	-116.90	1027.75	1039.98	1278.04	779.25	1274.28	253.15	793.74	1130.09	1685.44	-400.82

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3971.84	3971.84	1685.44	1130.09
Comp	0.00	5062.50	0.00	400.82

$\phi v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	505.46	419.06	773.74	265.96	456.18	510.68	347.64	629.88	370.27	309.58	560.16	201.05	335.80	373.95	259.12	458.17
Vuw (kip)	758.19	628.59	1160.60	398.93	684.27	766.01	521.46	944.82	---	---	---	---	---	---	---	---
Mv (k*ft)	426.48	353.58	652.84	224.40	384.90	430.88	293.32	531.46	208.28	174.14	315.09	113.09	188.89	210.35	145.75	257.72
Huw (kip)	2782.17	3648.55	2369.60	4343.57	3865.94	2726.86	3733.88	1804.03	839.67	613.96	590.04	918.99	914.35	678.86	855.04	570.94
Muw (k*ft)	2290.43	1135.26	2840.54	208.57	845.41	2364.19	1021.49	3594.63	711.16	207.18	925.27	7.24	295.58	605.12	199.32	1236.30
Mu (k*ft)	2716.92	1488.85	3493.38	432.97	1230.31	2795.07	1314.81	4126.09	919.43	381.31	1240.36	120.34	484.47	815.47	345.07	1494.03

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.98	31.45	20.43	37.44	33.33	23.51	32.19	15.55	7.24	5.29	5.09	7.92	7.88	5.85	7.37	4.92
PY1 (Vuw)	6.54	5.42	10.01	3.44	5.90	6.60	4.50	8.15	3.19	2.67	4.83	1.73	2.89	3.22	2.23	3.95
PX2 (Mu)	18.41	10.09	23.67	2.93	8.34	18.94	8.91	27.96	6.23	2.58	8.40	0.82	3.28	5.53	2.34	10.12
PY2 (Mu)	1.97	1.08	2.54	0.31	0.89	2.03	0.95	3.00	0.67	0.28	0.90	0.09	0.35	0.59	0.25	1.08
Pu (kip)	43.24	42.05	45.85	40.55	42.21	43.31	41.46	44.91	14.01	8.41	14.66	8.93	11.63	12.00	10.02	15.86

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1974.95	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	1996.89	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	1998.73	2778.75	2047.50	138.00	90.19	29.06	4231.31	2047.50	OK
BF Outside	1973.11	2743.13	2091.38	63.25	41.34	34.80	3056.54	2091.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2547.58	2632.50	OK
BF Outside	2514.92	2598.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.77	43.62	46.70	42.19	43.70	44.84	43.12	46.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1160.60
Rr (kip)	2193.67
Check	OK

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		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1996.89	18.49	OK	847.38	7.85	OK
BF	2547.58	26.54	OK	568.69	5.92	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1974.95	18.29	1.47	137.48	OK
TF	3971.84	36.78	1.47	274.95	OK
TF Inside	1996.89	18.49	1.47	148.93	OK
BF Inside	2547.58	26.54	1.47	137.48	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2514.92	26.20	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.85	22.92	OK	15.86	7.93	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.85	1.47	114.56	OK
Web SPL	22.92	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.24	NA
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.96	2.15	7.48
Web	1.58	2.12	2.50
BF	1.36	2.84	4.81

Plate	Shear	Flexure
Web	1.89	1.07

Field Splice

Type L2

Field Splice - Node 3253

Node 3253

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	116
BF	96

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3253 L	135.00	50.00	6750.00	135.00	50.00	6750.00	120.00	50.00	6000.00
3253 R	135.00	48.99	6613.26	138.00	68.58	9464.31	132.00	50.00	6600.00

Rh = 1.00

Controlling Section = 3253 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	105.92	50	65
	Web	96.00	1.25	---	120.00	81.48	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.500	56.50	67.50	48.38	---	50	65
	TF Inside	21.00	1.625	56.50	68.25	47.53	---	50	65
	BF Inside	21.00	1.375	50.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	50.50	56.25	40.31	---	50	65
	Web	89.00	0.6875	26.50	122.38	80.01	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.88	5.94	18.40	9.51	27.62	4.56	18.41	14.31	22.03	6.63	25.19	9.69	17.34	15.64	31.70	-8.13
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.58	0.12	0.37	0.19	0.55	0.09	0.37	0.29	0.44	0.13	0.50	0.19	0.35	0.31	0.63	0.16
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	28.88		18.40		27.62		18.41		22.03		25.19		17.34		31.70	
Fcf (ksi)	39.44		37.50		38.81		37.50		37.50		37.60		37.50		40.85	
Fcf (kip)	4177.40		3971.84		4110.80		3971.84		3971.84		3982.06		3971.84		4326.87	
fncf (ksi)		5.94		9.51		4.56		14.31		6.63		9.69		15.64		-8.13
Rcf		1.37		2.04		1.41		2.04		1.70		1.49		2.16		1.29
Fncf (ksi)		37.50		37.50		37.50		37.50		37.50		37.50		37.50		-37.50
Fncf (kip)		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		3971.84		-5062.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	18.42	3.88	13.86	6.91	17.92	-3.83	13.79	10.42	15.38	4.48	17.69	6.54	13.03	11.35	19.23	-6.19
Fs (ksi)	18.42	3.88	13.86	6.91	17.92	-3.83	13.79	10.42	15.38	4.48	17.69	6.54	13.03	11.35	19.23	-6.19
Fs (kip)	2487.17	524.34	1870.67	932.76	2419.41	-517.68	1861.63	1406.19	2076.66	604.26	2388.29	883.26	1759.57	1532.61	2595.49	-836.01

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4326.87	3971.84	2595.49	1532.61
Comp	0.00	5062.50	0.00	836.01

$\phi_v V_n$ (kip) = 2686.30

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	602.78	487.09	882.91	320.73	575.05	524.42	412.46	702.73	437.91	357.84	637.49	238.63	418.31	384.21	303.44	510.19
Vuw (kip)	904.17	730.64	1324.36	481.09	862.57	786.63	618.69	1054.10	---	---	---	---	---	---	---	---
Mv (k*ft)	508.60	410.98	744.95	270.61	485.20	442.48	348.01	592.93	246.32	201.28	358.59	134.23	235.30	216.12	170.68	286.98
Huw (kip)	2853.08	3413.27	2712.82	3999.12	2927.58	3123.60	4279.07	1822.51	1338.45	1245.97	845.22	1452.36	1191.52	1454.02	1463.19	781.99
Muw (k*ft)	2506.41	1448.98	2592.83	667.84	2096.55	1850.64	294.57	4106.30	1163.16	555.80	1740.50	269.89	872.53	891.87	134.49	2033.48
Mu (k*ft)	3015.01	1859.96	3337.78	938.46	2581.75	2293.11	642.58	4699.23	1409.48	757.08	2099.09	404.12	1107.83	1107.99	305.17	2320.46

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	6/11/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 3253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.60	29.42	23.39	34.48	25.24	26.93	36.89	15.71	11.54	10.74	7.29	12.52	10.27	12.53	12.61	6.74
PY1 (Vuw)	7.79	6.30	11.42	4.15	7.44	6.78	5.33	9.09	3.78	3.08	5.50	2.06	3.61	3.31	2.62	4.40
PX2 (Mu)	20.43	12.60	22.62	6.36	17.49	15.54	4.35	31.84	9.55	5.13	14.22	2.74	7.51	7.51	2.07	15.72
PY2 (Mu)	2.19	1.35	2.42	0.68	1.87	1.66	0.47	3.41	1.02	0.55	1.52	0.29	0.80	0.80	0.22	1.68
Pu (kip)	46.12	42.72	48.04	41.12	43.73	43.30	41.65	49.17	21.63	16.28	22.63	15.44	18.32	20.46	14.95	23.27

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2151.48	3206.25	2515.50	78.00	50.91	43.59	3802.21	2515.50	OK
TF Inside	2175.39	3241.88	2471.63	169.00	110.30	37.58	5280.62	2471.63	OK
BF Inside	2012.05	2743.13	2091.38	126.50	82.67	31.80	4146.82	2091.38	OK
BF Outside	1959.79	2671.88	2096.25	57.50	37.58	36.33	3022.42	2096.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	3037.50	OK
TF Inside	0.00	3071.25	OK
BF Inside	2564.56	2598.75	OK
BF Outside	2497.94	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.25	40.19	44.23	38.88	40.99	40.68	39.21	45.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1815.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1324.36
Rr (kip)	2413.04
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	6/11/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 3253**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.06	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2175.39	20.14	OK	1304.91	12.08	OK
BF	2564.56	26.71	OK	776.39	8.09	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2151.48	19.92	1.47	137.48	OK
TF	4326.87	40.06	1.47	274.95	OK
TF Inside	2175.39	20.14	1.47	148.93	OK
BF Inside	2564.56	26.71	1.47	126.02	OK
BF	5062.50	52.73	1.47	274.95	OK
BF Outside	2497.94	26.02	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.17	24.58	OK	23.27	11.64	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.17	1.47	114.56	OK
Web SPL	24.58	1.47	63.01	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.17	NA
TF Inside	1.14	NA
BF Inside	1.04	1.01
BF Outside	1.07	1.01

Bolt	Shear	Slip	Bearing
TF	1.80	1.39	6.86
Web	1.47	1.45	2.33
BF	1.35	2.08	4.40

Plate	Shear	Flexure
Web	1.82	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
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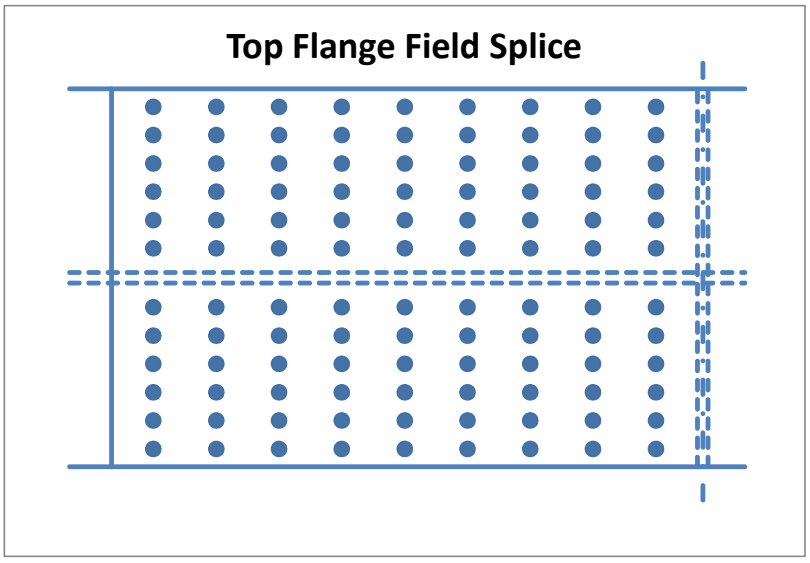
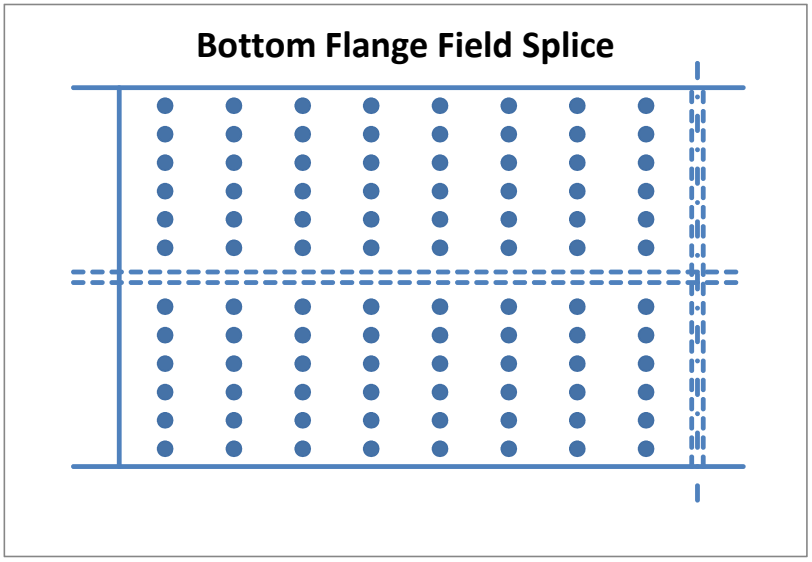
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 3253

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3.375
0	6.75	0	6.75
0	10.125	0	10.125
0	13.5	0	13.5
0	16.875	0	16.875
0	23.875	0	23.875
0	27.25	0	27.25
0	30.625	0	30.625
0	34	0	34
0	37.375	0	37.375
0	40.75	0	40.75
3	0	3	0
3	3.375	3	3.375
3	6.75	3	6.75
3	10.125	3	10.125
3	13.5	3	13.5
3	16.875	3	16.875
3	23.875	3	23.875
3	27.25	3	27.25
3	30.625	3	30.625
3	34	3	34
3	37.375	3	37.375
3	40.75	3	40.75
6	0	6	0
6	3.375	6	3.375
6	6.75	6	6.75
6	10.125	6	10.125
6	13.5	6	13.5
6	16.875	6	16.875
6	23.875	6	23.875
6	27.25	6	27.25
6	30.625	6	30.625
6	34	6	34
6	37.375	6	37.375
6	40.75	6	40.75
9	0	9	0
9	3.375	9	3.375
9	6.75	9	6.75
9	10.125	9	10.125
9	13.5	9	13.5
9	16.875	9	16.875
9	23.875	9	23.875
9	27.25	9	27.25
9	30.625	9	30.625
9	34	9	34
9	37.375	9	37.375
9	40.75	9	40.75
12	0	12	0
12	3.375	12	3.375
12	6.75	12	6.75
12	10.125	12	10.125
12	13.5	12	13.5
12	16.875	12	16.875
12	23.875	12	23.875
12	27.25	12	27.25
12	30.625	12	30.625
12	34	12	34
12	37.375	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	108.0		96.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	40.75	12	40.75
15	0	15	0
15	3.375	15	3.375
15	6.75	15	6.75
15	10.125	15	10.125
15	13.5	15	13.5
15	16.875	15	16.875
15	23.875	15	23.875
15	27.25	15	27.25
15	30.625	15	30.625
15	34	15	34
15	37.375	15	37.375
15	40.75	15	40.75
18	0	18	0
18	3.375	18	3.375
18	6.75	18	6.75
18	10.125	18	10.125
18	13.5	18	13.5
18	16.875	18	16.875
18	23.875	18	23.875
18	27.25	18	27.25
18	30.625	18	30.625
18	34	18	34
18	37.375	18	37.375
18	40.75	18	40.75
21	0	21	0
21	3.375	21	3.375
21	6.75	21	6.75
21	10.125	21	10.125
21	13.5	21	13.5
21	16.875	21	16.875
21	23.875	21	23.875
21	27.25	21	27.25
21	30.625	21	30.625
21	34	21	34
21	37.375	21	37.375
21	40.75	21	40.75
24	0		
24	3.375		
24	6.75		
24	10.125		
24	13.5		
24	16.875		
24	23.875		
24	27.25		
24	30.625		
24	34		
24	37.375		
24	40.75		

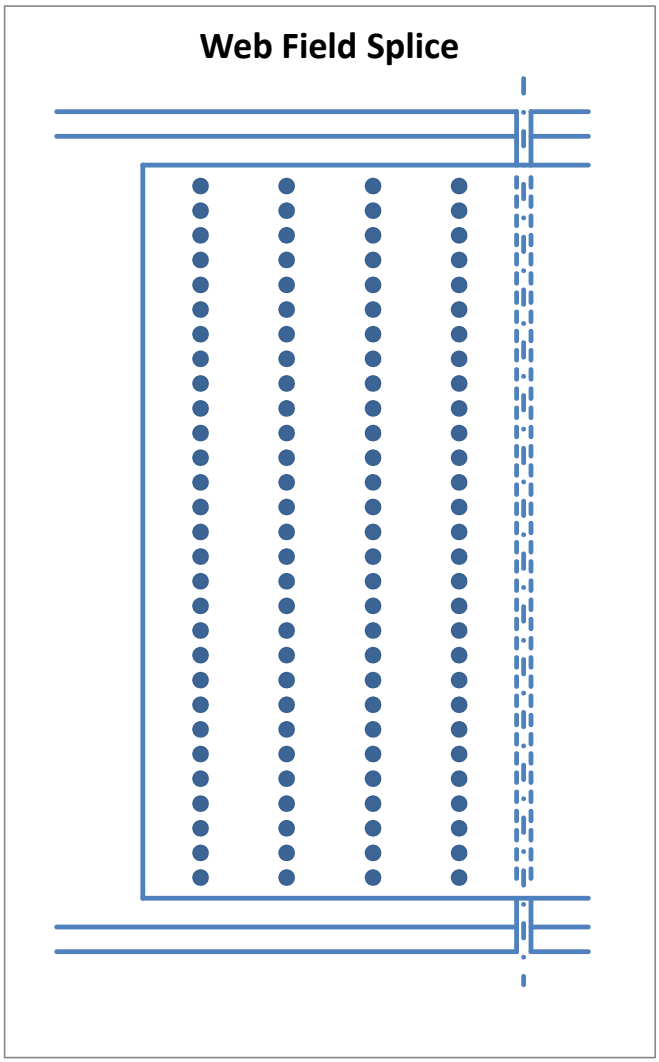
Flange Bolt Pattern Cont. - Node 3253

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3253	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 3253

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 3253

Web Bolt Pattern Cont. - Node 3253

522	4872	1305	73080

Field Splice

Type M

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1261	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type M

Field Splice - Node 1261

Node 1261

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1261 L	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00
1261 R	81.00	50.00	4050.00	97.50	45.58	4444.34	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 1261 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1261**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.97	-5.85	-3.67	6.59	-2.84	-2.68	-11.10	10.89	-10.86	13.14	16.60	-18.98	21.37	-25.31	-12.28	19.58
ϕf Fnc (ksi)	50.00	45.58	50.00	50.00	50.00	45.58	50.00	50.00	50.00	50.00	50.00	48.91	50.00	48.91	50.00	50.00
f / ϕf Fnc	0.04	0.13	0.07	0.13	0.06	0.06	0.22	0.22	0.22	0.26	0.33	0.39	0.43	0.52	0.25	0.39
α	1.00	0.91	1.00	1.00	1.00	0.91	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)		-5.85		6.59		-2.68	-11.10			13.14		-18.98		-25.31		19.58
Fcf (ksi)		-34.19		37.50		-34.19	-37.50			37.50		-36.69		-37.11		37.50
Fcf (kip)		-3333.25		2912.17		-3333.25	-3037.50			2912.17		-3576.83		-3618.25		2912.17
fncf (ksi)	-1.97		-3.67		-2.84			10.89	-10.86		16.60		21.37		-12.28	
Rcf	5.85		5.69		12.77			3.38	2.85		1.93		1.47		1.92	
Fncf (ksi)	-37.50		-37.50		-37.50			37.50	-37.50		37.50		37.50		-37.50	
Fncf (kip)	-3037.50		-3037.50		-3037.50			2912.17	-3037.50		2343.85		2343.85		-3037.50	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.67	-3.36	-4.24	4.55	-4.71	-1.61	-6.41	7.46	-7.96	8.80	11.74	-13.22	15.25	-18.61	-8.88	14.03
Fs (ksi)	-4.67	-3.36	-4.24	4.55	-4.71	-1.61	-6.41	7.46	-7.96	8.80	11.74	-13.22	15.25	-18.61	-8.88	14.03
Fs (kip)	-377.94	-327.78	-343.11	443.48	-381.42	-157.36	-519.43	727.82	-645.05	858.39	950.93	-1289.19	1234.85	-1814.79	-719.38	1367.53

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2343.85	2912.17	1234.85	1367.53
Comp	3037.50	3618.25	719.38	1814.79

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	458.89	336.17	705.90	134.71	540.74	377.74	453.83	309.47	336.79	244.49	511.31	102.15	394.62	273.86	333.21	225.62
Vuw (kip)	688.34	504.26	1040.64	202.06	811.11	566.61	680.75	464.21	---	---	---	---	---	---	---	---
Mv (k*ft)	387.19	283.65	585.36	113.66	456.25	318.72	382.92	261.12	189.44	137.52	287.61	57.46	221.97	154.04	187.43	126.91
Huw (kip)	-2194.32	797.85	-3379.77	-34.25	311.73	-221.35	-277.26	671.33	-385.33	15.00	-303.50	50.50	40.34	-71.16	-161.67	246.95
Muw (k*ft)	1450.20	3736.20	130.39	4754.33	4384.36	4400.59	4380.43	3904.90	83.47	562.20	198.08	888.16	1073.12	1597.59	2166.93	1466.06
Mu (k*ft)	1837.39	4019.85	715.75	4867.99	4840.61	4719.31	4763.35	4166.02	272.91	699.73	485.69	945.62	1295.09	1751.64	2354.36	1592.97

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1261**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.92	6.88	29.14	0.30	2.69	1.91	2.39	5.79	3.32	0.13	2.62	0.44	0.35	0.61	1.39	2.13
PY1 (Vuw)	5.93	4.35	8.97	1.74	6.99	4.88	5.87	4.00	2.90	2.11	4.41	0.88	3.40	2.36	2.87	1.95
PX2 (Mu)	12.45	27.24	4.85	32.98	32.80	31.98	32.27	28.23	1.85	4.74	3.29	6.41	8.77	11.87	15.95	10.79
PY2 (Mu)	1.33	2.92	0.52	3.53	3.51	3.43	3.46	3.02	0.20	0.51	0.35	0.69	0.94	1.27	1.71	1.16
Pu (kip)	32.20	34.88	35.29	33.69	37.01	34.89	35.90	34.73	6.03	5.53	7.59	7.02	10.10	13.00	17.94	13.29

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1161.17	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1182.68	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	1461.16	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	1451.01	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1504.82	1822.50	OK
TF Inside	1532.68	1856.25	OK
BF Inside	1815.43	2430.00	OK
BF Outside	1802.82	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.09	36.40	35.58	35.71	38.00	36.31	37.13	36.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1040.64
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1532.68	19.16	OK	623.09	7.79	OK
BF	1815.43	18.15	OK	910.56	9.11	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.82	18.81	1.47	103.11	OK
TF	3037.50	37.97	1.47	206.21	OK
TF Inside	1532.68	19.16	1.47	114.56	OK
BF Inside	1815.43	18.15	1.47	137.48	OK
BF	3618.25	36.18	1.47	229.13	OK
BF Outside	1802.82	18.03	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.01	18.50	OK	17.94	8.97	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.01	1.47	91.65	OK
Web SPL	18.50	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.35	1.34
BF Outside	1.40	1.34

Bolt	Shear	Slip	Bearing
TF	1.89	2.16	5.43
Web	1.96	1.88	2.48
BF	1.83	1.85	6.33

Plate	Shear	Flexure
Web	2.11	1.32

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
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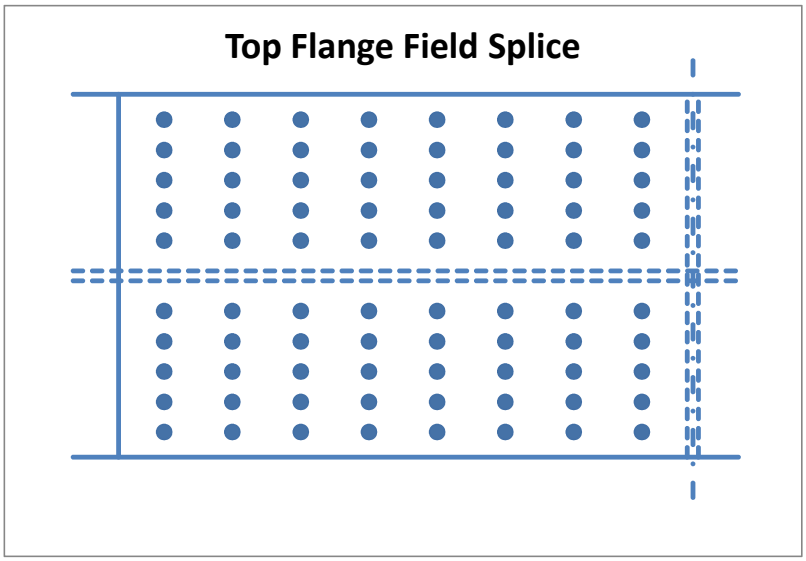
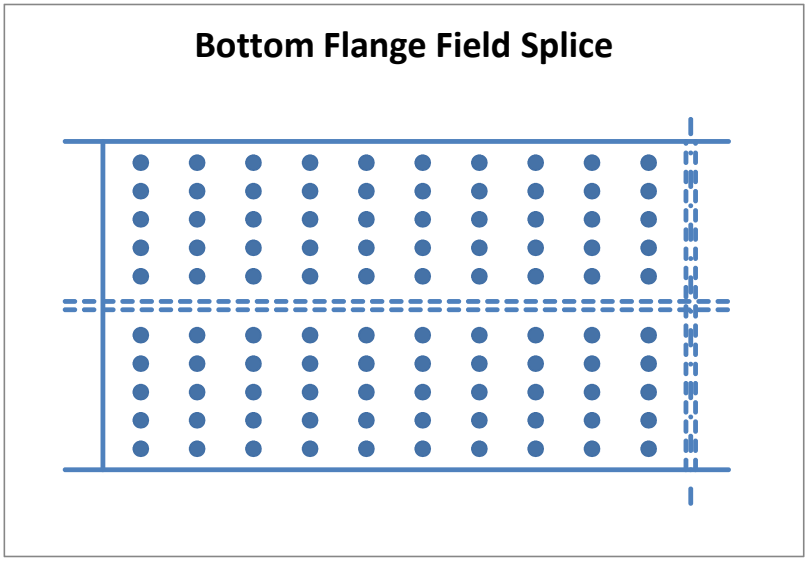
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1261

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3.375
0	6	0	6.75
0	9	0	10.125
0	12	0	13.5
0	19	0	20.5
0	22	0	23.875
0	25	0	27.25
0	28	0	30.625
0	31	0	34
3	0	3	0
3	3	3	3.375
3	6	3	6.75
3	9	3	10.125
3	12	3	13.5
3	19	3	20.5
3	22	3	23.875
3	25	3	27.25
3	28	3	30.625
3	31	3	34
6	0	6	0
6	3	6	3.375
6	6	6	6.75
6	9	6	10.125
6	12	6	13.5
6	19	6	20.5
6	22	6	23.875
6	25	6	27.25
6	28	6	30.625
6	31	6	34
9	0	9	0
9	3	9	3.375
9	6	9	6.75
9	9	9	10.125
9	12	9	13.5
9	19	9	20.5
9	22	9	23.875
9	25	9	27.25
9	28	9	30.625
9	31	9	34
12	0	12	0
12	3	12	3.375
12	6	12	6.75
12	9	12	10.125
12	12	12	13.5
12	19	12	20.5
12	22	12	23.875
12	25	12	27.25
12	28	12	30.625
12	31	12	34
15	0	15	0
15	3	15	3.375
15	6	15	6.75
15	9	15	10.125
15	12	15	13.5
15	19	15	20.5
15	22	15	23.875
15	25	15	27.25
15	28	15	30.625

	Top Flange		Bottom Flange	
No. Bolts =	80.0		100.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	7.0		9.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.000	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





Flange Bolt Pattern Cont. - Node 1261

15	31	15	34
18	0	18	0
18	3	18	3.375
18	6	18	6.75
18	9	18	10.125
18	12	18	13.5
18	19	18	20.5
18	22	18	23.875
18	25	18	27.25
18	28	18	30.625
18	31	18	34
21	0	21	0
21	3	21	3.375
21	6	21	6.75
21	9	21	10.125
21	12	21	13.5
21	19	21	20.5
21	22	21	23.875
21	25	21	27.25
21	28	21	30.625
21	31	21	34
		24	0
		24	3.375
		24	6.75
		24	10.125
		24	13.5
		24	20.5
		24	23.875
		24	27.25
		24	30.625
		24	34
		27	0
		27	3.375
		27	6.75
		27	10.125
		27	13.5
		27	20.5
		27	23.875
		27	27.25
		27	30.625
		27	34

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
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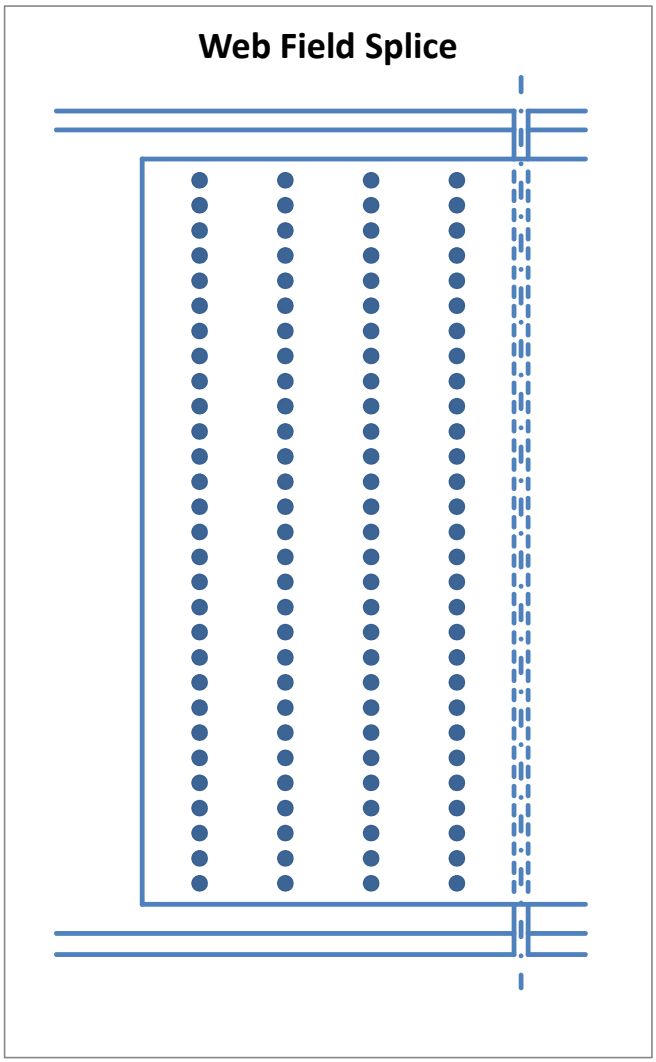
Web Bolt Pattern - Node 1261

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	1764
0	3	20.25	1521
0	6	20.25	1296
0	9	20.25	1089
0	12	20.25	900
0	15	20.25	729
0	18	20.25	576
0	21	20.25	441
0	24	20.25	324
0	27	20.25	225
0	30	20.25	144
0	33	20.25	81
0	36	20.25	36
0	39	20.25	9
0	42	20.25	0
0	45	20.25	9
0	48	20.25	36
0	51	20.25	81
0	54	20.25	144
0	57	20.25	225
0	60	20.25	324
0	63	20.25	441
0	66	20.25	576
0	69	20.25	729
0	72	20.25	900
0	75	20.25	1089
0	78	20.25	1296
0	81	20.25	1521
0	84	20.25	1764
3	0	2.25	1764
3	3	2.25	1521
3	6	2.25	1296
3	9	2.25	1089
3	12	2.25	900
3	15	2.25	729
3	18	2.25	576
3	21	2.25	441
3	24	2.25	324
3	27	2.25	225
3	30	2.25	144
3	33	2.25	81
3	36	2.25	36
3	39	2.25	9
3	42	2.25	0
3	45	2.25	9
3	48	2.25	36
3	51	2.25	81
3	54	2.25	144
3	57	2.25	225
3	60	2.25	324
3	63	2.25	441
3	66	2.25	576
3	69	2.25	729
3	72	2.25	900
3	75	2.25	1089
3	78	2.25	1296
3	81	2.25	1521
3	84	2.25	1764
6	0	2.25	1764

No. Bolts =	116.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1305	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	73080	
Σd^2 (in^2) =	74385	



6	3	2.25	1521
6	6	2.25	1296
6	9	2.25	1089
6	12	2.25	900
6	15	2.25	729
6	18	2.25	576
6	21	2.25	441
6	24	2.25	324
6	27	2.25	225
6	30	2.25	144
6	33	2.25	81
6	36	2.25	36
6	39	2.25	9
6	42	2.25	0
6	45	2.25	9
6	48	2.25	36
6	51	2.25	81
6	54	2.25	144
6	57	2.25	225
6	60	2.25	324
6	63	2.25	441
6	66	2.25	576
6	69	2.25	729
6	72	2.25	900
6	75	2.25	1089
6	78	2.25	1296
6	81	2.25	1521
6	84	2.25	1764
9	0	20.25	1764
9	3	20.25	1521
9	6	20.25	1296
9	9	20.25	1089
9	12	20.25	900
9	15	20.25	729
9	18	20.25	576
9	21	20.25	441
9	24	20.25	324
9	27	20.25	225
9	30	20.25	144
9	33	20.25	81
9	36	20.25	36
9	39	20.25	9
9	42	20.25	0
9	45	20.25	9
9	48	20.25	36
9	51	20.25	81
9	54	20.25	144
9	57	20.25	225
9	60	20.25	324
9	63	20.25	441
9	66	20.25	576
9	69	20.25	729
9	72	20.25	900
9	75	20.25	1089
9	78	20.25	1296
9	81	20.25	1521
9	84	20.25	1764

Web Bolt Pattern Cont. - Node 1261

Web Bolt Pattern Cont. - Node 1261

522	4872	1305	73080

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	Cleveland InnerBelt : Field Splice - Node 3262	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3262

Node 3262

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3262 L	94.50	50.00	4725.00	94.50	49.34	4662.29	96.00	50.00	4800.00
3262 R	81.00	50.00	4050.00	97.50	50.00	4875.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 3262 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.64	1.91	1.46	-2.19	1.85	-6.81	-10.04	7.86	-13.18	9.40	10.06	-13.17	17.64	-22.47	-12.33	17.18
ϕf Fnc (ksi)	50.00	50.00	50.00	48.85	50.00	47.93	50.00	50.00	50.00	50.00	50.00	48.88	50.00	48.89	50.00	50.00
f / ϕf Fnc	0.15	0.04	0.03	0.04	0.04	0.14	0.20	0.16	0.26	0.19	0.20	0.27	0.35	0.46	0.25	0.34
α	1.00	1.00	1.00	0.98	1.00	0.96	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-7.64			-2.19		-6.81	-10.04		-13.18			-13.17		-22.47		17.18
Fcf (ksi)	-37.50			-36.64		-35.95	-37.50		-37.50			-36.66		-36.67		37.50
Fcf (kip)	-3037.50			-3572.26		-3505.21	-3037.50		-3037.50			-3574.49		-3574.97		2912.17
fncf (ksi)		1.91	1.46		1.85			7.86		9.40	10.06		17.64		-12.33	
Rcf		4.91	16.74		5.28			3.73		2.84	2.78		1.63		2.18	
Fncf (ksi)		37.50	37.50		37.50			37.50		37.50	37.50		37.50		-37.50	
Fncf (kip)		2912.17	2343.85		2343.85			2912.17		2912.17	2343.85		2343.85		-3037.50	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.34	1.60	-3.67	-1.06	-4.36	-4.11	-6.45	5.42	-7.69	6.11	7.06	-9.22	12.63	-16.49	-8.98	12.22
Fs (ksi)	-6.34	1.60	-3.67	-1.06	-4.36	-4.11	-6.45	5.42	-7.69	6.11	7.06	-9.22	12.63	-16.49	-8.98	12.22
Fs (kip)	-513.42	156.35	-297.17	-103.54	-352.79	-400.25	-522.46	528.09	-622.82	595.48	572.11	-899.15	1022.96	-1607.81	-726.99	1191.49

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2343.85	2912.17	1022.96	1191.49
Comp	3037.50	3574.97	726.99	1607.81

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	595.22	354.92	776.02	150.32	558.05	440.84	492.51	370.54	430.76	256.80	558.50	112.24	404.50	317.50	358.19	267.84
Vuw (kip)	892.82	532.38	1075.70	225.47	837.08	661.26	738.77	555.81	---	---	---	---	---	---	---	---
Mv (k*ft)	502.21	299.46	605.08	126.83	470.86	371.96	415.56	312.64	242.30	144.45	314.15	63.14	227.53	178.60	201.48	150.66
Huw (kip)	-1349.20	-581.91	-1256.95	-391.71	-516.89	-415.78	-377.86	507.56	-227.28	-227.07	-406.11	-49.63	-75.92	-103.63	-185.34	155.77
Muw (k*ft)	3001.06	3913.86	2925.78	4277.72	4110.82	4138.29	4189.48	4123.25	508.29	166.84	16.01	759.45	882.98	1042.25	1863.65	1356.52
Mu (k*ft)	3503.28	4213.32	3530.87	4404.55	4581.68	4510.25	4605.03	4435.89	750.59	311.29	330.17	822.59	1110.51	1220.84	2065.13	1507.17

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	11.63	5.02	10.84	3.38	4.46	3.58	3.26	4.38	1.96	1.96	3.50	0.43	0.65	0.89	1.60	1.34
PY1 (Vuw)	7.70	4.59	9.27	1.94	7.22	5.70	6.37	4.79	3.71	2.21	4.81	0.97	3.49	2.74	3.09	2.31
PX2 (Mu)	23.74	28.55	23.92	29.84	31.04	30.56	31.20	30.06	5.09	2.11	2.24	5.57	7.52	8.27	13.99	10.21
PY2 (Mu)	2.54	3.06	2.56	3.20	3.33	3.27	3.34	3.22	0.54	0.23	0.24	0.60	0.81	0.89	1.50	1.09
Pu (kip)	36.82	34.42	36.72	33.62	37.03	35.30	35.80	35.35	8.23	4.74	7.65	6.20	9.24	9.86	16.25	12.05

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1161.17	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1182.68	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	1461.16	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	1451.01	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1504.82	1822.50	OK
TF Inside	1532.68	1856.25	OK
BF Inside	1793.71	2430.00	OK
BF Outside	1781.26	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.60	35.87	36.97	35.55	37.96	36.54	36.88	36.82
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1075.70
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1532.68	19.16	OK	516.17	6.45	OK
BF	1793.71	17.94	OK	806.71	8.07	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.82	18.81	1.47	103.11	OK
TF	3037.50	37.97	1.47	206.21	OK
TF Inside	1532.68	19.16	1.47	114.56	OK
BF Inside	1793.71	17.94	1.47	137.48	OK
BF	3574.97	35.75	1.47	229.13	OK
BF Outside	1781.26	17.81	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.03	18.52	OK	16.25	8.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.03	1.47	91.65	OK
Web SPL	18.52	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.35	1.35
BF Outside	1.40	1.35

Bolt	Shear	Slip	Bearing
TF	1.89	2.61	5.43
Web	1.95	2.07	2.47
BF	1.85	2.09	6.41

Plate	Shear	Flexure
Web	2.04	1.32

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 5262

Node 5262

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5262 L	94.50	50.00	4725.00	94.50	49.34	4662.89	96.00	50.00	4800.00
5262 R	81.00	50.00	4050.00	97.50	50.00	4875.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 5262 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.92	4.22	3.79	-4.77	-1.16	-4.74	-9.72	7.78	2.73	-7.48	-4.52	1.96	16.20	-20.88	-11.63	16.16
ϕf Fnc (ksi)	50.00	50.00	50.00	48.89	50.00	45.58	50.00	50.00	50.00	48.49	50.00	50.00	50.00	48.89	50.00	50.00
f / ϕf Fnc	0.20	0.08	0.08	0.10	0.02	0.10	0.19	0.16	0.05	0.15	0.09	0.04	0.32	0.43	0.23	0.32
α	1.00	1.00	1.00	0.98	1.00	0.91	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	-9.92			-4.77		-4.74	-9.72			-7.48	-4.52			-20.88		16.16
Fcf (ksi)	-37.50			-36.67		-34.19	-37.50			-36.37	-37.50			-36.66		37.50
Fcf (kip)	-3037.50			-3575.15		-3333.25	-3037.50			-3545.99	-3037.50			-3574.76		2912.17
fncf (ksi)		4.22	3.79		-1.16			7.78	2.73			1.96	16.20		-11.63	
Rcf		3.78	7.69		7.22			3.86	4.86			8.30	1.76		2.32	
Fncf (ksi)		37.50	37.50		-37.50			37.50	37.50			37.50	37.50		-37.50	
Fncf (kip)		2912.17	2343.85		-3037.50			2912.17	2343.85			2912.17	2343.85		-3037.50	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.54	3.33	-2.79	-3.08	-4.33	-2.64	-6.14	5.17	-3.93	-4.45	-5.01	1.64	11.68	-15.14	-8.50	11.40
Fs (ksi)	-6.54	3.33	-2.79	-3.08	-4.33	-2.64	-6.14	5.17	-3.93	-4.45	-5.01	1.64	11.68	-15.14	-8.50	11.40
Fs (kip)	-529.82	324.59	-226.15	-300.77	-350.46	-257.28	-497.54	503.88	-318.33	-433.88	-405.55	159.46	946.05	-1476.44	-688.66	1111.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2343.85	2912.17	946.05	1111.47
Comp	3037.50	3575.15	688.66	1476.44

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	551.98	260.86	715.66	96.44	483.52	274.09	444.66	320.89	394.79	192.47	513.79	72.94	349.78	198.46	322.32	231.52
Vuw (kip)	827.97	391.30	1045.52	144.66	725.28	411.14	666.99	481.34	---	---	---	---	---	---	---	---
Mv (k*ft)	465.74	220.10	588.11	81.37	407.97	231.27	375.18	270.75	222.07	108.26	289.01	41.03	196.75	111.63	181.31	130.23
Huw (kip)	-1034.22	-362.78	-2043.79	-359.07	-1109.00	-1021.44	-394.34	504.29	-154.17	-282.09	-334.34	-46.77	-402.24	-161.82	-166.24	139.09
Muw (k*ft)	3421.04	4209.83	1650.91	4321.24	3176.57	3438.08	4167.24	4127.61	631.69	18.74	108.03	723.86	33.28	425.11	1716.65	1273.71
Mu (k*ft)	3886.78	4429.94	2239.01	4402.61	3584.54	3669.35	4542.42	4398.37	853.76	127.00	397.04	764.89	230.04	536.74	1897.95	1403.94

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	8.92	3.13	17.62	3.10	9.56	8.81	3.40	4.35	1.33	2.43	2.88	0.40	3.47	1.40	1.43	1.20
PY1 (Vuw)	7.14	3.37	9.01	1.25	6.25	3.54	5.75	4.15	3.40	1.66	4.43	0.63	3.02	1.71	2.78	2.00
PX2 (Mu)	26.34	30.02	15.17	29.83	24.29	24.86	30.78	29.80	5.78	0.86	2.69	5.18	1.56	3.64	12.86	9.51
PY2 (Mu)	2.82	3.22	1.63	3.20	2.60	2.66	3.30	3.19	0.62	0.09	0.29	0.56	0.17	0.39	1.38	1.02
Pu (kip)	36.63	33.79	34.47	33.22	34.99	34.23	35.35	34.93	8.17	3.73	7.30	5.71	5.95	5.45	14.88	11.13

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1161.17	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1182.68	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	1461.16	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	1451.01	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1504.82	1822.50	OK
TF Inside	1532.68	1856.25	OK
BF Inside	1793.81	2430.00	OK
BF Outside	1781.35	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.56	35.47	34.65	35.24	36.03	35.86	36.58	36.52
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1045.52
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1532.68	19.16	OK	477.36	5.97	OK
BF	1793.81	17.94	OK	740.79	7.41	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.82	18.81	1.47	103.11	OK
TF	3037.50	37.97	1.47	206.21	OK
TF Inside	1532.68	19.16	1.47	114.56	OK
BF Inside	1793.81	17.94	1.47	137.48	OK
BF	3575.15	35.75	1.47	229.13	OK
BF Outside	1781.35	17.81	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
36.63	18.32	OK	14.88	7.44	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	36.63	1.47	91.65	OK
Web SPL	18.32	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.35	1.35
BF Outside	1.40	1.35

Bolt	Shear	Slip	Bearing
TF	1.89	2.82	5.43
Web	1.98	2.26	2.50
BF	1.85	2.27	6.41

Plate	Shear	Flexure
Web	2.10	1.33

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Field Splice - Node 7260

Node 7260

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7260 L	94.50	50.00	4725.00	94.50	49.50	4678.20	96.00	50.00	4800.00
7260 R	81.00	50.00	4050.00	97.50	50.00	4875.00	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 7260 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.75	3.30	1.87	-1.18	1.85	-5.18	-9.09	7.77	11.66	-13.55	-8.63	9.06	17.21	-20.23	-10.38	16.17
ϕf Fnc (ksi)	50.00	50.00	50.00	49.06	50.00	48.46	50.00	50.00	50.00	48.91	50.00	50.00	50.00	48.91	50.00	50.00
f / ϕf Fnc	0.15	0.07	0.04	0.02	0.04	0.11	0.18	0.16	0.23	0.28	0.17	0.18	0.34	0.41	0.21	0.32
α	1.00	1.00	1.00	0.98	1.00	0.97	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	-7.75		1.87			-5.18	-9.09			-13.55		9.06		-20.23		16.17
Fcf (ksi)	-37.50		37.50			-36.34	-37.50			-36.68		37.50		-36.68		37.50
Fcf (kip)	-3037.50		2343.85			-3543.41	-3037.50			-3576.55		2912.17		-3576.35		2912.17
fncf (ksi)		3.30		-1.18	1.85			7.77	11.66		-8.63		17.21		-10.38	
Rcf		4.84		20.03	7.02			4.12	2.71		4.14		1.81		2.32	
Fncf (ksi)		37.50		-36.79	37.50			37.50	37.50		-37.50		37.50		-37.50	
Fncf (kip)		2912.17		-3587.19	2343.85			2912.17	2343.85		-3037.50		2343.85		-3037.50	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.29	2.59	-2.65	-0.83	-2.67	-2.85	-5.43	5.09	8.59	-9.76	-6.40	6.33	12.51	-14.48	-7.61	11.33
Fs (ksi)	-5.29	2.59	-2.65	-0.83	-2.67	-2.85	-5.43	5.09	8.59	-9.76	-6.40	6.33	12.51	-14.48	-7.61	11.33
Fs (kip)	-428.64	252.81	-214.64	-81.00	-216.09	-277.83	-439.78	495.90	696.08	-951.78	-518.60	617.39	1013.58	-1411.43	-616.59	1104.29

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2343.85	2912.17	1013.58	1104.29
Comp	3037.50	3587.19	616.59	1411.43

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	466.60	199.57	625.43	7.83	301.68	352.53	341.89	223.73	333.22	146.14	447.02	9.09	218.28	252.63	246.69	161.62
Vuw (kip)	699.91	299.35	938.14	11.75	452.52	528.80	512.83	335.59	---	---	---	---	---	---	---	---
Mv (k*ft)	393.70	168.38	527.71	6.61	254.54	297.45	288.47	188.77	187.44	82.20	251.45	5.11	122.78	142.10	138.76	90.91
Huw (kip)	-1034.40	663.70	-1119.63	-261.07	-245.88	85.17	-262.66	644.34	-129.55	-167.07	-264.83	-16.47	-56.08	-3.37	-94.22	178.26
Muw (k*ft)	3420.80	3915.06	3159.02	4451.90	4367.52	4686.43	4344.90	3940.88	504.63	116.43	11.64	672.99	1174.75	815.02	1727.32	1212.05
Mu (k*ft)	3814.49	4083.45	3686.73	4458.51	4622.06	4983.88	4633.36	4129.66	692.06	198.63	263.08	678.10	1297.54	957.12	1866.09	1302.96

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	8.92	5.72	9.65	2.25	2.12	0.73	2.26	5.55	1.12	1.44	2.28	0.14	0.48	0.03	0.81	1.54
PY1 (Vuw)	6.03	2.58	8.09	0.10	3.90	4.56	4.42	2.89	2.87	1.26	3.85	0.08	1.88	2.18	2.13	1.39
PX2 (Mu)	25.85	27.67	24.98	30.21	31.32	33.77	31.39	27.98	4.69	1.35	1.78	4.59	8.79	6.49	12.64	8.83
PY2 (Mu)	2.77	2.96	2.68	3.24	3.36	3.62	3.36	3.00	0.50	0.14	0.19	0.49	0.94	0.69	1.35	0.95
Pu (kip)	35.86	33.85	36.27	32.63	34.22	35.46	34.55	34.05	6.72	3.12	5.73	4.77	9.70	7.12	13.90	10.63

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1161.17	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1182.68	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	1461.16	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	1451.01	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1504.82	1822.50	OK
TF Inside	1532.68	1856.25	OK
BF Inside	1799.85	2430.00	OK
BF Outside	1787.35	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.04	35.66	36.87	34.77	35.82	37.01	36.05	35.82
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	938.14
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1532.68	19.16	OK	511.44	6.39	OK
BF	1799.85	18.00	OK	708.17	7.08	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.82	18.81	1.47	103.11	OK
TF	3037.50	37.97	1.47	206.21	OK
TF Inside	1532.68	19.16	1.47	114.56	OK
BF Inside	1799.85	18.00	1.47	137.48	OK
BF	3587.19	35.87	1.47	229.13	OK
BF Outside	1787.35	17.87	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
36.27	18.13	OK	13.90	6.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	36.27	1.47	91.65	OK
Web SPL	18.13	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.35	1.35
BF Outside	1.40	1.35

Bolt	Shear	Slip	Bearing
TF	1.89	2.63	5.43
Web	2.00	2.42	2.53
BF	1.84	2.38	6.39

Plate	Shear	Flexure
Web	2.34	1.35

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 9261

Node 9261

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9261 L	94.50	50.00	4725.00	94.50	50.00	4725.00	96.00	50.00	4800.00
9261 R	81.00	50.00	4050.00	97.50	45.58	4444.34	96.00	50.00	4800.00

Rh = 1.00

Controlling Section = 9261 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.19	-2.79	0.83	3.37	1.98	-3.56	-7.21	5.83	17.75	-19.29	-6.78	10.26	20.01	-22.12	-8.40	15.83
ϕf Fnc (ksi)	50.00	45.58	50.00	50.00	50.00	48.81	50.00	50.00	50.00	48.93	50.00	50.00	50.00	48.92	50.00	50.00
f / ϕf Fnc	0.04	0.06	0.02	0.07	0.04	0.07	0.14	0.12	0.35	0.39	0.14	0.21	0.40	0.45	0.17	0.32
α	1.00	0.91	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)		-2.79		3.37		-3.56	-7.21			-19.29		10.26		-22.12		15.83
Fcf (ksi)		-34.19		37.50		-36.61	-37.50			-36.69		37.50		-36.69		37.50
Fcf (kip)		-3333.25		2912.17		-3569.27	-3037.50			-3577.72		2912.17		-3577.42		2912.17
fncf (ksi)	-2.19		0.83		1.98			5.83	17.75		-6.78		20.01		-8.40	
Rcf	12.23		11.12		10.27			5.20	1.90		3.65		1.66		2.37	
Fncf (ksi)	-37.50		37.50		37.50			37.50	37.50		-37.50		37.50		-37.50	
Fncf (kip)	-3037.50		2343.85		2343.85			2912.17	2343.85		-3037.50		2343.85		-3037.50	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.89	-1.19	-1.04	2.00	-1.27	-1.91	-3.94	3.87	12.95	-13.69	-5.03	7.12	14.54	-15.69	-6.18	11.05
Fs (ksi)	-2.89	-1.19	-1.04	2.00	-1.27	-1.91	-3.94	3.87	12.95	-13.69	-5.03	7.12	14.54	-15.69	-6.18	11.05
Fs (kip)	-234.11	-116.31	-84.60	195.34	-102.56	-185.82	-319.24	377.08	1048.57	-1334.52	-407.80	694.11	1177.95	-1529.57	-500.71	1077.67

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2343.85	2912.17	1177.95	1077.67
Comp	3037.50	3577.72	500.71	1529.57

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	162.50	75.13	386.78	130.90	162.02	139.73	185.34	39.35	117.04	55.75	275.93	90.25	117.14	100.95	133.61	30.03
Vuw (kip)	243.76	112.70	580.16	196.35	243.03	209.60	278.00	59.02	---	---	---	---	---	---	---	---
Mv (k*ft)	137.11	63.39	326.34	110.44	136.71	117.90	156.38	33.20	65.84	31.36	155.21	50.77	65.89	56.79	75.16	16.89
Huw (kip)	-2926.37	2241.29	-778.79	-346.11	-140.73	610.59	-168.14	844.37	-195.99	46.03	-152.26	-3.54	-35.62	100.05	-54.97	233.83
Muw (k*ft)	474.13	1811.61	3647.42	4338.52	4509.26	3985.89	4472.32	3674.18	108.63	195.07	40.94	499.76	1704.50	777.84	1934.75	1103.01
Mu (k*ft)	611.25	1875.00	3973.76	4448.96	4645.97	4103.78	4628.70	3707.38	174.47	226.43	196.16	550.53	1770.39	834.62	2009.91	1119.91

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9261**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.23	19.32	6.71	2.98	1.21	5.26	1.45	7.28	1.69	0.40	1.31	0.03	0.31	0.86	0.47	2.02
PY1 (Vuw)	2.10	0.97	5.00	1.69	2.10	1.81	2.40	0.51	1.01	0.48	2.38	0.78	1.01	0.87	1.15	0.26
PX2 (Mu)	4.14	12.70	26.92	30.14	31.48	27.81	31.36	25.12	1.18	1.53	1.33	3.73	12.00	5.66	13.62	7.59
PY2 (Mu)	0.44	1.36	2.88	3.23	3.37	2.98	3.36	2.69	0.13	0.16	0.14	0.40	1.29	0.61	1.46	0.81
Pu (kip)	29.48	32.11	34.55	33.49	33.15	33.41	33.31	32.56	3.09	2.04	3.65	3.94	12.51	6.68	14.33	9.66

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1161.17	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1182.68	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	1461.16	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	1451.01	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1504.82	1822.50	OK
TF Inside	1532.68	1856.25	OK
BF Inside	1795.09	2430.00	OK
BF Outside	1782.63	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.75	33.78	35.90	35.46	35.05	35.33	35.17	34.55
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	580.16
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9261**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.18

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1532.68	19.16	OK	594.38	7.43	OK
BF	1795.09	17.95	OK	767.45	7.67	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1504.82	18.81	1.47	103.11	OK
TF	3037.50	37.97	1.47	206.21	OK
TF Inside	1532.68	19.16	1.47	114.56	OK
BF Inside	1795.09	17.95	1.47	137.48	OK
BF	3577.72	35.78	1.47	229.13	OK
BF Outside	1782.63	17.83	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.55	17.28	OK	14.33	7.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.55	1.47	91.65	OK
Web SPL	17.28	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.28	1.21
TF Inside	1.23	1.21
BF Inside	1.35	1.35
BF Outside	1.40	1.35

Bolt	Shear	Slip	Bearing
TF	1.89	2.27	5.43
Web	2.09	2.35	2.65
BF	1.85	2.19	6.40

Plate	Shear	Flexure
Web	3.78	1.39

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1272	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1272

Node 1272

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1272 L	81.00	50.00	4050.00	97.50	48.98	4775.59	96.00	50.00	4800.00
1272 R	105.00	68.34	7176.06	105.00	65.93	6923.04	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 1272 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1272**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.70	-19.67	20.92	-26.38	20.43	-22.56	14.76	-16.10	35.46	-36.98	10.65	-11.69	6.18	-5.48	37.63	-40.55
ϕf Fnc (ksi)	50.00	48.98	50.00	48.89	50.00	48.92	50.00	48.93	50.00	48.94	50.00	48.92	50.00	48.97	50.00	48.93
f / ϕf Fnc	0.45	0.40	0.42	0.54	0.41	0.46	0.30	0.33	0.71	0.76	0.21	0.24	0.12	0.11	0.75	0.83
α	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
fcf (ksi)	22.70			-26.38		-22.56		-16.10		-36.98		-11.69	6.18			-40.55
Fcf (ksi)	37.50			-37.63		-36.69		-36.69		-42.96		-36.69	37.50			-44.74
Fcf (kip)	2343.85			-3669.33		-3577.44		-3577.65		-4188.65		-3577.55	2343.85			-4362.22
fncf (ksi)		-19.67	20.92		20.43		14.76		35.46		10.65			-5.48	37.63	
Rcf		1.65	1.43		1.63		2.28		1.16		3.14			6.07	1.10	
Fncf (ksi)		-36.74	37.50		37.50		37.50		41.19		37.50			-36.73	41.52	
Fncf (kip)		-3581.70	2343.85		2343.85		2343.85		2574.68		2343.85			-3581.29	2595.07	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	16.00	-13.54	14.10	-18.37	14.40	-15.58	7.02	-10.31	24.39	-25.89	6.72	-7.69	5.09	-3.91	26.55	-28.29
Fs (ksi)	16.00	-13.54	14.10	-18.37	14.40	-15.58	7.02	-10.31	24.39	-25.89	6.72	-7.69	5.09	-3.91	26.55	-28.29
Fs (kip)	1296.18	-1320.46	1141.92	-1791.04	1166.05	-1518.91	568.36	-1004.88	1975.98	-2524.01	544.58	-749.95	412.49	-381.53	2150.84	-2758.72

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2595.07	0.00	2150.84	0.00
Comp	0.00	4362.22	0.00	2758.72

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	620.53	673.41	922.71	364.28	582.71	756.38	624.61	640.69	457.19	489.13	670.69	270.73	425.05	553.17	454.65	471.43
Vuw (kip)	930.79	1010.12	1149.05	546.42	874.07	1065.88	936.91	961.03	---	---	---	---	---	---	---	---
Mv (k*ft)	523.57	568.19	646.34	307.36	491.67	599.56	527.01	540.58	257.17	275.14	377.26	152.28	239.09	311.16	255.74	265.18
Huw (kip)	239.85	-373.78	-166.31	-147.30	-84.83	-156.27	203.30	-154.62	118.03	-205.05	-56.78	-157.90	-71.64	-46.49	56.61	-83.56
Muw (k*ft)	4480.20	4318.80	4474.79	4500.41	5385.83	4488.31	4528.93	5520.65	1890.91	2077.92	1918.35	1108.68	3218.06	922.56	576.36	3510.28
Mu (k*ft)	5003.77	4887.00	5121.13	4807.77	5877.49	5087.87	5055.94	6061.23	2148.07	2353.05	2295.61	1260.97	3457.15	1233.72	832.10	3775.46

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1272**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	2.07	3.22	1.43	1.27	0.73	1.35	1.75	1.33	1.02	1.77	0.49	1.36	0.62	0.40	0.49	0.72
PY1 (Vuw)	8.02	8.71	9.91	4.71	7.54	9.19	8.08	8.28	3.94	4.22	5.78	2.33	3.66	4.77	3.92	4.06
PX2 (Mu)	33.90	33.11	34.70	32.58	39.82	34.47	34.26	41.07	14.55	15.94	15.55	8.54	23.42	8.36	5.64	25.58
PY2 (Mu)	3.63	3.55	3.72	3.49	4.27	3.69	3.67	4.40	1.56	1.71	1.67	0.92	2.51	0.90	0.60	2.74
Pu (kip)	37.81	38.35	38.62	34.82	42.24	38.07	37.88	44.26	16.51	18.68	17.69	10.42	24.82	10.43	7.62	27.17

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1285.63	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1309.44	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	0.00	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	0.00	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1822.50	OK
TF Inside	0.00	1856.25	OK
BF Inside	2188.71	2430.00	OK
BF Outside	2173.51	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.54	38.90	38.73	36.29	43.50	38.40	38.59	45.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1149.05
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1272**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1309.44	16.37	OK	1085.29	13.57	OK
BF	2188.71	21.89	OK	1384.16	13.84	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1285.63	16.07	1.47	103.11	OK
TF	2595.07	32.44	1.47	206.21	OK
TF Inside	1309.44	16.37	1.47	114.56	OK
BF Inside	2188.71	21.89	1.47	137.48	OK
BF	4362.22	43.62	1.47	229.13	OK
BF Outside	2173.51	21.74	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.26	22.13	OK	27.17	13.58	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.26	1.47	91.65	OK
Web SPL	22.13	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.15	NA
TF Inside	1.11	NA
BF Inside	NA	1.11
BF Outside	NA	1.11

Bolt	Shear	Slip	Bearing
TF	2.01	1.24	6.36
Web	1.64	1.24	2.07
BF	1.65	1.22	5.25

Plate	Shear	Flexure
Web	1.91	1.10

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3272	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3272

Node 3272

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3272 L	81.00	50.00	4050.00	97.50	48.93	4771.00	96.00	50.00	4800.00
3272 R	105.00	68.29	7170.66	105.00	65.86	6915.60	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 3272 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3272**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.55	-30.11	16.75	-23.05	21.77	-26.39	16.13	-19.71	33.54	-37.06	11.42	-15.79	7.09	-9.95	37.53	-42.18
ϕf Fnc (ksi)	50.00	48.93	50.00	48.87	50.00	48.90	50.00	48.90	50.00	48.92	50.00	48.87	50.00	48.87	50.00	48.92
f / ϕf Fnc	0.57	0.62	0.34	0.47	0.44	0.54	0.32	0.40	0.67	0.76	0.23	0.32	0.14	0.20	0.75	0.86
α	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
fcf (ksi)		-30.11		-23.05		-26.39		-19.71		-37.06		-15.79		-9.95		-42.18
Fcf (ksi)		-39.52		-36.65		-37.65		-36.67		-42.99		-36.65		-36.65		-45.55
Fcf (kip)		-3853.39		-3573.65		-3670.53		-3575.67		-4191.61		-3573.57		-3573.30		-4440.83
fncf (ksi)	28.55		16.75		21.77		16.13		33.54		11.42		7.09		37.53	
Rcf	1.31		1.59		1.43		1.86		1.16		2.32		3.68		1.08	
Fncf (ksi)	37.50		37.50		37.50		37.50		38.90		37.50		37.50		40.53	
Fncf (kip)	2343.85		2343.85		2343.85		2343.85		2431.62		2343.85		2343.85		2533.23	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.97	-20.89	6.90	-14.45	15.18	-18.27	6.77	-12.61	23.12	-25.87	6.18	-10.18	4.87	-6.65	26.31	-29.42
Fs (ksi)	19.97	-20.89	6.90	-14.45	15.18	-18.27	6.77	-12.61	23.12	-25.87	6.18	-10.18	4.87	-6.65	26.31	-29.42
Fs (kip)	1617.77	-2036.97	558.99	-1409.34	1229.51	-1780.88	548.58	-1228.99	1872.61	-2522.13	500.20	-992.34	394.10	-647.90	2131.43	-2868.10

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2533.23	0.00	2131.43	0.00
Comp	0.00	4440.83	0.00	2868.10

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	776.02	886.26	1126.88	499.80	766.79	918.32	823.64	786.60	565.96	639.70	813.85	366.66	555.29	666.49	595.46	573.43
Vuw (kip)	1075.70	1130.82	1251.13	749.70	1071.09	1146.85	1099.51	1081.00	---	---	---	---	---	---	---	---
Mv (k*ft)	605.08	636.09	703.76	421.71	602.49	645.10	618.48	608.06	318.35	359.83	457.79	206.25	312.35	374.90	334.95	322.56
Huw (kip)	-98.03	-480.51	-316.50	-320.39	-196.15	-486.75	-506.37	-240.81	-44.14	-362.58	-148.14	-279.96	-131.97	-192.13	-85.43	-148.92
Muw (k*ft)	4928.10	4050.88	4396.74	4267.03	5241.29	4042.45	4015.94	5508.92	2615.33	1366.78	2140.45	1240.16	3135.15	1046.60	736.67	3566.75
Mu (k*ft)	5533.18	4686.97	5100.50	4688.74	5843.78	4687.55	4634.42	6116.98	2933.68	1726.61	2598.24	1446.41	3447.50	1421.50	1071.62	3889.30

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.85	4.14	2.73	2.76	1.69	4.20	4.37	2.08	0.38	3.13	1.28	2.41	1.14	1.66	0.74	1.28
PY1 (Vuw)	9.27	9.75	10.79	6.46	9.23	9.89	9.48	9.32	4.88	5.51	7.02	3.16	4.79	5.75	5.13	4.94
PX2 (Mu)	37.49	31.76	34.56	31.77	39.59	31.76	31.40	41.45	19.88	11.70	17.60	9.80	23.36	9.63	7.26	26.35
PY2 (Mu)	4.02	3.40	3.70	3.40	4.24	3.40	3.36	4.44	2.13	1.25	1.89	1.05	2.50	1.03	0.78	2.82
Pu (kip)	40.57	38.23	40.00	35.91	43.43	38.33	38.00	45.65	21.44	16.30	20.87	12.92	25.56	13.17	9.94	28.71

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1254.99	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1278.23	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	0.00	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	0.00	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1822.50	OK
TF Inside	0.00	1856.25	OK
BF Inside	2228.15	2430.00	OK
BF Outside	2212.68	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.12	38.40	39.93	36.98	44.26	38.46	38.25	46.65
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1251.13
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1278.23	15.98	OK	1075.49	13.44	OK
BF	2228.15	22.28	OK	1439.05	14.39	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1254.99	15.69	1.47	103.11	OK
TF	2533.23	31.67	1.47	206.21	OK
TF Inside	1278.23	15.98	1.47	114.56	OK
BF Inside	2228.15	22.28	1.47	137.48	OK
BF	4440.83	44.41	1.47	229.13	OK
BF Outside	2212.68	22.13	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.65	22.82	OK	28.71	14.35	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.65	1.47	91.65	OK
Web SPL	22.82	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.18	NA
TF Inside	1.14	NA
BF Inside	NA	1.09
BF Outside	NA	1.09

Bolt	Shear	Slip	Bearing
TF	2.06	1.25	6.51
Web	1.59	1.17	2.01
BF	1.62	1.17	5.16

Plate	Shear	Flexure
Web	1.75	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 5271

Node 5271

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5271 L	81.00	50.00	4050.00	97.50	48.93	4770.54	96.00	50.00	4800.00
5271 R	105.00	68.29	7170.66	105.00	65.80	6909.44	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 5271 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	32.33	-34.76	10.01	-16.36	18.02	-23.43	15.21	-19.15	29.07	-32.51	10.82	-16.19	5.17	-8.84	36.14	-40.90
ϕf Fnc (ksi)	50.00	48.93	50.00	48.83	50.00	48.88	50.00	48.89	50.00	48.92	50.00	48.85	50.00	48.82	50.00	48.92
f / ϕf Fnc	0.65	0.71	0.20	0.34	0.36	0.48	0.30	0.39	0.58	0.66	0.22	0.33	0.10	0.18	0.72	0.84
α	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
fcf (ksi)		-34.76		-16.36		-23.43		-19.15		-32.51		-16.19		-8.84		-40.90
Fcf (ksi)		-41.85		-36.62		-36.66		-36.67		-40.71		-36.64		-36.62		-44.91
Fcf (kip)		-4079.99		-3570.78		-3574.61		-3575.16		-3969.54		-3572.24		-3570.06		-4378.38
fncf (ksi)	32.33		10.01		18.02		15.21		29.07		10.82		5.17		36.14	
Rcf	1.20		2.24		1.56		1.91		1.25		2.26		4.14		1.10	
Fncf (ksi)	38.91		37.50		37.50		37.50		37.50		37.50		37.50		39.68	
Fncf (kip)	2432.22		2343.85		2343.85		2343.85		2343.85		2343.85		2343.85		2480.26	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.41	-24.12	4.48	-10.19	12.33	-16.18	5.73	-12.07	20.10	-22.52	4.90	-10.21	3.46	-5.71	25.14	-28.52
Fs (ksi)	22.41	-24.12	4.48	-10.19	12.33	-16.18	5.73	-12.07	20.10	-22.52	4.90	-10.21	3.46	-5.71	25.14	-28.52
Fs (kip)	1815.05	-2351.45	362.58	-993.76	999.06	-1577.09	463.73	-1176.89	1628.41	-2196.03	396.86	-995.86	280.59	-556.77	2035.95	-2780.28

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2480.26	0.00	2035.95	0.00
Comp	0.00	4378.38	0.00	2780.28

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	722.05	764.62	1060.51	435.65	717.22	810.16	764.84	732.10	523.10	555.84	764.89	320.75	519.68	588.01	553.33	532.86
Vuw (kip)	1048.72	1070.00	1217.95	653.47	1046.30	1092.77	1070.11	1053.74	---	---	---	---	---	---	---	---
Mv (k*ft)	589.91	601.88	685.10	367.58	588.54	614.68	601.94	592.73	294.24	312.66	430.25	180.42	292.32	330.76	311.25	299.73
Huw (kip)	-140.74	-682.74	-406.32	-362.02	-206.86	-583.47	-729.25	-250.75	-82.05	-274.37	-184.38	-304.59	-116.14	-255.09	-107.82	-162.26
Muw (k*ft)	5168.64	3777.47	4151.07	4210.86	4935.48	3911.75	3714.52	5413.69	2977.63	938.79	1824.60	1138.93	2728.14	967.26	587.17	3433.66
Mu (k*ft)	5758.55	4379.35	4836.16	4578.44	5524.03	4526.43	4316.46	6006.42	3271.88	1251.45	2254.85	1319.35	3020.46	1298.02	898.42	3733.39

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.21	5.89	3.50	3.12	1.78	5.03	6.29	2.16	0.71	2.37	1.59	2.63	1.00	2.20	0.93	1.40
PY1 (Vuw)	9.04	9.22	10.50	5.63	9.02	9.42	9.23	9.08	4.51	4.79	6.59	2.77	4.48	5.07	4.77	4.59
PX2 (Mu)	39.02	29.67	32.77	31.02	37.43	30.67	29.25	40.70	22.17	8.48	15.28	8.94	20.47	8.79	6.09	25.30
PY2 (Mu)	4.18	3.18	3.51	3.32	4.01	3.29	3.13	4.36	2.38	0.91	1.64	0.96	2.19	0.94	0.65	2.71
Pu (kip)	42.35	37.66	38.88	35.30	41.32	37.89	37.62	44.92	23.89	12.25	18.77	12.15	22.48	12.53	8.87	27.68

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1228.75	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1251.51	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	0.00	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	0.00	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1822.50	OK
TF Inside	0.00	1856.25	OK
BF Inside	2196.82	2430.00	OK
BF Outside	2181.56	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.14	37.98	38.82	36.55	42.03	38.16	37.94	45.93
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1217.95
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1251.51	15.64	OK	1027.32	12.84	OK
BF	2196.82	21.97	OK	1394.98	13.95	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1228.75	15.36	1.47	103.11	OK
TF	2480.26	31.00	1.47	206.21	OK
TF Inside	1251.51	15.64	1.47	114.56	OK
BF Inside	2196.82	21.97	1.47	137.48	OK
BF	4378.38	43.78	1.47	229.13	OK
BF Outside	2181.56	21.82	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.92	22.46	OK	27.68	13.84	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.92	1.47	91.65	OK
Web SPL	22.46	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.21	NA
TF Inside	1.16	NA
BF Inside	NA	1.11
BF Outside	NA	1.11

Bolt	Shear	Slip	Bearing
TF	2.10	1.31	6.65
Web	1.61	1.22	2.04
BF	1.65	1.21	5.23

Plate	Shear	Flexure
Web	1.80	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7269	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7269

Node 7269

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7269 L	81.00	50.00	4050.00	97.50	48.94	4771.45	96.00	50.00	4800.00
7269 R	105.00	68.29	7170.66	105.00	65.85	6914.10	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 7269 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 7269**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	28.01	-28.97	13.15	-18.76	18.00	-22.39	15.81	-18.58	19.36	-23.37	25.37	-28.06	5.28	-7.76	36.21	-40.09
ϕf Fnc (ksi)	50.00	48.94	50.00	48.86	50.00	48.89	50.00	48.91	50.00	48.90	50.00	48.92	50.00	48.86	50.00	48.92
f / ϕf Fnc	0.56	0.59	0.26	0.38	0.36	0.46	0.32	0.38	0.39	0.48	0.51	0.57	0.11	0.16	0.72	0.82
α	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
fcf (ksi)		-28.97		-18.76		-22.39		-18.58		-23.37		-28.06		-7.76		-40.09
Fcf (ksi)		-38.95		-36.65		-36.67		-36.68		-36.68		-38.49		-36.64		-44.51
Fcf (kip)		-3797.77		-3573.03		-3575.37		-3576.36		-3575.89		-3752.81		-3572.53		-4339.52
fncf (ksi)	28.01		13.15		18.00		15.81		19.36		25.37		5.28		36.21	
Rcf	1.34		1.95		1.64		1.97		1.57		1.37		4.72		1.11	
Fncf (ksi)	37.67		37.50		37.50		37.50		37.50		37.50		37.50		40.19	
Fncf (kip)	2354.32		2343.85		2343.85		2343.85		2343.85		2343.85		2343.85		2512.24	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	19.59	-19.95	4.96	-11.64	12.24	-15.53	6.04	-11.70	13.48	-16.00	17.45	-19.54	3.50	-5.14	25.38	-27.82
Fs (ksi)	19.59	-19.95	4.96	-11.64	12.24	-15.53	6.04	-11.70	13.48	-16.00	17.45	-19.54	3.50	-5.14	25.38	-27.82
Fs (kip)	1586.78	-1945.43	401.77	-1135.26	991.74	-1514.12	489.47	-1140.60	1092.02	-1560.18	1413.29	-1904.70	283.67	-501.12	2055.93	-2712.07

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2512.24	0.00	2055.93	0.00
Comp	0.00	4339.52	0.00	2712.07

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	766.02	880.57	1100.53	452.51	894.35	780.00	823.40	758.96	555.01	638.57	793.98	333.51	645.68	567.52	598.18	550.02
Vuw (kip)	1070.70	1127.98	1237.96	678.77	1134.87	1077.70	1099.39	1067.17	---	---	---	---	---	---	---	---
Mv (k*ft)	602.27	634.49	696.35	381.81	638.36	606.20	618.41	600.29	312.19	359.19	446.61	187.60	363.19	319.23	336.48	309.39
Huw (kip)	-61.63	-526.51	-345.08	-262.41	-301.85	-177.34	-562.44	-207.06	-17.44	-320.81	-157.71	-271.47	-120.96	-100.19	-78.60	-116.84
Muw (k*ft)	4903.62	3988.74	4233.71	4345.24	4292.04	4690.32	3940.18	5420.93	2530.75	1062.65	1777.48	1135.44	1886.95	2366.93	553.08	3404.67
Mu (k*ft)	5505.88	4623.22	4930.06	4727.04	4930.40	5296.52	4558.59	6021.21	2842.94	1421.84	2224.09	1323.04	2250.14	2686.16	889.55	3714.06

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.53	4.54	2.97	2.26	2.60	1.53	4.85	1.79	0.15	2.77	1.36	2.34	1.04	0.86	0.68	1.01
PY1 (Vuw)	9.23	9.72	10.67	5.85	9.78	9.29	9.48	9.20	4.78	5.50	6.84	2.88	5.57	4.89	5.16	4.74
PX2 (Mu)	37.31	31.32	33.40	32.03	33.41	35.89	30.89	40.80	19.26	9.63	15.07	8.96	15.25	18.20	6.03	25.16
PY2 (Mu)	4.00	3.36	3.58	3.43	3.58	3.85	3.31	4.37	2.06	1.03	1.61	0.96	1.63	1.95	0.65	2.70
Pu (kip)	40.08	38.17	39.07	35.52	38.41	39.65	37.95	44.69	20.59	14.02	18.48	11.94	17.81	20.25	8.87	27.21

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1244.59	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1267.64	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	0.00	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	0.00	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1822.50	OK
TF Inside	0.00	1856.25	OK
BF Inside	2177.32	2430.00	OK
BF Outside	2162.20	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.59	38.35	38.95	36.73	38.57	40.11	38.20	45.65
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1237.96
Rr (kip)	2193.67
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1267.64	15.85	OK	1037.40	12.97	OK
BF	2177.32	21.77	OK	1360.76	13.61	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1244.59	15.56	1.47	103.11	OK
TF	2512.24	31.40	1.47	206.21	OK
TF Inside	1267.64	15.85	1.47	114.56	OK
BF Inside	2177.32	21.77	1.47	137.48	OK
BF	4339.52	43.40	1.47	229.13	OK
BF Outside	2162.20	21.62	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.69	22.35	OK	27.21	13.60	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.69	1.47	91.65	OK
Web SPL	22.35	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.19	NA
TF Inside	1.15	NA
BF Inside	NA	1.12
BF Outside	NA	1.12

Bolt	Shear	Slip	Bearing
TF	2.08	1.30	6.57
Web	1.62	1.24	2.05
BF	1.66	1.24	5.28

Plate	Shear	Flexure
Web	1.77	1.10

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Field Splice - Node 9269

Node 9269

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	116
BF	100

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9269 L	81.00	50.00	4050.00	97.50	48.99	4776.05	96.00	50.00	4800.00
9269 R	105.00	68.34	7176.06	105.00	65.93	6922.76	120.00	50.00	6000.00

Rh = 1.00

Controlling Section = 9269 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	62.50	50	65
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	39.00	2.50	---	97.50	70.94	77.66	50	65
Splice Plates	TF Outside	36.00	1.125	50.50	40.50	28.55	---	50	65
	TF Inside	16.50	1.250	50.50	41.25	27.97	---	50	65
	BF Inside	18.00	1.500	62.50	54.00	38.06	---	50	65
	BF Outside	39.00	1.375	62.50	53.63	39.02	---	50	65
	Web	89.00	0.625	26.50	111.25	72.73	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.34	-18.99	21.66	-27.41	19.29	-21.59	17.01	-18.03	12.98	-15.80	29.44	-29.28	6.34	-5.30	37.44	-40.84
ϕf Fnc (ksi)	50.00	48.99	50.00	48.89	50.00	48.92	50.00	48.93	50.00	48.90	50.00	48.95	50.00	48.99	50.00	48.93
f / ϕf Fnc	0.45	0.39	0.43	0.56	0.39	0.44	0.34	0.37	0.26	0.32	0.59	0.60	0.13	0.11	0.75	0.83
α	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98
fcf (ksi)	22.34			-27.41		-21.59		-18.03		-15.80		-29.28	6.34			-40.84
Fcf (ksi)	37.50			-38.15		-36.69		-36.70		-36.67		-39.11	37.50			-44.88
Fcf (kip)	2343.85			-3719.70		-3577.21		-3578.16		-3575.74		-3813.39	2343.85			-4375.85
fncf (ksi)		-18.99	21.66		19.29		17.01		12.98		29.44			-5.30	37.44	
Rcf		1.68	1.39		1.70		2.04		2.32		1.34			5.91	1.10	
Fncf (ksi)		-36.74	37.50		37.50		37.50		37.50		39.33			-36.74	41.15	
Fncf (kip)		-3582.04	2343.85		2343.85		2343.85		2343.85		2458.25			-3582.32	2571.99	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	15.75	-12.94	14.79	-19.13	13.60	-14.78	7.53	-11.58	6.23	-9.85	20.28	-20.45	4.76	-3.82	26.42	-28.38
Fs (ksi)	15.75	-12.94	14.79	-19.13	13.60	-14.78	7.53	-11.58	6.23	-9.85	20.28	-20.45	4.76	-3.82	26.42	-28.38
Fs (kip)	1276.00	-1262.10	1197.68	-1865.42	1101.38	-1441.00	609.76	-1129.20	504.29	-960.26	1642.99	-1993.84	385.91	-372.26	2140.14	-2767.06

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	2571.99	0.00	2140.14	0.00
Comp	0.00	4375.85	0.00	2767.06

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	514.46	596.16	805.33	273.90	609.04	465.30	537.06	554.11	377.46	435.12	582.96	207.43	444.28	342.66	393.36	405.47
Vuw (kip)	771.69	894.24	1090.36	410.84	913.55	697.95	805.59	831.16	---	---	---	---	---	---	---	---
Mv (k*ft)	434.08	503.01	613.33	231.10	513.87	392.60	453.14	467.53	212.32	244.75	327.91	116.68	249.90	192.75	221.27	228.08
Huw (kip)	270.14	-384.35	-187.27	-99.61	-314.97	10.50	294.15	-179.06	134.81	-208.62	-56.75	-194.57	-173.90	-7.96	45.42	-94.01
Muw (k*ft)	4439.81	4370.83	4446.54	4564.66	4274.34	5020.29	4407.79	5505.95	1836.66	2170.79	1816.11	1223.00	1028.78	2606.94	549.27	3507.30
Mu (k*ft)	4873.89	4873.84	5059.86	4795.76	4788.21	5412.88	4860.94	5973.48	2048.98	2415.54	2144.03	1339.68	1278.68	2799.69	770.54	3735.38

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	2.33	3.31	1.61	0.86	2.72	0.09	2.54	1.54	1.16	1.80	0.49	1.68	1.50	0.07	0.39	0.81
PY1 (Vuw)	6.65	7.71	9.40	3.54	7.88	6.02	6.94	7.17	3.25	3.75	5.03	1.79	3.83	2.95	3.39	3.50
PX2 (Mu)	33.02	33.02	34.28	32.49	32.44	36.68	32.94	40.47	13.88	16.37	14.53	9.08	8.66	18.97	5.22	25.31
PY2 (Mu)	3.54	3.54	3.67	3.48	3.48	3.93	3.53	4.34	1.49	1.75	1.56	0.97	0.93	2.03	0.56	2.71
Pu (kip)	36.79	38.04	38.20	34.08	36.95	38.09	36.99	43.56	15.77	18.98	16.40	11.10	11.22	19.68	6.86	26.85

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1274.20	1923.75	1484.44	51.75	33.82	24.12	2274.11	1484.44	OK
TF Inside	1297.79	1959.38	1454.38	115.00	75.16	19.38	3274.21	1454.38	OK
BF Inside	0.00	2565.00	1979.25	174.00	113.44	27.75	4864.28	1979.25	OK
BF Outside	0.00	2547.19	2028.81	79.75	51.99	33.60	3315.37	2028.81	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	1822.50	OK
TF Inside	0.00	1856.25	OK
BF Inside	2195.55	2430.00	OK
BF Outside	2180.30	2413.13	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.87	38.90	38.48	35.77	37.65	39.46	37.99	45.05
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 1650.2

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1090.36
Rr (kip)	2193.67
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9269**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.25	0.91	1.0	32.90
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1297.79	16.22	OK	1079.89	13.50	OK
BF	2195.55	21.96	OK	1388.35	13.88	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1274.20	15.93	1.47	103.11	OK
TF	2571.99	32.15	1.47	206.21	OK
TF Inside	1297.79	16.22	1.47	114.56	OK
BF Inside	2195.55	21.96	1.47	137.48	OK
BF	4375.85	43.76	1.47	229.13	OK
BF Outside	2180.30	21.80	1.47	126.02	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.56	21.78	OK	26.85	13.42	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.56	1.47	91.65	OK
Web SPL	21.78	1.47	57.28	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.17	NA
TF Inside	1.12	NA
BF Inside	NA	1.11
BF Outside	NA	1.11

Bolt	Shear	Slip	Bearing
TF	2.03	1.25	6.41
Web	1.66	1.25	2.10
BF	1.65	1.21	5.24

Plate	Shear	Flexure
Web	2.01	1.11

Field Splice

Type N

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1280	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type N

Field Splice - Node 1280

Node 1280

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1280 L	144.00	68.64	9884.03	144.00	67.75	9756.54	144.00	50.00	7200.00
1280 R	135.00	68.96	9308.95	135.00	67.77	9149.58	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 1280 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1280**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	30.31	-9.07	38.65	-6.34	36.98	-10.63	28.57	6.11	29.08	4.17	39.69	-11.71	42.31	-14.21	26.00	8.58
ϕf Fnc (ksi)	68.96	67.77	68.96	67.87	68.96	67.78	68.96	68.96	68.96	68.96	68.96	67.78	68.96	67.75	68.96	68.96
f / ϕf Fnc	0.44	0.13	0.56	0.09	0.54	0.16	0.41	0.09	0.42	0.06	0.58	0.17	0.61	0.21	0.38	0.12
α	0.99	0.97	0.99	0.97	0.99	0.97	0.99	0.99	0.99	0.99	0.99	0.97	0.99	0.97	0.99	0.99
fcf (ksi)	30.31		38.65		36.98		28.57		29.08		39.69		42.31		26.00	
Fcf (ksi)	51.72		54.10		53.25		51.72		51.72		54.62		55.95		51.72	
Fcf (kip)	5116.42		5351.85		5267.73		5116.42		5116.42		5404.11		5535.61		5116.42	
fncf (ksi)		-9.07		-6.34		-10.63		6.11		4.17		-11.71		-14.21		8.58
Rcf		1.71		1.40		1.44		1.81		1.78		1.38		1.32		1.99
Fncf (ksi)		-50.83		-50.90		-50.84		51.72		51.72		-50.83		-50.82		51.72
Fncf (kip)		-6862.18		-6871.38		-6862.91		5116.42		5116.42		-6862.45		-6860.04		5116.42

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.81	-6.57	26.37	-5.26	25.26	-7.72	21.32	3.59	21.63	2.44	26.54	-8.80	31.15	-10.19	20.44	5.37
Fs (ksi)	21.81	-6.57	26.37	-5.26	25.26	-7.72	21.32	3.59	21.63	2.44	26.54	-8.80	31.15	-10.19	20.44	5.37
Fs (kip)	2943.70	-887.34	3559.58	-710.05	3409.73	-1042.66	2878.40	484.95	2919.86	329.09	3583.17	-1187.97	4205.51	-1375.71	2759.98	724.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5535.61	5116.42	4205.51	724.47
Comp	0.00	6871.38	0.00	1375.71

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	626.45	607.68	914.84	371.50	437.82	702.63	758.03	487.23	459.56	446.53	663.54	279.43	326.51	513.39	552.75	361.20
Vuw (kip)	939.68	911.52	1145.11	557.25	656.72	1039.01	1066.71	730.85	---	---	---	---	---	---	---	---
Mv (k*ft)	646.03	626.67	787.26	383.11	451.50	714.32	733.36	502.46	315.95	306.99	456.18	192.11	224.48	352.95	380.02	248.33
Huw (kip)	1702.23	2132.02	1783.15	2976.63	2801.01	1809.27	1743.82	3264.34	731.15	1013.17	841.63	1195.86	1155.18	851.62	1006.15	1238.92
Muw (k*ft)	4251.24	3978.25	4336.20	2552.05	2786.21	4475.18	4730.06	2168.44	1816.20	2024.12	2110.76	1134.67	1228.21	2261.87	2645.91	964.99
Mu (k*ft)	4897.27	4604.92	5123.47	2935.16	3237.71	5189.50	5463.42	2670.90	2132.15	2331.11	2566.95	1326.78	1452.69	2614.83	3025.93	1213.31

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1280**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	11.74	14.70	12.30	20.53	19.32	12.48	12.03	22.51	5.04	6.99	5.80	8.25	7.97	5.87	6.94	8.54
PY1 (Vuw)	6.48	6.29	7.90	3.84	4.53	7.17	7.36	5.04	3.17	3.08	4.58	1.93	2.25	3.54	3.81	2.49
PX2 (Mu)	26.27	24.70	27.48	15.74	17.37	27.84	29.31	14.33	11.44	12.50	13.77	7.12	7.79	14.03	16.23	6.51
PY2 (Mu)	3.75	3.53	3.93	2.25	2.48	3.98	4.19	2.05	1.63	1.79	1.97	1.02	1.11	2.00	2.32	0.93
Pu (kip)	39.36	40.61	41.50	36.78	37.35	41.83	42.91	37.51	17.16	20.09	20.64	15.64	16.11	20.66	23.97	15.44

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2760.73	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2774.89	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.87	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.55	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	3480.90	3638.25	OK
BF Outside	3390.48	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.37	37.61	38.06	34.36	34.80	38.57	39.57	34.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1145.11
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1280**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2774.89	16.52	OK	2108.13	12.55	OK
BF	3480.90	26.37	OK	696.91	5.28	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2760.73	16.43	1.47	194.76	OK
TF	5535.61	32.95	1.47	359.55	OK
TF Inside	2774.89	16.52	1.47	209.74	OK
BF Inside	3480.90	26.37	1.47	164.79	OK
BF	6871.38	52.06	1.47	359.55	OK
BF Outside	3390.48	25.69	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.91	21.46	OK	23.97	11.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.91	1.47	91.65	OK
Web SPL	21.46	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.25	NA
BF Inside	1.06	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.19	1.34	10.91
Web	1.42	1.40	2.14
BF	1.37	3.19	5.83

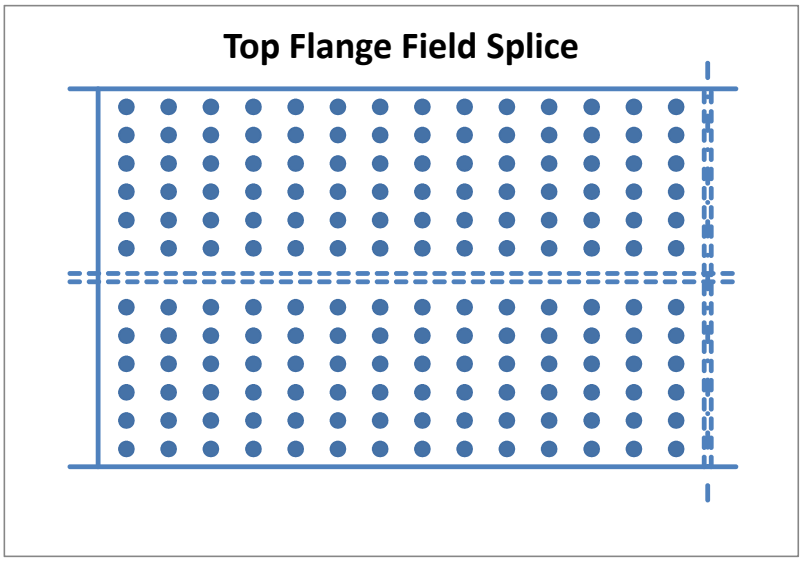
Plate	Shear	Flexure
Web	2.68	1.26

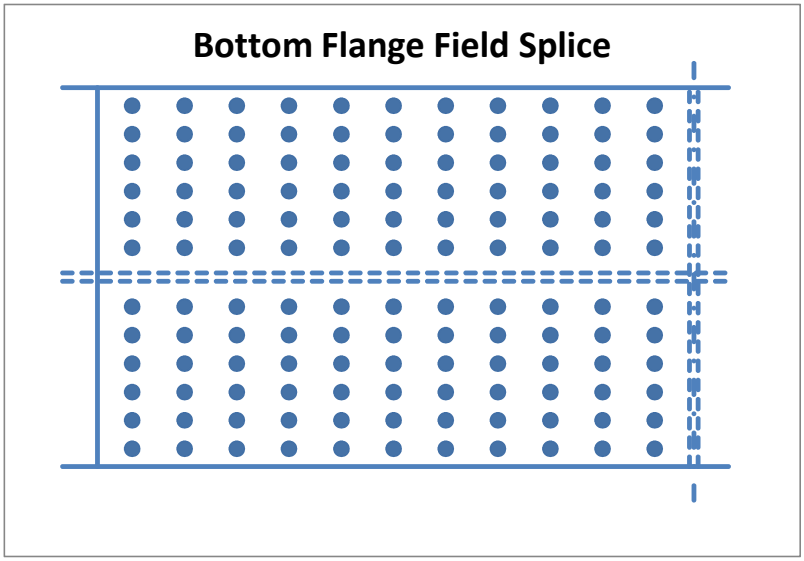
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1280	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1280

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3.375
0	6.75	0	6.75
0	10.125	0	10.125
0	13.5	0	13.5
0	16.875	0	16.875
0	23.875	0	23.875
0	27.25	0	27.25
0	30.625	0	30.625
0	34	0	34
0	37.375	0	37.375
0	40.75	0	40.75
3	0	3	0
3	3.375	3	3.375
3	6.75	3	6.75
3	10.125	3	10.125
3	13.5	3	13.5
3	16.875	3	16.875
3	23.875	3	23.875
3	27.25	3	27.25
3	30.625	3	30.625
3	34	3	34
3	37.375	3	37.375
3	40.75	3	40.75
6	0	6	0
6	3.375	6	3.375
6	6.75	6	6.75
6	10.125	6	10.125
6	13.5	6	13.5
6	16.875	6	16.875
6	23.875	6	23.875
6	27.25	6	27.25
6	30.625	6	30.625
6	34	6	34
6	37.375	6	37.375
6	40.75	6	40.75
9	0	9	0
9	3.375	9	3.375
9	6.75	9	6.75
9	10.125	9	10.125
9	13.5	9	13.5
9	16.875	9	16.875
9	23.875	9	23.875
9	27.25	9	27.25
9	30.625	9	30.625
9	34	9	34
9	37.375	9	37.375
9	40.75	9	40.75
12	0	12	0
12	3.375	12	3.375
12	6.75	12	6.75
12	10.125	12	10.125
12	13.5	12	13.5
12	16.875	12	16.875
12	23.875	12	23.875
12	27.25	12	27.25
12	30.625	12	30.625
12	34	12	34
12	37.375	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	168.0		132.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	13.0		10.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	40.75	12	40.75
15	0	15	0
15	3.375	15	3.375
15	6.75	15	6.75
15	10.125	15	10.125
15	13.5	15	13.5
15	16.875	15	16.875
15	23.875	15	23.875
15	27.25	15	27.25
15	30.625	15	30.625
15	34	15	34
15	37.375	15	37.375
15	40.75	15	40.75
18	0	18	0
18	3.375	18	3.375
18	6.75	18	6.75
18	10.125	18	10.125
18	13.5	18	13.5
18	16.875	18	16.875
18	23.875	18	23.875
18	27.25	18	27.25
18	30.625	18	30.625
18	34	18	34
18	37.375	18	37.375
18	40.75	18	40.75
21	0	21	0
21	3.375	21	3.375
21	6.75	21	6.75
21	10.125	21	10.125
21	13.5	21	13.5
21	16.875	21	16.875
21	23.875	21	23.875
21	27.25	21	27.25
21	30.625	21	30.625
21	34	21	34
21	37.375	21	37.375
21	40.75	21	40.75
24	0	24	0
24	3.375	24	3.375
24	6.75	24	6.75
24	10.125	24	10.125
24	13.5	24	13.5
24	16.875	24	16.875
24	23.875	24	23.875
24	27.25	24	27.25
24	30.625	24	30.625
24	34	24	34
24	37.375	24	37.375
24	40.75	24	40.75
27	0	27	0
27	3.375	27	3.375
27	6.75	27	6.75
27	10.125	27	10.125
27	13.5	27	13.5
27	16.875	27	16.875
27	23.875	27	23.875
27	27.25	27	27.25
27	30.625	27	30.625
27	34	27	34
27	37.375	27	37.375
27	40.75	27	40.75
30	0	30	0
30	3.375	30	3.375
30	6.75	30	6.75
30	10.125	30	10.125
30	13.5	30	13.5

Flange Bolt Pattern Cont. - Node 1280

30	16.875	30	16.875
30	23.875	30	23.875
30	27.25	30	27.25
30	30.625	30	30.625
30	34	30	34
30	37.375	30	37.375
30	40.75	30	40.75
33	0		
33	3.375		
33	6.75		
33	10.125		
33	13.5		
33	16.875		
33	23.875		
33	27.25		
33	30.625		
33	34		
33	37.375		
33	40.75		
36	0		
36	3.375		
36	6.75		
36	10.125		
36	13.5		
36	16.875		
36	23.875		
36	27.25		
36	30.625		
36	34		
36	37.375		
36	40.75		
39	0		
39	3.375		
39	6.75		
39	10.125		
39	13.5		
39	16.875		
39	23.875		
39	27.25		
39	30.625		
39	34		
39	37.375		
39	40.75		

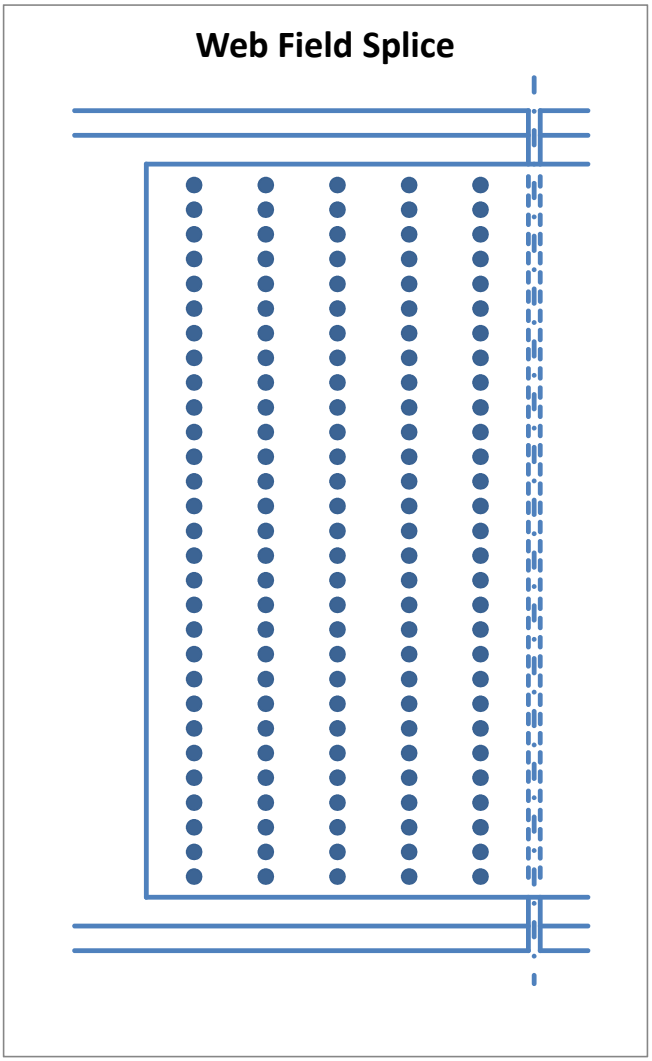
Flange Bolt Pattern Cont. - Node 1280

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1280	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1280

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	1764
0	3	36	1521
0	6	36	1296
0	9	36	1089
0	12	36	900
0	15	36	729
0	18	36	576
0	21	36	441
0	24	36	324
0	27	36	225
0	30	36	144
0	33	36	81
0	36	36	36
0	39	36	9
0	42	36	0
0	45	36	9
0	48	36	36
0	51	36	81
0	54	36	144
0	57	36	225
0	60	36	324
0	63	36	441
0	66	36	576
0	69	36	729
0	72	36	900
0	75	36	1089
0	78	36	1296
0	81	36	1521
0	84	36	1764
3	0	9	1764
3	3	9	1521
3	6	9	1296
3	9	9	1089
3	12	9	900
3	15	9	729
3	18	9	576
3	21	9	441
3	24	9	324
3	27	9	225
3	30	9	144
3	33	9	81
3	36	9	36
3	39	9	9
3	42	9	0
3	45	9	9
3	48	9	36
3	51	9	81
3	54	9	144
3	57	9	225
3	60	9	324
3	63	9	441
3	66	9	576
3	69	9	729
3	72	9	900
3	75	9	1089
3	78	9	1296
3	81	9	1521
3	84	9	1764
6	0	0	1764

No. Bolts =	145.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	28.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	42	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2610	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	91350	
Σd^2 (in^2) =	93960	



Web Bolt Pattern Cont. - Node 1280

6	3	0	1521
6	6	0	1296
6	9	0	1089
6	12	0	900
6	15	0	729
6	18	0	576
6	21	0	441
6	24	0	324
6	27	0	225
6	30	0	144
6	33	0	81
6	36	0	36
6	39	0	9
6	42	0	0
6	45	0	9
6	48	0	36
6	51	0	81
6	54	0	144
6	57	0	225
6	60	0	324
6	63	0	441
6	66	0	576
6	69	0	729
6	72	0	900
6	75	0	1089
6	78	0	1296
6	81	0	1521
6	84	0	1764
9	0	9	1764
9	3	9	1521
9	6	9	1296
9	9	9	1089
9	12	9	900
9	15	9	729
9	18	9	576
9	21	9	441
9	24	9	324
9	27	9	225
9	30	9	144
9	33	9	81
9	36	9	36
9	39	9	9
9	42	9	0
9	45	9	9
9	48	9	36
9	51	9	81
9	54	9	144
9	57	9	225
9	60	9	324
9	63	9	441
9	66	9	576
9	69	9	729
9	72	9	900
9	75	9	1089
9	78	9	1296
9	81	9	1521
9	84	9	1764
12	0	36	1764
12	3	36	1521
12	6	36	1296
12	9	36	1089
12	12	36	900
12	15	36	729
12	18	36	576
12	21	36	441
12	24	36	324

12	27	36	225
12	30	36	144
12	33	36	81
12	36	36	36
12	39	36	9
12	42	36	0
12	45	36	9
12	48	36	36
12	51	36	81
12	54	36	144
12	57	36	225
12	60	36	324
12	63	36	441
12	66	36	576
12	69	36	729
12	72	36	900
12	75	36	1089
12	78	36	1296
12	81	36	1521
12	84	36	1764
870	6090	2610	91350

Web Bolt Pattern Cont. - Node 1280

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3281	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3281

Node 3281

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3281 L	144.00	68.63	9883.19	144.00	67.75	9755.74	144.00	50.00	7200.00
3281 R	135.00	68.95	9308.28	135.00	67.95	9173.00	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 3281 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3281**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	29.86	-1.76	40.09	1.46	37.55	-3.67	30.53	7.91	39.58	-4.19	37.25	-3.39	42.37	-6.68	26.17	7.56
ϕf Fnc (ksi)	68.95	67.95	68.95	68.95	68.95	67.91	68.95	68.95	68.95	67.91	68.95	67.92	68.95	67.87	68.95	68.95
f / ϕf Fnc	0.43	0.03	0.58	0.02	0.54	0.05	0.44	0.11	0.57	0.06	0.54	0.05	0.61	0.10	0.38	0.11
α	0.99	0.97	0.99	0.99	0.99	0.97	0.99	0.99	0.99	0.97	0.99	0.97	0.99	0.97	0.99	0.99
fcf (ksi)	29.86		40.09		37.55		30.53		39.58		37.25		42.37		26.17	
Fcf (ksi)	51.71		54.83		53.53		51.71		54.57		53.38		55.98		51.71	
Fcf (kip)	5116.05		5423.99		5296.24		5116.05		5398.33		5281.41		5538.62		5116.05	
fncf (ksi)		-1.76		1.46		-3.67		7.91		-4.19		-3.39		-6.68		7.56
Rcf		1.73		1.37		1.43		1.69		1.38		1.43		1.32		1.98
Fncf (ksi)		-50.96		51.71		-50.94		51.71		-50.93		-50.94		-50.90		51.71
Fncf (kip)		-6879.75		5116.05		-6876.29		5116.05		-6875.58		-6876.87		-6871.39		5116.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.62	-1.36	27.03	-1.78	25.33	-2.93	22.83	4.71	27.39	-3.54	25.69	-2.83	31.12	-4.86	20.60	4.58
Fs (ksi)	21.62	-1.36	27.03	-1.78	25.33	-2.93	22.83	4.71	27.39	-3.54	25.69	-2.83	31.12	-4.86	20.60	4.58
Fs (kip)	2919.31	-182.96	3649.22	-240.12	3419.25	-395.01	3081.76	635.40	3698.04	-478.31	3468.57	-382.50	4200.84	-655.49	2780.85	618.60

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5538.62	5116.05	4200.84	635.40
Comp	0.00	6879.75	0.00	655.49

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	639.26	676.80	984.51	418.82	650.08	653.71	795.99	521.51	466.24	493.28	710.68	310.49	474.40	476.45	577.49	383.05
Vuw (kip)	958.88	1015.19	1179.95	628.22	975.12	980.57	1085.69	782.27	---	---	---	---	---	---	---	---
Mv (k*ft)	659.23	697.95	811.21	431.90	670.39	674.14	746.41	537.81	320.54	339.13	488.59	213.46	326.15	327.56	397.02	263.34
Huw (kip)	2298.34	2688.18	2280.15	3087.81	2302.30	2290.81	2223.27	3162.32	972.93	1212.12	1075.28	1321.65	1144.79	1097.27	1260.57	1208.69
Muw (k*ft)	3455.50	3328.15	3709.38	2402.88	3809.95	3676.27	4094.11	2303.53	1470.70	1843.84	1808.24	1159.76	1979.90	1825.69	2302.26	1025.06
Mu (k*ft)	4114.73	4026.09	4520.59	2834.78	4480.34	4350.41	4840.52	2841.34	1791.24	2182.96	2296.84	1373.22	2306.05	2153.25	2699.28	1288.41

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3281**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.85	18.54	15.73	21.30	15.88	15.80	15.33	21.81	6.71	8.36	7.42	9.11	7.90	7.57	8.69	8.34
PY1 (Vuw)	6.61	7.00	8.14	4.33	6.72	6.76	7.49	5.39	3.22	3.40	4.90	2.14	3.27	3.29	3.98	2.64
PX2 (Mu)	22.07	21.60	24.25	15.21	24.03	23.34	25.96	15.24	9.61	11.71	12.32	7.37	12.37	11.55	14.48	6.91
PY2 (Mu)	3.15	3.09	3.46	2.17	3.43	3.33	3.71	2.18	1.37	1.67	1.76	1.05	1.77	1.65	2.07	0.99
Pu (kip)	39.16	41.38	41.62	37.08	41.18	40.42	42.79	37.82	16.95	20.70	20.83	16.79	20.88	19.74	23.95	15.67

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2762.23	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2776.39	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.69	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.37	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	3485.14	3638.25	OK
BF Outside	3394.61	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.13	38.17	38.12	34.55	38.05	37.30	39.42	35.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1179.95
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3281**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2776.39	16.53	OK	2105.79	12.53	OK
BF	3485.14	26.40	OK	332.06	2.52	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2762.23	16.44	1.47	194.76	OK
TF	5538.62	32.97	1.47	359.55	OK
TF Inside	2776.39	16.53	1.47	209.74	OK
BF Inside	3485.14	26.40	1.47	164.79	OK
BF	6879.75	52.12	1.47	359.55	OK
BF Outside	3394.61	25.72	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.79	21.39	OK	23.95	11.97	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.79	1.47	91.65	OK
Web SPL	21.39	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.29	NA
TF Inside	1.25	NA
BF Inside	1.06	1.04
BF Outside	1.09	1.04

Bolt	Shear	Slip	Bearing
TF	2.19	1.34	10.91
Web	1.42	1.41	2.14
BF	1.37	6.69	5.83

Plate	Shear	Flexure
Web	2.60	1.27

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5279	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5279

Node 5279

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5279 L	144.00	68.63	9883.19	144.00	67.75	9755.74	144.00	50.00	7200.00
5279 R	135.00	68.95	9308.28	135.00	67.94	9171.31	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 5279 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5279**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	31.55	-2.30	41.23	-1.66	38.39	-3.11	31.52	7.16	39.65	-3.82	38.80	-3.20	44.00	-7.22	27.99	8.45
ϕf Fnc (ksi)	68.95	67.94	68.95	67.97	68.95	67.93	68.95	68.95	68.95	67.92	68.95	67.93	68.95	67.86	68.95	68.95
f / ϕf Fnc	0.46	0.03	0.60	0.02	0.56	0.05	0.46	0.10	0.58	0.06	0.56	0.05	0.64	0.11	0.41	0.12
α	0.99	0.97	0.99	0.97	0.99	0.97	0.99	0.99	0.99	0.97	0.99	0.97	0.99	0.97	0.99	0.99
fcf (ksi)	31.55		41.23		38.39		31.52		39.65		38.80		44.00		27.99	
Fcf (ksi)	51.71		55.40		53.96		51.71		54.60		54.17		56.81		51.71	
Fcf (kip)	5116.05		5481.07		5338.67		5116.05		5401.76		5359.39		5620.40		5116.05	
fncf (ksi)		-2.30		-1.66		-3.11		7.16		-3.82		-3.20		-7.22		8.45
Rcf		1.64		1.34		1.41		1.64		1.38		1.40		1.29		1.85
Fncf (ksi)		-50.95		-50.97		-50.95		51.71		-50.94		-50.95		-50.90		51.71
Fncf (kip)		-6878.49		-6881.53		-6877.74		5116.05		-6876.40		-6877.63		-6870.91		5116.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	22.80	-1.67	27.74	-2.08	25.94	-2.58	23.70	4.31	27.56	-3.37	26.48	-2.71	32.20	-5.35	21.94	5.16
Fs (ksi)	22.80	-1.67	27.74	-2.08	25.94	-2.58	23.70	4.31	27.56	-3.37	26.48	-2.71	32.20	-5.35	21.94	5.16
Fs (kip)	3078.52	-224.79	3745.35	-280.18	3501.92	-348.37	3199.95	582.43	3721.03	-455.46	3575.34	-366.20	4346.90	-722.69	2962.15	696.77

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5620.40	5116.05	4346.90	696.77
Comp	0.00	6881.53	0.00	722.69

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	762.00	809.60	1131.64	525.68	790.60	787.29	933.00	656.54	556.33	589.00	817.48	388.40	575.57	574.19	676.19	481.82
Vuw (kip)	1068.69	1092.49	1253.51	788.52	1082.99	1081.34	1154.19	984.81	---	---	---	---	---	---	---	---
Mv (k*ft)	734.73	751.09	861.79	542.11	744.56	743.42	793.51	677.05	382.47	404.93	562.02	267.03	395.71	394.76	464.88	331.25
Huw (kip)	2264.21	2512.30	2341.28	3008.95	2328.92	2347.05	2238.75	3193.87	1014.66	1232.06	1121.26	1344.84	1161.09	1141.03	1288.61	1300.95
Muw (k*ft)	3501.00	3635.40	3681.95	2508.02	3778.83	3700.66	4177.71	2261.46	1566.01	1908.40	1825.32	1240.90	1979.97	1868.58	2403.36	1073.96
Mu (k*ft)	4235.73	4386.48	4543.74	3050.13	4523.39	4444.08	4971.22	2938.51	1948.49	2313.34	2387.34	1507.93	2375.67	2263.34	2868.24	1405.21

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5279**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.62	17.33	16.15	20.75	16.06	16.19	15.44	22.03	7.00	8.50	7.73	9.27	8.01	7.87	8.89	8.97
PY1 (Vuw)	7.37	7.53	8.64	5.44	7.47	7.46	7.96	6.79	3.84	4.06	5.64	2.68	3.97	3.96	4.66	3.32
PX2 (Mu)	22.72	23.53	24.37	16.36	24.26	23.84	26.67	15.76	10.45	12.41	12.81	8.09	12.74	12.14	15.39	7.54
PY2 (Mu)	3.25	3.36	3.48	2.34	3.47	3.41	3.81	2.25	1.49	1.77	1.83	1.16	1.82	1.73	2.20	1.08
Pu (kip)	39.78	42.28	42.30	37.92	41.78	41.47	43.72	38.86	18.25	21.70	21.85	17.78	21.54	20.80	25.22	17.09

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2803.01	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2817.39	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.69	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.37	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	3486.04	3638.25	OK
BF Outside	3395.49	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.54	38.91	38.63	35.16	38.45	38.15	40.20	35.77
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1253.51
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5279**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2817.39	16.77	OK	2179.01	12.97	OK
BF	3486.04	26.41	OK	366.10	2.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2803.01	16.68	1.47	194.76	OK
TF	5620.40	33.45	1.47	359.55	OK
TF Inside	2817.39	16.77	1.47	209.74	OK
BF Inside	3486.04	26.41	1.47	164.79	OK
BF	6881.53	52.13	1.47	359.55	OK
BF Outside	3395.49	25.72	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.72	21.86	OK	25.22	12.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.72	1.47	91.65	OK
Web SPL	21.86	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.27	NA
TF Inside	1.24	NA
BF Inside	1.06	1.04
BF Outside	1.09	1.04

Bolt	Shear	Slip	Bearing
TF	2.16	1.30	10.75
Web	1.39	1.33	2.10
BF	1.37	6.07	5.82

Plate	Shear	Flexure
Web	2.45	1.24

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7277	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7277

Node 7277

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7277 L	144.00	68.63	9883.19	144.00	67.75	9755.74	144.00	50.00	7200.00
7277 R	135.00	68.95	9308.28	135.00	67.83	9156.45	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 7277 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7277**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	35.18	-7.49	45.60	-8.16	42.91	-9.74	35.56	12.74	45.79	-11.43	36.76	-2.72	47.20	-12.42	33.63	14.13
ϕf Fnc (ksi)	68.95	67.83	68.95	67.85	68.95	67.82	68.95	68.95	68.95	67.80	68.95	67.93	68.95	67.79	68.95	68.95
f / ϕf Fnc	0.51	0.11	0.66	0.12	0.62	0.14	0.52	0.18	0.66	0.17	0.53	0.04	0.68	0.18	0.49	0.20
α	0.99	0.97	0.99	0.97	0.99	0.97	0.99	0.99	0.99	0.97	0.99	0.97	0.99	0.97	0.99	0.99
fcf (ksi)	35.18		45.60		42.91		35.56		45.79		36.76		47.20		33.63	
Fcf (ksi)	52.33		57.62		56.25		52.53		57.72		53.14		58.43		51.71	
Fcf (kip)	5177.52		5700.53		5565.37		5196.44		5710.10		5256.93		5781.03		5116.05	
fncf (ksi)		-7.49		-8.16		-9.74		12.74		-11.43		-2.72		-12.42		14.13
Rcf		1.49		1.26		1.31		1.48		1.26		1.45		1.24		1.54
Fncf (ksi)		-50.87		-50.89		-50.86		51.71		-50.85		-50.95		-50.84		51.71
Fncf (kip)		-6867.34		-6869.78		-6866.37		5116.05		-6864.85		-6878.39		-6863.97		5116.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.69	-5.73	30.75	-6.42	29.14	-7.55	26.82	8.40	32.03	-8.99	25.63	-2.41	34.55	-9.31	26.11	9.42
Fs (ksi)	25.69	-5.73	30.75	-6.42	29.14	-7.55	26.82	8.40	32.03	-8.99	25.63	-2.41	34.55	-9.31	26.11	9.42
Fs (kip)	3467.51	-772.99	4151.03	-866.97	3933.38	-1019.56	3621.25	1134.07	4323.40	-1214.23	3460.65	-325.46	4664.08	-1256.22	3524.26	1272.28

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5781.03	5116.05	4664.08	1272.28
Comp	0.00	6878.39	0.00	1256.22

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	671.28	737.67	1009.72	475.24	709.73	656.81	824.76	572.25	490.47	536.82	729.58	351.42	517.63	479.69	598.90	419.95
Vuw (kip)	1006.92	1056.53	1192.55	712.86	1042.56	985.21	1100.07	858.38	---	---	---	---	---	---	---	---
Mv (k*ft)	692.26	726.36	819.88	490.09	716.76	677.33	756.30	590.13	337.20	369.07	501.59	241.60	355.87	329.79	411.74	288.72
Huw (kip)	1939.63	2229.18	2046.88	3386.85	2037.32	2323.74	2024.56	3488.31	958.05	1167.67	1036.03	1690.78	1105.48	1114.73	1211.68	1705.44
Muw (k*ft)	4012.11	4292.57	4363.39	2106.60	4560.58	3601.17	4667.99	1868.88	2010.31	2378.90	2348.06	1179.11	2625.25	1794.90	2806.66	1067.61
Mu (k*ft)	4704.36	5018.93	5183.27	2596.70	5277.34	4278.50	5424.29	2459.01	2347.51	2747.97	2849.64	1420.71	2981.12	2124.68	3218.40	1356.32

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7277**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.38	15.37	14.12	23.36	14.05	16.03	13.96	24.06	6.61	8.05	7.15	11.66	7.62	7.69	8.36	11.76
PY1 (Vuw)	6.94	7.29	8.22	4.92	7.19	6.79	7.59	5.92	3.38	3.70	5.03	2.42	3.57	3.31	4.13	2.90
PX2 (Mu)	25.23	26.92	27.80	13.93	28.31	22.95	29.10	13.19	12.59	14.74	15.29	7.62	15.99	11.40	17.26	7.28
PY2 (Mu)	3.60	3.85	3.97	1.99	4.04	3.28	4.16	1.88	1.80	2.11	2.18	1.09	2.28	1.63	2.47	1.04
Pu (kip)	40.03	43.74	43.66	37.92	43.82	40.26	44.63	38.06	19.89	23.52	23.56	19.60	24.33	19.71	26.46	19.44

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2883.12	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2897.91	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.69	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.37	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	3484.45	3638.25	OK
BF Outside	3393.94	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.89	40.38	40.06	35.23	40.49	37.14	41.17	35.17
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1192.55
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7277**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2897.91	17.25	OK	2338.00	13.92	OK
BF	3484.45	26.40	OK	644.51	4.88	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2883.12	17.16	1.47	194.76	OK
TF	5781.03	34.41	1.47	359.55	OK
TF Inside	2897.91	17.25	1.47	209.74	OK
BF Inside	3484.45	26.40	1.47	164.79	OK
BF	6878.39	52.11	1.47	359.55	OK
BF Outside	3393.94	25.71	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.63	22.32	OK	26.46	13.23	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.63	1.47	91.65	OK
Web SPL	22.32	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.24	NA
TF Inside	1.20	NA
BF Inside	1.06	1.04
BF Outside	1.09	1.04

Bolt	Shear	Slip	Bearing
TF	2.10	1.21	10.45
Web	1.36	1.27	2.05
BF	1.37	3.45	5.83

Plate	Shear	Flexure
Web	2.58	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 9277

Node 9277

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9277 L	144.00	68.64	9884.03	144.00	68.64	9884.03	144.00	50.00	7200.00
9277 R	135.00	68.96	9308.95	135.00	67.79	9151.35	96.00	50.00	4800.00

Rh = 0.99

Controlling Section = 9277 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 9277**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.69	-7.69	33.35	9.40	34.20	-8.86	26.64	13.63	34.26	9.59	28.02	3.96	38.50	-11.89	24.84	14.34
ϕf Fnc (ksi)	68.96	67.79	68.96	68.96	68.96	67.80	68.96	68.96	68.96	68.96	68.96	68.96	68.96	67.77	68.96	68.96
f / ϕf Fnc	0.40	0.11	0.48	0.14	0.50	0.13	0.39	0.20	0.50	0.14	0.41	0.06	0.56	0.18	0.36	0.21
α	0.99	0.97	0.99	0.99	0.99	0.97	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.97	0.99	0.99
fcf (ksi)	27.69		33.35		34.20		26.64		34.26		28.02		38.50		24.84	
Fcf (ksi)	51.72		51.72		51.84		51.72		51.87		51.72		54.02		51.72	
Fcf (kip)	5116.42		5116.42		5128.46		5116.42		5131.45		5116.42		5344.23		5116.42	
fncf (ksi)		-7.69		9.40		-8.86		13.63		9.59		3.96		-11.89		14.34
Rcf		1.87		1.55		1.52		1.94		1.51		1.85		1.40		2.08
Fncf (ksi)		-50.84		51.72		-50.85		51.72		51.72		51.72		-50.83		51.72
Fncf (kip)		-6863.51		5116.42		-6864.70		5116.42		5116.42		5116.42		-6861.61		5116.42

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	20.43	-5.79	24.64	6.86	25.24	-6.30	19.01	9.10	25.07	6.94	20.87	3.01	28.28	-8.44	18.30	9.71
Fs (ksi)	20.43	-5.79	24.64	6.86	25.24	-6.30	19.01	9.10	25.07	6.94	20.87	3.01	28.28	-8.44	18.30	9.71
Fs (kip)	2758.11	-781.74	3326.10	925.64	3407.88	-850.27	2566.83	1227.83	3384.77	937.22	2817.74	406.71	3817.72	-1139.47	2469.95	1310.26

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5344.23	5116.42	3817.72	1310.26
Comp	0.00	6864.70	0.00	1139.47

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	561.78	493.14	847.07	327.22	501.01	549.05	713.18	403.27	411.05	366.23	616.29	245.33	368.11	405.73	521.69	299.06
Vuw (kip)	842.67	739.70	1111.23	490.83	751.51	823.57	1044.28	604.90	---	---	---	---	---	---	---	---
Mv (k*ft)	579.34	508.55	763.97	337.45	516.66	566.20	717.94	415.87	282.60	251.78	423.70	168.66	253.08	278.94	358.66	205.60
Huw (kip)	1755.88	3145.15	1806.49	3715.25	3149.55	2796.21	1753.26	3879.01	702.71	1511.73	909.37	1349.21	1536.71	1146.47	952.27	1344.07
Muw (k*ft)	4179.72	2327.35	4127.58	1567.22	2340.65	2792.62	4473.56	1348.87	1678.15	1137.99	2018.68	634.79	1160.32	1143.01	2350.08	549.78
Mu (k*ft)	4759.06	2835.90	4891.55	1904.67	2857.31	3358.82	5191.51	1764.74	1960.75	1389.78	2442.38	803.45	1413.40	1421.95	2708.74	755.38

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	12.11	21.69	12.46	25.62	21.72	19.28	12.09	26.75	4.85	10.43	6.27	9.30	10.60	7.91	6.57	9.27
PY1 (Vuw)	5.81	5.10	7.66	3.39	5.18	5.68	7.20	4.17	2.83	2.53	4.25	1.69	2.54	2.80	3.60	2.06
PX2 (Mu)	25.53	15.21	26.24	10.22	15.33	18.02	27.85	9.47	10.52	7.45	13.10	4.31	7.58	7.63	14.53	4.05
PY2 (Mu)	3.65	2.17	3.75	1.46	2.19	2.57	3.98	1.35	1.50	1.06	1.87	0.62	1.08	1.09	2.08	0.58
Pu (kip)	38.81	37.61	40.34	36.16	37.77	38.20	41.47	36.64	15.96	18.24	20.32	13.81	18.54	16.01	21.85	13.58

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2665.28	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2678.95	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.87	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.55	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	3477.51	3638.25	OK
BF Outside	3387.19	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.99	34.92	37.01	33.75	35.06	35.40	38.22	34.07
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1111.23
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2678.95	15.95	OK	1913.74	11.39	OK
BF	3477.51	26.34	OK	663.75	5.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2665.28	15.86	1.47	194.76	OK
TF	5344.23	31.81	1.47	359.55	OK
TF Inside	2678.95	15.95	1.47	209.74	OK
BF Inside	3477.51	26.34	1.47	164.79	OK
BF	6864.70	52.01	1.47	359.55	OK
BF Outside	3387.19	25.66	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.47	20.74	OK	21.85	10.92	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.47	1.47	91.65	OK
Web SPL	20.74	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.34	NA
TF Inside	1.30	NA
BF Inside	1.06	1.05
BF Outside	1.09	1.05

Bolt	Shear	Slip	Bearing
TF	2.27	1.48	11.30
Web	1.47	1.54	2.21
BF	1.37	3.35	5.84

Plate	Shear	Flexure
Web	2.76	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 1290

Node 1290

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1290 L	135.00	68.96	9308.95	135.00	68.96	9308.95	96.00	50.00	4800.00
1290 R	144.00	68.64	9884.03	144.00	68.64	9884.03	144.00	50.00	7200.00

Rh = 0.99

Controlling Section = 1290 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1290**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	26.29	8.35	13.26	11.67	25.75	4.08	14.01	16.35	23.97	6.71	20.15	13.23	12.18	16.88	30.00	-0.54
ϕf Fnc (ksi)	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	67.99
f / ϕf Fnc	0.38	0.12	0.19	0.17	0.37	0.06	0.20	0.24	0.35	0.10	0.29	0.19	0.18	0.24	0.44	0.01
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.97
fcf (ksi)	26.29		13.26		25.75			16.35	23.97		20.15			16.88	30.00	
Fcf (ksi)	51.72		51.72		51.72			51.72	51.72		51.72			51.72	51.72	
Fcf (kip)	5116.42		5116.42		5116.42			5116.42	5116.42		5116.42			5116.42	5116.42	
fncf (ksi)		8.35		11.67		4.08	14.01			6.71		13.23	12.18			-0.54
Rcf		1.97		3.90		2.01	3.16			2.16		2.57	3.06			1.72
Fncf (ksi)		51.72		51.72		51.72	51.72			51.72		51.72	51.72			-50.99
Fncf (kip)		5116.42		5116.42		5116.42	5116.42			5116.42		5116.42	5116.42			-6884.22

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.19	5.57	9.65	8.24	16.34	2.93	10.66	11.83	16.13	4.87	14.64	9.00	9.16	12.19	21.99	0.08
Fs (ksi)	17.19	5.57	9.65	8.24	16.34	2.93	10.66	11.83	16.13	4.87	14.64	9.00	9.16	12.19	21.99	0.08
Fs (kip)	2321.23	751.53	1303.25	1111.93	2206.03	395.61	1438.97	1597.46	2178.04	656.85	1976.04	1215.30	1236.84	1645.26	2969.22	10.82

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5116.42	5116.42	2969.22	1645.26
Comp	0.00	6884.22	0.00	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	403.06	260.85	658.99	147.08	368.52	327.59	204.06	521.30	294.91	194.75	476.04	114.05	270.50	241.90	154.62	378.45
Vuw (kip)	604.59	391.28	988.48	220.61	552.78	491.39	306.09	781.95	---	---	---	---	---	---	---	---
Mv (k*ft)	415.65	269.00	679.58	151.67	380.04	337.83	210.44	537.59	202.75	133.89	327.27	78.41	185.97	166.30	106.30	260.18
Huw (kip)	3233.46	4630.52	2838.22	4572.30	3140.33	4075.53	4236.29	2400.85	1092.54	858.73	925.03	1079.62	1007.96	1134.70	1024.75	1059.57
Muw (k*ft)	2209.61	346.86	2736.59	424.49	2333.78	1086.85	872.50	3319.76	744.15	90.70	858.27	75.14	721.16	360.64	193.62	1402.50
Mu (k*ft)	2625.26	615.87	3416.17	576.16	2713.82	1424.68	1082.93	3857.35	946.90	224.59	1185.54	153.55	907.13	526.95	299.92	1662.69

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.30	31.93	19.57	31.53	21.66	28.11	29.22	16.56	7.53	5.92	6.38	7.45	6.95	7.83	7.07	7.31
PY1 (Vuw)	4.17	2.70	6.82	1.52	3.81	3.39	2.11	5.39	2.03	1.34	3.28	0.79	1.87	1.67	1.07	2.61
PX2 (Mu)	14.08	3.30	18.32	3.09	14.56	7.64	5.81	20.69	5.08	1.20	6.36	0.82	4.87	2.83	1.61	8.92
PY2 (Mu)	2.01	0.47	2.62	0.44	2.08	1.09	0.83	2.96	0.73	0.17	0.91	0.12	0.70	0.40	0.23	1.27
Pu (kip)	36.90	35.38	39.06	34.68	36.69	36.03	35.15	38.17	12.91	7.29	13.41	8.32	12.09	10.85	8.77	16.68

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2551.67	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2564.75	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.87	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.55	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	3487.40	3638.25	OK
BF Outside	3396.82	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.40	32.93	35.97	32.35	34.26	33.57	32.82	35.45
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	988.48
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1290**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2564.75	15.27	OK	1488.41	8.86	OK
BF	3487.40	26.42	OK	833.45	6.31	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2551.67	15.19	1.47	194.76	OK
TF	5116.42	30.45	1.47	359.55	OK
TF Inside	2564.75	15.27	1.47	209.74	OK
BF Inside	3487.40	26.42	1.47	164.79	OK
BF	6884.22	52.15	1.47	359.55	OK
BF Outside	3396.82	25.73	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.06	19.53	OK	16.68	8.34	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.06	1.47	91.65	OK
Web SPL	19.53	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.40	NA
TF Inside	1.36	NA
BF Inside	1.06	1.04
BF Outside	1.09	1.04

Bolt	Shear	Slip	Bearing
TF	2.37	1.90	11.81
Web	1.56	2.02	2.35
BF	1.37	2.67	5.82

Plate	Shear	Flexure
Web	3.11	1.39

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3291	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3291

Node 3291

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3291 L	135.00	68.95	9308.28	135.00	68.95	9308.28	96.00	50.00	4800.00
3291 R	144.00	68.63	9883.19	144.00	68.63	9883.19	144.00	50.00	7200.00

Rh = 0.99

Controlling Section = 3291 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3291**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	31.92	10.89	21.54	13.23	32.66	7.18	22.24	18.99	27.35	9.06	29.23	13.84	20.42	19.57	36.68	3.62
ϕf Fnc (ksi)	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95
f / ϕf Fnc	0.46	0.16	0.31	0.19	0.47	0.10	0.32	0.28	0.40	0.13	0.42	0.20	0.30	0.28	0.53	0.05
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	31.92		21.54		32.66		22.24		27.35		29.23		20.42		36.68	
Fcf (ksi)	51.71		51.71		51.71		51.71		51.71		51.71		51.71		53.10	
Fcf (kip)	5116.05		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05		5252.90	
fncf (ksi)		10.89		13.23		7.18		18.99		9.06		13.84		19.57		3.62
Rcf		1.62		2.40		1.58		2.33		1.89		1.77		2.53		1.45
Fncf (ksi)		51.71		51.71		51.71		51.71		51.71		51.71		51.71		51.71
Fncf (kip)		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	21.32	7.32	15.97	9.77	21.44	5.12	16.47	13.84	18.79	6.24	20.55	9.72	15.18	14.25	26.80	2.91
Fs (ksi)	21.32	7.32	15.97	9.77	21.44	5.12	16.47	13.84	18.79	6.24	20.55	9.72	15.18	14.25	26.80	2.91
Fs (kip)	2877.66	988.58	2156.24	1318.61	2894.37	690.64	2223.31	1868.22	2537.09	841.95	2774.33	1312.47	2049.89	1923.87	3618.65	393.43

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5252.90	5116.05	3618.65	1923.87
Comp	0.00	0.00	0.00	0.00

$\phi v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	482.58	376.01	780.59	216.38	500.37	411.72	296.80	613.25	351.54	274.40	562.09	161.62	364.11	299.63	218.44	443.86
Vuw (kip)	723.87	564.01	1077.99	324.57	750.55	617.58	445.19	919.87	---	---	---	---	---	---	---	---
Mv (k*ft)	497.66	387.76	741.12	223.14	516.00	424.58	306.07	632.41	241.68	188.65	386.44	111.12	250.32	206.00	150.18	305.15
Huw (kip)	3291.71	3969.47	2990.63	4564.39	3266.86	3620.68	4824.00	2761.93	1374.66	1235.50	1274.67	1454.77	1201.44	1453.09	1412.89	1426.52
Muw (k*ft)	2131.01	1227.33	2532.44	434.10	2164.14	1692.38	87.95	3011.78	895.56	397.10	1044.73	168.34	803.63	693.03	59.74	1528.99
Mu (k*ft)	2628.67	1615.09	3273.56	657.24	2680.15	2116.97	394.02	3644.19	1137.25	585.75	1431.17	279.45	1053.95	899.03	209.92	1834.15

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3291**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.70	27.38	20.63	31.48	22.53	24.97	33.27	19.05	9.48	8.52	8.79	10.03	8.29	10.02	9.74	9.84
PY1 (Vuw)	4.99	3.89	7.43	2.24	5.18	4.26	3.07	6.34	2.42	1.89	3.88	1.11	2.51	2.07	1.51	3.06
PX2 (Mu)	14.10	8.66	17.56	3.53	14.38	11.36	2.11	19.55	6.10	3.14	7.68	1.50	5.65	4.82	1.13	9.84
PY2 (Mu)	2.01	1.24	2.51	0.50	2.05	1.62	0.30	2.79	0.87	0.45	1.10	0.21	0.81	0.69	0.16	1.41
Pu (kip)	37.46	36.40	39.46	35.11	37.61	36.80	35.54	39.66	15.93	11.90	17.20	11.61	14.33	15.10	11.00	20.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2619.73	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2633.17	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.69	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.37	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	0.00	3638.25	OK
BF Outside	0.00	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.79	33.88	36.20	32.72	34.90	34.24	33.02	36.66
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1077.99
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3291**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2633.17	15.67	OK	1813.95	10.80	OK
BF	2591.69	19.63	OK	974.59	7.38	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.66	19.83	OK	20.18	10.09	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2619.73	15.59	1.47	194.76	OK
TF	5252.90	31.27	1.47	359.55	OK
TF Inside	2633.17	15.67	1.47	209.74	OK
BF Inside	2591.69	19.63	1.47	164.79	OK
BF	5116.05	38.76	1.47	359.55	OK
BF Outside	2524.37	19.12	1.47	149.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.66	1.47	91.65	OK
Web SPL	19.83	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.36	NA
TF Inside	1.32	NA
BF Inside	1.06	NA
BF Outside	1.09	NA

Bolt	Shear	Slip	Bearing
TF	2.31	1.56	11.50
Web	1.54	1.67	2.31
BF	1.84	2.28	7.83

Plate	Shear	Flexure
Web	2.85	1.36

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5289	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5289

Node 5289

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5289 L	135.00	68.95	9308.28	135.00	68.95	9308.28	96.00	50.00	4800.00
5289 R	144.00	68.63	9883.19	144.00	68.63	9883.19	144.00	50.00	7200.00

Rh = 0.99

Controlling Section = 5289 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5289**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	37.57	12.50	25.17	15.17	34.96	10.32	28.16	20.27	32.99	9.88	34.98	15.73	25.55	20.65	41.58	5.64
ϕf Fnc (ksi)	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95
f / ϕf Fnc	0.54	0.18	0.37	0.22	0.51	0.15	0.41	0.29	0.48	0.14	0.51	0.23	0.37	0.30	0.60	0.08
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	37.57		25.17		34.96		28.16		32.99		34.98		25.55		41.58	
Fcf (ksi)	53.55		51.71		52.22		51.71		51.71		52.23		51.71		55.58	
Fcf (kip)	5297.51		5116.05		5166.23		5116.05		5116.05		5167.15		5116.05		5498.91	
fncf (ksi)		12.50		15.17		10.32		20.27		9.88		15.73		20.65		5.64
Rcf		1.43		2.05		1.49		1.84		1.57		1.49		2.02		1.34
Fncf (ksi)		51.71		51.71		51.71		51.71		51.71		51.71		51.71		51.71
Fncf (kip)		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05		5116.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.17	8.51	19.64	11.05	23.70	7.26	21.52	14.04	22.55	6.92	24.58	11.14	19.03	15.14	30.32	4.35
Fs (ksi)	25.17	8.51	19.64	11.05	23.70	7.26	21.52	14.04	22.55	6.92	24.58	11.14	19.03	15.14	30.32	4.35
Fs (kip)	3398.22	1149.01	2651.54	1491.93	3199.10	980.46	2905.81	1895.30	3044.25	933.84	3317.95	1503.59	2568.60	2044.12	4092.61	587.71

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5498.91	5116.05	4092.61	2044.12
Comp	0.00	0.00	0.00	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	503.62	403.75	845.77	203.74	635.11	353.17	338.11	658.31	364.89	294.13	606.63	152.82	457.79	258.40	247.75	474.18
Vuw (kip)	755.43	605.63	1110.58	305.61	952.67	529.76	507.16	987.47	---	---	---	---	---	---	---	---
Mv (k*ft)	519.35	416.37	763.52	210.11	654.96	364.21	348.67	678.88	250.86	202.21	417.06	105.06	314.73	177.65	170.33	326.00
Huw (kip)	3386.65	3941.49	3208.68	4231.65	3188.35	3596.68	4451.18	2990.14	1616.79	1473.23	1486.07	1707.06	1414.43	1714.32	1640.08	1664.11
Muw (k*ft)	2235.68	1264.63	2305.67	877.75	2268.81	1789.49	585.04	3021.01	1066.29	549.74	1051.80	479.06	1000.49	860.14	248.64	1661.58
Mu (k*ft)	2755.03	1681.01	3069.19	1087.86	2923.78	2153.70	933.72	3699.89	1317.15	751.95	1468.86	584.12	1315.22	1037.79	418.97	1987.58

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5289**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.36	27.18	22.13	29.18	21.99	24.80	30.70	20.62	11.15	10.16	10.25	11.77	9.75	11.82	11.31	11.48
PY1 (Vuw)	5.21	4.18	7.66	2.11	6.57	3.65	3.50	6.81	2.52	2.03	4.18	1.05	3.16	1.78	1.71	3.27
PX2 (Mu)	14.78	9.02	16.46	5.84	15.68	11.55	5.01	19.85	7.07	4.03	7.88	3.13	7.05	5.57	2.25	10.66
PY2 (Mu)	2.11	1.29	2.35	0.83	2.24	1.65	0.72	2.84	1.01	0.58	1.13	0.45	1.01	0.80	0.32	1.52
Pu (kip)	38.83	36.61	39.87	35.14	38.69	36.74	35.95	41.60	18.55	14.43	18.89	14.98	17.32	17.58	13.71	22.65

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2742.42	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2756.49	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.69	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.37	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	0.00	3638.25	OK
BF Outside	0.00	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.05	34.04	36.54	32.82	35.66	34.28	33.43	38.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1110.58
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2756.49	16.41	OK	2051.54	12.21	OK
BF	2591.69	19.63	OK	1035.51	7.84	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.60	20.80	OK	22.65	11.33	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2742.42	16.32	1.47	194.76	OK
TF	5498.91	32.73	1.47	359.55	OK
TF Inside	2756.49	16.41	1.47	209.74	OK
BF Inside	2591.69	19.63	1.47	164.79	OK
BF	5116.05	38.76	1.47	359.55	OK
BF Outside	2524.37	19.12	1.47	149.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.60	1.47	91.65	OK
Web SPL	20.80	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.30	NA
TF Inside	1.26	NA
BF Inside	1.06	NA
BF Outside	1.09	NA

Bolt	Shear	Slip	Bearing
TF	2.21	1.38	10.98
Web	1.46	1.49	2.20
BF	1.84	2.15	7.83

Plate	Shear	Flexure
Web	2.77	1.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 7287

Node 7287

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7287 L	135.00	68.95	9308.28	135.00	68.95	9308.28	96.00	50.00	4800.00
7287 R	144.00	68.63	9883.19	144.00	68.63	9883.19	144.00	50.00	7200.00

Rh = 0.99

Controlling Section = 7287 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	36.41	18.51	26.66	18.55	37.08	12.46	25.87	25.82	30.82	14.10	35.52	20.09	26.44	25.52	40.92	9.36
ϕf Fnc (ksi)	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95	68.95
f / ϕf Fnc	0.53	0.27	0.39	0.27	0.54	0.18	0.38	0.37	0.45	0.20	0.52	0.29	0.38	0.37	0.59	0.14
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	36.41		26.66		37.08		25.87		30.82		35.52		26.44		40.92	
Fcf (ksi)	52.96		51.71		53.30		51.71		51.71		52.51		51.71		55.25	
Fcf (kip)	5238.99		5116.05		5272.89		5116.05		5116.05		5194.65		5116.05		5465.86	
fncf (ksi)		18.51		18.55		12.46		25.82		14.10		20.09		25.52		9.36
Rcf		1.45		1.94		1.44		2.00		1.68		1.48		1.96		1.35
Fncf (ksi)		51.71		51.71		51.71		52.40		51.71		51.71		51.71		51.71
Fncf (kip)		5116.05		5116.05		5116.05		5183.67		5116.05		5116.05		5116.05		5116.05

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	25.10	13.16	19.81	13.62	24.68	9.06	20.74	18.16	21.59	10.12	25.16	14.52	19.81	18.86	26.27	7.01
Fs (ksi)	25.10	13.16	19.81	13.62	24.68	9.06	20.74	18.16	21.59	10.12	25.16	14.52	19.81	18.86	26.27	7.01
Fs (kip)	3387.97	1776.97	2674.78	1838.87	3331.20	1223.06	2800.42	2451.93	2914.69	1365.73	3396.31	1959.55	2674.98	2546.05	3546.29	946.61

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5465.86	5183.67	3546.29	2546.05
Comp	0.00	0.00	0.00	0.00

$\phi v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	452.02	371.57	794.42	199.61	493.92	402.45	260.86	628.87	326.31	273.01	571.76	147.98	359.45	291.29	191.25	454.79
Vuw (kip)	678.03	557.36	1084.90	299.42	740.87	603.67	391.29	943.30	---	---	---	---	---	---	---	---
Mv (k*ft)	466.15	383.19	745.87	205.85	509.35	415.02	269.01	648.52	224.34	187.69	393.08	101.74	247.12	200.26	131.49	312.67
Huw (kip)	3796.39	4171.74	3379.49	4922.28	3580.54	3908.24	4840.81	3218.44	1836.42	1604.85	1619.29	1867.50	1521.92	1904.31	1856.37	1597.48
Muw (k*ft)	1614.77	957.63	2213.83	43.08	1745.90	1409.14	65.54	2674.51	763.73	396.29	999.41	165.21	734.32	681.13	61.12	1232.44
Mu (k*ft)	2080.91	1340.82	2959.70	248.93	2255.25	1824.16	334.56	3323.03	988.07	583.98	1392.50	266.95	981.44	881.39	192.61	1545.11

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.18	28.77	23.31	33.95	24.69	26.95	33.38	22.20	12.66	11.07	11.17	12.88	10.50	13.13	12.80	11.02
PY1 (Vuw)	4.68	3.84	7.48	2.06	5.11	4.16	2.70	6.51	2.25	1.88	3.94	1.02	2.48	2.01	1.32	3.14
PX2 (Mu)	11.16	7.19	15.88	1.34	12.10	9.78	1.79	17.82	5.30	3.13	7.47	1.43	5.26	4.73	1.03	8.29
PY2 (Mu)	1.59	1.03	2.27	0.19	1.73	1.40	0.26	2.55	0.76	0.45	1.07	0.20	0.75	0.68	0.15	1.18
Pu (kip)	37.87	36.29	40.38	35.35	37.42	37.16	35.30	41.03	18.22	14.39	19.30	14.36	16.09	18.06	13.91	19.78

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2725.94	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2739.92	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2625.94	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2557.73	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	0.00	3638.25	OK
BF Outside	0.00	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	35.18	33.75	37.07	32.90	34.70	34.57	32.82	37.92
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1084.90
Rr (kip)	3071.14
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2739.92	16.31	OK	1777.68	10.58	OK
BF	2625.94	19.89	OK	1289.78	9.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2725.94	16.23	1.47	194.76	OK
TF	5465.86	32.53	1.47	359.55	OK
TF Inside	2739.92	16.31	1.47	209.74	OK
BF Inside	2625.94	19.89	1.47	164.79	OK
BF	5183.67	39.27	1.47	359.55	OK
BF Outside	2557.73	19.38	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.03	20.52	OK	19.78	9.89	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.03	1.47	91.65	OK
Web SPL	20.52	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.31	NA
TF Inside	1.27	NA
BF Inside	1.04	NA
BF Outside	1.07	NA

Bolt	Shear	Slip	Bearing
TF	2.22	1.59	11.05
Web	1.48	1.70	2.23
BF	1.82	1.72	7.73

Plate	Shear	Flexure
Web	2.83	1.32

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 9287

Node 9287

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	168
Web	145
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9287 L	135.00	68.96	9308.95	135.00	68.96	9308.95	96.00	50.00	4800.00
9287 R	144.00	68.64	9884.03	144.00	68.64	9884.03	144.00	50.00	7200.00

Rh = 0.99

Controlling Section = 9287 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	96.00	1.00	---	96.00	65.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	86.50	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	86.50	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	89.00	0.875	32.50	155.75	101.83	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 9287**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	27.43	9.20	14.42	13.41	23.92	10.44	14.60	17.64	15.82	12.25	26.21	11.46	14.01	19.54	29.82	4.47
ϕf Fnc (ksi)	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96	68.96
f / ϕf Fnc	0.40	0.13	0.21	0.19	0.35	0.15	0.21	0.26	0.23	0.18	0.38	0.17	0.20	0.28	0.43	0.06
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	27.43		14.42		23.92			17.64	15.82		26.21			19.54	29.82	
Fcf (ksi)	51.72		51.72		51.72			51.72	51.72		51.72			51.72	51.72	
Fcf (kip)	5116.42		5116.42		5116.42			5116.42	5116.42		5116.42			5116.42	5116.42	
fncf (ksi)		9.20		13.41		10.44	14.60			12.25		11.46	14.01			4.47
Rcf		1.89		3.59		2.16	2.93			3.27		1.97	2.65			1.73
Fncf (ksi)		51.72		51.72		51.72	51.72			51.72		51.72	51.72			51.72
Fncf (kip)		5116.42		5116.42		5116.42	5116.42			5116.42		5116.42	5116.42			5116.42

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	17.63	6.59	10.78	9.72	15.95	7.29	11.09	13.02	11.86	8.41	17.55	8.35	10.68	14.37	18.24	3.32
Fs (ksi)	17.63	6.59	10.78	9.72	15.95	7.29	11.09	13.02	11.86	8.41	17.55	8.35	10.68	14.37	18.24	3.32
Fs (kip)	2379.65	889.35	1455.79	1312.70	2153.37	983.67	1497.62	1758.07	1600.99	1135.59	2369.80	1127.54	1441.80	1939.91	2462.87	448.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	5116.42	5116.42	2462.87	1939.91
Comp	0.00	0.00	0.00	0.00

$\phi_v V_n$ (kip) = 1375.39

e_v (in) = 8.25

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	424.61	236.67	638.86	105.19	241.95	404.72	169.37	512.36	307.75	176.54	460.70	82.07	180.28	293.70	127.42	371.33
Vuw (kip)	636.91	355.00	958.29	157.78	362.92	607.08	254.05	768.54	---	---	---	---	---	---	---	---
Mv (k*ft)	437.88	244.06	658.82	108.47	249.51	417.37	174.66	528.37	211.58	121.37	316.73	56.43	123.94	201.92	87.60	255.29
Huw (kip)	3278.01	4753.89	3528.83	4500.19	4366.75	3531.18	4225.41	2817.48	1162.31	984.35	1115.39	1157.58	973.00	1243.50	1202.39	1035.26
Muw (k*ft)	2150.20	182.38	1815.78	520.63	698.55	1812.65	887.01	2764.24	706.51	67.84	554.52	123.47	220.63	588.92	236.14	954.81
Mu (k*ft)	2588.08	426.44	2474.60	629.11	948.07	2230.02	1061.67	3292.61	918.09	189.21	871.26	179.90	344.57	790.84	323.74	1210.10

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9287**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.61	32.79	24.34	31.04	30.12	24.35	29.14	19.43	8.02	6.79	7.69	7.98	6.71	8.58	8.29	7.14
PY1 (Vuw)	4.39	2.45	6.61	1.09	2.50	4.19	1.75	5.30	2.12	1.22	3.18	0.57	1.24	2.03	0.88	2.56
PX2 (Mu)	13.88	2.29	13.27	3.37	5.09	11.96	5.69	17.66	4.92	1.01	4.67	0.96	1.85	4.24	1.74	6.49
PY2 (Mu)	1.98	0.33	1.90	0.48	0.73	1.71	0.81	2.52	0.70	0.14	0.67	0.14	0.26	0.61	0.25	0.93
Pu (kip)	37.04	35.18	38.56	34.45	35.35	36.79	34.93	37.91	13.25	7.92	12.95	8.98	8.69	13.09	10.09	14.07

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2551.67	4862.81	3563.63	133.25	86.63	47.23	6628.20	3563.63	OK
TF Inside	2564.75	4887.75	3480.75	287.00	186.59	40.47	10111.13	3480.75	OK
BF Inside	2591.87	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2524.55	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	0.00	4606.88	OK
TF Inside	0.00	4630.50	OK
BF Inside	0.00	3638.25	OK
BF Outside	0.00	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.49	32.74	35.51	32.16	32.96	34.26	32.64	35.19
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 2310.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	958.29
Rr (kip)	3071.14
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9287**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.84	1.0	30.46
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2564.75	15.27	OK	1234.58	7.35	OK
BF	2591.87	19.64	OK	982.72	7.44	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2551.67	15.19	1.47	194.76	OK
TF	5116.42	30.45	1.47	359.55	OK
TF Inside	2564.75	15.27	1.47	209.74	OK
BF Inside	2591.87	19.64	1.47	164.79	OK
BF	5116.42	38.76	1.47	359.55	OK
BF Outside	2524.55	19.13	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.56	19.28	OK	14.07	7.03	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.56	1.47	91.65	OK
Web SPL	19.28	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.40	NA
TF Inside	1.36	NA
BF Inside	1.06	NA
BF Outside	1.09	NA

Bolt	Shear	Slip	Bearing
TF	2.37	2.29	11.81
Web	1.58	2.39	2.38
BF	1.84	2.26	7.83

Plate	Shear	Flexure
Web	3.20	1.41

Field Splice

Type O

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1298	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

C:\Users\sjlarson\Application Data\Microsoft\Excel\[Field Splice (version 1).xlsb]Type O

Field Splice - Node 1298

Node 1298

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	140
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1298 L	105.00	68.22	7163.05	105.00	68.22	7163.05	142.50	50.00	7125.00
1298 R	144.00	68.45	9856.80	144.00	68.45	9856.80	171.00	50.00	8550.00

Rh = 0.97

Controlling Section = 1298 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.50	---	105.00	73.13	74.77	70	85
	Web	114.00	1.25	---	142.50	96.02	---	50	65
	BF	42.00	2.50	---	105.00	73.13	74.77	70	85
Splice Plates	TF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	Web	107.00	0.875	26.50	187.25	122.17	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1298**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.61	9.88	-18.48	25.01	-19.55	27.88	-15.35	20.00	-13.49	16.52	-16.90	22.02	-22.92	34.23	1.82	-2.23
ϕf Fnc (ksi)	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	65.71
f / ϕf Fnc	0.14	0.14	0.27	0.37	0.29	0.41	0.22	0.29	0.20	0.24	0.25	0.32	0.34	0.50	0.03	0.03
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.94
fcf (ksi)		9.88		25.01		27.88		20.00		16.52		22.02		34.23		-2.23
Fcf (ksi)		51.16		51.16		51.16		51.16		51.16		51.16		51.67		-49.28
Fcf (kip)		3825.81		3825.81		3825.81		3825.81		3825.81		3825.81		3863.89		-5174.80
fncf (ksi)	-9.61		-18.48		-19.55		-15.35		-13.49		-16.90		-22.92		1.82	
Rcf	5.18		2.05		1.84		2.56		3.10		2.32		1.51		22.05	
Fncf (ksi)	-51.16		-51.16		-51.16		-51.16		-51.16		-51.16		-51.16		51.16	
Fncf (kip)	-5372.29		-5372.29		-5372.29		-5372.29		-5372.29		-5372.29		-5372.29		3825.81	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.11	7.52	-13.66	18.00	-14.39	19.99	-11.18	14.67	-7.08	6.96	-13.25	17.25	-16.81	24.51	-3.31	-0.08
Fs (ksi)	-7.11	7.52	-13.66	18.00	-14.39	19.99	-11.18	14.67	-7.08	6.96	-13.25	17.25	-16.81	24.51	-3.31	-0.08
Fs (kip)	-746.62	789.35	-1434.72	1889.74	-1511.12	2099.39	-1173.63	1540.87	-742.90	730.51	-1391.00	1810.98	-1764.73	2574.02	-347.89	-8.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	3825.81	3863.89	0.00	2574.02
Comp	5372.29	5174.80	1764.73	8.81

$\phi_v V_n$ (kip) = 2262.15

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	833.74	1121.17	680.97	1194.99	785.62	1000.76	968.91	890.62	615.60	813.51	502.50	870.83	616.65	773.50	705.94	655.79
Vuw (kip)	1250.62	1681.75	1021.45	1728.57	1178.43	1501.15	1453.37	1335.93	---	---	---	---	---	---	---	---
Mv (k*ft)	703.47	945.98	574.57	972.32	662.87	844.39	817.52	751.46	346.28	457.60	282.66	489.84	346.87	435.09	397.09	368.88
Huw (kip)	8.27	859.76	996.51	754.63	576.09	755.15	1122.72	-568.12	28.99	308.76	399.18	249.20	-8.40	284.98	549.17	-242.05
Muw (k*ft)	11237.31	9889.11	9672.59	10055.57	10338.25	10054.75	9584.76	9937.32	1650.25	3571.81	3879.15	2916.48	1583.04	3440.22	4661.57	364.31
Mu (k*ft)	11940.78	10835.10	10247.15	11027.89	11001.12	10899.15	10402.28	10688.78	1996.53	4029.41	4161.81	3406.32	1929.90	3875.31	5058.67	733.19

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1298**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.06	6.14	7.12	5.39	4.11	5.39	8.02	4.06	0.21	2.21	2.85	1.78	0.06	2.04	3.92	1.73
PY1 (Vuw)	8.93	12.01	7.30	12.35	8.42	10.72	10.38	9.54	4.40	5.81	3.59	6.22	4.40	5.52	5.04	4.68
PX2 (Mu)	56.17	50.97	48.21	51.88	51.75	51.27	48.93	50.28	9.39	18.96	19.58	16.02	9.08	18.23	23.80	3.45
PY2 (Mu)	4.96	4.50	4.25	4.58	4.57	4.52	4.32	4.44	0.83	1.67	1.73	1.41	0.80	1.61	2.10	0.30
Pu (kip)	57.92	59.45	56.52	59.72	57.36	58.68	58.82	56.11	10.93	22.45	23.05	19.37	10.52	21.48	28.63	7.19

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	1871.14	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK
TF Inside	1954.67	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Inside	1974.13	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Outside	1889.77	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2627.49	2646.00	OK
TF Inside	2744.79	2764.13	OK
BF Inside	2643.89	2764.13	OK
BF Outside	2530.91	2646.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.95	43.53	42.15	43.66	42.61	43.20	43.38	41.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 3339.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1728.57
Rr (kip)	3684.70
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1298**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.84	1.0	30.25
Web	0.13	1.00	1.0	36.19
BF	0.50	0.84	1.0	30.25

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2744.79	22.87	OK	901.63	7.51	OK
BF	2643.89	22.03	OK	1315.11	10.96	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2627.49	21.90	1.47	119.85	OK
TF	5372.29	44.77	1.47	299.63	OK
TF Inside	2744.79	22.87	1.47	134.83	OK
BF Inside	2643.89	22.03	1.47	134.83	OK
BF	5174.80	43.12	1.47	299.63	OK
BF Outside	2530.91	21.09	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.72	29.86	OK	28.63	14.31	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.72	1.47	114.56	OK
Web SPL	29.86	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.01
TF Inside	1.03	1.01
BF Inside	1.02	1.05
BF Outside	1.05	1.05

Bolt	Shear	Slip	Bearing
TF	1.32	2.24	5.47
Web	1.21	1.18	1.92
BF	1.37	1.54	5.68

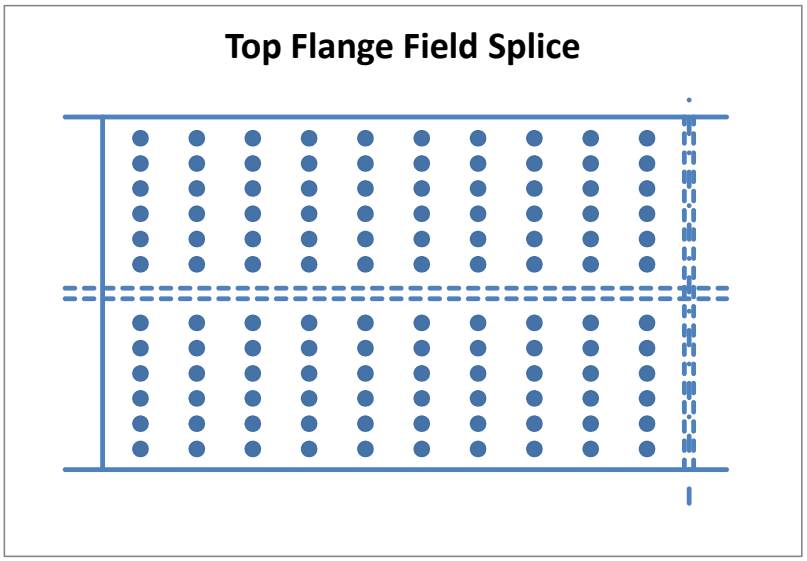
Plate	Shear	Flexure
Web	2.13	1.15

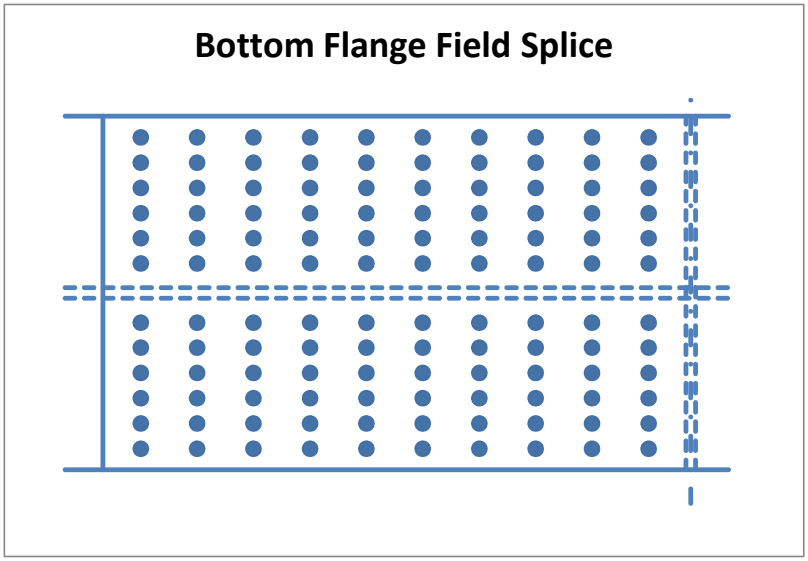
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1298	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1298

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	15	0	15
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
0	34	0	34
0	37	0	37
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	15	3	15
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
3	34	3	34
3	37	3	37
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	15	6	15
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
6	34	6	34
6	37	6	37
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	15	9	15
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
9	34	9	34
9	37	9	37
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	15	12	15
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
12	34	12	34

	Top Flange		Bottom Flange	
No. Bolts =	120.0		120.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		9.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	37	12	37
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	15	15	15
15	22	15	22
15	25	15	25
15	28	15	28
15	31	15	31
15	34	15	34
15	37	15	37
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	15	18	15
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
18	34	18	34
18	37	18	37
21	0	21	0
21	3	21	3
21	6	21	6
21	9	21	9
21	12	21	12
21	15	21	15
21	22	21	22
21	25	21	25
21	28	21	28
21	31	21	31
21	34	21	34
21	37	21	37
24	0	24	0
24	3	24	3
24	6	24	6
24	9	24	9
24	12	24	12
24	15	24	15
24	22	24	22
24	25	24	25
24	28	24	28
24	31	24	31
24	34	24	34
24	37	24	37
27	0	27	0
27	3	27	3
27	6	27	6
27	9	27	9
27	12	27	12
27	15	27	15
27	22	27	22
27	25	27	25
27	28	27	28
27	31	27	31
27	34	27	34
27	37	27	37

Flange Bolt Pattern Cont. - Node 1298

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
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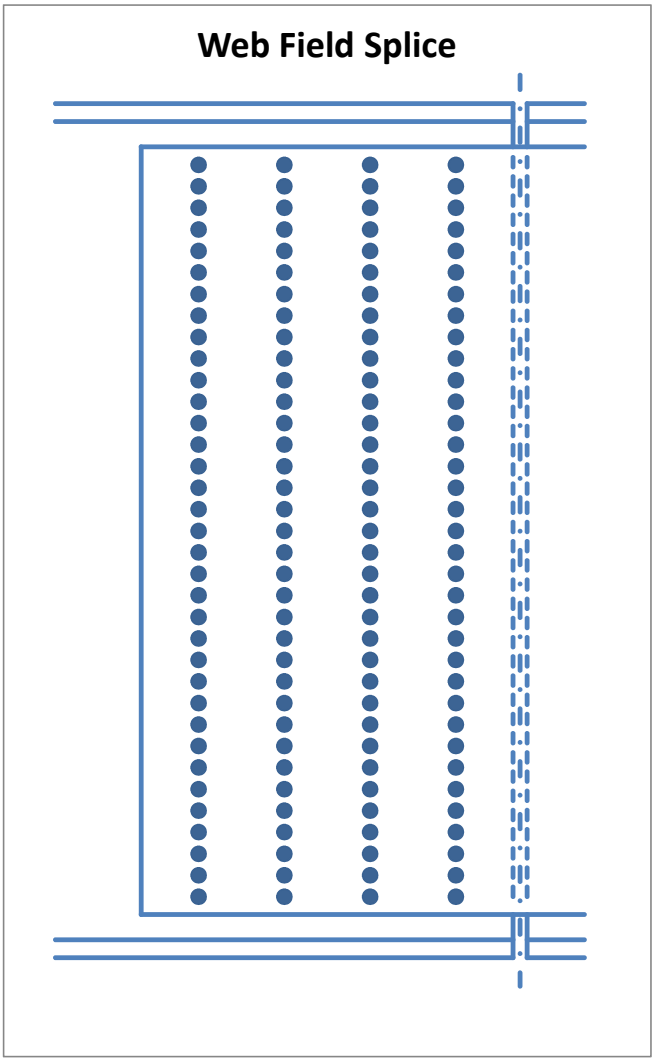
Web Bolt Pattern - Node 1298

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	20.25	2601
0	3	20.25	2304
0	6	20.25	2025
0	9	20.25	1764
0	12	20.25	1521
0	15	20.25	1296
0	18	20.25	1089
0	21	20.25	900
0	24	20.25	729
0	27	20.25	576
0	30	20.25	441
0	33	20.25	324
0	36	20.25	225
0	39	20.25	144
0	42	20.25	81
0	45	20.25	36
0	48	20.25	9
0	51	20.25	0
0	54	20.25	9
0	57	20.25	36
0	60	20.25	81
0	63	20.25	144
0	66	20.25	225
0	69	20.25	324
0	72	20.25	441
0	75	20.25	576
0	78	20.25	729
0	81	20.25	900
0	84	20.25	1089
0	87	20.25	1296
0	90	20.25	1521
0	93	20.25	1764
0	96	20.25	2025
0	99	20.25	2304
0	102	20.25	2601
3	0	2.25	2601
3	3	2.25	2304
3	6	2.25	2025
3	9	2.25	1764
3	12	2.25	1521
3	15	2.25	1296
3	18	2.25	1089
3	21	2.25	900
3	24	2.25	729
3	27	2.25	576
3	30	2.25	441
3	33	2.25	324
3	36	2.25	225
3	39	2.25	144
3	42	2.25	81
3	45	2.25	36
3	48	2.25	9
3	51	2.25	0
3	54	2.25	9
3	57	2.25	36
3	60	2.25	81
3	63	2.25	144
3	66	2.25	225
3	69	2.25	324

No. Bolts =	140.0	
Splice Plate to First Column (in) =	2.000	OK
No. Longitudinal Space =	3.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	34.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	4.5	
y_{bar} (in) =	51	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1575	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	128520	
Σd^2 (in^2) =	130095	



3	72	2.25	441
3	75	2.25	576
3	78	2.25	729
3	81	2.25	900
3	84	2.25	1089
3	87	2.25	1296
3	90	2.25	1521
3	93	2.25	1764
3	96	2.25	2025
3	99	2.25	2304
3	102	2.25	2601
6	0	2.25	2601
6	3	2.25	2304
6	6	2.25	2025
6	9	2.25	1764
6	12	2.25	1521
6	15	2.25	1296
6	18	2.25	1089
6	21	2.25	900
6	24	2.25	729
6	27	2.25	576
6	30	2.25	441
6	33	2.25	324
6	36	2.25	225
6	39	2.25	144
6	42	2.25	81
6	45	2.25	36
6	48	2.25	9
6	51	2.25	0
6	54	2.25	9
6	57	2.25	36
6	60	2.25	81
6	63	2.25	144
6	66	2.25	225
6	69	2.25	324
6	72	2.25	441
6	75	2.25	576
6	78	2.25	729
6	81	2.25	900
6	84	2.25	1089
6	87	2.25	1296
6	90	2.25	1521
6	93	2.25	1764
6	96	2.25	2025
6	99	2.25	2304
6	102	2.25	2601
9	0	20.25	2601
9	3	20.25	2304
9	6	20.25	2025
9	9	20.25	1764
9	12	20.25	1521
9	15	20.25	1296
9	18	20.25	1089
9	21	20.25	900
9	24	20.25	729
9	27	20.25	576
9	30	20.25	441
9	33	20.25	324
9	36	20.25	225
9	39	20.25	144
9	42	20.25	81
9	45	20.25	36
9	48	20.25	9
9	51	20.25	0
9	54	20.25	9
9	57	20.25	36

Web Bolt Pattern Cont. - Node 1298

9	60	20.25	81
9	63	20.25	144
9	66	20.25	225
9	69	20.25	324
9	72	20.25	441
9	75	20.25	576
9	78	20.25	729
9	81	20.25	900
9	84	20.25	1089
9	87	20.25	1296
9	90	20.25	1521
9	93	20.25	1764
9	96	20.25	2025
9	99	20.25	2304
9	102	20.25	2601
630	7140	1575	128520

Web Bolt Pattern Cont. - Node 1298

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Field Splice - Node 3300

Node 3300

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	140
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3300 L	105.00	68.21	7161.95	105.00	68.21	7161.95	142.50	50.00	7125.00
3300 R	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00

Rh = 0.97

Controlling Section = 3300 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.50	---	105.00	73.13	74.77	70	85
	Web	114.00	1.25	---	142.50	96.02	---	50	65
	BF	42.00	2.50	---	105.00	73.13	74.77	70	85
Splice Plates	TF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	Web	107.00	0.875	26.50	187.25	122.17	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3300**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.68	11.09	-19.51	26.93	-18.10	24.78	-16.29	21.51	-13.70	16.16	-15.84	19.52	-22.56	33.46	-1.43	0.84
ϕf Fnc (ksi)	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21
f / ϕf Fnc	0.16	0.16	0.29	0.39	0.27	0.36	0.24	0.32	0.20	0.24	0.23	0.29	0.33	0.49	0.02	0.01
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		11.09		26.93		24.78		21.51		16.16		19.52		33.46	-1.43	
Fcf (ksi)		51.16		51.16		51.16		51.16		51.16		51.16		51.27	-51.16	
Fcf (kip)		3825.22		3825.22		3825.22		3825.22		3825.22		3825.22		3833.93	-5371.46	
fncf (ksi)	-10.68		-19.51		-18.10		-16.29		-13.70		-15.84		-22.56			0.84
Rcf	4.61		1.90		2.06		2.38		3.16		2.62		1.53			35.67
Fncf (ksi)	-51.16		-51.16		-51.16		-51.16		-51.16		-51.16		-51.16			51.16
Fncf (kip)	-5371.46		-5371.46		-5371.46		-5371.46		-5371.46		-5371.46		-5371.46			3825.22

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.88	8.31	-14.39	19.47	-13.39	17.95	-11.84	15.67	-9.88	11.68	-12.16	14.96	-16.54	24.08	-4.71	1.84
Fs (ksi)	-7.88	8.31	-14.39	19.47	-13.39	17.95	-11.84	15.67	-9.88	11.68	-12.16	14.96	-16.54	24.08	-4.71	1.84
Fs (kip)	-827.16	872.05	-1510.72	2043.87	-1406.03	1884.48	-1243.66	1645.51	-1037.58	1226.86	-1276.49	1570.33	-1736.88	2528.51	-494.83	192.96

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3833.93	0.00	2528.51
Comp	5371.46	0.00	1736.88	0.00

$\phi_v V_n$ (kip) = 2262.15

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	1062.92	1240.80	851.15	1416.52	1086.50	1180.93	1227.72	1088.42	776.48	899.74	624.44	1026.31	816.01	898.30	890.50	794.49
Vuw (kip)	1594.38	1751.48	1276.73	1839.33	1629.75	1721.54	1744.93	1632.62	---	---	---	---	---	---	---	---
Mv (k*ft)	896.84	985.20	718.16	1034.63	916.73	968.37	981.53	918.35	436.77	506.10	351.25	577.30	459.01	505.29	500.90	446.90
Huw (kip)	42.03	910.29	888.86	791.69	463.48	593.20	1096.41	-1409.88	30.46	361.78	324.66	272.68	128.44	199.39	537.18	-204.84
Muw (k*ft)	11180.40	9805.65	9839.58	9993.44	10513.10	10307.71	9536.55	9014.63	1825.63	3819.07	3535.34	3104.14	2432.92	3058.64	4582.75	738.97
Mu (k*ft)	12077.24	10790.85	10557.74	11028.07	11429.83	11276.07	10518.08	9932.98	2262.40	4325.17	3886.59	3681.43	2891.93	3563.93	5083.65	1185.87

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3300**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.30	6.50	6.35	5.65	3.31	4.24	7.83	10.07	0.22	2.58	2.32	1.95	0.92	1.42	3.84	1.46
PY1 (Vuw)	11.39	12.51	9.12	13.14	11.64	12.30	12.46	11.66	5.55	6.43	4.46	7.33	5.83	6.42	6.36	5.67
PX2 (Mu)	56.81	50.76	49.67	51.88	53.77	53.05	49.48	46.73	10.64	20.35	18.28	17.32	13.60	16.77	23.91	5.58
PY2 (Mu)	5.01	4.48	4.38	4.58	4.74	4.68	4.37	4.12	0.94	1.80	1.61	1.53	1.20	1.48	2.11	0.49
Pu (kip)	59.42	59.73	57.62	60.20	59.38	59.75	59.73	58.95	12.65	24.36	21.48	21.21	16.13	19.83	29.02	9.36

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK
TF Inside	0.00	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Inside	1958.82	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Outside	1875.11	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2627.09	2646.00	OK
TF Inside	2744.37	2764.13	OK
BF Inside	0.00	2764.13	OK
BF Outside	0.00	2646.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.62	43.64	42.69	43.86	43.55	43.69	43.65	43.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 3339.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1839.33
Rr (kip)	3684.70
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3300**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.84	1.0	30.25
Web	0.13	1.00	1.0	36.19
BF	0.50	0.84	1.0	30.25

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2744.37	22.87	OK	887.40	7.40	OK
BF	1958.82	16.32	OK	1291.86	10.77	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2627.09	21.89	1.47	119.85	OK
TF	5371.46	44.76	1.47	299.63	OK
TF Inside	2744.37	22.87	1.47	134.83	OK
BF Inside	1958.82	16.32	1.47	134.83	OK
BF	3833.93	31.95	1.47	299.63	OK
BF Outside	1875.11	15.63	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.20	30.10	OK	29.02	14.51	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.20	1.47	114.56	OK
Web SPL	30.10	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	1.03	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.32	2.28	5.47
Web	1.20	1.16	1.90
BF	1.85	1.56	7.67

Plate	Shear	Flexure
Web	2.00	1.14

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Field Splice - Node 5297

Node 5297

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	140
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5297 L	105.00	68.21	7161.95	105.00	68.21	7161.95	142.50	50.00	7125.00
5297 R	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00

Rh = 0.97

Controlling Section = 5297 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.50	---	105.00	73.13	74.77	70	85
	Web	114.00	1.25	---	142.50	96.02	---	50	65
	BF	42.00	2.50	---	105.00	73.13	74.77	70	85
Splice Plates	TF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	Web	107.00	0.875	26.50	187.25	122.17	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.55	11.38	-17.85	24.34	-18.35	25.98	-14.54	18.27	-16.47	21.36	-11.27	11.96	-21.80	32.37	-2.04	1.24
ϕf Fnc (ksi)	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21
f / ϕf Fnc	0.15	0.17	0.26	0.36	0.27	0.38	0.21	0.27	0.24	0.31	0.17	0.18	0.32	0.47	0.03	0.02
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		11.38		24.34		25.98		18.27		21.36		11.96		32.37	-2.04	
Fcf (ksi)		51.16		51.16		51.16		51.16		51.16		51.16		51.16	-51.16	
Fcf (kip)		3825.22		3825.22		3825.22		3825.22		3825.22		3825.22		3825.22	-5371.46	
fncf (ksi)	-10.55		-17.85		-18.35		-14.54		-16.47		-11.27		-21.80			1.24
Rcf	4.49		2.10		1.97		2.80		2.40		4.28		1.58			25.13
Fncf (ksi)	-51.16		-51.16		-51.16		-51.16		-51.16		-51.16		-51.16			51.16
Fncf (kip)	-5371.46		-5371.46		-5371.46		-5371.46		-5371.46		-5371.46		-5371.46			3825.22

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.95	8.64	-12.98	17.56	-13.36	18.86	-10.65	13.27	-12.51	16.42	-8.45	9.05	-15.80	23.37	-4.62	1.89
Fs (ksi)	-7.95	8.64	-12.98	17.56	-13.36	18.86	-10.65	13.27	-12.51	16.42	-8.45	9.05	-15.80	23.37	-4.62	1.89
Fs (kip)	-834.51	907.08	-1363.10	1844.01	-1402.57	1979.80	-1117.78	1393.82	-1313.91	1724.34	-887.44	950.02	-1658.60	2453.83	-484.74	198.09

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3825.22	0.00	2453.83
Comp	5371.46	0.00	1658.60	0.00

$\phi_v V_n$ (kip) = 2262.15

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	989.76	1305.12	828.02	1418.18	1070.62	1081.23	1216.68	1050.48	721.53	945.15	607.26	1025.03	806.81	786.16	881.86	765.24
Vuw (kip)	1484.63	1783.63	1242.02	1840.17	1605.93	1621.85	1739.41	1575.73	---	---	---	---	---	---	---	---
Mv (k*ft)	835.11	1003.29	698.64	1035.09	903.34	912.29	978.42	886.35	405.86	531.65	341.58	576.58	453.83	442.21	496.04	430.45
Huw (kip)	173.18	878.60	977.76	650.47	740.99	119.25	1097.21	-1332.87	49.25	326.33	391.70	187.31	278.51	42.47	539.62	-194.52
Muw (k*ft)	10972.75	9855.83	9698.83	10217.04	10073.71	11058.13	9509.70	9136.57	1871.18	3445.74	3634.03	2698.48	3264.31	1974.17	4418.42	733.64
Mu (k*ft)	11807.85	10859.12	10397.47	11252.13	10977.05	11970.42	10488.12	10022.91	2277.04	3977.38	3975.61	3275.05	3718.14	2416.38	4914.46	1164.09

Note: Mu = Muw + Mv

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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.24	6.28	6.98	4.65	5.29	0.85	7.84	9.52	0.35	2.33	2.80	1.34	1.99	0.30	3.85	1.39
PY1 (Vuw)	10.60	12.74	8.87	13.14	11.47	11.58	12.42	11.26	5.15	6.75	4.34	7.32	5.76	5.62	6.30	5.47
PX2 (Mu)	55.55	51.08	48.91	52.93	51.64	56.31	49.34	47.15	10.71	18.71	18.70	15.41	17.49	11.37	23.12	5.48
PY2 (Mu)	4.90	4.51	4.32	4.67	4.56	4.97	4.35	4.16	0.95	1.65	1.65	1.36	1.54	1.00	2.04	0.48
Pu (kip)	58.86	59.90	57.43	60.27	59.14	59.51	59.59	58.73	12.63	22.66	22.32	18.86	20.81	13.42	28.23	9.08

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK
TF Inside	0.00	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Inside	1954.37	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Outside	1870.85	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2627.09	2646.00	OK
TF Inside	2744.37	2764.13	OK
BF Inside	0.00	2764.13	OK
BF Outside	0.00	2646.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.36	43.72	42.59	43.91	43.40	43.65	43.55	43.14
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 3339.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1840.17
Rr (kip)	3684.70
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.84	1.0	30.25
Web	0.13	1.00	1.0	36.19
BF	0.50	0.84	1.0	30.25

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2744.37	22.87	OK	847.41	7.06	OK
BF	1954.37	16.29	OK	1253.70	10.45	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2627.09	21.89	1.47	119.85	OK
TF	5371.46	44.76	1.47	299.63	OK
TF Inside	2744.37	22.87	1.47	134.83	OK
BF Inside	1954.37	16.29	1.47	134.83	OK
BF	3825.22	31.88	1.47	299.63	OK
BF Outside	1870.85	15.59	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.27	30.14	OK	28.23	14.12	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.27	1.47	114.56	OK
Web SPL	30.14	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	1.03	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.32	2.38	5.47
Web	1.20	1.19	1.90
BF	1.86	1.61	7.69

Plate	Shear	Flexure
Web	2.00	1.14

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Field Splice - Node 7295

Node 7295

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	140
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7295 L	105.00	68.21	7161.95	105.00	68.21	7161.95	142.50	50.00	7125.00
7295 R	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00

Rh = 0.97

Controlling Section = 7295 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.50	---	105.00	73.13	74.77	70	85
	Web	114.00	1.25	---	142.50	96.02	---	50	65
	BF	42.00	2.50	---	105.00	73.13	74.77	70	85
Splice Plates	TF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	Web	107.00	0.875	26.50	187.25	122.17	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.58	10.07	-20.34	25.98	-18.87	24.03	-17.01	20.86	-21.01	27.15	-6.65	6.64	-22.92	32.20	-2.73	1.47
ϕf Fnc (ksi)	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21	68.21
f / ϕf Fnc	0.14	0.15	0.30	0.38	0.28	0.35	0.25	0.31	0.31	0.40	0.10	0.10	0.34	0.47	0.04	0.02
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		10.07		25.98		24.03		20.86		27.15	-6.65			32.20	-2.73	
Fcf (ksi)		51.16		51.16		51.16		51.16		51.16	-51.16			51.16	-51.16	
Fcf (kip)		3825.22		3825.22		3825.22		3825.22		3825.22	-5371.46			3825.22	-5371.46	
fncf (ksi)	-9.58		-20.34		-18.87		-17.01		-21.01			6.64	-22.92			1.47
Rcf	5.08		1.97		2.13		2.45		1.88			7.70	1.59			18.76
Fncf (ksi)	-51.16		-51.16		-51.16		-51.16		-51.16			52.42	-51.16			51.16
Fncf (kip)	-5371.46		-5371.46		-5371.46		-5371.46		-5371.46			3919.77	-5371.46			3825.22

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.55	6.94	-14.93	18.68	-13.89	17.31	-12.42	15.43	-15.40	19.51	-6.95	5.80	-16.59	23.44	-5.92	2.19
Fs (ksi)	-7.55	6.94	-14.93	18.68	-13.89	17.31	-12.42	15.43	-15.40	19.51	-6.95	5.80	-16.59	23.44	-5.92	2.19
Fs (kip)	-793.25	728.71	-1567.31	1961.73	-1458.37	1817.42	-1303.58	1620.00	-1616.84	2048.42	-729.37	608.97	-1741.59	2461.64	-621.44	229.92

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3919.77	0.00	2461.64
Comp	5371.46	0.00	1741.59	0.00

$\phi_v V_n$ (kip) = 2262.15

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	1010.05	1196.69	824.25	1377.44	1116.67	1035.89	1194.55	1040.71	750.63	868.49	605.36	996.74	811.96	755.42	867.52	758.29
Vuw (kip)	1515.07	1729.42	1236.38	1819.80	1675.01	1553.84	1728.35	1561.06	---	---	---	---	---	---	---	---
Mv (k*ft)	852.23	972.80	695.46	1023.64	942.19	874.03	972.20	878.10	422.23	488.53	340.51	560.66	456.73	424.92	487.98	426.54
Huw (kip)	84.71	698.15	689.88	578.98	731.32	87.79	957.96	-1590.70	-43.79	267.65	243.64	214.72	292.86	-81.70	488.60	-265.68
Muw (k*ft)	11112.81	10141.54	10154.63	10330.24	10089.02	11385.95	9730.18	8728.34	1635.19	3791.62	3519.53	3141.12	3937.97	1437.92	4515.97	914.71
Mu (k*ft)	11965.04	11114.34	10850.09	11353.87	11031.21	12259.98	10702.38	9606.44	2057.42	4280.15	3860.05	3701.78	4394.70	1862.84	5003.95	1341.25

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 7295**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.61	4.99	4.93	4.14	5.22	0.63	6.84	11.36	0.31	1.91	1.74	1.53	2.09	0.58	3.49	1.90
PY1 (Vuw)	10.82	12.35	8.83	13.00	11.96	11.10	12.35	11.15	5.36	6.20	4.32	7.12	5.80	5.40	6.20	5.42
PX2 (Mu)	56.29	52.28	51.04	53.41	51.89	57.67	50.35	45.19	9.68	20.13	18.16	17.41	20.67	8.76	23.54	6.31
PY2 (Mu)	4.97	4.61	4.50	4.71	4.58	5.09	4.44	3.99	0.85	1.78	1.60	1.54	1.82	0.77	2.08	0.56
Pu (kip)	59.04	59.73	57.54	60.21	59.46	60.51	59.60	58.54	11.77	23.45	20.76	20.83	24.01	11.20	28.27	10.15

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK
TF Inside	0.00	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Inside	2002.68	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Outside	1917.09	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2627.09	2646.00	OK
TF Inside	2744.37	2764.13	OK
BF Inside	0.00	2764.13	OK
BF Outside	0.00	2646.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.45	43.67	42.67	43.89	43.55	44.53	43.58	43.02
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 3339.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1819.80
Rr (kip)	3684.70
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7295**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.84	1.0	30.25
Web	0.13	1.00	1.0	36.19
BF	0.50	0.84	1.0	30.25

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2744.37	22.87	OK	889.81	7.42	OK
BF	2002.68	16.69	OK	1257.69	10.48	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2627.09	21.89	1.47	119.85	OK
TF	5371.46	44.76	1.47	299.63	OK
TF Inside	2744.37	22.87	1.47	134.83	OK
BF Inside	2002.68	16.69	1.47	134.83	OK
BF	3919.77	32.66	1.47	299.63	OK
BF Outside	1917.09	15.98	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.51	30.25	OK	28.27	14.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.51	1.47	114.56	OK
Web SPL	30.25	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	1.00	NA
BF Outside	1.04	NA

Bolt	Shear	Slip	Bearing
TF	1.32	2.27	5.47
Web	1.20	1.19	1.89
BF	1.81	1.61	7.50

Plate	Shear	Flexure
Web	2.02	1.12

Field Splice - Node 9295

Node 9295

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	140
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9295 L	105.00	68.22	7163.05	105.00	68.22	7163.05	142.50	50.00	7125.00
9295 R	144.00	68.45	9856.80	144.00	68.45	9856.80	171.00	50.00	8550.00

Rh = 0.97

Controlling Section = 9295 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.50	---	105.00	73.13	74.77	70	85
	Web	114.00	1.25	---	142.50	96.02	---	50	65
	BF	42.00	2.50	---	105.00	73.13	74.77	70	85
Splice Plates	TF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.125	62.50	43.88	29.53	---	70	85
	BF Outside	42.00	1.000	62.50	42.00	29.25	---	70	85
	Web	107.00	0.875	26.50	187.25	122.17	---	50	65

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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.33	22.69	-14.41	15.27	-20.54	27.70	-17.22	21.51	-22.98	31.54	-3.37	3.30	-23.67	33.90	-2.03	1.22
ϕf Fnc (ksi)	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22	68.22
f / ϕf Fnc	0.25	0.33	0.21	0.22	0.30	0.41	0.25	0.32	0.34	0.46	0.05	0.05	0.35	0.50	0.03	0.02
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		22.69		15.27		27.70		21.51		31.54	-3.37			33.90	-2.03	
Fcf (ksi)		51.16		51.16		51.16		51.16		51.16	-51.16			51.50	-51.16	
Fcf (kip)		3825.81		3825.81		3825.81		3825.81		3825.81	-5372.29			3850.86	-5372.29	
fncf (ksi)	-17.33		-14.41		-20.54		-17.22		-22.98			3.30	-23.67			1.22
Rcf	2.26		3.35		1.85		2.38		1.62			15.20	1.52			25.20
Fncf (ksi)	-51.16		-51.16		-51.16		-51.16		-51.16			51.39	-51.16			51.16
Fncf (kip)	-5372.29		-5372.29		-5372.29		-5372.29		-5372.29			3842.79	-5372.29			3825.81

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.67	16.81	-10.79	11.14	-15.12	19.93	-12.59	15.98	-16.84	22.64	-5.80	3.80	-17.15	24.73	-5.71	2.11
Fs (ksi)	-12.67	16.81	-10.79	11.14	-15.12	19.93	-12.59	15.98	-16.84	22.64	-5.80	3.80	-17.15	24.73	-5.71	2.11
Fs (kip)	-1330.46	1765.55	-1132.95	1169.47	-1587.50	2092.16	-1322.19	1678.41	-1768.40	2376.86	-609.48	398.85	-1801.10	2596.89	-599.91	221.60

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3850.86	0.00	2596.89
Comp	5372.29	0.00	1801.10	0.00

$\phi_v V_n$ (kip) = 2262.15

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	716.52	929.16	570.73	1069.55	920.56	748.47	851.74	777.32	528.72	676.27	423.02	778.15	670.19	551.29	624.26	568.99
Vuw (kip)	1074.77	1393.74	856.09	1604.32	1380.84	1122.70	1277.60	1165.98	---	---	---	---	---	---	---	---
Mv (k*ft)	604.56	783.98	481.55	902.43	776.72	631.52	718.65	655.87	297.41	380.40	237.95	437.71	376.98	310.10	351.14	320.06
Huw (kip)	768.25	111.30	850.07	635.10	897.08	15.77	1013.11	-1359.91	295.24	24.78	342.45	241.72	412.88	-142.93	540.00	-256.72
Muw (k*ft)	10034.01	11074.18	9904.45	10244.83	9830.02	11275.37	9719.97	9097.21	3326.37	2473.74	3953.44	3223.85	4453.69	1083.34	4725.22	882.63
Mu (k*ft)	10638.57	11858.16	10386.00	11147.26	10606.75	11906.89	10438.62	9753.08	3623.78	2854.14	4191.39	3661.56	4830.67	1393.45	5076.36	1202.69

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 9295**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	5.49	0.79	6.07	4.54	6.41	0.11	7.24	9.71	2.11	0.18	2.45	1.73	2.95	1.02	3.86	1.83
PY1 (Vuw)	7.68	9.96	6.11	11.46	9.86	8.02	9.13	8.33	3.78	4.83	3.02	5.56	4.79	3.94	4.46	4.06
PX2 (Mu)	50.05	55.78	48.86	52.44	49.90	56.01	49.11	45.88	17.05	13.43	19.72	17.22	22.72	6.56	23.88	5.66
PY2 (Mu)	4.42	4.92	4.31	4.63	4.40	4.94	4.33	4.05	1.50	1.18	1.74	1.52	2.01	0.58	2.11	0.50
Pu (kip)	56.84	58.50	55.91	59.20	58.08	57.60	57.93	56.96	19.87	14.87	22.67	20.23	26.56	8.82	28.50	8.77

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK
TF Inside	0.00	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Inside	1967.47	2917.69	2008.13	130.50	85.08	21.80	4837.67	2008.13	OK
BF Outside	1883.39	2793.00	1989.00	58.00	37.81	25.31	3212.58	1989.00	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2627.49	2646.00	OK
TF Inside	2744.79	2764.13	OK
BF Inside	0.00	2764.13	OK
BF Outside	0.00	2646.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.33	43.21	41.86	43.45	42.91	42.87	42.92	42.31
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 3339.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1604.32
Rr (kip)	3684.70
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9295**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.50	0.84	1.0	30.25
Web	0.13	1.00	1.0	36.19
BF	0.50	0.84	1.0	30.25

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2744.79	22.87	OK	920.21	7.67	OK
BF	1967.47	16.40	OK	1326.79	11.06	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2627.49	21.90	1.47	119.85	OK
TF	5372.29	44.77	1.47	299.63	OK
TF Inside	2744.79	22.87	1.47	134.83	OK
BF Inside	1967.47	16.40	1.47	134.83	OK
BF	3850.86	32.09	1.47	299.63	OK
BF Outside	1883.39	15.69	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.20	29.60	OK	28.50	14.25	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.20	1.47	114.56	OK
Web SPL	29.60	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	1.02	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.32	2.19	5.47
Web	1.22	1.18	1.94
BF	1.84	1.52	7.64

Plate	Shear	Flexure
Web	2.30	1.15

Field Splice

Type P

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	Cleveland InnerBelt : Field Splice - Node 1307	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1307

Node 1307

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	140
Web	210
BF	168

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1307 L	144.00	68.45	9856.80	144.00	68.45	9856.80	171.00	50.00	8550.00
1307 R	144.00	68.45	9856.80	144.00	68.45	9856.80	171.00	50.00	8550.00

Rh = 0.98

Controlling Section = 1307 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	48.00	3.00	---	144.00	99.38	101.62	70	85
	Web	114.00	1.50	---	171.00	115.22	---	50	65
	BF	48.00	3.00	---	144.00	105.75	108.14	70	85
Splice Plates	TF Outside	48.00	1.250	62.50	60.00	41.41	---	70	85
	TF Inside	22.50	1.375	62.50	61.88	41.42	---	70	85
	BF Inside	22.50	1.500	86.50	67.50	48.38	---	70	85
	BF Outside	48.00	1.500	86.50	72.00	52.88	---	70	85
	Web	107.00	1.125	38.50	240.75	157.08	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1307**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.47	30.80	-35.75	42.06	-36.61	43.81	-28.83	31.12	-34.97	41.21	-28.64	30.68	-38.03	46.59	-25.84	25.73
ϕf Fnc (ksi)	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45
f / ϕf Fnc	0.42	0.45	0.52	0.61	0.53	0.64	0.42	0.45	0.51	0.60	0.42	0.45	0.56	0.68	0.38	0.38
α	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
fcf (ksi)		30.80		42.06		43.81		31.12		41.21		30.68		46.59	-25.84	
Fcf (ksi)		51.34		55.73		56.63		51.34		55.30		51.34		58.05	-51.34	
Fcf (kip)		5551.40		6026.46		6123.32		5551.40		5979.75		5551.40		6276.82	-7392.60	
fncf (ksi)	-28.47		-35.75		-36.61		-28.83		-34.97		-28.64		-38.03			25.73
Rcf	1.67		1.33		1.29		1.65		1.34		1.67		1.25			1.99
Fncf (ksi)	-51.34		-51.34		-51.34		-51.34		-51.34		-51.34		-51.34			52.28
Fncf (kip)	-7392.60		-7392.60		-7392.60		-7392.60		-7392.60		-7392.60		-7392.60			5653.71

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.25	23.05	-26.13	30.23	-26.74	31.47	-21.50	23.27	-25.75	29.81	-21.37	22.97	-28.01	34.21	-19.13	18.70
Fs (ksi)	-21.25	23.05	-26.13	30.23	-26.74	31.47	-21.50	23.27	-25.75	29.81	-21.37	22.97	-28.01	34.21	-19.13	18.70
Fs (kip)	-3059.96	3319.53	-3763.00	4353.52	-3851.12	4531.75	-3096.47	3351.55	-3708.67	4292.17	-3077.15	3307.20	-4032.77	4925.56	-2755.17	2692.64

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	6276.82	0.00	4925.56
Comp	7392.60	0.00	4032.77	0.00

$\phi_v V_n$ (kip) = 3908.99

e_v (in) = 9.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	184.41	394.36	495.37	45.76	322.98	187.54	354.06	114.96	135.93	287.49	358.85	37.97	237.05	138.14	255.79	90.08
Vuw (kip)	276.62	591.55	743.05	68.64	484.47	281.32	531.09	172.43	---	---	---	---	---	---	---	---
Mv (k*ft)	224.75	480.63	603.73	55.77	393.63	228.57	431.51	140.10	110.44	233.59	291.57	30.85	192.61	112.24	207.83	73.19
Huw (kip)	234.96	609.63	688.26	225.39	611.54	194.76	801.45	79.10	154.12	350.62	404.13	151.46	346.46	136.59	530.09	-37.13
Muw (k*ft)	13219.82	13789.72	13902.38	13234.97	13672.33	13283.47	14098.99	13717.09	5997.39	7630.38	7880.77	6061.81	7521.62	6001.95	8421.76	5121.51
Mu (k*ft)	13444.57	14270.36	14506.11	13290.74	14065.96	13512.04	14530.50	13857.19	6107.83	7863.96	8172.34	6092.66	7714.23	6114.20	8629.59	5194.70

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1307**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.12	2.90	3.28	1.07	2.91	0.93	3.82	0.38	0.73	1.67	1.92	0.72	1.65	0.65	2.52	0.18
PY1 (Vuw)	1.32	2.82	3.54	0.33	2.31	1.34	2.53	0.82	0.65	1.37	1.71	0.18	1.13	0.66	1.22	0.43
PX2 (Mu)	41.49	44.04	44.77	41.02	43.41	41.70	44.85	42.77	18.85	24.27	25.22	18.80	23.81	18.87	26.63	16.03
PY2 (Mu)	6.10	6.48	6.58	6.03	6.38	6.13	6.60	6.29	2.77	3.57	3.71	2.77	3.50	2.78	3.92	2.36
Pu (kip)	43.25	47.86	49.10	42.57	47.13	43.28	49.51	43.73	19.88	26.41	27.68	19.75	25.88	19.82	29.61	16.45

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3990.00	2815.63	72.50	47.27	36.48	4345.09	2815.63	OK
TF Inside	0.00	4114.69	2816.69	159.50	103.98	31.97	6275.02	2816.69	OK
BF Inside	3037.17	4488.75	3289.50	246.00	159.94	38.44	8921.69	3289.50	OK
BF Outside	3239.65	4788.00	3595.50	123.00	79.97	47.34	6373.34	3595.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3639.43	3780.00	OK
TF Inside	3753.16	3898.13	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4536.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.55	42.42	43.40	38.08	41.85	38.58	43.94	39.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 4293.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	743.05
Rr (kip)	4737.48
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1307**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3753.16	26.81	OK	2047.41	14.62	OK
BF	3239.65	19.28	OK	2542.22	15.13	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3639.43	26.00	1.47	149.81	OK
TF	7392.60	52.80	1.47	359.55	OK
TF Inside	3753.16	26.81	1.47	164.79	OK
BF Inside	3037.17	18.08	1.47	179.78	OK
BF	6276.82	37.36	1.47	359.55	OK
BF Outside	3239.65	19.28	1.47	179.78	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.51	24.76	OK	29.61	14.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.51	1.47	137.48	OK
Web SPL	24.76	1.47	103.11	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.04
TF Inside	NA	1.04
BF Inside	1.08	NA
BF Outside	1.11	NA

Bolt	Shear	Slip	Bearing
TF	1.35	1.15	5.76
Web	1.46	1.14	2.78
BF	1.88	1.11	9.32

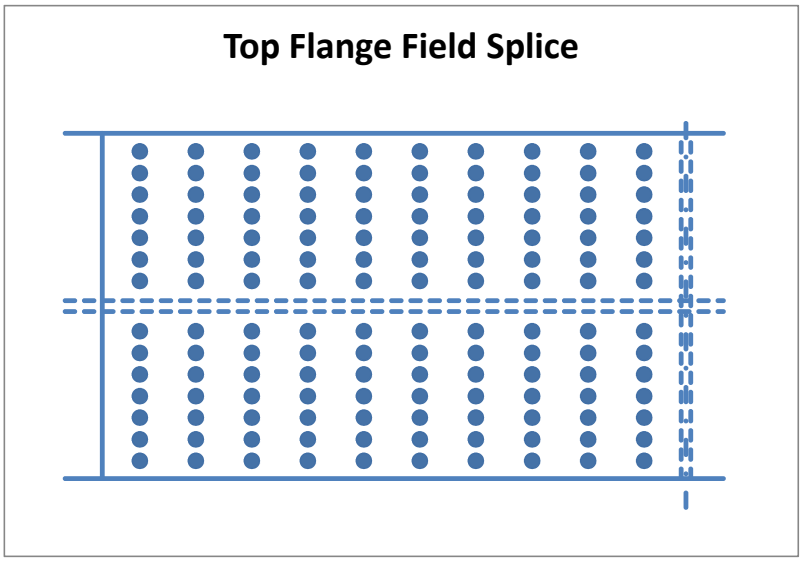
Plate	Shear	Flexure
Web	6.38	1.14

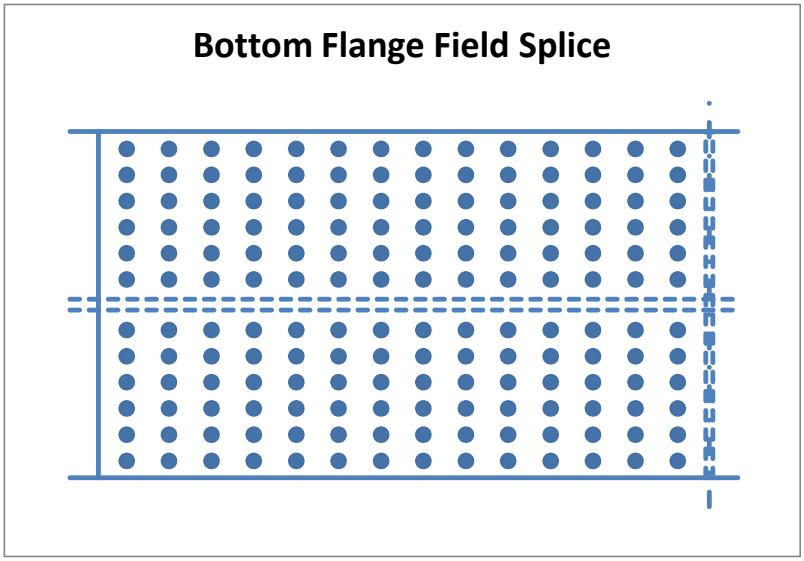
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1307	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1307

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3.625
0	6	0	7.25
0	9	0	10.875
0	12	0	14.5
0	15	0	18.125
0	18	0	25.125
0	25	0	28.75
0	28	0	32.375
0	31	0	36
0	34	0	39.625
0	37	0	43.25
0	40	3	0
0	43	3	3.625
3	0	3	7.25
3	3	3	10.875
3	6	3	14.5
3	9	3	18.125
3	12	3	25.125
3	15	3	28.75
3	18	3	32.375
3	25	3	36
3	28	3	39.625
3	31	3	43.25
3	34	6	0
3	37	6	3.625
3	40	6	7.25
3	43	6	10.875
6	0	6	14.5
6	3	6	18.125
6	6	6	25.125
6	9	6	28.75
6	12	6	32.375
6	15	6	36
6	18	6	39.625
6	25	6	43.25
6	28	9	0
6	31	9	3.625
6	34	9	7.25
6	37	9	10.875
6	40	9	14.5
6	43	9	18.125
9	0	9	25.125
9	3	9	28.75
9	6	9	32.375
9	9	9	36
9	12	9	39.625
9	15	9	43.25
9	18	12	0
9	25	12	3.625
9	28	12	7.25
9	31	12	10.875
9	34	12	14.5
9	37	12	18.125
9	40	12	25.125
9	43	12	28.75
12	0	12	32.375
12	3	12	36
12	6	12	39.625

	Top Flange		Bottom Flange	
No. Bolts =	140.0		168.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		13.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.375	OK
No. Trans Space (per side of web) =	6.0		5.0	
Transverse Spacing (in) =	3.000	OK	3.625	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





Flange Bolt Pattern Cont. - Node 1307

12	9	12	43.25
12	12	15	0
12	15	15	3.625
12	18	15	7.25
12	25	15	10.875
12	28	15	14.5
12	31	15	18.125
12	34	15	25.125
12	37	15	28.75
12	40	15	32.375
12	43	15	36
15	0	15	39.625
15	3	15	43.25
15	6	18	0
15	9	18	3.625
15	12	18	7.25
15	15	18	10.875
15	18	18	14.5
15	25	18	18.125
15	28	18	25.125
15	31	18	28.75
15	34	18	32.375
15	37	18	36
15	40	18	39.625
15	43	18	43.25
18	0	21	0
18	3	21	3.625
18	6	21	7.25
18	9	21	10.875
18	12	21	14.5
18	15	21	18.125
18	18	21	25.125
18	25	21	28.75
18	28	21	32.375
18	31	21	36
18	34	21	39.625
18	37	21	43.25
18	40	24	0
18	43	24	3.625
21	0	24	7.25
21	3	24	10.875
21	6	24	14.5
21	9	24	18.125
21	12	24	25.125
21	15	24	28.75
21	18	24	32.375
21	25	24	36
21	28	24	39.625
21	31	24	43.25
21	34	27	0
21	37	27	3.625
21	40	27	7.25
21	43	27	10.875
24	0	27	14.5
24	3	27	18.125
24	6	27	25.125
24	9	27	28.75
24	12	27	32.375
24	15	27	36
24	18	27	39.625
24	25	27	43.25
24	28	30	0
24	31	30	3.625
24	34	30	7.25
24	37	30	10.875
24	40	30	14.5

24	43	30	18.125
27	0	30	25.125
27	3	30	28.75
27	6	30	32.375
27	9	30	36
27	12	30	39.625
27	15	30	43.25
27	18	33	0
27	25	33	3.625
27	28	33	7.25
27	31	33	10.875
27	34	33	14.5
27	37	33	18.125
27	40	33	25.125
27	43	33	28.75
		33	32.375
		33	36
		33	39.625
		33	43.25
		36	0
		36	3.625
		36	7.25
		36	10.875
		36	14.5
		36	18.125
		36	25.125
		36	28.75
		36	32.375
		36	36
		36	39.625
		36	43.25
		39	0
		39	3.625
		39	7.25
		39	10.875
		39	14.5
		39	18.125
		39	25.125
		39	28.75
		39	32.375
		39	36
		39	39.625
		39	43.25

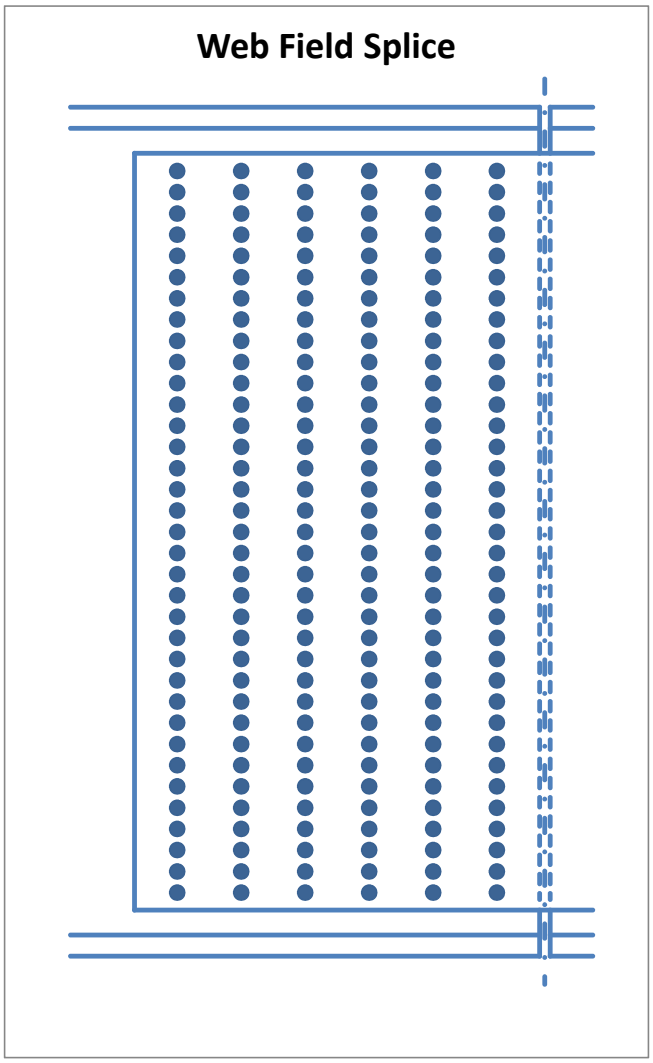
Flange Bolt Pattern Cont. - Node 1307

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1307	Backchk'd	SAE	Date	8/5/2011	Sheet No.	

Web Bolt Pattern - Node 1307

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	56.25	2601
0	3	56.25	2304
0	6	56.25	2025
0	9	56.25	1764
0	12	56.25	1521
0	15	56.25	1296
0	18	56.25	1089
0	21	56.25	900
0	24	56.25	729
0	27	56.25	576
0	30	56.25	441
0	33	56.25	324
0	36	56.25	225
0	39	56.25	144
0	42	56.25	81
0	45	56.25	36
0	48	56.25	9
0	51	56.25	0
0	54	56.25	9
0	57	56.25	36
0	60	56.25	81
0	63	56.25	144
0	66	56.25	225
0	69	56.25	324
0	72	56.25	441
0	75	56.25	576
0	78	56.25	729
0	81	56.25	900
0	84	56.25	1089
0	87	56.25	1296
0	90	56.25	1521
0	93	56.25	1764
0	96	56.25	2025
0	99	56.25	2304
0	102	56.25	2601
3	0	20.25	2601
3	3	20.25	2304
3	6	20.25	2025
3	9	20.25	1764
3	12	20.25	1521
3	15	20.25	1296
3	18	20.25	1089
3	21	20.25	900
3	24	20.25	729
3	27	20.25	576
3	30	20.25	441
3	33	20.25	324
3	36	20.25	225
3	39	20.25	144
3	42	20.25	81
3	45	20.25	36
3	48	20.25	9
3	51	20.25	0
3	54	20.25	9
3	57	20.25	36
3	60	20.25	81
3	63	20.25	144
3	66	20.25	225
3	69	20.25	324

No. Bolts =	210.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	5.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	34.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	7.5	
y_{bar} (in) =	51	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	5512.5	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	192780	
Σd^2 (in^2) =	198292.5	



Web Bolt Pattern Cont. - Node 1307

3	72	20.25	441
3	75	20.25	576
3	78	20.25	729
3	81	20.25	900
3	84	20.25	1089
3	87	20.25	1296
3	90	20.25	1521
3	93	20.25	1764
3	96	20.25	2025
3	99	20.25	2304
3	102	20.25	2601
6	0	2.25	2601
6	3	2.25	2304
6	6	2.25	2025
6	9	2.25	1764
6	12	2.25	1521
6	15	2.25	1296
6	18	2.25	1089
6	21	2.25	900
6	24	2.25	729
6	27	2.25	576
6	30	2.25	441
6	33	2.25	324
6	36	2.25	225
6	39	2.25	144
6	42	2.25	81
6	45	2.25	36
6	48	2.25	9
6	51	2.25	0
6	54	2.25	9
6	57	2.25	36
6	60	2.25	81
6	63	2.25	144
6	66	2.25	225
6	69	2.25	324
6	72	2.25	441
6	75	2.25	576
6	78	2.25	729
6	81	2.25	900
6	84	2.25	1089
6	87	2.25	1296
6	90	2.25	1521
6	93	2.25	1764
6	96	2.25	2025
6	99	2.25	2304
6	102	2.25	2601
9	0	2.25	2601
9	3	2.25	2304
9	6	2.25	2025
9	9	2.25	1764
9	12	2.25	1521
9	15	2.25	1296
9	18	2.25	1089
9	21	2.25	900
9	24	2.25	729
9	27	2.25	576
9	30	2.25	441
9	33	2.25	324
9	36	2.25	225
9	39	2.25	144
9	42	2.25	81
9	45	2.25	36
9	48	2.25	9
9	51	2.25	0
9	54	2.25	9
9	57	2.25	36

9	60	2.25	81
9	63	2.25	144
9	66	2.25	225
9	69	2.25	324
9	72	2.25	441
9	75	2.25	576
9	78	2.25	729
9	81	2.25	900
9	84	2.25	1089
9	87	2.25	1296
9	90	2.25	1521
9	93	2.25	1764
9	96	2.25	2025
9	99	2.25	2304
9	102	2.25	2601
12	0	20.25	2601
12	3	20.25	2304
12	6	20.25	2025
12	9	20.25	1764
12	12	20.25	1521
12	15	20.25	1296
12	18	20.25	1089
12	21	20.25	900
12	24	20.25	729
12	27	20.25	576
12	30	20.25	441
12	33	20.25	324
12	36	20.25	225
12	39	20.25	144
12	42	20.25	81
12	45	20.25	36
12	48	20.25	9
12	51	20.25	0
12	54	20.25	9
12	57	20.25	36
12	60	20.25	81
12	63	20.25	144
12	66	20.25	225
12	69	20.25	324
12	72	20.25	441
12	75	20.25	576
12	78	20.25	729
12	81	20.25	900
12	84	20.25	1089
12	87	20.25	1296
12	90	20.25	1521
12	93	20.25	1764
12	96	20.25	2025
12	99	20.25	2304
12	102	20.25	2601
15	0	56.25	2601
15	3	56.25	2304
15	6	56.25	2025
15	9	56.25	1764
15	12	56.25	1521
15	15	56.25	1296
15	18	56.25	1089
15	21	56.25	900
15	24	56.25	729
15	27	56.25	576
15	30	56.25	441
15	33	56.25	324
15	36	56.25	225
15	39	56.25	144
15	42	56.25	81
15	45	56.25	36

Web Bolt Pattern Cont. - Node 1307

15	48	56.25	9
15	51	56.25	0
15	54	56.25	9
15	57	56.25	36
15	60	56.25	81
15	63	56.25	144
15	66	56.25	225
15	69	56.25	324
15	72	56.25	441
15	75	56.25	576
15	78	56.25	729
15	81	56.25	900
15	84	56.25	1089
15	87	56.25	1296
15	90	56.25	1521
15	93	56.25	1764
15	96	56.25	2025
15	99	56.25	2304
15	102	56.25	2601
1575	10710	5512.5	192780

Web Bolt Pattern Cont. - Node 1307

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 3310

Node 3310

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	140
Web	210
BF	168

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3310 L	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00
3310 R	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00

Rh = 0.98

Controlling Section = 3310 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	48.00	3.00	---	144.00	99.38	101.62	70	85
	Web	114.00	1.50	---	171.00	115.22	---	50	65
	BF	48.00	3.00	---	144.00	105.75	108.14	70	85
Splice Plates	TF Outside	48.00	1.250	62.50	60.00	41.41	---	70	85
	TF Inside	22.50	1.375	62.50	61.88	41.42	---	70	85
	BF Inside	22.50	1.500	86.50	67.50	48.38	---	70	85
	BF Outside	48.00	1.500	86.50	72.00	52.88	---	70	85
	Web	107.00	1.125	38.50	240.75	157.08	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3310**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.49	32.84	-36.07	41.80	-37.48	44.36	-30.98	33.55	-34.00	38.65	-32.17	35.34	-38.86	46.99	-28.25	28.63
ϕf Fnc (ksi)	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44
f / ϕf Fnc	0.45	0.48	0.53	0.61	0.55	0.65	0.45	0.49	0.50	0.56	0.47	0.52	0.57	0.69	0.41	0.42
α	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
fcf (ksi)		32.84		41.80		44.36		33.55		38.65		35.34		46.99		28.63
Fcf (ksi)		51.33		55.60		56.91		51.38		53.99		52.29		58.25		51.33
Fcf (kip)		5550.56		6011.84		6153.52		5555.70		5837.70		5654.53		6298.93		5550.56
fncf (ksi)	-30.49		-36.07		-37.48		-30.98		-34.00		-32.17		-38.86		-28.25	
Rcf	1.56		1.33		1.28		1.53		1.40		1.48		1.24		1.79	
Fncf (ksi)	-51.33		-51.33		-51.33		-51.33		-51.33		-51.33		-51.33		-51.81	
Fncf (kip)	-7391.48		-7391.48		-7391.48		-7391.48		-7391.48		-7391.48		-7391.48		-7459.98	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.61	24.33	-26.34	30.09	-27.33	31.90	-22.96	24.82	-24.98	27.96	-23.80	26.09	-28.53	34.32	-20.82	20.79
Fs (ksi)	-22.61	24.33	-26.34	30.09	-27.33	31.90	-22.96	24.82	-24.98	27.96	-23.80	26.09	-28.53	34.32	-20.82	20.79
Fs (kip)	-3256.19	3502.82	-3792.56	4332.67	-3935.93	4593.32	-3305.86	3574.80	-3596.74	4026.44	-3426.79	3756.62	-4107.62	4942.16	-2997.83	2993.30

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	6298.93	0.00	4942.16
Comp	7459.98	0.00	4107.62	0.00

$\phi_v V_n$ (kip) = 3908.99

e_v (in) = 9.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	336.62	564.06	671.97	147.18	364.56	403.02	477.84	266.32	245.45	410.82	487.06	111.61	269.86	292.37	345.22	200.45
Vuw (kip)	504.93	846.09	1007.96	220.78	546.84	604.53	716.75	399.48	---	---	---	---	---	---	---	---
Mv (k*ft)	410.26	687.45	818.97	179.38	444.30	491.18	582.36	324.57	199.43	333.79	395.73	90.68	219.26	237.55	280.49	162.87
Huw (kip)	216.61	545.90	646.67	238.87	452.07	301.52	750.85	-39.76	146.44	320.69	390.32	159.68	255.14	195.84	495.51	-2.69
Muw (k*ft)	13244.77	13852.60	14039.88	13222.10	13574.88	13364.84	14230.90	13650.69	6354.17	7638.57	8018.39	6468.54	7166.59	6753.15	8507.74	5632.29
Mu (k*ft)	13655.03	14540.05	14858.85	13401.48	14019.18	13856.03	14813.27	13975.26	6553.60	7972.35	8414.12	6559.22	7385.85	6990.70	8788.23	5795.16

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 3310**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.03	2.60	3.08	1.14	2.15	1.44	3.58	0.19	0.70	1.53	1.86	0.76	1.21	0.93	2.36	0.01
PY1 (Vuw)	2.40	4.03	4.80	1.05	2.60	2.88	3.41	1.90	1.17	1.96	2.32	0.53	1.29	1.39	1.64	0.95
PX2 (Mu)	42.14	44.88	45.86	41.36	43.27	42.76	45.72	43.13	20.23	24.61	25.97	20.24	22.80	21.58	27.12	17.89
PY2 (Mu)	6.20	6.60	6.74	6.08	6.36	6.29	6.72	6.34	2.97	3.62	3.82	2.98	3.35	3.17	3.99	2.63
Pu (kip)	44.02	48.65	50.28	43.09	46.30	45.14	50.33	44.10	21.33	26.72	28.50	21.30	24.45	22.97	30.02	18.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3990.00	2815.63	72.50	47.27	36.48	4345.09	2815.63	OK
TF Inside	0.00	4114.69	2816.69	159.50	103.98	31.97	6275.02	2816.69	OK
BF Inside	3047.87	4488.75	3289.50	246.00	159.94	38.44	8921.69	3289.50	OK
BF Outside	3251.06	4788.00	3595.50	123.00	79.97	47.34	6373.34	3595.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3672.60	3780.00	OK
TF Inside	3787.37	3898.13	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4536.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.07	42.91	44.22	38.45	41.06	39.98	44.52	39.23
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 4293.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1007.96
Rr (kip)	4737.48
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3787.37	27.05	OK	2085.41	14.90	OK
BF	3251.06	19.35	OK	2550.79	15.18	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3672.60	26.23	1.47	149.81	OK
TF	7459.98	53.29	1.47	359.55	OK
TF Inside	3787.37	27.05	1.47	164.79	OK
BF Inside	3047.87	18.14	1.47	179.78	OK
BF	6298.93	37.49	1.47	359.55	OK
BF Outside	3251.06	19.35	1.47	179.78	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.33	25.16	OK	30.02	15.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.33	1.47	137.48	OK
Web SPL	25.16	1.47	103.11	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.03
TF Inside	NA	1.03
BF Inside	1.08	NA
BF Outside	1.11	NA

Bolt	Shear	Slip	Bearing
TF	1.34	1.13	5.71
Web	1.44	1.12	2.73
BF	1.87	1.11	9.29

Plate	Shear	Flexure
Web	4.70	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Field Splice - Node 5306

Node 5306

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	140
Web	210
BF	168

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5306 L	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00
5306 R	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00

Rh = 0.98

Controlling Section = 5306 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	48.00	3.00	---	144.00	99.38	101.62	70	85
	Web	114.00	1.50	---	171.00	115.22	---	50	65
	BF	48.00	3.00	---	144.00	105.75	108.14	70	85
Splice Plates	TF Outside	48.00	1.250	62.50	60.00	41.41	---	70	85
	TF Inside	22.50	1.375	62.50	61.88	41.42	---	70	85
	BF Inside	22.50	1.500	86.50	67.50	48.38	---	70	85
	BF Outside	48.00	1.500	86.50	72.00	52.88	---	70	85
	Web	107.00	1.125	38.50	240.75	157.08	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-33.33	35.45	-41.84	49.42	-41.09	48.43	-34.52	37.12	-33.97	36.29	-34.44	36.72	-43.07	51.86	-31.62	32.17
ϕf Fnc (ksi)	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44
f / ϕf Fnc	0.49	0.52	0.61	0.72	0.60	0.71	0.50	0.54	0.50	0.53	0.50	0.54	0.63	0.76	0.46	0.47
α	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
fcf (ksi)		35.45		49.42		48.43		37.12		36.29		36.72		51.86		32.17
Fcf (ksi)		52.35		59.50		58.99		53.20		52.78		53.00		60.74		51.33
Fcf (kip)		5660.58		6433.57		6378.67		5753.26		5707.28		5730.87		6567.98		5550.56
fncf (ksi)	-33.33		-41.84		-41.09		-34.52		-33.97		-34.44		-43.07		-31.62	
Rcf	1.48		1.20		1.22		1.43		1.45		1.44		1.17		1.60	
Fncf (ksi)	-51.33		-51.51		-51.33		-51.33		-51.33		-51.33		-51.60		-51.60	
Fncf (kip)	-7391.48		-7418.06		-7391.48		-7391.48		-7391.48		-7391.48		-7430.91		-7430.74	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.54	25.95	-30.67	35.90	-30.02	35.13	-25.49	27.20	-25.55	27.60	-28.28	31.84	-31.42	37.55	-23.44	23.70
Fs (ksi)	-24.54	25.95	-30.67	35.90	-30.02	35.13	-25.49	27.20	-25.55	27.60	-28.28	31.84	-31.42	37.55	-23.44	23.70
Fs (kip)	-3533.91	3737.12	-4415.90	5169.01	-4322.97	5058.22	-3671.02	3917.41	-3678.85	3974.85	-4072.32	4585.12	-4524.97	5406.51	-3375.65	3413.10

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	6567.98	0.00	5406.51
Comp	7430.91	0.00	4524.97	0.00

$\phi_v V_n$ (kip) = 3908.99

e_v (in) = 9.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	191.36	264.18	488.07	2.68	221.50	215.72	284.04	126.37	141.82	191.34	351.45	6.58	118.40	260.09	207.30	93.97
Vuw (kip)	287.03	396.27	732.10	4.02	332.26	323.58	426.05	189.55	---	---	---	---	---	---	---	---
Mv (k*ft)	233.22	321.97	594.83	3.26	269.96	262.91	346.17	154.01	115.22	155.47	285.55	5.35	96.20	211.32	168.43	76.35
Huw (kip)	167.10	667.19	652.25	217.64	188.43	180.21	763.62	-22.79	120.65	447.16	436.56	146.29	175.75	304.47	523.41	22.24
Muw (k*ft)	13592.49	14692.97	14582.21	13739.36	13673.03	13743.80	14869.30	13623.82	6835.53	9010.81	8819.30	7133.91	7195.27	8138.89	9336.62	6382.14
Mu (k*ft)	13825.71	15014.94	15177.04	13742.63	13942.98	14006.71	15215.47	13777.83	6950.75	9166.28	9104.85	7139.26	7291.48	8350.21	9505.05	6458.49

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	0.80	3.18	3.11	1.04	0.90	0.86	3.64	0.11	0.57	2.13	2.08	0.70	0.84	1.45	2.49	0.11
PY1 (Vuw)	1.37	1.89	3.49	0.02	1.58	1.54	2.03	0.90	0.68	0.91	1.67	0.03	0.56	1.24	0.99	0.45
PX2 (Mu)	42.67	46.34	46.84	42.41	43.03	43.23	46.96	42.52	21.45	28.29	28.10	22.03	22.50	25.77	29.34	19.93
PY2 (Mu)	6.28	6.81	6.89	6.24	6.33	6.36	6.91	6.25	3.15	4.16	4.13	3.24	3.31	3.79	4.31	2.93
Pu (kip)	44.13	50.28	51.01	43.90	44.64	44.79	51.38	43.23	22.36	30.84	30.73	22.97	23.66	27.68	32.27	20.32

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3990.00	2815.63	72.50	47.27	36.48	4345.09	2815.63	OK
TF Inside	0.00	4114.69	2816.69	159.50	103.98	31.97	6275.02	2816.69	OK
BF Inside	3178.05	4488.75	3289.50	246.00	159.94	38.44	8921.69	3289.50	OK
BF Outside	3389.92	4788.00	3595.50	123.00	79.97	47.34	6373.34	3595.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3658.30	3780.00	OK
TF Inside	3772.62	3898.13	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4536.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.34	44.74	45.13	39.31	39.75	39.90	45.70	38.60
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 4293.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	732.10
Rr (kip)	4737.48
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5306**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3772.62	26.95	OK	2297.29	16.41	OK
BF	3389.92	20.18	OK	2790.45	16.61	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3658.30	26.13	1.47	149.81	OK
TF	7430.91	53.08	1.47	359.55	OK
TF Inside	3772.62	26.95	1.47	164.79	OK
BF Inside	3178.05	18.92	1.47	179.78	OK
BF	6567.98	39.10	1.47	359.55	OK
BF Outside	3389.92	20.18	1.47	179.78	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.38	25.69	OK	32.27	16.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.38	1.47	137.48	OK
Web SPL	25.69	1.47	103.11	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.03
TF Inside	NA	1.03
BF Inside	1.04	NA
BF Outside	1.06	NA

Bolt	Shear	Slip	Bearing
TF	1.34	1.03	5.73
Web	1.41	1.04	2.68
BF	1.79	1.01	8.91

Plate	Shear	Flexure
Web	6.47	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7305	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7305

Node 7305

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	140
Web	210
BF	168

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7305 L	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00
7305 R	144.00	68.44	9855.31	144.00	68.44	9855.31	171.00	50.00	8550.00

Rh = 0.98

Controlling Section = 7305 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	48.00	3.00	---	144.00	99.38	101.62	70	85
	Web	114.00	1.50	---	171.00	115.22	---	50	65
	BF	48.00	3.00	---	144.00	105.75	108.14	70	85
Splice Plates	TF Outside	48.00	1.250	62.50	60.00	41.41	---	70	85
	TF Inside	22.50	1.375	62.50	61.88	41.42	---	70	85
	BF Inside	22.50	1.500	86.50	67.50	48.38	---	70	85
	BF Outside	48.00	1.500	86.50	72.00	52.88	---	70	85
	Web	107.00	1.125	38.50	240.75	157.08	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7305**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.23	32.60	-36.11	41.67	-37.35	44.07	-31.21	34.10	-30.90	33.22	-31.19	33.43	-38.80	47.08	-28.61	29.18
ϕf Fnc (ksi)	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44	68.44
f / ϕf Fnc	0.44	0.48	0.53	0.61	0.55	0.64	0.46	0.50	0.45	0.49	0.46	0.49	0.57	0.69	0.42	0.43
α	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
fcf (ksi)		32.60		41.67		44.07		34.10		33.22		33.43		47.08		29.18
Fcf (ksi)		51.33		55.53		56.76		51.66		51.33		51.33		58.30		51.33
Fcf (kip)		5550.56		6004.57		6137.70		5586.06		5550.56		5550.56		6304.10		5550.56
fncf (ksi)	-30.23		-36.11		-37.35		-31.21		-30.90		-31.19		-38.80		-28.61	
Rcf	1.57		1.33		1.29		1.51		1.55		1.54		1.24		1.76	
Fncf (ksi)	-51.33		-51.33		-51.33		-51.33		-51.33		-51.33		-51.33		-51.47	
Fncf (kip)	-7391.48		-7391.48		-7391.48		-7391.48		-7391.48		-7391.48		-7391.48		-7411.58	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.02	23.79	-26.55	30.21	-27.42	31.91	-22.93	25.14	-23.27	25.76	-25.83	29.14	-28.30	34.32	-21.25	21.39
Fs (ksi)	-22.02	23.79	-26.55	30.21	-27.42	31.91	-22.93	25.14	-23.27	25.76	-25.83	29.14	-28.30	34.32	-21.25	21.39
Fs (kip)	-3170.28	3425.24	-3822.50	4350.11	-3949.00	4595.03	-3302.26	3620.34	-3351.27	3709.52	-3719.20	4196.49	-4074.50	4941.37	-3059.80	3080.19

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	6304.10	0.00	4941.37
Comp	7411.58	0.00	4074.50	0.00

$\phi_v V_n$ (kip) = 3908.99

e_v (in) = 9.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	262.67	474.11	575.60	84.51	299.18	293.73	375.28	208.22	186.52	343.73	415.43	66.19	227.79	305.36	271.62	155.87
Vuw (kip)	394.01	711.17	863.39	126.77	448.77	440.60	562.92	312.34	---	---	---	---	---	---	---	---
Mv (k*ft)	320.13	577.82	701.51	103.00	364.63	357.99	457.37	253.77	151.55	279.28	337.53	53.78	185.08	248.10	220.69	126.65
Huw (kip)	220.34	527.52	632.02	275.49	208.59	196.58	765.56	-11.67	151.39	313.26	383.58	188.86	212.71	283.39	514.70	12.10
Muw (k*ft)	13238.85	13863.92	14024.36	13238.46	13257.46	13276.48	14220.27	13606.21	6200.48	7683.11	8032.28	6507.96	6637.88	7441.57	8475.85	5772.23
Mu (k*ft)	13558.98	14441.74	14725.86	13341.45	13622.08	13634.46	14677.65	13859.98	6352.03	7962.38	8369.81	6561.74	6822.96	7689.68	8696.54	5898.88

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7305**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	1.05	2.51	3.01	1.31	0.99	0.94	3.65	0.06	0.72	1.49	1.83	0.90	1.01	1.35	2.45	0.06
PY1 (Vuw)	1.88	3.39	4.11	0.60	2.14	2.10	2.68	1.49	0.89	1.64	1.98	0.32	1.08	1.45	1.29	0.74
PX2 (Mu)	41.85	44.57	45.45	41.18	42.04	42.08	45.30	42.78	19.60	24.57	25.83	20.25	21.06	23.73	26.84	18.21
PY2 (Mu)	6.15	6.55	6.68	6.06	6.18	6.19	6.66	6.29	2.88	3.61	3.80	2.98	3.10	3.49	3.95	2.68
Pu (kip)	43.64	48.12	49.65	43.01	43.83	43.81	49.83	43.53	20.67	26.59	28.26	21.41	22.46	25.57	29.76	18.58

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3990.00	2815.63	72.50	47.27	36.48	4345.09	2815.63	OK
TF Inside	0.00	4114.69	2816.69	159.50	103.98	31.97	6275.02	2816.69	OK
BF Inside	3050.37	4488.75	3289.50	246.00	159.94	38.44	8921.69	3289.50	OK
BF Outside	3253.73	4788.00	3595.50	123.00	79.97	47.34	6373.34	3595.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3648.78	3780.00	OK
TF Inside	3762.80	3898.13	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4536.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.81	42.56	43.78	38.43	38.94	38.92	44.20	38.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 4293.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	863.39
Rr (kip)	4737.48
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7305**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3762.80	26.88	OK	2068.59	14.78	OK
BF	3253.73	19.37	OK	2550.38	15.18	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3648.78	26.06	1.47	149.81	OK
TF	7411.58	52.94	1.47	359.55	OK
TF Inside	3762.80	26.88	1.47	164.79	OK
BF Inside	3050.37	18.16	1.47	179.78	OK
BF	6304.10	37.52	1.47	359.55	OK
BF Outside	3253.73	19.37	1.47	179.78	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.83	24.91	OK	29.76	14.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.83	1.47	137.48	OK
Web SPL	24.91	1.47	103.11	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.04
TF Inside	NA	1.04
BF Inside	1.08	NA
BF Outside	1.11	NA

Bolt	Shear	Slip	Bearing
TF	1.35	1.14	5.75
Web	1.45	1.13	2.76
BF	1.87	1.11	9.28

Plate	Shear	Flexure
Web	5.49	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9305	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9305

Node 9305

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	140
Web	210
BF	168

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9305 L	144.00	68.45	9856.80	144.00	68.45	9856.80	171.00	50.00	8550.00
9305 R	144.00	68.45	9856.80	144.00	68.45	9856.80	171.00	50.00	8550.00

Rh = 0.98

Controlling Section = 9305 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	48.00	3.00	---	144.00	99.38	101.62	70	85
	Web	114.00	1.50	---	171.00	115.22	---	50	65
	BF	48.00	3.00	---	144.00	105.75	108.14	70	85
Splice Plates	TF Outside	48.00	1.250	62.50	60.00	41.41	---	70	85
	TF Inside	22.50	1.375	62.50	61.88	41.42	---	70	85
	BF Inside	22.50	1.500	86.50	67.50	48.38	---	70	85
	BF Outside	48.00	1.500	86.50	72.00	52.88	---	70	85
	Web	107.00	1.125	38.50	240.75	157.08	---	50	65

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9305**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.17	30.70	-27.37	31.11	-30.51	36.79	-24.68	27.38	-24.69	27.58	-25.12	27.30	-31.85	39.91	-22.08	22.52
ϕf Fnc (ksi)	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45	68.45
f / ϕf Fnc	0.38	0.45	0.40	0.45	0.45	0.54	0.36	0.40	0.36	0.40	0.37	0.40	0.47	0.58	0.32	0.33
α	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
fcf (ksi)		30.70		31.11		36.79		27.38		27.58		27.30		39.91		22.52
Fcf (ksi)		51.34		51.34		53.04		51.34		51.34		51.34		54.63		51.34
Fcf (kip)		5551.40		5551.40		5735.33		5551.40		5551.40		5551.40		5907.79		5551.40
fncf (ksi)	-26.17		-27.37		-30.51		-24.68		-24.69		-25.12		-31.85		-22.08	
Rcf	1.67		1.65		1.44		1.87		1.86		1.88		1.37		2.28	
Fncf (ksi)	-51.34		-51.34		-51.34		-51.34		-51.34		-51.34		-51.34		-51.47	
Fncf (kip)	-7392.60		-7392.60		-7392.60		-7392.60		-7392.60		-7392.60		-7392.60		-7411.20	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.29	22.79	-20.24	22.64	-22.46	26.66	-18.23	20.44	-19.02	21.98	-19.90	22.35	-23.30	29.30	-16.50	16.57
Fs (ksi)	-19.29	22.79	-20.24	22.64	-22.46	26.66	-18.23	20.44	-19.02	21.98	-19.90	22.35	-23.30	29.30	-16.50	16.57
Fs (kip)	-2777.28	3281.20	-2914.45	3260.44	-3234.07	3839.04	-2625.48	2943.81	-2739.31	3165.22	-2865.80	3218.56	-3355.32	4218.70	-2376.14	2386.70

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5907.79	0.00	4218.70
Comp	7411.20	0.00	3355.32	0.00

$\phi_v V_n$ (kip) = 3908.99

e_v (in) = 9.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	278.06	296.83	467.49	70.53	230.34	224.43	333.77	136.67	202.27	217.95	338.53	55.65	210.50	128.25	241.64	104.80
Vuw (kip)	417.09	445.24	701.23	105.79	345.51	336.64	500.66	205.00	---	---	---	---	---	---	---	---
Mv (k*ft)	338.88	361.76	569.75	85.95	280.73	273.52	406.78	166.56	164.35	177.09	275.05	45.21	171.03	104.20	196.33	85.15
Huw (kip)	550.64	430.58	674.30	336.68	363.25	253.62	840.32	-10.80	299.20	205.43	359.20	189.01	252.89	209.45	512.63	6.27
Muw (k*ft)	12719.99	12910.10	12974.54	13058.76	13016.70	13190.28	13133.93	13608.95	5695.60	5805.04	6649.46	5235.72	5550.87	5719.94	7120.37	4477.57
Mu (k*ft)	13058.88	13271.85	13544.29	13144.71	13297.43	13463.80	13540.71	13775.51	5859.94	5982.13	6924.51	5280.93	5721.91	5824.14	7316.70	4562.71

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9305**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	2.62	2.05	3.21	1.60	1.73	1.21	4.00	0.05	1.42	0.98	1.71	0.90	1.20	1.00	2.44	0.03
PY1 (Vuw)	1.99	2.12	3.34	0.50	1.65	1.60	2.38	0.98	0.96	1.04	1.61	0.26	1.00	0.61	1.15	0.50
PX2 (Mu)	40.30	40.96	41.80	40.57	41.04	41.55	41.79	42.52	18.09	18.46	21.37	16.30	17.66	17.98	22.58	14.08
PY2 (Mu)	5.93	6.02	6.15	5.97	6.04	6.11	6.15	6.25	2.66	2.72	3.14	2.40	2.60	2.64	3.32	2.07
Pu (kip)	43.65	43.78	46.00	42.67	43.45	43.45	46.58	43.18	19.84	19.80	23.57	17.40	19.20	19.25	25.42	14.34

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3990.00	2815.63	72.50	47.27	36.48	4345.09	2815.63	OK
TF Inside	0.00	4114.69	2816.69	159.50	103.98	31.97	6275.02	2816.69	OK
BF Inside	2858.61	4488.75	3289.50	246.00	159.94	38.44	8921.69	3289.50	OK
BF Outside	3049.18	4788.00	3595.50	123.00	79.97	47.34	6373.34	3595.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3648.59	3780.00	OK
TF Inside	3762.61	3898.13	OK
BF Inside	0.00	4252.50	OK
BF Outside	0.00	4536.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.79	38.88	40.66	38.14	38.68	38.68	41.34	38.55
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 4293.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	701.23
Rr (kip)	4737.48
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	WME	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9305**	Backchk'd	SAE	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.00	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3762.61	26.88	OK	1703.47	12.17	OK
BF	3049.18	18.15	OK	2177.39	12.96	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3648.59	26.06	1.47	149.81	OK
TF	7411.20	52.94	1.47	359.55	OK
TF Inside	3762.61	26.88	1.47	164.79	OK
BF Inside	2858.61	17.02	1.47	179.78	OK
BF	5907.79	35.17	1.47	359.55	OK
BF Outside	3049.18	18.15	1.47	179.78	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.58	23.29	OK	25.42	12.71	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.58	1.47	137.48	OK
Web SPL	23.29	1.47	103.11	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.04
TF Inside	NA	1.04
BF Inside	1.15	NA
BF Outside	1.18	NA

Bolt	Shear	Slip	Bearing
TF	1.35	1.38	5.75
Web	1.55	1.32	2.95
BF	1.99	1.30	9.91

Plate	Shear	Flexure
Web	6.76	1.21

Field Splice

Summary Table

HNTB The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number 49633
	Checked	MCC	Date	6/10/2011	
For **Cleveland Innerbelt**	Backchk'd	SAE	Date	6/10/2011	Sheet No.
\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Summary	Made	SJL	Date	5/15/2012	
	Checked	DJG	Date	5/16/2012	
	Backchk'd	SJL	Date	5/16/2012	

Field Splice Variable Table

Ref. Sketches for Variable Definitions and Splice Type Locations

	Top Flange							Bottom Flange							Web			
Type	A	B	C	D	E	F	Fill Pl	G	H	J	K	L	M	Fill Pl	N	P	Q	Fill Pl
AA	5	3.000	2.500	8	1.000 x 42.000 x 56.500 GR 70	1.125 x 19.500 x 56.500 GR 70	---	5	3.000	2.500	6	0.875 x 42.000 x 44.500 GR 70	1.000 x 19.500 x 44.500 GR 70	t x 42.000 x 22.000 GR 50	12	6	1.250 x 44.5 x 41 GR 50	(2) t x 22.0 x 41 GR 50
BB	4	3.000	2.500	9	1.375 x 36.000 x 62.500 GR 50	1.500 x 16.500 x 62.500 GR 50	0.250 x 36.000 x 31.000 GR 50	4	3.000	2.500	6	1.125 x 36.000 x 44.500 GR 50	1.250 x 16.500 x 44.500 GR 50	0.250 x 36.000 x 22.000 GR 50	12	5	1.000 x 38.5 x 41 GR 50	(2) 0.188 x 19.0 x 41 GR 50
CC	4	3.000	2.500	7	1.000 x 36.000 x 50.500 GR 70	1.000 x 16.500 x 50.500 GR 70	---	4	3.000	2.500	7	1.000 x 36.000 x 50.500 GR 70	1.000 x 16.500 x 50.500 GR 70	---	12	4	0.875 x 32.5 x 41 GR 50	(2) 0.125 x 16.0 x 41 GR 50
DD	3	3.500	2.000	9	1.500 x 32.000 x 62.500 GR 50	1.625 x 14.500 x 62.500 GR 50	---	3	3.500	2.000	7	1.250 x 32.000 x 50.500 GR 50	1.375 x 14.500 x 50.500 GR 50	---	12	4	0.875 x 32.5 x 41 GR 50	(2) 0.188 x 16.0 x 41 GR 50
EE	3	3.500	2.000	8	1.000 x 32.000 x 56.500 GR 70	1.125 x 14.500 x 56.500 GR 70	---	3	3.500	2.000	9	1.125 x 32.000 x 62.500 GR 70	1.250 x 14.500 x 62.500 GR 70	---	12	4	0.883 x 32.5 x 41 GR 62.6	(2) 0.125 x 16.0 x 41 GR 50
EE2	3	3.500	2.000	8	1.000 x 32.000 x 56.500 GR 70	1.125 x 14.500 x 56.500 GR 70	---	3	3.500	2.000	9	1.125 x 32.000 x 62.500 GR 70	1.250 x 14.500 x 62.500 GR 70	---	12	4	1.000 x 32.5 x 41 GR 50	(2) 0.125 x 16.0 x 41 GR 50
FF	3	3.500	2.000	13	1.750 x 32.000 x 86.500 GR 50	1.875 x 14.500 x 86.500 GR 50	0.250 x 32.000 x 43.000 GR 50	3	3.500	2.000	6	1.125 x 32.000 x 44.500 GR 50	1.250 x 14.500 x 44.500 GR 50	t x 32.000 x 22.000 GR 50	12	5	1.000 x 37.8 x 41 GR 50	(2) 0.188 x 18.7 x 41 GR 50
GG	4	3.000	2.500	11	1.750 x 36.000 x 74.500 GR 50	1.750 x 16.500 x 74.500 GR 50	---	4	3.000	2.500	6	1.250 x 36.000 x 44.500 GR 50	1.250 x 16.500 x 44.500 GR 50	---	12	5	1.000 x 38.5 x 41 GR 50	(2) 0.188 x 19.0 x 41 GR 50
HH	4	3.000	2.500	8	1.125 x 36.000 x 56.500 GR 70	1.250 x 16.500 x 56.500 GR 70	---	4	3.000	2.500	8	1.125 x 36.000 x 56.500 GR 70	1.250 x 16.500 x 56.500 GR 70	---	12	4	1.000 x 32.5 x 41 GR 50	(2) 0.125 x 16.0 x 41 GR 50
II	5	3.000	2.500	12	1.500 x 42.000 x 80.500 GR 70	1.625 x 19.500 x 80.500 GR 70	0.250 x 42.000 x 40.000 GR 50	5	3.375	2.125	8	1.250 x 45.000 x 56.500 GR 50	1.375 x 21.000 x 56.500 GR 50	0.250 x 45.000 x 28.000 GR 50	12	6	1.250 x 44.5 x 41 GR 50	(2) 0.188 x 22.0 x 41 GR 50
II2	5	3.375	2.125	12	1.375 x 45.000 x 80.500 GR 70	1.500 x 21.000 x 80.500 GR 70	0.250 x 45.000 x 40.000 GR 50	5	3.375	2.125	8	1.250 x 45.000 x 56.500 GR 50	1.375 x 21.000 x 56.500 GR 50	0.250 x 45.000 x 28.000 GR 50	12	5	1.250 x 38.5 x 41 GR 50	(2) 0.188 x 19.0 x 41 GR 50
II3	5	3.000	2.500	12	1.500 x 42.000 x 80.500 GR 70	1.625 x 19.500 x 80.500 GR 70	0.250 x 42.000 x 40.000 GR 50	5	3.375	2.125	8	1.250 x 45.000 x 56.500 GR 50	1.375 x 21.000 x 56.500 GR 50	0.250 x 45.000 x 28.000 GR 50	12	6	1.375 x 44.5 x 41 GR 50	(2) 0.188 x 22.0 x 41 GR 50
JJ	5	3.375	2.125	9	1.125 x 45.000 x 62.500 GR 70	1.250 x 21.000 x 62.500 GR 70	---	5	3.375	2.125	9	1.125 x 45.000 x 62.500 GR 70	1.250 x 21.000 x 62.500 GR 70	---	12	4	1.000 x 32.5 x 41 GR 50	(2) 0.125 x 16.0 x 41 GR 50
KK	5	3.375	2.125	11	1.375 x 45.000 x 74.500 GR 70	1.500 x 21.000 x 74.500 GR 70	---	5	3.375	2.125	10	1.250 x 45.000 x 68.500 GR 70	1.375 x 21.000 x 68.500 GR 70	---	12	4	1.000 x 32.5 x 41 GR 50	(2) t x 16.0 x 41 GR 50
LL	5	3.375	2.125	15	1.625 x 45.000 x 94.750 GR 70	1.750 x 21.000 x 94.750 GR 70	---	5	3.375	2.125	10	1.250 x 45.000 x 68.500 GR 70	1.375 x 21.000 x 68.500 GR 70	---	12	5	1.000 x 38.5 x 41 GR 50	(2) 0.250 x 19.0 x 41 GR 50

Note: Where fill plate thickness varies within a given "Type" a value of "t" is provided for plate thickness.

Flange Stress Values for Web Splice Calculations

Flange Stre

STRENGTH I

Splice	Splice	MAX FX				MIN FX			
Node	Side	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
1007.0	1007 L	0.11	0.11	-35.07	28.18	-0.12	-0.12	-43.93	42.57
	1007 R	-0.12	-0.12	-43.93	42.57	0.11	0.11	-35.07	28.18
1015.0	1015 L	0.16	0.16	-6.02	4.49	-0.12	-0.12	-13.24	14.70
	1015 R	-0.16	-0.16	-15.01	22.40	0.16	0.16	-6.94	6.89
1021.0	1021 L	15.17	15.17	7.98	-7.99	10.25	10.25	2.32	-0.36
	1021 R	13.30	13.30	2.87	-0.25	19.62	19.62	8.75	-9.40
1035.0	1035 L	19.62	19.62	21.29	-22.51	13.25	13.25	16.44	-16.97
	1035 R	10.21	10.21	14.02	-13.56	15.17	15.17	18.63	-18.37
1041.0	1041 L	1.61	1.61	14.05	-16.25	-1.11	-1.11	13.12	-15.21
	1041 R	-1.37	-1.37	16.14	-19.50	2.06	2.06	17.20	-20.72
1051.0	1051 L	2.06	2.06	3.91	-3.73	-1.37	-1.37	9.52	-10.21
	1051 R	-1.31	-1.31	8.58	-9.14	1.92	1.92	3.54	-3.38
1057.0	1057 L	13.69	13.69	12.53	-12.92	8.71	8.71	6.74	-5.61
	1057 R	9.13	9.13	6.82	-5.74	14.33	14.33	12.60	-13.22
1071.0	1071 L	14.33	14.33	10.04	-10.33	9.13	9.13	5.38	-3.72
	1071 R	8.71	8.71	5.31	-3.66	13.69	13.69	10.03	-10.15
1077.0	1077 L	1.92	1.92	-11.50	10.89	-1.28	-1.28	-6.59	5.29
	1077 R	-1.11	-1.11	-5.89	4.23	1.70	1.70	-10.02	8.32
1089.0	1089 L	1.28	1.28	2.16	-0.09	-1.11	-1.11	9.93	-9.50
	1089 R	-1.14	-1.14	9.53	-10.36	1.28	1.28	1.92	0.05
1095.0	1095 L	15.62	15.62	12.92	-13.45	10.12	10.12	8.05	-8.08
	1095 R	10.74	10.74	7.82	-7.84	16.55	16.55	12.45	-12.99
1109.0	1109 L	16.55	16.55	16.05	-16.69	10.94	10.94	9.77	-8.66
	1109 R	10.31	10.31	10.07	-8.99	15.62	15.62	16.64	-17.27
1115.0	1115 L	1.98	1.98	9.13	-11.18	-1.36	-1.36	3.85	-5.26
	1115 R	-1.50	-1.50	4.36	-5.69	2.25	2.25	10.88	-12.30
1127.0	1127 L	2.25	2.25	-1.62	1.55	-0.92	-0.92	-0.21	-0.22
	1127 R	-0.97	-0.97	-0.19	-0.40	2.38	2.38	-1.90	2.06
1133.0	1133 L	13.99	13.99	9.01	-8.38	8.56	8.56	5.51	-4.25
	1133 R	11.15	11.15	6.57	-5.66	18.04	18.04	10.13	-10.63
1147.0	1147 L	18.04	18.04	18.06	-19.11	11.15	11.15	9.29	-7.43
	1147 R	8.56	8.56	7.69	-5.57	14.00	14.00	15.74	-14.71
1153.0	1153 L	2.96	2.96	10.30	-13.24	-1.98	-1.98	-4.23	3.46
	1153 R	-2.10	-2.10	-4.79	3.87	3.19	3.19	10.90	-14.43
1163.0	1163 L	3.19	3.19	2.99	-3.45	-1.16	-1.16	-0.40	2.99
	1163 R	-1.13	-1.13	-0.53	3.02	2.96	2.96	2.78	-3.18
1169.0	1169 L	12.86	12.86	12.55	-11.32	7.96	7.96	6.05	-4.44
	1169 R	10.48	10.48	7.11	-6.13	16.78	16.78	14.10	-15.19
1183.0	1183 L	16.77	16.77	9.65	-9.90	10.48	10.48	6.87	-5.29
	1183 R	7.96	7.96	5.77	-3.83	12.86	12.86	8.60	-7.46
1189.0	1189 L	2.69	2.69	-6.31	4.92	-1.51	-1.51	-6.56	5.20
	1189 R	-1.44	-1.44	-5.91	4.99	2.61	2.61	-5.87	4.95
1199.0	1199 L	3.10	3.10	2.64	-2.89	-1.00	-1.00	3.46	-3.85
	1199 R	-0.98	-0.98	3.35	-3.23	2.89	2.89	2.76	-2.68
1205.0	1205 L	14.76	14.76	13.57	-13.04	8.63	8.63	6.67	-5.14
	1205 R	10.34	10.34	6.78	-5.69	17.54	17.54	13.53	-14.46
1219.0	1219 L	17.53	17.53	11.92	-12.36	10.34	10.34	7.93	-6.64
	1219 R	8.63	8.63	7.71	-5.94	14.75	14.75	11.97	-11.22
1225.0	1225 L	2.62	2.62	-6.06	4.94	-1.87	-1.87	3.18	-5.08
	1225 R	-1.70	-1.70	2.94	-4.70	2.41	2.41	-5.11	4.46
1234.0	1234 L	2.41	2.41	-4.47	4.75	-0.99	-0.99	-2.42	2.31
	1234 R	-0.95	-0.95	-2.33	2.31	2.30	2.30	-4.19	4.46
1242.0	1242 L	11.64	11.64	6.95	-7.65	6.70	6.70	2.96	-2.37
	1242 R	6.75	6.75	2.97	-2.27	11.73	11.73	6.89	-7.27
1253.0	1253 L	11.73	11.73	9.87	-10.28	6.75	6.75	4.36	-2.85
	1253 R	6.70	6.70	4.33	-2.99	11.64	11.64	9.86	-10.72
1261.0	1261 L	2.27	2.27	-4.16	3.13	-1.70	-1.70	1.32	-3.12
	1261 R	-1.73	-1.73	1.12	-2.94	2.37	2.37	-4.67	3.03
1272.0	1272 L	2.37	2.37	19.94	-20.96	-1.74	-1.74	21.85	-22.93
	1272 R	-1.47	-1.47	17.99	-20.51	1.97	1.97	16.44	-18.78
1280.0	1280 L	13.74	13.74	15.64	-16.07	8.97	8.97	13.50	-13.77
	1280 R	10.58	10.58	15.16	-15.51	16.17	16.17	17.37	-17.90
1290.0	1290 L	16.17	16.17	8.70	-9.06	10.72	10.72	1.89	0.39
	1290 R	9.07	9.07	1.32	0.53	13.74	13.74	7.74	-8.03
1298.0	1298 L	0.43	0.43	-9.59	8.93	-0.27	-0.27	-17.88	24.47
	1298 R	-0.23	-0.23	-14.34	18.59	0.35	0.35	-7.15	6.63
1307.0	1307 L	0.35	0.35	-27.35	28.78	-0.23	-0.23	-34.66	40.94
	1307 R	-0.23	-0.23	-34.66	40.94	0.35	0.35	-27.35	28.78
1402.0	1402 L	-14.19	-14.19	-11.51	12.40	-21.09	-21.09	-6.46	6.96
	1402 R	-22.33	-22.33	-6.59	6.59	-15.03	-15.03	-11.74	11.74
1407.0	1407 L	-15.40	-15.40	4.16	-4.16	-22.51	-22.51	0.68	-0.68
	1407 R	-21.40	-21.40	0.67	-0.67	-14.65	-14.65	4.08	-4.08
1411.0	1411 L	-14.43	-14.43	4.84	-4.84	-21.31	-21.31	1.77	-1.77
	1411 R	-22.42	-22.42	1.80	-1.80	-15.18	-15.18	4.93	-4.93
1416.0	1416 L	-14.66	-14.66	-4.83	4.83	-22.25	-22.25	-1.90	1.90
	1416 R	-21.02	-21.02	-1.86	2.01	-13.84	-13.84	-4.73	5.09
1422.0	1422 L	-11.23	-11.23	-12.40	12.40	-18.76	-18.76	-8.93	8.93
	1422 R	-22.02	-22.02	-10.11	10.11	-13.19	-13.19	-14.04	14.04
1427.0	1427 L	-13.74	-13.74	7.99	-7.99	-22.13	-22.13	3.98	-3.98
	1427 R	-20.91	-20.91	3.90	-3.90	-12.99	-12.99	7.82	-7.82
1431.0	1431 L	-13.03	-13.03	7.64	-7.64	-20.96	-20.96	4.50	-4.50
	1431 R	-22.18	-22.18	4.57	-4.57	-13.78	-13.78	7.80	-7.80
1436.0	1436 L	-13.21	-13.21	-15.11	15.11	-22.00	-22.00	-11.77	11.77
	1436 R	-18.74	-18.74	-10.39	10.39	-11.24	-11.24	-13.34	13.34
1442.0	1442 L	-13.58	-13.58	-7.12	7.12	-21.21	-21.21	-4.29	4.29
	1442 R	-25.13	-25.13	-4.91	4.91	-16.10	-16.10	-8.15	8.15
1447.0	1447 L	-16.60	-16.60	3.78	-3.78	-25.28	-25.28	0.13	-0.13
	1447 R	-23.87	-23.87	0.13	-0.13	-15.68	-15.68	3.71	-3.71
1451.0	1451 L	-15.67	-15.67	3.74	-3.74	-23.84	-23.84	-0.44	0.44
	1451 R	-25.25	-25.25	-0.45	0.45	-16.59	-16.59	3.82	-3.82
1456.0	1456 L	-16.03	-16.03	-7.79	7.79	-25.11	-25.11	-3.49	3.49
	1456 R	-21.20	-21.20	-3.04	3.04	-13.52	-13.52	-6.80	6.80
1462.0	1462 L	-10.74	-10.74	-10.90	12.56	-19.59	-19.59	-7.07	8.14
	1462 R	-23.12	-23.12	-8.61	8.61	-12.68	-12.68	-13.27	13.27
1467.0	1467 L	-12.58	-12.58	6.38	-6.38	-22.93	-22.93	4.02	-4.02
	1467 R	-21.65	-21.65	3.94	-3.94	-11.89	-11.89	6.25	-6.25

Splice	Splice	MAX FY				MIN FY			
Node	Side	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
1007.0	1007 L	0.05	0.05	-35.96	29.62	-0.11	-0.11	-43.43	41.76
	1007 R	-0.10	-0.10	-43.25	41.47	0.04	0.04	-37.67	32.40
1015.0	1015 L	0.01	0.01	-9.67	8.91	-0.04	-0.04	-14.38	16.55
	1015 R	-0.07	-0.07	-15.39	23.22	-0.02	-0.02	-11.58	14.96
1021.0	1021 L	12.05	12.05	0.77	2.66	13.44	13.44	8.50	-8.53
	1021 R	17.36	17.36	10.53	-11.43	15.44	15.44	0.91	4.39
1035.0	1035 L	16.26	16.26	23.25	-24.74	17.49	17.49	9.90	-9.52
	1035 R	13.51	13.51	9.15	-8.47	13.17	13.17	16.23	-15.87
1041.0	1041 L	0.28	0.28	8.70	-10.26	-0.30	-0.30	11.43	-13.32
	1041 R	-0.13	-0.13	16.48	-19.89	0.35	0.35	9.79	-12.17
1051.0	1051 L	-0.46	-0.46	9.16	-9.79	0.44	0.44	3.10	2.03
	1051 R	0.41	0.41	2.95	1.16	-0.34	-0.34	5.93	-5.96
1057.0	1057 L	10.94	10.94	4.96	-2.01	12.02	12.02	10.97	-11.21
	1057 R	12.43	12.43	15.69	-16.66	11.44	11.44	4.75	-1.40
1071.0	1071 L	12.07	12.07	9.24	-9.44	11.70	11.70	3.12	1.01
	1071 R	11.20	11.20	3.35	0.30	11.55	11.55	8.31	-8.28
1077.0	1077 L	0.49	0.49	-13.98	13.72	-0.50	-0.50	-9.55	8.67
	1077 R	-0.40	-0.40	-6.92	5.26	0.46	0.46	-13.16	11.43
1089.0	1089 L	-0.06	-0.06	4.13	-3.76	0.26	0.26	0.72	2.74
	1089 R	0.22	0.22	0.87	2.34	0.01	0.01	3.11	-2.53
1095.0	1095 L	13.58	13.58	4.15	-3.77	13.37	13.37	12.19	-12.65
	1095 R	14.19	14.19	16.17	-17.12	14.41	14.41	3.45	-2.99
1109.0	1109 L	14.42	14.42	18.76	-19.70	13.33	13.33	7.63	-4.23
	1109 R	12.60	12.60	8.15	-5.13	13.70	13.70	14.99	-15.46
1115.0	1115 L	0.51	0.51	-1.57	0.81	-0.48	-0.48	6.27	-7.98
	1115 R	-0.50	-0.50	9.25	-10.65	0.60	0.60	-3.02	1.78
1127.0	1127 L	-0.52	-0.52	1.33	-1.45	0.48	0.48	-4.36	8.72
	1127 R	0.42	0.42	-4.00	9.07	-0.28	-0.28	-0.44	0.24
1133.0	1133 L	11.95	11.95	1.66	-1.10	11.65	11.65	9.80	-9.16
	1133 R	14.99	14.99	12.19	-12.97	15.38	15.38	1.23	-0.50
1147.0	1147 L	15.28	15.28	15.07	-15.71	13.44	13.44	7.28	-2.70
	1147 R	10.51	10.51	6.08	-2.61	11.84	11.84	12.17	-11.17
1153.0	1153 L	0.87	0.87	-5.04	4.40	-0.82	-0.82	3.21	-5.09
	1153 R	-0.66	-0.66	6.08	-8.80	0.90	0.90	-6.53	5.89
1163.0	1163 L	-0.89	-0.89	3.38	-3.90	0.96	0.96	-2.00	7.24
	1163 R	0.92	0.92	-1.66	5.90	-0.49	-0.49	1.02	-0.94
1169.0	1169 L	9.80	9.80	4.12	-0.87	11.06	11.06	11.06	-9.91
	1169 R	14.43	14.43	13.56	-14.57	12.65	12.65	4.79	-0.36
1183.0	1183 L	14.08	14.08	11.50	-12.03	13.31	13.31	5.18	-1.06
	1183 R	10.35	10.35	4.45	-1.39	10.81	10.81	9.20	-8.04
1189.0	1189 L	0.70	0.70	-11.02	10.36	-0.49	-0.49	-4.29	2.59
	1189 R	-0.23	-0.23	-2.00	0.20	0.66	0.66	-10.89	11.10
1199.0	1199 L	-0.34	-0.34	9.86	-11.75	0.88	0.88	-0.38	7.15
	1199 R	0.75	0.75	0.15	4.88	-0.34	-0.34	7.97	-8.34
1205.0	1205 L	11.13	11.13	4.57	-0.84	12.14	12.14	15.79	-15.29
	1205 R	14.43	14.43	16.88	-18.25	13.51	13.51	4.57	-0.24
1219.0	1219 L	14.88	14.88	17.51	-18.69	13.30	13.30	5.41	-0.42
	1219 R	10.92	10.92	5.31	-1.01	12.53	12.53	16.36	-15.66
1225.0	1225 L	0.04	0.04	-7.81	6.83	-0.22	-0.22	-2.22	0.77
	1225 R	0.15	0.15	4.96	-6.98	0.12	0.12	-7.57	7.26
1234.0	1234 L	-0.30	-0.30	-2.95	3.65	0.43	0.43	-5.96	11.22
	1234 R	0.41	0.41	-5.44	10.21	-0.31	-0.31	-3.32	4.82
1242.0	1242 L	9.64	9.64	0.19	0.09	9.46	9.46	7.60	-8.40
	1242 R	9.52	9.52	7.88	-8.36	9.73	9.73	-0.36	0.70
1253.0	1253 L	10.02	10.02	11.32	-11.87	8.89	8.89	2.73	0.55
	1253 R	8.82	8.82	2.80	0.29	9.97	9.97	10.56	-11.52
1261.0	1261 L	0.62	0.62	-8.63	8.21	-0.56	-0.56	-1.15	-0.29
	1261 R	-0.55	-0.55	-0.82	-0.94	0.65	0.65	-10.59	9.12
1272.0	1272 L	-0.16	-0.16	19.64	-20.66	0.05	0.05	14.25	-15.10
	1272 R	0.03	0.03	12.16	-13.97	-0.17	-0.17	14.91	-17.05
1280.0	1280 L	11.95	11.95	10.27	-10.30	11.29	11.29	16.29	-16.76
	1280 R	13.30	13.30	18.63	-19.28	14.09	14.09	11.00	-10.98
1290.0	1290 L	14.44	14.44	10.44	-10.95	12.91	12.91	0.55	2.85
	1290 R	11.01	11.01	0.32	2.24	12.28	12.28	8.96	-9.34
1298.0	1298 L	-0.01	-0.01	-19.23	27.01	0.05	0.05	-15.14	19.34
	1298 R	0.04	0.04	-11.58	14.00	-0.01	-0.01	-15.66	20.79
1307.0	1307 L	-0.09	-0.09	-35.53	42.38	0.17	0.17	-27.81	29.55
	1307 R	0.17	0.17	-27.27	28.63	-0.10	-0.10	-36.07	43.28
1402.0	1402 L	-18.93	-18.93	-16.41	17.67	-17.90	-17.90	-1.16	1.25
	1402 R	-19.42	-19.42	-0.56	0.56	-19.68	-19.68	-17.21	17.21
1407.0	1407 L	-17.58	-17.58	6.98	-6.98	-21.37	-21.37	-1.67	1.67
	1407 R	-20.52	-20.52	-1.50	1.50	-16.15	-16.15	6.40	-6.40
1411.0	1411 L	-20.44	-20.44	-0.77	0.77	-15.93	-15.93	7.24	-7.24
	1411 R	-17.37	-17.37	7.84	-7.84	-21.42	-21.42	-0.85	0.85
1416.0	1416 L	-18.84	-18.84	3.02	-3.02	-19.07	-19.07	-10.94	10.94
	1416 R	-18.56	-18.56	-10.03	10.81	-16.88	-16.88	1.64	-1.77
1422.0	1422 L	-16.26	-16.26	-17.39	17.39	-14.12	-14.12	-5.82	5.82
	1422 R	-18.11	-18.11	-4.34	4.34	-18.33	-18.33	-20.63	20.63
1427.0	1427 L	-16.24	-16.24	11.17	-11.17	-21.04	-21.04	1.58	-1.58
	1427 R	-19.97	-19.97	1.61	-1.61	-14.67	-14.67	10.37	-10.37
1431.0	1431 L	-19.99	-19.99	1.39	-1.39	-14.71	-14.71	10.23	-10.23
	1431 R	-16.23	-16.23	10.95	-10.95	-21.07	-21.07	1.34	-1.34
1436.0	1436 L	-18.19	-18.19	-5.39	5.39	-18.51	-18.51	-21.69	21.69
	1436 R	-16.42	-16.42	-18.30	18.30	-14.71	-14.71	-5.80	5.80
1442.0	1442 L	-18.75	-18.75	-12.19	12.19	-16.95	-16.95	0.18	-0.18
	1442 R	-20.98	-20.98	1.43	-1.43	-21.51	-21.51	-14.85	14.85
1447.0	1447 L	-19.13	-19.13	6.91	-6.91	-24.12	-24.12	-2.98	2.98
	1447 R	-22.87	-22.87	-2.85	2.85	-17.40	-17.40	6.28	-6.28
1451.0	1451 L	-22.87	-22.87	-2.63	2.63	-17.37	-17.37	6.29	-6.29
	1451 R	-19.08	-19.08	6.92	-6.92	-24.12	-24.12	-2.76	2.76
1456.0	1456 L	-21.09	-21.09	2.54	-2.54	-21.38	-21.38	-14.12	14.12
	1456 R	-18.66	-18.66	-11.51	11.51	-16.88	-16.88	0.85	-0.85
1462.0	1462 L	-17.83	-17.83	-14.96	17.24	-13.24	-13.24	-5.04	5.81
	1462 R	-16.70	-16.70	-4.58	4.58	-19.94	-19.94	-19.80	19.80
1467.0	1467 L	-15.52	-15.52	11.07	-11.07	-21.58	-21.58	1.08	-1.08
	1467 R	-20.52	-20.52	1.15	-1.15	-13.96	-13.96	10.22	-10.22

Splice	Splice	MAX MY				MIN MY			
Node	Side	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
1007.0	1007 L	-0.03	-0.03	-35.79	29.34	0.05	0.05	-35.72	29.24
	1007 R	0.05	0.05	-35.72	29.24	-0.03	-0.03	-35.79	29.34
1015.0	1015 L	0.09	0.09	3.67	-3.70	-0.08	-0.08	-15.26	17.98
	1015 R	-0.11	-0.11	-16.66	25.98	0.08	0.08	3.99	-5.36
1021.0	1021 L	13.37	13.37	7.79	-7.79	13.15	13.15	4.84	-4.71
	1021 R	17.03	17.03	5.30	-5.47	17.30	17.30	8.70	-9.34
1035.0	1035 L	17.26	17.26	18.23	-19.02	16.98	16.98	18.19	-18.97
	1035 R	13.11	13.11	15.77	-15.39	13.34	13.34	15.83	-15.45
1041.0	1041 L	0.70	0.70	24.51	-27.97	-0.17	-0.17	4.79	-5.88
	1041 R	-0.19	-0.19	5.81	-7.58	0.92	0.92	30.33	-35.89
1051.0	1051 L	0.71	0.71	23.76	-26.65	0.13	0.13	1.70	5.58
	1051 R	0.10	0.10	1.24	5.27	0.64	0.64	21.91	-24.36
1057.0	1057 L	11.96	11.96	10.97	-11.22	11.60	11.60	9.44	-9.55
	1057 R	12.14	12.14	9.50	-9.77	12.52	12.52	11.04	-11.49
1071.0	1071 L	12.42	12.42	8.44	-8.55	12.23	12.23	6.76	-6.68
	1071 R	11.69	11.69	6.76	-6.58	11.87	11.87	8.42	-8.39
1077.0	1077 L	0.55	0.55	7.58	-10.89	0.14	0.14	-14.91	19.42
	1077 R	0.14	0.14	-13.46	15.30	0.50	0.50	7.19	-8.70
1089.0	1089 L	0.22	0.22	17.68	-17.17	0.33	0.33	-1.02	6.17
	1089 R	0.31	0.31	-1.19	6.79	0.20	0.20	16.85	-18.56
1095.0	1095 L	13.50	13.50	12.43	-12.92	13.55	13.55	11.44	-11.82
	1095 R	14.37	14.37	11.05	-11.44	14.32	14.32	12.02	-12.51
1109.0	1109 L	14.98	14.98	14.37	-14.83	13.74	13.74	12.24	-12.45
	1109 R	12.96	12.96	12.66	-12.88	14.13	14.13	14.88	-15.33
1115.0	1115 L	1.05	1.05	20.43	-23.84	-0.46	-0.46	-4.67	4.29
	1115 R	-0.49	-0.49	-6.01	4.81	1.21	1.21	24.61	-26.21
1127.0	1127 L	0.77	0.77	7.67	-7.87	0.06	0.06	-3.69	7.27
	1127 R	0.05	0.05	-3.75	8.45	0.80	0.80	7.79	-9.08
1133.0	1133 L	11.69	11.69	5.81	-5.21	11.59	11.59	8.75	-8.12
	1133 R	14.96	14.96	10.03	-10.52	15.09	15.09	6.62	-6.64
1147.0	1147 L	16.22	16.22	12.14	-12.37	13.95	13.95	12.12	-12.35
	1147 R	10.80	10.80	10.40	-9.42	12.57	12.57	10.53	-9.56
1153.0	1153 L	2.08	2.08	15.49	-19.21	-0.84	-0.84	-5.51	4.93
	1153 R	-0.88	-0.88	-6.17	5.47	2.24	2.24	16.57	-21.04
1163.0	1163 L	2.50	2.50	10.89	-12.65	-0.58	-0.58	-1.26	5.28
	1163 R	-0.58	-0.58	-1.27	4.89	2.31	2.31	9.98	-11.50
1169.0	1169 L	11.46	11.46	8.08	-7.07	10.15	10.15	9.39	-8.31
	1169 R	13.26	13.26	10.71	-11.29	14.96	14.96	9.10	-9.44
1183.0	1183 L	14.08	14.08	7.63	-7.57	14.05	14.05	9.92	-10.21
	1183 R	10.76	10.76	8.70	-7.55	10.78	10.78	6.69	-5.65
1189.0	1189 L	0.78	0.78	4.53	-7.61	0.43	0.43	-10.50	9.76
	1189 R	0.44	0.44	-9.67	9.61	0.77	0.77	4.32	-7.54
1199.0	1199 L	1.52	1.52	21.15	-25.58	0.04	0.04	-1.62	10.72
	1199 R	0.01	0.01	-1.56	9.23	1.40	1.40	20.64	-22.07
1205.0	1205 L	12.86	12.86	11.68	-11.14	11.46	11.46	8.19	-7.60
	1205 R	13.65	13.65	8.11	-8.33	15.30	15.30	11.70	-12.39
1219.0	1219 L	14.48	14.48	11.74	-12.16	14.44	14.44	9.53	-9.65
	1219 R	12.13	12.13	9.52	-8.74	12.17	12.17	11.60	-10.85
1225.0	1225 L	0.34	0.34	16.61	-19.64	0.43	0.43	-8.98	12.49
	1225 R	0.41	0.41	-7.77	11.50	0.33	0.33	14.71	-18.07
1234.0	1234 L	0.63	0.63	11.53	-13.43	0.50	0.50	-7.33	14.67
	1234 R	0.47	0.47	-6.87	13.84	0.60	0.60	10.84	-12.64
1242.0	1242 L	9.68	9.68	6.97	-7.68	9.39	9.39	1.15	-1.01
	1242 R	9.47	9.47	1.12	-0.92	9.75	9.75	6.95	-7.33
1253.0	1253 L	9.68	9.68	9.07	-9.40	9.56	9.56	4.91	-4.82
	1253 R	9.49	9.49	4.90	-5.04	9.61	9.61	9.05	-9.80
1261.0	1261 L	0.40	0.40	15.15	-18.85	0.21	0.21	-8.15	10.95
	1261 R	0.24	0.24	-9.11	10.83	0.44	0.44	16.33	-18.61
1272.0	1272 L	0.56	0.56	34.89	-36.36	0.08	0.08	9.23	-9.93
	1272 R	0.05	0.05	7.62	-8.87	0.46	0.46	28.71	-32.56
1280.0	1280 L	12.01	12.01	17.28	-17.83	11.90	11.90	10.85	-10.92
	1280 R	14.02	14.02	12.17	-12.25	14.14	14.14	19.22	-19.92
1290.0	1290 L	13.43	13.43	8.34	-8.67	14.31	14.31	3.47	-3.37
	1290 R	12.15	12.15	2.95	-2.87	11.40	11.40	7.38	-7.64
1298.0	1298 L	0.27	0.27	-12.91	15.15	-0.11	-0.11	-15.99	20.93
	1298 R	-0.09	-0.09	-12.70	15.87	0.22	0.22	-10.02	11.41
1307.0	1307 L	-0.11	-0.11	-34.22	40.20	0.23	0.23	-27.27	28.64
	1307 R	0.23	0.23	-27.27	28.64	-0.11	-0.11	-34.22	40.20
1402.0	1402 L	-18.39	-18.39	-11.20	12.06	-18.32	-18.32	-4.93	5.31
	1402 R	-19.40	-19.40	-5.03	5.03	-19.48	-19.48	-11.42	11.42
1407.0	1407 L	-16.45	-16.45	1.73	-1.73	-17.71	-17.71	2.30	-2.30
	1407 R	-16.84	-16.84	2.26	-2.26	-15.64	-15.64	1.70	-1.70
1411.0	1411 L	-15.55	-15.55	2.60	-2.60	-16.63	-16.63	2.90	-2.90
	1411 R	-17.49	-17.49	2.95	-2.95	-16.35	-16.35	2.65	-2.65
1416.0	1416 L	-19.80	-19.80	-3.15	3.15	-18.28	-18.28	-1.62	1.62
	1416 R	-17.26	-17.26	-1.62	1.74	-18.71	-18.71	-2.94	3.17
1422.0	1422 L	-15.84	-15.84	-11.25	11.25	-15.34	-15.34	-7.73	7.73
	1422 R	-18.01	-18.01	-8.75	8.75	-18.59	-18.59	-12.79	12.79
1427.0	1427 L	-15.24	-15.24	5.24	-5.24	-16.65	-16.65	5.85	-5.85
	1427 R	-15.74	-15.74	5.73	-5.73	-14.40	-14.40	5.13	-5.13
1431.0	1431 L	-14.49	-14.49	5.04	-5.04	-15.72	-15.72	5.47	-5.47
	1431 R	-16.62	-16.62	5.59	-5.59	-15.32	-15.32	5.15	-5.15
1436.0	1436 L	-18.97	-18.97	-13.30	13.30	-17.80	-17.80	-10.21	10.21
	1436 R	-15.17	-15.17	-9.05	9.05	-16.16	-16.16	-11.63	11.63
1442.0	1442 L	-18.85	-18.85	-4.70	4.70	-17.34	-17.34	-3.46	3.46
	1442 R	-20.54	-20.54	-3.97	3.97	-22.33	-22.33	-5.38	5.38
1447.0	1447 L	-17.95	-17.95	1.56	-1.56	-19.59	-19.59	1.12	-1.12
	1447 R	-18.50	-18.50	1.10	-1.10	-16.95	-16.95	1.53	-1.53
1451.0	1451 L	-16.92	-16.92	1.61	-1.61	-18.49	-18.49	1.17	-1.17
	1451 R	-19.58	-19.58	1.19	-1.19	-17.91	-17.91	1.65	-1.65
1456.0	1456 L	-21.47	-21.47	-7.14	7.14	-21.19	-21.19	-1.84	1.84
	1456 R	-17.88	-17.88	-1.62	1.62	-18.14	-18.14	-6.11	6.11
1462.0	1462 L	-17.44	-17.44	-9.29	10.70	-14.03	-14.03	-8.19	9.43
	1462 R	-16.56	-16.56	-9.98	9.98	-20.60	-20.60	-11.22	11.22
1467.0	1467 L	-15.08	-15.08	4.52	-4.52	-16.11	-16.11	4.89	-4.89
	1467 R	-15.22	-15.22	4.79	-4.79	-14.24	-14.24	4.43	-4.43

Splice	Splice	MAX MZ				MIN MZ				
Node	Side	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange
		TF	BF	TF	BF	TF	BF	TF	BF	TF
1007.0	1007 L	0.00	0.00	-45.28	44.76	-0.04	-0.04	-32.15	23.43	0.13
	1007 R	-0.04	-0.04	-32.15	23.43	0.00	0.00	-45.28	44.76	-0.16
1015.0	1015 L	-0.07	-0.07	-16.92	20.67	0.08	0.08	6.94	-6.47	0.13
	1015 R	0.07	0.07	7.60	-9.41	-0.10	-0.10	-18.44	29.84	-0.20
1021.0	1021 L	11.40	11.40	-0.04	4.23	14.07	14.07	15.52	-15.86	10.25
	1021 R	18.19	18.19	17.57	-19.46	14.68	14.68	0.34	5.75	9.78
1035.0	1035 L	15.80	15.80	7.37	-6.64	17.68	17.68	26.92	-28.92	13.02
	1035 R	13.69	13.69	23.36	-23.32	11.70	11.70	9.49	-6.33	7.53
1041.0	1041 L	0.51	0.51	1.34	-2.02	0.07	0.07	27.41	-31.22	1.20
	1041 R	0.12	0.12	34.03	-40.16	0.68	0.68	1.43	-2.51	-0.65
1051.0	1051 L	0.77	0.77	-0.53	11.24	-0.08	-0.08	28.73	-32.39	1.10
	1051 R	-0.09	-0.09	26.49	-29.58	0.72	0.72	-0.94	10.48	-0.65
1057.0	1057 L	10.28	10.28	3.59	0.75	12.50	12.50	18.98	-19.96	9.21
	1057 R	13.08	13.08	19.17	-20.54	10.76	10.76	3.64	0.92	6.74
1071.0	1071 L	10.87	10.87	2.04	3.28	13.02	13.02	16.20	-17.19	9.62
	1071 R	12.44	12.44	16.07	-16.75	10.39	10.39	2.00	3.02	6.43
1077.0	1077 L	0.65	0.65	-16.66	23.61	-0.15	-0.15	11.31	-15.15	1.04
	1077 R	-0.10	-0.10	10.51	-12.00	0.59	0.59	-15.13	18.58	-0.57
1089.0	1089 L	0.46	0.46	-2.90	9.86	0.05	0.05	21.48	-20.93	0.95
	1089 R	0.01	0.01	20.50	-22.65	0.46	0.46	-3.05	10.83	-0.60
1095.0	1095 L	11.89	11.89	5.15	-1.36	14.38	14.38	20.50	-21.84	10.58
	1095 R	15.24	15.24	19.85	-21.20	12.59	12.59	4.98	-1.07	8.03
1109.0	1109 L	12.59	12.59	6.66	-2.22	15.30	15.30	21.89	-23.18	11.18
	1109 R	14.44	14.44	22.62	-23.89	11.89	11.89	6.88	-2.58	7.56
1115.0	1115 L	0.73	0.73	-4.32	8.00	-0.09	-0.09	24.05	-27.90	1.47
	1115 R	-0.05	-0.05	29.00	-30.67	0.82	0.82	-5.32	8.70	-0.73
1127.0	1127 L	0.69	0.69	-6.49	13.31	0.10	0.10	13.90	-14.18	1.22
	1127 R	0.08	0.08	14.23	-16.49	0.78	0.78	-6.61	15.55	-0.77
1133.0	1133 L	10.45	10.45	2.73	0.88	12.14	12.14	16.01	-15.30	9.37
	1133 R	15.65	15.65	18.39	-20.02	13.41	13.41	3.57	1.41	8.26
1147.0	1147 L	12.75	12.75	6.18	-0.11	16.64	16.64	22.69	-24.38	11.87
	1147 R	12.91	12.91	19.67	-18.60	9.90	9.90	4.77	-0.20	6.34
1153.0	1153 L	0.52	0.52	-6.88	11.57	1.04	1.04	21.47	-26.08	2.22
	1153 R	1.14	1.14	23.11	-28.66	0.57	0.57	-7.56	12.74	-0.86
1163.0	1163 L	0.80	0.80	-4.59	14.13	0.67	0.67	18.64	-21.68	1.69
	1163 R	0.61	0.61	17.02	-19.64	0.73	0.73	-4.44	12.96	-0.84
1169.0	1169 L	9.37	9.37	3.08	1.07	11.73	11.73	17.74	-16.25	8.57
	1169 R	15.26	15.26	20.13	-22.13	12.20	12.20	3.95	1.72	7.75
1183.0	1183 L	12.39	12.39	3.97	1.92	14.95	14.95	18.06	-19.58	10.98
	1183 R	11.47	11.47	15.86	-14.36	9.54	9.54	3.04	1.23	5.88
1189.0	1189 L	0.93	0.93	-12.78	16.78	0.35	0.35	11.03	-15.13	1.47
	1189 R	0.35	0.35	10.41	-15.00	0.92	0.92	-11.72	16.58	-0.60
1199.0	1199 L	1.33	1.33	-3.53	16.20	-0.21	-0.21	25.28	-30.63	1.61
	1199 R	-0.21	-0.21	24.52	-26.28	1.23	1.23	-3.37	13.80	-0.78
1205.0	1205 L	10.44	10.44	3.59	1.16	13.33	13.33	20.07	-19.62	9.74
	1205 R	15.81	15.81	20.59	-22.45	12.40	12.40	3.59	2.19	7.55
1219.0	1219 L	12.33	12.33	4.48	1.88	15.89	15.89	21.14	-22.79	11.42
	1219 R	13.40	13.40	20.52	-19.86	10.37	10.37	4.36	0.93	6.29
1225.0	1225 L	0.48	0.48	-11.00	17.60	0.26	0.26	21.44	-24.88	1.38
	1225 R	0.25	0.25	18.93	-22.87	0.46	0.46	-9.66	16.25	-0.81
1234.0	1234 L	0.82	0.82	-9.75	20.75	-0.07	-0.07	14.87	-17.23	1.30
	1234 R	-0.07	-0.07	13.97	-16.21	0.78	0.78	-9.13	19.58	-0.78
1242.0	1242 L	8.26	8.26	0.41	3.08	10.46	10.46	12.29	-13.79	7.74
	1242 R	10.53	10.53	12.27	-13.19	8.32	8.32	0.42	3.03	4.96
1253.0	1253 L	8.28	8.28	1.84	2.39	10.49	10.49	14.65	-15.53	7.79
	1253 R	10.42	10.42	14.62	-16.18	8.22	8.22	1.81	2.43	4.92
1261.0	1261 L	0.86	0.86	-10.59	17.16	-0.18	-0.18	19.76	-24.09	1.26
	1261 R	-0.16	-0.16	21.34	-23.77	0.90	0.90	-11.58	16.86	-0.81
1272.0	1272 L	0.78	0.78	4.56	-5.12	-0.04	-0.04	37.43	-38.98	1.83
	1272 R	-0.05	-0.05	30.79	-34.89	0.63	0.63	3.79	-4.57	-0.75
1280.0	1280 L	11.06	11.06	7.58	-7.41	12.24	12.24	20.50	-21.29	9.52
	1280 R	14.41	14.41	22.74	-23.75	13.05	13.05	8.61	-8.38	7.81
1290.0	1290 L	12.03	12.03	-0.27	4.37	14.99	14.99	14.53	-15.41	11.11
	1290 R	12.73	12.73	13.05	-13.73	10.23	10.23	-0.75	4.06	6.61
1298.0	1298 L	-0.09	-0.09	-22.63	33.38	0.30	0.30	1.66	-2.43	0.40
	1298 R	0.23	0.23	1.43	-1.88	-0.08	-0.08	-18.43	25.40	-0.29
1307.0	1307 L	0.10	0.10	-36.89	44.65	0.01	0.01	-24.87	24.64	0.33
	1307 R	0.01	0.01	-24.87	24.64	0.10	0.10	-36.89	44.65	-0.29
1402.0	1402 L	-17.03	-17.03	-17.71	19.08	-19.18	-19.18	0.04	-0.04	-10.48
	1402 R	-20.31	-20.31	0.04	-0.04	-18.06	-18.06	-18.07	18.07	-16.31
1407.0	1407 L	-20.94	-20.94	-1.87	1.87	-18.94	-18.94	7.67	-7.67	-11.37
	1407 R	-18.02	-18.02	7.54	-7.54	-19.90	-19.90	-1.83	1.83	-15.62
1411.0	1411 L	-19.35	-19.35	-1.30	1.30	-17.82	-17.82	8.39	-8.39	-10.66
	1411 R	-18.73	-18.73	8.54	-8.54	-20.36	-20.36	-1.32	1.32	-16.37
1416.0	1416 L	-18.34	-18.34	-11.46	11.46	-19.96	-19.96	3.98	-3.98	-10.83
	1416 R	-18.86	-18.86	3.90	-4.20	-17.31	-17.31	-11.23	12.10	-15.35
1422.0	1422 L	-14.84	-14.84	-18.75	18.75	-16.88	-16.88	-2.77	2.77	-8.30
	1422 R	-19.81	-19.81	-3.14	3.14	-17.44	-17.44	-21.23	21.23	-16.08
1427.0	1427 L	-19.76	-19.76	1.28	-1.28	-17.73	-17.73	11.94	-11.94	-10.15
	1427 R	-16.78	-16.78	11.70	-11.70	-18.67	-18.67	1.26	-1.26	-15.27
1431.0	1431 L	-18.77	-18.77	1.06	-1.06	-16.81	-16.81	11.55	-11.55	-9.63
	1431 R	-17.77	-17.77	11.79	-11.79	-19.87	-19.87	1.08	-1.08	-16.19
1436.0	1436 L	-17.60	-17.60	-22.25	22.25	-19.73	-19.73	-4.35	4.35	-9.78
	1436 R	-16.81	-16.81	-3.85	3.85	-14.98	-14.98	-19.65	19.65	-13.68
1442.0	1442 L	-17.36	-17.36	-13.47	13.47	-19.19	-19.19	2.32	-2.32	-10.02
	1442 R	-22.73	-22.73	2.65	-2.65	-20.58	-20.58	-15.43	15.43	-18.37
1447.0	1447 L	-22.95	-22.95	-3.34	3.34	-20.73	-20.73	7.65	-7.65	-12.23
	1447 R	-19.58	-19.58	7.49	-7.49	-21.67	-21.67	-3.27	3.27	-17.45
1451.0	1451 L	-21.68	-21.68	-3.15	3.15	-19.55	-19.55	7.54	-7.54	-11.55
	1451 R	-20.69	-20.69	7.69	-7.69	-22.97	-22.97	-3.21	3.21	-18.46
1456.0	1456 L	-20.46	-20.46	-14.71	14.71	-22.83	-22.83	3.75	-3.75	-11.82
	1456 R	-19.28	-19.28	3.27	-3.27	-17.26	-17.26	-12.84	12.84	-15.50
1462.0	1462 L	-14.95	-14.95	-17.58	20.26	-16.70	-16.70	-2.13	2.45	-7.83
	1462 R	-19.71	-19.71	-2.59	2.59	-17.67	-17.67	-21.41	21.41	-17.05
1467.0	1467 L	-18.69	-18.69	-0.89	0.89	-17.47	-17.47	12.20	-12.20	-9.13
	1467 R	-16.51	-16.51	11.95	-11.95	-17.64	-17.64	-0.87	0.87	-16.00

Made By: WME 8/5/11 Checked By: MTB 8/5/11 BackChecked By: WME 8/5/11

Flange Stress Values for Web Splice Calculations

STRENGTH I

Splice Node	Splice Side	MAX FX				MIN FX			
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
1471.0	1471 L	-11.91	-11.91	6.21	-6.21	-20.83	-20.83	4.53	-4.53
	1471 R	-22.05	-22.05	4.63	-4.63	-12.60	-12.60	6.34	-6.34
1476.0	1476 L	-12.44	-12.44	-12.41	12.41	-22.34	-22.34	-9.17	9.17
	1476 R	-18.92	-18.92	-7.53	8.68	-10.53	-10.53	-10.19	11.75
1482.0	1482 L	-9.42	-9.42	-12.45	15.29	-18.11	-18.11	-10.11	12.42
	1482 R	-20.68	-20.68	-12.13	12.13	-10.77	-10.77	-14.94	14.94
1487.0	1487 L	-10.51	-10.51	8.00	-8.00	-19.87	-19.87	6.38	-6.38
	1487 R	-18.77	-18.77	6.25	-6.25	-9.94	-9.94	7.84	-7.84
1491.0	1491 L	-10.15	-10.15	7.72	-7.72	-18.89	-18.89	6.61	-6.61
	1491 R	-19.99	-19.99	6.74	-6.74	-10.73	-10.73	7.88	-7.88
1496.0	1496 L	-11.12	-11.12	-14.80	14.80	-20.66	-20.66	-13.02	13.02
	1496 R	-18.09	-18.09	-10.85	13.33	-9.73	-9.73	-12.34	15.16
1502.0	1502 L	-10.40	-10.40	-11.61	12.29	-18.73	-18.73	-7.02	7.43
	1502 R	-20.77	-20.77	-7.68	7.68	-11.54	-11.54	-12.70	12.70
1507.0	1507 L	-12.25	-12.25	7.03	-7.03	-20.89	-20.89	4.15	-4.15
	1507 R	-19.90	-19.90	4.08	-4.08	-11.68	-11.68	6.92	-6.92
1511.0	1511 L	-11.74	-11.74	7.19	-7.19	-19.91	-19.91	4.10	-4.10
	1511 R	-20.90	-20.90	4.17	-4.17	-12.31	-12.31	7.31	-7.31
1516.0	1516 L	-11.73	-11.73	-12.33	12.33	-20.94	-20.94	-7.23	7.23
	1516 R	-18.88	-18.88	-6.60	6.99	-10.57	-10.57	-11.27	11.93
1522.0	1522 L	-8.14	-8.14	-14.88	14.13	-14.76	-14.76	-10.20	9.68
	1522 R	-16.37	-16.37	-10.71	10.71	-9.04	-9.04	-15.54	15.54
1527.0	1527 L	-9.51	-9.51	9.14	-9.14	-16.43	-16.43	5.94	-5.94
	1527 R	-15.78	-15.78	5.86	-5.86	-9.15	-9.15	9.02	-9.02
1531.0	1531 L	-8.99	-8.99	9.09	-9.09	-15.77	-15.77	6.26	-6.26
	1531 R	-16.42	-16.42	6.31	-6.31	-9.35	-9.35	9.22	-9.22
1536.0	1536 L	-8.85	-8.85	-15.11	15.11	-16.71	-16.71	-9.65	9.65
	1536 R	-15.06	-15.06	-9.24	8.77	-7.97	-7.97	-14.48	13.74
1542.0	1542 L	-12.08	-12.08	-4.85	5.09	-17.88	-17.88	-1.86	1.96
	1542 R	-19.77	-19.77	-2.02	2.02	-13.36	-13.36	-5.25	5.25
1547.0	1547 L	-13.42	-13.42	5.39	-5.39	-19.50	-19.50	2.46	-2.46
	1547 R	-18.77	-18.77	2.43	-2.43	-12.92	-12.92	5.33	-5.33
1551.0	1551 L	-13.11	-13.11	5.06	-5.06	-19.18	-19.18	2.95	-2.95
	1551 R	-19.93	-19.93	2.99	-2.99	-13.61	-13.61	5.12	-5.12
1556.0	1556 L	-13.32	-13.32	-11.56	11.56	-20.11	-20.11	-6.97	6.97
	1556 R	-18.17	-18.17	-6.44	6.76	-12.02	-12.02	-10.68	11.21
3007.0	3007 L	0.04	0.04	-37.72	30.42	-0.12	-0.12	-44.91	42.74
	3007 R	-0.12	-0.12	-44.91	42.74	0.04	0.04	-37.72	30.42
3015.0	3015 L	0.06	0.06	-2.84	1.79	-0.12	-0.12	-11.48	12.47
	3015 R	-0.16	-0.16	-13.29	19.57	0.05	0.05	-4.11	3.72
3021.0	3021 L	16.47	16.47	12.56	-12.61	11.90	11.90	3.98	-3.58
	3021 R	15.43	15.43	4.61	-4.31	21.30	21.30	14.10	-15.23
3035.0	3035 L	21.30	21.30	21.92	-23.04	15.43	15.43	17.56	-18.02
	3035 R	11.90	11.90	14.99	-14.44	16.47	16.47	19.16	-18.82
3041.0	3041 L	0.61	0.61	17.74	-20.60	-1.04	-1.04	8.92	-10.64
	3041 R	-1.30	-1.30	10.96	-13.73	0.79	0.79	21.77	-26.34
3051.0	3051 L	0.79	0.79	7.27	-7.69	-0.90	-0.90	4.75	-2.59
	3051 R	-0.89	-0.89	4.26	-2.31	0.73	0.73	6.65	-7.01
3057.0	3057 L	14.65	14.65	15.09	-15.59	10.00	10.00	8.57	-7.51
	3057 R	10.48	10.48	8.67	-7.69	15.33	15.33	15.19	-15.98
3071.0	3071 L	15.33	15.33	12.00	-12.37	10.48	10.48	7.08	-5.52
	3071 R	10.00	10.00	7.00	-5.42	14.65	14.65	11.98	-12.15
3077.0	3077 L	0.60	0.60	-7.47	6.25	-1.25	-1.25	-10.27	9.47
	3077 R	-1.08	-1.08	-8.52	6.83	0.55	0.55	-6.46	4.78
3089.0	3089 L	0.55	0.55	3.63	-3.29	-0.80	-0.80	3.34	-2.52
	3089 R	-0.83	-0.83	2.98	-2.29	0.53	0.53	3.41	-3.51
3095.0	3095 L	16.25	16.25	15.98	-16.71	11.25	11.25	9.78	-9.84
	3095 R	11.94	11.94	9.49	-9.54	17.23	17.23	15.45	-16.19
3109.0	3109 L	17.23	17.23	18.20	-18.97	12.02	12.02	11.12	-9.99
	3109 R	11.33	11.33	11.46	-10.36	16.25	16.25	18.84	-19.60
3115.0	3115 L	0.60	0.60	10.74	-13.06	-1.34	-1.34	2.13	-3.36
	3115 R	-1.48	-1.48	2.13	-3.46	0.70	0.70	13.59	-15.13
3127.0	3127 L	0.70	0.70	0.52	-0.63	-1.07	-1.07	-1.42	2.70
	3127 R	-1.15	-1.15	-1.37	2.99	0.73	0.73	0.46	-0.65
3133.0	3133 L	15.02	15.02	11.86	-11.10	9.74	9.74	6.67	-5.23
	3133 R	12.65	12.65	7.95	-6.93	19.36	19.36	13.44	-14.24
3147.0	3147 L	19.36	19.36	19.33	-20.39	12.65	12.65	10.99	-9.18
	3147 R	9.74	9.74	9.14	-6.91	15.02	15.02	16.80	-15.66
3153.0	3153 L	1.39	1.39	13.50	-17.12	-2.60	-2.60	-6.37	5.86
	3153 R	-2.75	-2.75	-6.70	5.99	1.50	1.50	14.28	-18.69
3163.0	3163 L	1.50	1.50	6.96	-8.14	-1.89	-1.89	-0.58	4.06
	3163 R	-1.80	-1.80	-0.61	3.77	1.38	1.38	6.36	-7.40
3169.0	3169 L	14.68	14.68	14.56	-13.15	9.74	9.74	7.46	-5.57
	3169 R	12.79	12.79	8.73	-7.64	19.14	19.14	16.36	-17.65
3183.0	3183 L	19.14	19.14	13.07	-13.58	12.79	12.79	9.15	-7.66
	3183 R	9.74	9.74	7.74	-5.57	14.68	14.68	11.56	-10.13
3189.0	3189 L	0.75	0.75	-3.13	1.02	-1.94	-1.94	-7.12	5.68
	3189 R	-1.85	-1.85	-6.43	5.45	0.74	0.74	-2.84	0.99
3199.0	3199 L	0.99	0.99	7.43	-8.89	-1.49	-1.49	1.72	1.13
	3199 R	-1.43	-1.43	1.61	1.10	0.91	0.91	7.23	-7.67
3205.0	3205 L	15.66	15.66	15.25	-14.66	9.72	9.72	7.88	-7.10
	3205 R	11.59	11.59	8.01	-7.96	18.61	18.61	15.25	-16.28
3219.0	3219 L	18.61	18.61	16.63	-17.58	11.91	11.91	9.89	-8.65
	3219 R	9.97	9.97	9.59	-7.71	15.66	15.66	16.41	-15.64
3225.0	3225 L	0.91	0.91	0.26	-2.24	-1.98	-1.98	-4.61	3.13
	3225 R	-1.79	-1.79	-3.85	2.80	0.85	0.85	0.44	-2.15
3234.0	3234 L	0.85	0.85	-2.20	1.89	-1.20	-1.20	-4.87	7.18
	3234 R	-1.16	-1.16	-4.55	6.76	0.80	0.80	-2.08	1.78
3242.0	3242 L	13.01	13.01	8.16	-9.03	8.02	8.02	3.62	-3.74
	3242 R	8.08	8.08	3.63	-3.58	13.11	13.11	8.07	-8.56
3253.0	3253 L	13.10	13.10	11.04	-11.57	8.29	8.29	5.19	-3.44
	3253 R	7.98	7.98	5.10	-3.36	12.63	12.63	10.90	-11.25
3262.0	3262 L	0.89	0.89	0.84	-2.78	-1.77	-1.77	-4.35	3.26
	3262 R	-1.81	-1.81	-4.72	2.94	0.94	0.94	0.59	-2.69
3272.0	3272 L	0.93	0.93	26.64	-28.96	-1.81	-1.81	16.88	-18.62
	3272 R	-1.55	-1.55	14.27	-16.95	0.76	0.76	22.17	-26.04

Splice Side	MAX FY				MIN FY			
	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
	TF	BF	TF	BF	TF	BF	TF	BF
1471 L	-19.34	-19.34	0.26	-0.26	-13.83	-13.83	10.17	-10.17
1471 R	-15.26	-15.26	10.82	-10.82	-19.97	-19.97	-0.36	0.36
1476 L	-16.62	-16.62	-2.93	2.93	-19.74	-19.74	-18.28	18.28
1476 R	-16.94	-16.94	-14.70	16.94	-13.67	-13.67	-3.03	3.50
1482 L	-16.24	-16.24	-16.61	20.41	-12.11	-12.11	-6.99	8.59
1482 R	-14.91	-14.91	-6.81	6.81	-17.91	-17.91	-20.86	20.86
1487 L	-13.18	-13.18	12.10	-12.10	-18.36	-18.36	2.37	-2.37
1487 R	-17.43	-17.43	2.40	-2.40	-11.76	-11.76	11.16	-11.16
1491 L	-17.30	-17.30	2.15	-2.15	-12.12	-12.12	11.67	-11.67
1491 R	-13.65	-13.65	12.73	-12.73	-18.23	-18.23	2.12	-2.12
1496 L	-14.66	-14.66	-6.84	6.84	-18.16	-18.16	-21.70	21.70
1496 R	-16.44	-16.44	-17.34	21.31	-12.23	-12.23	-6.53	8.02
1502 L	-15.69	-15.69	-16.66	17.65	-14.05	-14.05	-4.01	4.25
1502 R	-16.74	-16.74	-2.82	2.82	-16.44	-16.44	-19.50	19.50
1507 L	-14.93	-14.93	10.74	-10.74	-19.56	-19.56	0.80	-0.80
1507 R	-18.79	-18.79	0.88	-0.88	-13.50	-13.50	9.94	-9.94
1511 L	-18.77	-18.77	0.83	-0.83	-13.61	-13.61	10.17	-10.17
1511 R	-15.08	-15.08	10.97	-10.97	-19.53	-19.53	0.81	-0.81
1516 L	-17.28	-17.28	-1.90	1.90	-16.66	-16.66	-19.59	19.59
1516 R	-16.09	-16.09	-16.61	17.59	-14.22	-14.22	-3.47	3.67
1522 L	-12.70	-12.70	-19.54	18.55	-11.22	-11.22	-8.26	7.84
1522 R	-13.46	-13.46	-7.40	7.40	-13.65	-13.65	-20.89	20.89
1527 L	-11.73	-11.73	12.24	-12.24	-15.29	-15.29	3.53	-3.53
1527 R	-14.83	-14.83	3.57	-3.57	-10.62	-10.62	11.54	-11.54
1531 L	-14.80	-14.80	3.92	-3.92	-10.53	-10.53	11.52	-11.52
1531 R	-11.68	-11.68	12.24	-12.24	-15.29	-15.29	3.90	-3.90
1536 L	-13.20	-13.20	-6.43	6.43	-13.68	-13.68	-20.54	20.54
1536 R	-13.10	-13.10	-18.74	17.79	-10.94	-10.94	-7.45	7.08
1542 L	-16.15	-16.15	-8.99	9.44	-14.69	-14.69	1.30	-1.37
1542 R	-16.89	-16.89	2.13	-2.13	-17.47	-17.47	-10.16	10.16
1547 L	-15.59	-15.59	7.86	-7.86	-18.05	-18.05	-0.56	0.56
1547 R	-17.60	-17.60	-0.51	0.51	-14.33	-14.33	7.38	-7.38
1551 L	-18.04	-18.04	0.14	-0.14	-14.41	-14.41	7.12	-7.12
1551 R	-15.08	-15.08	7.24	-7.24	-18.67	-18.67	0.08	-0.08
1556 L	-16.65	-16.65	-0.92	0.92	-18.16	-18.16	-15.68	15.68
1556 R	-16.52	-16.52	-14.37	15.09	-14.85	-14.85	-1.24	1.30
3007 L	0.00	0.00	-37.54	30.11	-0.09	-0.09	-45.97	44.56
3007 R	-0.09	-0.09	-45.37	43.53	0.00	0.00	-38.11	31.09
3015 L	-0.01	-0.01	-8.82	7.92	-0.08	-0.08	-12.06	13.48
3015 R	-0.11	-0.11	-13.83	20.81	-0.05	-0.05	-10.46	13.15
3021 L	13.32	13.32	3.86	-0.85	14.98	14.98	14.03	-14.16
3021 R	19.37	19.37	16.73	-18.25	17.04	17.04	4.45	0.03
3035 L	18.49	18.49	24.31	-25.79	19.09	19.09	13.16	-12.97
3035 R	14.76	14.76	11.97	-11.25	14.29	14.29	20.36	-20.09
3041 L	-0.27	-0.27	9.67	-11.48	-0.41	-0.41	10.38	-12.29
3041 R	-0.46	-0.46	14.69	-18.09	-0.35	-0.35	10.72	-13.45
3051 L	-0.64	-0.64	9.33	-10.10	-0.11	-0.11	3.49	0.79
3051 R	-0.10	-0.10	3.41	-0.20	-0.63	-0.63	6.75	-7.12
3057 L	11.77	11.77	7.38	-5.02	13.00	13.00	15.92	-16.51
3057 R	13.59	13.59	16.76	-17.74	12.29	12.29	7.19	-4.49
3071 L	13.12	13.12	13.29	-13.82	12.66	12.66	5.43	-1.95
3071 R	12.13	12.13	5.65	-2.59	12.54	12.54	12.52	-12.74
3077 L	-0.23	-0.23	-11.88	11.32	-0.60	-0.60	-9.62	8.73
3077 R	-0.49	-0.49	-7.10	5.41	-0.19	-0.19	-11.53	9.83
3089 L	-0.30	-0.30	3.88	-3.54	-0.28	-0.28	1.32	1.58
3089 R	-0.29	-0.29	1.57	0.85	-0.29	-0.29	3.05	-2.45
3095 L	14.20	14.20	7.05	-6.81	14.18	14.18	16.95	-17.79
3095 R	15.02	15.02	17.07	-18.00	15.05	15.05	6.26	-5.94
3109 L	15.14	15.14	18.79	-19.62	14.85	14.85	7.30	-6.81
3109 R	14.01	14.01	8.13	-7.73	14.28	14.28	18.74	-19.49
3115 L	-0.23	-0.23	-0.15	-0.79	-0.67	-0.67	5.65	-7.32
3115 R	-0.71	-0.71	8.29	-9.74	-0.25	-0.25	-1.61	0.35
3127 L	-0.55	-0.55	1.17	-1.30	-0.37	-0.37	-3.38	7.02
3127 R	-0.41	-0.41	-2.96	7.05	-0.51	-0.51	-0.29	0.25
3133 L	13.23	13.23	5.49	-4.77	12.12	12.12	11.29	-10.53
3133 R	15.63	15.63	13.79	-14.63	17.11	17.11	5.68	-5.36
3147 L	17.57	17.57	20.25	-21.44	14.31	14.31	9.11	-4.64
3147 R	11.16	11.16	7.67	-4.13	13.62	13.62	16.83	-15.69
3153 L	-0.35	-0.35	-4.04	3.16	-1.28	-1.28	4.67	-6.90
3153 R	-1.65	-1.65	8.18	-11.52	-0.07	-0.07	-7.34	6.74
3163 L	-1.84	-1.84	6.29	-7.36	-0.03	-0.03	-1.84	7.55
3163 R	-0.22	-0.22	-0.88	4.50	-1.45	-1.45	2.70	-3.12
3169 L	11.13	11.13	5.91	-2.57	13.38	13.38	15.34	-13.90
3169 R	17.45	17.45	18.16	-19.75	14.41	14.41	6.80	-2.58
3183 L	15.86	15.86	14.69	-15.45	16.81	16.81	5.19	-4.40
3183 R	12.91	12.91	5.17	-4.00	12.16	12.16	12.12	-10.66
3189 L	-0.62	-0.62	-10.00	9.05	-0.90	-0.90	-3.50	1.45
3189 R	-0.82	-0.82	-1.65	-0.48	-0.61	-0.61	-10.09	10.00
3199 L	-1.18	-1.18	5.38	-6.34	-0.44	-0.44	0.67	4.38
3199 R	-0.41	-0.41	1.06	2.62	-1.15	-1.15	3.09	-3.10
3205 L	12.99	12.99	4.80	-3.95	13.15	13.15	16.36	-15.79
3205 R	15.63	15.63	17.60	-18.98	15.40	15.40	3.63	-2.93
3219 L	16.19	16.19	18.57	-19.82	13.99	13.99	7.64	-2.63
3219 R	11.87	11.87	7.73	-3.59	13.63	13.63	17.21	-16.45
3225 L	-0.68	-0.68	-7.41	6.22	-0.88	-0.88	0.22	-2.19
3225 R	-0.76	-0.76	2.34	-4.36	-0.64	-0.64	-7.42	6.94
3234 L	-1.01	-1.01	-2.70	2.47	-0.32	-0.32	-6.04	10.43
3234 R	-0.30	-0.30	-5.26	8.78	-0.67	-0.67	-3.80	4.61
3242 L	10.84	10.84	0.83	-0.48	11.00	11.00	8.15	-9.03
3242 R	11.07	11.07	8.83	-9.40	10.22	10.22	2.69	-0.23
3253 L	11.64	11.64	11.08	-11.62	9.78	9.78	3.78	-0.19
3253 R	9.44	9.44	3.93	-0.75	11.23	11.23	10.19	-10.47
3262 L	-0.22	-0.22	-6.78	6.08	-1.04	-1.04	1.59	-3.65
3262 R	-1.05	-1.05	2.57	-4.79	-0.25	-0.25	-8.93	7.40
3272 L	-0.81	-0.81	20.99	-22.98	-0.56	-0.56	15.47	-17.13
3272 R	-0.46	-0.46	13.92	-16.55	-0.72	-0.72	16.53	-19.55

Splice Side	MAX MY				MIN MY			
	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
	TF	BF	TF	BF	TF	BF	TF	BF
1471 L	-13.96	-13.96	4.17	-4.17	-15.09	-15.09	4.80	-4.80
1471 R	-15.98	-15.98	4.90	-4.90	-14.78	-14.78	4.26	-4.26
1476 L	-18.83	-18.83	-13.48	13.48	-17.52	-17.52	-6.07	6.07
1476 R	-14.85	-14.85	-4.97	5.73	-15.94	-15.94	-11.09	12.78
1482 L	-15.20	-15.20	-13.06	16.05	-13.63	-13.63	-8.26	10.15
1482 R	-15.55	-15.55	-9.97	9.97	-17.42	-17.42	-15.38	15.38
1487 L	-12.87	-12.87	5.79	-5.79	-13.99	-13.99	6.64	-6.64
1487 R	-13.22	-13.22	6.51	-6.51	-12.17	-12.17	5.67	-5.67
1491 L	-12.37	-12.37	5.98	-5.98	-13.09	-13.09	6.20	-6.20
1491 R	-13.85	-13.85	6.33	-6.33	-13.09	-13.09	6.10	-6.10
1496 L	-17.52	-17.52	-15.26	15.26	-15.46	-15.46	-11.05	11.05
1496 R	-13.53	-13.53	-9.21	11.31	-15.33	-15.33	-12.71	15.62
1502 L	-15.50	-15.50	-11.54	12.23	-15.36	-15.36	-6.21	6.58
1502 R	-17.03	-17.03	-6.79	6.79	-17.20	-17.20	-12.65	12.65
1507 L	-14.07	-14.07	4.53	-4.53	-15.31	-15.31	4.70	-4.70
1507 R	-14.59	-14.59	4.62	-4.62	-13.41	-13.41	4.45	-4.45
1511 L	-13.43	-13.43	4.52	-4.52	-14.63	-14.63	4.64	-4.64
1511 R	-15.36	-15.36	4.72	-4.72	-14.10	-14.10	4.59	-4.59
1516 L	-18.00	-18.00	-11.87	11.87	-16.60	-16.60	-7.36	7.36
1516 R	-14.96	-14.96	-6.72	7.12	-16.22	-16.22	-10.91	11.55
1522 L	-11.97	-11.97	-12.33	11.71	-11.17	-11.17	-11.34	10.77
1522 R	-12.40	-12.40	-11.78	11.78	-13.28	-13.28	-12.92	12.92
1527 L	-11.27	-11.27	7.00	-7.00	-11.83	-11.83	6.79	-6.79
1527 R	-11.37	-11.37	6.70	-6.70	-10.82	-10.82	6.90	-6.90
1531 L	-10.48	-10.48	6.91	-6.91	-11.59	-11.59	6.95	-6.95
1531 R	-12.06	-12.06	7.05	-7.05	-10.91	-10.91	7.00	-7.00
1536 L	-12.68	-12.68	-16.64	16.64	-13.51	-13.51	-8.34	8.34
1536 R	-12.18	-12.18	-7.99	7.59	-11.42	-11.42	-15.94	15.13
1542 L	-15.07	-15.07	-1.82	1.91	-16.19	-16.19	-3.35	3.51
1542 R	-17.92	-17.92	-3.54	3.54	-16.64	-16.64	-2.07	2.07
1547 L	-16.78	-16.78	1.80	-1.80	-16.60	-16.60	3.78	-3.78
1547 R	-15.98	-15.98	3.73	-3.73	-16.15	-16.15	1.77	-1.77
1551 L	-14.01	-14.01	2.89	-2.89	-15.09	-15.09	3.27	-3.27
1551 R	-15.67	-15.67	3.31	-3.31	-14.56	-14.56	2.92	-2.92
1556 L	-16.36	-16.36	-14.62	14.62	-17.60	-17.60	-1.62	1.62
1556 R	-15.91	-15.91	-1.51	1.58	-14.77	-14.77	-13.49	14.16
3007 L	-0.08	-0.08	-38.39	31.57	0.01	0.01	-38.38	31.56
3007 R	0.01	0.01	-38.38	31.56	-0.08	-0.08	-38.39	31.57
3015 L	0.03	0.03	0.42	-0.99	-0.10	-0.10	-13.20	15.42
3015 R	-0.14	-0.14	-14.49	22.30	0.01	0.01	0.43	-1.40
3021 L	14.87	14.87	10.05	-9.97	14.83	14.83	8.11	-7.93
3021 R	19.20	19.20	9.11	-9.49	19.25	19.25	11.35	-12.06
3035 L	19.22	19.22	20.12	-20.97	19.24	19.24	20.50	-21.41
3035 R	14.86	14.86	17.79	-17.38	14.85	14.85	17.46	-17.04
3041 L	0.39	0.39	21.53	-24.88	-0.81	-0.81	5.98	-7.32
3041 R	-1.00	-1.00	7.29	-9.45	0.52	0.52	26.50	-31.87
3051 L	0.31	0.31	19.09	-21.48	-0.63	-0.63	2.72	2.84
3051 R	-0.62	-0.62	2.23	2.74	0.27	0.27	17.64	-19.65
3057 L	13.02	13.02	12.51	-12.76	12.87	12.87	11.75	-11.93
3057 R	13.47	13.47	11.84	-12.22	13.62	13.62	12.60	-13.08
3071 L	13.55	13.55	9.72	-9.82	13.52	13.52	8.78	-8.76
3071 R	12.92	12.92	8.77	-8.62	12.94	12.94	9.69	-9.64
3077 L	0.01	0.01	3.95	-6.90	-0.51	-0.51	-13.18	15.76
3077 R	-0.44	-0.44	-11.86	12.45	0.03	0.03	3.89	-5.52
3089 L	-0.11	-0.11	14.30	-13.91	-0.34	-0.34	0.17	3.92
3089 R	-0.37	-0.37	0.03	4.27	-0.13	-0.13	13.67	-15.07
3095 L	14.40	14.40	14.07	-14.59	14.44	14.44	13.35	-13.79
3095 R	15.31	15.31	12.92	-13.37	15.26	15.26	13.62	-14.14
3109 L	15.64	15.64	15.33	-15.77	14.94	14.94	14.07	-14.36
3109 R	14.09	14.09	14.55	-14.84	14.75	14.75	15.86	-16.29
3115 L	0.17	0.17	16.79	-19.87	-0.93	-0.93	-1.98	1.27
3115 R	-1.02	-1.02	-2.78	1.53	0.22	0.22	20.10	-21.77
3127 L	0.04	0.04	5.68	-5.89	-0.66	-0.66	-2.91	5.98
3127 R	-0.72	-0.72	-2.88	6.86	0.02	0.02	5.82	-6.85
3133 L	12.85	12.85	10.03	-9.28	12.43	12.43	8.95	-8.21
3133 R	16.06	16.06	10.30	-10.64	16.58	16.58	11.51	-12.03
3147 L	17.33	17.33	14.20	-14.51	16.10	16.10	14.06	-14.36
3147 R	12.47	12.47	12.08	-10.97	13.43	13.43	12.26	-11.15
3153 L	0.68	0.68	13.47	-17.08	-1.88	-1.88	-4.92	4.18
3153 R	-1.99	-1.99	-5.54	4.63	0.74	0.74	14.26	-18.66
3163 L	1.07	1.07	9.08	-10.64	-1.66	-1.66	-0.19	2.95
3163 R	-1.58	-1.58	-0.23	2.75	0.98	0.98	8.29	-9.65
3169 L	13.22	13.22	10.50	-9.26	12.23	12.23	10.38	-9.15
3169 R	15.98	15.98	11.80	-12.35	17.26	17.26	11.85	-12.41
3183 L	16.38	16.38	10.67	-10.77	16.91	16.91	11.87	-12.17
3183 R	12.96	12.96	10.40	-9.01	12.55	12.55	9.32	-7.98
3189 L	-0.01	-0.01	1.87	-4.83	-1.23	-1.23	-9.40	8.35
3189 R	-1.17	-1.17	-8.58	8.12	0.01	0.01	1.84	-4.82
3199 L	0.31	0.31	16.06	-19.61	-1.12	-1.12	-0.05	6.59
3199 R	-1.08	-1.08	-0.09	5.78	0.27	0.27	15.55	-16.84
3205 L	13.78	13.78	12.64	-11.99	13.05	13.05	12.14	-11.47
3205 R	15.53	15.53	12.21	-12.79	16.38	16.38	12.67	-13.32
3219 L	15.99	15.99	12.73	-13.09	16.06	16.06	12.60	-12.94
3219 R	13.50	13.50	12.45	-11.58	13.45	13.45	12.57	-11.70
3225 L	-0.16	-0.16	9.94	-12.91	-0.70	-0.70	-8.74	10.64
3225 R	-0.63	-0.63	-7.45	9.73	-0.13	-0.13	8.87	-11.92
3234 L	0.03	0.03	7.15	-8.93	-0.73	-0.73	-7.28	13.87
3234 R	-0.71	-0.71	-6.76	13.07	0.01	0.01	6.67	-8.40
3242 L	11.18	11.18	7.32	-8.05	10.88	10.88	4.25	-4.48
3242 R	10.96	10.96	4.20	-4.23	11.26	11.26	7.27	-7.66
3253 L	11.36	11.36	7.50	-7.62	11.28	11.28	7.55	-7.67
3253 R	10.87	10.87	7.45	-7.46	10.94	10.94	7.41	-7.41
3262 L	0.16	0.16	9.74	-13.14	-1.12	-1.12	-9.34	9.07
3262 R	-1.13	-1.13	-10.53	9.10	0.18	0.18	10.20	-12.88
3272 L	0.22	0.22	32.66	-35.35	-1.14	-1.14	10.53	-11.90
3272 R	-0.98	-0.98	8.85	-10.71	0.17	0.17	27.14	-31.76

Splice Side	MAX MZ				MIN MZ				Flange Stre
	Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange
	TF	BF	TF	BF	TF	BF	TF	BF	TF
1471 L	-17.65	-17.65	-1.07	1.07	-16.50	-16.50	11.54	-11.54	-8.83
1471 R	-17.45	-17.45	11.78	-11.78	-18.70	-18.70	-1.10	1.10	-16.02
1476 L	-17.14	-17.14	-20.57	20.57	-19.60	-19.60	-0.19	0.19	-9.19
1476 R	-16.61	-16.61	-0.15	0.18	-14.51	-14.51	-16.89	19.46	-13.78
1482 L	-13.56	-13.56	-19.15	23.53	-15.76	-15.76	-3.57	4.39	-6.95
1482 R	-17.99	-17.99	-4.29	4.29	-15.50	-15.50	-22.98	22.98	-15.04
1487 L	-16.38	-16.38	1.50	-1.50	-15.25	-15.25	13.20	-13.20	-7.77
1487 R	-14.42	-14.42	12.93	-12.93	-15.47	-15.47	1.47	-1.47	-13.62
1491 L	-15.08	-15.08	0.92	-0.92	-14.41	-14.41	13.35	-13.35	-7.30
1491 R	-15.24	-15.24	13.63	-13.63	-15.96	-15.96	0.94	-0.94	-14.81
1496 L	-15.87	-15.87	-23.28	23.28	-17.52	-17.52	-4.92	4.92	-8.04
1496 R	-15.35	-15.35	-4.10	5.04	-13.88	-13.88	-19.40	23.84	-13.39
1502 L	-13.67	-13.67	-18.58	19.67	-16.95	-16.95	-1.26	1.34	-7.64
1502 R	-18.79	-18.79	-1.38	1.38	-15.18	-15.18	-20.33	20.33	-15.17
1507 L	-18.86	-18.86	0.22	-0.22	-16.10	-16.10	11.50	-11.50	-9.01
1507 R	-15.35	-15.35	11.31	-11.31	-17.96	-17.96	0.21	-0.21	-14.52
1511 L	-18.03	-18.03	0.34	-0.34	-15.38	-15.38	11.33	-11.33	-8.64
1511 R	-16.13	-16.13	11.52	-11.52	-18.94	-18.94	0.34	-0.34	-15.25
1516 L	-15.54	-15.54	-20.36	20.36	-18.92	-18.92	-0.86	0.86	-8.66
1516 R	-17.07	-17.07	-0.79	0.83	-14.00	-14.00	-18.61	19.71	-13.76
1522 L	-10.78	-10.78	-20.60	19.55	-13.31	-13.31	-6.24	5.92	-6.07
1522 R	-14.76	-14.76	-6.51	6.51	-11.97	-11.97	-21.50	21.50	-11.94
1527 L	-14.72	-14.72	3.21	-3.21	-12.36	-12.36	12.54	-12.54	-7.06
1527 R	-11.89	-11.89	12.37	-12.37	-14.14	-14.14	3.17	-3.17	-11.55
1531 L	-14.12	-14.12	3.46	-3.46	-11.87	-11.87	12.44	-12.44	-6.69
1531 R	-12.34	-12.34	12.61	-12.61	-14.71	-14.71	3.51	-3.51	-11.98
1536 L	-11.98	-11.98	-21.45	21.45	-14.63	-14.63	-5.37	5.37	-6.58
1536 R	-13.19	-13.19	-5.14	4.88	-10.78	-10.78	-20.55	19.51	-11.01
1542 L	-14.61	-14.61	-9.88	10.37	-16.19	-16.19	2.54	-2.67	-8.92
1542 R	-17.89	-17.89	2.75	-2.75	-16.16	-16.16	-10.69	10.69	-14.48
1547 L	-17.70	-17.70	-0.87	0.87	-16.14	-16.14	8.22	-8.22	-9.93
1547 R	-15.55	-15.55	8.12	-8.12	-17.04	-17.04	-0.86	0.86	-13.73
1551 L	-16.90	-16.90	-0.42	0.42	-16.01	-16.01	7.90	-7.90	-9.64
1551 R	-16.63	-16.63	8.00	-8.00	-17.57	-17.57	-0.43	0.43	-14.61
1556 L	-16.38	-16.38	-16.91	16.91	-17.84	-17.84	-0.24	0.24	-9.84
1556 R	-16.13	-16.13	-0.22	0.24	-14.79	-14.79	-15.63	16.40	-13.30
3007 L	-0.01	-0.01	-47.27	46.78	-0.06	-0.06	-35.27	26.22	0.06
3007 R	-0.06	-0.06	-35.27	26.22	-0.01	-0.01	-47.27	46.78	-0.14
3015 L	-0.09	-0.09	-15.83	19.94	0.02	0.02	5.90	-5.68	0.06
3015 R	0.00	0.00	6.51	-8.27	-0.13	-0.13	-17.35	28.78	-0.17
3021 L	13.06	13.06	3.24	0.41	15.48	15.48	17.18	-17.48	11.10
3021 R	20.01	20.01	19.52	-21.47	16.78	16.78	4.07	0.97	11.25
3035 L	17.69	17.69	11.11	-10.61	19.95	19.95	27.72	-29.72	14.13
3035 R	15.44	15.44	24.09	-24.02	13.63	13.63	9.56	-8.72	8.68
3041 L	-0.31	-0.31	1.48	-2.23	-0.03	-0.03	25.71	-29.60	0.47
3041 R	-0.02	-0.02	31.76	-38.00	-0.36	-0.36	1.61	-2.83	-0.69
3051 L	-0.21	-0.21	-0.22	10.69	-0.17	-0.17	26.18	-29.76	0.35
3051 R	-0.15	-0.15	24.21	-27.21	-0.24	-0.24	-0.68	9.99	-0.68
3057 L	11.15	11.15	6.16	-2.48	13.69	13.69	19.82	-20.79	9.84
3057 R	14.33	14.33	20.01	-21.39	11.66	11.66	6.25	-2.44	7.73
3071 L	11.76	11.76	4.40	0.30	14.25	14.25	16.76	-17.70	10.27
3071 R	13.62	13.62	16.64	-17.27	11.24	11.24	4.34	0.14	7.38
3077 L	-0.13	-0.13	-15.81	22.30	-0.39	-0.39	9.76	-13.58	0.26
3077 R	-0.32	-0.32	9.14	-10.75	-0.10	-0.10	-14.41	17.62	-0.60
3089 L	-0.22	-0.22	-2.49	9.30	-0.17	-0.17	19.95	-19.54	0.26
3089 R	-0.20	-0.20	19.09	-21.18	-0.24	-0.24	-2.62	10.16	-0.63
3095 L	12.65	12.65	7.53	-4.45	15.29	15.29	21.21	-22.50	11.01
3095 R	16.20	16.20	20.54	-21.86	13.40	13.40	7.30	-4.12	8.83
3109 L	13.22	13.22	8.80	-5.11	16.19	16.19	22.15	-23.37	11.63
3109 R	15.27	15.27	22.89	-24.08	12.48	12.48	9.09	-5.51	8.32
3115 L	-0.22	-0.22	-3.86	7.21	-0.40	-0.40	22.16	-25.92	0.46
3115 R	-0.43	-0.43	26.64	-28.43	-0.22	-0.22	-4.87	7.91	-0.80
3127 L	-0.32	-0.32	-5.87	12.53	-0.28	-0.28	13.19	-13.54	0.30
3127 R	-0.33	-0.33	13.55	-15.79	-0.37	-0.37	-5.88	14.50	-0.86
3133 L	11.19	11.19	4.62	-1.36	13.49	13.49	16.43	-15.65	10.08
3133 R	17.38	17.38	18.86	-20.44	14.38	14.38	5.73	-1.58	9.33
3147 L	13.92	13.92	8.46	-3.08	18.28	18.28	23.40	-25.04	12.79
3147 R	14.18	14.18	20.27	-19.10	10.81	10.81	6.76	-2.42	7.18
3153 L	-0.78	-0.78	-7.13	11.92	0.07	0.07	20.09	-24.73	1.20
3153 R	0.09	0.09	21.45	-27.12	-0.80	-0.80	-7.82	13.09	-1.45
3163 L	-0.64	-0.64	-4.03	13.64	-0.22	-0.22	18.11	-21.26	0.71
3163 R	-0.22	-0.22	16.49	-19.24	-0.61	-0.61	-3.85	12.51	-1.38
3169 L	10.87	10.87	5.17	-1.12	13.82	13.82	18.53	-16.96	9.80
3169 R	17.98	17.98	20.96	-23.01	14.14	14.14	6.31	-1.28	9.42
3183 L	14.54	14.54	6.83	-1.57	17.43	17.43	19.55	-21.11	12.56
3183 R	13.36	13.36	17.16	-15.50	11.21	11.21	5.55	-1.31	7.17
3189 L	-0.50	-0.50	-12.99	17.13	-0.44	-0.44	10.08	-14.43	0.28
3189 R	-0.41	-0.41	9.50	-14.34	-0.46	-0.46	-11.86	16.84	-0.96
3199 L	-0.32	-0.32	-2.69	14.74	-0.70	-0.70	22.30	-27.37	0.37
3199 R	-0.67	-0.67	21.52	-23.42	-0.32	-0.32	-2.60	12.69	-1.07
3205 L	11.27	11.27	6.51	-2.23	14.38	14.38	20.96	-20.50	10.28
3205 R	17.06	17.06	21.45	-23.41	13.57	13.57	6.61	-1.81	8.72
3219 L	13.49	13.49	7.12	-1.24	17.26	17.26	22.09	-23.85	12.06
3219 R	14.53	14.53	21.46	-20.81	11.38	11.38	6.89	-1.73	7.29
3225 L	-0.43	-0.43	-11.45	18.13	-0.34	-0.34	18.37	-22.20	0.37
3225 R	-0.29	-0.29	16.22	-20.43	-0.38	-0.38	-9.96	16.70	-0.92
3234 L	-0.26	-0.26	-9.43	19.81	-0.46	-0.46	12.41	-15.02	0.36
3234 R	-0.45	-0.45	11.59	-14.12	-0.27	-0.27	-8.72	18.67	-0.89
3242 L	9.62	9.62	1.79	1.82	11.92	11.92	12.95	-14.63	8.53
3242 R	12.00	12.00	12.90	-13.96	9.70	9.70	1.79	1.84	6.10
3253 L	9.58	9.58	3.07	1.45	12.13	12.13	14.75	-15.73	8.59
3253 R	11.69	11.69	14.58	-15.29	9.23	9.23	2.98	1.37	5.87
3262 L	-0.37	-0.37	-9.91	16.59	-0.30	-0.30	16.94	-21.51	0.35
3262 R	-0.30	-0.30	17.99	-21.12	-0.37	-0.37	-10.93	16.39	-0.95
3272 L	-0.61	-0.61	6.07	-7.16	-0.13	-0.13	36.64	-39.57	0.74
3272 R	-0.13	-0.13	30.42	-35.54	-0.54	-0.54	5.17	-6.47	-0.85

Flange Stress Values for Web Splice Calculations

STRENGTH I

Splice Node	Splice Side	MAX FX				MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ				Flange Stre
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange
		TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF
3281.0	3281 L	16.42	16.42	16.84	-17.33	11.79	11.79	13.46	-13.69	14.42	14.42	10.10	-10.07	14.44	14.44	16.78	-17.27	14.30	14.30	15.16	-15.52	14.96	14.96	15.58	-15.98	13.57	13.57	8.09	-7.91	15.39	15.39	20.92	-21.73	11.33
	3281 R	13.90	13.90	15.16	-15.45	19.34	19.34	18.69	-19.31	17.02	17.02	19.62	-20.32	17.35	17.35	11.12	-11.04	17.63	17.63	17.37	-17.86	16.85	16.85	16.93	-17.38	18.12	18.12	23.21	-24.23	16.00	16.00	9.21	-8.96	10.15
3291.0	3291 L	19.35	19.35	10.21	-10.58	13.90	13.90	4.79	-3.32	17.70	17.70	12.29	-12.84	16.13	16.13	3.07	-0.12	17.68	17.68	8.90	-9.14	16.99	16.99	7.52	-7.64	15.46	15.46	2.24	1.43	18.14	18.14	15.87	-16.75	13.24
	3291 R	11.79	11.79	3.94	-2.76	16.43	16.43	9.04	-9.33	13.76	13.76	2.62	-0.46	15.04	15.04	10.20	-10.58	14.42	14.42	6.56	-6.65	15.01	15.01	7.83	-8.02	15.41	15.41	14.19	-14.87	13.17	13.17	1.50	1.46	8.60
3300.0	3300 L	0.12	0.12	-10.50	10.55	-0.33	-0.33	-18.67	26.19	-0.20	-0.20	-17.63	24.21	-0.06	-0.06	-15.84	20.77	0.01	0.01	-12.86	15.07	-0.22	-0.22	-14.58	18.36	-0.22	-0.22	-22.05	32.67	0.04	0.04	-1.16	0.64	0.16
	3300 R	-0.26	-0.26	-15.02	19.90	0.10	0.10	-7.94	7.89	-0.04	-0.04	-12.21	15.13	-0.16	-0.16	-14.50	19.02	-0.17	-0.17	-11.48	13.90	0.01	0.01	-9.99	11.36	0.04	0.04	-0.75	0.44	-0.18	-0.18	-17.93	24.86	-0.27
3310.0	3310 L	0.10	0.10	-29.31	31.23	-0.26	-0.26	-34.88	40.68	-0.18	-0.18	-36.22	42.96	0.00	0.00	-29.90	32.23	-0.17	-0.17	-33.15	37.75	0.00	0.00	-30.69	33.57	-0.05	-0.05	-37.53	45.20	-0.12	-0.12	-27.25	27.73	0.13
	3310 R	-0.26	-0.26	-34.88	40.68	0.10	0.10	-29.31	31.23	0.00	0.00	-29.26	31.15	-0.19	-0.19	-36.84	44.02	0.00	0.00	-30.69	33.57	-0.17	-0.17	-33.15	37.75	-0.12	-0.12	-27.25	27.73	-0.05	-0.05	-37.53	45.20	-0.27
3402.0	3402 L	-16.57	-16.57	-11.32	12.19	-22.89	-22.89	-5.45	5.87	-20.50	-20.50	-16.63	17.91	-19.85	-19.85	-2.18	2.35	-20.92	-20.92	-10.34	11.14	-20.45	-20.45	-4.84	5.22	-19.38	-19.38	-17.52	18.87	-21.25	-21.25	-1.03	1.11	-12.18
	3402 R	-24.24	-24.24	-6.68	6.68	-17.55	-17.55	-11.54	11.54	-21.46	-21.46	-1.67	1.67	-21.40	-21.40	-17.35	17.35	-21.65	-21.65	-4.93	4.93	-22.16	-22.16	-10.57	10.57	-22.50	-22.50	-1.05	1.05	-20.54	-20.54	-17.87	17.87	-17.64
3407.0	3407 L	-17.58	-17.58	4.65	-4.65	-24.08	-24.08	1.31	-1.31	-19.03	-19.03	7.10	-7.10	-23.02	-23.02	-0.85	0.85	-18.77	-18.77	2.37	-2.37	-19.12	-19.12	2.88	-2.88	-22.59	-22.59	-1.06	1.06	-20.36	-20.36	7.91	-7.91	-12.91
	3407 R	-22.89	-22.89	1.29	-1.29	-16.72	-16.72	4.57	-4.57	-21.96	-21.96	-0.78	0.78	-18.04	-18.04	6.93	-6.93	-18.18	-18.18	2.83	-2.83	-17.85	-17.85	2.33	-2.33	-19.37	-19.37	7.77	-7.77	-21.47	-21.47	-1.04	1.04	-16.68
3411.0	3411 L	-16.66	-16.66	5.40	-5.40	-22.88	-22.88	1.89	-1.89	-22.20	-22.20	0.03	-0.03	-17.98	-17.98	7.72	-7.72	-17.83	-17.83	3.12	-3.12	-18.13	-18.13	3.42	-3.42	-21.59	-21.59	-0.58	0.58	-19.34	-19.34	8.60	-8.60	-12.22
	3411 R	-24.07	-24.07	1.92	-1.92	-17.52	-17.52	5.50	-5.50	-18.97	-18.97	7.90	-7.90	-23.13	-23.13	-0.22	0.22	-19.07	-19.07	3.48	-3.48	-18.75	-18.75	3.17	-3.17	-20.33	-20.33	8.76	-8.76	-22.72	-22.72	-0.59	0.59	-17.54
3416.0	3416 L	-17.53	-17.53	-5.97	5.97	-24.41	-24.41	-2.70	2.70	-21.85	-21.85	1.08	-1.08	-21.25	-21.25	-11.72	11.72	-22.62	-22.62	-2.84	2.84	-21.16	-21.16	-4.18	4.18	-20.50	-20.50	-12.36	12.36	-22.87	-22.87	1.93	-1.93	-12.85
	3416 R	-23.06	-23.06	-2.65	2.85	-16.55	-16.55	-5.86	6.31	-20.64	-20.64	-10.79	11.62	-19.57	-19.57	-0.21	0.22	-19.98	-19.98	-4.10	4.41	-21.36	-21.36	-2.78	2.99	-21.60	-21.60	1.89	-2.04	-19.35	-19.35	-12.12	13.05	-16.79
3422.0	3422 L	-13.36	-13.36	-12.40	12.40	-20.34	-20.34	-8.18	8.18	-17.74	-17.74	-17.26	17.26	-16.58	-16.58	-5.88	5.88	-18.24	-18.24	-10.93	10.93	-17.48	-17.48	-7.67	7.67	-16.26	-16.26	-18.62	18.62	-18.81	-18.81	-3.85	3.85	-9.81
	3422 R	-23.87	-23.87	-9.26	9.26	-15.70	-15.70	-14.05	14.05	-20.63	-20.63	-5.20	5.20	-19.99	-19.99	-20.52	20.52	-20.52	-20.52	-8.68	8.68	-21.41	-21.41	-12.38	12.38	-22.08	-22.08	-4.36	4.36	-19.10	-19.10	-21.08	21.08	-17.38
3427.0	3427 L	-15.89	-15.89	8.17	-8.17	-23.57	-23.57	3.93	-3.93	-17.95	-17.95	11.03	-11.03	-22.56	-22.56	2.06	-2.06	-17.55	-17.55	5.73	-5.73	-17.97	-17.97	5.87	-5.87	-21.99	-21.99	1.78	-1.78	-19.16	-19.16	11.77	-11.77	-11.68
	3427 R	-22.27	-22.27	3.85	-3.85	-15.03	-15.03	8.00	-8.00	-21.38	-21.38	2.08	-2.08	-16.51	-16.51	10.52	-10.52	-16.99	-16.99	5.76	-5.76	-16.59	-16.59	5.62	-5.62	-18.13	-18.13	11.53	-11.53	-20.77	-20.77	1.74	-1.74	-16.22
3431.0	3431 L	-15.10	-15.10	7.92	-7.92	-22.30	-22.30	3.69	-3.69	-21.39	-21.39	1.86	-1.86	-16.58	-16.58	10.40	-10.40	-16.63	-16.63	5.56	-5.56	-16.98	-16.98	5.56	-5.56	-20.80	-20.80	1.59	-1.59	-18.16	-18.16	11.42	-11.42	-11.09
	3431 R	-23.59	-23.59	3.77	-3.77	-15.96	-15.96	8.08	-8.08	-18.01	-18.01	10.94	-10.94	-22.56	-22.56	1.83	-1.83	-17.97	-17.97	5.67	-5.67	-17.59	-17.59	5.68	-5.68	-19.20	-19.20	11.66	-11.66	-22.02	-22.02	1.62	-1.62	-17.18
3436.0	3436 L	-15.89	-15.89	-15.20	15.20	-23.85	-23.85	-11.18	11.18	-20.63	-20.63	-6.43	6.43	-20.19	-20.19	-21.75	21.75	-21.65	-21.65	-13.43	13.43	-20.38	-20.38	-10.08	10.08	-19.24	-19.24	-22.30	22.30	-21.83	-21.83	-5.68	5.68	-11.67
	3436 R	-20.32	-20.32	-9.87	9.87	-13.52	-13.52	-13.43	13.43	-17.80	-17.80	-18.45	18.45	-16.75	-16.75	-6.74	6.74	-17.36	-17.36	-8.91	8.91	-18.44	-18.44	-11.81	11.81	-18.60	-18.60	-5.02	5.02	-16.37	-16.37	-19.70	19.70	-14.78
3442.0	3442 L	-15.49	-15.49	-7.22	7.22	-22.43	-22.43	-3.44	3.44	-19.79	-19.79	-12.23	12.23	-18.71	-18.71	-0.50	0.50	-20.63	-20.63	-5.16	5.16	-19.23	-19.23	-3.15	3.15	-18.41	-18.41	-13.46	13.46	-20.77	-20.77	1.35	-1.35	-11.35
	3442 R	-26.58	-26.58	-3.94	3.94	-18.36	-18.36	-8.28	8.28	-23.20	-23.20	0.75	-0.75	-22.71	-22.71	-14.88	14.88	-22.79	-22.79	-3.61	3.61	-24.44	-24.44	-5.92	5.92	-24.60	-24.60	1.55	-1.55	-21.82	-21.82	-15.42	15.42	-19.39
3447.0	3447 L	-18.45	-18.45	4.00	-4.00	-26.30	-26.30	-0.16	0.16	-20.52	-20.52	6.84	-6.84	-25.22	-25.22	-2.59	2.59	-19.91	-19.91	1.81	-1.81	-20.56	-20.56	1.41	-1.41	-24.71	-24.71	-2.78	2.78	-21.76	-21.76	7.51	-7.51	-13.52
	3447 R	-24.84	-24.84	-0.15	0.15	-17.43	-17.43	3.92	-3.92	-23.94	-23.94	-2.44	2.44	-19.04	-19.04	6.46	-6.46	-19.42	-19.42	1.38	-1.38	-18.80	-18.80	1.77	-1.77	-20.56	-20.56	7.35	-7.35	-23.33	-23.33	-2.72	2.72	-18.13
3451.0	3451 L	-17.43	-17.43	4.01	-4.01	-24.88	-24.88	-0.45	0.45	-23.98	-23.98	-2.17	2.17	-18.91	-18.91	6.49	-6.49	-18.81	-18.81	1.92	-1.92	-19.43	-19.43	1.49	-1.49	-23.38	-23.38	-2.57	2.57	-20.55	-20.55	7.48	-7.48	-12.77
	3451 R	-26.35	-26.35	-0.46	0.46	-18.45	-18.45	4.09	-4.09	-20.22	-20.22	6.75	-6.75	-25.27	-25.27	-2.32	2.32	-20.58	-20.58	1.52	-1.52	-19.91	-19.91	1.97	-1.97	-21.75	-21.75	7.64	-7.64	-24.77	-24.77	-2.62	2.62	-19.24
3456.0	3456 L	-18.41	-18.41	-8.06	8.06	-26.73	-26.73	-2.55	2.55	-23.51	-23.51	1.65	-1.65	-22.70	-22.70	-14.25	14.25	-24.12	-24.12	-6.71	6.71	-23.36	-23.36	-2.10	2.10	-21.84	-21.84	-14.79	14.79	-24.71	-24.71	2.43	-2.43	-13.49
	3456 R	-22.57	-22.57	-2.22	2.22	-15.54	-15.54	-7.03	7.03	-19.90	-19.90	-11.58	11.58	-18.81	-18.81	0.12	-0.12	-19.72	-19.72	-1.84	1.84	-20.36	-20.36	-5.85	5.85	-20.86	-20.86	2.12	-2.12	-18.42	-18.42	-12.91	12.91	-16.46
3462.0	3462 L	-13.08	-13.08	-10.94	12.61	-21.31	-21.31	-6.99	8.05	-19.23	-19.23	-14.62	16.85	-15.55	-15.55	-5.49	6.33	-19.45	-19.45	-8.89	10.24	-15.99	-15.99	-8.02	9.24	-16.67	-16.67	-17.07	19.67	-18.87	-18.87	-2.64	3.05	-9.54
	3462 R	-25.15	-25.15	-8.51	8.51	-15.45	-15.45	-13.32	13.32	-19.70	-19.70	-4.87	4.87	-21.38	-21.38	-19.54	19.54	-18.88	-18.88	-9.77	9.77	-22.95	-22.95	-10.81	10.81	-22.26	-22.26	-3.22	3.22	-19.69	-19.69	-20.79	20.79	-18.44
3467.0	3467 L	-16.36	-16.36	7.77	-7.77	-25.69	-25.69	4.60	-4.60	-19.03	-19.03	11.91	-11.91	-23.87	-23.87	1.30	-1.30	-18.72	-18.72	5.67	-5.67	-19.03	-19.03	5.84	-5.84	-22.36	-22.36	0.54	-0.54	-20.65	-20.65	13.01	-13.01	-11.96
	3467 R	-24.27	-24.27	4.50	-4.50	-15.47	-15.47	7.62	-7.62	-23.01	-23.01	1.77	-1.77	-17.47	-17.47	11.30	-11.30	-17.98	-17.98	5.73	-5.73	-17.68	-17.68	5.55	-5.55	-19.53	-19.53	12.74	-12.74	-21.12	-21.12	0.53	-0.53	-17.81
3471.0	3471 L	-15.27	-15.27	7.01	-7.01	-24.22	-24.22	5.39	-5.39	-22.77	-22.77	1.70	-1.70	-17.13	-17.13	10.72	-10.72	-17.40	-17.40	5.18	-5.18	-18.23	-18.23	6.19	-6.19	-21.43	-21.43	0.59	-0.59	-19.54	-19.54	12.44	-12.44	-11.10
	3471 R	-25.63	-25.63	5.51	-5.51	-16.16	-16.16	7.16	-7.16	-18.86	-18.86	11.72	-11.72	-23.74	-23.74	1.16	-1.16	-19.30	-19.30	6.32	-6.32	-18.41	-18.41	5.28	-5.28	-20.67	-20.67	12.70	-12.70	-22.69	-22.69	0.60	-0.60	-18.76
3476.0	3476 L	-15.43	-15.43	-13.28	13.28	-25.21	-25.21	-9.44	9.44	-19.68	-19.68	-4.65	4.65	-22.13	-22.13	-19.56	19.56	-22.41	-22.41	-14.10	14.10	-20.64	-20.64	-7.25	7.25	-19.45	-19.45	-21.54	21.54	-22.56	-22.56	-2.57	2.57	-11.24
	3476 R	-21.36	-21.36	-7.75	8.93	-13.07	-13.07	-10.91	12.57	-19.12	-19.12	-15.54	17.90	-16.23	-16.23	-4.42	5.09	-17.49	-17.49	-5.91	6.81	-18.98	-18.98	-11.63	13.40	-19.12	-19.12	-2.11	2.43	-16.46	-16.46	-17.69	20.38	-15.58
3482.0	3482 L	-12.85	-12.85	-14.56	17.89	-21.60	-21.60	-11.91	14.64	-19.65	-19.65	-18.76	23.05	-15.39	-15.39	-9.92	12.18	-19.16	-19.16	-14.79	18.16	-17.43	-17.43	-10.68	13.13	-16.54	-16.54	-21.31	26.18	-19.35	-19.35	-6.79	8.34	-9.35
	3482 R	-24.67	-24.67	-14.30	14.30	-14.69	-14.69	-17.47	17.47	-18.49	-18.49	-10.59	10.59	-21.93	-21.93	-23.24	23.24	-19.90	-19.90	-12.84	12.84	-21.88	-21.88	-17.73	17.73	-22.09	-22.09	-8.15	8.15	-18.91	-18.91	-25.57	25.57	-17.98
3487.0	3487 L	-15.71	-15.71	9.35	-9.35	-25.54	-25.54	8.36	-8.36	-19.08	-19.08	14.16	-14.16	-23.78	-23.78	4.66	-4.66	-18.27	-18.27	7.59	-7.59	-19.17	-19.17	8.73	-8.73	-22.25	-22.25	3.81	-3.81	-20.47	-20.47	15.00	-15.00	-11.41
	3487 R	-24.13	-24.13	8.19	-8.19	-14.85	-14.85	9.16	-9.16	-22.71	-22.71	4.72	-4.72	-16.95	-16.95	12.97	-12.97	-18.12	-18.12	8.55	-8.55	-17.26	-17.26	7.44	-7.44	-19.35	-19.35	14.70	-14.70	-21.02	-21.02	3.73	-3.73	-17.65
3491.0	3491 L	-15.52	-15.52	9.87	-9.87	-23.83	-23.83	8.11	-8.11	-22.29	-22.29	4.09	-4.09	-17.77	-17.77	14.16	-14.16	-17.67	-17.67	8.08	-8.08	-17.85	-17.85	8.10	-8.10	-20.64	-20.64	3.02	-3.02	-19.63	-19.63	15.42	-15.42	-11.29
	3491 R	-25.22	-25.22	8.28	-8.28	-16.41	-16.41	10.08	-10.08	-19.73	-19.73	15.09	-15.09	-23.33	-23.33	4.00	-4.00	-18.89	-18.89	8.26	-8.26	-18.70	-18.70	8.25	-8.25	-20.75	-20.75	15.74	-15.74	-21.85	-21.85	3.09	-3.09	-18.56
3496.0	3496 L	-15.28	-15.28	-17.41	17.41	-24.46	-24.46	-15.05	15.05	-18.89	-18.89	-9.71	9.71	-21.55	-21.55	-24.52	24.52	-22.03	-22.03	-17.63	17.63	-19.80	-19.80	-13.07	13.07	-19.44	-19.44	-26.02	26.02	-21.13	-21.13	-8.09	8.09	-11.08
	3496 R	-21.42	-21.42	-12.52	15.38	-13.37	-13.37	-14.51	17.83	-19.47	-19.47	-19.70	24.20	-15.88	-15.88	-8.90	10.93	-17.34	-17.34	-10.92	13.42	-19.29	-19.29	-14.68	18.03	-18.51	-18.51	-6.75	8.29	-17.01	-17.01	-21.68	26.64	-15.75
3502.0	3502 L	-13.11	-13.11	-11.93	12.63	-21.15	-21.15	-8.76	9.28	-18.25	-18.25	-17.83	18.89	-16.36	-16.36	-5.89	6.24	-18.75	-18.75	-10.75	11.38	-17.71	-17.71	-7.69	8.15	-16.42	-16.42	-19.56	20.72	-19.42	-19.42	-3.30	3.50	-9.56
	3502 R	-23.46	-23.46	-9.59	9.59	-14.55	-14.55	-13.05	13.05	-19.95	-19.95	-4.52	4.52	-19.18	-19.18	-20.75	20.75	-19.63	-19.63	-8.36	8.36	-20.80	-20.80	-11.78	11.78	-21.53	-21.53	-3.61	3.61	-18.23	-18.23	-21.40	21.40	-17.07
3507.0	3507 L	-14.65	-14.65	7.74	-7.74	-23.06	-23.06	4.26	-4.26	-17.34	-17.34	11.77	-11.77	-22.02	-22.02	1.59	-1.59	-16.48	-16.48	5.31	-5.31	-16.94	-16.94	5.46	-5.46	-21.43	-21.43	1.21	-1.21	-18.15	-18.15	12.19	-12.19	-10.69
	3507 R	-21.97	-21.97	4.18	-4.18	-13.97	-13.97	7.61	-7.61	-21.05	-21.05	1.62	-1.62	-15.57	-15.57	10.72	-10.72	-16.14	-16.14	5.37	-5.37	-15.71	-15.71	5.22	-5.22	-17.31	-17.31	11.98	-11.98	-20.41	-20.41	1.19	-1.19	-15.99
3511.0	3511 L	-13.95	-13.95	7.66	-7.66	-21.94	-21.94	4.31	-4.31	-21.06	-21.06	1.73	-1.73	-15.58	-15.58	10.77	-10.77	-15.69	-15.69	5.24	-5.24	-16.14	-16.14	5.37	-5.37	-20.36	-20.36	1.28	-1.28	-17.34	-17.34	11.95	-11.95	-10.19
	3511 R	-23.04	-23.04	4.38	-4.38	-14.64	-14.64	7.79	-7.79	-17.46	-17.46	11.79	-11.79	-22.03	-22.03	1.69	-1.69	-16.94	-16.94	5.46	-5.46	-16.47	-16.47	5.33	-5.33	-18.19	-18.19	12.15	-12.15	-21.38	-21.38	1.30	-1.30	-16.77
3516.0	3516 L	-14.52	-14.52	-13.05	13.05	-23.39	-23.39	-8.64	8.64	-19.73	-19.73	-3.84	3.84	-19.21	-19.21	-20.99	20.99	-20.89	-20.89	-11.29	11.29	-19.08	-19.08	-9.02	9.02	-18.14	-18.14	-21.64	21.64	-21.53	-21.53	-2.97	2.97	-10.61
	3516 R	-21.09	-21.09	-7.90	8.36	-13.08	-13.08	-11.93	12.63	-18.37	-18.37	-18.02	19.09	-16.50	-16.50	-5.00	5.29	-17.20	-17.20	-8.25	8.74	-18.84	-18.84	-10.31	10.92	-19.42	-19.42	-2.72	2.88	-16.34	-16.34	-19.78	20.95	-15.33
3522.0	3522 L	-10.75	-10.75	-17.80	16.90	-17.44	-17.44	-15.70	14.91	-15.25	-15.25	-23.25	22.07	-13.61	-13.61	-12.27	11.65	-15.56	-15.56	-17.15	16.28	-13.86	-13.86	-14.77	14.02	-13.87	-13.87	-24.59	23.34	-15.93	-15.93	-10.31	9.79	-7.89
	3522 R	-19.35	-19.35	-16.39	16.39	-11.94	-11.94	-18.59	18.59	-16.11	-16.11	-11.61	11.61	-16.13	-16.13	-25.17	25.17	-15.39	-15.39	-15.40	15.40	-17.27	-17.27	-17.94	17.94	-17.67	-17.67	-10.76	10.76	-15.40	-15.40	-25.67	25.67	-14.05
3527.0	3527 L	-12.07	-12.07	10.52	-10.52	-19.25	-19.25	7.60	-7.60	-14.72	-14.72	13.82	-13.82	-18.29	-18.29	5.37	-5.37	-13.89	-13.89	8.25	-8.25	-14.01	-14.01	8.39	-8.39	-17.74	-17.74	5.04	-5.04	-15.27	-15.27	14.05	-14.05	-8.86
	3527 R	-18.49	-18.49	7.49	-7.49	-11.61	-11.61	10.38	-10.38	-17.65	-17.65	5.36	-5.36	-13.17	-13.17	12.96	-12.96	-13.46	-13.46	8.27	-8.27	-13.35	-13.35	8.15	-8.15	-14.68	-14.68	13.86	-13.86	-17.03	-17.03	4.98	-4.98	-13.45
3531.0	3531 L	-11.56	-11.56	10.50	-10.50	-18.50	-18.50	7.61	-7.61	-17.71	-17.71	5.77	-5.77	-13.07	-13.07	13.06	-13.06	-13.10	-13.10	8.25	-8.25	-13.65	-13.65	8.62	-8.62	-17.00	-17.00	5.32	-5.32	-14.65	-14.65	14.05	-14.05	-8.49
	3531 R	-19.26	-19.26	7.71	-7.71	-12.02	-12.02	10.65	-10.65	-14.27	-14.27	13.77	-13.77	-18.37	-18.37	5.78	-5.78	-14.21	-14.21	8.74	-8.74	-13.63	-13.63	8.36	-8.36	-15.24	-15.24	14.25	-14.25	-17.71	-17.71	5.39	-5.39	-14.00
3536.0	3536 L	-11.81	-11.81	-15.89	15.89	-19.60	-19.60	-12.34	12.34	-16.22	-16.22	-8.42	8.42	-16.12	-16.12	-21.66	21.66	-16.90	-16.90	-15.15	15.15	-16.15	-16.15	-11.95	11.95	-15.09	-15.09	-22.33	22.33	-17.91	-17.91	-7.52	7.52	-8.66
	3536 R	-17.05	-17.05	-10.94	11.13	-10.26	-10.26	-14.10	14.34	-14.79	-14.79	-18.31	18.62	-13.13	-13.13	-8.64	8.79	-14.05	-14.05	-10.65	10.83	-14.70	-14.70	-13.12	13.34	-15.57	-15.57	-6.67	6.79	-13.10	-13.10	-19.81	20.14	-12.40
3542.0	3542 L	-15.74	-15.74	-6.60	6.92	-21.98	-21.98	-5.61	5.89	-20.32	-20.32	-10.94	11.48	-17.77	-17.77	-2.74	2.87	-19.93	-19.93	-3.61	3.79	-18.20	-18.20	-9.43	9.90	-18.69	-18.69	-12.37	12.99	-20.24	-20.24	-0.61	0.64	-11.53
	3542 R	-24.31	-24.31	-6.07	6.07	-17.41	-17.41	-7.04	7.04	-21.18	-21.18	-1.36	1.36	-21.64	-21.64	-12.75	12.75	-20.14	-20.14	-10.19	10.19	-22.04	-22.04	-3.92	3.92	-22.38	-22.38	-0.66	0.66	-20.68	-20.68	-13.39	13.39	-17.69
3547.0	3547 L	-17.55	-17.55	6.16	-6.16	-24.13	-24.13	3.76	-3.76	-19.78	-19.78	9.00	-9.00	-23.04	-23.04	1.53	-1.53	-19.13	-19.13	4.53	-4.53	-18.81	-18.81	4.29	-4.29	-22.44	-22.44	1.12	-1.12	-20.68	-20.68	9.38	-9.38	-12.89
	3547 R	-23.22	-23.22	3.72	-3.72	-16.90	-16.90	6.09	-6.09	-22.38	-22.38	1.72	-1.72	-18.39	-18.39	8.41	-8.41	-18.11	-18.11	4.23	-4.23	-18.41	-18.41	4.48	-4.48	-19.92	-19.92	9.27	-9.27	-21.59	-21.59	1.11	-1.11	-16.89
3551.0	3551 L	-16.99	-16.99	6.15	-6.15	-23.28	-23.28	4.15	-4.15	-22.42	-22.42	2.24	-2.24	-18.27	-18.27	8.38	-8.38	-18.04	-18.04	4.44	-4.44	-18.55	-18.55	4.71	-4.71	-21.38	-21.38	1.70	-1.70	-20.00	-20.00	9.40	-9.40	-12.45
	3551 R	-24.19	-24.19	4.21	-4.21	-17.64	-17.64	6.23	-6.23	-19.21	-19.21	8.62	-8.62	-23.06	-23.06	2.13	-2.13	-19.27	-19.27	4.77	-4.77	-18.74	-18.74	4.49	-4.49	-20.77	-20.77	9.52	-9.52	-22.22	-22.22	1.72	-1.72	-17.62
3556.0	3556 L	-17.59	-17.59	-11.99	11.99	-24.27	-24.27	-8.16	8.16	-20.92	-20.92	-4.11	4.11	-21.83	-21.83	-17.01	17.01	-21.91	-21.91	-14.72	14.72	-21.86	-21.86	-4.73	4.73	-20.88	-20.88	-17.66	17.66	-22.19	-22.19	-3.21	3.21	-12.92
	3556 R	-21.93	-21.93	-7.54	7.91	-15.89	-15.89	-11.08	11.63	-20.02	-20.02	-15.30	16.06	-18.38	-18.38	-4.54	4.76	-19.76	-19.76	-4.37	4.59	-19.79	-19.79	-13.61	14.29	-20.06	-20.06	-2.97	3.11	-18.85	-18.85	-16.32	17.14	-15.95
5007.0	5007 L	-0.01	-0.01	-38.68	31.86	-0.07	-0.07	-44.80	42.35	-0.04	-0.04	-37.92	30.56	-0.05	-0.05	-45.70	43.88	-0.04	-0.04	-38.57	31.67	-0.03	-0.03	-38.54	31.62	-0.06	-0.06	-47.09	46.25	-0.03	-0.03	-35.81	26.94	-0.01
	5007 R	-0.07	-0.07	-44.80	42.34	-0.01	-0.01	-38.68	31.86	-0.05	-0.05	-45.13	42.90	-0.04	-0.04	-38.46	31.49	-0.03	-0.03	-38.54	31.62	-0.04	-0.04	-38.57	31.67	-0.03	-0.03	-35.81	26.94	-0.06	-0.06	-47.09	46.25	-0.05
5015.0	5015 L	-0.01	-0.01	-7.57	6.02	-0.07	-0.07	-10.31	10.71	-0.06	-0.06	-7.75	6.34	-0.04	-0.04	-12.39	14.28	-0.04	-0.04	-6.97	5.00	-0.05	-0.05	-9.59	9.47	-0.05	-0.05	-15.07	18.86	-0.04	-0.04	5.13	-5.00	-0.01
	5015 R	-0.12	-0.12	-11.95	16.90	-0.04	-0.04	-8.54	9.16	-0.07	-0.07	-13.55	20.53	-0.11	-0.11	-9.22	10.70	-0.09	-0.09	-10.58	13.78	-0.07	-0.07	-7.76	7.38	-0.07	-0.07	5.66	-7.28	-0.08	-0.08	-16.51	27.23	-0.08
5021.0	5021 L	16.76	16.76	13.68	-13.74	12.39	12.39	4.30	-3.86	14.15	14.15	1.56	-0.97	15.52	15.52	14.19	-14.27	15.05	15.05	9.50	-9.34	15.42	15.42	9.52	-9.36	13.39	13.39	3.90	-0.46	15.85	15.85	17.16	-17.40	11.28
	5021 R	16.07	16.07	4.97	-4.65	21.67	21.67	15.41	-16.66	20.06	20.06	16.81	-18.27	17.35	17.35	5.22	-1.10	19.96	19.96	10.72	-11.26	19.48	19.48	10.74	-11.28	20.49	20.49	19.51	-21.38	17.21	17.21	4.83	-0.12	11.71
5035.0	5035 L	21.67	21.67	20.50	-21.47	16.07	16.07	17.44	-17.95	18.80	18.80	22.94	-24.28	19.58	19.58	13.27	-13.16	19.90	19.90	19.07	-19.83	19.51	19.51	20.21	-21.13	18.16	18.16	11.11	-10.67	20.27	20.27	26.38	-28.24	14.37
	5035 R	12.39	12.39	14.91	-14.39	16.76	16.76	17.94	-17.58	15.14	15.14	12.05	-11.38	14.52	14.52	19.26	-18.97	15.07	15.07	17.54	-17.16	15.38	15.38	16.59	-16.15	15.67	15.67	22.93	-22.84	14.01	14.01	9.58	-8.77	9.05
5041.0	5041 L	0.63	0.63	19.81	-22.94	-1.22	-1.22	6.90	-8.35	-0.28	-0.28	9.61	-11.42	-0.75	-0.75	11.20	-13.21	0.24	0.24	15.57	-18.15	-0.82	-0.82	10.76	-12.71	-0.39	-0.39	1.88	-2.68	-0.10	-0.10	24.08	-27.76	0.45
	5041 R	-1.52	-1.52	8.47	-10.83	0.82	0.82	24.33	-29.33	-0.90	-0.90	15.52	-19.05	-0.37	-0.37	10.74	-13.47	-1.01	-1.01	13.22	-16.37	0.32	0.32	19.09	-23.22	-0.12	-0.12	29.73	-35.63	-0.46	-0.46	2.11	-3.40	-0.77
5051.0	5051 L	0.82	0.82	9.43	-10.24	-1.08	-1.08	4.74	-2.73	-1.01	-1.01	10.62	-11.63	-0.21	-0.21	3.73	-0.03	0.28	0.28	8.39	-9.01	-0.96	-0.96	6.94	-7.33	-0.30	-0.30	0.16	9.51	-0.29	-0.29	24.63	-27.97	0.30
	5051 R	-1.06	-1.06	4.25	-2.43	0.76	0.76	8.67	-9.35	-0.20	-0.20	3.63	-0.87	-0.98	-0.98	8.14	-8.73	-0.93	-0.93	6.34	-6.66	0.25	0.25	7.71	-8.24	-0.29	-0.29	22.77	-25.57	-0.30	-0.30	-0.29	8.89	-0.75
5057.0	5057 L	14.86	14.86	15.02	-15.51	10.36	10.36	7.78	-7.56	12.52	12.52	5.21	-4.73	13.35	13.35	15.56	-16.10	13.20	13.20	11.89	-12.07	13.26	13.26	12.52	-12.77	11.35	11.35	6.51	-3.17	13.94	13.94	19.27	-20.18	10.00
	5057 R	10.84	10.84	7.85	-7.75	15.55	15.55	15.12	-15.90	13.96	13.96	16.31	-17.23	12.50	12.50	7.35	-4.80	13.87	13.87	12.62	-13.09	13.81	13.81	11.97	-12.37	14.58	14.58	19.46	-20.76	11.87	11.87	6.59	-3.15	8.06
5071.0	5071 L	15.55	15.55	11.81	-12.15	10.93	10.93	7.23	-5.83	13.59	13.59	12.91	-13.39	12.78	12.78	5.57	-2.21	13.70	13.70	8.99	-9.00	13.93	13.93	9.71	-9.80	12.05	12.05	4.71	-0.36	14.63	14.63	16.23	-17.11	10.44
	5071 R	10.44	10.44	7.16	-5.72	14.86	14.86	11.79	-11.94	12.26	12.26	5.77	-2.84	12.99	12.99	12.23	-12.42	13.31	13.31	9.69	-9.63	13.09	13.09	8.97	-8.84	13.98	13.98	16.12	-16.70	11.39	11.39	4.66	-0.50	7.69
5077.0	5077 L	0.52	0.52	-3.73	2.01	-1.46	-1.46	-12.21	11.77	-0.39	-0.39	-10.77	10.11	-0.89	-0.89	-7.51	6.36	-0.14	-0.14	-3.21	1.41	-0.86	-0.86	-7.08	5.86	-0.35	-0.35	-14.85	20.61	-0.41	-0.41	8.93	-12.57	0.17
	5077 R	-1.26	-1.26	-11.02	9.36	0.48	0.48	-3.06	1.44	-0.76	-0.76	-5.35	3.71	-0.30	-0.30	-10.44	8.78	-0.73	-0.73	-6.26	4.63	-0.10	-0.10	-2.67	1.05	-0.32	-0.32	8.38	-9.96	-0.30	-0.30	-13.53	16.30	-0.68
5089.0	5089 L	0.48	0.48	6.72	-6.37	-0.96	-0.96	1.71	0.87	-0.69	-0.69	5.35	-5.00	-0.31	-0.31	1.70	0.90	-0.09	-0.09	7.75	-7.39	-0.71	-0.71	3.61	-3.27	-0.29	-0.29	-2.02	8.44	-0.35	-0.35	19.03	-18.62	0.18
	5089 R	-1.00	-1.00	1.60	0.89	0.46	0.46	6.37	-6.85	-0.35	-0.35	1.92	0.17	-0.74	-0.74	3.88	-4.04	-0.74	-0.74	3.63	-3.76	-0.12	-0.12	7.41	-8.01	-0.39	-0.39	18.22	-20.19	-0.31	-0.31	-2.14	9.22	-0.71
5095.0	5095 L	16.29	16.29	16.40	-17.17	11.67	11.67	10.22	-10.31	14.23	14.23	7.12	-6.87	14.41	14.41	16.84	-17.65	14.65	14.65	13.70	-14.18	14.65	14.65	13.55	-14.00	12.98	12.98	7.80	-4.96	15.28	15.28	20.72	-21.96	11.04
	5095 R	12.38	12.38	9.91	-10.00	17.27	17.27	15.86	-16.64	15.27	15.27	16.89	-17.78	15.09	15.09	6.59	-6.30	15.53	15.53	13.11	-13.57	15.54	15.54	13.26	-13.74	16.20	16.20	20.07	-21.33	13.75	13.75	7.55	-4.62	9.13
5109.0	5109 L	17.27	17.27	17.31	-17.97	12.38	12.38	9.98	-9.81	15.54	15.54	18.25	-19.02	14.74	14.74	7.41	-6.94	15.51	15.51	14.42	-14.75	15.50	15.50	14.60	-14.95	13.35	13.35	9.01	-5.61	16.32	16.32	21.42	-22.55	11.67
	5109 R	11.67	11.67	10.30	-10.13	16.29	16.29	17.92	-18.58	13.93	13.93	8.24	-7.85	14.66	14.66	18.26	-18.96	14.62	14.62	15.10	-15.45	14.63	14.63	14.91	-15.24	15.40	15.40	22.13	-23.24	12.60	12.60	9.30	-6.00	8.61

Flange Stress Values for Web Splice Calculations

STRENGTH I

Splice Node	Splice Side	MAX FX				MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ				Flange Stre
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange
		TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF
5115.0	5115 L	0.56	0.56	9.94	-12.12	-1.44	-1.44	1.64	-2.77	-0.20	-0.20	0.36	-1.32	-1.03	-1.03	7.97	-9.89	-0.11	-0.11	9.85	-12.01	-0.75	-0.75	5.14	-6.70	-0.21	-0.21	-7.02	6.99	-0.52	-0.52	20.95	-24.51	0.23
	5115 R	-1.59	-1.59	1.61	-2.88	0.65	0.65	11.81	-13.27	-1.11	-1.11	10.92	-12.37	-0.22	-0.22	-0.93	-0.29	-0.82	-0.82	5.90	-7.25	-0.10	-0.10	11.65	-13.11	-0.56	-0.56	25.17	-26.88	-0.22	-0.22	-8.91	7.83	-0.83
5127.0	5127 L	0.65	0.65	5.21	-5.40	-1.17	-1.17	-2.39	5.16	-0.63	-0.63	1.55	-1.67	-0.49	-0.49	-2.77	5.99	-0.31	-0.31	-0.42	0.79	-0.64	-0.64	1.05	-1.15	-0.48	-0.48	-5.29	11.57	-0.20	-0.20	12.82	-13.14	0.26
	5127 R	-1.25	-1.25	-2.33	5.84	0.67	0.67	5.27	-6.20	-0.52	-0.52	-2.38	5.97	-0.72	-0.72	0.20	-0.34	-0.71	-0.71	1.14	-1.42	-0.36	-0.36	-0.39	0.89	-0.24	-0.24	13.16	-15.32	-0.53	-0.53	-5.28	13.37	-0.89
5133.0	5133 L	14.77	14.77	12.38	-11.58	9.57	9.57	6.52	-5.75	13.38	13.38	6.87	-6.10	11.89	11.89	11.64	-10.85	11.91	11.91	9.51	-8.73	12.50	12.50	9.30	-8.52	10.95	10.95	5.32	-2.23	13.29	13.29	16.95	-16.12	9.94
	5133 R	12.39	12.39	7.73	-7.64	19.04	19.04	14.07	-14.89	15.33	15.33	14.16	-14.99	17.19	17.19	7.15	-6.98	16.14	16.14	10.70	-11.04	15.38	15.38	10.99	-11.37	17.13	17.13	19.48	-21.08	14.08	14.08	6.53	-2.77	9.29
5147.0	5147 L	19.04	19.04	19.26	-20.26	12.64	12.64	11.37	-9.73	17.20	17.20	20.20	-21.34	14.50	14.50	9.82	-6.00	16.49	16.49	14.77	-15.13	15.69	15.69	12.91	-13.00	13.73	13.73	8.92	-3.82	17.76	17.76	23.30	-24.89	12.61
	5147 R	9.74	9.74	9.47	-7.33	14.77	14.77	16.72	-15.55	11.34	11.34	8.31	-5.14	13.33	13.33	16.83	-15.67	12.15	12.15	11.06	-9.93	12.78	12.78	12.72	-11.57	13.77	13.77	20.15	-18.97	10.65	10.65	7.17	-2.98	7.15
5153.0	5153 L	1.51	1.51	10.12	-13.22	-2.66	-2.66	-5.39	4.72	0.12	0.12	-5.01	4.28	-1.73	-1.73	6.87	-9.45	-0.08	-0.08	7.11	-9.73	-0.55	-0.55	2.14	-3.99	-0.67	-0.67	-6.93	11.29	0.04	0.04	18.95	-23.43	1.37
	5153 R	-2.81	-2.81	-6.03	5.19	1.63	1.63	10.61	-14.38	-1.80	-1.80	8.79	-12.24	0.10	0.10	-6.70	5.98	-0.57	-0.57	2.04	-4.31	-0.07	-0.07	7.40	-10.61	0.06	0.06	20.22	-25.69	-0.68	-0.68	-7.64	12.42	-1.49
5163.0	5163 L	1.63	1.63	6.86	-8.00	-1.91	-1.91	-0.06	3.00	-1.49	-1.49	5.04	-5.85	-0.22	-0.22	-0.70	4.79	0.36	0.36	4.21	-4.89	-0.96	-0.96	1.49	-1.29	-0.57	-0.57	-3.42	12.35	-0.16	-0.16	17.45	-20.46	0.84
	5163 R	-1.82	-1.82	-0.12	2.81	1.50	1.50	6.27	-7.27	-0.20	-0.20	-0.38	3.51	-1.43	-1.43	3.14	-3.61	-1.23	-1.23	1.54	-1.73	0.31	0.31	3.84	-4.43	-0.16	-0.16	15.89	-18.52	-0.56	-0.56	-3.28	11.34	-1.41
5169.0	5169 L	14.52	14.52	15.01	-13.56	9.68	9.68	6.93	-5.80	11.91	11.91	4.13	-3.12	13.17	13.17	15.31	-13.85	12.62	12.62	9.81	-8.56	12.09	12.09	11.03	-9.74	10.81	10.81	5.71	-1.84	13.53	13.53	18.62	-17.02	9.74
	5169 R	12.68	12.68	8.10	-7.98	18.93	18.93	16.90	-18.22	17.19	17.19	18.08	-19.60	14.69	14.69	7.61	-4.14	15.79	15.79	12.57	-13.18	16.48	16.48	11.12	-11.50	17.63	17.63	21.10	-23.11	14.06	14.06	6.91	-2.30	9.45
5183.0	5183 L	18.93	18.93	13.58	-14.09	12.88	12.88	9.68	-8.38	15.64	15.64	14.69	-15.38	17.12	17.12	6.65	-6.03	15.94	15.94	9.94	-9.86	16.06	16.06	12.40	-12.72	14.58	14.58	7.45	-2.54	17.33	17.33	19.80	-21.33	12.48
	5183 R	9.82	9.82	8.21	-6.10	14.52	14.52	11.98	-10.49	13.17	13.17	6.42	-5.15	11.99	11.99	12.16	-10.66	12.30	12.30	10.81	-9.37	12.20	12.20	8.66	-7.30	13.28	13.28	17.35	-15.64	11.24	11.24	6.11	-2.01	7.19
5189.0	5189 L	0.67	0.67	1.26	-4.11	-1.99	-1.99	-10.74	9.92	-0.73	-0.73	-9.27	8.20	-1.14	-1.14	-2.78	0.61	-0.09	-0.09	-3.62	1.60	-1.12	-1.12	-2.34	0.10	-0.61	-0.61	-12.67	16.40	-0.42	-0.42	9.51	-13.76	0.48
	5189 R	-1.90	-1.90	-9.84	9.69	0.66	0.66	1.25	-4.08	-1.06	-1.06	-1.10	-1.17	-0.72	-0.72	-9.34	9.07	-1.06	-1.06	-2.02	-0.02	-0.07	-0.07	-3.26	1.52	-0.39	-0.39	8.97	-13.67	-0.56	-0.56	-11.57	16.11	-0.94
5199.0	5199 L	0.84	0.84	9.83	-11.88	-1.57	-1.57	1.24	2.58	-1.68	-1.68	5.86	-6.94	-0.39	-0.39	0.83	3.83	-0.25	-0.25	9.66	-11.66	-0.99	-0.99	1.86	0.65	-0.47	-0.47	-2.34	13.61	-0.71	-0.71	20.81	-25.51	0.26
	5199 R	-1.51	-1.51	0.96	2.84	0.77	0.77	9.53	-10.21	-0.39	-0.39	1.26	2.02	-1.12	-1.12	3.21	-3.37	-0.96	-0.96	1.75	0.66	-0.26	-0.26	9.32	-9.98	-0.69	-0.69	20.07	-21.82	-0.47	-0.47	-2.27	11.73	-1.07
5205.0	5205 L	15.87	15.87	15.69	-15.08	10.25	10.25	8.28	-7.49	13.34	13.34	5.93	-5.09	13.69	13.69	15.77	-15.17	13.66	13.66	13.08	-12.41	13.91	13.91	12.10	-11.40	11.69	11.69	6.83	-2.80	14.67	14.67	20.62	-20.14	10.41
	5205 R	12.22	12.22	8.40	-8.38	18.86	18.86	15.71	-16.78	16.26	16.26	16.87	-18.11	15.82	15.82	4.84	-4.28	16.55	16.55	12.09	-12.62	16.25	16.25	13.16	-13.85	17.41	17.41	21.08	-22.96	14.05	14.05	6.92	-2.45	9.15
5219.0	5219 L	18.86	18.86	15.37	-16.20	12.43	12.43	9.36	-8.08	16.43	16.43	17.28	-18.39	14.57	14.57	7.36	-2.72	16.99	16.99	13.87	-14.47	15.12	15.12	9.73	-9.71	14.05	14.05	6.69	-0.94	17.56	17.56	21.03	-22.71	12.22
	5219 R	10.42	10.42	9.12	-7.26	15.87	15.87	15.24	-14.48	12.36	12.36	7.49	-3.67	13.83	13.83	16.06	-15.32	12.71	12.71	9.68	-8.79	14.29	14.29	13.70	-12.91	14.79	14.79	20.48	-19.85	11.86	11.86	6.52	-1.51	7.66
5225.0	5225 L	0.91	0.91	1.34	-3.45	-1.98	-1.98	-6.95	5.69	-0.27	-0.27	-7.43	6.22	-1.24	-1.24	-2.10	0.34	-0.12	-0.12	4.41	-6.83	-1.04	-1.04	-3.66	2.06	-0.43	-0.43	-11.56	18.13	-0.35	-0.35	17.60	-21.37	0.32
	5225 R	-1.79	-1.79	-5.89	5.15	0.85	0.85	1.39	-3.28	-1.08	-1.08	0.15	-1.84	-0.26	-0.26	-7.36	6.84	-0.93	-0.93	-3.00	1.80	-0.09	-0.09	4.05	-6.35	-0.30	-0.30	15.56	-19.68	-0.38	-0.38	-10.04	16.69	-0.86
5233.0	5233 L	0.86	0.86	-0.63	-0.23	-1.21	-1.21	-6.94	10.24	-0.78	-0.78	-5.06	5.02	-0.32	-0.32	-6.91	10.15	-0.13	-0.13	1.53	-2.74	-0.60	-0.60	-6.36	8.63	-0.33	-0.33	-10.40	19.83	-0.28	-0.28	10.64	-13.28	0.31
	5233 R	-1.17	-1.17	-6.56	9.86	0.80	0.80	-0.63	-0.21	-0.33	-0.33	-6.16	8.72	-0.76	-0.76	-5.18	5.92	-0.58	-0.58	-5.95	8.12	-0.14	-0.14	1.41	-2.58	-0.28	-0.28	9.92	-12.49	-0.33	-0.33	-9.65	18.69	-0.83
5241.0	5241 L	12.90	12.90	7.28	-8.11	8.18	8.18	3.00	-2.42	10.77	10.77	0.42	-0.11	11.11	11.11	6.11	-6.74	10.76	10.76	5.37	-5.88	10.75	10.75	3.79	-4.04	9.58	9.58	0.76	2.88	11.95	11.95	11.11	-12.57	8.44
	5241 R	8.24	8.24	3.00	-2.30	13.00	13.00	7.19	-7.67	11.18	11.18	6.62	-7.03	10.03	10.03	1.78	0.50	10.83	10.83	3.74	-3.81	10.84	10.84	5.32	-5.58	12.04	12.04	11.05	-11.98	9.66	9.66	0.76	2.86	6.07
5253.0	5253 L	12.99	12.99	10.44	-10.93	8.24	8.24	4.99	-3.37	11.64	11.64	10.04	-10.49	9.77	9.77	3.70	-0.39	11.51	11.51	8.80	-9.09	10.71	10.71	3.60	-3.28	9.69	9.69	2.81	1.65	11.98	11.98	14.23	-15.17	8.50
	5253 R	8.17	8.17	4.96	-3.53	12.90	12.90	10.41	-11.39	9.72	9.72	3.91	-1.05	11.57	11.57	9.42	-10.23	10.63	10.63	3.58	-3.42	11.43	11.43	8.77	-9.47	11.89	11.89	14.19	-15.80	9.62	9.62	2.77	1.66	6.02
5262.0	5262 L	0.80	0.80	3.19	-5.38	-1.93	-1.93	-6.41	5.79	-0.18	-0.18	-7.05	6.53	-1.37	-1.37	-0.24	-1.39	-0.27	-0.27	-2.93	1.74	-0.97	-0.97	3.44	-5.67	-0.55	-0.55	-9.55	16.26	-0.38	-0.38	15.74	-19.98	0.22
	5262 R	-1.98	-1.98	-7.27	5.79	0.83	0.83	3.15	-5.26	-1.40	-1.40	0.92	-2.89	-0.20	-0.20	-8.88	7.50	-0.99	-0.99	3.34	-5.46	-0.27	-0.27	-3.54	1.83	-0.37	-0.37	16.69	-19.60	-0.56	-0.56	-10.52	16.08	-0.99
5271.0	5271 L	0.83	0.83	31.06	-33.89	-1.98	-1.98	11.00	-12.64	-1.19	-1.19	18.36	-20.44	-0.62	-0.62	15.22	-17.11	0.22	0.22	28.77	-31.46	-1.48	-1.48	11.02	-12.66	-0.92	-0.92	5.22	-6.52	-0.10	-0.10	35.72	-38.83	0.59
	5271 R	-1.68	-1.68	9.29	-11.40	0.69	0.69	25.89	-30.49	-0.51	-0.51	13.49	-16.23	-1.04	-1.04	14.35	-17.21	-1.26	-1.26	9.32	-11.42	0.17	0.17	23.99	-28.31	-0.09	-0.09	29.72	-34.91	-0.79	-0.79	4.54	-5.92	-0.87
5279.0	5279 L	16.79	16.79	17.44	-17.94	12.28	12.28	14.12	-14.37	14.78	14.78	11.18	-11.19	15.00	15.00	16.84	-17.29	15.09	15.09	16.70	-17.14	15.13	15.13	15.69	-16.06	14.12	14.12	8.51	-8.32	15.87	15.87	21.48	-22.29	11.52
	5279 R	14.48	14.48	15.89	-16.20	19.77	19.77	19.36	-19.99	17.66	17.66	19.44	-20.07	17.39	17.39	11.95	-11.90	17.82	17.82	17.51	-17.96	17.78	17.78	18.61	-19.17	18.66	18.66	23.83	-24.86	16.66	16.66	9.67	-9.42	10.61
5289.0	5289 L	19.79	19.79	12.15	-12.60	14.49	14.49	4.97	-4.76	18.04	18.04	11.93	-12.35	17.66	17.66	4.02	-3.72	18.00	18.00	11.20	-11.56	17.78	17.78	9.38	-9.57	15.89	15.89	4.02	-0.77	18.58	18.58	17.26	-18.17	13.47
	5289 R	12.25	12.25	5.31	-4.26	16.80	16.80	10.79	-11.14	14.99	14.99	3.91	-3.73	15.33	15.33	10.17	-10.47	15.09	15.09	8.24	-8.39	15.28	15.28	9.91	-10.19	15.77	15.77	15.44	-16.15	13.53	13.53	3.13	-0.50	9.01
5297.0	5297 L	-0.09	-0.09	-10.31	11.16	-0.41	-0.41	-16.82	23.61	-0.21	-0.21	-17.59	25.10	-0.35	-0.35	-13.84	17.90	-0.31	-0.31	-14.97	20.07	-0.17	-0.17	-10.34	11.21	-0.31	-0.31	-20.84	31.31	-0.19	-0.19	-1.65	1.33	-0.06
	5297 R	-0.33	-0.33	-13.56	17.96	-0.07	-0.07	-7.93	8.39	-0.27	-0.27	-10.61	12.94	-0.17	-0.17	-14.17	18.99	-0.13	-0.13	-7.96	8.44	-0.25	-0.25	-11.96	15.23	-0.14	-0.14	-1.17	0.98	-0.25	-0.25	-17.02	23.84	-0.23
5306.0	5306 L	-0.07	-0.07	-32.37	34.38	-0.33	-0.33	-40.46	48.12	-0.24	-0.24	-39.90	47.18	-0.18	-0.18	-33.35	36.03	-0.18	-0.18	-32.96	35.38	-0.14	-0.14	-32.80	35.11	-0.25	-0.25	-41.88	50.53	-0.14	-0.14	-30.48	31.16	-0.04
	5306 R	-0.33	-0.33	-40.46	48.12	-0.07	-0.07	-32.37	34.38	-0.18	-0.18	-32.75	35.02	-0.24	-0.24	-40.53	48.24	-0.14	-0.14	-32.80	35.11	-0.18	-0.18	-32.96	35.38	-0.14	-0.14	-30.48	31.16	-0.25	-0.25	-41.88	50.53	-0.23
5402.0	5402 L	-17.16	-17.16	-11.43	12.31	-23.37	-23.37	-5.77	6.21	-20.96	-20.96	-16.50	17.77	-20.28	-20.28	-2.90	3.12	-21.46	-21.46	-7.77	8.37	-20.93	-20.93	-6.92	7.45	-19.72	-19.72	-17.58	18.93	-21.79	-21.79	-1.62	1.74	-12.58
	5402 R	-24.74	-24.74	-5.88	5.88	-18.18	-18.18	-11.66	11.66	-22.02	-22.02	-2.29	2.29	-21.79	-21.79	-17.35	17.35	-22.16	-22.16	-7.01	7.01	-22.76	-22.76	-8.02	8.02	-23.07	-23.07	-1.65	1.65	-20.90	-20.90	-17.94	17.94	-17.99
5407.0	5407 L	-18.25	-18.25	4.89	-4.89	-24.57	-24.57	1.75	-1.75	-19.55	-19.55	7.39	-7.39	-23.63	-23.63	-0.30	0.30	-19.47	-19.47	3.10	-3.10	-19.52	-19.52	2.98	-2.98	-23.16	-23.16	-0.53	0.53	-20.70	-20.70	8.20	-8.20	-13.37
	5407 R	-23.36	-23.36	1.72	-1.72	-17.36	-17.36	4.81	-4.81	-22.53	-22.53	-0.23	0.23	-18.54	-18.54	7.22	-7.22	-18.56	-18.56	2.93	-2.93	-18.51	-18.51	3.04	-3.04	-19.69	-19.69	8.06	-8.06	-22.01	-22.01	-0.52	0.52	-17.00
5411.0	5411 L	-17.32	-17.32	5.48	-5.48	-23.40	-23.40	2.40	-2.40	-22.66	-22.66	0.31	-0.31	-18.52	-18.52	7.85	-7.85	-18.53	-18.53	3.69	-3.69	-18.54	-18.54	3.39	-3.39	-22.17	-22.17	-0.16	0.16	-19.79	-19.79	8.76	-8.76	-12.69
	5411 R	-24.62	-24.62	2.45	-2.45	-18.21	-18.21	5.58	-5.58	-19.91	-19.91	8.35	-8.35	-23.68	-23.68	0.07	-0.07	-19.50	-19.50	3.45	-3.45	-19.49	-19.49	3.76	-3.76	-20.81	-20.81	8.92	-8.92	-23.32	-23.32	-0.16	0.16	-17.92
5416.0	5416 L	-18.22	-18.22	-6.56	6.56	-25.06	-25.06	-2.90	2.90	-22.38	-22.38	-0.04	0.04	-21.90	-21.90	-12.17	12.17	-23.04	-23.04	-4.88	4.88	-22.20	-22.20	-3.32	3.32	-21.03	-21.03	-12.87	12.87	-23.76	-23.76	0.90	-0.90	-13.35
	5416 R	-23.67	-23.67	-2.84	3.06	-17.20	-17.20	-6.43	6.92	-21.49	-21.49	-10.92	11.76	-19.44	-19.44	-2.03	2.18	-20.99	-20.99	-3.34	3.60	-21.81	-21.81	-4.30	4.63	-22.44	-22.44	0.88	-0.95	-19.85	-19.85	-12.61	13.59	-17.21
5422.0	5422 L	-13.97	-13.97	-12.29	12.29	-20.86	-20.86	-7.67	7.67	-18.39	-18.39	-16.92	16.92	-16.77	-16.77	-6.65	6.65	-18.79	-18.79	-8.98	8.98	-17.52	-17.52	-9.04	9.04	-16.69	-16.69	-18.42	18.42	-19.27	-19.27	-4.34	4.34	-10.25
	5422 R	-24.49	-24.49	-8.69	8.69	-16.41	-16.41	-13.92	13.92	-21.02	-21.02	-5.92	5.92	-20.61	-20.61	-20.25	20.25	-20.57	-20.57	-10.22	10.22	-22.06	-22.06	-10.19	10.19	-22.62	-22.62	-4.91	4.91	-19.60	-19.60	-20.86	20.86	-17.80
5427.0	5427 L	-16.66	-16.66	8.12	-8.12	-24.11	-24.11	4.53	-4.53	-19.11	-19.11	11.42	-11.42	-23.17	-23.17	2.39	-2.39	-18.38	-18.38	5.77	-5.77	-18.36	-18.36	6.12	-6.12	-22.72	-22.72	2.09	-2.09	-19.70	-19.70	11.66	-11.66	-12.22
	5427 R	-22.78	-22.78	4.44	-4.44	-15.75	-15.75	7.95	-7.95	-22.08	-22.08	2.49	-2.49	-17.08	-17.08	10.44	-10.44	-17.36	-17.36	5.99	-5.99	-17.38	-17.38	5.65	-5.65	-18.63	-18.63	11.42	-11.42	-21.44	-21.44	2.05	-2.05	-16.57
5431.0	5431 L	-15.85	-15.85	7.79	-7.79	-22.82	-22.82	4.28	-4.28	-22.08	-22.08	2.30	-2.30	-17.18	-17.18	10.28	-10.28	-17.43	-17.43	5.56	-5.56	-17.38	-17.38	5.77	-5.77	-21.50	-21.50	1.86	-1.86	-18.58	-18.58	11.28	-11.28	-11.63
	5431 R	-24.14	-24.14	4.36	-4.36	-16.76	-16.76	7.96	-7.96	-18.91	-18.91	11.08	-11.08	-23.17	-23.17	2.19	-2.19	-18.39	-18.39	5.89	-5.89	-18.44	-18.44	5.67	-5.67	-19.64	-19.64	11.51	-11.51	-22.75	-22.75	1.90	-1.90	-17.55
5436.0	5436 L	-16.71	-16.71	-15.10	15.10	-24.50	-24.50	-10.70	10.70	-21.14	-21.14	-7.10	7.10	-20.88	-20.88	-21.50	21.50	-22.20	-22.20	-11.09	11.09	-20.22	-20.22	-12.37	12.37	-19.87	-19.87	-22.11	22.11	-22.57	-22.57	-6.26	6.26	-12.24
	5436 R	-20.88	-20.88	-9.45	9.45	-14.23	-14.23	-13.33	13.33	-18.47	-18.47	-18.17	18.17	-17.07	-17.07	-7.43	7.43	-17.22	-17.22	-10.83	10.83	-18.94	-18.94	-9.92	9.92	-19.23	-19.23	-5.53	5.53	-16.91	-16.91	-19.52	19.52	-15.17
5442.0	5442 L	-16.06	-16.06	-7.34	7.34	-22.83	-22.83	-3.24	3.24	-20.34	-20.34	-12.00	12.00	-18.90	-18.90	-1.23	1.23	-20.67	-20.67	-3.64	3.64	-19.88	-19.88	-3.91	3.91	-18.75	-18.75	-13.41	13.41	-21.16	-21.16	0.80	-0.80	-11.75
	5442 R	-27.05	-27.05	-3.71	3.71	-19.04	-19.04	-8.41	8.41	-23.52	-23.52	-0.06	0.06	-23.20	-23.20	-14.77	14.77	-23.53	-23.53	-4.38	4.38	-24.50	-24.50	-4.23	4.23	-25.07	-25.07	0.91	-0.91	-22.23	-22.23	-15.36	15.36	-19.71
5447.0	5447 L	-19.08	-19.08	4.01	-4.01	-26.65	-26.65	0.11	-0.11	-21.52	-21.52	7.24	-7.24	-25.63	-25.63	-2.10	2.10	-20.63	-20.63	2.04	-2.04	-20.79	-20.79	1.58	-1.58	-25.13	-25.13	-2.39	2.39	-22.10	-22.10	7.47	-7.47	-13.95
	5447 R	-25.17	-25.17	0.11	-0.11	-18.02	-18.02	3.93	-3.93	-24.32	-24.32	-1.96	1.96	-19.35	-19.35	6.38	-6.38	-19.63	-19.63	1.55	-1.55	-19.48	-19.48	2.00	-2.00	-20.89	-20.89	7.31	-7.31	-23.73	-23.73	-2.34	2.34	-18.36
5451.0	5451 L	-18.00	-18.00	4.01	-4.01	-25.20	-25.20	0.26	-0.26	-24.38	-24.38	-1.82	1.82	-19.30	-19.30	6.48	-6.48	-19.48	-19.48	2.17	-2.17	-19.62	-19.62	1.65	-1.65	-23.77	-23.77	-2.17	2.17	-20.85	-20.85	7.44	-7.44	-13.16
	5451 R	-26.69	-26.69	0.27	-0.27	-19.06	-19.06	4.09	-4.09	-20.51	-20.51	6.68	-6.68	-25.70	-25.70	-1.96	1.96	-20.78	-20.78	1.69	-1.69	-20.63	-20.63	2.21	-2.21	-22.07	-22.07	7.60	-7.60	-25.18	-25.18	-2.22	2.22	-19.48
5456.0	5456 L	-18.96	-18.96	-8.00	8.00	-27.15	-27.15	-2.54	2.54	-23.68	-23.68	0.69	-0.69	-23.12	-23.12	-14.12	14.12	-24.65	-24.65	-3.80	3.80	-23.60	-23.60	-3.57	3.57	-22.13	-22.13	-14.71	14.71	-25.24	-25.24	1.67	-1.67	-13.86
	5456 R	-22.91	-22.91	-2.15	2.15	-16.00	-16.00	-6.98	6.98	-20.34	-20.34	-11.39	11.39	-18.88	-18.88	-0.75	0.75	-19.95	-19.95	-3.23	3.23	-20.78	-20.78	-3.17	3.17	-21.31	-21.31	1.46	-1.46	-18.67	-18.67	-12.84	12.84	-16.70
5462.0	5462 L	-13.28	-13.28	-11.55	13.31	-21.05	-21.05	-7.97	9.18	-18.79	-18.79	-16.05	18.49	-15.75	-15.75	-5.84	6.73	-17.84	-17.84	-8.52	9.82	-16.44	-16.44	-9.35	10.77	-16.65	-16.65	-18.06	20.81	-18.66	-18.66	-3.45	3.97	-9.67
	5462 R	-24.85	-24.85	-9.70	9.70	-15.68	-15.68	-14.07	14.07	-19.77	-19.77	-5.61	5.61	-21.11	-21.11	-20.89	20.89	-19.43	-19.43	-11.57	11.57	-21.05	-21.05	-10.19	10.19	-22.02	-22.02	-4.20	4.20	-19.68	-19.68	-21.99	21.99	-18.16
5467.0	5467 L	-15.54	-15.54	6.86	-6.86	-24.07	-24.07	3.87	-3.87	-17.90	-17.90	10.94	-10.94	-22.31	-22.31	0.37	-0.37	-17.78	-17.78	5.04	-5.04	-17.60	-17.60	4.72	-4.72	-21.12	-21.12	-0.26	0.26	-19.23	-19.23	11.87	-11.87	-11.34
	5467 R	-22.73	-22.73	3.79	-3.79	-14.68	-14.68	6.72	-6.72	-21.58	-21.58	1.01	-1.01	-16.45	-16.45	10.30	-10.30	-16.63	-16.63	4.63	-4.63	-16.79	-16.79	4.94	-4.94	-18.18	-18.18	11.63	-11.63	-19.94	-19.94	-0.26	0.26	-16.58
5471.0	5471 L	-14.29	-14.29	5.97	-5.97	-22.72	-22.72	3.91	-3.91	-21.75	-21.75	1.31	-1.31	-15.86	-15.86	9.48	-9.48	-16.46	-16.46	4.48	-4.48	-16.75	-16.75	4.92	-4.92	-20.03	-20.03	-0.20	0.20	-18.06	-18.06	11.11	-11.11	-10.28
	5471 R	-24.06	-24.06	3.99	-3.99	-15.12	-15.12	6.10	-6.10	-17.19	-17.19	10.22	-10.22	-22.39	-22.39	0.54	-0.54	-17.74	-17.74	5.02	-5.02	-17.43	-17.43	4.57	-4.57	-19.10	-19.10	11.34	-11.34	-21.21	-21.21	-0.21	0.21	-17.59
5476.0	5476 L	-15.34	-15.34	-12.85	12.85	-24.86	-24.86	-8.12	8.12	-19.40	-19.40	-4.41	4.41	-21.74	-21.74	-18.81	18.81	-20.50	-20.50	-10.03	10.03	-20.50	-20.50	-8.25	8.25	-19.04	-19.04	-20.66	20.66	-22.13	-22.13	-2.54	2.54	-11.09
	5476 R	-21.06	-21.06	-6.62	7.62	-12.99	-12.99	-10.55	12.16	-18.72	-18.72	-15.03	17.32	-15.96	-15.96	-4.27	4.92	-17.36	-17.36	-6.69	7.71	-17.37	-17.37	-8.31	9.57	-18.75	-18.75	-2.09	2.41	-16.12	-16.12	-16.97	19.55	-15.36
5482.0	5482 L	-12.92	-12.92	-14.08	17.29	-21.44	-21.44	-11.14	13.69	-19.44	-19.44	-18.21	22.38	-15.31	-15.31	-9.64	11.84	-18.82	-18.82	-10.57	12.98	-16.64	-16.64	-12.61	15.50	-16.37	-16.37	-20.65	25.37	-19.27	-19.27	-6.68	8.20	-9.34
	5482 R	-24.49	-24.49	-13.37	13.37	-14.76	-14.76	-16.89	16.89	-18.32	-18.32	-10.40	10.40	-21.68	-21.68	-22.58	22.58	-19.36	-19.36	-16.91	16.91	-21.43	-21.43	-12.37	12.37	-22.00	-22.00	-8.01	8.01	-18.72	-18.72	-24.78	24.78	-17.83
5487.0	5487 L	-14.79	-14.79	8.25	-8.25	-24.04	-24.04	7.33	-7.33	-17.96	-17.96	13.02	-13.02	-22.54	-22.54	3.74	-3.74	-17.35	-17.35	6.81	-6.81	-17.67	-17.67	7.39	-7.39	-20.84	-20.84	2.82	-2.82	-19.11	-19.11	13.65	-13.65	-10.64
	5487 R	-22.71	-22.71	7.18	-7.18	-13.98	-13.98	8.09	-8.09	-21.37	-21.37	3.73	-3.73	-15.84	-15.84	11.75	-11.75	-16.70	-16.70	7.24	-7.24	-16.40	-16.40	6.67	-6.67	-18.06	-18.06	13.37	-13.37	-19.68	-19.68	2.76	-2.76	-16.58
5491.0	5491 L	-14.77	-14.77	8.75	-8.75	-22.36	-22.36	6.87	-6.87	-21.01	-21.01	3.15	-3.15	-16.70	-16.70	12.89	-12.89	-16.75	-16.75	7.18	-7.18	-16.54	-16.54	6.88	-6.88	-19.49	-19.49	2.10	-2.10	-18.28	-18.28	13.99	-13.99	-10.75
	5491 R	-23.67	-23.67	7.01	-7.01	-15.63	-15.63	8.93	-8.93	-18.58	-18.58	13.83	-13.83	-22.16	-22.16	3.14	-3.14	-17.51	-17.51	7.03	-7.03	-17.73	-17.73	7.33	-7.33	-19.33	-19.33	14.28	-14.28	-20.63	-20.63	2.14	-2.14	-17.29
5496.0	5496 L	-15.61	-15.61	-16.91	16.91	-24.30	-24.30	-13.76	13.76	-18.97	-18.97	-9.47	9.47	-21.42	-21.42	-23.72	23.72	-20.72	-20.72	-14.62	14.62	-19.20	-19.20	-14.10	14.10	-19.40	-19.40	-25.23	25.23	-21.51	-21.51	-7.88	7.88	-11.32
	5496 R	-21.28	-21.28	-11.47	14.09	-13.66	-13.66	-14.10	17.32	-19.27	-19.27	-19.13	23.51	-16.00	-16.00	-8.65	10.62	-16.97	-16.97	-11.99	14.73	-18.01	-18.01	-11.92	14.64	-18.84	-18.84	-6.56	8.06	-16.97	-16.97	-21.03	25.83	-15.56
5502.0	5502 L	-13.58	-13.58	-12.40	13.14	-21.93	-21.93	-8.71	9.23	-18.95	-18.95	-18.48	19.57	-16.61	-16.61	-6.78	7.18	-19.22	-19.22	-9.26	9.81	-18.32	-18.32	-8.64	9.15	-16.97	-16.97	-20.29	21.50	-20.00	-20.00	-3.86	4.08	-9.89
	5502 R	-24.32	-24.32	-9.56	9.56	-15.07	-15.07	-13.58	13.58	-20.42	-20.42	-5.23	5.23	-19.94	-19.94	-21.42	21.42	-20.31	-20.31	-9.40	9.40	-21.34	-21.34	-10.21	10.21	-22.17	-22.17	-4.22	4.22	-18.83	-18.83	-22.21	22.21	-17.66
5507.0	5507 L	-15.23	-15.23	8.08	-8.08	-23.77	-23.77	4.45	-4.45	-18.20	-18.20	12.60	-12.60	-22.72	-22.72	2.03	-2.03	-17.11	-17.11	5.90	-5.90	-17.23	-17.23	5.71	-5.71	-22.07	-22.07	1.59	-1.59	-18.62	-18.62	12.86	-12.86	-11.09
	5507 R	-22.64	-22.64	4.37	-4.37	-14.51	-14.51	7.95	-7.95	-21.72	-21.72	2.06	-2.06	-16.14	-16.14	11.33	-11.33	-16.42	-16.42	5.62	-5.62	-16.30	-16.30	5.80	-5.80	-17.76	-17.76	12.65	-12.65	-21.02	-21.02	1.56	-1.56	-16.47
5511.0	5511 L	-14.47	-14.47	7.86	-7.86	-22.57	-22.57	4.26	-4.26	-21.68	-21.68	2.01	-2.01	-16.14	-16.14	11.28	-11.28	-16.26	-16.26	5.77	-5.77	-16.40	-16.40	5.60	-5.60	-20.92	-20.92	1.60	-1.60	-17.79	-17.79	12.55	-12.55	-10.55
	5511 R	-23.69	-23.69	4.33	-4.33	-15.18	-15.18	7.99	-7.99	-18.15	-18.15	12.53	-12.53	-22.67	-22.67	1.97	-1.97	-17.21	-17.21	5.69	-5.69	-17.07	-17.07	5.86	-5.86	-18.66	-18.66	12.76	-12.76	-21.97	-21.97	1.63	-1.63	-17.23
5516.0	5516 L	-14.91	-14.91	-13.55	13.55	-23.98	-23.98	-9.22	9.22	-20.00	-20.00	-4.75	4.75	-19.92	-19.92	-21.90	21.90	-20.59	-20.59	-10.39	10.39	-19.55	-19.55	-9.98	9.98	-18.64	-18.64	-22.69	22.69	-21.99	-21.99	-3.74	3.74	-10.87
	5516 R	-21.63	-21.63	-8.43	8.93	-13.43	-13.43	-12.38	13.11	-18.88	-18.88	-18.97	20.10	-16.77	-16.77	-5.84	6.19	-17.63	-17.63	-9.17	9.72	-18.56	-18.56	-9.40	9.96	-19.84	-19.84	-3.42	3.62	-16.79	-16.79	-20.73	21.96	-15.71
5522.0	5522 L	-10.58	-10.58	-14.96	14.21	-17.64	-17.64	-12.08	11.47	-15.72	-15.72	-19.16	18.19	-12.78	-12.78	-10.90	10.35	-15.16	-15.16	-14.92	14.16	-13.55	-13.55	-12.12	11.51	-13.71	-13.71	-21.09	20.02	-15.94	-15.94	-8.02	7.61	-7.74
	5522 R	-19.57	-19.57	-12.62	12.62	-11.75	-11.75	-15.62	15.62	-16.02	-16.02	-9.37	9.37	-16.26	-16.26	-21.37	21.37	-14.97	-14.97	-12.47	12.47	-16.87	-16.87	-15.74	15.74	-17.68	-17.68	-8.37	8.37	-15.23	-15.23	-22.02	22.02	-14.19
5527.0	5527 L	-12.01	-12.01	11.32	-11.32	-19.46	-19.46	8.47	-8.47	-14.39	-14.39	14.79	-14.79	-18.46	-18.46	6.39	-6.39	-13.84	-13.84	9.37	-9.37	-13.89	-13.89	9.07	-9.07	-17.79	-17.79	6.03	-6.03	-15.39	-15.39	15.39	-15.39	-8.79
	5527 R	-18.70	-18.70	8.35	-8.35	-11.55	-11.55	11.17	-11.17	-17.81	-17.81	6.36	-6.36	-13.23	-13.23	14.07	-14.07	-13.35	-13.35	8.95	-8.95	-13.30	-13.30	9.24	-9.24	-14.80	-14.80	15.18	-15.18	-17.09	-17.09	5.95	-5.95	-13.57

Made By: WME 8/5/11   Checked By: MTB 8/5/11   BackChecked By: WME 8/5/11

Flange Stress Values for Web Splice Calculations

STRENGTH I

Splice Node	Splice Side	MAX FX				MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ				Flange Stre
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange
		TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF
5531.0	5531 L	-11.51	-11.51	10.95	-10.95	-18.78	-18.78	8.50	-8.50	-17.88	-17.88	6.34	-6.34	-13.29	-13.29	13.87	-13.87	-13.17	-13.17	9.01	-9.01	-13.55	-13.55	9.03	-9.03	-17.10	-17.10	5.96	-5.96	-14.87	-14.87	14.95	-14.95	-8.43
	5531 R	-19.55	-19.55	8.60	-8.60	-11.97	-11.97	11.10	-11.10	-14.45	-14.45	14.57	-14.57	-18.54	-18.54	6.37	-6.37	-14.10	-14.10	9.16	-9.16	-13.71	-13.71	9.13	-9.13	-15.46	-15.46	15.15	-15.15	-17.80	-17.80	6.04	-6.04	-14.19
5536.0	5536 L	-11.55	-11.55	-19.21	19.21	-19.79	-19.79	-17.15	17.15	-15.70	-15.70	-12.33	12.33	-16.53	-16.53	-26.49	26.49	-15.84	-15.84	-19.55	19.55	-15.72	-15.72	-15.76	15.76	-15.39	-15.39	-27.27	27.27	-17.71	-17.71	-11.18	11.18	-8.47
	5536 R	-17.83	-17.83	-16.43	15.60	-10.40	-10.40	-18.40	17.47	-15.79	-15.79	-24.31	23.08	-13.07	-13.07	-13.17	12.50	-14.17	-14.17	-15.10	14.33	-14.27	-14.27	-18.73	17.78	-15.97	-15.97	-10.71	10.16	-13.85	-13.85	-26.12	24.80	-12.93
5542.0	5542 L	-16.38	-16.38	-7.63	8.01	-22.96	-22.96	-7.46	7.83	-21.29	-21.29	-13.24	13.90	-18.61	-18.61	-3.55	3.72	-20.56	-20.56	-4.62	4.85	-18.83	-18.83	-10.51	11.03	-19.70	-19.70	-14.63	15.35	-20.87	-20.87	-1.70	1.78	-12.00
	5542 R	-25.40	-25.40	-8.07	8.07	-18.13	-18.13	-8.26	8.26	-21.74	-21.74	-2.57	2.57	-22.75	-22.75	-15.21	15.21	-20.84	-20.84	-11.35	11.35	-22.74	-22.74	-5.01	5.01	-23.08	-23.08	-1.84	1.84	-21.80	-21.80	-15.83	15.83	-18.45
5547.0	5547 L	-18.26	-18.26	6.24	-6.24	-25.10	-25.10	4.27	-4.27	-20.68	-20.68	9.72	-9.72	-23.70	-23.70	1.69	-1.69	-19.74	-19.74	4.78	-4.78	-19.40	-19.40	4.71	-4.71	-23.20	-23.20	1.45	-1.45	-21.66	-21.66	10.21	-10.21	-13.38
	5547 R	-24.16	-24.16	4.22	-4.22	-17.59	-17.59	6.16	-6.16	-23.16	-23.16	1.94	-1.94	-19.29	-19.29	9.05	-9.05	-18.68	-18.68	4.65	-4.65	-19.00	-19.00	4.72	-4.72	-20.86	-20.86	10.08	-10.08	-22.33	-22.33	1.43	-1.43	-17.55
5551.0	5551 L	-17.68	-17.68	6.26	-6.26	-24.15	-24.15	4.61	-4.61	-23.16	-23.16	2.51	-2.51	-19.33	-19.33	9.08	-9.08	-18.59	-18.59	4.71	-4.71	-19.11	-19.11	5.01	-5.01	-21.96	-21.96	1.88	-1.88	-20.98	-20.98	10.21	-10.21	-12.95
	5551 R	-25.09	-25.09	4.66	-4.66	-18.36	-18.36	6.33	-6.33	-20.69	-20.69	9.74	-9.74	-23.82	-23.82	2.36	-2.36	-19.85	-19.85	5.07	-5.07	-19.31	-19.31	4.76	-4.76	-21.79	-21.79	10.34	-10.34	-22.83	-22.83	1.91	-1.91	-18.23
5556.0	5556 L	-18.26	-18.26	-12.78	12.78	-25.24	-25.24	-9.93	9.93	-21.24	-21.24	-5.31	5.31	-22.92	-22.92	-18.63	18.63	-22.75	-22.75	-15.36	15.36	-22.33	-22.33	-7.06	7.06	-21.77	-21.77	-19.46	19.46	-22.83	-22.83	-4.26	4.26	-13.36
	5556 R	-22.81	-22.81	-9.18	9.63	-16.49	-16.49	-11.81	12.40	-21.10	-21.10	-16.68	17.51	-18.53	-18.53	-5.82	6.11	-20.18	-20.18	-6.61	6.94	-20.55	-20.55	-14.16	14.86	-20.64	-20.64	-3.93	4.13	-19.65	-19.65	-17.99	18.88	-16.56
7007.0	7007 L	0.08	0.08	-35.08	28.28	-0.09	-0.09	-41.59	39.43	0.04	0.04	-34.97	28.10	-0.05	-0.05	-42.94	41.76	0.03	0.03	-35.71	29.37	-0.02	-0.02	-35.66	29.28	0.02	0.02	-44.11	43.75	-0.03	-0.03	-32.80	24.38	0.11
	7007 R	-0.09	-0.09	-41.59	39.43	0.08	0.08	-35.08	28.28	-0.05	-0.05	-42.35	40.73	0.04	0.04	-35.54	29.08	-0.02	-0.02	-35.66	29.28	0.03	0.03	-35.71	29.37	-0.03	-0.03	-32.80	24.38	0.02	0.02	-44.11	43.75	-0.10
7015.0	7015 L	0.11	0.11	-3.29	2.21	-0.09	-0.09	-10.95	11.91	-0.06	-0.06	-8.40	7.55	0.02	0.02	-11.69	13.17	-0.07	-0.07	-11.98	13.67	0.09	0.09	-2.30	1.36	0.02	0.02	-15.34	19.42	-0.04	-0.04	6.08	-5.80	0.11
	7015 R	-0.13	-0.13	-12.28	17.77	0.11	0.11	-5.38	5.20	-0.07	-0.07	-13.31	20.11	-0.01	-0.01	-10.07	12.76	0.08	0.08	-2.59	2.05	-0.11	-0.11	-13.17	19.79	-0.08	-0.08	6.71	-8.46	0.00	0.00	-16.82	28.06	-0.13
7021.0	7021 L	16.32	16.32	13.28	-13.36	11.79	11.79	4.17	-3.76	13.13	13.13	3.94	-0.91	14.92	14.92	14.00	-14.12	14.77	14.77	8.77	-8.60	14.69	14.69	9.36	-9.22	12.96	12.96	3.33	0.32	15.32	15.32	17.11	-17.39	11.00
	7021 R	15.29	15.29	4.83	-4.54	21.11	21.11	14.94	-16.17	19.29	19.29	16.69	-18.19	16.81	16.81	4.55	-0.04	19.02	19.02	10.55	-11.13	19.11	19.11	9.86	-10.33	19.81	19.81	19.46	-21.37	16.64	16.64	4.19	0.86	11.18
7035.0	7035 L	21.11	21.11	19.77	-20.71	15.29	15.29	16.55	-17.00	18.28	18.28	22.95	-24.37	18.98	18.98	12.28	-12.09	18.99	18.99	19.22	-20.07	19.16	19.16	18.96	-19.78	17.68	17.68	10.19	-9.69	19.61	19.61	26.27	-28.18	14.00
	7035 R	11.79	11.79	14.15	-13.63	16.32	16.32	17.32	-16.97	14.68	14.68	11.23	-10.55	14.12	14.12	19.22	-18.97	14.81	14.81	16.49	-16.10	14.67	14.67	16.70	-16.32	15.17	15.17	22.84	-22.79	13.61	13.61	8.80	-8.00	8.63
7041.0	7041 L	0.65	0.65	15.62	-18.23	-1.01	-1.01	8.72	-10.44	-0.14	-0.14	8.22	-9.87	-0.45	-0.45	8.86	-10.59	-0.72	-0.72	6.29	-7.69	0.31	0.31	16.69	-19.44	-0.26	-0.26	0.36	-0.99	-0.02	-0.02	23.64	-27.29	0.53
	7041 R	-1.26	-1.26	10.70	-13.47	0.85	0.85	19.12	-23.29	-0.53	-0.53	12.76	-15.87	-0.18	-0.18	8.91	-11.38	0.41	0.41	20.48	-24.88	-0.89	-0.89	7.65	-9.91	-0.01	-0.01	29.18	-35.03	-0.30	-0.30	0.21	-1.23	-0.65
7051.0	7051 L	0.85	0.85	6.87	-7.31	-0.87	-0.87	4.43	-2.59	-0.48	-0.48	8.65	-9.39	-0.16	-0.16	3.06	1.06	-0.56	-0.56	2.81	1.73	0.27	0.27	16.34	-18.36	-0.24	-0.24	-0.56	10.70	-0.03	-0.03	25.15	-28.64	0.40
	7051 R	-0.86	-0.86	3.97	-2.31	0.78	0.78	6.29	-6.66	-0.15	-0.15	3.03	0.05	-0.48	-0.48	6.19	-6.54	0.24	0.24	15.10	-16.80	-0.56	-0.56	2.36	1.71	-0.02	-0.02	23.26	-26.20	-0.27	-0.27	-0.97	10.00	-0.64
7057.0	7057 L	14.76	14.76	14.91	-15.42	10.07	10.07	8.40	-7.39	12.35	12.35	4.89	-4.41	13.17	13.17	15.58	-16.16	13.03	13.03	11.83	-12.04	13.05	13.05	11.98	-12.20	11.19	11.19	6.08	-2.53	13.84	13.84	19.37	-20.33	9.94
	7057 R	10.55	10.55	8.50	-7.57	15.45	15.45	15.01	-15.80	13.77	13.77	16.41	-17.37	12.32	12.32	7.07	-4.47	13.66	13.66	12.06	-12.50	13.64	13.64	11.91	-12.33	14.48	14.48	19.56	-20.90	11.71	11.71	6.16	-2.49	7.77
7071.0	7071 L	15.45	15.45	11.87	-12.25	10.55	10.55	7.04	-5.59	13.21	13.21	13.11	-13.65	12.75	12.75	5.43	-2.10	13.65	13.65	9.04	-9.08	13.63	13.63	9.28	-9.35	11.80	11.80	4.41	0.11	14.42	14.42	16.53	-17.47	10.38
	7071 R	10.07	10.07	6.96	-5.49	14.76	14.76	11.85	-12.04	12.21	12.21	5.65	-2.74	12.63	12.63	12.35	-12.58	13.02	13.02	9.26	-9.19	13.05	13.05	9.03	-8.93	13.79	13.79	16.42	-17.05	11.28	11.28	4.36	-0.04	7.41
7077.0	7077 L	0.63	0.63	-4.58	3.02	-1.24	-1.24	-9.86	9.09	-0.27	-0.27	-11.30	10.75	-0.51	-0.51	-9.06	8.18	-0.60	-0.60	-12.96	12.66	0.07	0.07	-0.64	-1.52	-0.13	-0.13	-15.07	21.32	-0.33	-0.33	9.81	-13.55	0.30
	7077 R	-1.06	-1.06	-8.84	7.21	0.58	0.58	-3.83	2.23	-0.41	-0.41	-6.65	5.03	-0.21	-0.21	-10.97	9.33	0.08	0.08	-0.31	-1.28	-0.50	-0.50	-11.60	9.96	-0.26	-0.26	9.18	-10.73	-0.10	-0.10	-13.73	16.84	-0.58
7089.0	7089 L	0.58	0.58	4.65	-4.31	-0.79	-0.79	3.22	-2.34	-0.39	-0.39	3.87	-3.54	-0.16	-0.16	1.31	1.55	-0.35	-0.35	1.33	1.51	-0.09	-0.09	9.75	-9.39	-0.16	-0.16	-2.40	9.07	-0.19	-0.19	19.63	-19.23	0.30
	7089 R	-0.82	-0.82	3.09	-2.60	0.56	0.56	4.38	-4.61	-0.20	-0.20	1.55	0.83	-0.35	-0.35	3.05	-2.50	-0.11	-0.11	9.31	-10.17	-0.37	-0.37	1.18	1.65	-0.22	-0.22	18.79	-20.84	-0.19	-0.19	-2.52	9.91	-0.61
7095.0	7095 L	16.12	16.12	15.16	-15.82	11.33	11.33	9.97	-10.06	14.12	14.12	6.91	-6.67	14.17	14.17	16.68	-17.51	14.50	14.50	13.58	-14.07	14.25	14.25	13.30	-13.76	12.66	12.66	7.42	-4.39	15.17	15.17	20.81	-22.08	10.88
	7095 R	12.02	12.02	9.67	-9.76	17.09	17.09	14.66	-15.32	15.01	15.01	16.80	-17.72	14.96	14.96	6.12	-5.81	15.11	15.11	12.87	-13.33	15.38	15.38	13.14	-13.63	16.09	16.09	20.16	-21.45	13.41	13.41	7.18	-4.06	8.92
7109.0	7109 L	17.09	17.09	17.28	-17.98	12.02	12.02	9.70	-9.53	15.16	15.16	18.16	-18.96	14.75	14.75	7.05	-6.57	14.97	14.97	14.17	-14.51	15.53	15.53	14.31	-14.67	13.26	13.26	8.50	-4.88	16.09	16.09	21.47	-22.65	11.50
	7109 R	11.36	11.36	11.15	-10.13	16.12	16.12	17.89	-18.58	13.92	13.92	7.87	-7.48	14.31	14.31	18.10	-18.81	14.65	14.65	14.81	-15.17	14.12	14.12	14.65	-14.99	15.18	15.18	22.18	-23.34	12.52	12.52	8.78	-5.27	8.41
7115.0	7115 L	0.64	0.64	10.37	-12.59	-1.31	-1.31	1.68	-2.81	-0.11	-0.11	-0.41	-0.46	-0.78	-0.78	6.07	-7.76	-0.92	-0.92	0.40	-1.36	0.21	0.21	11.09	-13.40	-0.23	-0.23	-3.88	7.26	-0.32	-0.32	21.28	-24.89	0.51
	7115 R	-1.45	-1.45	1.54	-2.81	0.74	0.74	12.44	-13.91	-0.84	-0.84	8.76	-10.16	-0.12	-0.12	-1.90	0.69	0.26	0.26	13.17	-14.65	-1.00	-1.00	0.12	-1.37	-0.33	-0.33	25.58	-27.30	-0.24	-0.24	-4.87	7.96	-0.78
7127.0	7127 L	0.74	0.74	3.04	-3.19	-1.05	-1.05	-1.77	3.71	-0.41	-0.41	1.37	-1.49	-0.41	-0.41	-3.07	6.58	-0.67	-0.67	-1.82	3.84	0.15	0.15	5.29	-5.48	-0.36	-0.36	-5.56	12.08	-0.15	-0.15	13.43	-13.77	0.34
	7127 R	-1.13	-1.13	-1.72	4.18	0.77	0.77	2.41	-2.90	-0.44	-0.44	-2.66	6.60	-0.49	-0.49	-0.13	0.04	0.14	0.14	5.42	-6.37	-0.73	-0.73	-1.79	4.38	-0.19	-0.19	13.78	-16.04	-0.40	-0.40	-5.56	13.99	-0.84
7133.0	7133 L	14.97	14.97	11.90	-11.14	9.68	9.68	6.84	-5.48	13.04	13.04	5.51	-4.79	12.19	12.19	11.59	-10.84	12.53	12.53	9.99	-9.24	12.25	12.25	8.95	-8.21	11.10	11.10	4.76	-1.56	13.46	13.46	16.56	-15.77	10.11
	7133 R	12.56	12.56	8.13	-7.26	19.30	19.30	13.48	-14.28	15.71	15.71	14.12	-15.02	16.79	16.79	5.51	-5.17	15.82	15.82	10.30	-10.64	16.17	16.17	11.47	-11.99	17.34	17.34	19.00	-20.59	14.27	14.27	5.88	-1.85	9.21
7147.0	7147 L	19.30	19.30	18.91	-19.94	12.56	12.56	10.76	-9.01	17.39	17.39	19.92	-21.10	14.30	14.30	8.83	-4.36	16.15	16.15	14.21	-14.56	17.10	17.10	13.39	-13.63	13.94	13.94	8.22	-2.87	18.05	18.05	22.99	-24.60	12.81
	7147 R	9.68	9.68	8.96	-6.79	14.97	14.97	16.44	-15.33	11.15	11.15	7.44	-3.93	13.48	13.48	16.55	-15.44	13.25	13.25	11.57	-10.48	12.51	12.51	12.22	-11.13	14.00	14.00	19.91	-18.77	10.83	10.83	6.56	-2.28	7.08
7153.0	7153 L	1.53	1.53	12.77	-16.29	-2.64	-2.64	-6.50	5.99	0.13	0.13	-5.83	5.22	-1.65	-1.65	5.69	-8.10	-1.97	-1.97	-0.49	-0.96	0.72	0.72	6.72	-9.29	-0.67	-0.67	-7.38	12.19	0.00	0.00	19.44	-24.01	1.45
	7153 R	-2.80	-2.80	-6.91	6.21	1.65	1.65	13.47	-17.77	-1.71	-1.71	7.67	-10.93	0.10	0.10	-7.67	7.11	0.78	0.78	6.95	-10.09	-2.08	-2.08	-0.75	-1.03	0.02	0.02	20.75	-26.32	-0.68	-0.68	-8.09	13.39	-1.53
7163.0	7163 L	1.65	1.65	7.10	-8.29	-1.92	-1.92	-0.35	3.65	-1.32	-1.32	4.82	-5.61	-0.29	-0.29	-1.03	5.54	-1.13	-1.13	-0.25	3.38	0.23	0.23	7.82	-9.13	-0.52	-0.52	-3.73	13.05	-0.28	-0.28	17.98	-21.09	0.89
	7163 R	-1.82	-1.82	-0.40	3.42	1.52	1.52	6.49	-7.54	-0.26	-0.26	-0.66	4.12	-1.28	-1.28	2.81	-3.23	0.19	0.19	7.12	-8.28	-1.08	-1.08	-0.29	3.14	-0.28	-0.28	16.36	-19.08	-0.51	-0.51	-3.57	11.97	-1.46
7169.0	7169 L	14.82	14.82	14.67	-13.25	9.66	9.66	6.69	-5.59	11.31	11.31	6.09	-2.82	13.34	13.34	15.39	-13.94	12.54	12.54	11.07	-9.80	13.23	13.23	10.27	-9.03	11.05	11.05	5.35	-1.37	13.75	13.75	18.53	-16.96	9.98
	7169 R	12.66	12.66	7.81	-7.69	19.32	19.32	16.47	-17.77	17.40	17.40	18.22	-19.80	14.64	14.64	6.99	-2.90	17.27	17.27	11.59	-12.09	16.37	16.37	12.56	-13.22	17.92	17.92	20.98	-23.01	14.36	14.36	6.50	-1.62	9.43
7183.0	7183 L	19.32	19.32	12.86	-13.31	12.89	12.89	9.33	-8.03	16.16	16.16	14.87	-15.66	16.76	16.76	5.11	-4.30	16.76	16.76	10.85	-10.98	16.81	16.81	11.82	-12.10	14.64	14.64	6.95	-1.76	17.63	17.63	19.52	-21.06	12.77
	7183 R	9.82	9.82	7.91	-5.84	14.82	14.82	11.38	-9.94	12.87	12.87	5.10	-3.92	12.39	12.39	12.29	-10.82	12.87	12.87	10.35	-8.96	12.83	12.83	9.50	-8.14	13.52	13.52	17.13	-15.46	11.29	11.29	5.66	-1.45	7.17
7189.0	7189 L	0.79	0.79	-1.52	-0.84	-1.86	-1.86	-7.76	6.46	-0.77	-0.77	-9.74	8.77	-0.65	-0.65	-3.62	1.62	-1.09	-1.09	-10.01	9.09	-0.07	-0.07	1.77	-4.69	-0.57	-0.57	-12.87	17.01	-0.24	-0.24	10.07	-14.40	0.32
	7189 R	-1.77	-1.77	-7.04	6.23	0.78	0.78	-1.34	-0.85	-0.58	-0.58	-1.77	-0.31	-0.76	-0.76	-9.85	9.73	-0.05	-0.05	1.76	-4.70	-1.03	-1.03	-9.16	8.87	-0.21	-0.21	9.48	-14.29	-0.52	-0.52	-11.74	16.71	-0.92
7199.0	7199 L	1.03	1.03	6.16	-7.34	-1.45	-1.45	1.91	-0.08	-1.29	-1.29	4.97	-5.86	-0.31	-0.31	0.39	4.59	-1.04	-1.04	1.68	0.64	0.33	0.33	7.67	-9.22	-0.27	-0.27	-2.65	13.98	-0.68	-0.68	20.16	-24.73	0.40
	7199 R	-1.39	-1.39	1.79	0.05	0.94	0.94	6.00	-6.33	-0.29	-0.29	0.79	2.81	-0.91	-0.91	2.80	-2.74	0.29	0.29	7.44	-7.92	-1.01	-1.01	1.57	0.65	-0.66	-0.66	19.45	-21.15	-0.28	-0.28	-2.56	12.03	-1.03
7205.0	7205 L	15.47	15.47	13.47	-12.81	9.88	9.88	8.62	-7.84	13.05	13.05	5.38	-4.52	13.06	13.06	15.92	-15.32	13.09	13.09	13.23	-12.57	13.71	13.71	11.95	-11.25	11.37	11.37	6.77	-2.68	14.08	14.08	20.43	-19.94	10.12
	7205 R	11.78	11.78	8.79	-8.82	18.38	18.38	13.38	-14.10	15.51	15.51	17.13	-18.41	15.47	15.47	4.26	-3.61	16.31	16.31	11.94	-12.45	15.57	15.57	13.37	-14.09	16.70	16.70	20.92	-22.77	13.68	13.68	6.88	-2.32	8.88
7219.0	7219 L	18.38	18.38	16.39	-17.42	12.00	12.00	9.03	-7.73	16.26	16.26	17.55	-18.75	13.83	13.83	6.76	-1.64	16.33	16.33	12.85	-13.35	15.51	15.51	10.50	-10.65	13.48	13.48	6.31	-0.44	17.14	17.14	20.89	-22.59	11.88
	7219 R	10.06	10.06	8.80	-6.95	15.47	15.47	16.18	-15.49	11.72	11.72	6.90	-2.75	13.68	13.68	16.25	-15.56	13.04	13.04	10.46	-9.62	13.73	13.73	12.71	-11.93	14.44	14.44	20.33	-19.74	11.37	11.37	6.14	-1.07	7.43
7225.0	7225 L	1.13	1.13	0.57	-2.53	-1.94	-1.94	-5.36	4.00	-0.21	-0.21	-7.11	5.93	-1.08	-1.08	0.03	-1.94	-1.00	-1.00	-8.43	7.39	0.09	0.09	5.69	-8.18	-0.38	-0.38	-11.31	18.09	-0.15	-0.15	18.36	-22.14	0.48
	7225 R	-1.75	-1.75	-4.56	3.67	1.05	1.05	0.70	-2.42	-0.93	-0.93	2.08	-4.02	-0.22	-0.22	-7.15	6.67	0.10	0.10	5.15	-7.58	-0.90	-0.90	-7.17	6.69	-0.12	-0.12	16.22	-20.39	-0.33	-0.33	-9.84	16.66	-0.89
7233.0	7233 L	1.05	1.05	-3.19	2.35	-1.19	-1.19	-8.89	11.71	-0.57	-0.57	-7.54	7.97	-0.33	-0.33	-9.07	12.20	-0.62	-0.62	-7.86	8.85	0.18	0.18	-2.78	1.88	-0.21	-0.21	-12.56	21.90	-0.28	-0.28	8.43	-11.11	0.46
	7233 R	-1.14	-1.14	-8.32	11.01	0.99	0.99	-3.03	2.21	-0.32	-0.32	-8.24	10.79	-0.56	-0.56	-7.26	8.00	0.16	0.16	-2.63	1.75	-0.60	-0.60	-7.38	8.33	-0.28	-0.28	7.85	-10.45	-0.21	-0.21	-11.68	20.64	-0.86
7241.0	7241 L	12.37	12.37	6.88	-7.67	7.56	7.56	2.96	-2.46	9.60	9.60	1.66	0.61	10.26	10.26	7.11	-7.94	10.26	10.26	4.86	-5.31	10.86	10.86	4.44	-4.82	8.97	8.97	0.66	2.98	11.30	11.30	11.38	-12.91	8.13
	7241 R	7.62	7.62	2.97	-2.36	12.47	12.47	6.80	-7.25	10.33	10.33	7.82	-8.40	9.65	9.65	1.43	1.18	10.94	10.94	4.38	-4.55	10.33	10.33	4.81	-5.03	11.38	11.38	11.33	-12.32	9.04	9.04	0.66	2.95	5.58
7252.0	7252 L	12.46	12.46	8.83	-9.19	7.62	7.62	4.28	-2.50	11.09	11.09	9.66	-10.12	9.09	9.09	2.96	0.52	10.86	10.86	7.28	-7.46	10.34	10.34	5.94	-5.96	8.86	8.86	2.22	2.24	11.60	11.60	13.38	-14.29	8.18
	7252 R	7.56	7.56	4.25	-2.62	12.37	12.37	8.81	-9.58	9.04	9.04	3.20	-0.13	11.03	11.03	8.90	-9.69	10.26	10.26	5.92	-6.21	10.78	10.78	7.26	-7.78	11.51	11.51	13.35	-14.88	8.80	8.80	2.18	2.27	5.54
7260.0	7260 L	1.36	1.36	0.65	-2.24	-1.40	-1.40	-5.15	4.51	0.01	0.01	-6.61	6.21	-0.49	-0.49	1.58	-3.32	-0.49	-0.49	-6.46	8.79	0.58	0.58	9.96	-13.08	-0.17	-0.17	-8.99	16.03	0.30	0.30	15.84	-19.91	0.65
	7260 R	-1.43	-1.43	-5.95	4.60	1.41	1.41	0.45	-2.17	-0.48	-0.48	2.66	-4.52	-0.01	-0.01	-8.50	7.31	0.61	0.61	10.50	-12.83	-0.48	-0.48	-7.31	8.76	0.32	0.32	16.87	-19.57	-0.16	-0.16	-9.83	15.81	-0.70
7269.0	7269 L	1.41	1.41	25.44	-28.07	-1.43	-1.43	13.71	-15.63	-0.64	-0.64	17.68	-19.84	0.03	0.03	14.82	-16.81	-0.40	-0.40	19.32	-21.58	0.47	0.47	23.32	-25.81	-0.29	-0.29	4.39	-5.75	0.38	0.38	34.97	-38.16	1.15
	7269 R	-1.23	-1.23	11.44	-13.95	1.16	1.16	21.26	-25.26	0.03	0.03	13.48	-16.31	-0.58	-0.58	14.17	-17.09	0.38	0.38	19.50	-23.22	-0.36	-0.36	16.19	-19.42	0.30	0.30	29.11	-34.30	-0.28	-0.28	3.86	-5.23	-0.63
7277.0	7277 L	15.93	15.93	17.85	-18.39	11.62	11.62	13.84	-14.07	14.07	14.07	10.24	-10.20	14.15	14.15	17.31	-17.81	14.38	14.38	15.50	-15.86	14.51	14.51	15.55	-15.91	13.38	13.38	8.49	-8.30	15.02	15.02	21.24	-22.04	11.04
	7277 R	13.70	13.70	15.57	-15.87	18.76	18.76	19.81	-20.48	16.68	16.68	20.18	-20.90	16.57	16.57	11.22	-11.11	17.10	17.10	17.34	-17.80	16.94	16.94	17.30	-17.74	17.67	17.67	23.56	-24.58	15.79	15.79	9.64	-9.39	10.02
7287.0	7287 L	18.77	18.77	8.70	-8.99	13.67	13.67	4.57	-3.36	17.08	17.08	11.86	-12.43	16.74	16.74	0.26	0.22	16.36	16.36	8.12	-8.35	17.00	17.00	7.52	-7.70	15.42	15.42	2.12	1.22	17.40	17.40	15.14	-16.01	12.90
	7287 R	11.60	11.60	3.78	-2.79	15.93	15.93	7.68	-7.90	14.20	14.20	0.49	-0.16	14.52	14.52	9.85	-10.25	14.43	14.43	6.58	-6.72	13.89	13.89	7.12	-7.30	14.77	14.77	13.53	-14.21	13.15	13.15	1.43	1.27	8.50
7295.0	7295 L	0.23	0.23	-9.19	9.21	-0.40	-0.40	-17.96	23.99	-0.24	-0.24	-17.14	22.41	-0.09	-0.09	-15.46	19.20	-0.34	-0.34	-18.35	24.74	0.15	0.15	-6.54	6.31	-0.11	-0.11	-21.13	30.05	-0.16	-0.16	-1.63	0.93	0.22
	7295 R	-0.32	-0.32	-14.26	18.20	0.18	0.18	-6.85	6.86	-0.06	-0.06	-11.74	13.90	-0.19	-0.19	-13.96	17.68	0.11	0.11	-4.82	4.68	-0.27	-0.27	-14.60	18.76	-0.13	-0.13	-1.07	0.66	-0.09	-0.09	-16.98	22.82	-0.29
7305.0	7305 L	0.13	0.13	-29.40	31.27	-0.31	-0.31	-34.92	40.66	-0.22	-0.22	-36.24	42.89	0.00	0.00	-30.46	33.08	-0.08	-0.08	-29.90	32.13	-0.06	-0.06	-29.74	31.85	-0.07	-0.07	-37.94	45.78	-0.11	-0.11	-27.64	28.28	0.19
	7305 R	-0.31	-0.31	-34.92	40.66	0.13	0.13	-29.40	31.27	0.00	0.00	-29.83	32.01	-0.22	-0.22	-36.86	43.94	-0.06	-0.06	-29.74	31.85	-0.08	-0.08	-29.90	32.13	-0.11	-0.11	-27.64	28.28	-0.07	-0.07	-37.94	45.78	-0.29
7402.0	7402 L	-16.33	-16.33	-12.09	13.02	-22.68	-22.68	-7.10	7.65	-20.25	-20.25	-17.55	18.91	-19.68	-19.68	-3.35	3.61	-19.75	-19.75	-8.61	9.27	-20.94	-20.94	-10.11	10.89	-19.16	-19.16	-18.45	19.87	-21.07	-21.07	-2.17	2.34	-11.97
	7402 R	-24.02	-24.02	-7.24	7.24	-17.30	-17.30	-12.33	12.33	-21.32	-21.32	-2.81	2.81	-21.12	-21.12	-18.31	18.31	-22.18	-22.18	-10.26	10.26	-20.92	-20.92	-8.81	8.81	-22.31	-22.31	-2.21	2.21	-20.31	-20.31	-18.83	18.83	-17.49
7407.0	7407 L	-17.40	-17.40	5.40	-5.40	-23.89	-23.89	2.03	-2.03	-18.87	-18.87	7.88	-7.88	-22.88	-22.88	0.07	-0.07	-18.93	-18.93	3.46	-3.46	-18.60	-18.60	3.40	-3.40	-22.43	-22.43	-0.14	0.14	-20.22	-20.22	8.72	-8.72	-12.78
	7407 R	-22.71	-22.71	2.00	-2.00	-16.55	-16.55	5.31	-5.31	-21.82	-21.82	0.14	-0.14	-17.88	-17.88	7.70	-7.70	-17.69	-17.69	3.34	-3.34	-18.00	-18.00	3.40	-3.40	-19.24	-19.24	8.57	-8.57	-21.32	-21.32	-0.14	0.14	-16.54
7411.0	7411 L	-16.51	-16.51	6.00	-6.00	-22.73	-22.73	2.98	-2.98	-21.92	-21.92	0.54	-0.54	-17.85	-17.85	8.36	-8.36	-18.01	-18.01	4.06	-4.06	-17.68	-17.68	3.79	-3.79	-21.45	-21.45	0.20	-0.20	-19.22	-19.22	9.27	-9.27	-12.12
	7411 R	-23.90	-23.90	3.04	-3.04	-17.36	-17.36	6.11	-6.11	-19.08	-19.08	8.73	-8.73	-22.94	-22.94	0.40	-0.40	-18.59	-18.59	3.86	-3.86	-18.94	-18.94	4.13	-4.13	-20.20	-20.20	9.44	-9.44	-22.57	-22.57	0.21	-0.21	-17.41
7416.0	7416 L	-17.33	-17.33	-7.33	7.33	-24.18	-24.18	-4.65	4.65	-21.56	-21.56	-0.68	0.68	-21.14	-21.14	-13.11	13.11	-20.70	-20.70	-5.97	5.97	-22.68	-22.68	-4.36	4.36	-20.35	-20.35	-13.78	13.78	-22.78	-22.78	0.17	-0.17	-12.73
	7416 R	-22.84	-22.84	-4.56	4.91	-16.36	-16.36	-7.18	7.74	-20.57	-20.57	-12.09	13.02	-18.86	-18.86	-2.49	2.68	-21.42	-21.42	-4.27	4.60	-19.55	-19.55	-5.86	6.31	-21.52	-21.52	0.17	-0.18	-19.20	-19.20	-13.50	14.55	-16.61
7422.0	7422 L	-13.50	-13.50	-12.58	12.58	-20.39	-20.39	-8.80	8.80	-17.98	-17.98	-17.42	17.42	-16.50	-16.50	-6.65	6.65	-17.15	-17.15	-8.98	8.98	-18.49	-18.49	-11.25	11.25	-16.41	-16.41	-18.87	18.87	-18.84	-18.84	-4.50	4.50	-9.93
	7422 R	-23.94	-23.94	-9.97	9.97	-15.86	-15.86	-14.25	14.25	-20.59	-20.59	-6.01	6.01	-20.19	-20.19	-20.74	20.74	-21.72	-21.72	-12.72	12.72	-20.13	-20.13	-10.19	10.19	-22.11	-22.11	-5.10	5.10	-19.28	-19.28	-21.37	21.37	-17.40
7427.0	7427 L	-16.09	-16.09	8.26	-8.26	-23.70	-23.70	4.87	-4.87	-18.15	-18.15	11.15	-11.15	-22.67	-22.67	2.48	-2.48	-18.10	-18.10	6.15	-6.15	-17.70	-17.70	5.91	-5.91	-22.09	-22.09	2.20	-2.20	-19.37	-19.37	11.91	-11.91	-11.83
	7427 R	-22.40	-22.40	4.77	-4.77	-15.21	-15.21	8.09	-8.09	-21.62	-21.62	2.59	-2.59	-16.71	-16.71	10.62	-10.62	-16.73	-16.73	5.79	-5.79	-17.11	-17.11	6.03	-6.03	-18.32	-18.32	11.67	-11.67	-20.87	-20.87	2.15	-2.15	-16.30
7431.0	7431 L	-15.28	-15.28	7.99	-7.99	-22.43	-22.43	4.55	-4.55	-21.65	-21.65	2.36	-2.36	-16.77	-16.77	10.49	-10.49	-17.15	-17.15	5.97	-5.97	-16.76	-16.76	5.57	-5.57	-20.91	-20.91	2.00	-2.00	-18.35	-18.35	11.55	-11.55	-11.23
	7431 R	-23.74	-23.74	4.64	-4.64	-16.15	-16.15	8.15	-8.15	-18.21	-18.21	11.04	-11.04	-22.69	-22.69	2.25	-2.25	-17.73	-17.73	5.69	-5.69	-18.14	-18.14	6.09	-6.09	-19.40	-19.40	11.79	-11.79	-22.13	-22.13	2.04	-2.04	-17.27
7436.0	7436 L	-16.03	-16.03	-15.37	15.37	-23.96	-23.96	-12.14	12.14	-20.64	-20.64	-7.17	7.17	-20.38	-20.38	-21.97	21.97	-20.64	-20.64	-10.50	10.50	-21.63	-21.63	-14.16	14.16	-19.40	-19.40	-22.55	22.55	-21.90	-21.90	-6.38	6.38	-11.77
	7436 R	-20.41	-20.41	-10.40	10.40	-13.65	-13.65	-13.58	13.58	-18.05	-18.05	-18.55	18.55	-16.65	-16.65	-7.52	7.52	-18.41	-18.41	-12.54	12.54	-17.59	-17.59	-9.25	9.25	-18.66	-18.66	-5.64	5.64	-16.51	-16.51	-19.91	19.91	-14.85

Flange Stress Values for Web Splice Calculations

STRENGTH I

Splice Node	Splice Side	MAX FX Axial Flange Stress (ksi)		MAX FX MZ Flange Stress (ksi)		MIN FX Axial Flange Stress (ksi)		MIN FX MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
7442.0	7442 L	-15.44	-15.44	-7.68	7.68	-22.35	-22.35	-4.04	4.04
	7442 R	-26.48	-26.48	-4.63	4.63	-18.30	-18.30	-8.80	8.80
7447.0	7447 L	-18.42	-18.42	4.35	-4.35	-26.22	-26.22	0.44	-0.44
	7447 R	-24.76	-24.76	0.44	-0.44	-17.40	-17.40	4.27	-4.27
7451.0	7451 L	-17.40	-17.40	4.29	-4.29	-24.80	-24.80	0.59	-0.59
	7451 R	-26.26	-26.26	0.18	-0.18	-18.42	-18.42	4.38	-4.38
7456.0	7456 L	-18.37	-18.37	-8.67	8.67	-26.61	-26.61	-3.56	3.56
	7456 R	-22.46	-22.46	-3.11	3.11	-15.50	-15.50	-7.57	7.57
7462.0	7462 L	-13.09	-13.09	-10.84	12.49	-21.12	-21.12	-7.17	8.26
	7462 R	-24.93	-24.93	-8.73	8.73	-15.46	-15.46	-13.20	13.20
7467.0	7467 L	-16.34	-16.34	7.66	-7.66	-25.42	-25.42	4.73	-4.73
	7467 R	-24.01	-24.01	4.65	-4.65	-15.45	-15.45	7.51	-7.51
7471.0	7471 L	-15.18	-15.18	6.90	-6.90	-23.99	-23.99	5.35	-5.35
	7471 R	-25.39	-25.39	5.46	-5.46	-16.06	-16.06	7.04	-7.04
7476.0	7476 L	-15.35	-15.35	-13.19	13.19	-25.01	-25.01	-9.45	9.45
	7476 R	-21.19	-21.19	-7.73	8.91	-13.00	-13.00	-10.83	12.48
7482.0	7482 L	-13.02	-13.02	-14.32	17.59	-21.63	-21.63	-11.87	14.58
	7482 R	-24.70	-24.70	-14.24	14.24	-14.88	-14.88	-17.19	17.19
7487.0	7487 L	-15.91	-15.91	9.21	-9.21	-25.57	-25.57	8.33	-8.33
	7487 R	-24.16	-24.16	8.17	-8.17	-15.04	-15.04	9.02	-9.02
7491.0	7491 L	-15.82	-15.82	9.66	-9.66	-23.75	-23.75	8.23	-8.23
	7491 R	-25.14	-25.14	8.40	-8.40	-16.73	-16.73	9.86	-9.86
7496.0	7496 L	-15.61	-15.61	-17.04	17.04	-24.37	-24.37	-15.14	15.14
	7496 R	-21.34	-21.34	-12.62	15.50	-13.66	-13.66	-14.20	17.44
7502.0	7502 L	-13.06	-13.06	-12.47	13.21	-21.07	-21.07	-9.64	10.21
	7502 R	-23.37	-23.37	-10.55	10.55	-14.49	-14.49	-13.65	13.65
7507.0	7507 L	-14.56	-14.56	8.26	-8.26	-22.94	-22.94	4.88	-4.88
	7507 R	-21.85	-21.85	4.80	-4.80	-13.88	-13.88	8.12	-8.12
7511.0	7511 L	-13.86	-13.86	7.94	-7.94	-21.82	-21.82	4.74	-4.74
	7511 R	-22.90	-22.90	4.82	-4.82	-14.54	-14.54	8.07	-8.07
7516.0	7516 L	-14.30	-14.30	-13.70	13.70	-23.22	-23.22	-9.43	9.43
	7516 R	-20.93	-20.93	-8.59	9.10	-12.88	-12.88	-12.52	13.26
7522.0	7522 L	-9.81	-9.81	-22.04	20.92	-16.81	-16.81	-20.69	19.65
	7522 R	-18.67	-18.67	-21.63	21.63	-10.90	-10.90	-23.01	23.01
7527.0	7527 L	-11.02	-11.02	12.23	-12.23	-18.39	-18.39	9.84	-9.84
	7527 R	-17.67	-17.67	9.71	-9.71	-10.60	-10.60	12.06	-12.06
7531.0	7531 L	-10.41	-10.41	12.17	-12.17	-17.47	-17.47	9.69	-9.69
	7531 R	-18.18	-18.18	9.82	-9.82	-10.82	-10.82	12.34	-12.34
7536.0	7536 L	-10.36	-10.36	-19.47	19.47	-18.16	-18.16	-17.65	17.65
	7536 R	-16.36	-16.36	-16.91	16.05	-9.32	-9.32	-18.65	17.70
7542.0	7542 L	-15.08	-15.08	-7.63	8.00	-21.07	-21.07	-6.38	6.69
	7542 R	-23.31	-23.31	-6.90	6.90	-16.69	-16.69	-8.25	8.25
7547.0	7547 L	-16.80	-16.80	6.96	-6.96	-23.02	-23.02	4.58	-4.58
	7547 R	-22.16	-22.16	4.52	-4.52	-16.18	-16.18	6.88	-6.88
7551.0	7551 L	-16.30	-16.30	6.48	-6.48	-22.19	-22.19	4.75	-4.75
	7551 R	-23.06	-23.06	4.81	-4.81	-16.93	-16.93	6.56	-6.56
7556.0	7556 L	-16.66	-16.66	-15.06	15.06	-22.93	-22.93	-13.78	13.78
	7556 R	-20.71	-20.71	-12.74	13.37	-15.04	-15.04	-13.92	14.61
9007.0	9007 L	0.16	0.16	-28.79	22.72	-0.07	-0.07	-36.96	35.98
	9007 R	-0.07	-0.07	-36.96	35.98	0.16	0.16	-29.32	23.57
9015.0	9015 L	0.16	0.16	-6.54	4.67	-0.07	-0.07	-10.85	11.67
	9015 R	-0.11	-0.11	-12.03	17.20	0.15	0.15	-7.46	7.29
9021.0	9021 L	14.95	14.95	8.63	-8.68	10.04	10.04	2.06	-0.07
	9021 R	13.03	13.03	2.57	0.11	19.33	19.33	9.51	-10.28
9035.0	9035 L	19.33	19.33	17.88	-18.81	12.97	12.97	14.88	-15.39
	9035 R	9.99	9.99	12.70	-12.30	14.95	14.95	15.71	-15.44
9041.0	9041 L	1.61	1.61	10.48	-12.29	-1.19	-1.19	11.57	-13.52
	9041 R	-1.49	-1.49	14.14	-17.25	2.07	2.07	12.71	-15.60
9051.0	9051 L	2.07	2.07	3.13	-3.00	-1.49	-1.49	9.26	-10.08
	9051 R	-1.41	-1.41	8.44	-9.12	1.93	1.93	2.84	-2.73
9057.0	9057 L	13.98	13.98	12.02	-12.42	8.87	8.87	6.42	-5.40
	9057 R	9.30	9.30	6.48	-5.52	14.63	14.63	12.07	-12.69
9071.0	9071 L	14.63	14.63	9.58	-9.88	9.30	9.30	5.09	-3.61
	9071 R	8.87	8.87	5.04	-3.56	13.98	13.98	9.58	-9.72
9077.0	9077 L	1.96	1.96	-10.10	9.48	-1.24	-1.24	-6.19	5.02
	9077 R	-1.08	-1.08	-5.69	4.17	1.74	1.74	-8.77	7.22
9089.0	9089 L	1.31	1.31	1.88	0.18	-1.08	-1.08	9.91	-9.51
	9089 R	-1.11	-1.11	9.38	-10.22	1.31	1.31	1.65	0.35
9095.0	9095 L	15.57	15.57	12.08	-12.56	10.23	10.23	7.80	-7.83
	9095 R	10.86	10.86	7.56	-7.60	16.50	16.50	11.64	-12.13
9109.0	9109 L	16.50	16.50	14.93	-15.52	11.02	11.02	9.19	-8.25
	9109 R	10.39	10.39	9.47	-8.56	15.57	15.57	15.48	-16.06
9115.0	9115 L	2.07	2.07	7.62	-9.41	-1.24	-1.24	4.55	-5.97
	9115 R	-1.37	-1.37	5.22	-6.46	2.35	2.35	9.07	-10.37
9127.0	9127 L	2.35	2.35	0.04	-0.15	-0.81	-0.81	-0.25	0.04
	9127 R	-0.86	-0.86	-0.32	0.15	2.49	2.49	-0.18	0.07
9133.0	9133 L	13.85	13.85	9.60	-8.93	8.34	8.34	6.16	-4.98
	9133 R	10.86	10.86	7.32	-6.63	17.84	17.84	10.82	-11.35
9147.0	9147 L	17.85	17.85	17.11	-18.10	10.86	10.86	8.78	-7.03
	9147 R	8.34	8.34	7.28	-5.28	13.85	13.85	14.94	-13.97
9153.0	9153 L	3.19	3.19	9.08	-11.89	-2.08	-2.08	-4.81	4.09
	9153 R	-2.20	-2.20	-5.39	4.51	3.43	3.43	9.58	-12.94
9163.0	9163 L	3.43	3.43	3.33	-3.81	-1.23	-1.23	-0.05	2.54
	9163 R	-1.20	-1.20	-0.13	2.40	3.18	3.18	3.09	-3.51
9169.0	9169 L	13.10	13.10	12.74	-11.49	8.08	8.08	6.36	-4.84
	9169 R	10.64	10.64	7.45	-6.68	17.09	17.09	14.30	-15.40
9183.0	9183 L	17.09	17.09	9.32	-9.50	10.64	10.64	7.19	-5.91
	9183 R	8.08	8.08	6.06	-4.28	13.10	13.10	8.31	-7.18
9189.0	9189 L	2.85	2.85	-4.75	3.16	-1.47	-1.47	-3.83	2.10
	9189 R	-1.40	-1.40	-3.38	1.93	2.77	2.77	-4.42	3.22
9199.0	9199 L	3.28	3.28	1.31	-1.30	-0.99	-0.99	3.02	-3.65
	9199 R	-0.97	-0.97	2.76	-2.64	3.06	3.06	1.49	-1.35
9205.0	9205 L	14.61	14.61	9.72	-9.13	8.62	8.62	7.08	-5.90
	9205 R	10.32	10.32	7.20	-6.60	17.37	17.37	9.45	-9.81
9219.0	9219 L	17.37	17.37	13.56	-14.35	10.32	10.32	6.80	-5.50
	9219 R	8.62	8.62	6.65	-4.99	14.62	14.62	13.51	-12.88

Splice Node	Splice Side	MAX FY Axial Flange Stress (ksi)		MAX FY MZ Flange Stress (ksi)		MIN FY Axial Flange Stress (ksi)		MIN FY MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
7442.0	7442 L	-19.87	-19.87	-12.59	12.59	-18.46	-18.46	-1.44	1.44
	7442 R	-23.03	-23.03	-0.18	0.18	-22.70	-22.70	-15.44	15.44
7447.0	7447 L	-20.50	-20.50	7.20	-7.20	-25.18	-25.18	-1.95	1.95
	7447 R	-23.85	-23.85	-1.86	1.86	-19.02	-19.02	6.80	-6.80
7451.0	7451 L	-23.89	-23.89	-1.70	1.70	-18.88	-18.88	6.82	-6.82
	7451 R	-20.19	-20.19	7.08	-7.08	-25.23	-25.23	-1.80	1.80
7456.0	7456 L	-23.31	-23.31	0.55	-0.55	-22.68	-22.68	-14.93	14.93
	7456 R	-19.89	-19.89	-12.17	12.17	-18.63	-18.63	-0.85	0.85
7462.0	7462 L	-19.06	-19.06	-14.81	17.07	-15.53	-15.53	-5.39	6.21
	7462 R	-19.59	-19.59	-4.92	4.92	-21.31	-21.31	-19.58	19.58
7467.0	7467 L	-18.99	-18.99	11.80	-11.80	-23.50	-23.50	1.31	-1.31
	7467 R	-22.62	-22.62	1.69	-1.69	-17.45	-17.45	11.22	-11.22
7471.0	7471 L	-22.63	-22.63	1.91	-1.91	-17.03	-17.03	10.57	-10.57
	7471 R	-18.80	-18.80	11.57	-11.57	-23.43	-23.43	1.24	-1.24
7476.0	7476 L	-19.50	-19.50	-4.73	4.73	-21.99	-21.99	-19.48	19.48
	7476 R	-19.01	-19.01	-15.46	17.82	-16.06	-16.06	-4.51	5.20
7482.0	7482 L	-19.75	-19.75	-18.53	22.76	-15.41	-15.41	-10.00	12.28
	7482 R	-18.57	-18.57	-10.61	10.61	-22.00	-22.00	-23.00	23.00
7487.0	7487 L	-19.24	-19.24	13.92	-13.92	-23.98	-23.98	4.87	-4.87
	7487 R	-22.74	-22.74	4.83	-4.83	-17.11	-17.11	12.74	-12.74
7491.0	7491 L	-22.23	-22.23	4.08	-4.08	-18.03	-18.03	14.06	-14.06
	7491 R	-19.95	-19.95	14.91	-14.91	-23.44	-23.44	4.09	-4.09
7496.0	7496 L	-19.10	-19.10	-9.49	9.49	-21.55	-21.55	-24.48	24.48
	7496 R	-19.38	-19.38	-19.77	24.29	-16.13	-16.13	-8.64	10.61
7502.0	7502 L	-18.18	-18.18	-18.45	19.54	-16.08	-16.08	-7.02	7.43
	7502 R	-19.67	-19.67	-5.64	5.64	-19.15	-19.15	-21.33	21.33
7507.0	7507 L	-17.27	-17.27	12.30	-12.30	-21.83	-21.83	2.23	-2.23
	7507 R	-20.88	-20.88	2.26	-2.26	-15.50	-15.50	11.28	-11.28
7511.0	7511 L	-20.91	-20.91	2.34	-2.34	-15.45	-15.45	11.14	-11.14
	7511 R	-17.20	-17.20	12.17	-12.17	-21.86	-21.86	2.28	-2.28
7516.0	7516 L	-19.33	-19.33	-5.05	5.05	-19.22	-19.22	-21.60	21.60
	7516 R	-18.22	-18.22	-18.72	19.82	-16.24	-16.24	-6.03	6.38
7522.0	7522 L	-14.80	-14.80	-28.10	26.67	-12.13	-12.13	-17.66	16.76
	7522 R	-15.01	-15.01	-16.68	16.68	-15.57	-15.57	-30.32	30.32
7527.0	7527 L	-13.78	-13.78	15.64	-15.64	-17.31	-17.31	7.54	-7.54
	7527 R	-16.72	-16.72	7.50	-7.50	-12.25	-12.25	14.67	-14.67
7531.0	7531 L	-16.64	-16.64	7.91	-7.91	-12.01	-12.01	14.89	-14.89
	7531 R	-13.51	-13.51	15.86	-15.86	-17.22	-17.22	7.94	-7.94
7536.0	7536 L	-14.41	-14.41	-13.13	13.13	-15.06	-15.06	-25.72	25.72
	7536 R	-14.43	-14.43	-23.61	22.41	-11.63	-11.63	-14.24	13.52
7542.0	7542 L	-19.27	-19.27	-12.57	13.19	-17.16	-17.16	-3.96	4.15
	7542 R	-20.14	-20.14	-2.91	2.91	-20.77	-20.77	-14.23	14.23
7547.0	7547 L	-19.21	-19.21	10.02	-10.02	-22.02	-22.02	2.77	-2.77
	7547 R	-21.33	-21.33	2.84	-2.84	-17.58	-17.58	9.22	-9.22
7551.0	7551 L	-21.35	-21.35	2.98	-2.98	-17.71	-17.71	8.99	-8.99
	7551 R	-19.01	-19.01	9.65	-9.65	-22.04	-22.04	2.91	-2.91
7556.0	7556 L	-19.45	-19.45	-8.13	8.13	-20.83	-20.83	-20.61	20.61
	7556 R	-19.24	-19.24	-18.41	19.32	-16.99	-16.99	-8.41	8.83
9007.0	9007 L	0.09	0.09	-28.91	22.90	-0.06	-0.06	-37.19	36.36
	9007 R	-0.05	-0.05	-36.90	35.88	0.08	0.08	-31.72	27.46
9015.0	9015 L	0.06	0.06	-8.79	8.33	0.01	0.01	-13.20	15.49
	9015 R	-0.01	-0.01	-14.10	21.68	0.04	0.04	-10.55	13.98
9021.0	9021 L	11.74	11.74	0.36	3.24	13.34	13.34	8.17	-8.20
	9021 R	17.22	17.22	10.14	-11.01	15.05	15.05	0.46	5.12
9035.0	9035 L	15.87	15.87	21.31	-22.72	17.36	17.36	8.18	-7.75
	9035 R	13.41	13.41	7.70	-7.07	12.97	12.97	14.73	-14.42
9041.0	9041 L	0.39	0.39	6.09	-7.38	-0.46	-0.46	7.99	-9.50
	9041 R	-0.34	-0.34	12.07	-14.87	0.50	0.50	6.51	-8.45
9051.0	9051 L	-0.27	-0.27	7.69	-8.26	0.37	0.37	1.95	3.31
	9051 R	0.22	0.22	2.28	1.43	-0.46	-0.46	4.54	-4.68
9057.0	9057 L	11.08	11.08	4.61	-1.75	12.37	12.37	10.53	-10.79
	9057 R	12.92	12.92	11.49	-12.04	11.59	11.59	4.39	-1.13
9071.0	9071 L	12.19	12.19	8.89	-9.12	11.99	11.99	2.78	1.23
	9071 R	11.48	11.48	3.02	0.52	11.66	11.66	7.97	-7.97
9077.0	9077 L	0.32	0.32	-12.50	12.22	-0.41	-0.41	-9.05	8.28
	9077 R	-0.17	-0.17	-6.33	4.81	0.31	0.31	-11.83	10.26
9089.0	9089 L	-0.15	-0.15	3.63	-3.30	0.40	0.40	0.67	2.57
	9089 R	0.36	0.36	0.82	2.17	-0.05	-0.05	2.82	-2.18
9095.0	9095 L	13.65	13.65	3.59	-3.18	13.32	13.32	11.91	-12.38
	9095 R	14.20	14.20	15.78	-16.72	14.47	14.47	2.91	-2.43
9109.0	9109 L	14.63	14.63	14.34	-14.87	13.33	13.33	6.92	-3.56
	9109 R	12.59	12.59	7.42	-4.43	13.81	13.81	13.97	-14.40
9115.0	9115 L	0.91	0.91	-2.82	2.29	-0.64	-0.64	4.43	-5.84
	9115 R	-0.53	-0.53	7.58	-8.85	1.05	1.05	-4.48	3.36
9127.0	9127 L	-0.17	-0.17	1.23	-1.36	0.46	0.46	-3.87	7.85
	9127 R	0.46	0.46	-3.65	8.40	-0.01	-0.01	-0.37	0.27
9133.0	9133 L	11.69	11.69	2.46	-1.86	11.54	11.54	10.39	-9.70
	9133 R	14.84	14.84	12.87	-13.69	15.04	15.04	2.17	-1.51
9147.0	9147 L	14.89	14.89	14.47	-15.10	13.32	13.32	6.65	-2.00
	9147 R	10.44	10.44	5.55	-2.10	11.54	11.54	11.66	-10.72
9153.0	9153 L	1.28	1.28	-7.07	6.69	-1.11	-1.11	3.69	-5.68
	9153 R	-0.98	-0.98	6.57	-9.43	1.36	1.36	-8.76	8.44
9163.0	9163 L	-0.63	-0.63	3.60	-4.13	0.85	0.85	-1.52	6.45
	9163 R	0.80	0.80	-1.22	5.18	-0.34	-0.34	1.28	-1.19
9169.0	9169 L	10.05	10.05	4.40	-1.21	11.04	11.04	11.24	-10.06
	9169 R	14.40	14.40	13.77	-14.79	12.97	12.97	5.09	-0.81
9183.0	9183 L	14.50	14.50	11.49	-12.00	13.33	13.33	5.26	-1.09
	9183 R	10.35	10.35	4.52	-1.41	11.13	11.13	9.21	-8.03
9189.0	9189 L	0.53	0.53	-10.65	9.97	-0.16	-0.16	-4.41	2.76
	9189 R	-0.11	-0.11	-2.21	0.51	0.53	0.53	-10.55	10.72
9199.0	9199 L	-0.42	-0.42	7.22	-8.54	0.87	0.87	-0.29	5.83
	9199 R	0.80	0.80	0.11	4.08	-0.26	-0.26	2.29	-1.45
9205.0	9205 L	11.29	11.29	4.91	-1.45	11.81	11.81	14.91	-14.38
	9205 R	14.02	14.02	15.97	-17.18	13.70	13.70	4.94	-1.02
9219.0	9219 L	15.09	15.09	16.23	-17.37	12.92	12.92	3.87	1.70
	9219 R	10.92	10.92	4.12	0.20	12.70	12.70	15.15	-14.54

Splice Node	Splice Side	MAX MY Axial Flange Stress (ksi)		MAX MY MZ Flange Stress (ksi)		MIN MY Axial Flange Stress (ksi)		MIN MY MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF
7442.0	7442 L	-19.32	-19.32	-3.36	3.36	-20.38	-20.38	-6.37	6.37
	7442 R	-24.15	-24.15	-7.29	7.29	-22.89	-22.89	-3.85	3.85
7447.0	7447 L	-20.46	-20.46	2.15	-2.15	-19.89	-19.89	1.93	-1.93
	7447 R	-18.78	-18.78	1.89	-1.89	-19.32	-19.32	2.11	-2.11
7451.0	7451 L	-19.36	-19.36	2.23	-2.23	-18.79	-18.79	1.93	-1.93
	7451 R	-19.89	-19.89	1.97	-1.97	-20.49	-20.49	2.27	-2.27
7456.0	7456 L	-23.23	-23.23	-3.12	3.12	-24.06	-24.06	-7.60	7.60
	7456 R	-20.31	-20.31	-6.64	6.64	-19.61	-19.61	-2.71	2.71
7462.0	7462 L	-16.48	-16.48	-7.43	8.56	-19.13	-19.13	-9.33	10.75
	7462 R	-22.58	-22.58	-11.39	11.39	-19.46	-19.46	-9.03	9.03
7467.0	7467 L	-18.90	-18.90	5.70	-5.70	-18.59	-18.59	5.75	-5.75
	7467 R	-17.57	-17.57	5.64	-5.64	-17.86	-17.86	5.59	-5.59
7471.0	7471 L	-18.11	-18.11	6.05	-6.05	-17.24	-17.24	5.15	-5.15
	7471 R	-18.25	-18.25	5.26	-5.26	-19.17	-19.17	6.17	-6.17
7476.0	7476 L	-20.47	-20.47	-7.98	7.98	-22.26	-22.26	-13.48	13.48
	7476 R	-18.86	-18.86	-11.05	12.73	-17.34	-17.34	-6.56	7.56
7482.0	7482 L	-17.50	-17.50	-10.55	12.96	-19.22	-19.22	-14.99	18.42
	7482 R	-21.93	-21.93	-18.27	18.27	-19.99	-19.99	-12.61	12.61
7487.0	7487 L	-19.23	-19.23	8.52	-8.52	-18.37	-18.37	7.58	-7.58
	7487 R	-17.37	-17.37	7.42	-7.42	-18.18	-18.18	8.35	-8.35
7491.0	7491 L	-18.25	-18.25	8.34	-8.34	-17.45	-17.45	7.63	-7.63
	7491 R	-18.46	-18.46	7.79	-7.79	-19.31	-19.31	8.51	-8.51
7496.0	7496 L	-19.69	-19.69	-13.43	13.43	-22.16	-22.16	-17.44	17.44
	7496 R	-19.40	-19.40	-14.53	17.85	-17.24	-17.24	-11.22	13.78
7502.0	7502 L	-16.67	-16.67	-10.07	10.67	-19.05	-19.05	-10.83	11.47
	7502 R	-21.13	-21.13	-11.85	11.85	-18.49	-18.49	-11.03	11.03
7507.0	7507 L	-16.81	-16.81	5.96	-5.96	-16.34	-16.34	5.81	-5.81
	7507 R	-15.57	-15.57	5.71	-5.71	-16.02	-16.02	5.86	-5.86
7511.0	7511 L	-15.98	-15.98	5.82	-5.82	-15.54	-15.54	5.69	-5.69
	7511 R	-16.31	-16.31	5.79	-5.79	-16.77	-16.77	5.91	-5.91
7516.0	7516 L	-18.56	-18.56	-10.02	10.02	-20.53	-20.53	-12.89	12.89
	7516 R	-18.52	-18.52	-11.90	12.60	-16.73	-16.73	-9.11	9.65
7522.0	7522 L	-14.10	-14.10	-21.65	20.55	-13.62	-13.62	-22.51	21.37
	7522 R	-15.13	-15.13	-23.48	23.48	-15.66	-15.66	-22.61	22.61
7527.0	7527 L	-13.23	-13.23	10.33	-10.33	-12.86	-12.86	9.88	-9.88
	7527 R	-12.36	-12.36	9.74	-9.74	-12.71	-12.71	10.19	-10.19
7531.0	7531 L	-12.30	-12.30	10.32	-10.32	-12.42	-12.42	10.14	-10.14
	7531 R	-12.91	-12.91	10.28	-10.28	-12.79	-12.79	10.45	-10.45
7536.0	7536 L	-12.18	-12.18	-18.81	18.81	-16.48	-16.48	-15.58	15.58
	7536 R	-14.87	-14.87	-14.99	14.23	-10.96	-10.96	-17.96	17.05
7542.0	7542 L	-18.84	-18.84	-8.80	9.23	-17.61	-17.61	-5.49	5.77
	7542 R	-19.47	-19.47	-5.89	5.89	-20.86	-20.86	-9.57	9.57
7547.0	7547 L	-18.24	-18.24	5.40	-5.40	-17.89	-17.89	5.18	-5.18
	7547 R	-17.23	-17.23	5.11	-5.11	-17.56	-17.56	5.34	-5.34
7551.0	7551 L	-17.20	-17.20	4.98	-4.98	-17.64	-17.64	5.29	-5.29
	7551 R	-18.32	-18.32	5.36	-5.36	-17.87	-17.87	5.04	-5.04
7556.0	7556 L	-20.26	-20.26	-17.78	17.78	-20.91	-20.91	-10.82	10.82
	7556 R	-18.88	-18.88	-10.00	10.50	-18.29	-18.29	-16.43	17.24
9007.0	9007 L	0.10	0.10	-29.91	24.52	-0.03	-0.03	-29.89	24.50
	9007 R	-0.03	-0.03	-29.89	24.50	0.10	0.10	-29.91	24.52
9015.0	9015 L	-0.02	-0.02	-13.32	15.68	0.13	0.13	2.99	-3.06
	9015 R	0.13	0.13	3.24	-4.41	-0.05	-0.05	-14.55	22.67
9021.0	9021 L	13.14	13.14	4.91	-4.79	12.94	12.94	6.69	-6.65
	9021 R	16.76	16.76	7.45	-7.93	17.01	17.01	5.37	-5.56
9035.0	9035 L	16.44	16.44	16.41	-17.14	17.25	17.25	16.40	-17.12
	9035 R	13.33	13.33	14.29	-13.96	12.69	12.69	14.25	-13.92
9041.0	9041 L	-0.23	-0.23	2.36	-3.20	0.74	0.74	19.76	-22.69
	9041 R	0.97	0.97	24.38	-29.08	-0.26	-0.26	2.77	-4.12
9051.0	9051 L	0.04	0.04	1.46	4.54	0.77	0.77	19.68	-22.12
	9051 R	0.71	0.71	18.15	-20.22	0.01	0.01	1.08	4.29
9057.0	9057 L	11.90	11.90	9.27	-9.41	12.14	12.14	10.22	-10.45
	9057 R	12.70	12.70	10.28	-10.70	12.45	12.45	9.31	-9.62
9071.0	9071 L	12.60	12.60	6.86	-6.85	12.55	12.55	7.61	-7.68
	9071 R	11.99	11.99	7.60	-7.56	12.04	12.04	6.86	-6.75
9077.0	9077 L	0.19	0.19	-12.95	16.35	0.56	0.56	3.79	-6.38
	9077 R	0.51	0.51	3.73	-5.14	0.18	0.18	-11.65	12.87
9089.0	9089 L	0.30	0.30	-0.25	4.38	0.38	0.38	14.31	-13.87
	9089 R	0.37	0.37	13.62	-14.97	0.28	0.28	-0.42	4.84
9095.0	9095 L	13.71	13.71	11.38	-11.80	13.41	13.41	11.46	-11.88
	9095 R	14.22	14.22	11.07	-11.49	14.53	14.53	10.99	-11.41
9109.0	9109 L	13.75	13.75	11.91	-12.16	15.02	15.02	12.85	-13.21
	9109 R	14.17	14.17	13.31	-13.67	12.97	12.97	12.32	-12.58
9115.0	9115 L	-0.35	-0.35	-3.36	2.89	1.18	1.18	14.54	-17.17
	9115 R	1.36	1.36	17.47	-18.87	-0.36	-0.36	-4.38	3.26
9127.0	9127 L	0.18	0.18	-2.74	5.40	0.86	0.86	6.51	-6.70
	9127 R	0.90	0.90	6.58	-7.71	0.17	0.17	-2.80	6.29
9133.0	9133 L	11.05	11.05	8.82	-8.15	11.84	11.84	7.19	-6.54
	9133 R	15.28	15.28	8.19	-8.36	14.27	14.27	10.15	-10.59
9147.0	9147 L	13.92	13.92	12.63	-13.01	15.76	15.76	10.34	-10.40
	9147 R	12.22	12.22	8.99	-8.07	10.78	10.78	10.87	-9.93
9153.0	9153 L	-0.97	-0.97	-2.89	1.88	2.23	2.23	8.72	-11.46
	9153 R	2.41	2.41	9.20	-12.49	-1.02	-1.02	-3.32	2.10
9163.0	9163 L	-0.12	-0.12	-0.90	4.79	1.85	1.85	10.16	-11.76
	9163 R	1.71	1.71	9.30	-10.68	-0.14	-0.14	-0.93	4.43
9169.0	9169 L	10.26	10.26	9.43	-8.34	11.66	11.66	8.66	-7.61
	9169 R	15.21	15.21	9.76	-10.18	13.40	13.40	10.76	-11.32
9183.0	9183 L	14.03	14.03	8.48	-8.54	14.50	14.50	9.23	-9.39
	9183 R	11.10	11.10	8.10	-6.98	10.74	10.74	7.43	-6.34
9189.0	9189 L	0.39	0.39	-11.71	11.20	1.15	1.15	4.60	-7.65
	9189 R	1.13	1.13	4.37	-7.55	0.39	0.39	-10.80	11.03
9199.0	9199 L	0.12	0.12	-0.70	7.03	1.66	1.66	12.33	-14.81
	9199 R	1.54	1.54	12.10	-12.84	0.09	0.09	-0.67	6.04
9205.0	9205 L	11.26	11.26	9.24	-8.64	12.80	12.80	10.70	-10.12
	9205 R	15.22	15.22	10.67	-11.19	13.40	13.40	9.25	-9.58
9219.0	9219 L	14.70	14.70	7.88	-7.92	14.01	14.01	9.71	-9.99
	9219 R	11.78	11.78	9.67	-9.00	12.36	12.36	8.00	-7.31

Splice Node	Splice Side	MAX MZ Axial Flange Stress (ksi)		MAX MZ MZ Flange Stress (ksi)		MIN MZ Axial Flange Stress (ksi)		MIN MZ MZ Flange Stress (ksi)		Flange Stre… Axial Flange…
		TF	BF	TF	BF	TF	BF	TF	BF	TF
7442.0	7442 L	-18.36	-18.36	-13.97	13.97	-20.67	-20.67	0.58	-0.58	-11.30
	7442 R	-24.49	-24.49	0.67	-0.67	-21.76	-21.76	-16.01	16.01	-19.31
7447.0	7447 L	-24.61	-24.61	-2.18	2.18	-21.72	-21.72	7.91	-7.91	-13.49
	7447 R	-20.53	-20.53	7.75	-7.75	-23.23	-23.23	-2.13	2.13	-18.08
7451.0	7451 L	-23.28	-23.28	-2.03	2.03	-20.52	-20.52	7.82	-7.82	-12.75
	7451 R	-21.72	-21.72	7.99	-7.99	-24.66	-24.66	-2.07	2.07	-19.18
7456.0	7456 L	-21.80	-21.80	-15.49	15.49	-24.55	-24.55	1.35	-1.35	-13.45
	7456 R	-20.73	-20.73	1.17	-1.17	-18.39	-18.39	-13.52	13.52	-16.39
7462.0	7462 L	-16.64	-16.64	-17.01	19.60	-18.70	-18.70	-2.80	3.23	-9.54
	7462 R	-22.06	-22.06	-3.41	3.41	-19.66	-19.66	-20.71	20.71	-18.29
7467.0	7467 L	-22.15	-22.15	0.57	-0.57	-20.60	-20.60	12.99	-12.99	-11.94
	7467 R	-19.48	-19.48	12.72	-12.72	-20.92	-20.92	0.55	-0.55	-17.63
7471.0	7471 L	-21.15	-21.15	0.66	-0.66	-19.44	-19.44	12.28	-12.28	-11.01
	7471 R	-20.57	-20.57	12.54	-12.54	-22.40	-22.40	0.68	-0.68	-18.60
7476.0	7476 L	-19.39	-19.39	-21.38	21.38	-22.29	-22.29	-2.72	2.72	-11.15
	7476 R	-18.89	-18.89	-2.23	2.57	-16.41	-16.41	-17.56	20.23	-15.48
7482.0	7482 L	-16.68	-16.68	-21.04	25.84	-19.51	-19.51	-6.85	8.42	-9.49
	7482 R	-22.28	-22.28	-8.22	8.22	-19.07	-19.07	-25.25	25.25	-17.99
7487.0	7487 L	-22.25	-22.25	3.98	-3.98	-20.61	-20.61	14.77	-14.77	-11.57
	7487 R	-19.49	-19.49	14.47	-14.47	-21.02	-21.02	3.90	-3.90	-17.66
7491.0	7491 L	-20.65	-20.65	2.98	-2.98	-19.80	-19.80	15.27	-15.27	-11.53
	7491 R	-20.93	-20.93	15.58	-15.58	-21.86	-21.86	3.04	-3.04	-18.48
7496.0	7496 L	-19.66	-19.66	-25.76	25.76	-21.11	-21.11	-8.10	8.10	-11.34
	7496 R	-18.49	-18.49	-6.75	8.29	-17.20	-17.20	-21.47	26.37	-15.66
7502.0	7502 L	-16.41	-16.41	-20.09	21.28	-19.19	-19.19	-4.31	4.56	-9.53
	7502 R	-21.28	-21.28	-4.71	4.71	-18.22	-18.22	-21.99	21.99	-16.99
7507.0	7507 L	-21.23	-21.23	1.86	-1.86	-18.06	-18.06	12.68	-12.68	-10.62
	7507 R	-17.22	-17.22	12.47	-12.47	-20.22	-20.22	1.83	-1.83	-15.91
7511.0	7511 L	-19.98	-19.98	1.91	-1.91	-17.25	-17.25	12.38	-12.38	-10.10
	7511 R	-18.09	-18.09	12.59	-12.59	-20.98	-20.98	1.94	-1.94	-16.68
7516.0	7516 L	-17.94	-17.94	-22.44	22.44	-20.98	-20.98	-4.04	4.04	-10.41
	7516 R	-18.92	-18.92	-3.69	3.91	-16.16	-16.16	-20.50	21.72	-15.24
7522.0	7522 L	-13.09	-13.09	-29.67	28.17	-14.92	-14.92	-15.17	14.40	-7.19
	7522 R	-16.56	-16.56	-15.84	15.84	-14.56	-14.56	-30.98	30.98	-13.55
7527.0	7527 L	-16.74	-16.74	7.23	-7.23	-14.36	-14.36	15.88	-15.88	-8.10
	7527 R	-13.81	-13.81	15.66	-15.66	-16.08	-16.08	7.14	-7.14	-12.82
7531.0	7531 L	-15.87	-15.87	7.46	-7.46	-13.65	-13.65	15.91	-15.91	-7.65
	7531 R	-14.19	-14.19	16.13	-16.13	-16.52	-16.52	7.56	-7.56	-13.20
7536.0	7536 L	-13.81	-13.81	-26.57	26.57	-16.38	-16.38	-11.95	11.95	-7.62
	7536 R	-14.76	-14.76	-11.44	10.86	-12.43	-12.43	-25.45	24.16	-11.85
7542.0	7542 L	-17.92	-17.92	-13.73	14.42	-19.50	-19.50	-2.01	2.11	-11.07
	7542 R	-21.56	-21.56	-2.17	2.17	-19.84	-19.84	-14.86	14.86	-16.94
7547.0	7547 L	-21.43	-21.43	2.39	-2.39	-19.78	-19.78	10.28	-10.28	-12.33
	7547 R	-19.05	-19.05	10.15	-10.15	-20.63	-20.63	2.36	-2.36	-16.13
7551.0	7551 L	-20.27	-20.27	2.48	-2.48	-19.18	-19.18	9.97	-9.97	-11.97
	7551 R	-19.91	-19.91	10.10	-10.10	-21.06	-21.06	2.51	-2.51	-16.77
7556.0	7556 L	-19.80	-19.80	-21.44	21.44	-20.78	-20.78	-7.03	7.03	-12.20
	7556 R	-18.78	-18.78	-6.50	6.82	-17.87	-17.87	-19.81	20.80	-15.07
9007.0	9007 L	0.05	0.05	-38.61	38.65	0.01	0.01	-26.58	19.13	0.19
	9007 R	0.01	0.01	-26.58	19.13	0.05	0.05	-38.61	38.65	-0.10
9015.0	9015 L	0.09	0.09	-15.54	19.29	-0.02	-0.02	7.52	-6.89	0.19
	9015 R	-0.04	-0.04	8.27	-10.05	0.08	0.08	-16.95	27.88	-0.13
9021.0	9021 L	11.25	11.25	-0.35	4.62	13.79	13.79	15.03	-15.36	10.10
	9021 R	17.83	17.83	17.02	-18.84	14.48	14.48	-0.01	6.25	9.63
9035.0	9035 L	15.70	15.70	5.90	-5.16	17.23	17.23	24.71	-26.60	12.84
	9035 R	13.35	13.35	21.47	-21.47	11.60	11.60	8.23	-5.16	7.42
9041.0	9041 L	0.55	0.55	-1.01	0.58	-0.07	-0.07	23.27	-26.61	0.93
	9041 R	-0.06	-0.06	28.85	-34.25	0.73	0.73	-1.53	0.84	-0.69
9051.0	9051 L	0.66	0.66	-1.14	11.14	-0.03	-0.03	26.66	-30.18	1.13
	9051 R	-0.04	-0.04	24.59	-27.57	0.60	0.60	-1.46	10.37	-0.68
9057.0	9057 L	10.42	10.42	3.32	0.84	12.84	12.84	18.30	-19.27	9.44
	9057 R	13.43	13.43	18.47	-19.82	10.90	10.90	3.37	1.01	6.86
9071.0	9071 L	10.99	10.99	1.77	3.34	13.42	13.42	15.63	-16.62	9.85
	9071 R	12.83	12.83	15.52	-16.20	10.50	10.50	1.75	3.08	6.54
9077.0	9077 L	0.70	0.70	-15.20	21.75	-0.12	-0.12	11.33	-14.99	1.09
	9077 R	-0.08	-0.08	10.51	-11.86	0.64	0.64	-13.80	17.11	-0.53
9089.0	9089 L	0.63	0.63	-2.83	9.46	-0.10	-0.10	20.61	-20.10	1.00
	9089 R	-0.14	-0.14	19.68	-21.76	0.62	0.62	-2.98	10.41	-0.56
9095.0	9095 L	12.00	12.00	4.83	-1.09	14.29	14.29	19.86	-21.16	10.52
	9095 R	15.15	15.15	19.22	-20.55	12.71	12.71	4.66	-0.80	8.17
9109.0	9109 L	12.75	12.75	5.99	-1.63	15.14	15.14	20.69	-21.92	11.11
	9109 R	14.28	14.28	21.39	-22.60	12.04	12.04	6.20	-1.97	7.70
9115.0	9115 L	0.77	0.77	-4.47	8.22	0.08	0.08	22.06	-25.59	1.18
	9115 R	0.12	0.12	26.61	-28.14	0.87	0.87	-5.44	8.93	-0.62
9127.0	9127 L	0.71	0.71	-6.01	12.46	0.35	0.35	13.98	-14.28	1.31
	9127 R	0.34	0.34	14.30	-16.58	0.74	0.74	-6.12	14.55	-0.66
9133.0	9133 L	10.18	10.18	3.33	0.24	12.06	12.06	16.76	-16.02	9.37
	9133 R	15.53	15.53	19.26	-20.95	13.06	13.06	4.27	0.57	7.93
9147.0	9147 L	12.68	12.68	5.60	0.46	16.12	16.12	21.90	-23.55	11.85
	9147 R	12.51	12.51	18.99	-17.97	9.86	9.86	4.30	0.21	6.08
9153.0	9153 L	0.69	0.69	-7.40	12.16	0.87	0.87	20.21	-24.67	2.66
	9153 R	0.95	0.95	21.74	-27.11	0.76	0.76	-8.13	13.39	-1.05
9163.0	9163 L	1.00	1.00	-3.99	13.02	0.51	0.51	18.44	-21.42	2.00
	9163 R	0.45	0.45	16.84	-19.40	0.92	0.92	-3.87	11.94	-1.02
9169.0	9169 L	9.68	9.68	3.43	0.59	11.64	11.64	17.77	-16.27	8.88
	9169 R	15.15	15.15	20.18	-22.17	12.57	12.57	4.33	1.09	7.73
9183.0	9183 L	12.51	12.51	4.15	1.66	15.21	15.21	17.99	-19.48	11.35
	9183 R	11.67	11.67	15.80	-14.30	9.64	9.64	3.20	1.03	5.85
9189.0	9189 L	0.89	0.89	-12.55	16.58	0.61	0.61	11.08	-15.14	1.57
	9189 R	0.59	0.59	10.44	-14.99	0.87	0.87	-11.50	16.38	-0.56
9199.0	9199 L	1.29	1.29	-3.33	14.55	0.02	0.02	20.96	-25.38	1.71
	9199 R	0.01	0.01	20.35	-21.79	1.20	1.20	-3.17	12.39	-0.75
9205.0	9205 L	10.65	10.65	4.00	0.41	12.74	12.74	18.86	-18.37	9.61
	9205 R	15.10	15.10	19.36	-21.02	12.63	12.63	4.00	1.31	7.64
9219.0	9219 L	12.16	12.16	3.18	3.41	15.98	15.98	19.68	-21.27	11.26
	9219 R	13.46	13.46	19.17	-18.60	10.25	10.25	3.14	2.21	6.38

Made By: WME 8/5/11 Checked By: MTB 8/5/11 BackChecked By: WME 8/5/11

Flange Stress Values for Web Splice Calculations

Splice Node	Splice Side	STRENGTH I																																Flange Stre
		MAX FX				MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ				
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange
		TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF
9225.0	9225 L	2.79	2.79	-5.41	4.38	-1.68	-1.68	2.10	-3.76	0.89	0.89	-7.21	6.34	-0.09	-0.09	6.11	-8.11	0.63	0.63	-7.80	10.88	0.28	0.28	14.98	-17.72	0.73	0.73	-10.20	16.97	0.22	0.22	21.62	-24.91	1.49
	9225 R	-1.52	-1.52	1.86	-3.33	2.56	2.56	-4.55	3.96	-0.05	-0.05	6.91	-9.08	0.80	0.80	-7.01	6.75	0.27	0.27	13.27	-16.30	0.60	0.60	-6.74	10.00	0.21	0.21	19.07	-22.90	0.69	0.69	-8.99	15.69	-0.70
9232.0	9232 L	2.56	2.56	-10.28	10.35	-0.87	-0.87	-8.49	8.60	0.18	0.18	-4.35	3.62	0.26	0.26	-10.24	13.02	0.24	0.24	-10.89	14.66	0.73	0.73	1.16	-2.64	1.05	1.05	-14.04	22.58	-0.04	-0.04	8.08	-10.51	1.40
	9232 R	-0.84	-0.84	-7.98	8.09	2.44	2.44	-9.64	9.71	0.25	0.25	-9.48	11.91	-0.15	-0.15	-8.27	8.15	0.69	0.69	1.09	-2.50	0.23	0.23	-10.23	13.81	-0.04	-0.04	7.59	-9.90	1.00	1.00	-13.17	21.28	-0.67
9242.0	9242 L	10.13	10.13	3.59	-4.06	4.74	4.74	-0.04	0.98	7.45	7.45	-1.45	4.00	7.83	7.83	4.55	-5.15	7.05	7.05	-0.52	0.66	8.20	8.20	0.96	-1.04	6.48	6.48	-2.48	6.20	8.88	8.88	8.21	-9.35	6.67
	9242 R	4.78	4.78	-0.03	0.93	10.21	10.21	3.53	-3.82	7.88	7.88	5.30	-5.76	7.51	7.51	-1.57	4.12	8.26	8.26	0.92	-0.95	7.11	7.11	-0.55	0.66	8.94	8.94	8.18	-8.93	6.54	6.54	-2.48	6.02	3.51
9253.0	9253 L	10.20	10.20	6.65	-6.90	4.78	4.78	2.35	-0.71	8.24	8.24	7.85	-8.23	7.16	7.16	1.11	1.87	8.00	8.00	1.80	-1.57	8.02	8.02	5.36	-5.49	6.48	6.48	0.07	4.03	9.00	9.00	11.65	-12.40	6.72
	9253 R	4.75	4.75	2.33	-0.75	10.13	10.13	6.64	-7.20	7.10	7.10	1.33	1.39	8.20	8.20	7.54	-8.23	7.96	7.96	5.35	-5.73	7.94	7.94	1.80	-1.65	8.93	8.93	11.63	-12.92	6.43	6.43	0.04	4.14	3.48
9261.0	9261 L	2.59	2.59	-1.47	0.62	-1.64	-1.64	0.01	-1.07	-0.16	-0.16	-5.58	5.29	0.00	0.00	0.78	-1.94	0.50	0.50	-5.71	8.80	0.48	0.48	15.35	-18.52	0.76	0.76	-7.96	14.51	0.27	0.27	17.99	-21.52	1.45
	9261 R	-1.70	-1.70	-0.19	-0.97	2.68	2.68	-1.65	0.53	0.01	0.01	2.17	-3.40	-0.17	-0.17	-6.66	5.69	0.50	0.50	16.64	-18.31	0.52	0.52	-6.29	8.65	0.29	0.29	19.51	-21.27	0.78	0.78	-8.58	14.22	-0.74
9269.0	9269 L	2.68	2.68	18.54	-19.79	-1.70	-1.70	22.68	-24.05	-0.11	-0.11	18.65	-19.90	0.43	0.43	15.49	-16.64	-0.56	-0.56	13.18	-14.26	1.37	1.37	26.65	-28.14	1.10	1.10	4.40	-5.22	-0.10	-0.10	36.60	-38.39	2.11
	9269 R	-1.45	-1.45	18.46	-21.23	2.23	2.23	15.36	-17.75	0.36	0.36	13.63	-15.80	-0.15	-0.15	14.48	-16.75	1.13	1.13	22.00	-25.21	-0.49	-0.49	10.92	-12.75	-0.11	-0.11	30.17	-34.38	0.90	0.90	3.72	-4.67	-1.14
9277.0	9277 L	13.22	13.22	10.51	-11.25	8.85	8.85	10.63	-11.38	11.78	11.78	6.00	-6.41	11.31	11.31	14.11	-15.12	11.28	11.28	10.48	-11.21	11.89	11.89	10.77	-11.53	10.88	10.88	4.62	-4.92	12.00	12.00	17.56	-18.82	9.79
	9277 R	10.42	10.42	11.72	-12.68	15.55	15.55	11.45	-12.39	13.31	13.31	16.13	-17.48	13.87	13.87	6.27	-6.75	13.99	13.99	11.78	-12.74	13.28	13.28	11.48	-12.42	14.11	14.11	19.22	-20.84	12.82	12.82	5.06	-5.44	7.62
9287.0	9287 L	15.66	15.66	8.79	-9.28	10.63	10.63	1.32	0.35	14.06	14.06	6.52	-6.82	12.72	12.72	-0.07	2.89	13.30	13.30	1.83	-1.72	14.10	14.10	7.12	-7.47	12.19	12.19	-0.93	4.49	14.54	14.54	12.14	-12.93	10.79
	9287 R	9.01	9.01	0.86	0.49	13.30	13.30	7.84	-8.23	10.85	10.85	-0.20	2.29	11.96	11.96	5.32	-5.52	11.97	11.97	6.30	-6.57	11.28	11.28	1.47	-1.38	12.34	12.34	10.88	-11.49	10.38	10.38	-1.29	4.16	6.62
9295.0	9295 L	0.64	0.64	-16.27	20.03	-0.05	-0.05	-12.93	13.77	0.26	0.26	-19.05	25.25	0.29	0.29	-15.89	19.31	0.25	0.25	-20.58	28.11	0.35	0.35	-3.36	2.78	0.43	0.43	-21.97	30.72	0.11	0.11	-1.24	0.47	0.60
	9295 R	-0.05	-0.05	-9.83	10.34	0.51	0.51	-12.69	15.09	0.23	0.23	-11.95	13.87	0.20	0.20	-15.27	19.39	0.27	0.27	-2.37	2.03	0.20	0.20	-16.43	21.31	0.08	0.08	-0.76	0.30	0.34	0.34	-17.62	23.30	-0.11
9305.0	9305 L	0.51	0.51	-26.09	29.29	-0.06	-0.06	-26.60	30.14	0.06	0.06	-29.88	35.59	0.24	0.24	-24.29	26.29	0.37	0.37	-24.16	26.07	0.07	0.07	-24.03	25.85	0.34	0.34	-31.60	38.44	0.11	0.11	-21.44	21.54	0.48
	9305 R	-0.06	-0.06	-26.61	30.14	0.51	0.51	-26.10	29.29	0.27	0.27	-23.70	25.30	0.15	0.15	-30.77	37.06	0.07	0.07	-24.03	25.85	0.37	0.37	-24.16	26.08	0.11	0.11	-21.44	21.55	0.34	0.34	-31.60	38.45	-0.11
9402.0	9402 L	-13.82	-13.82	-13.62	14.67	-20.76	-20.76	-10.18	10.97	-18.64	-18.64	-18.80	20.25	-17.53	-17.53	-3.97	4.28	-17.78	-17.78	-7.84	8.44	-18.37	-18.37	-13.19	14.21	-16.71	-16.71	-19.92	21.46	-18.90	-18.90	-2.69	2.89	-10.23
	9402 R	-21.99	-21.99	-10.39	10.39	-14.65	-14.65	-13.89	13.89	-19.02	-19.02	-3.40	3.40	-19.52	-19.52	-19.48	19.48	-19.46	-19.46	-13.45	13.45	-18.83	-18.83	-8.01	8.01	-20.01	-20.01	-2.74	2.74	-17.72	-17.72	-20.32	20.32	-16.05
9407.0	9407 L	-15.29	-15.29	5.69	-5.69	-22.36	-22.36	2.82	-2.82	-17.48	-17.48	8.64	-8.64	-20.80	-20.80	0.54	-0.54	-17.57	-17.57	3.90	-3.90	-16.45	-16.45	3.59	-3.59	-20.73	-20.73	0.16	-0.16	-18.95	-18.95	9.35	-9.35	-11.32
	9407 R	-21.26	-21.26	3.49	-3.49	-14.55	-14.55	5.59	-5.59	-20.38	-20.38	0.52	-0.52	-16.05	-16.05	8.01	-8.01	-15.64	-15.64	3.52	-3.52	-16.71	-16.71	3.83	-3.83	-18.04	-18.04	9.18	-9.18	-19.71	-19.71	0.16	-0.16	-15.51
9411.0	9411 L	-14.50	-14.50	6.43	-6.43	-21.25	-21.25	3.95	-3.95	-20.33	-20.33	0.99	-0.99	-16.01	-16.01	8.74	-8.74	-16.65	-16.65	4.59	-4.59	-15.52	-15.52	4.07	-4.07	-19.32	-19.32	0.59	-0.59	-17.93	-17.93	9.94	-9.94	-10.73
	9411 R	-22.35	-22.35	4.03	-4.03	-15.24	-15.24	6.55	-6.55	-17.47	-17.47	9.47	-9.47	-21.29	-21.29	0.94	-0.94	-16.33	-16.33	4.14	-4.14	-17.51	-17.51	4.67	-4.67	-18.84	-18.84	10.12	-10.12	-20.32	-20.32	0.60	-0.60	-16.30
9416.0	9416 L	-14.60	-14.60	-8.09	8.09	-21.96	-21.96	-5.88	5.88	-18.46	-18.46	-1.20	1.20	-19.10	-19.10	-14.27	14.27	-18.16	-18.16	-5.73	5.73	-19.63	-19.63	-6.34	6.34	-18.28	-18.28	-14.84	14.84	-19.68	-19.68	-0.21	0.21	-10.81
	9416 R	-20.73	-20.73	-5.77	6.21	-13.78	-13.78	-7.93	8.54	-18.71	-18.71	-13.11	14.13	-16.04	-16.04	-3.02	3.25	-18.54	-18.54	-6.21	6.69	-17.14	-17.14	-5.62	6.05	-18.58	-18.58	-0.20	0.22	-17.24	-17.24	-14.55	15.67	-15.13
9422.0	9422 L	-11.63	-11.63	-12.98	12.98	-19.08	-19.08	-10.31	10.31	-17.08	-17.08	-17.65	17.65	-14.17	-14.17	-7.60	7.60	-15.61	-15.61	-9.40	9.40	-16.51	-16.51	-12.04	12.04	-15.29	-15.29	-19.45	19.45	-17.19	-17.19	-4.31	4.31	-8.62
	9422 R	-22.40	-22.40	-11.67	11.67	-13.67	-13.67	-14.70	14.70	-18.31	-18.31	-6.26	6.26	-18.96	-18.96	-21.34	21.34	-19.39	-19.39	-13.62	13.62	-18.32	-18.32	-10.66	10.66	-20.18	-20.18	-4.88	4.88	-17.97	-17.97	-22.02	22.02	-16.32
9427.0	9427 L	-14.39	-14.39	8.23	-8.23	-22.71	-22.71	4.85	-4.85	-16.88	-16.88	11.38	-11.38	-21.59	-21.59	2.49	-2.49	-17.24	-17.24	6.16	-6.16	-15.86	-15.86	5.99	-5.99	-20.29	-20.29	2.20	-2.20	-18.49	-18.49	12.30	-12.30	-10.64
	9427 R	-21.47	-21.47	4.75	-4.75	-13.61	-13.61	8.07	-8.07	-20.50	-20.50	2.51	-2.51	-15.29	-15.29	10.64	-10.64	-15.00	-15.00	5.87	-5.87	-16.30	-16.30	6.04	-6.04	-17.49	-17.49	12.05	-12.05	-19.17	-19.17	2.16	-2.16	-15.66
9431.0	9431 L	-13.60	-13.60	7.95	-7.95	-21.46	-21.46	5.38	-5.38	-20.47	-20.47	2.33	-2.33	-15.29	-15.29	10.52	-10.52	-16.26	-16.26	5.94	-5.94	-14.95	-14.95	5.62	-5.62	-19.26	-19.26	2.00	-2.00	-17.41	-17.41	11.90	-11.90	-10.05
	9431 R	-22.71	-22.71	5.49	-5.49	-14.37	-14.37	8.11	-8.11	-16.85	-16.85	11.27	-11.27	-21.57	-21.57	2.30	-2.30	-15.81	-15.81	5.74	-5.74	-17.20	-17.20	6.06	-6.06	-18.41	-18.41	12.15	-12.15	-20.39	-20.39	2.04	-2.04	-16.56
9436.0	9436 L	-13.57	-13.57	-15.69	15.69	-22.27	-22.27	-12.94	12.94	-18.34	-18.34	-7.09	7.09	-19.02	-19.02	-22.34	22.34	-18.23	-18.23	-11.44	11.44	-19.30	-19.30	-14.40	14.40	-18.00	-18.00	-22.97	22.97	-20.00	-20.00	-6.01	6.01	-10.05
	9436 R	-18.97	-18.97	-11.43	11.43	-11.54	-11.54	-13.86	13.86	-16.97	-16.97	-18.72	18.72	-14.23	-14.23	-8.28	8.28	-16.42	-16.42	-12.86	12.86	-15.52	-15.52	-10.09	10.09	-17.04	-17.04	-5.31	5.31	-15.32	-15.32	-20.28	20.28	-13.84
9442.0	9442 L	-13.63	-13.63	-8.17	8.17	-21.15	-21.15	-5.77	5.77	-19.00	-19.00	-13.15	13.15	-16.29	-16.29	-2.52	2.52	-17.49	-17.49	-4.76	4.76	-18.79	-18.79	-6.58	6.58	-17.42	-17.42	-14.65	14.65	-19.21	-19.21	0.64	-0.64	-10.04
	9442 R	-25.06	-25.06	-6.61	6.61	-16.16	-16.16	-9.36	9.36	-20.93	-20.93	-0.51	0.51	-21.64	-21.64	-16.17	16.17	-22.27	-22.27	-7.53	7.53	-20.73	-20.73	-5.46	5.46	-22.76	-22.76	0.74	-0.74	-20.65	-20.65	-16.78	16.78	-18.33
9447.0	9447 L	-16.69	-16.69	4.54	-4.54	-25.25	-25.25	1.54	-1.54	-19.23	-19.23	7.70	-7.70	-24.09	-24.09	-1.69	1.69	-19.59	-19.59	2.33	-2.33	-18.06	-18.06	2.18	-2.18	-22.90	-22.90	-2.06	2.06	-20.84	-20.84	8.50	-8.50	-12.29
	9447 R	-23.84	-23.84	1.51	-1.51	-15.76	-15.76	4.44	-4.44	-22.84	-22.84	-1.58	1.58	-17.49	-17.49	7.02	-7.02	-17.06	-17.06	2.13	-2.13	-18.50	-18.50	2.29	-2.29	-19.69	-19.69	8.32	-8.32	-21.61	-21.61	-2.01	2.01	-17.44
9451.0	9451 L	-15.74	-15.74	4.45	-4.45	-23.83	-23.83	0.75	-0.75	-22.85	-22.85	-1.49	1.49	-17.45	-17.45	7.02	-7.02	-18.50	-18.50	2.38	-2.38	-16.97	-16.97	2.12	-2.12	-21.65	-21.65	-1.92	1.92	-19.66	-19.66	8.34	-8.34	-11.59
	9451 R	-25.23	-25.23	0.77	-0.77	-16.66	-16.66	4.55	-4.55	-19.16	-19.16	7.70	-7.70	-24.10	-24.10	-1.60	1.60	-17.97	-17.97	2.16	-2.16	-19.59	-19.59	2.43	-2.43	-20.81	-20.81	8.51	-8.51	-22.94	-22.94	-1.96	1.96	-18.45
9456.0	9456 L	-15.98	-15.98	-9.15	9.15	-25.00	-25.00	-5.54	5.54	-20.95	-20.95	0.33	-0.33	-21.41	-21.41	-15.60	15.60	-21.02	-21.02	-4.05	4.05	-21.49	-21.49	-8.75	8.75	-20.46	-20.46	-16.23	16.23	-22.70	-22.70	1.55	-1.55	-11.78
	9456 R	-21.10	-21.10	-4.84	4.84	-13.48	-13.48	-7.99	7.99	-18.79	-18.79	-12.69	12.69	-16.25	-16.25	-1.82	1.82	-18.13	-18.13	-7.64	7.64	-17.75	-17.75	-3.52	3.52	-19.17	-19.17	1.35	-1.35	-17.25	-17.25	-14.16	14.16	-15.44
9462.0	9462 L	-10.54	-10.54	-10.14	11.68	-19.04	-19.04	-8.02	9.24	-17.36	-17.36	-14.56	16.77	-12.91	-12.91	-4.39	5.06	-14.14	-14.14	-7.26	8.37	-16.48	-16.48	-9.32	10.74	-14.70	-14.70	-16.91	19.49	-16.19	-16.19	-1.74	2.00	-7.68
	9462 R	-22.48	-22.48	-9.78	9.78	-12.44	-12.44	-12.34	12.34	-16.20	-16.20	-3.91	3.91	-19.56	-19.56	-19.11	19.11	-19.45	-19.45	-11.36	11.36	-16.69	-16.69	-8.83	8.83	-19.10	-19.10	-2.12	2.12	-17.37	-17.37	-20.59	20.59	-16.59
9467.0	9467 L	-12.24	-12.24	5.89	-5.89	-22.14	-22.14	4.14	-4.14	-15.22	-15.22	10.69	-10.69	-20.19	-20.19	0.28	-0.28	-15.61	-15.61	4.56	-4.56	-14.60	-14.60	4.28	-4.28	-17.98	-17.98	-1.13	1.13	-17.14	-17.14	11.96	-11.96	-8.88
	9467 R	-20.91	-20.91	4.06	-4.06	-11.57	-11.57	5.77	-5.77	-19.73	-19.73	1.14	-1.14	-13.58	-13.58	9.60	-9.60	-13.79	-13.79	4.19	-4.19	-14.75	-14.75	4.46	-4.46	-16.20	-16.20	11.72	-11.72	-16.98	-16.98	-1.11	1.11	-15.46
9471.0	9471 L	-11.69	-11.69	5.69	-5.69	-20.40	-20.40	4.81	-4.81	-19.04	-19.04	0.41	-0.41	-13.61	-13.61	9.56	-9.56	-14.81	-14.81	4.68	-4.68	-13.64	-13.64	4.01	-4.01	-17.07	-17.07	-0.91	0.91	-16.25	-16.25	11.30	-11.30	-8.64
	9471 R	-21.60	-21.60	4.91	-4.91	-12.36	-12.36	5.81	-5.81	-15.02	-15.02	10.22	-10.22	-19.74	-19.74	0.50	-0.50	-14.44	-14.44	4.10	-4.10	-15.68	-15.68	4.77	-4.77	-17.19	-17.19	11.53	-11.53	-18.08	-18.08	-0.93	0.93	-15.71
9476.0	9476 L	-12.20	-12.20	-12.16	12.16	-21.94	-21.94	-9.19	9.19	-16.30	-16.30	-2.95	2.95	-19.33	-19.33	-18.18	18.18	-17.11	-17.11	-6.40	6.40	-18.53	-18.53	-13.00	13.00	-16.89	-16.89	-20.32	20.32	-19.16	-19.16	-0.36	0.36	-8.98
	9476 R	-18.59	-18.59	-7.55	8.70	-10.33	-10.33	-9.99	11.51	-16.63	-16.63	-14.55	16.77	-13.34	-13.34	-3.11	3.59	-15.69	-15.69	-10.69	12.32	-14.50	-14.50	-5.24	6.04	-16.24	-16.24	-0.29	0.34	-14.30	-14.30	-16.69	19.23	-13.56
9482.0	9482 L	-9.72	-9.72	-11.90	14.61	-18.16	-18.16	-9.94	12.21	-16.46	-16.46	-16.06	19.73	-12.12	-12.12	-7.06	8.68	-13.69	-13.69	-8.33	10.24	-15.44	-15.44	-12.39	15.23	-13.84	-13.84	-18.62	22.87	-15.72	-15.72	-3.58	4.40	-7.18
	9482 R	-20.74	-20.74	-11.92	11.92	-11.11	-11.11	-14.28	14.28	-14.95	-14.95	-6.86	6.86	-18.07	-18.07	-20.31	20.31	-17.64	-17.64	-14.87	14.87	-15.64	-15.64	-10.00	10.00	-17.95	-17.95	-4.30	4.30	-15.82	-15.82	-22.34	22.34	-15.07
9487.0	9487 L	-10.80	-10.80	7.51	-7.51	-19.96	-19.96	6.41	-6.41	-13.46	-13.46	11.64	-11.64	-18.41	-18.41	2.49	-2.49	-14.13	-14.13	6.34	-6.34	-13.03	-13.03	5.56	-5.56	-16.37	-16.37	1.66	-1.66	-15.52	-15.52	12.76	-12.76	-7.97
	9487 R	-18.86	-18.86	6.29	-6.29	-10.21	-10.21	7.36	-7.36	-17.48	-17.48	2.51	-2.51	-12.03	-12.03	10.72	-10.72	-12.31	-12.31	5.45	-5.45	-13.35	-13.35	6.21	-6.21	-14.68	-14.68	12.50	-12.50	-15.46	-15.46	1.62	-1.62	-13.70
9491.0	9491 L	-10.60	-10.60	7.22	-7.22	-18.84	-18.84	6.62	-6.62	-17.29	-17.29	2.13	-2.13	-13.10	-13.10	11.96	-11.96	-13.27	-13.27	5.98	-5.98	-12.56	-12.56	5.76	-5.76	-15.07	-15.07	0.82	-0.82	-15.08	-15.08	13.04	-13.04	-7.64
	9491 R	-19.94	-19.94	6.75	-6.75	-11.21	-11.21	7.37	-7.37	-14.00	-14.00	12.33	-12.33	-18.22	-18.22	2.10	-2.10	-13.29	-13.29	5.87	-5.87	-14.04	-14.04	6.10	-6.10	-15.95	-15.95	13.31	-13.31	-15.96	-15.96	0.84	-0.84	-14.75
9496.0	9496 L	-11.53	-11.53	-14.16	14.16	-20.58	-20.58	-13.12	13.12	-14.74	-14.74	-6.68	6.68	-18.30	-18.30	-21.39	21.39	-15.31	-15.31	-11.00	11.00	-17.97	-17.97	-15.01	15.01	-16.19	-16.19	-22.75	22.75	-17.50	-17.50	-4.94	4.94	-8.37
	9496 R	-18.02	-18.02	-10.93	13.43	-10.09	-10.09	-11.80	14.50	-16.35	-16.35	-17.38	21.35	-12.47	-12.47	-6.16	7.56	-15.73	-15.73	-12.52	15.38	-13.41	-13.41	-9.15	11.24	-15.33	-15.33	-4.12	5.06	-14.16	-14.16	-18.96	23.29	-13.30
9502.0	9502 L	-10.49	-10.49	-12.07	12.78	-18.38	-18.38	-9.38	9.93	-15.80	-15.80	-17.42	18.45	-13.10	-13.10	-6.92	7.33	-14.42	-14.42	-9.44	10.00	-16.08	-16.08	-11.66	12.35	-13.78	-13.78	-19.38	20.53	-16.61	-16.61	-3.51	3.72	-7.72
	9502 R	-20.38	-20.38	-10.27	10.27	-11.64	-11.64	-13.21	13.21	-16.58	-16.58	-4.94	4.94	-16.43	-16.43	-20.48	20.48	-17.83	-17.83	-12.62	12.62	-16.01	-16.01	-10.35	10.35	-18.42	-18.42	-3.84	3.84	-15.30	-15.30	-21.21	21.21	-14.87
9507.0	9507 L	-12.26	-12.26	8.15	-8.15	-20.75	-20.75	5.03	-5.03	-14.99	-14.99	11.87	-11.87	-19.25	-19.25	2.03	-2.03	-15.16	-15.16	5.77	-5.77	-13.92	-13.92	5.50	-5.50	-18.87	-18.87	1.63	-1.63	-15.91	-15.91	12.45	-12.45	-9.01
	9507 R	-19.77	-19.77	4.95	-4.95	-11.69	-11.69	8.01	-8.01	-18.58	-18.58	2.16	-2.16	-14.17	-14.17	11.57	-11.57	-13.26	-13.26	5.41	-5.41	-14.44	-14.44	5.67	-5.67	-15.17	-15.17	12.24	-12.24	-17.97	-17.97	1.60	-1.60	-14.43
9511.0	9511 L	-11.61	-11.61	7.69	-7.69	-19.87	-19.87	5.03	-5.03	-18.78	-18.78	2.32	-2.32	-13.40	-13.40	10.76	-10.76	-14.46	-14.46	5.59	-5.59	-13.34	-13.34	5.39	-5.39	-17.76	-17.76	1.71	-1.71	-15.34	-15.34	12.08	-12.08	-8.52
	9511 R	-20.86	-20.86	5.12	-5.12	-12.18	-12.18	7.82	-7.82	-14.82	-14.82	11.67	-11.67	-19.56	-19.56	2.23	-2.23	-13.99	-13.99	5.48	-5.48	-15.18	-15.18	5.68	-5.68	-16.09	-16.09	12.28	-12.28	-18.64	-18.64	1.74	-1.74	-15.23
9516.0	9516 L	-11.38	-11.38	-13.93	13.93	-20.81	-20.81	-9.23	9.23	-16.64	-16.64	-4.88	4.88	-16.93	-16.93	-20.75	20.75	-16.73	-16.73	-9.05	9.05	-17.56	-17.56	-14.70	14.70	-15.02	-15.02	-22.13	22.13	-18.84	-18.84	-3.36	3.36	-8.34
	9516 R	-18.76	-18.76	-8.43	8.93	-10.25	-10.25	-12.73	13.48	-16.18	-16.18	-17.72	18.77	-13.14	-13.14	-6.99	7.41	-15.82	-15.82	-13.45	14.25	-15.09	-15.09	-8.25	8.74	-16.99	-16.99	-3.07	3.26	-13.53	-13.53	-20.22	21.42	-13.71
9522.0	9522 L	-5.57	-5.57	-17.91	17.00	-12.58	-12.58	-15.66	14.86	-11.26	-11.26	-22.07	20.95	-6.96	-6.96	-15.53	14.74	-8.85	-8.85	-14.55	13.81	-10.26	-10.26	-19.72	18.72	-8.46	-8.46	-23.93	22.72	-11.02	-11.02	-11.59	11.00	-4.17
	9522 R	-13.97	-13.97	-16.36	16.36	-6.20	-6.20	-18.70	18.70	-9.62	-9.62	-13.95	13.95	-11.56	-11.56	-24.10	24.10	-11.40	-11.40	-20.59	20.59	-9.83	-9.83	-15.19	15.19	-12.23	-12.23	-12.10	12.10	-9.41	-9.41	-24.99	24.99	-10.19
9527.0	9527 L	-7.03	-7.03	10.96	-10.96	-14.28	-14.28	8.74	-8.74	-9.51	-9.51	13.98	-13.98	-13.13	-13.13	6.79	-6.79	-10.07	-10.07	9.35	-9.35	-9.02	-9.02	8.83	-8.83	-12.74	-12.74	6.49	-6.49	-10.25	-10.25	14.36	-14.36	-5.25
	9527 R	-13.73	-13.73	8.62	-8.62	-6.77	-6.77	10.81	-10.81	-12.93	-12.93	6.93	-6.93	-8.41	-8.41	13.23	-13.23	-8.68	-8.68	8.70	-8.70	-9.68	-9.68	9.23	-9.23	-9.87	-9.87	14.16	-14.16	-12.24	-12.24	6.40	-6.40	-10.00
9531.0	9531 L	-6.80	-6.80	11.11	-11.11	-13.82	-13.82	9.03	-9.03	-13.08	-13.08	7.43	-7.43	-8.37	-8.37	13.44	-13.44	-9.47	-9.47	9.41	-9.41	-8.92	-8.92	9.14	-9.14	-12.18	-12.18	6.79	-6.79	-9.94	-9.94	14.41	-14.41	-5.06
	9531 R	-14.39	-14.39	9.15	-9.15	-7.07	-7.07	11.26	-11.26	-9.43	-9.43	14.21	-14.21	-13.35	-13.35	7.31	-7.31	-9.28	-9.28	9.27	-9.27	-9.85	-9.85	9.53	-9.53	-10.33	-10.33	14.61	-14.61	-12.68	-12.68	6.88	-6.88	-10.51
9536.0	9536 L	-6.22	-6.22	-18.08	18.08	-14.05	-14.05	-15.03	15.03	-10.12	-10.12	-12.17	12.17	-11.35	-11.35	-23.23	23.23	-8.72	-8.72	-15.98	15.98	-11.23	-11.23	-14.89	14.89	-9.48	-9.48	-24.13	24.13	-12.25	-12.25	-10.66	10.66	-4.66
	9536 R	-12.65	-12.65	-14.36	13.63	-5.59	-5.59	-17.31	16.44	-11.40	-11.40	-20.73	19.68	-6.83	-6.83	-14.76	14.01	-10.13	-10.13	-14.37	13.64	-7.83	-7.83	-15.23	14.46	-11.04	-11.04	-10.21	9.69	-8.52	-8.52	-23.11	21.94	-9.20
9542.0	9542 L	-11.34	-11.34	-5.86	6.15	-17.46	-17.46	-5.51	5.79	-16.47	-16.47	-10.72	11.25	-12.04	-12.04	-4.71	4.95	-13.93	-13.93	-4.94	5.19	-15.89	-15.89	-7.61	7.99	-14.28	-14.28	-12.07	12.67	-15.72	-15.72	-1.05	1.10	-8.39
	9542 R	-19.32	-19.32	-5.97	5.97	-12.55	-12.55	-6.33	6.33	-15.01	-15.01	-2.96	2.96	-17.71	-17.71	-12.15	12.15	-17.58	-17.58	-8.23	8.23	-15.41	-15.41	-5.35	5.35	-17.38	-17.38	-1.13	1.13	-15.81	-15.81	-13.06	13.06	-14.11
9547.0	9547 L	-13.22	-13.22	5.42	-5.42	-19.66	-19.66	4.09	-4.09	-15.68	-15.68	8.64	-8.64	-18.49	-18.49	1.98	-1.98	-17.81	-17.81	4.14	-4.14	-15.97	-15.97	4.22	-4.22	-17.91	-17.91	1.57	-1.57	-16.37	-16.37	9.01	-9.01	-9.75
	9547 R	-18.93	-18.93	4.04	-4.04	-12.73	-12.73	5.35	-5.35	-17.89	-17.89	2.04	-2.04	-14.39	-14.39	8.01	-8.01	-15.37	-15.37	4.17	-4.17	-17.14	-17.14	4.09	-4.09	-15.77	-15.77	8.90	-8.90	-17.24	-17.24	1.55	-1.55	-13.85
9551.0	9551 L	-13.06	-13.06	5.32	-5.32	-18.94	-18.94	4.32	-4.32	-18.05	-18.05	2.27	-2.27	-14.18	-14.18	7.46	-7.46	-16.54	-16.54	4.26	-4.26	-16.21	-16.21	4.20	-4.20	-17.40	-17.40	1.81	-1.81	-15.84	-15.84	8.74	-8.74	-9.67
	9551 R	-19.68	-19.68	4.37	-4.37	-13.56	-13.56	5.38	-5.38	-15.73	-15.73	8.41	-8.41	-18.68	-18.68	2.23	-2.23	-16.84	-16.84	4.25	-4.25	-17.19	-17.19	4.32	-4.32	-16.44	-16.44	8.85	-8.85	-18.08	-18.08	1.84	-1.84	-14.39
9556.0	9556 L	-12.80	-12.80	-12.29	12.29	-19.18	-19.18	-8.45	8.45	-16.00	-16.00	-5.81	5.81	-17.38	-17.38	-15.96	15.96	-15.40	-15.40	-11.55	11.55	-17.76	-17.76	-8.88	8.88	-15.63	-15.63	-17.54	17.54	-17.68	-17.68	-4.50	4.50	-9.48
	9556 R	-17.32	-17.32	-7.79	8.18	-11.56	-11.56	-11.36	11.93	-16.42	-16.42	-13.69	14.37	-13.15	-13.15	-7.38	7.75	-16.05	-16.05	-8.26	8.67	-13.91	-13.91	-10.55	11.07	-15.98	-15.98	-4.16	4.37	-14.11	-14.11	-16.21	17.01	-12.66

Made By: WME 8/5/11 Checked By: MTB 8/5/11 BackChecked By: WME 8/5/11

ss Values for Web Splice Calculations

		SERVICE II																														
		MAX FX			MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ			
Splice	Splice	Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
Node	Side	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
1007.0	1007 L	0.13	-26.16	20.89	-0.16	-0.16	-32.33	30.91	0.08	0.08	-26.79	21.91	-0.15	-0.15	-31.98	30.34	-0.10	-0.10	-24.92	18.87	0.07	0.07	-31.01	28.77	0.05	0.05	-33.37	32.61	-0.10	-0.10	-24.00	17.39
	1007 R	-0.16	-32.33	30.91	0.13	0.13	-26.16	20.89	-0.15	-0.15	-31.85	30.13	0.08	0.08	-28.00	23.88	0.07	0.07	-31.01	28.77	-0.10	-0.10	-24.92	18.87	-0.10	-0.10	-24.00	17.39	0.05	0.05	-33.37	32.61
1015.0	1015 L	0.13	-4.96	2.95	-0.16	-0.16	-9.69	10.64	0.06	0.06	-7.15	6.51	-0.10	-0.10	-10.50	11.94	0.10	0.10	-2.10	-1.70	-0.13	-0.13	-11.12	12.95	-0.12	-0.12	-12.29	14.85	0.09	0.09	-1.02	-3.45
	1015 R	-0.20	-10.97	16.17	0.13	0.13	-5.65	4.62	-0.13	-0.13	-11.24	16.75	0.04	0.04	-8.54	10.90	-0.16	-0.16	-12.14	18.70	0.09	0.09	-2.50	-2.22	0.09	0.09	-1.34	-4.74	-0.16	-0.16	-13.39	21.43
1021.0	1021 L	10.25	4.44	-5.50	7.53	7.53	1.82	-0.40	8.95	8.95	0.75	1.67	9.20	9.20	4.58	-5.78	9.31	9.31	4.38	-5.38	9.05	9.05	3.37	-3.42	8.33	8.33	0.15	2.84	10.38	10.38	11.19	-11.42
	1021 R	9.78	2.25	-0.39	13.02	13.02	4.84	-6.54	11.76	11.76	5.35	-7.74	11.47	11.47	0.89	2.83	11.60	11.60	3.79	-4.03	11.91	11.91	4.82	-6.50	13.42	13.42	12.69	-14.02	10.75	10.75	0.47	3.85
1035.0	1035 L	13.02	12.85	-15.88	9.78	9.78	11.32	-12.25	11.41	11.41	13.44	-17.27	11.82	11.82	9.37	-7.61	11.71	11.71	11.86	-13.53	11.75	11.75	11.92	-13.68	11.00	11.00	8.62	-5.82	13.06	13.06	19.66	-21.07
	1035 R	7.53	9.70	-9.76	10.25	10.25	11.31	-12.89	9.24	9.24	8.09	-6.63	9.21	9.21	10.51	-11.34	9.18	9.18	10.36	-11.05	9.15	9.15	10.30	-10.93	10.11	10.11	17.04	-16.98	8.55	8.55	7.16	-4.82
1041.0	1041 L	1.20	9.75	-11.29	-0.58	-0.58	5.73	-9.58	0.11	0.11	4.32	-6.50	-0.05	-0.05	5.27	-8.57	0.39	0.39	16.97	-19.38	0.01	0.01	3.14	-3.95	0.23	0.23	1.96	-1.38	0.12	0.12	19.19	-21.86
	1041 R	-0.65	6.29	-12.12	1.55	1.55	11.92	-14.38	0.00	0.00	11.41	-13.80	0.15	0.15	4.52	-7.62	0.05	0.05	3.48	-5.00	0.51	0.51	21.01	-24.88	0.17	0.17	23.81	-28.12	0.31	0.31	2.18	-1.70
1051.0	1051 L	1.10	3.52	-2.34	-0.65	-0.65	5.24	-6.72	-0.22	-0.22	5.14	-6.46	0.38	0.38	1.80	2.01	0.47	0.47	9.06	-16.40	0.00	0.00	0.97	4.12	0.61	0.61	-0.76	8.52	-0.19	-0.19	20.14	-22.73
	1051 R	-0.65	4.81	-6.04	1.04	1.04	3.17	-2.11	0.35	0.35	1.72	1.35	-0.32	-0.32	3.98	-4.05	-0.02	-0.02	0.66	3.88	0.43	0.43	8.60	-15.11	-0.19	-0.19	18.56	-20.75	0.56	0.56	-1.03	7.93
1057.0	1057 L	9.21	7.44	-8.97	6.43	6.43	5.16	-4.39	8.09	8.09	3.83	-1.70	8.27	8.27	6.98	-8.06	8.33	8.33	6.91	-7.91	8.05	8.05	6.47	-7.02	7.62	7.62	2.86	0.25	8.52	8.52	9.68	-13.50
	1057 R	6.74	5.23	-4.50	9.62	9.62	7.47	-9.20	8.56	8.56	8.57	-11.50	8.46	8.46	3.69	-1.28	8.42	8.42	6.51	-7.20	8.70	8.70	6.95	-8.11	8.89	8.89	9.72	-13.92	7.97	7.97	2.91	0.36
1071.0	1071 L	9.62	6.19	-7.26	6.74	6.74	4.11	-2.89	8.47	8.47	5.92	-6.70	8.56	8.56	2.51	0.45	8.56	8.56	5.66	-6.15	8.55	8.55	5.10	-4.98	8.06	8.06	1.74	2.07	8.86	8.86	8.24	-11.55
	1071 R	6.43	4.05	-2.84	9.21	9.21	6.17	-7.12	8.19	8.19	2.66	-0.03	8.11	8.11	5.60	-5.95	8.18	8.18	5.07	-4.90	8.19	8.19	5.63	-6.02	8.49	8.49	8.21	-11.22	7.70	7.70	1.71	1.89
1077.0	1077 L	1.04	-8.44	7.86	-0.63	-0.63	-6.97	4.35	0.35	0.35	-9.17	9.62	-0.25	-0.25	-7.85	6.44	0.27	0.27	5.15	-7.59	0.15	0.15	-10.97	13.91	0.51	0.51	-12.20	16.87	-0.23	-0.23	7.79	-10.60
	1077 R	-0.57	-6.05	3.43	0.95	0.95	-7.36	6.00	-0.22	-0.22	-6.38	4.07	0.33	0.33	-8.35	7.95	0.14	0.14	-9.88	10.95	0.24	0.24	4.89	-6.06	-0.18	-0.18	7.24	-8.38	0.47	0.47	-11.05	13.27
1089.0	1089 L	0.95	1.73	-0.33	-0.57	-0.57	4.62	-6.02	0.07	0.07	3.04	-2.91	0.11	0.11	0.47	2.16	0.21	0.21	7.32	-11.32	0.16	0.16	-0.76	4.58	0.25	0.25	-2.09	7.19	0.10	0.10	15.49	-15.08
	1089 R	-0.60	4.48	-6.59	0.95	0.95	1.55	-0.25	0.08	0.08	0.57	1.89	0.05	0.05	2.39	-2.07	0.14	0.14	-0.88	5.03	0.20	0.20	7.11	-12.30	0.07	0.07	14.78	-16.31	0.25	0.25	-2.20	7.89
1095.0	1095 L	10.58	8.18	-9.66	7.56	7.56	6.35	-6.00	9.36	9.36	5.02	-3.31	9.42	9.42	7.93	-9.16	9.49	9.49	8.01	-9.33	9.34	9.34	7.52	-8.33	8.68	8.68	3.95	-1.16	10.62	10.62	15.00	-15.95
	1095 R	8.03	6.17	-5.80	11.18	11.18	7.91	-9.40	9.97	9.97	9.18	-12.03	9.90	9.90	4.67	-2.71	9.89	9.89	7.28	-8.10	10.04	10.04	7.76	-9.09	11.25	11.25	14.52	-15.49	9.20	9.20	3.82	-0.95
1109.0	1109 L	11.18	9.94	-11.86	8.03	8.03	7.34	-6.49	9.91	9.91	10.82	-13.69	9.90	9.90	5.87	-3.44	10.20	10.20	9.32	-10.58	9.74	9.74	8.63	-9.15	9.20	9.20	5.14	-1.94	11.30	11.30	15.93	-16.83
	1109 R	7.56	7.57	-6.73	10.59	10.59	10.28	-12.18	9.35	9.35	6.25	-4.09	9.42	9.42	9.67	-10.95	9.20	9.20	8.91	-9.44	9.64	9.64	9.63	-10.88	10.66	10.66	16.46	-17.34	8.68	8.68	5.31	-2.20
1115.0	1115 L	1.47	6.06	-7.45	-0.70	-0.70	0.94	-3.11	0.24	0.24	-0.83	0.73	-0.14	-0.14	1.65	-4.66	0.64	0.64	14.20	-16.57	-0.12	-0.12	-1.92	3.09	0.56	0.56	-3.29	6.07	-0.17	-0.17	16.76	-19.44
	1115 R	-0.73	0.54	-3.22	1.67	1.67	7.21	-8.19	-0.11	-0.11	1.88	-6.10	0.29	0.29	-1.60	1.38	-0.11	-0.11	-2.54	3.41	0.73	0.73	17.11	-18.22	-0.16	-0.16	20.21	-21.37	0.63	0.63	-4.02	6.60
1127.0	1127 L	1.22	-0.95	1.60	-0.73	-0.73	0.35	-1.20	-0.26	-0.26	0.67	-1.90	0.39	0.39	-3.35	6.77	0.36	0.36	2.51	-5.85	0.10	0.10	-2.88	5.75	0.54	0.54	-4.86	10.02	0.04	0.04	4.31	-9.73
	1127 R	-0.77	0.37	-1.50	1.26	1.26	-1.05	2.03	0.36	0.36	-3.10	7.13	-0.29	-0.29	0.19	-1.05	0.09	0.09	-2.93	6.68	0.37	0.37	2.48	-6.75	0.03	0.03	4.31	-11.30	0.61	0.61	-4.95	11.70
1133.0	1133 L	9.37	5.90	-6.42	6.34	6.34	4.00	-2.92	8.23	8.23	3.01	-1.10	8.15	8.15	6.16	-6.90	8.10	8.10	4.39	-3.64	8.12	8.12	5.81	-6.26	7.67	7.67	2.03	0.70	8.41	8.41	8.22	-10.70
	1133 R	8.26	4.81	-3.90	11.86	11.86	6.65	-8.24	10.39	10.39	7.27	-9.69	10.49	10.49	3.51	-0.86	10.38	10.38	6.62	-8.17	10.35	10.35	5.13	-4.67	10.71	10.71	9.13	-14.07	9.85	9.85	2.69	1.09
1147.0	1147 L	11.87	10.00	-12.63	8.26	8.26	7.21	-6.07	10.45	10.45	9.51	-11.49	9.96	9.96	5.38	-1.76	10.99	10.99	8.22	-8.45	9.80	9.80	8.63	-9.40	9.48	9.48	4.60	0.08	12.09	12.09	16.86	-18.09
	1147 R	6.34	5.98	-4.54	9.37	9.37	8.77	-9.69	7.79	7.79	4.45	-1.73	8.18	8.18	7.98	-8.22	7.64	7.64	7.39	-7.14	8.63	8.63	7.04	-6.50	8.73	8.73	10.47	-12.82	7.35	7.35	3.53	-0.02
1153.0	1153 L	2.22	6.40	-8.43	-0.86	-0.86	-2.31	1.49	0.48	0.48	-2.54	2.06	-0.18	-0.18	-0.87	-2.10	1.39	1.39	11.74	-14.56	-0.19	-0.19	-3.35	4.05	0.46	0.46	-5.34	9.00	0.66	0.66	15.96	-19.42
	1153 R	-0.86	-2.78	1.71	2.39	2.39	6.74	-9.17	-0.07	-0.07	-0.57	-4.15	0.50	0.50	-3.24	2.93	-0.17	-0.17	-3.82	4.49	1.50	1.50	12.56	-15.95	0.72	0.72	17.18	-21.34	0.50	0.50	-5.86	9.91
1163.0	1163 L	1.69	1.01	-1.24	-0.86	-0.86	0.07	1.26	-0.17	-0.17	1.11	-1.51	0.63	0.63	-1.06	4.27	1.38	1.38	3.10	-6.81	-0.46	-0.46	-0.54	2.88	0.66	0.66	-3.59	10.99	0.40	0.40	5.85	-14.13
	1163 R	-0.84	-0.04	1.35	1.59	1.59	0.94	-1.16	0.60	0.60	-0.84	3.39	-0.26	-0.26	0.39	0.25	-0.45	-0.45	-0.56	2.68	1.29	1.29	2.94	-6.26	0.36	0.36	5.57	-12.94	0.61	0.61	-3.47	10.07
1169.0	1169 L	8.57	6.68	-7.28	5.88	5.88	4.76	-3.71	7.25	7.25	2.98	-0.41	7.59	7.59	6.63	-7.19	7.86	7.86	5.28	-4.68	7.12	7.12	6.11	-6.22	6.94	6.94	2.24	0.96	7.93	7.93	8.73	-11.08
	1169 R	7.75	5.58	-5.15	10.98	10.98	7.45	-9.81	9.79	9.79	7.74	-10.52	9.37	9.37	3.50	0.02	9.24	9.24	6.93	-8.50	10.12	10.12	6.03	-6.26	11.08	11.08	15.04	-16.52	9.05	9.05	2.91	1.49
1183.0	1183 L	10.98	6.80	-7.97	7.75	7.75	5.02	-3.53	9.71	9.71	7.33	-9.28	9.75	9.75	3.82	-0.55	9.63	9.63	5.68	-5.18	9.70	9.70	6.88	-8.16	9.10	9.10	2.97	1.56	10.12	10.12	9.20	-13.93
	1183 R	5.88	4.17	-2.55	8.57	8.57	5.99	-5.93	7.56	7.56	3.24	-0.83	7.53	7.53	6.18	-6.28	7.50	7.50	6.03	-5.99	7.44	7.44	4.87	-3.85	7.86	7.86	8.27	-10.15	6.99	6.99	2.25	1.02
1189.0	1189 L	1.47	-6.59	4.78	-0.68	-0.68	-5.81	2.81	0.55	0.55	-7.90	8.11	-0.20	-0.20	-5.19	1.21	0.68	0.68	2.21	-4.36	0.23	0.23	-6.91	5.60	0.74	0.74	-9.74	12.80	0.08	0.08	8.94	-12.14
	1189 R	-0.60	-5.46	2.70	1.39	1.39	-6.19	4.80	-0.06	-0.06	-4.44	-0.23	0.52	0.52	-7.50	8.55	0.24	0.24	-6.44	5.52	0.57	0.57	-3.53	-2.84	0.08	0.08	8.43	-12.04	0.73	0.73	-8.93	12.65
1199.0	1199 L	1.61	2.31	-2.19	-0.80	-0.80	2.56	-2.90	0.07	0.07	4.20	-7.61	0.52	0.52	-0.15	4.87	0.72	0.72	7.18	-16.18	0.11	0.11	-1.07	7.52	1.02	1.02	-2.42	11.39	-0.31	-0.31	18.03	-21.84
	1199 R	-0.78	2.48	-2.42	1.51	1.51	2.32	-2.02	0.44	0.44	0.21	3.31	0.04	0.04	3.68	-5.48	0.08	0.08	-1.03	6.47	0.67	0.67	7.04	-13.98	-0.30	-0.30	17.47	-18.72	0.95	0.95	-2.31	9.69
1205.0	1205 L	9.74	7.55	-9.06	6.29	6.29	5.00	-3.83	8.28	8.28	3.62	-0.99	8.22	8.22	8.13	-10.23	8.58	8.58	6.88	-7.68	8.11	8.11	5.92	-5.71	7.57	7.57	2.83	0.63	9.86	9.86	14.62	-14.27
	1205 R	7.55	5.10	-4.26	11.42	11.42	7.48	-10.12	9.71	9.71	8.35	-12.27	10.05	10.05	3.63	-0.62	9.59	9.59	5.93	-6.29	10.11	10.11	6.87	-8.61	11.70	11.70	15.00	-16.33	9.01	9.01	2.85	1.31
1219.0	1219 L	11.42	7.57	-8.90	7.55	7.55	5.95	-4.90	10.17	10.17	9.17	-12.85	9.64	9.64	4.17	-0.51	9.99	9.99	7.52	-8.78	9.71	9.71	6.79	-6.97	8.96	8.96	3.51	1.12	11.75	11.75	15.40	-16.57
	1219 R	6.29	5.76	-4.37	9.74	9.74	7.54	-8.02	7.91	7.91	4.07	-0.89	8.64	8.64	8.87	-10.75	8.22	8.22	6.69	-6.28	8.47	8.47	7.43	-7.79	9.07	9.07	10.14	-13.33	7.52	7.52	3.40	0.48
1225.0	1225 L	1.38	-4.38	3.24	-0.88	-0.88	-2.14	-2.43	-0.01	-0.01	-5.01	4.86	0.09	0.09	-3.37	0.69	0.38	0.38	11.94	-14.19	0.18	0.18	-6.67	9.05	0.22	0.22	-8.09	12.65	0.32	0.32	15.36	-17.89
	1225 R	-0.81	-1.51	-2.37	1.30	1.30	-3.60	2.90	0.25	0.25	-0.77	-4.22	0.03	0.03	-4.46	5.06	0.18	0.18	-5.76	8.32	0.36	0.36	10.59	-13.06	0.31	0.31	13.57	-16.45	0.21	0.21	-7.09	11.68
1234.0	1234 L	1.30	-2.32	3.12	-0.81	-0.81	-1.73	1.63	-0.33	-0.33	-2.11	2.58	0.39	0.39	-4.21	7.87	0.27	0.27	2.15	-8.14	0.44	0.44	-5.18	10.31	0.47	0.47	-6.91	14.66	0.15	0.15	3.11	-10.56
	1234 R	-0.78	-1.67	1.64	1.23	1.23	-2.18	2.93	0.38	0.38	-3.84	7.17	-0.33	-0.33	-2.37	3.41	0.41	0.41	-4.85	9.73	0.25	0.25	2.01	-7.70	0.13	0.13	2.91	-9.98	0.44	0.44	-6.47	13.84
1242.0	1242 L	7.74	3.90	-5.35	4.92	4.92	2.27	-1.85	6.57	6.57	1.59	-0.40	6.63	6.63	4.12	-5.82	6.59	6.59	3.89	-5.34	6.59	6.59	1.93	-1.14	6.02	6.02	0.47	2.00	7.13	7.13	5.71	-9.24
	1242 R	4.96	2.28	-1.78	7.79	7.79	3.87	-5.09	6.67	6.67	4.21	-5.79	6.63	6.63	1.41	0.01	6.64	6.64	1.93	-1.05	6.64	6.64	3.88	-5.11	7.18	7.18	5.69	-8.87	6.07	6.07	0.48	1.96
1253.0	1253 L	7.79	5.65	-7.09	4.96	4.96	3.35	-2.31	6.78	6.78	6.21	-8.25	6.62	6.62	2.12	0.25	6.75	6.75	5.38	-6.53	6.55	6.55	4.05	-3.76	6.19	6.19	1.49	1.55	7.02	7.02	7.33	-10.58
	1253 R	4.92	3.33	-2.41	7.74	7.74	5.64	-7.38	6.57	6.57	2.17	0.06	6.74	6.74	5.95	-8.04	6.50	6.50	4.03	-3.93	6.70	6.70	5.37	-6.79	6.97	6.97	7.33	-10.99	6.14	6.14	1.47	1.57
1261.0	1261 L	1.26	-3.88	2.43	-0.82	-0.82	-2.16	-1.93	0.49	0.49	-5.13	5.60	-0.29	-0.29	-2.86	-0.16	0.44	0.44	10.60	-13.28	0.02	0.02	-5.81	7.35	0.72	0.72	-7.72	12.19	-0.33	-0.33	14.30	-17.49
	1261 R	-0.81	-2.84	-1.71	1.29	1.29	-4.53	2.40	-0.27	-0.27	-3.35	-0.48	0.52	0.52	-6.08	6.16	0.04	0.04	-6.54	7.29	0.47	0.47	11.40	-13.11	-0.33	-0.33	15.42	-17.25	0.74	0.74	-8.47	11.98
1272.0	1272 L	1.83	13.85	-14.57	-1.44	-1.44	14.98	-15.74	0.05	0.05	13.64	-14.36	0.00	0.00	6.70	-9.61	0.18	0.18	24.19	-25.23	0.26	0.26	5.47	-6.61	0.33	0.33	4.17	-3.45	0.13	0.13	26.20	-27.30
	1272 R	-0.75	7.79	-13.03	1.53	1.53	11.42	-13.05	-0.02	-0.02	6.07	-8.96	0.09	0.09	6.96	-11.06	0.20	0.20	4.80	-5.96	0.14	0.14	19.91	-22.59	0.10	0.10	21.56	-24.44	0.27	0.27	3.59	-3.11
1280.0	1280 L	9.52	10.39	-11.61	6.61	6.61	9.46	-10.02	8.27	8.27	8.14	-7.77	8.15	8.15	10.66	-12.06	8.30	8.30	11.00	-12.65	8.49	8.49	8.44	-8.28	7.78	7.78	7.04	-5.90	9.10	9.10	14.99	-15.55
	1280 R	7.81	10.60	-11.31	11.11	11.11	11.51	-12.98	9.56	9.56	12.00	-13.88	9.70	9.70	8.99	-8.36	9.94	9.94	9.50	-9.29	9.73	9.73	12.17	-14.19	10.72	10.72	16.65	-17.36	9.14	9.14	8.07	-6.66
1290.0	1290 L	11.11	5.07	-6.40	7.81	7.81	1.50	0.16	9.89	9.89	5.68	-7.51	9.63	9.63	0.62	1.78	9.62	9.62	4.93	-6.14	9.82	9.82	2.98	-2.56	8.74	8.74	-0.03	2.97	11.13	11.13	10.51	-11.12
	1290 R	6.61	1.06	0.29	9.52	9.52	4.53	-5.63	8.22	8.22	0.42	1.38	8.46	8.46	4.96	-6.37	8.38	8.38	2.51	-2.18	8.21	8.21	4.38	-5.38	8.95	8.95	6.70	-9.32	7.42	7.42	-0.40	2.78
1298.0	1298 L	0.40	-7.19	6.74	-0.35	-0.35	-13.06	17.75	-0.16	-0.16	-14.02	19.54	0.13	0.13	-11.11	14.09	0.30	0.30	-6.85	6.09	-0.24	-0.24	-12.48	16.64	-0.22	-0.22	-16.42	24.04	0.27	0.27	-3.42	-0.33
	1298 R	-0.29	-10.46	13.49	0.33	0.33	-5.36	5.00	0.11	0.11	-8.49	10.21	-0.13	-0.13	-11.40	15.04	-0.20	-0.20	-9.95	12.64	0.24	0.24	-5.07	4.51	0.22	0.22	-2.11	-0.41	-0.18	-0.18	-13.36	18.30
1307.0	1307 L	0.33	-20.37	21.37	-0.29	-0.29	-25.39	29.73	-0.19	-0.19	-26.00	30.74	0.20	0.20	-20.69	21.91	-0.20	-0.20	-25.08	29.21	0.25	0.25	-20.31	21.27	0.15	0.15	-27.11	32.58	-0.12	-0.12	-18.47	18.22
	1307 R	-0.29	-25.39	29.73	0.33	0.33	-20.37	21.37	0.20	0.20	-20.30	21.27	-0.19	-0.19	-26.39	31.38	0.25	0.25	-20.31	21.27	-0.20	-0.20	-25.08	29.21	-0.12	-0.12	-18.47	18.22	0.15	0.15	-27.11	32.58
1402.0	1402 L	-10.48	-8.29	8.93	-15.40	-15.40	-4.63	4.99	-13.83	-13.83	-11.75	12.66	-13.14	-13.14	-0.89	0.96	-13.49	-13.49	-7.98	8.60	-13.40	-13.40	-3.64	3.92	-12.49	-12.49	-12.68	13.65	-14.05	-14.05	-0.04	0.05
	1402 R	-16.31	-4.73	4.73	-11.10	-11.10	-8.46	8.46	-14.25	-14.25	-0.46	0.46	-14.38	-14.38	-12.33	12.33	-14.19	-14.19	-3.72	3.72	-14.29	-14.29	-8.14	8.14	-14.87	-14.87	-0.04	0.04	-13.24	-13.24	-12.93	12.93
1407.0	1407 L	-11.37	2.98	-2.98	-16.43	-16.43	0.47	-0.47	-12.91	-12.91	4.98	-4.98	-15.63	-15.63	-1.19	1.19	-12.90	-12.90	2.63	-2.63	-14.41	-14.41	0.16	-0.16	-15.32	-15.32	-1.33	1.33	-13.87	-13.87	5.47	-5.47
	1407 R	-15.62	0.47	-0.47	-10.82	-10.82	2.93	-2.93	-15.00	-15.00	-1.07	1.07	-11.87	-11.87	4.56	-4.56	-13.70	-13.70	0.17	-0.17	-12.26	-12.26	2.58	-2.58	-13.19	-13.19	5.37	-5.37	-14.56	-14.56	-1.30	1.30
1411.0	1411 L	-10.66	3.49	-3.49	-15.56	-15.56	1.27	-1.27	-14.95	-14.95	-0.52	0.52	-11.72	-11.72	5.19	-5.19	-11.88	-11.88	3.51	-3.51	-13.86	-13.86	1.08	-1.08	-14.17	-14.17	-0.89	0.89	-13.05	-13.05	6.00	-6.00
	1411 R	-16.37	1.30	-1.30	-11.21	-11.21	3.56	-3.56	-12.76	-12.76	5.61	-5.61	-15.66	-15.66	-0.58	0.58	-14.58	-14.58	1.05	-1.05	-12.49	-12.49	3.60	-3.60	-13.72	-13.72	6.11	-6.11	-14.91	-14.91	-0.91	0.91
1416.0	1416 L	-10.83	-3.39	3.39	-16.26	-16.26	-1.19	1.19	-13.84	-13.84	2.29	-2.29	-13.94	-13.94	-7.70	7.70	-14.46	-14.46	-2.20	2.20	-13.45	-13.45	-0.99	0.99	-13.43	-13.43	-8.07	8.07	-14.64	-14.64	2.96	-2.96
	1416 R	-15.35	-1.17	1.25	-10.22	-10.22	-3.32	3.58	-13.56	-13.56	-7.07	7.61	-12.43	-12.43	1.31	-1.41	-12.70	-12.70	-0.99	1.07	-13.66	-13.66	-2.06	2.22	-13.83	-13.83	2.90	-3.13	-12.67	-12.67	-7.91	8.52
1422.0	1422 L	-8.30	-8.99	8.99	-13.70	-13.70	-6.39	6.39	-11.86	-11.86	-12.52	12.52	-10.68	-10.68	-3.75	3.75	-11.56	-11.56	-8.18	8.18	-11.28	-11.28	-5.54	5.54	-10.86	-10.86	-13.48	13.48	-12.37	-12.37	-2.04	2.04
	1422 R	-16.08	-7.24	7.24	-9.76	-9.76	-10.19	10.19	-13.31	-13.31	-3.16	3.16	-13.39	-13.39	-14.85	14.85	-13.25	-13.25	-6.28	6.28	-13.57	-13.57	-9.31	9.31	-14.52	-14.52	-2.31	2.31	-12.76	-12.76	-15.27	15.27
1427.0	1427 L	-10.15	5.83	-5.83	-16.16	-16.16	2.88	-2.88	-11.92	-11.92	8.07	-8.07	-15.39	-15.39	1.18	-1.18	-11.61	-11.61	5.83	-5.83	-14.09	-14.09	2.35	-2.35	-14.48	-14.48	0.98	-0.98	-12.97	-12.97	8.62	-8.62
	1427 R	-15.27	2.83	-2.83	-9.60	-9.60	5.71	-5.71	-14.60	-14.60	1.21	-1.21	-10.79	-10.79	7.51	-7.51	-13.32	-13.32	2.35	-2.35	-10.97	-10.97	5.68	-5.68	-12.27	-12.27	8.44	-8.44	-13.68	-13.68	0.96	-0.96
1431.0	1431 L	-9.63	5.58	-5.58	-15.31	-15.31	3.23	-3.23	-14.62	-14.62	1.03	-1.03	-10.82	-10.82	7.40	-7.40	-11.17	-11.17	5.40	-5.40	-13.20	-13.20	2.37	-2.37	-13.76	-13.76	0.80	-0.80	-12.30	-12.30	8.34	-8.34
	1431 R	-16.19	3.29	-3.29	-10.18	-10.18	5.69	-5.69	-11.91	-11.91	7.92	-7.92	-15.41	-15.41	1.01	-1.01	-13.97	-13.97	2.39	-2.39	-11.82	-11.82	5.53	-5.53	-13.00	-13.00	8.51	-8.51	-14.56	-14.56	0.82	-0.82
1436.0	1436 L	-9.78	-10.97	10.97	-16.06	-16.06	-8.49	8.49	-13.36	-13.36	-3.98	3.98	-13.53	-13.53	-15.62	15.62	-13.91	-13.91	-9.57	9.57	-13.03	-13.03	-7.51	7.51	-12.88	-12.88	-16.01	16.01	-14.45	-14.45	-3.25	3.25
	1436 R	-13.68	-7.49	7.49	-8.33	-8.33	-9.68	9.68	-11.98	-11.98	-13.19	13.19	-10.83	-10.83	-4.25	4.25	-11.10	-11.10	-6.66	6.66	-11.85	-11.85	-8.36	8.36	-12.32	-12.32	-2.87	2.87	-10.96	-10.96	-14.14	14.14
1442.0	1442 L	-10.02	-5.18	5.18	-15.51	-15.51	-2.94	2.94	-13.66	-13.66	-8.77	8.77	-12.50	-12.50	0.22	-0.22	-13.84	-13.84	-3.23	3.23	-12.67	-12.67	-2.60	2.60	-12.68	-12.68	-9.67	9.67	-14.08	-14.08	1.73	-1.73
	1442 R	-18.37	-3.37	3.37	-11.87	-11.87	-5.94	5.94	-15.44	-15.44	1.11	-1.11	-15.69	-15.69	-10.67	10.67	-15.01	-15.01	-2.98	2.98	-16.40	-16.40	-3.70	3.70	-16.68	-16.68	1.98	-1.98	-15.04	-15.04	-11.08	11.08
1447.0	1447 L	-12.23	2.77	-2.77	-18.48	-18.48	0.01	-0.01	-14.02	-14.02	4.98	-4.98	-17.67	-17.67	-2.18	2.18	-13.53	-13.53	2.57	-2.57	-16.59	-16.59	-0.80	0.80	-16.84	-16.84	-2.44	2.44	-15.15	-15.15	5.50	-5.50
	1447 R	-17.45	0.01	-0.01	-11.55	-11.55	2.71	-2.71	-16.74	-16.74	-2.09	2.09	-12.77	-12.77	4.54	-4.54	-15.67	-15.67	-0.75	0.75	-12.77	-12.77	2.49	-2.49	-14.31	-14.31	5.39	-5.39	-15.90	-15.90	-2.39	2.39
1451.0	1451 L	-11.55	2.75	-2.75	-17.43	-17.43	-0.39	0.39	-16.74	-16.74	-1.93	1.93	-12.75	-12.75	4.55	-4.55	-13.68	-13.68	2.08	-2.08	-15.40	-15.40	-0.49	0.49	-15.91	-15.91	-2.30	2.30	-14.29	-14.29	5.43	-5.43
	1451 R	-18.46	-0.40	0.40	-12.23	-12.23	2.80	-2.80	-13.98	-13.98	4.99	-4.99	-17.67	-17.67	-2.02	2.02	-16.32	-16.32	-0.50	0.50	-14.48	-14.48	2.12	-2.12	-15.12	-15.12	5.54	-5.54	-16.85	-16.85	-2.34	2.34
1456.0	1456 L	-11.82	-5.60	5.60	-18.36	-18.36	-2.36	2.36	-15.52	-15.52	1.90	-1.90	-15.60	-15.60	-10.07	10.07	-15.79	-15.79	-4.94	4.94	-15.46	-15.46	-1.40	1.40	-14.95	-14.95	-10.49	10.49	-16.75	-16.75	2.75	-2.75
	1456 R	-15.50	-2.06	2.06	-9.97	-9.97	-4.89	4.89	-13.60	-13.60	-8.22	8.22	-12.45	-12.45	0.69	-0.69	-13.05	-13.05	-1.23	1.23	-13.34	-13.34	-4.23	4.23	-14.15	-14.15	2.40	-2.40	-12.61	-12.61	-9.16	9.16
1462.0	1462 L	-7.83	-7.85	9.05	-14.45	-14.45	-5.07	5.84	-13.20	-13.20	-10.64	12.27	-9.60	-9.60	-3.71	4.28	-12.93	-12.93	-6.64	7.65	-10.16	-10.16	-5.93	6.84	-10.81	-10.81	-12.57	14.49	-12.41	-12.41	-1.58	1.82
	1462 R	-17.05	-6.17	6.17	-9.25	-9.25	-9.56	9.56	-12.09	-12.09	-3.42	3.42	-14.81	-14.81	-14.08	14.08	-11.99	-11.99	-7.23	7.23	-15.27	-15.27	-8.02	8.02	-14.64	-14.64	-1.92	1.92	-12.78	-12.78	-15.31	15.31
1467.0	1467 L	-9.13	4.43	-4.43	-16.94	-16.94	3.18	-3.18	-11.21	-11.21	7.75	-7.75	-15.99	-15.99	1.10	-1.10	-12.59	-12.59	5.02	-5.02	-14.61	-14.61	2.38	-2.38	-13.45	-13.45	-0.70	0.70	-13.08	-13.08	8.95	-8.95
	1467 R	-16.00	3.11	-3.11	-8.63	-8.63	4.34	-4.34	-15.19	-15.19	1.14	-1.14	-10.09	-10.09	7.15	-7.15	-13.82	-13.82	2.23	-2.23	-11.87	-11.87	5.10	-5.10	-12.37	-12.37	8.77	-8.77	-12.70	-12.70	-0.68	0.68

ss Values for Web Splice Calculations

SERVICE II

Splice Node	Splice Side	MAX FX			MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ			
		Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
1471.0	1471 L	-8.83	4.63	-4.63	-15.13	-15.13	3.07	-3.07	-14.08	-14.08	0.05	-0.05	-10.19	-10.19	7.43	-7.43	-11.28	-11.28	4.03	-4.03	-13.62	-13.62	3.14	-3.14	-12.89	-12.89	-0.90	0.90	-12.07	-12.07	8.39	-8.39
	1471 R	-16.02	3.13	-3.13	-9.34	-9.34	4.72	-4.72	-11.22	-11.22	7.89	-7.89	-14.55	-14.55	-0.40	0.40	-14.42	-14.42	3.25	-3.25	-12.25	-12.25	3.99	-3.99	-12.77	-12.77	8.56	-8.56	-13.65	-13.65	-0.92	0.92
1476.0	1476 L	-9.19	-9.00	9.00	-16.27	-16.27	-6.50	6.50	-12.15	-12.15	-2.30	2.30	-14.44	-14.44	-12.94	12.94	-13.79	-13.79	-9.55	9.55	-12.78	-12.78	-4.52	4.52	-12.51	-12.51	-14.76	14.76	-14.34	-14.34	-0.16	0.16
	1476 R	-13.78	-5.34	6.15	-7.78	-7.78	-7.39	8.52	-12.38	-12.38	-10.41	11.99	-10.00	-10.00	-2.33	2.69	-10.83	-10.83	-3.70	4.26	-11.68	-11.68	-7.86	9.06	-12.15	-12.15	-0.13	0.15	-10.59	-10.59	-12.12	13.97
1482.0	1482 L	-6.95	-9.03	11.10	-13.17	-13.17	-7.25	8.90	-11.85	-11.85	-11.84	14.55	-8.85	-8.85	-5.18	6.36	-11.04	-11.04	-9.47	11.63	-10.00	-10.00	-5.94	7.30	-9.87	-9.87	-13.77	16.92	-11.51	-11.51	-2.63	3.23
	1482 R	-15.04	-8.70	8.70	-7.95	-7.95	-10.84	10.84	-10.87	-10.87	-5.10	5.10	-13.08	-13.08	-14.86	14.86	-11.42	-11.42	-7.16	7.16	-12.64	-12.64	-11.15	11.15	-13.14	-13.14	-3.15	3.15	-11.29	-11.29	-16.52	16.52
1487.0	1487 L	-7.77	5.98	-5.98	-14.42	-14.42	4.36	-4.36	-9.65	-9.65	8.88	-8.88	-13.35	-13.35	1.53	-1.53	-10.13	-10.13	5.45	-5.45	-12.90	-12.90	4.24	-4.24	-11.95	-11.95	0.91	-0.91	-11.12	-11.12	9.65	-9.65
	1487 R	-13.62	4.27	-4.27	-7.34	-7.34	5.86	-5.86	-12.67	-12.67	1.55	-1.55	-8.63	-8.63	8.21	-8.21	-12.20	-12.20	4.10	-4.10	-9.56	-9.56	5.44	-5.44	-10.51	-10.51	9.46	-9.46	-11.29	-11.29	0.89	-0.89
1491.0	1491 L	-7.30	5.44	-5.44	-13.99	-13.99	5.01	-5.01	-12.87	-12.87	1.86	-1.86	-8.69	-8.69	8.24	-8.24	-10.25	-10.25	5.42	-5.42	-11.74	-11.74	4.15	-4.15	-10.78	-10.78	0.64	-0.64	-10.83	-10.83	9.77	-9.77
	1491 R	-14.81	5.11	-5.11	-7.71	-7.71	5.56	-5.56	-9.78	-9.78	8.99	-8.99	-13.57	-13.57	1.85	-1.85	-12.42	-12.42	4.27	-4.27	-10.84	-10.84	5.50	-5.50	-11.45	-11.45	9.98	-9.98	-11.41	-11.41	0.66	-0.66
1496.0	1496 L	-8.04	-10.76	10.76	-15.30	-15.30	-9.26	9.26	-10.54	-10.54	-5.13	5.13	-13.53	-13.53	-15.39	15.39	-12.56	-12.56	-11.08	11.08	-11.62	-11.62	-7.87	7.87	-11.40	-11.40	-16.75	16.75	-13.08	-13.08	-3.54	3.54
	1496 R	-13.39	-7.72	9.48	-7.03	-7.03	-8.96	11.01	-12.23	-12.23	-12.31	15.12	-8.80	-8.80	-4.86	5.97	-10.18	-10.18	-6.56	8.06	-10.99	-10.99	-9.23	11.34	-11.46	-11.46	-2.95	3.62	-9.97	-9.97	-13.96	17.15
1502.0	1502 L	-7.64	-8.45	8.95	-13.68	-13.68	-5.00	5.29	-11.53	-11.53	-11.81	12.51	-10.22	-10.22	-3.08	3.27	-11.25	-11.25	-8.40	8.90	-11.30	-11.30	-4.43	4.69	-9.95	-9.95	-13.37	14.16	-12.42	-12.42	-0.94	0.99
	1502 R	-15.17	-5.47	5.47	-8.48	-8.48	-9.25	9.25	-12.32	-12.32	-2.04	2.04	-11.94	-11.94	-14.05	14.05	-12.53	-12.53	-4.85	4.85	-12.48	-12.48	-9.21	9.21	-13.77	-13.77	-1.02	1.02	-11.05	-11.05	-14.63	14.63
1507.0	1507 L	-9.01	5.15	-5.15	-15.25	-15.25	2.99	-2.99	-10.90	-10.90	7.77	-7.77	-14.31	-14.31	0.62	-0.62	-10.46	-10.46	5.55	-5.55	-13.40	-13.40	1.63	-1.63	-13.81	-13.81	0.21	-0.21	-11.73	-11.73	8.30	-8.30
	1507 R	-14.52	2.94	-2.94	-8.59	-8.59	5.06	-5.06	-13.74	-13.74	0.67	-0.67	-9.87	-9.87	7.20	-7.20	-12.77	-12.77	1.62	-1.62	-9.97	-9.97	5.44	-5.44	-11.18	-11.18	8.16	-8.16	-13.15	-13.15	0.20	-0.20
1511.0	1511 L	-8.64	5.26	-5.26	-14.53	-14.53	2.95	-2.95	-13.72	-13.72	0.63	-0.63	-9.96	-9.96	7.37	-7.37	-10.53	-10.53	5.31	-5.31	-12.88	-12.88	1.50	-1.50	-13.20	-13.20	0.29	-0.29	-11.22	-11.22	8.19	-8.19
	1511 R	-15.25	3.00	-3.00	-9.06	-9.06	5.35	-5.35	-11.02	-11.02	7.93	-7.93	-14.28	-14.28	0.63	-0.63	-13.51	-13.51	1.50	-1.50	-11.05	-11.05	5.43	-5.43	-11.76	-11.76	8.32	-8.32	-13.86	-13.86	0.29	-0.29
1516.0	1516 L	-8.66	-8.99	8.99	-15.26	-15.26	-5.14	5.14	-12.68	-12.68	-1.37	1.37	-12.14	-12.14	-14.12	14.12	-13.19	-13.19	-8.42	8.42	-12.10	-12.10	-5.48	5.48	-11.35	-11.35	-14.67	14.67	-13.83	-13.83	-0.64	0.64
	1516 R	-13.76	-4.70	4.97	-7.80	-7.80	-8.22	8.71	-11.70	-11.70	-11.99	12.70	-10.47	-10.47	-2.48	2.63	-10.91	-10.91	-5.01	5.30	-11.88	-11.88	-7.74	8.20	-12.48	-12.48	-0.59	0.62	-10.22	-10.22	-13.40	14.20
1522.0	1522 L	-6.07	-10.89	10.33	-10.76	-10.76	-7.49	7.11	-9.29	-9.29	-14.17	13.46	-8.26	-8.26	-6.12	5.81	-8.79	-8.79	-9.00	8.54	-8.21	-8.21	-8.38	7.96	-7.93	-7.93	-14.92	14.17	-9.74	-9.74	-4.69	4.45
	1522 R	-11.94	-7.86	7.86	-6.74	-6.74	-11.36	11.36	-9.89	-9.89	-5.53	5.53	-10.00	-10.00	-15.14	15.14	-9.11	-9.11	-8.71	8.71	-9.76	-9.76	-9.42	9.42	-10.80	-10.80	-4.90	4.90	-8.81	-8.81	-15.58	15.58
1527.0	1527 L	-7.06	6.72	-6.72	-12.02	-12.02	4.35	-4.35	-8.62	-8.62	8.91	-8.91	-11.22	-11.22	2.65	-2.65	-9.59	-9.59	5.76	-5.76	-10.11	-10.11	4.53	-4.53	-10.81	-10.81	2.42	-2.42	-9.07	-9.07	9.12	-9.12
	1527 R	-11.55	4.29	-4.29	-6.79	-6.79	6.63	-6.63	-10.87	-10.87	2.67	-2.67	-7.83	-7.83	8.41	-8.41	-9.71	-9.71	4.48	-4.48	-9.21	-9.21	5.67	-5.67	-8.72	-8.72	9.00	-9.00	-10.38	-10.38	2.39	-2.39
1531.0	1531 L	-6.69	6.69	-6.69	-11.51	-11.51	4.58	-4.58	-10.82	-10.82	2.93	-2.93	-7.78	-7.78	8.40	-8.40	-8.23	-8.23	5.97	-5.97	-9.94	-9.94	4.52	-4.52	-10.34	-10.34	2.60	-2.60	-8.73	-8.73	9.05	-9.05
	1531 R	-11.98	4.62	-4.62	-6.96	-6.96	6.78	-6.78	-8.60	-8.60	8.91	-8.91	-11.18	-11.18	2.91	-2.91	-10.34	-10.34	4.57	-4.57	-8.57	-8.57	6.06	-6.06	-9.07	-9.07	9.17	-9.17	-10.77	-10.77	2.64	-2.64
1536.0	1536 L	-6.58	-11.07	11.07	-12.21	-12.21	-7.03	7.03	-9.73	-9.73	-4.76	4.76	-9.99	-9.99	-14.91	14.91	-9.29	-9.29	-12.16	12.16	-9.95	-9.95	-6.10	6.10	-8.79	-8.79	-15.56	15.56	-10.74	-10.74	-4.00	4.00
	1536 R	-11.01	-6.73	6.39	-5.92	-5.92	-10.61	10.07	-9.55	-9.55	-13.62	12.93	-8.10	-8.10	-5.47	5.19	-8.97	-8.97	-5.85	5.55	-8.36	-8.36	-11.64	11.05	-9.69	-9.69	-3.84	3.64	-7.91	-7.91	-14.90	14.15
1542.0	1542 L	-8.92	-3.50	3.68	-13.10	-13.10	-1.27	1.34	-11.79	-11.79	-6.43	6.75	-10.85	-10.85	0.96	-1.01	-11.03	-11.03	-1.36	1.43	-11.90	-11.90	-2.32	2.43	-10.70	-10.70	-7.05	7.40	-11.90	-11.90	1.84	-1.93
	1542 R	-14.48	-1.38	1.38	-9.86	-9.86	-3.79	3.79	-12.45	-12.45	1.55	-1.55	-12.77	-12.77	-7.26	7.26	-13.18	-13.18	-2.45	2.45	-12.18	-12.18	-1.54	1.54	-13.15	-13.15	1.99	-1.99	-11.84	-11.84	-7.63	7.63
1547.0	1547 L	-9.93	3.92	-3.92	-14.26	-14.26	1.82	-1.82	-11.50	-11.50	5.64	-5.64	-13.21	-13.21	-0.28	0.28	-12.76	-12.76	1.08	-1.08	-12.51	-12.51	2.91	-2.91	-12.99	-12.99	-0.53	0.53	-11.86	-11.86	5.92	-5.92
	1547 R	-13.73	1.80	-1.80	-9.57	-9.57	3.88	-3.88	-12.90	-12.90	-0.28	0.28	-10.56	-10.56	5.33	-5.33	-12.04	-12.04	2.87	-2.87	-12.28	-12.28	1.06	-1.06	-11.42	-11.42	5.85	-5.85	-12.50	-12.50	-0.53	0.53
1551.0	1551 L	-9.64	3.66	-3.66	-14.07	-14.07	2.18	-2.18	-13.26	-13.26	0.19	-0.19	-10.57	-10.57	5.12	-5.12	-12.01	-12.01	0.75	-0.75	-12.70	-12.70	3.30	-3.30	-12.32	-12.32	-0.21	0.21	-11.83	-11.83	5.67	-5.67
	1551 R	-14.61	2.20	-2.20	-10.01	-10.01	3.70	-3.70	-11.05	-11.05	5.20	-5.20	-13.72	-13.72	0.15	-0.15	-13.19	-13.19	3.34	-3.34	-12.49	-12.49	0.77	-0.77	-12.28	-12.28	5.74	-5.74	-12.81	-12.81	-0.22	0.22
1556.0	1556 L	-9.84	-8.39	8.39	-14.72	-14.72	-5.10	5.10	-12.20	-12.20	-0.88	0.88	-13.35	-13.35	-11.25	11.25	-12.07	-12.07	-10.51	10.51	-12.87	-12.87	-1.37	1.37	-12.01	-12.01	-12.18	12.18	-13.12	-13.12	-0.35	0.35
	1556 R	-13.30	-4.71	4.95	-8.88	-8.88	-7.76	8.14	-12.14	-12.14	-10.32	10.83	-10.88	-10.88	-1.09	1.14	-11.63	-11.63	-1.28	1.34	-10.90	-10.90	-9.70	10.18	-11.86	-11.86	-0.32	0.34	-10.84	-10.84	-11.25	11.81
3007.0	3007 L	0.06	-28.02	22.40	-0.14	-0.14	-33.06	31.03	0.04	0.04	-27.89	22.18	-0.12	-0.12	-33.81	32.31	-0.09	-0.09	-27.24	21.06	0.02	0.02	-32.59	30.23	0.02	0.02	-34.77	33.96	-0.10	-0.10	-26.24	19.36
	3007 R	-0.14	-33.06	31.03	0.06	0.06	-28.02	22.40	-0.11	-0.11	-33.39	31.59	0.03	0.03	-28.30	22.87	0.02	0.02	-32.59	30.23	-0.09	-0.09	-27.24	21.06	-0.10	-0.10	-26.24	19.36	0.02	0.02	-34.77	33.96
3015.0	3015 L	0.06	-4.16	1.75	-0.14	-0.14	-8.43	9.06	0.02	0.02	-6.52	5.78	-0.11	-0.11	-8.85	9.77	0.05	0.05	-3.13	-0.01	-0.12	-0.12	-9.65	11.14	-0.12	-0.12	-11.51	14.33	0.04	0.04	-1.40	-2.98
	3015 R	-0.17	-9.74	14.18	0.05	0.05	-4.96	3.34	-0.14	-0.14	-10.13	15.05	0.00	0.00	-7.71	9.57	-0.16	-0.16	-10.60	16.11	0.03	0.03	-3.57	0.17	0.03	0.03	-1.69	-4.09	-0.15	-0.15	-12.61	20.68
3021.0	3021 L	11.10	6.78	-8.54	8.68	8.68	4.00	-2.90	9.73	9.73	2.92	-0.73	10.35	10.35	7.25	-9.49	10.29	10.29	5.98	-6.92	10.18	10.18	5.32	-5.57	9.55	9.55	2.49	0.16	11.35	11.35	12.37	-12.56
	3021 R	11.25	4.76	-3.52	14.13	14.13	7.52	-10.40	13.22	13.22	8.27	-12.28	12.48	12.48	3.41	-0.16	13.03	13.03	6.05	-6.74	13.17	13.17	6.73	-8.44	14.68	14.68	14.09	-15.45	12.29	12.29	3.14	0.50
3035.0	3035 L	14.13	13.80	-16.35	11.25	11.25	12.50	-13.11	12.81	12.81	14.48	-18.05	12.97	12.97	11.24	-9.97	13.04	13.04	13.23	-14.95	13.16	13.16	13.39	-15.33	12.31	12.31	10.65	-8.51	14.64	14.64	20.22	-21.61
	3035 R	8.68	10.68	-10.47	11.11	11.11	12.06	-13.27	10.14	10.14	9.71	-8.52	10.00	10.00	12.44	-14.05	10.29	10.29	11.62	-12.38	10.18	10.18	11.47	-12.07	11.32	11.32	17.54	-17.44	9.57	9.57	8.94	-6.96
3041.0	3041 L	0.47	12.32	-14.32	-0.59	-0.59	4.20	-6.72	-0.21	-0.21	4.43	-7.25	-0.21	-0.21	4.70	-7.86	0.21	0.21	14.89	-17.23	-0.41	-0.41	3.34	-4.78	-0.23	-0.23	1.90	-1.52	0.02	0.02	17.96	-20.69
	3041 R	-0.69	4.57	-8.56	0.61	0.61	15.11	-18.31	-0.22	-0.22	5.61	-11.35	-0.26	-0.26	4.50	-8.38	-0.47	-0.47	3.63	-6.06	0.29	0.29	18.33	-22.07	0.04	0.04	22.17	-26.55	-0.26	-0.26	2.07	-1.89
3051.0	3051 L	0.35	4.31	-4.77	-0.69	-0.69	3.14	-1.65	-0.39	-0.39	5.00	-6.61	-0.05	-0.05	2.11	1.10	0.13	0.13	7.47	-13.21	-0.50	-0.50	1.70	2.19	-0.12	-0.12	-0.52	8.09	-0.20	-0.20	18.33	-20.86
	3051 R	-0.68	2.80	-1.46	0.33	0.33	3.96	-4.36	-0.04	-0.04	2.07	0.35	-0.39	-0.39	4.12	-4.75	-0.49	-0.49	1.37	2.11	0.11	0.11	7.10	-12.18	-0.18	-0.18	16.95	-19.07	-0.14	-0.14	-0.82	7.56
3057.0	3057 L	9.84	8.89	-10.77	7.38	7.38	6.47	-5.71	8.66	8.66	5.56	-3.82	8.97	8.97	9.22	-11.46	9.01	9.01	8.04	-9.01	8.90	8.90	7.86	-8.62	8.22	8.22	4.71	-2.03	9.32	9.32	10.49	-14.12
	3057 R	7.73	6.54	-5.85	10.26	10.26	8.94	-11.05	9.36	9.36	9.50	-12.28	9.05	9.05	5.44	-3.46	9.30	9.30	7.92	-8.84	9.41	9.41	8.10	-9.24	9.73	9.73	10.55	-14.55	8.60	8.60	4.77	-2.01
3071.0	3071 L	10.27	7.39	-8.63	7.73	7.73	5.32	-4.15	9.16	9.16	7.80	-9.53	9.28	9.28	4.16	-1.63	9.34	9.34	6.66	-7.06	9.36	9.36	6.35	-6.38	8.67	8.67	3.42	-0.02	9.69	9.69	8.93	-11.97
	3071 R	7.38	5.26	-4.07	9.84	9.84	7.36	-8.45	8.88	8.88	4.31	-2.07	8.77	8.77	7.54	-8.82	8.96	8.96	6.31	-6.26	8.94	8.94	6.62	-6.91	9.28	9.28	8.89	-11.65	8.29	8.29	3.37	-0.12
3077.0	3077 L	0.26	-7.19	4.95	-0.67	-0.67	-7.98	6.93	-0.13	-0.13	-8.45	8.09	-0.37	-0.37	-7.80	6.47	-0.05	-0.05	2.58	-4.76	-0.34	-0.34	-9.74	11.31	-0.07	-0.07	-11.60	15.93	-0.34	-0.34	6.68	-9.48
	3077 R	-0.60	-6.82	5.04	0.26	0.26	-6.20	3.76	-0.31	-0.31	-6.39	4.15	-0.10	-0.10	-7.75	6.92	-0.29	-0.29	-8.74	8.92	-0.05	-0.05	-3.01	-2.70	-0.28	-0.28	6.27	-7.51	-0.04	-0.04	-10.54	12.58
3089.0	3089 L	0.26	2.84	-2.61	-0.60	-0.60	2.31	-1.55	-0.16	-0.16	2.91	-2.77	-0.23	-0.23	0.89	1.34	-0.06	-0.06	6.11	-9.26	-0.28	-0.28	0.08	2.99	-0.19	-0.19	-1.80	6.80	-0.09	-0.09	7.85	-12.79
	3089 R	-0.63	2.05	-1.37	0.25	0.25	2.69	-2.79	-0.24	-0.24	1.06	0.85	-0.18	-0.18	2.35	-2.02	-0.30	-0.30	-0.03	3.27	-0.08	-0.08	5.97	-10.08	-0.11	-0.11	7.70	-13.93	-0.21	-0.21	-1.90	7.43
3095.0	3095 L	11.01	9.79	-11.81	8.32	8.32	7.54	-7.21	9.83	9.83	6.62	-5.32	9.94	9.94	10.11	-12.48	10.05	10.05	9.14	-10.49	9.96	9.96	8.74	-9.67	9.25	9.25	5.64	-3.32	11.23	11.23	15.49	-16.41
	3095 R	8.83	7.32	-6.98	11.63	11.63	9.48	-11.53	10.51	10.51	10.02	-12.68	10.40	10.40	6.23	-4.68	10.54	10.54	8.47	-9.41	10.63	10.63	8.86	-10.23	11.90	11.90	15.01	-15.94	9.80	9.80	5.47	-3.08
3109.0	3109 L	11.63	11.14	-13.37	8.83	8.83	8.31	-7.42	10.45	10.45	11.30	-13.71	10.42	10.42	7.46	-5.63	10.70	10.70	10.13	-11.26	10.47	10.47	9.74	-10.44	9.68	9.68	6.67	-3.97	11.10	11.10	12.46	-16.18
	3109 R	8.32	8.56	-7.69	11.01	11.01	11.50	-13.72	9.85	9.85	7.89	-6.32	9.88	9.88	11.43	-13.57	9.89	9.89	10.06	-10.75	10.12	10.12	10.46	-11.58	10.50	10.50	12.87	-16.51	9.13	9.13	6.89	-4.26
3115.0	3115 L	0.46	7.20	-8.77	-0.75	-0.75	0.37	-1.91	-0.20	-0.20	-0.36	-0.28	-0.36	-0.36	1.42	-4.24	0.07	0.07	11.64	-13.77	-0.49	-0.49	-1.01	1.18	-0.13	-0.13	-2.96	5.51	-0.34	-0.34	15.43	-18.05
	3115 R	-0.80	-0.12	-1.85	0.53	0.53	9.13	-10.19	-0.37	-0.37	1.54	-5.53	-0.22	-0.22	-1.18	0.49	-0.52	-0.52	-1.59	1.40	0.09	0.09	13.93	-15.09	-0.36	-0.36	18.55	-19.79	-0.13	-0.13	-3.70	6.04
3127.0	3127 L	0.30	-0.22	0.20	-0.80	-0.80	-0.52	0.88	-0.36	-0.36	0.70	-1.81	-0.24	-0.24	-2.63	5.54	-0.08	-0.08	1.97	-4.64	-0.44	-0.44	-2.30	4.80	-0.21	-0.21	-4.39	9.43	-0.23	-0.23	4.10	-9.34
	3127 R	-0.86	-0.48	0.91	0.29	0.29	-0.23	0.29	-0.26	-0.26	-2.34	5.66	-0.41	-0.41	0.28	-1.03	-0.49	-0.49	-2.29	5.52	-0.10	-0.10	1.99	-5.39	-0.26	-0.26	4.14	-10.86	-0.24	-0.24	-4.40	10.92
3133.0	3133 L	10.08	7.27	-8.20	7.18	7.18	4.81	-3.56	9.07	9.07	4.73	-3.41	8.60	8.60	7.08	-7.85	8.97	8.97	6.67	-7.08	8.90	8.90	5.92	-5.66	8.20	8.20	3.35	-0.82	9.30	9.30	8.76	-11.01
	3133 R	9.33	5.77	-4.74	12.79	12.79	8.20	-10.60	11.01	11.01	8.30	-10.84	11.60	11.60	5.44	-3.93	11.37	11.37	6.85	-7.34	11.46	11.46	7.64	-9.23	11.84	11.84	9.80	-14.44	10.55	10.55	4.21	-0.96
3147.0	3147 L	12.79	11.02	-13.54	9.33	9.33	8.42	-7.28	11.82	11.82	11.69	-15.16	10.62	10.62	6.70	-3.11	11.82	11.82	9.51	-9.90	11.12	11.12	9.87	-10.77	10.35	10.35	6.24	-2.01	12.16	12.16	12.61	-17.39
	3147 R	7.18	7.01	-5.46	10.08	10.08	9.61	-10.37	8.27	8.27	5.59	-2.78	9.27	9.27	10.00	-11.10	8.68	8.68	8.45	-8.18	9.27	9.27	8.14	-7.58	9.56	9.56	11.12	-13.21	8.03	8.03	4.95	-1.58
3153.0	3153 L	1.20	8.61	-11.10	-1.41	-1.41	-3.04	2.93	-0.36	-0.36	-2.40	1.28	-0.55	-0.55	-0.67	-3.12	0.32	0.32	10.35	-13.12	-0.83	-0.83	-3.33	3.67	-0.41	-0.41	-5.54	9.31	-0.11	-0.11	15.03	-18.52
	3153 R	-1.45	-3.46	2.97	1.29	1.29	9.06	-12.10	-0.95	-0.95	0.34	-7.61	0.01	0.01	-4.33	5.36	-0.85	-0.85	-3.87	4.09	0.36	0.36	10.97	-14.34	-0.10	-0.10	16.05	-20.32	-0.42	-0.42	-6.08	10.23
3163.0	3163 L	0.71	2.13	-4.11	-1.45	-1.45	-0.05	1.98	-1.04	-1.04	2.64	-5.51	0.12	0.12	-1.62	6.33	0.52	0.52	2.68	-5.61	-1.28	-1.28	0.23	1.19	-0.31	-0.31	-3.17	10.62	-0.31	-0.31	5.66	-13.91
	3163 R	-1.38	-0.09	1.85	0.66	0.66	1.99	-3.77	-0.26	-0.26	-0.28	2.37	-0.62	-0.62	1.02	-1.16	-1.22	-1.22	0.17	1.13	0.48	0.48	2.50	-5.15	-0.30	-0.30	5.31	-12.72	-0.30	-0.30	-3.02	9.74
3169.0	3169 L	9.80	7.83	-8.53	7.17	7.17	5.74	-4.46	8.24	8.24	4.29	-1.64	9.06	9.06	8.42	-9.69	9.08	9.08	6.61	-6.15	8.49	8.49	6.93	-6.79	8.06	8.06	3.76	-0.61	9.28	9.28	9.38	-11.55
	3169 R	9.42	6.72	-6.15	12.56	12.56	8.75	-11.50	11.67	11.67	9.62	-13.78	10.68	10.68	4.98	-1.58	11.00	11.00	7.89	-9.23	11.70	11.70	7.53	-8.28	11.92	11.92	10.39	-15.78	10.49	10.49	4.63	-0.67
3183.0	3183 L	12.56	8.66	-10.42	9.43	9.43	6.68	-5.21	11.06	11.06	9.10	-11.58	11.38	11.38	6.00	-3.42	11.19	11.19	7.49	-7.34	11.54	11.54	8.33	-9.56	10.66	10.66	5.04	-0.90	11.77	11.77	10.43	-15.05
	3183 R	7.17	5.61	-3.78	9.80	9.80	7.62	-7.70	8.83	8.83	5.20	-2.99	8.55	8.55	7.79	-8.03	8.95	8.95	7.27	-7.02	8.65	8.65	6.45	-5.41	9.15	9.15	9.30	-10.97	8.20	8.20	4.06	-0.76
3189.0	3189 L	0.28	-5.92	2.36	-1.04	-1.04	-6.23	3.17	-0.34	-0.34	-7.74	7.27	-0.57	-0.57	-5.27	0.59	-0.06	-0.06	-4.60	-1.21	-0.72	-0.72	-6.83	4.81	-0.32	-0.32	-9.86	12.98	-0.42	-0.42	8.20	-11.61
	3189 R	-0.96	-5.86	3.06	0.26	0.26	-5.63	2.35	-0.51	-0.51	-4.69	-0.55	-0.32	-0.32	-7.41	7.84	-0.66	-0.66	-6.39	4.68	-0.06	-0.06	-4.48	-1.19	-0.39	-0.39	7.73	-11.54	-0.29	-0.29	-9.00	12.76
3199.0	3199 L	0.37	3.41	-5.81	-1.12	-1.12	1.34	0.58	-0.57	-0.57	2.91	-4.26	-0.38	-0.38	0.60	2.88	-0.02	-0.02	5.59	-12.53	-0.76	-0.76	0.03	4.63	-0.19	-0.19	-1.84	10.39	-0.46	-0.46	7.12	-17.26
	3199 R	-1.07	1.25	0.60	0.34	0.34	3.29	-5.02	-0.35	-0.35	0.86	1.67	-0.56	-0.56	2.28	-2.23	-0.73	-0.73	0.00	4.05	-0.03	-0.03	5.38	-10.76	-0.44	-0.44	6.83	-14.77	-0.20	-0.20	-1.77	8.94
3205.0	3205 L	10.28	8.72	-10.16	7.29	7.29	6.57	-5.41	9.01	9.01	5.76	-3.61	8.93	8.93	8.97	-10.72	9.23	9.23	7.92	-8.39	9.04	9.04	7.84	-8.21	8.21	8.21	4.95	-1.81	9.67	9.67	10.33	-13.73
	3205 R	8.72	6.73	-6.07	12.06	12.06	8.71	-11.37	10.54	10.54	9.28	-12.92	10.61	10.61	5.61	-3.08	10.67	10.67	7.90	-9.20	10.88	10.88	7.97	-9.40	11.36	11.36	10.36	-15.80	9.90	9.90	5.05	-1.57
3219.0	3219 L	12.06	9.62	-12.34	8.72	8.72	7.36	-6.29	10.97	10.97	10.13	-13.73	10.20	10.20	5.77	-2.04	10.88	10.88	8.58	-9.55	10.74	10.74	8.42	-9.13	9.84	9.84	5.41	-1.05	11.45	11.45	11.07	-16.23
	3219 R	7.29	7.12	-5.60	10.28	10.28	9.52	-10.89	8.63	8.63	5.81	-2.68	9.31	9.31	9.74	-11.39	9.10	9.10	8.27	-8.13	9.22	9.22	8.43	-8.48	9.74	9.74	10.94	-14.05	8.29	8.29	5.22	-1.37
3225.0	3225 L	0.37	-3.33	-1.07	-1.02	-1.02	-4.70	2.73	-0.45	-0.45	-5.39	4.61	-0.41	-0.41	-3.34	-1.04	-0.04	-0.04	7.24	-9.47	-0.57	-0.57	-6.54	7.79	-0.38	-0.38	-8.46	13.08	-0.16	-0.16	13.20	-16.03
	3225 R	-0.92	-3.87	2.41	0.36	0.36	-2.59	-1.15	-0.35	-0.35	-2.09	-2.51	-0.42	-0.42	-4.80	4.97	-0.51	-0.51	-5.57	7.11	-0.08	-0.08	-0.41	-7.20	-0.13	-0.13	11.66	-14.76	-0.34	-0.34	-7.34	12.04
3234.0	3234 L	0.36	-2.27	1.53	-0.92	-0.92	-3.59	5.17	-0.58	-0.58	-2.42	1.93	-0.19	-0.19	-4.40	7.43	-0.12	-0.12	0.13	-5.13	-0.47	-0.47	-5.28	9.86	-0.25	-0.25	-6.81	14.09	-0.22	-0.22	1.50	-8.94
	3234 R	-0.89	-3.35	4.87	0.32	0.32	-2.15	1.44	-0.17	-0.17	-3.84	6.26	-0.54	-0.54	-2.82	3.35	-0.46	-0.46	-4.90	9.29	-0.13	-0.13	0.05	-4.85	-0.22	-0.22	1.31	-8.45	-0.25	-0.25	-6.30	13.29
3242.0	3242 L	8.53	4.57	-6.28	6.05	6.05	3.16	-2.93	7.42	7.42	2.30	-0.88	7.56	7.56	4.57	-6.27	7.58	7.58	4.31	-5.65	7.50	7.50	3.36	-3.41	7.04	7.04	1.47	1.09	8.01	8.01	6.06	-9.80
	3242 R	6.10	3.17	-2.81	8.59	8.59	4.54	-5.97	7.61	7.61	4.78	-6.50	7.46	7.46	2.10	-0.36	7.55	7.55	3.35	-3.23	7.64	7.64	4.29	-5.39	8.06	8.06	6.03	-9.39	7.09	7.09	1.47	1.11
3253.0	3253 L	8.59	6.27	-8.00	6.10	6.10	3.99	-2.76	7.82	7.82	6.34	-8.16	7.22	7.22	2.94	-0.33	7.75	7.75	5.18	-5.50	7.64	7.64	5.25	-5.66	7.07	7.07	2.43	0.83	8.06	8.06	7.47	-10.76
	3253 R	5.87	3.92	-2.69	8.30	8.30	6.20	-7.77	6.96	6.96	3.03	-0.72	7.55	7.55	6.04	-7.40	7.38	7.38	5.18	-5.50	7.48	7.48	5.11	-5.35	7.78	7.78	7.40	-10.44	6.82	6.82	2.36	0.78
3262.0	3262 L	0.35	-2.67	-1.28	-0.95	-0.95	-3.85	2.09	-0.14	-0.14	-4.60	4.23	-0.63	-0.63	-2.35	-2.21	0.20	0.20	6.80	-9.29	-0.66	-0.66	-5.11	5.70	-0.22	-0.22	-7.23	11.75	-0.35	-0.35	12.27	-15.65
	3262 R	-0.95	-4.56	1.96	0.36	0.36	-3.46	-1.13	-0.62	-0.62	-2.87	-2.79	-0.15	-0.15	-5.67	5.07	-0.66	-0.66	-5.91	5.74	0.21	0.21	7.10	-9.10	-0.35	-0.35	13.01	-15.35	-0.21	-0.21	-8.01	11.61
3272.0	3272 L	0.74	18.44	-20.08	-0.95	-0.95	6.62	-11.68	-0.49	-0.49	14.45	-15.85	-0.42	-0.42	6.30	-10.76	0.02	0.02	22.60	-24.49	-0.52	-0.52	5.18	-7.64	-0.44	-0.44	4.11	-4.64	-0.01	-0.01	25.51	-27.57
	3272 R	-0.85	6.15	-10.73	0.61	0.61	15.36	-18.06	-0.36	-0.36	6.06	-10.48	-0.35	-0.35	6.78	-12.41	-0.47	-0.47	4.75	-6.95	0.00	0.00	18.79	-22.00	-0.02	-0.02	21.19	-24.77	-0.39	-0.39	3.75	-4.25

Made By: WME 8/5/11 Checked By: MTB 8/5/11 BackChecked By: WME 8/5/11

ss Values for Web Splice Calculations

SERVICE II

Splice Node	Splice Side	MAX FX			MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ			
		Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
3281.0	3281 L	11.33	11.04	-12.44	8.60	8.60	9.62	-10.00	10.07	10.07	8.27	-7.66	10.23	10.23	11.01	-12.40	10.00	10.00	10.31	-11.18	10.52	10.52	10.53	-11.57	9.59	9.59	7.46	-6.26	11.30	11.30	15.27	-15.84
	3281 R	10.15	10.84	-11.32	13.24	13.24	12.23	-13.92	11.99	11.99	12.59	-14.58	12.00	12.00	9.30	-8.44	12.32	12.32	11.73	-12.98	11.73	11.73	11.51	-12.57	13.31	13.31	16.97	-17.68	11.28	11.28	8.57	-7.08
3291.0	3291 L	13.24	6.28	-7.50	10.15	10.15	3.58	-2.47	12.36	12.36	7.07	-8.98	11.73	11.73	2.36	-0.21	12.35	12.35	5.77	-6.57	11.81	11.81	5.18	-5.45	11.26	11.26	1.78	0.89	13.32	13.32	11.47	-12.09
	3291 R	8.60	2.93	-2.03	11.33	11.33	5.56	-6.58	10.00	10.00	2.00	-0.41	10.57	10.57	6.03	-7.39	10.07	10.07	4.49	-4.73	10.55	10.55	5.07	-5.73	10.77	10.77	7.64	-10.17	9.58	9.58	1.21	0.94
3300.0	3300 L	0.16	-7.81	7.84	-0.34	-0.34	-13.64	19.00	-0.24	-0.24	-12.91	17.60	0.03	0.03	-11.58	15.07	0.08	0.08	-9.39	10.88	-0.26	-0.26	-11.13	14.20	-0.26	-0.26	-16.03	23.58	0.08	0.08	-4.55	1.61
	3300 R	-0.27	-10.96	14.44	0.13	0.13	-5.90	5.86	0.03	0.03	-8.92	10.98	-0.20	-0.20	-10.59	13.82	-0.21	-0.21	-8.79	10.76	0.06	0.06	-7.27	8.19	0.07	0.07	-3.10	1.09	-0.21	-0.21	-13.02	17.95
3310.0	3310 L	0.13	-21.68	22.98	-0.27	-0.27	-25.53	29.52	-0.22	-0.22	-26.48	31.13	0.05	0.05	-22.10	23.69	-0.20	-0.20	-24.31	27.45	0.06	0.06	-22.66	24.64	0.02	0.02	-27.49	32.85	-0.17	-0.17	-20.14	20.37
	3310 R	-0.27	-25.53	29.52	0.13	0.13	-21.68	22.98	0.06	0.06	-21.65	22.92	-0.22	-0.22	-26.92	31.88	0.06	0.06	-22.66	24.64	-0.20	-0.20	-24.31	27.45	-0.17	-0.17	-20.14	20.37	0.02	0.02	-27.49	32.85
3402.0	3402 L	-12.18	-8.16	8.79	-16.66	-16.66	-3.91	4.21	-14.96	-14.96	-11.92	12.84	-14.51	-14.51	-1.60	1.73	-15.27	-15.27	-7.37	7.94	-14.92	-14.92	-3.59	3.87	-14.17	-14.17	-12.54	13.51	-15.50	-15.50	-0.79	0.85
	3402 R	-17.64	-4.78	4.78	-12.90	-12.90	-8.33	8.33	-15.68	-15.68	-1.24	1.24	-15.62	-15.62	-12.43	12.43	-15.79	-15.79	-3.65	3.65	-16.17	-16.17	-7.53	7.53	-16.41	-16.41	-0.81	0.81	-15.01	-15.01	-12.80	12.80
3407.0	3407 L	-12.91	3.36	-3.36	-17.54	-17.54	0.94	-0.94	-13.93	-13.93	5.08	-5.08	-16.80	-16.80	-0.59	0.59	-15.00	-15.00	2.22	-2.22	-15.78	-15.78	1.16	-1.16	-16.49	-16.49	-0.74	0.74	-14.88	-14.88	5.66	-5.66
	3407 R	-16.68	0.92	-0.92	-12.28	-12.28	3.30	-3.30	-16.02	-16.02	-0.53	0.53	-13.21	-13.21	4.96	-4.96	-15.01	-15.01	1.18	-1.18	-14.26	-14.26	2.16	-2.16	-14.15	-14.15	5.56	-5.56	-15.67	-15.67	-0.72	0.72
3411.0	3411 L	-12.22	3.91	-3.91	-16.67	-16.67	1.38	-1.38	-16.19	-16.19	0.06	-0.06	-13.16	-13.16	5.55	-5.55	-13.91	-13.91	3.14	-3.14	-15.34	-15.34	1.96	-1.96	-15.76	-15.76	-0.37	0.37	-14.12	-14.12	6.17	-6.17
	3411 R	-17.54	1.40	-1.40	-12.85	-12.85	3.98	-3.98	-13.88	-13.88	5.68	-5.68	-16.87	-16.87	-0.11	0.11	-16.13	-16.13	1.95	-1.95	-14.46	-14.46	3.41	-3.41	-14.84	-14.84	6.28	-6.28	-16.58	-16.58	-0.37	0.37
3416.0	3416 L	-12.85	-4.21	4.21	-17.78	-17.78	-1.79	1.79	-15.97	-15.97	0.88	-0.88	-15.48	-15.48	-8.28	8.28	-16.45	-16.45	-2.00	2.00	-15.48	-15.48	-2.83	2.83	-14.95	-14.95	-8.73	8.73	-16.69	-16.69	1.48	-1.48
	3416 R	-16.79	-1.76	1.89	-12.13	-12.13	-4.13	4.45	-15.02	-15.02	-7.61	8.20	-14.33	-14.33	-0.03	0.03	-14.62	-14.62	-2.78	2.99	-15.53	-15.53	-1.95	2.11	-15.76	-15.76	1.45	-1.57	-14.11	-14.11	-8.55	9.21
3422.0	3422 L	-9.81	-8.98	8.98	-14.81	-14.81	-5.88	5.88	-12.90	-12.90	-12.41	12.41	-12.15	-12.15	-4.25	4.25	-13.25	-13.25	-7.94	7.94	-12.79	-12.79	-5.52	5.52	-11.85	-11.85	-13.37	13.37	-13.73	-13.73	-2.82	2.82
	3422 R	-17.38	-6.66	6.66	-11.52	-11.52	-10.17	10.17	-15.09	-15.09	-3.78	3.78	-14.56	-14.56	-14.74	14.74	-15.01	-15.01	-6.25	6.25	-15.56	-15.56	-9.00	9.00	-16.11	-16.11	-3.19	3.19	-13.93	-13.93	-15.14	15.14
3427.0	3427 L	-11.68	5.95	-5.95	-17.16	-17.16	2.88	-2.88	-13.13	-13.13	7.98	-7.98	-16.45	-16.45	1.56	-1.56	-13.70	-13.70	5.18	-5.18	-15.20	-15.20	3.14	-3.14	-16.04	-16.04	1.36	-1.36	-13.99	-13.99	8.49	-8.49
	3427 R	-16.22	2.82	-2.82	-11.04	-11.04	5.83	-5.83	-15.59	-15.59	1.57	-1.57	-12.09	-12.09	7.61	-7.61	-14.38	-14.38	3.09	-3.09	-12.95	-12.95	5.06	-5.06	-13.23	-13.23	8.32	-8.32	-15.16	-15.16	1.33	-1.33
3431.0	3431 L	-11.09	5.77	-5.77	-16.23	-16.23	2.69	-2.69	-15.60	-15.60	1.40	-1.40	-12.14	-12.14	7.53	-7.53	-13.07	-13.07	4.93	-4.93	-14.27	-14.27	3.06	-3.06	-15.18	-15.18	1.21	-1.21	-13.25	-13.25	8.24	-8.24
	3431 R	-17.18	2.75	-2.75	-11.73	-11.73	5.89	-5.89	-13.17	-13.17	7.91	-7.91	-16.45	-16.45	1.38	-1.38	-15.10	-15.10	3.14	-3.14	-13.82	-13.82	4.99	-4.99	-14.01	-14.01	8.41	-8.41	-16.06	-16.06	1.24	-1.24
3436.0	3436 L	-11.67	-11.02	11.02	-17.35	-17.35	-8.08	8.08	-15.07	-15.07	-4.72	4.72	-14.71	-14.71	-15.64	15.64	-15.79	-15.79	-9.67	9.67	-14.84	-14.84	-7.40	7.40	-14.04	-14.04	-16.04	16.04	-15.92	-15.92	-4.19	4.19
	3436 R	-14.78	-7.13	7.13	-9.93	-9.93	-9.73	9.73	-12.95	-12.95	-13.28	13.28	-12.26	-12.26	-4.92	4.92	-12.64	-12.64	-6.54	6.54	-13.45	-13.45	-8.51	8.51	-13.57	-13.57	-3.70	3.70	-11.95	-11.95	-14.16	14.16
3442.0	3442 L	-11.35	-5.26	5.26	-16.36	-16.36	-2.33	2.33	-14.38	-14.38	-8.81	8.81	-13.73	-13.73	-0.26	0.26	-15.09	-15.09	-3.55	3.55	-13.99	-13.99	-2.39	2.39	-13.41	-13.41	-9.67	9.67	-15.19	-15.19	1.05	-1.05
	3442 R	-19.39	-2.67	2.67	-13.45	-13.45	-6.03	6.03	-17.00	-17.00	0.63	-0.63	-16.52	-16.52	-10.70	10.70	-16.58	-16.58	-2.73	2.73	-17.88	-17.88	-4.07	4.07	-17.99	-17.99	1.20	-1.20	-15.90	-15.90	-11.08	11.08
3447.0	3447 L	-13.52	2.94	-2.94	-19.20	-19.20	-0.17	0.17	-14.99	-14.99	4.94	-4.94	-18.44	-18.44	-1.89	1.89	-15.47	-15.47	1.84	-1.84	-17.35	-17.35	0.11	-0.11	-18.08	-18.08	-2.02	2.02	-15.86	-15.86	5.41	-5.41
	3447 R	-18.13	-0.16	0.16	-12.77	-12.77	2.88	-2.88	-17.50	-17.50	-1.79	1.79	-13.91	-13.91	4.67	-4.67	-16.38	-16.38	0.06	-0.06	-14.61	-14.61	1.83	-1.83	-14.98	-14.98	5.30	-5.30	-17.07	-17.07	-1.98	1.98
3451.0	3451 L	-12.77	2.95	-2.95	-18.16	-18.16	-0.38	0.38	-17.53	-17.53	-1.59	1.59	-13.82	-13.82	4.70	-4.70	-14.94	-14.94	1.68	-1.68	-16.39	-16.39	0.30	-0.30	-17.10	-17.10	-1.87	1.87	-14.97	-14.97	5.40	-5.40
	3451 R	-19.24	-0.39	0.39	-13.52	-13.52	3.01	-3.01	-14.77	-14.77	4.89	-4.89	-18.47	-18.47	-1.70	1.70	-17.36	-17.36	0.31	-0.31	-15.82	-15.82	1.71	-1.71	-15.85	-15.85	5.51	-5.51	-18.12	-18.12	-1.91	1.91
3456.0	3456 L	-13.49	-5.79	5.79	-19.50	-19.50	-1.70	1.70	-17.22	-17.22	1.26	-1.26	-16.52	-16.52	-10.17	10.17	-17.66	-17.66	-4.64	4.64	-16.99	-16.99	-1.58	1.58	-15.91	-15.91	-10.55	10.55	-18.07	-18.07	1.81	-1.81
	3456 R	-16.46	-1.48	1.48	-11.38	-11.38	-5.06	5.06	-14.46	-14.46	-8.27	8.27	-13.81	-13.81	0.17	-0.17	-14.34	-14.34	-1.39	1.39	-14.90	-14.90	-4.05	4.05	-15.26	-15.26	1.58	-1.58	-13.42	-13.42	-9.21	9.21
3462.0	3462 L	-9.54	-7.96	9.18	-15.63	-15.63	-4.93	5.68	-14.16	-14.16	-10.32	11.89	-11.28	-11.28	-4.11	4.74	-14.31	-14.31	-6.27	7.22	-11.60	-11.60	-5.90	6.80	-12.07	-12.07	-12.30	14.17	-13.90	-13.90	-1.86	2.14
	3462 R	-18.44	-6.00	6.00	-11.27	-11.27	-9.70	9.70	-14.27	-14.27	-3.73	3.73	-15.78	-15.78	-13.79	13.79	-13.69	-13.69	-7.19	7.19	-16.89	-16.89	-7.63	7.63	-16.40	-16.40	-2.26	2.26	-14.26	-14.26	-14.97	14.97
3467.0	3467 L	-11.96	5.47	-5.47	-18.86	-18.86	3.63	-3.63	-13.85	-13.85	8.39	-8.39	-17.57	-17.57	1.30	-1.30	-14.68	-14.68	6.36	-6.36	-16.67	-16.67	2.83	-2.83	-16.20	-16.20	0.36	-0.36	-15.30	-15.30	9.57	-9.57
	3467 R	-17.81	3.56	-3.56	-11.31	-11.31	5.36	-5.36	-16.92	-16.92	1.62	-1.62	-12.72	-12.72	7.96	-7.96	-15.74	-15.74	2.79	-2.79	-13.88	-13.88	6.22	-6.22	-14.46	-14.46	9.38	-9.38	-15.30	-15.30	0.35	-0.35
3471.0	3471 L	-11.10	4.75	-4.75	-17.72	-17.72	4.18	-4.18	-16.70	-16.70	1.57	-1.57	-12.41	-12.41	7.37	-7.37	-13.38	-13.38	5.19	-5.19	-15.83	-15.83	4.19	-4.19	-15.45	-15.45	0.21	-0.21	-14.42	-14.42	9.16	-9.16
	3471 R	-18.76	4.27	-4.27	-11.75	-11.75	4.85	-4.85	-13.98	-13.98	8.66	-8.66	-17.10	-17.10	0.61	-0.61	-16.75	-16.75	4.29	-4.29	-14.16	-14.16	5.28	-5.28	-15.25	-15.25	9.35	-9.35	-16.36	-16.36	0.22	-0.22
3476.0	3476 L	-11.24	-9.50	9.50	-18.39	-18.39	-6.83	6.83	-14.24	-14.24	-3.40	3.40	-16.22	-16.22	-13.99	13.99	-16.41	-16.41	-10.13	10.13	-14.92	-14.92	-5.24	5.24	-14.32	-14.32	-15.38	15.38	-16.27	-16.27	-1.93	1.93
	3476 R	-15.58	-5.61	6.47	-9.52	-9.52	-7.80	8.99	-14.00	-14.00	-11.11	12.81	-11.75	-11.75	-3.22	3.71	-12.64	-12.64	-4.27	4.92	-13.90	-13.90	-8.35	9.62	-13.79	-13.79	-1.59	1.83	-12.12	-12.12	-12.63	14.56
3482.0	3482 L	-9.35	-10.45	12.84	-15.75	-15.75	-8.70	10.68	-14.37	-14.37	-13.54	16.63	-11.14	-11.14	-7.16	8.80	-13.80	-13.80	-10.61	13.03	-12.80	-12.80	-7.83	9.62	-12.17	-12.17	-15.34	18.84	-13.94	-13.94	-4.96	6.09
	3482 R	-17.98	-10.44	10.44	-10.68	-10.68	-12.54	12.54	-13.37	-13.37	-7.67	7.67	-16.04	-16.04	-16.75	16.75	-14.62	-14.62	-9.41	9.41	-15.77	-15.77	-12.72	12.72	-15.92	-15.92	-5.95	5.95	-13.91	-13.91	-18.40	18.40
3487.0	3487 L	-11.41	6.39	-6.39	-18.68	-18.68	6.40	-6.40	-14.11	-14.11	10.50	-10.50	-17.12	-17.12	3.08	-3.08	-14.18	-14.18	7.18	-7.18	-16.67	-16.67	5.90	-5.90	-16.04	-16.04	2.48	-2.48	-15.10	-15.10	11.10	-11.10
	3487 R	-17.65	6.27	-6.27	-10.79	-10.79	6.26	-6.26	-16.35	-16.35	3.12	-3.12	-12.58	-12.58	9.65	-9.65	-15.75	-15.75	5.81	-5.81	-13.41	-13.41	7.03	-7.03	-14.27	-14.27	10.87	-10.87	-15.15	-15.15	2.43	-2.43
3491.0	3491 L	-11.29	7.02	-7.02	-17.54	-17.54	6.18	-6.18	-16.45	-16.45	3.34	-3.34	-12.88	-12.88	10.05	-10.05	-13.83	-13.83	7.36	-7.36	-15.37	-15.37	5.71	-5.71	-14.91	-14.91	2.18	-2.18	-14.57	-14.57	11.35	-11.35
	3491 R	-18.56	6.31	-6.31	-11.94	-11.94	7.17	-7.17	-14.29	-14.29	10.71	-10.71	-17.23	-17.23	3.28	-3.28	-16.27	-16.27	5.85	-5.85	-14.64	-14.64	7.51	-7.51	-15.41	-15.41	11.58	-11.58	-15.79	-15.79	2.23	-2.23
3496.0	3496 L	-11.08	-12.73	12.73	-17.98	-17.98	-10.69	10.69	-13.63	-13.63	-7.29	7.29	-15.93	-15.93	-17.39	17.39	-15.85	-15.85	-12.88	12.88	-14.69	-14.69	-9.29	9.29	-14.02	-14.02	-18.81	18.81	-15.63	-15.63	-5.78	5.78
	3496 R	-15.75	-8.90	10.93	-9.69	-9.69	-10.61	13.03	-14.37	-14.37	-13.97	17.17	-11.47	-11.47	-6.64	8.16	-12.86	-12.86	-7.77	9.54	-13.87	-13.87	-10.73	13.18	-13.69	-13.69	-4.82	5.92	-12.26	-12.26	-15.67	19.25
3502.0	3502 L	-9.56	-8.67	9.18	-15.39	-15.39	-6.24	6.61	-13.34	-13.34	-12.65	13.39	-11.85	-11.85	-4.41	4.67	-13.54	-13.54	-7.83	8.30	-12.96	-12.96	-5.48	5.81	-11.90	-11.90	-14.06	14.89	-14.17	-14.17	-2.38	2.52
	3502 R	-17.07	-6.83	6.83	-10.61	-10.61	-9.49	9.49	-14.59	-14.59	-3.25	3.25	-13.88	-13.88	-14.92	14.92	-14.37	-14.37	-5.96	5.96	-15.02	-15.02	-8.59	8.59	-15.70	-15.70	-2.61	2.61	-13.21	-13.21	-15.39	15.39
3507.0	3507 L	-10.69	5.67	-5.67	-16.79	-16.79	3.06	-3.06	-12.60	-12.60	8.52	-8.52	-16.05	-16.05	1.18	-1.18	-12.51	-12.51	5.41	-5.41	-14.81	-14.81	2.70	-2.70	-15.63	-15.63	0.91	-0.91	-13.17	-13.17	8.81	-8.81
	3507 R	-15.99	3.01	-3.01	-10.19	-10.19	5.57	-5.57	-15.35	-15.35	1.20	-1.20	-11.33	-11.33	7.78	-7.78	-14.11	-14.11	2.66	-2.66	-11.92	-11.92	5.32	-5.32	-12.55	-12.55	8.67	-8.67	-14.89	-14.89	0.90	-0.90
3511.0	3511 L	-10.19	5.61	-5.61	-15.97	-15.97	3.10	-3.10	-15.35	-15.35	1.27	-1.27	-11.34	-11.34	7.81	-7.81	-12.32	-12.32	4.88	-4.88	-14.08	-14.08	2.71	-2.71	-14.86	-14.86	0.96	-0.96	-12.59	-12.59	8.64	-8.64
	3511 R	-16.77	3.15	-3.15	-10.69	-10.69	5.70	-5.70	-12.68	-12.68	8.53	-8.53	-16.06	-16.06	1.25	-1.25	-14.78	-14.78	2.76	-2.76	-12.93	-12.93	4.96	-4.96	-13.20	-13.20	8.79	-8.79	-15.60	-15.60	0.98	-0.98
3516.0	3516 L	-10.61	-9.52	9.52	-17.00	-17.00	-6.12	6.12	-14.41	-14.41	-2.73	2.73	-13.93	-13.93	-15.13	15.13	-15.23	-15.23	-7.99	7.99	-13.84	-13.84	-6.67	6.67	-13.17	-13.17	-15.59	15.59	-15.69	-15.69	-2.12	2.12
	3516 R	-15.33	-5.59	5.92	-9.56	-9.56	-8.70	9.22	-13.30	-13.30	-13.01	13.78	-12.08	-12.08	-3.54	3.75	-12.48	-12.48	-6.11	6.47	-13.73	-13.73	-7.30	7.73	-14.15	-14.15	-1.93	2.05	-11.87	-11.87	-14.25	15.09
3522.0	3522 L	-7.89	-12.96	12.30	-12.66	-12.66	-11.42	10.84	-11.11	-11.11	-16.75	15.90	-9.91	-9.91	-9.05	8.59	-11.33	-11.33	-12.44	11.81	-10.09	-10.09	-10.82	10.27	-10.09	-10.09	-17.75	16.85	-11.59	-11.59	-7.61	7.22
	3522 R	-14.05	-11.92	11.92	-8.76	-8.76	-13.53	13.53	-11.76	-11.76	-8.54	8.54	-11.73	-11.73	-18.18	18.18	-11.20	-11.20	-11.27	11.27	-12.58	-12.58	-13.01	13.01	-12.86	-12.86	-7.94	7.94	-11.21	-11.21	-18.53	18.53
3527.0	3527 L	-8.86	7.70	-7.70	-14.00	-14.00	5.54	-5.54	-10.72	-10.72	10.03	-10.03	-13.33	-13.33	3.97	-3.97	-11.13	-11.13	7.22	-7.22	-11.95	-11.95	5.42	-5.42	-12.93	-12.93	3.74	-3.74	-11.11	-11.11	10.19	-10.19
	3527 R	-13.45	5.47	-5.47	-8.52	-8.52	7.60	-7.60	-12.86	-12.86	3.96	-3.96	-9.62	-9.62	9.42	-9.42	-11.48	-11.48	5.36	-5.36	-10.70	-10.70	7.11	-7.11	-10.69	-10.69	10.06	-10.06	-12.42	-12.42	3.69	-3.69
3531.0	3531 L	-8.49	7.69	-7.69	-13.44	-13.44	5.56	-5.56	-12.89	-12.89	4.26	-4.26	-9.56	-9.56	9.50	-9.50	-10.19	-10.19	6.92	-6.92	-11.96	-11.96	5.75	-5.75	-12.39	-12.39	3.94	-3.94	-10.67	-10.67	10.20	-10.20
	3531 R	-14.00	5.63	-5.63	-8.83	-8.83	7.79	-7.79	-10.42	-10.42	10.00	-10.00	-13.37	-13.37	4.27	-4.27	-12.45	-12.45	5.81	-5.81	-10.61	-10.61	7.03	-7.03	-11.10	-11.10	10.34	-10.34	-12.90	-12.90	4.00	-4.00
3536.0	3536 L	-8.66	-11.57	11.57	-14.26	-14.26	-8.93	8.93	-11.87	-11.87	-6.16	6.16	-11.71	-11.71	-15.64	15.64	-12.26	-12.26	-11.04	11.04	-11.82	-11.82	-8.65	8.65	-10.98	-10.98	-16.11	16.11	-13.06	-13.06	-5.53	5.53
	3536 R	-12.40	-7.92	8.05	-7.52	-7.52	-10.26	10.43	-10.72	-10.72	-13.24	13.46	-9.63	-9.63	-6.29	6.40	-10.28	-10.28	-7.71	7.84	-10.66	-10.66	-9.57	9.73	-11.36	-11.36	-4.90	4.99	-9.53	-9.53	-14.29	14.53
3542.0	3542 L	-11.53	-4.76	5.00	-16.00	-16.00	-3.93	4.12	-14.77	-14.77	-7.83	8.22	-13.03	-13.03	-1.90	1.99	-14.49	-14.49	-2.65	2.78	-13.33	-13.33	-6.63	6.96	-13.62	-13.62	-8.84	9.28	-14.77	-14.77	-0.39	0.41
	3542 R	-17.69	-4.25	4.25	-12.75	-12.75	-5.08	5.08	-15.48	-15.48	-0.92	0.92	-15.75	-15.75	-9.11	9.11	-14.75	-14.75	-7.16	7.16	-16.02	-16.02	-2.87	2.87	-16.33	-16.33	-0.42	0.42	-15.07	-15.07	-9.57	9.57
3547.0	3547 L	-12.89	4.51	-4.51	-17.55	-17.55	2.74	-2.74	-14.47	-14.47	6.51	-6.51	-16.78	-16.78	1.17	-1.17	-16.48	-16.48	3.48	-3.48	-15.43	-15.43	3.19	-3.19	-16.36	-16.36	0.88	-0.88	-15.11	-15.11	6.78	-6.78
	3547 R	-16.89	2.71	-2.71	-12.42	-12.42	4.45	-4.45	-16.30	-16.30	1.30	-1.30	-13.47	-13.47	6.09	-6.09	-14.84	-14.84	3.19	-3.19	-15.88	-15.88	3.38	-3.38	-14.55	-14.55	6.70	-6.70	-15.74	-15.74	0.87	-0.87
3551.0	3551 L	-12.45	4.48	-4.48	-16.95	-16.95	3.02	-3.02	-16.34	-16.34	1.67	-1.67	-13.36	-13.36	6.06	-6.06	-15.10	-15.10	2.83	-2.83	-15.40	-15.40	4.06	-4.06	-15.61	-15.61	1.29	-1.29	-14.58	-14.58	6.78	-6.78
	3551 R	-17.62	3.06	-3.06	-12.93	-12.93	4.54	-4.54	-14.04	-14.04	6.23	-6.23	-16.81	-16.81	1.59	-1.59	-16.00	-16.00	4.10	-4.10	-15.63	-15.63	2.98	-2.98	-15.14	-15.14	6.87	-6.87	-16.22	-16.22	1.31	-1.31
3556.0	3556 L	-12.92	-8.73	8.73	-17.65	-17.65	-5.90	5.90	-15.28	-15.28	-3.04	3.04	-15.91	-15.91	-12.28	12.28	-15.98	-15.98	-10.54	10.54	-15.93	-15.93	-3.61	3.61	-15.24	-15.24	-12.74	12.74	-16.18	-16.18	-2.40	2.40
	3556 R	-15.95	-5.45	5.72	-11.66	-11.66	-8.07	8.47	-14.58	-14.58	-11.05	11.60	-13.44	-13.44	-3.33	3.50	-14.40	-14.40	-3.34	3.50	-14.44	-14.44	-9.74	10.23	-14.63	-14.63	-2.22	2.33	-13.76	-13.76	-11.78	12.36
5007.0	5007 L	-0.01	-28.67	23.38	-0.05	-0.05	-32.96	30.73	-0.03	-0.03	-28.10	22.40	-0.04	-0.04	-33.63	31.87	-0.02	-0.02	-28.97	23.88	-0.04	-0.04	-31.06	27.46	-0.04	-0.04	-34.61	33.55	-0.02	-0.02	-26.61	19.84
	5007 R	-0.05	-32.96	30.73	-0.01	-0.01	-28.67	23.38	-0.04	-0.04	-33.23	31.18	-0.03	-0.03	-28.48	23.06	-0.04	-0.04	-31.06	27.46	-0.02	-0.02	-28.97	23.88	-0.02	-0.02	-26.61	19.84	-0.04	-0.04	-34.61	33.55
5015.0	5015 L	-0.01	-5.60	4.38	-0.05	-0.05	-7.55	7.72	-0.05	-0.05	-5.74	4.64	-0.03	-0.03	-9.08	10.35	-0.03	-0.03	-5.19	3.69	-0.04	-0.04	-7.10	6.96	-0.03	-0.03	-10.97	13.58	-0.03	-0.03	-1.53	-2.59
	5015 R	-0.08	-8.74	12.17	-0.03	-0.03	-6.34	6.73	-0.05	-0.05	-9.94	14.89	-0.08	-0.08	-6.81	7.80	-0.06	-0.06	-7.84	10.12	-0.05	-0.05	-5.78	5.45	-0.05	-0.05	-1.81	-3.55	-0.06	-0.06	-12.03	19.63
5021.0	5021 L	11.28	7.32	-9.27	9.05	9.05	4.28	-3.12	9.94	9.94	3.40	-1.34	10.65	10.65	7.48	-9.60	10.42	10.42	5.98	-6.56	10.59	10.59	5.95	-6.49	9.83	9.83	2.96	-0.45	10.82	10.82	8.43	-11.52
	5021 R	11.71	5.09	-3.78	14.37	14.37	8.13	-11.34	13.61	13.61	8.53	-12.34	12.76	12.76	3.96	-0.96	13.55	13.55	6.74	-7.88	13.34	13.34	6.79	-8.00	14.95	14.95	14.08	-15.39	12.65	12.65	3.69	-0.27
5035.0	5035 L	14.37	13.13	-15.28	11.71	11.71	12.23	-13.02	13.02	13.02	13.83	-17.02	13.37	13.37	11.03	-10.05	13.52	13.52	12.70	-14.19	13.35	13.35	13.05	-15.07	12.70	12.70	10.41	-8.50	14.80	14.80	19.23	-20.51
	5035 R	9.05	10.47	-10.41	11.28	11.28	11.46	-12.42	10.45	10.45	9.55	-8.56	10.15	10.15	11.88	-13.28	10.43	10.43	11.33	-12.16	10.57	10.57	11.00	-11.49	10.73	10.73	13.06	-15.65	9.87	9.87	8.76	-6.96
5041.0	5041 L	0.45	13.72	-15.90	-0.66	-0.66	3.53	-5.36	-0.19	-0.19	4.35	-7.22	-0.42	-0.42	4.85	-8.38	0.17	0.17	10.72	-12.51	-0.46	-0.46	4.72	-8.06	-0.24	-0.24	1.96	-1.81	-0.08	-0.08	16.77	-19.35
	5041 R	-0.77	3.83	-6.84	0.58	0.58	16.84	-20.33	-0.48	-0.48	5.71	-11.87	-0.24	-0.24	4.41	-8.41	-0.54	-0.54	5.10	-10.23	0.23	0.23	13.14	-16.00	-0.09	-0.09	20.70	-24.83	-0.28	-0.28	2.11	-2.25
5051.0	5051 L	0.30	4.96	-6.64	-0.77	-0.77	3.00	-1.41	-0.53	-0.53	5.28	-7.49	-0.15	-0.15	2.29	0.50	0.05	0.05	4.57	-5.59	-0.51	-0.51	4.30	-4.86	-0.21	-0.21	-0.24	7.24	-0.20	-0.20	9.03	-17.49
	5051 R	-0.75	2.68	-1.24	0.29	0.29	4.62	-6.09	-0.14	-0.14	2.23	-0.14	-0.53	-0.53	4.47	-5.71	-0.50	-0.50	3.96	-4.43	0.04	0.04	4.24	-5.13	-0.20	-0.20	8.65	-16.13	-0.22	-0.22	-0.53	6.76
5057.0	5057 L	10.00	8.93	-10.83	7.69	7.69	6.51	-5.78	8.79	8.79	5.67	-4.03	9.24	9.24	9.10	-11.19	9.13	9.13	7.85	-8.58	9.19	9.19	8.11	-9.12	8.34	8.34	4.95	-2.51	9.54	9.54	10.32	-13.73
	5057 R	8.06	6.59	-5.92	10.44	10.44	8.98	-11.12	9.65	9.65	9.36	-11.95	9.17	9.17	5.55	-3.67	9.60	9.60	8.17	-9.37	9.54	9.54	7.91	-8.80	9.96	9.96	10.37	-14.14	8.73	8.73	5.01	-2.51
5071.0	5071 L	10.44	7.34	-8.51	8.06	8.06	5.42	-4.34	9.43	9.43	7.68	-9.26	9.40	9.40	4.25	-1.81	9.52	9.52	6.43	-6.55	9.60	9.60	6.65	-7.02	8.85	8.85	3.64	-0.48	9.98	9.98	8.76	-11.60
	5071 R	7.69	5.36	-4.25	10.00	10.00	7.31	-8.34	9.01	9.01	4.39	-2.24	9.03	9.03	7.44	-8.61	9.19	9.19	6.61	-6.88	9.11	9.11	6.39	-6.42	9.56	9.56	8.73	-11.29	8.37	8.37	3.59	-0.57
5077.0	5077 L	0.17	-5.91	2.27	-0.77	-0.77	-8.33	8.31	-0.26	-0.26	-7.92	7.28	-0.49	-0.49	-6.99	4.96	-0.14	-0.14	-5.76	1.90	-0.48	-0.48	-6.87	4.65	-0.24	-0.24	-10.91	14.72	-0.29	-0.29	6.10	-8.76
	5077 R	-0.68	-7.42	6.59	0.18	0.18	-4.98	1.63	-0.43	-0.43	-5.68	3.05	-0.20	-0.20	-7.24	6.23	-0.42	-0.42	-5.96	3.63	-0.10	-0.10	-4.86	1.38	-0.22	-0.22	5.75	-6.95	-0.21	-0.21	-9.90	11.64
5089.0	5089 L	0.18	3.57	-4.04	-0.68	-0.68	1.41	0.35	-0.40	-0.40	3.40	-3.68	-0.22	-0.22	1.15	0.88	-0.10	-0.10	4.14	-5.18	-0.40	-0.40	2.61	-2.09	-0.20	-0.20	-1.47	6.20	-0.23	-0.23	7.60	-12.21
	5089 R	-0.71	1.32	0.34	0.17	0.17	3.43	-4.35	-0.24	-0.24	1.30	0.38	-0.43	-0.43	2.88	-3.13	-0.42	-0.42	2.55	-2.40	-0.12	-0.12	4.01	-5.64	-0.26	-0.26	7.46	-13.32	-0.21	-0.21	-1.57	6.77
5095.0	5095 L	11.04	9.93	-12.09	8.61	8.61	7.69	-7.49	9.93	9.93	6.64	-5.35	10.07	10.07	10.08	-12.39	10.20	10.20	9.02	-10.22	10.14	10.14	8.81	-9.79	9.52	9.52	5.82	-3.67	10.52	10.52	11.39	-15.07
	5095 R	9.13	7.46	-7.26	11.67	11.67	9.62	-11.81	10.65	10.65	9.97	-12.54	10.51	10.51	6.34	-4.90	10.73	10.73	8.54	-9.53	10.79	10.79	8.74	-9.96	11.13	11.13	11.04	-14.80	10.09	10.09	5.64	-3.42
5109.0	5109 L	11.67	10.80	-12.72	9.14	9.14	8.30	-7.45	10.73	10.73	11.09	-13.32	10.39	10.39	7.47	-5.69	10.78	10.78	9.83	-10.67	10.72	10.72	9.85	-10.72	9.81	9.81	6.82	-4.32	11.18	11.18	12.18	-15.64
	5109 R	8.61	8.56	-7.73	11.04	11.04	11.16	-13.06	9.83	9.83	7.90	-6.37	10.15	10.15	11.24	-13.23	10.13	10.13	10.17	-11.04	10.19	10.19	10.14	-10.98	10.58	10.58	12.58	-15.97	9.25	9.25	7.03	-4.61

ss Values for Web Splice Calculations

SERVICE II

Splice Node	Splice Side	MAX FX			MIN FX				MAX FY				MIN FY			
		Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
5115.0	5115 L	0.23	2.93	-7.43	-0.77	-0.77	0.21	-1.38	-0.14	-0.14	-0.13	-0.63	-0.57	-0.57	2.22	-5.87
	5115 R	-0.83	-0.25	-1.33	0.48	0.48	8.06	-9.07	-0.60	-0.60	2.38	-7.16	-0.16	-0.16	-0.90	0.09
5127.0	5127 L	0.26	1.95	-4.35	-0.83	-0.83	-1.93	4.22	-0.35	-0.35	0.91	-2.06	-0.35	-0.35	-2.20	4.80
	5127 R	-0.89	-1.89	4.79	0.24	0.24	1.94	-5.00	-0.37	-0.37	-1.93	4.88	-0.40	-0.40	0.54	-1.41
5133.0	5133 L	9.94	7.64	-8.56	7.15	7.15	5.24	-4.04	9.10	9.10	5.35	-4.26	8.46	8.46	7.40	-8.11
	5133 R	9.29	6.27	-5.38	12.61	12.61	8.64	-11.10	10.84	10.84	8.66	-11.16	11.58	11.58	6.10	-4.97
5147.0	5147 L	12.61	11.11	-13.49	9.29	9.29	8.70	-7.68	11.58	11.58	11.78	-15.12	10.76	10.76	7.21	-4.08
	5147 R	7.15	7.25	-5.76	9.94	9.94	9.67	-10.33	8.41	8.41	6.06	-3.51	9.08	9.08	10.09	-11.10
5153.0	5153 L	1.37	6.18	-8.30	-1.45	-1.45	-2.80	2.22	0.17	0.17	-3.42	3.79	-1.02	-1.02	0.60	-6.47
	5153 R	-1.49	-3.33	2.47	1.48	1.48	6.41	-8.99	-1.03	-1.03	0.46	-8.06	0.16	0.16	-4.23	4.97
5163.0	5163 L	0.84	2.23	-4.07	-1.49	-1.49	0.32	1.24	-0.55	-0.55	1.76	-2.77	-0.29	-0.29	-0.14	2.51
	5163 R	-1.41	0.25	1.18	0.78	0.78	2.08	-3.74	-0.27	-0.27	0.07	1.68	-0.54	-0.54	1.24	-1.50
5169.0	5169 L	9.74	8.11	-8.84	7.19	7.19	6.01	-4.76	8.44	8.44	4.84	-2.48	8.93	8.93	8.53	-9.66
	5169 R	9.45	7.04	-6.56	12.48	12.48	9.08	-11.94	11.51	11.51	9.75	-13.70	10.91	10.91	5.58	-2.74
5183.0	5183 L	12.48	8.99	-10.77	9.45	9.45	7.08	-5.75	10.98	10.98	9.30	-11.57	11.48	11.48	6.60	-4.49
	5183 R	7.19	5.96	-4.16	9.74	9.74	7.90	-7.95	8.92	8.92	5.74	-3.74	8.48	8.48	7.96	-8.06
5189.0	5189 L	0.48	1.90	-4.24	-1.02	-1.02	-7.88	7.74	-0.45	-0.45	-7.49	6.69	-0.62	-0.62	-5.06	0.13
	5189 R	-0.94	-7.28	7.58	0.18	0.18	-3.95	-2.69	-0.56	-0.56	-4.53	-0.91	-0.43	-0.43	-7.16	7.21
5199.0	5199 L	0.26	4.05	-7.84	-1.12	-1.12	0.92	1.82	-0.84	-0.84	3.00	-4.59	-0.28	-0.28	0.72	2.46
	5199 R	-1.07	0.72	2.01	0.23	0.23	3.90	-6.74	-0.27	-0.27	1.01	1.22	-0.80	-0.80	2.32	-2.38
5205.0	5205 L	10.41	8.87	-10.39	7.66	7.66	6.75	-5.68	9.20	9.20	6.11	-4.28	9.30	9.30	8.87	-10.38
	5205 R	9.15	6.89	-6.37	12.22	12.22	8.87	-11.66	10.98	10.98	9.15	-12.41	10.85	10.85	5.97	-3.90
5219.0	5219 L	12.22	9.05	-11.44	9.15	9.15	6.96	-5.85	11.13	11.13	9.55	-12.80	10.67	10.67	5.55	-2.06
	5219 R	7.66	6.77	-5.25	10.41	10.41	8.98	-10.15	9.04	9.04	5.62	-2.72	9.44	9.44	9.21	-10.66
5225.0	5225 L	0.32	-3.36	-1.21	-0.95	-0.95	-5.15	3.74	-0.20	-0.20	-5.49	4.68	-0.63	-0.63	-3.97	0.48
	5225 R	-0.86	-4.28	3.36	0.31	0.31	-2.60	-1.29	-0.55	-0.55	-2.72	-0.97	-0.18	-0.18	-4.86	4.98
5233.0	5233 L	0.31	-2.63	0.44	-0.86	-0.86	-5.13	7.39	-0.55	-0.55	-3.81	3.72	-0.23	-0.23	-5.11	7.33
	5233 R	-0.83	-4.85	7.12	0.28	0.28	-2.51	0.41	-0.24	-0.24	-4.57	6.30	-0.54	-0.54	-3.88	4.34
5241.0	5241 L	8.44	3.83	-5.56	6.02	6.02	2.28	-1.87	7.41	7.41	1.71	-0.52	7.53	7.53	3.47	-4.70
	5241 R	6.07	2.28	-1.79	8.50	8.50	3.80	-5.28	7.58	7.58	3.63	-4.88	7.38	7.38	1.42	0.20
5253.0	5253 L	8.50	6.01	-7.69	6.07	6.07	3.79	-2.58	7.84	7.84	5.89	-7.41	7.15	7.15	2.87	-0.47
	5253 R	6.02	3.76	-2.70	8.44	8.44	6.00	-8.00	7.11	7.11	3.02	-0.95	7.80	7.80	5.69	-7.27
5262.0	5262 L	0.22	-1.79	-3.24	-0.99	-0.99	-4.33	4.00	-0.22	-0.22	-4.49	4.46	-0.74	-0.74	-2.66	-0.76
	5262 R	-0.99	-5.07	4.04	0.21	0.21	-2.55	-3.04	-0.74	-0.74	-3.06	-1.59	-0.24	-0.24	-5.44	5.08
5271.0	5271 L	0.59	21.50	-23.50	-0.99	-0.99	4.71	-7.94	-0.85	-0.85	12.53	-13.99	-0.40	-0.40	5.69	-10.69
	5271 R	-0.87	4.46	-7.25	0.49	0.49	17.93	-21.15	-0.34	-0.34	5.57	-10.24	-0.58	-0.58	5.79	-10.85
5279.0	5279 L	11.52	11.43	-12.86	9.00	9.00	10.07	-10.50	10.40	10.40	8.91	-8.50	10.51	10.51	11.16	-12.40
	5279 R	10.61	11.32	-11.87	13.46	13.46	12.67	-14.39	12.32	12.32	12.68	-14.40	12.18	12.18	9.85	-9.12
5289.0	5289 L	13.47	7.48	-8.91	10.62	10.62	4.68	-3.70	12.53	12.53	7.39	-8.75	12.32	12.32	4.32	-3.02
	5289 R	9.01	3.94	-3.14	11.53	11.53	6.66	-7.84	10.51	10.51	3.83	-2.95	10.71	10.71	6.41	-7.41
5297.0	5297 L	-0.06	-7.72	8.41	-0.29	-0.29	-12.23	17.03	-0.15	-0.15	-12.87	18.26	-0.25	-0.25	-10.12	13.00
	5297 R	-0.23	-9.84	12.95	-0.04	-0.04	-5.94	6.33	-0.20	-0.20	-7.75	9.40	-0.12	-0.12	-10.35	13.81
5306.0	5306 L	-0.04	-23.91	25.25	-0.23	-0.23	-29.58	34.88	-0.17	-0.17	-29.23	34.29	-0.13	-0.13	-24.55	26.34
	5306 R	-0.23	-29.58	34.88	-0.04	-0.04	-23.91	25.25	-0.13	-0.13	-24.13	25.62	-0.17	-0.17	-29.67	35.04
5402.0	5402 L	-12.58	-8.25	8.89	-16.99	-16.99	-4.13	4.45	-15.26	-15.26	-11.84	12.75	-14.81	-14.81	-2.11	2.27
	5402 R	-17.99	-4.22	4.22	-13.32	-13.32	-8.42	8.42	-16.07	-16.07	-1.68	1.68	-15.88	-15.88	-12.44	12.44
5407.0	5407 L	-13.37	3.55	-3.55	-17.88	-17.88	1.26	-1.26	-14.30	-14.30	5.32	-5.32	-17.22	-17.22	-0.19	0.19
	5407 R	-17.00	1.23	-1.23	-12.72	-12.72	3.49	-3.49	-16.42	-16.42	-0.15	0.15	-13.56	-13.56	5.19	-5.19
5411.0	5411 L	-12.69	3.98	-3.98	-17.03	-17.03	1.74	-1.74	-16.51	-16.51	0.26	-0.26	-13.54	-13.54	5.66	-5.66
	5411 R	-17.92	1.77	-1.77	-13.34	-13.34	4.05	-4.05	-14.54	-14.54	6.01	-6.01	-17.25	-17.25	0.09	-0.09
5416.0	5416 L	-13.35	-4.64	4.64	-18.22	-18.22	-1.96	1.96	-16.33	-16.33	0.06	-0.06	-15.95	-15.95	-8.61	8.61
	5416 R	-17.21	-1.92	2.07	-12.60	-12.60	-4.55	4.90	-15.63	-15.63	-7.72	8.32	-14.22	-14.22	-1.34	1.44
5422.0	5422 L	-10.25	-8.89	8.89	-15.16	-15.16	-5.54	5.54	-13.37	-13.37	-12.17	12.17	-12.27	-12.27	-4.81	4.81
	5422 R	-17.80	-6.27	6.27	-12.03	-12.03	-10.07	10.07	-15.35	-15.35	-4.32	4.32	-15.00	-15.00	-14.55	14.55
5427.0	5427 L	-12.22	5.91	-5.91	-17.53	-17.53	3.32	-3.32	-13.95	-13.95	8.25	-8.25	-16.87	-16.87	1.81	-1.81
	5427 R	-16.57	3.25	-3.25	-11.56	-11.56	5.79	-5.79	-16.07	-16.07	1.88	-1.88	-12.49	-12.49	7.55	-7.55
5431.0	5431 L	-11.63	5.68	-5.68	-16.59	-16.59	3.12	-3.12	-16.07	-16.07	1.73	-1.73	-12.57	-12.57	7.43	-7.43
	5431 R	-17.55	3.19	-3.19	-12.30	-12.30	5.80	-5.80	-13.81	-13.81	8.00	-8.00	-16.87	-16.87	1.66	-1.66
5436.0	5436 L	-12.24	-10.94	10.94	-17.80	-17.80	-7.75	7.75	-15.42	-15.42	-5.21	5.21	-15.19	-15.19	-15.46	15.46
	5436 R	-15.17	-6.85	6.85	-10.43	-10.43	-9.66	9.66	-13.42	-13.42	-13.08	13.08	-12.47	-12.47	-5.42	5.42
5442.0	5442 L	-11.75	-5.36	5.36	-16.64	-16.64	-2.20	2.20	-14.77	-14.77	-8.66	8.66	-13.86	-13.86	-0.78	0.78
	5442 R	-19.71	-2.52	2.52	-13.92	-13.92	-6.14	6.14	-17.22	-17.22	0.06	-0.06	-16.87	-16.87	-10.64	10.64
5447.0	5447 L	-13.95	2.95	-2.95	-19.45	-19.45	0.02	-0.02	-15.68	-15.68	5.24	-5.24	-18.73	-18.73	-1.54	1.54
	5447 R	-18.36	0.02	-0.02	-13.18	-13.18	2.89	-2.89	-17.76	-17.76	-1.44	1.44	-14.12	-14.12	4.62	-4.62
5451.0	5451 L	-13.16	2.96	-2.96	-18.39	-18.39	0.13	-0.13	-17.81	-17.81	-1.34	1.34	-14.08	-14.08	4.70	-4.70
	5451 R	-19.48	0.14	-0.14	-13.93	-13.93	3.02	-3.02	-14.96	-14.96	4.84	-4.84	-18.77	-18.77	-1.44	1.44
5456.0	5456 L	-13.86	-5.77	5.77	-19.79	-19.79	-1.70	1.70	-17.34	-17.34	0.58	-0.58	-16.80	-16.80	-10.09	10.09
	5456 R	-16.70	-1.44	1.44	-11.69	-11.69	-5.03	5.03	-14.76	-14.76	-8.15	8.15	-13.85	-13.85	-0.45	0.45
5462.0	5462 L	-9.67	-8.42	9.70	-15.39	-15.39	-5.59	6.45	-13.79	-13.79	-11.30	13.02	-11.41	-11.41	-4.38	5.05
	5462 R	-18.16	-6.81	6.81	-11.42	-11.42	-10.25	10.25	-14.31	-14.31	-4.28	4.28	-15.52	-15.52	-14.71	14.71
5467.0	5467 L	-11.34	4.80	-4.80	-17.55	-17.55	3.04	-3.04	-13.01	-13.01	7.68	-7.68	-16.31	-16.31	0.56	-0.56
	5467 R	-16.58	2.98	-2.98	-10.72	-10.72	4.70	-4.70	-15.76	-15.76	1.01	-1.01	-11.96	-11.96	7.23	-7.23
5471.0	5471 L	-10.28	3.97	-3.97	-16.61	-16.61	3.08	-3.08	-15.92	-15.92	1.24	-1.24	-11.40	-11.40	6.45	-6.45
	5471 R	-17.59	3.15	-3.15	-10.88	-10.88	4.06	-4.06	-12.74	-12.74	7.55	-7.55	-16.02	-16.02	0.13	-0.13
5476.0	5476 L	-11.09	-9.13	9.13	-18.13	-18.13	-5.90	5.90	-13.95	-13.95	-3.16	3.16	-15.93	-15.93	-13.46	13.46
	5476 R	-15.36	-4.81	5.54	-9.39	-9.39	-7.50	8.64	-13.71	-13.71	-10.76	12.39	-11.49	-11.49	-3.06	3.52
5482.0	5482 L	-9.34	-10.04	12.33	-15.61	-15.61	-8.15	10.02	-14.20	-14.20	-13.15	16.16	-11.03	-11.03	-6.90	8.48
	5482 R	-17.83	-9.79	9.79	-10.67	-10.67	-12.05	12.05	-13.19	-13.19	-7.46	7.46	-15.85	-15.85	-16.29	16.29
5487.0	5487 L	-10.64	5.59	-5.59	-17.56	-17.56	5.61	-5.61	-13.26	-13.26	9.63	-9.63	-16.12	-16.12	2.40	-2.40
	5487 R	-16.58	5.49	-5.49	-10.06	-10.06	5.47	-5.47	-15.28	-15.28	2.40	-2.40	-11.73	-11.73	8.72	-8.72
5491.0	5491 L	-10.75	6.21	-6.21	-16.33	-16.33	5.19	-5.19	-15.37	-15.37	2.56	-2.56	-12.11	-12.11	9.14	-9.14
	5491 R	-17.29	5.30	-5.30	-11.37	-11.37	6.34	-6.34	-13.45	-13.45	9.80	-9.80	-16.22	-16.22	2.56	-2.56
5496.0	5496 L	-11.32	-12.37	12.37	-17.78	-17.78	-9.70	9.70	-13.70	-13.70	-7.11	7.11	-15.74	-15.74	-16.74	16.74
	5496 R	-15.56	-8.09	9.93	-9.91	-9.91	-10.31	12.67	-14.15	-14.15	-13.50	16.59	-11.56	-11.56	-6.46	7.94
5502.0	5502 L	-9.89	-9.01	9.55	-15.93	-15.93	-6.21	6.57	-13.69	-13.69	-13.30	14.09	-12.17	-12.17	-4.84	5.13
	5502 R	-17.66	-6.81	6.81	-10.98	-10.98	-9.86	9.86	-14.91	-14.91	-3.75	3.75	-14.41	-14.41	-15.41	15.41
5507.0	5507 L	-11.09	5.94	-5.94	-17.29	-17.29	3.19	-3.19	-13.19	-13.19	9.14	-9.14	-16.54	-16.54	1.48	-1.48
	5507 R	-16.47	3.13	-3.13	-10.57	-10.57	5.85	-5.85	-15.81	-15.81	1.50	-1.50	-11.72	-11.72	8.24	-8.24
5511.0	5511 L	-10.55	5.78	-5.78	-16.42	-16.42	3.06	-3.06	-15.79	-15.79	1.47	-1.47	-11.72	-11.72	8.19	-8.19
	5511 R	-17.23	3.11	-3.11	-11.06	-11.06	5.87	-5.87	-13.16	-13.16	9.08	-9.08	-16.51	-16.51	1.44	-1.44
5516.0	5516 L	-10.87	-9.90	9.90	-17.43	-17.43	-6.52	6.52	-14.62	-14.62	-3.36	3.36	-14.41	-14.41	-15.80	15.80
	5516 R	-15.71	-5.96	6.31	-9.79	-9.79	-9.05	9.58	-13.64	-13.64	-13.71	14.52	-12.28	-12.28	-4.13	4.38
5522.0	5522 L	-7.74	-10.87	10.32	-12.79	-12.79	-8.81	8.36	-11.43	-11.43	-13.81	13.11	-9.30	-9.30	-8.01	7.60
	5522 R	-14.19	-9.20	9.20	-8.60	-8.60	-11.35	11.35	-11.62	-11.62	-6.94	6.94	-11.85	-11.85	-15.38	15.38
5527.0	5527 L	-8.79	8.26	-8.26	-14.13	-14.13	6.20	-6.20	-10.48	-10.48	10.71	-10.71	-13.41	-13.41	4.73	-4.73
	5527 R	-13.57	6.11	-6.11	-8.46	-8.46	8.15	-8.15	-12.95	-12.95	4.71	-4.71	-9.65	-9.65	10.20	-10.20

Splice Node	Splice Side	MAX MY				MIN MY				MAX MZ				MIN MZ			
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
5115.0	5115 L	-0.10	-0.10	2.90	-7.37	-0.43	-0.43	1.32	-3.86	-0.17	-0.17	-2.56	4.78	-0.35	-0.35	14.57	-17.04
	5115 R	-0.46	-0.46	0.96	-4.02	-0.05	-0.05	7.95	-8.96	-0.38	-0.38	17.50	-18.68	-0.17	-0.17	-3.24	5.25
5127.0	5127 L	-0.21	-0.21	0.19	-0.47	-0.37	-0.37	0.04	-0.14	-0.35	-0.35	-3.98	8.74	-0.15	-0.15	4.10	-9.11
	5127 R	-0.41	-0.41	0.07	-0.21	-0.24	-0.24	0.21	-0.57	-0.18	-0.18	4.14	-10.59	-0.38	-0.38	-3.98	10.11
5133.0	5133 L	8.61	8.61	6.71	-6.82	8.89	8.89	6.23	-5.90	8.00	8.00	3.85	-1.43	9.18	9.18	9.13	-11.37
	5133 R	11.36	11.36	7.21	-7.66	11.03	11.03	7.74	-8.92	11.70	11.70	10.23	-14.93	10.31	10.31	4.78	-1.78
5147.0	5147 L	11.24	11.24	10.19	-11.28	11.01	11.01	9.25	-8.99	10.21	10.21	6.57	-2.55	11.85	11.85	12.70	-17.32
	5147 R	8.60	8.60	7.83	-6.86	8.79	8.79	8.75	-8.58	9.30	9.30	11.17	-13.14	7.92	7.92	5.25	-1.98
5153.0	5153 L	-0.25	-0.25	0.67	-6.64	-0.14	-0.14	-1.43	-1.28	-0.27	-0.27	-5.42	8.91	-0.17	-0.17	14.25	-17.63
	5153 R	-0.14	-0.14	-1.99	-1.25	-0.26	-0.26	0.11	-7.08	-0.16	-0.16	15.20	-19.34	-0.27	-0.27	-5.97	9.80
5163.0	5163 L	0.27	0.27	1.55	-2.19	-0.81	-0.81	1.41	-1.79	-0.20	-0.20	-2.72	9.69	-0.30	-0.30	5.60	-13.45
	5163 R	-0.77	-0.77	1.44	-2.03	0.25	0.25	1.43	-2.00	-0.29	-0.29	5.25	-12.30	-0.20	-0.20	-2.61	8.89
5169.0	5169 L	8.79	8.79	6.55	-5.79	8.39	8.39	7.24	-7.15	8.03	8.03	4.17	-1.16	9.10	9.10	9.52	-11.59
	5169 R	10.87	10.87	8.25	-9.75	11.36	11.36	7.51	-7.81	11.71	11.71	10.58	-15.86	10.46	10.46	5.09	-1.44
5183.0	5183 L	10.94	10.94	7.50	-6.85	11.17	11.17	8.67	-9.93	10.65	10.65	5.50	-1.61	11.75	11.75	10.69	-15.22
	5183 R	8.63	8.63	7.55	-7.27	8.44	8.44	6.41	-5.04	9.13	9.13	9.52	-11.09	8.19	8.19	4.47	-1.28
5189.0	5189 L	-0.16	-0.16	-5.99	2.65	-0.61	-0.61	-4.94	-0.18	-0.44	-0.44	-9.61	12.41	-0.29	-0.29	7.73	-11.05
	5189 R	-0.56	-0.56	-4.76	-0.21	-0.15	-0.15	-5.67	2.61	-0.27	-0.27	7.29	-10.98	-0.40	-0.40	-8.78	12.19
5199.0	5199 L	-0.22	-0.22	4.01	-7.71	-0.71	-0.71	1.36	0.46	-0.34	-0.34	-1.60	9.61	-0.41	-0.41	6.75	-16.14
	5199 R	-0.68	-0.68	1.28	0.47	-0.22	-0.22	3.85	-6.60	-0.40	-0.40	6.47	-13.82	-0.34	-0.34	-1.56	8.29
5205.0	5205 L	9.29	9.29	8.11	-8.69	9.48	9.48	7.86	-8.14	8.56	8.56	5.19	-2.25	9.84	9.84	10.27	-13.49
	5205 R	11.18	11.18	7.90	-9.08	10.97	10.97	8.16	-9.77	11.56	11.56	10.30	-15.50	10.30	10.30	5.28	-2.05
5219.0	5219 L	11.37	11.37	8.64	-10.37	10.46	10.46	7.40	-7.04	10.30	10.30	5.08	-0.80	11.63	11.63	10.55	-15.48
	5219 R	8.84	8.84	7.26	-6.35	9.65	9.65	8.54	-9.18	9.89	9.89	10.46	-13.43	8.68	8.68	4.93	-1.19
5225.0	5225 L	-0.14	-0.14	-2.38	-3.89	-0.54	-0.54	-4.57	2.15	-0.30	-0.30	-8.56	13.14	-0.25	-0.25	12.68	-15.48
	5225 R	-0.48	-0.48	-3.73	1.86	-0.11	-0.11	-1.71	-3.77	-0.21	-0.21	11.22	-14.26	-0.26	-0.26	-7.43	12.09
5233.0	5233 L	-0.12	-0.12	-2.07	-1.11	-0.43	-0.43	-4.72	6.25	-0.23	-0.23	-7.58	14.18	-0.20	-0.20	0.29	-7.65
	5233 R	-0.42	-0.42	-4.42	5.89	-0.13	-0.13	-1.99	-1.06	-0.20	-0.20	0.17	-7.23	-0.23	-0.23	-7.04	13.36
5241.0	5241 L	7.40	7.40	3.24	-4.16	7.35	7.35	2.75	-3.00	7.05	7.05	0.70	1.87	7.94	7.94	5.02	-8.37
	5241 R	7.41	7.41	2.74	-2.84	7.45	7.45	3.23	-3.96	8.00	8.00	4.99	-8.01	7.11	7.11	0.70	1.86
5253.0	5253 L	7.74	7.74	5.45	-6.42	7.39	7.39	3.90	-2.85	7.09	7.09	2.25	0.96	8.00	8.00	7.17	-10.38
	5253 R	7.34	7.34	3.88	-2.98	7.68	7.68	5.44	-6.67	7.95	7.95	7.17	-10.77	7.04	7.04	2.22	0.96
5262.0	5262 L	-0.26	-0.26	-3.45	1.48	-0.56	-0.56	-1.73	-3.42	-0.40	-0.40	-6.95	11.49	-0.27	-0.27	11.36	-14.49
	5262 R	-0.56	-0.56	-2.50	-3.16	-0.27	-0.27	-4.20	1.60	-0.26	-0.26	12.03	-14.21	-0.41	-0.41	-7.69	11.37
5271.0	5271 L	0.15	0.15	19.88	-21.78	-0.78	-0.78	4.72	-7.96	-0.54	-0.54	3.37	-4.19	-0.08	-0.08	24.80	-26.99
	5271 R	-0.69	-0.69	4.47	-7.27	0.12	0.12	16.59	-19.60	-0.08	-0.08	20.64	-24.27	-0.47	-0.47	3.21	-3.87
5279.0	5279 L	10.56	10.56	11.11	-12.30	10.59	10.59	10.73	-11.64	10.03	10.03	7.81	-6.60	11.55	11.55	15.67	-16.23
	5279 R	12.41	12.41	11.97	-13.08	12.38	12.38	12.36	-13.81	13.59	13.59	17.41	-18.13	11.78	11.78	8.95	-7.45
5289.0	5289 L	12.51	12.51	7.11	-8.24	12.38	12.38	6.36	-6.83	11.65	11.65	3.08	-0.70	13.53	13.53	12.48	-13.11
	5289 R	10.57	10.57	5.57	-5.97	10.68	10.68	6.30	-7.22	10.95	10.95	8.53	-11.08	9.92	9.92	2.40	-0.48
5297.0	5297 L	-0.24	-0.24	-11.42	15.49	-0.12	-0.12	-7.74	8.45	-0.22	-0.22	-15.16	22.65	-0.13	-0.13	-4.34	1.94
	5297 R	-0.09	-0.09	-5.96	6.36	-0.19	-0.19	-9.14	11.76	-0.10	-0.10	-3.03	1.37	-0.17	-0.17	-12.37	17.24
5306.0	5306 L	-0.09	-0.09	-24.91	26.95	-0.19	-0.19	-27.19	30.83	-0.18	-0.18	-30.62	36.66	-0.11	-0.11	-22.52	22.89
	5306 R	-0.19	-0.19	-27.19	30.83	-0.09	-0.09	-24.91	26.95	-0.11	-0.11	-22.52	22.89	-0.18	-0.18	-30.62	36.66
5402.0	5402 L	-15.65	-15.65	-5.55	5.98	-15.24	-15.24	-5.07	5.46	-14.38	-14.38	-12.60	13.57	-15.88	-15.88	-1.20	1.29
	5402 R	-16.13	-16.13	-5.13	5.13	-16.59	-16.59	-5.73	5.73	-16.81	-16.81	-1.23	1.23	-15.24	-15.24	-12.85	12.85
5407.0	5407 L	-15.13	-15.13	2.29	-2.29	-16.37	-16.37	1.68	-1.68	-16.89	-16.89	-0.35	0.35	-15.11	-15.11	5.89	-5.89
	5407 R	-15.55	-15.55	1.68	-1.68	-14.42	-14.42	2.22	-2.22	-14.37	-14.37	5.79	-5.79	-16.05	-16.05	-0.35	0.35
5411.0	5411 L	-15.09	-15.09	3.10	-3.10	-14.89	-14.89	2.72	-2.72	-16.16	-16.16	-0.07	0.07	-14.44	-14.44	6.30	-6.30
	5411 R	-15.67	-15.67	2.82	-2.82	-15.89	-15.89	3.05	-3.05	-15.18	-15.18	6.41	-6.41	-17.00	-17.00	-0.07	0.07
5416.0	5416 L	-16.75	-16.75	-3.46	3.46	-16.20	-16.20	-2.26	2.26	-15.33	-15.33	-9.10	9.10	-17.30	-17.30	0.73	-0.73
	5416 R	-15.31	-15.31	-2.27	2.44	-15.86	-15.86	-3.05	3.28	-16.34	-16.34	0.72	-0.77	-14.47	-14.47	-8.92	9.61
5422.0	5422 L	-13.65	-13.65	-6.56	6.56	-12.80	-12.80	-6.51	6.51	-12.16	-12.16	-13.23	13.23	-14.04	-14.04	-3.18	3.18
	5422 R	-15.03	-15.03	-7.35	7.35	-16.03	-16.03	-7.44	7.44	-16.48	-16.48	-3.60	3.60	-14.29	-14.29	-14.98	14.98
5427.0	5427 L	-13.92	-13.92	4.70	-4.70	-15.74	-15.74	3.95	-3.95	-16.55	-16.55	1.60	-1.60	-14.37	-14.37	8.41	-8.41
	5427 R	-14.92	-14.92	3.89	-3.89	-13.16	-13.16	4.60	-4.60	-13.59	-13.59	8.24	-8.24	-15.62	-15.62	1.56	-1.56
5431.0	5431 L	-14.16	-14.16	4.12	-4.12	-14.00	-14.00	4.00	-4.00	-15.66	-15.66	1.41	-1.41	-13.55	-13.55	8.14	-8.14
	5431 R	-14.81	-14.81	4.07	-4.07	-14.56	-14.56	4.40	-4.40	-14.33	-14.33	8.31	-8.31	-16.57	-16.57	1.44	-1.44
5436.0	5436 L	-16.17	-16.17	-8.03	8.03	-14.72	-14.72	-9.01	9.01	-14.48	-14.48	-15.90	15.90	-16.44	-16.44	-4.62	4.62
	5436 R	-12.54	-12.54	-7.89	7.89	-13.80	-13.80	-7.18	7.18	-14.01	-14.01	-4.08	4.08	-12.32	-12.32	-14.04	14.04
5442.0	5442 L	-15.12	-15.12	-2.48	2.48	-14.44	-14.44	-2.94	2.94	-13.65	-13.65	-9.65	9.65	-15.46	-15.46	0.65	-0.65
	5442 R	-17.10	-17.10	-3.30	3.30	-17.91	-17.91	-2.88	2.88	-18.31	-18.31	0.75	-0.75	-16.18	-16.18	-11.06	11.06
5447.0	5447 L	-16.34	-16.34	0.86	-0.86	-17.17	-17.17	2.24	-2.24	-18.37	-18.37	-1.74	1.74	-16.09	-16.09	5.39	-5.39
	5447 R	-16.12	-16.12	2.28	-2.28	-15.55	-15.55	0.75	-0.75	-15.21	-15.21	5.28	-5.28	-17.34	-17.34	-1.71	1.71
5451.0	5451 L	-16.04	-16.04	0.76	-0.76	-16.21	-16.21	1.94	-1.94	-17.38	-17.38	-1.59	1.59	-15.18	-15.18	5.38	-5.38
	5451 R	-17.16	-17.16	2.00	-2.00	-16.98	-16.98	0.77	-0.77	-16.06	-16.06	5.49	-5.49	-18.41	-18.41	-1.62	1.62
5456.0	5456 L	-18.03	-18.03	-2.59	2.59	-17.14	-17.14	-2.64	2.64	-16.10	-16.10	-10.51	10.51	-18.44	-18.44	1.27	-1.27
	5456 R	-14.49	-14.49	-2.38	2.38	-15.19	-15.19	-2.16	2.16	-15.57	-15.57	1.11	-1.11	-13.58	-13.58	-9.17	9.17
5462.0	5462 L	-12.89	-12.89	-6.28	7.23	-12.13	-12.13	-6.57	7.57	-12.05	-12.05	-13.01	15.00	-13.70	-13.70	-2.40	2.77
	5462 R	-14.33	-14.33	-8.13	8.13	-15.21	-15.21	-7.51	7.51	-16.16	-16.16	-2.92	2.92	-14.24	-14.24	-15.85	15.85
5467.0	5467 L	-14.98	-14.98	5.61	-5.61	-14.27	-14.27	2.75	-2.75	-15.28	-15.28	-0.23	0.23	-14.14	-14.14	8.69	-8.69
	5467 R	-13.59	-13.59	2.39	-2.39	-14.07	-14.07	5.63	-5.63	-13.36	-13.36	8.51	-8.51	-14.43	-14.43	-0.23	0.23
5471.0	5471 L	-12.42	-12.42	3.75	-3.75	-13.76	-13.76	3.70	-3.70	-14.34	-14.34	-0.39	0.39	-13.31	-13.31	8.17	-8.17
	5471 R	-14.71	-14.71	3.36	-3.36	-13.12	-13.12	4.00	-4.00	-14.09	-14.09	8.34	-8.34	-15.19	-15.19	-0.40	0.40
5476.0	5476 L	-15.05	-15.05	-7.25	7.25	-14.73	-14.73	-5.88	5.88	-14.02	-14.02	-14.76	14.76	-15.88	-15.88	-1.85	1.85
	5476 R	-12.48	-12.48	-4.77	5.50	-12.76	-12.76	-6.01	6.92	-13.46	-13.46	-1.52	1.75	-11.87	-11.87	-12.13	13.97
5482.0	5482 L	-13.51	-13.51	-7.56	9.29	-12.22	-12.22	-9.19	11.29	-12.03	-12.03	-14.87	18.27	-13.83	-13.83	-4.81	5.91
	5482 R	-14.20	-14.20	-12.29	12.29	-15.39	-15.39	-8.86	8.86	-15.79	-15.79	-5.78	5.78	-13.75	-13.75	-17.85	17.85
5487.0	5487 L	-13.96	-13.96	6.07	-6.07	-14.41	-14.41	5.14	-5.14	-14.92	-14.92	1.74	-1.74	-14.07	-14.07	10.07	-10.07
	5487 R	-13.52	-13.52	4.93	-4.93	-13.44	-13.44	6.23	-6.23	-13.30	-13.30	9.86	-9.86	-14.09	-14.09	1.71	-1.71
5491.0	5491 L	-12.95	-12.95	5.21	-5.21	-14.09	-14.09	5.80	-5.80	-14.07	-14.07	1.51	-1.51	-13.44	-13.44	10.22	-10.22
	5491 R	-14.89	-14.89	5.74	-5.74	-13.71	-13.71	5.47	-5.47	-14.22	-14.22	10.43	-10.43	-14.90	-14.90	1.54	-1.54
5496.0	5496 L	-14.93	-14.93	-10.75	10.75	-14.17	-14.17	-9.95	9.95	-14.00	-14.00	-18.25	18.25	-15.80	-15.80	-5.55	5.55
	5496 R	-12.52	-12.52	-8.46	10.39	-12.98	-12.98	-8.77	10.78	-13.84	-13.84	-4.62	5.68	-12.25	-12.25	-15.21	18.68
5502.0	5502 L	-13.88	-13.88	-6.79	7.19	-13.38	-13.38	-6.15	6.52	-12.28	-12.28	-14.59	15.45	-14.57	-14.57	-2.78	2.94
	5502 R	-14.83	-14.83	-6.69	6.69	-15.40	-15.40	-7.49	7.49	-16.15	-16.15	-3.04	3.04	-13.64	-13.64	-15.96	15.96
5507.0	5507 L	-13.54	-13.54	4.96	-4.96	-14.27	-14.27	4.05	-4.05	-16.09	-16.09	1.17	-1.17	-13.49	-13.49	9.32	-9.32
	5507 R	-13.59	-13.59	3.96	-3.96	-12.90	-12.90	4.90	-4.90	-12.86	-12.86	9.16	-9.16	-15.32	-15.32	1.15	-1.15
5511.0	5511 L	-12.81	-12.81	4.32	-4.32	-14.10	-14.10	4.14	-4.14	-15.25	-15.25	1.18	-1.18	-12.89	-12.89	9.09	-9.09
	5511 R	-14.88	-14.88	4.13	-4.13	-13.37	-13.37	4.48	-4.48	-13.52	-13.52	9.25	-9.25	-16.01	-16.01	1.20	-1.20
5516.0	5516 L	-15.03	-15.03	-7.35	7.35	-14.14	-14.14	-7.38	7.38	-13.50	-13.50	-16.36	16.36	-16.02	-16.02	-2.65	2.65
	5516 R	-12.75	-12.75	-6.78	7.18	-13.55	-13.55	-6.65	7.04	-14.45	-14.45	-2.42	2.57	-12.16	-12.16	-14.95	15.83
5522.0	5522 L	-11.04	-11.04	-10.81	10.26	-9.84	-9.84	-8.87	8.42	-9.96	-9.96	-15.20	14.43	-11.59	-11.59	-5.94	5.64
	5522 R	-10.88	-10.88	-9.12	9.12	-12.28	-12.28	-11.40	11.40	-12.86	-12.86	-6.20	6.20	-11.06	-11.06	-15.87	15.87
5527.0	5527 L	-11.88	-11.88	7.29	-7.29	-11.46	-11.46	6.87	-6.87	-12.94	-12.94	4.48	-4.48	-11.18	-11.18	11.13	-11.13
	5527 R	-11.02	-11.02	6.79	-6.79	-11.41	-11.41	7.16	-7.16	-10.75	-10.75	10.98	-10.98	-12.43	-12.43	4.42	-4.42

ss Values for Web Splice Calculations

SERVICE II

Splice Node	Splice Side	MAX FX			MIN FX				MAX FY				MIN FY			
		Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
5531.0	5531 L	-8.43	7.99	-7.99	-13.63	-13.63	6.23	-6.23	-12.99	-12.99	4.70	-4.70	-9.69	-9.69	10.05	-10.05
	5531 R	-14.19	6.30	-6.30	-8.77	-8.77	8.10	-8.10	-10.52	-10.52	10.55	-10.55	-13.47	-13.47	4.73	-4.73
5536.0	5536 L	-8.47	-13.96	13.96	-14.35	-14.35	-12.43	12.43	-11.40	-11.40	-9.10	9.10	-12.04	-12.04	-19.02	19.02
	5536 R	-12.93	-11.90	11.30	-7.62	-7.62	-13.37	12.69	-11.48	-11.48	-17.47	16.59	-9.51	-9.51	-9.67	9.18
5542.0	5542 L	-12.00	-5.49	5.77	-16.68	-16.68	-5.24	5.50	-15.47	-15.47	-9.46	9.93	-13.60	-13.60	-2.48	2.60
	5542 R	-18.45	-5.67	5.67	-13.28	-13.28	-5.94	5.94	-15.86	-15.86	-1.79	1.79	-16.54	-16.54	-10.85	10.85
5547.0	5547 L	-13.38	4.58	-4.58	-18.23	-18.23	3.09	-3.09	-15.09	-15.09	7.04	-7.04	-17.25	-17.25	1.27	-1.27
	5547 R	-17.55	3.06	-3.06	-12.89	-12.89	4.52	-4.52	-16.84	-16.84	1.45	-1.45	-14.09	-14.09	6.56	-6.56
5551.0	5551 L	-12.95	4.58	-4.58	-17.55	-17.55	3.33	-3.33	-16.85	-16.85	1.84	-1.84	-14.12	-14.12	6.58	-6.58
	5551 R	-18.23	3.36	-3.36	-13.45	-13.45	4.63	-4.63	-15.10	-15.10	7.04	-7.04	-17.33	-17.33	1.73	-1.73
5556.0	5556 L	-13.36	-9.31	9.31	-18.33	-18.33	-7.15	7.15	-15.50	-15.50	-3.88	3.88	-16.66	-16.66	-13.44	13.44
	5556 R	-16.56	-6.61	6.93	-12.07	-12.07	-8.60	9.03	-15.33	-15.33	-12.04	12.64	-13.54	-13.54	-4.23	4.44
7007.0	7007 L	0.11	-26.09	20.88	-0.10	-0.10	-30.59	28.60	0.08	0.08	-26.01	20.75	-0.08	-0.08	-31.55	30.24
	7007 R	-0.10	-30.59	28.60	0.11	0.11	-26.09	20.88	-0.07	-0.07	-31.13	29.51	0.08	0.08	-26.41	21.44
7015.0	7015 L	0.11	-4.22	2.10	-0.10	-0.10	-7.99	8.54	-0.08	-0.08	-6.19	5.46	0.07	0.07	-8.60	9.59
	7015 R	-0.13	-8.95	12.74	0.11	0.11	-5.26	4.38	-0.09	-0.09	-9.68	14.40	0.05	0.05	-7.50	9.45
7021.0	7021 L	11.00	7.02	-8.93	8.63	8.63	4.14	-3.11	9.70	9.70	2.99	-0.78	10.22	10.22	7.29	-9.48
	7021 R	11.18	4.92	-3.78	14.00	14.00	7.77	-10.90	13.06	13.06	8.32	-12.26	12.42	12.42	3.49	-0.22
7035.0	7035 L	14.00	12.69	-14.72	11.18	11.18	11.77	-12.43	12.67	12.67	13.61	-16.99	12.92	12.92	10.55	-9.38
	7035 R	8.63	10.07	-9.94	11.00	11.00	11.08	-11.98	10.10	10.10	9.14	-8.05	9.88	9.88	11.69	-13.21
7041.0	7041 L	0.53	10.82	-12.64	-0.56	-0.56	3.85	-6.59	-0.05	-0.05	3.71	-6.28	-0.29	-0.29	3.90	-6.69
	7041 R	-0.65	4.11	-8.38	0.69	0.69	13.23	-16.14	-0.32	-0.32	4.66	-9.85	-0.07	-0.07	3.64	-7.13
7051.0	7051 L	0.40	4.09	-4.79	-0.65	-0.65	2.80	-1.35	-0.21	-0.21	4.57	-6.06	-0.15	-0.15	1.84	1.23
	7051 R	-0.64	2.50	-1.19	0.38	0.38	3.78	-4.38	-0.15	-0.15	1.83	0.48	-0.21	-0.21	3.75	-4.31
7057.0	7057 L	9.94	8.79	-10.74	7.41	7.41	6.29	-5.50	8.63	8.63	5.48	-3.81	9.13	9.13	9.01	-11.20
	7057 R	7.77	6.36	-5.64	10.38	10.38	8.84	-11.03	9.53	9.53	9.29	-12.00	9.02	9.02	5.35	-3.45
7071.0	7071 L	10.38	7.31	-8.57	7.77	7.77	5.28	-4.18	9.16	9.16	7.69	-9.41	9.41	9.41	4.16	-1.74
	7071 R	7.41	5.22	-4.10	9.94	9.94	7.28	-8.40	9.01	9.01	4.31	-2.19	8.77	8.77	7.43	-8.71
7077.0	7077 L	0.30	-6.10	2.89	-0.66	-0.66	-7.60	6.63	-0.20	-0.20	-8.02	7.66	-0.24	-0.24	-7.38	6.08
	7077 R	-0.58	-6.70	5.24	0.30	0.30	-5.17	2.12	-0.19	-0.19	-6.03	3.87	-0.16	-0.16	-7.36	6.56
7089.0	7089 L	0.30	2.87	-2.73	-0.59	-0.59	2.48	-1.92	-0.25	-0.25	2.89	-2.76	-0.07	-0.07	0.87	1.34
	7089 R	-0.61	2.38	-2.13	0.28	0.28	2.73	-2.92	-0.10	-0.10	1.03	0.86	-0.28	-0.28	2.35	-2.06
7095.0	7095 L	10.88	9.28	-10.92	8.41	8.41	7.68	-7.64	9.85	9.85	6.50	-5.22	9.88	9.88	9.95	-12.28
	7095 R	8.92	7.46	-7.41	11.50	11.50	8.99	-10.64	10.44	10.44	9.86	-12.48	10.42	10.42	6.11	-4.58
7109.0	7109 L	11.50	10.63	-12.63	8.92	8.92	8.11	-7.32	10.52	10.52	10.93	-13.26	10.31	10.31	7.22	-5.44
	7109 R	8.41	8.36	-7.59	10.88	10.88	10.99	-12.96	9.74	9.74	7.65	-6.12	9.95	9.95	11.06	-13.11
7115.0	7115 L	0.51	7.10	-8.64	-0.73	-0.73	0.16	-1.42	-0.06	-0.06	-0.45	-0.08	-0.47	-0.47	1.56	-4.54
	7115 R	-0.78	-0.35	-1.30	0.59	0.59	8.53	-9.55	-0.49	-0.49	1.69	-5.82	-0.07	-0.07	-1.26	0.70
7127.0	7127 L	0.34	1.32	-3.01	-0.78	-0.78	-1.50	3.20	-0.21	-0.21	0.84	-1.97	-0.33	-0.33	-2.41	5.23
	7127 R	-0.84	-1.46	3.63	0.33	0.33	1.13	-2.99	-0.35	-0.35	-2.13	5.34	-0.25	-0.25	0.43	-1.19
7133.0	7133 L	10.11	7.32	-8.25	7.08	7.08	4.92	-3.72	8.91	8.91	4.76	-3.42	8.68	8.68	7.22	-8.06
	7133 R	9.21	5.89	-4.96	12.81	12.81	8.26	-10.66	11.10	11.10	8.45	-11.11	11.36	11.36	5.42	-3.81
7147.0	7147 L	12.81	10.76	-13.21	9.21	9.21	8.26	-7.17	11.65	11.65	11.48	-14.93	10.69	10.69	6.49	-2.89
	7147 R	7.08	6.88	-5.38	10.11	10.11	9.40	-10.13	8.34	8.34	5.42	-2.63	9.14	9.14	9.82	-10.93
7153.0	7153 L	1.45	8.03	-10.44	-1.50	-1.50	-3.17	3.00	0.21	0.21	-3.72	4.40	-1.03	-1.03	0.21	-5.63
	7153 R	-1.53	-3.63	3.10	1.56	1.56	8.41	-11.35	-1.05	-1.05	0.10	-7.26	0.19	0.19	-4.56	5.69
7163.0	7163 L	0.89	2.26	-4.28	-1.53	-1.53	0.10	1.73	-0.45	-0.45	1.68	-2.66	-0.38	-0.38	-0.38	3.07
	7163 R	-1.46	0.04	1.65	0.82	0.82	2.11	-3.93	-0.35	-0.35	-0.14	2.14	-0.44	-0.44	1.13	-1.30
7169.0	7169 L	9.98	7.93	-8.65	7.17	7.17	5.84	-4.59	8.46	8.46	4.45	-1.88	9.00	9.00	8.45	-9.68
	7169 R	9.43	6.83	-6.34	12.77	12.77	8.86	-11.65	11.60	11.60	9.67	-13.77	10.95	10.95	5.14	-1.89
7183.0	7183 L	12.77	8.62	-10.21	9.43	9.43	6.83	-5.51	11.32	11.32	9.16	-11.65	11.30	11.30	6.03	-3.42
	7183 R	7.17	5.74	-3.99	9.98	9.98	7.58	-7.56	8.76	8.76	5.22	-2.98	8.77	8.77	7.85	-8.10
7189.0	7189 L	0.32	-4.72	-0.71	-1.00	-1.00	-7.06	5.59	-0.50	-0.50	-7.58	7.00	-0.33	-0.33	-5.28	0.79
	7189 R	-0.92	-6.57	5.44	0.29	0.29	-4.59	-0.67	-0.30	-0.30	-4.70	-0.34	-0.48	-0.48	-7.26	7.57
7199.0	7199 L	0.40	3.02	-5.07	-1.08	-1.08	1.39	-0.05	-0.71	-0.71	2.64	-3.89	-0.17	-0.17	0.41	2.98
	7199 R	-1.03	1.30	0.05	0.37	0.37	2.91	-4.37	-0.15	-0.15	0.69	1.75	-0.69	-0.69	2.02	-1.92
7205.0	7205 L	10.12	8.23	-8.97	7.43	7.43	6.87	-5.95	8.94	8.94	5.95	-3.92	8.97	8.97	8.92	-10.50
	7205 R	8.88	7.02	-6.70	11.87	11.87	8.24	-9.95	10.58	10.58	9.24	-12.63	10.54	10.54	5.81	-3.46
7219.0	7219 L	11.88	9.02	-11.77	8.88	8.88	6.86	-5.97	10.90	10.90	9.48	-13.00	10.19	10.19	5.10	-1.26
	7219 R	7.43	6.67	-5.34	10.12	10.12	8.96	-10.40	8.63	8.63	5.18	-2.04	9.25	9.25	9.13	-10.78
7225.0	7225 L	0.48	-3.39	-0.63	-0.99	-0.99	-4.58	2.64	-0.10	-0.10	-5.26	4.53	-0.61	-0.61	-3.26	-0.98
	7225 R	-0.89	-3.78	2.37	0.46	0.46	-2.65	-0.74	-0.53	-0.53	-2.06	-2.39	-0.10	-0.10	-4.68	4.89
7233.0	7233 L	0.46	-4.35	2.27	-0.89	-0.89	-6.59	8.47	-0.34	-0.34	-5.64	5.84	-0.29	-0.29	-6.71	8.82
	7233 R	-0.86	-6.17	7.96	0.43	0.43	-4.13	2.13	-0.27	-0.27	-6.11	7.81	-0.33	-0.33	-5.43	5.85
7241.0	7241 L	8.13	3.68	-5.30	5.54	5.54	2.23	-1.87	7.11	7.11	1.34	0.24	6.97	6.97	3.72	-5.41
	7241 R	5.58	2.24	-1.79	8.19	8.19	3.65	-5.03	7.02	7.02	3.94	-5.70	7.15	7.15	1.18	0.65
7252.0	7252 L	8.18	5.24	-6.52	5.58	5.58	3.26	-1.95	7.52	7.52	5.50	-7.10	6.62	6.62	2.33	0.19
	7252 R	5.54	3.24	-2.04	8.13	8.13	5.23	-6.78	6.58	6.58	2.49	-0.28	7.48	7.48	5.26	-6.85
7260.0	7260 L	0.65	-2.12	-1.29	-0.70	-0.70	-3.66	3.12	-0.09	-0.09	-4.03	4.18	-0.16	-0.16	-1.88	-1.96
	7260 R	-0.70	-4.32	3.21	0.65	0.65	-2.76	-1.17	-0.15	-0.15	-2.25	-2.61	-0.10	-0.10	-4.92	4.87
7269.0	7269 L	1.15	17.59	-19.44	-0.70	-0.70	4.98	-9.72	-0.55	-0.55	12.05	-13.57	0.07	0.07	5.26	-10.49
	7269 R	-0.63	4.75	-8.77	0.95	0.95	14.71	-17.50	0.06	0.06	5.31	-10.28	-0.34	-0.34	5.47	-10.71
7277.0	7277 L	11.04	11.53	-13.10	8.49	8.49	9.92	-10.33	10.00	10.00	8.46	-7.80	9.90	9.90	11.32	-12.75
	7277 R	10.02	11.16	-11.67	12.89	12.89	12.76	-14.65	11.61	11.61	12.92	-14.95	11.72	11.72	9.48	-8.54
7287.0	7287 L	12.90	5.45	-6.31	10.02	10.02	3.46	-2.58	11.83	11.83	6.71	-8.65	11.81	11.81	2.24	-0.30
	7287 R	8.50	2.85	-2.14	11.04	11.04	4.80	-5.51	10.07	10.07	1.90	-0.50	10.11	10.11	5.73	-7.11
7295.0	7295 L	0.22	-7.36	6.32	-0.36	-0.36	-13.09	17.29	-0.25	-0.25	-12.51	16.17	0.06	0.06	-11.45	14.14
	7295 R	-0.29	-10.37	13.11	0.18	0.18	-5.40	4.67	0.05	0.05	-8.69	10.25	-0.20	-0.20	-10.15	12.75
7305.0	7305 L	0.19	-21.69	22.93	-0.29	-0.29	-25.55	29.48	-0.22	-0.22	-26.47	31.06	0.10	0.10	-22.54	24.36
	7305 R	-0.29	-25.55	29.48	0.19	0.19	-21.69	22.93	0.10	0.10	-22.09	23.61	-0.22	-0.22	-26.91	31.80
7402.0	7402 L	-11.97	-8.75	9.42	-16.52	-16.52	-5.09	5.49	-14.74	-14.74	-12.61	13.58	-14.39	-14.39	-2.45	2.63
	7402 R	-17.49	-5.20	5.20	-12.69	-12.69	-8.93	8.93	-15.59	-15.59	-2.06	2.06	-15.38	-15.38	-13.15	13.15
7407.0	7407 L	-12.78	3.94	-3.94	-17.40	-17.40	1.46	-1.46	-13.81	-13.81	5.69	-5.69	-16.69	-16.69	0.07	-0.07
	7407 R	-16.54	1.43	-1.43	-12.15	-12.15	3.87	-3.87	-15.91	-15.91	0.12	-0.12	-13.09	-13.09	5.56	-5.56
7411.0	7411 L	-12.12	4.37	-4.37	-16.55	-16.55	2.16	-2.16	-15.98	-15.98	0.43	-0.43	-13.07	-13.07	6.04	-6.04
	7411 R	-17.41	2.20	-2.20	-12.75	-12.75	4.45	-4.45	-13.97	-13.97	6.30	-6.30	-16.73	-16.73	0.33	-0.33
7416.0	7416 L	-12.73	-5.21	5.21	-17.59	-17.59	-3.23	3.23	-15.74	-15.74	-0.42	0.42	-15.42	-15.42	-9.30	9.30
	7416 R	-16.61	-3.16	3.41	-12.02	-12.02	-5.11	5.50	-14.99	-14.99	-8.57	9.23	-14.06	-14.06	-1.35	1.45
7422.0	7422 L	-9.93	-9.10	9.10	-14.82	-14.82	-6.37	6.37	-13.09	-13.09	-12.52	12.52	-12.07	-12.07	-4.85	4.85
	7422 R	-17.40	-7.21	7.21	-11.66	-11.66	-10.31	10.31	-15.03	-15.03	-4.41	4.41	-14.72	-14.72	-14.89	14.89
7427.0	7427 L	-11.83	6.00	-6.00	-17.24	-17.24	3.59	-3.59	-13.29	-13.29	8.04	-8.04	-16.52	-16.52	1.89	-1.89
	7427 R	-16.30	3.51	-3.51	-11.19	-11.19	5.88	-5.88	-15.75	-15.75	1.97	-1.97	-12.24	-12.24	7.66	-7.66
7431.0	7431 L	-11.23	5.81	-5.81	-16.32	-16.32	3.34	-3.34	-15.77	-15.77	1.80	-1.80	-12.28	-12.28	7.57	-7.57
	7431 R	-17.27	3.41	-3.41	-11.87	-11.87	5.93	-5.93	-13.33	-13.33	7.97	-7.97	-16.54	-16.54	1.72	-1.72
7436.0	7436 L	-11.77	-11.14	11.14	-17.43	-17.43	-8.80	8.80	-15.08	-15.08	-5.29	5.29	-14.85	-14.85	-15.80	15.80
	7436 R	-14.85	-7.54	7.54	-10.02	-10.02	-9.83	9.83	-13.18	-13.18	-13.31	13.31	-12.14	-12.14	-5.56	5.56

Splice Node	Splice Side	MAX MY				MIN MY				MAX MZ				MIN MZ			
		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
5531.0	5531 L	-10.60	-10.60	6.89	-6.89	-12.16	-12.16	6.62	-6.62	-12.44	-12.44	4.43	-4.43	-10.81	-10.81	10.81	-10.81
	5531 R	-12.65	-12.65	6.69	-6.69	-11.04	-11.04	7.00	-7.00	-11.24	-11.24	10.96	-10.96	-12.95	-12.95	4.49	-4.49
5536.0	5536 L	-11.89	-11.89	-14.91	14.91	-11.47	-11.47	-11.44	11.44	-11.18	-11.18	-19.65	19.65	-12.88	-12.88	-8.21	8.21
	5536 R	-10.34	-10.34	-10.96	10.41	-10.71	-10.71	-14.29	13.56	-11.61	-11.61	-7.86	7.46	-10.06	-10.06	-18.83	17.87
5542.0	5542 L	-14.95	-14.95	-3.36	3.53	-13.76	-13.76	-7.39	7.76	-14.34	-14.34	-10.44	10.95	-15.20	-15.20	-1.17	1.23
	5542 R	-15.22	-15.22	-7.99	7.99	-16.54	-16.54	-3.65	3.65	-16.81	-16.81	-1.27	1.27	-15.87	-15.87	-11.29	11.29
5547.0	5547 L	-16.80	-16.80	3.40	-3.40	-16.04	-16.04	3.73	-3.73	-16.89	-16.89	1.10	-1.10	-15.78	-15.78	7.38	-7.38
	5547 R	-15.44	-15.44	3.70	-3.70	-16.17	-16.17	3.35	-3.35	-15.20	-15.20	7.29	-7.29	-16.26	-16.26	1.09	-1.09
5551.0	5551 L	-15.08	-15.08	3.04	-3.04	-16.35	-16.35	4.43	-4.43	-16.00	-16.00	1.40	-1.40	-15.28	-15.28	7.37	-7.37
	5551 R	-16.98	-16.98	4.48	-4.48	-15.67	-15.67	3.11	-3.11	-15.87	-15.87	7.47	-7.47	-16.63	-16.63	1.42	-1.42
5556.0	5556 L	-16.57	-16.57	-10.98	10.98	-16.24	-16.24	-5.27	5.27	-15.84	-15.84	-14.03	14.03	-16.63	-16.63	-3.14	3.14
	5556 R	-14.68	-14.68	-4.93	5.17	-14.97	-14.97	-10.12	10.63	-15.03	-15.03	-2.90	3.04	-14.30	-14.30	-12.97	13.61
7007.0	7007 L	0.06	0.06	-29.29	26.37	-0.05	-0.05	-26.41	21.43	0.07	0.07	-32.47	31.80	-0.06	-0.06	-24.38	17.96
	7007 R	-0.05	-0.05	-26.41	21.43	0.06	0.06	-29.29	26.37	-0.06	-0.06	-24.38	17.96	0.07	0.07	-32.47	31.80
7015.0	7015 L	-0.09	-0.09	-8.71	9.79	0.10	0.10	-3.91	1.56	0.07	0.07	-11.18	14.01	-0.06	-0.06	-1.17	-3.12
	7015 R	0.10	0.10	-4.40	2.43	-0.12	-0.12	-9.58	14.17	-0.09	-0.09	-1.42	-4.33	0.06	0.06	-12.27	20.26
7021.0	7021 L	10.14	10.14	5.61	-6.09	10.17	10.17	5.76	-6.39	9.57	9.57	2.56	0.09	10.42	10.42	8.28	-11.49
	7021 R	13.01	13.01	6.52	-7.76	12.98	12.98	6.36	-7.38	14.41	14.41	14.05	-15.39	12.31	12.31	3.23	0.42
7035.0	7035 L	13.00	13.00	12.53	-14.32	13.00	13.00	12.47	-14.15	12.38	12.38	9.94	-7.87	14.27	14.27	19.11	-20.44
	7035 R	10.16	10.16	10.82	-11.45	10.16	10.16	10.88	-11.58	10.35	10.35	12.85	-15.56	9.62	9.62	8.36	-6.47
7041.0	7041 L	-0.34	-0.34	3.12	-4.93	0.17	0.17	11.55	-13.46	-0.19	-0.19	1.27	-0.74	0.05	0.05	16.49	-19.05
	7041 R	0.24	0.24	14.16	-17.23	-0.39	-0.39	3.31	-6.23	0.08	0.08	20.34	-24.44	-0.22	-0.22	1.30	-0.89
7051.0	7051 L	-0.43	-0.43	1.66	1.70	0.14	0.14	6.63	-11.55	-0.21	-0.21	-0.72	8.04	0.06	0.06	17.54	-20.00
	7051 R	0.12	0.12	6.30	-10.65	-0.43	-0.43	1.36	1.65	0.07	0.07	16.23	-18.29	-0.23	-0.23	-0.99	7.51
7057.0	7057 L	8.97	8.97	7.74	-8.55	9.08	9.08	7.84	-8.75	8.20	8.20	4.64	-2.07	9.48	9.48	10.25	-13.79
	7057 R	9.48	9.48	7.89	-8.97	9.38	9.38	7.80	-8.77	9.89	9.89	10.30	-14.21	8.58	8.58	4.70	-2.05
7071.0	7071 L	9.48	9.48	6.40	-6.60	9.37	9.37	6.46	-6.73	8.65	8.65	3.43	-0.15	9.86	9.86	8.81	-11.83
	7071 R	8.97	8.97	6.42	-6.60	9.07	9.07	6.36	-6.48	9.45	9.45	8.77	-11.52	8.27	8.27	3.38	-0.25
7077.0	7077 L	-0.28	-0.28	-8.49	8.85	-0.04	-0.04	-4.97	0.07	-0.05	-0.05	-11.05	15.23	-0.28	-0.28	6.73	-9.47
	7077 R	-0.02	-0.02	-4.08	-0.09	-0.24	-0.24	-7.55	6.96	-0.22	-0.22	6.32	-7.50	-0.03	-0.03	-10.04	12.02
7089.0	7089 L	-0.27	-0.27	1.14	0.80	-0.03	-0.03	4.44	-5.91	-0.07	-0.07	-1.75	6.65	-0.16	-0.16	7.73	-12.59
	7089 R	-0.05	-0.05	4.31	-6.43	-0.29	-0.29	1.03	0.87	-0.18	-0.18	7.59	-13.73	-0.09	-0.09	-1.85	7.27
7095.0	7095 L	10.04	10.04	8.90	-10.14	9.92	9.92	8.66	-9.63	9.33	9.33	5.55	-3.28	11.08	11.08	15.21	-16.10
	7095 R	10.50	10.50	8.39	-9.37	10.63	10.63	8.63	-9.88	10.99	10.99	10.99	-14.87	9.88	9.88	5.38	-3.03
7109.0	7109 L	10.42	10.42	9.62	-10.49	10.71	10.71	9.63	-10.52	9.78	9.78	6.45	-3.80	10.99	10.99	12.08	-15.68
	7109 R	10.12	10.12	9.95	-10.84	9.85	9.85	9.93	-10.80	10.39	10.39	12.47	-16.00	9.23	9.23	6.66	-4.09
7115.0	7115 L	-0.46	-0.46	-0.19	-0.65	0.11	0.11	7.47	-9.05	-0.20	-0.20	-2.96	5.52	-0.17	-0.17	14.82	-17.32
	7115 R	0.14	0.14	8.87	-9.89	-0.49	-0.49	-0.69	-0.57	-0.17	-0.17	17.81	-19.00	-0.20	-0.20	-3.68	6.05
7127.0	7127 L	-0.43	-0.43	-0.80	1.66	-0.02	-0.02	1.22	-2.79	-0.29	-0.29	-4.17	9.12	-0.08	-0.08	4.26	-9.51
	7127 R	-0.04	-0.04	1.23	-3.24	-0.47	-0.47	-0.78	1.88	-0.11	-0.11	4.29	-11.05	-0.32	-0.32	-4.17	10.55
7133.0	7133 L	9.10	9.10	6.77	-7.20	8.69	8.69	5.98	-5.73	8.09	8.09	3.45	-0.95	9.33	9.33	8.84	-11.11
	7133 R	11.13	11.13	6.93	-7.45	11.61	11.61	7.72	-9.37	11.87	11.87	9.88	-14.57	10.42	10.42	4.31	-1.13
7147.0	7147 L	11.06	11.06	9.80	-10.88	11.76	11.76	9.15	-9.31	10.43	10.43	6.05	-1.84	11.96	11.96	12.37	-17.10
	7147 R	9.23	9.23	7.81	-7.14	8.64	8.64	8.41	-8.27	9.40	9.40	10.91	-12.98	8.11	8.11	4.80	-1.46
7153.0	7153 L	-1.18	-1.18	-1.51	-1.25	0.48	0.48	-0.24	-4.49	-0.23	-0.23	-5.75	9.56	-0.26	-0.26	14.61	-18.05
	7153 R	0.50	0.50	-0.82	-4.70	-1.21	-1.21	-2.05	-1.28	-0.26	-0.26	15.59	-19.80	-0.24	-0.24	-6.30	10.52
7163.0	7163 L	-0.55	-0.55	-0.47	3.31	-0.18	-0.18	3.08	-6.56	-0.12	-0.12	-2.93	10.14	-0.40	-0.40	5.68	-13.78
	7163 R	-0.18	-0.18	2.87	-5.99	-0.53	-0.53	-0.48	3.05	-0.39	-0.39	5.32	-12.60	-0.13	-0.13	-2.79	9.29
7169.0	7169 L	8.60	8.60	7.16	-7.15	9.19	9.19	6.61	-6.08	8.28	8.28	3.92	-0.85	9.20	9.20	9.40	-11.52
	7169 R	11.83	11.83	7.53	-8.16	11.13	11.13	8.13	-9.73	11.83	11.83	10.42	-15.75	10.76	10.76	4.79	-0.97
7183.0	7183 L	11.30	11.30	7.59	-7.52	11.62	11.62	8.33	-9.47	10.67	10.67	5.14	-1.08	11.99	11.99	10.43	-14.97
	7183 R	9.01	9.01	7.27	-6.96	8.74	8.74	6.54	-5.54	9.33	9.33	9.31	-10.92	8.20	8.20	4.15	-0.90
7189.0	7189 L	-0.65	-0.65	-7.66	7.20	-0.07	-0.07	-3.85	-3.07	-0.46	-0.46	-9.74	12.81	-0.07	-0.07	8.09	-11.45
	7189 R	-0.07	-0.07	-3.83	-3.02	-0.59	-0.59	-7.09	7.05	-0.05	-0.05	7.60	-11.36	-0.42	-0.42	-8.89	12.58
7199.0	7199 L	-0.68	-0.68	1.32	0.18	-0.01	-0.01	3.30	-5.93	-0.24	-0.24	-1.83	9.89	-0.34	-0.34	6.45	-15.66
	7199 R	-0.02	-0.02	3.17	-5.09	-0.66	-0.66	1.24	0.23	-0.33	-0.33	6.19	-13.41	-0.24	-0.24	-1.77	8.52
7205.0	7205 L	8.98	8.98	8.16	-8.82	9.26	9.26	7.81	-8.03	8.38	8.38	5.17	-2.19	9.44	9.44	10.21	-13.35
	7205 R	10.92	10.92	7.86	-8.95	10.61	10.61	8.23	-9.95	11.10	11.10	10.25	-15.37	10.09	10.09	5.27	-2.00
7219.0	7219 L	10.93	10.93	8.23	-9.64	10.58	10.58	7.45	-7.57	9.95	9.95	4.79	-0.42	11.30	11.30	10.37	-15.39
	7219 R	8.96	8.96	7.34	-6.81	9.27	9.27	8.12	-8.56	9.61	9.61	10.28	-13.33	8.38	8.38	4.64	-0.86
7225.0	7225 L	-0.57	-0.57	-5.33	4.71	0.03	0.03	-2.14	-4.07	-0.19	-0.19	-8.39	13.16	-0.20	-0.20	13.27	-16.08
	7225 R	0.04	0.04	-1.50	-3.93	-0.52	-0.52	-4.45	4.24	-0.17	-0.17	11.73	-14.81	-0.16	-0.16	-7.29	12.11
7233.0	7233 L	-0.37	-0.37	-5.86	6.46	-0.04	-0.04	-4.24	1.96	-0.08	-0.08	-9.19	15.68	-0.24	-0.24	-1.34	-6.08
	7233 R	-0.05	-0.05	-4.02	1.83	-0.36	-0.36	-5.51	6.08	-0.24	-0.24	-1.37	-5.75	-0.09	-0.09	-8.55	14.78
7241.0	7241 L	7.10	7.10	3.05	-3.82	7.26	7.26	2.90	-3.44	6.54	6.54	0.61	1.98	7.61	7.61	5.07	-8.60
	7241 R	7.31	7.31	2.88	-3.26	7.15	7.15	3.04	-3.63	7.66	7.66	5.04	-8.24	6.59	6.59	0.61	1.96
7252.0	7252 L	7.28	7.28	4.73	-5.32	7.16	7.16	4.35	-4.47	6.46	6.46	1.81	1.40	7.77	7.77	6.65	-9.74
	7252 R	7.11	7.11	4.34	-4.66	7.22	7.22	4.71	-5.54	7.71	7.71	6.64	-10.11	6.42	6.42	1.78	1.42
7260.0	7260 L	-0.40	-0.40	-4.73	6.18	0.56	0.56	7.24	-9.55	-0.18	-0.18	-6.52	11.29	0.36	0.36	11.39	-14.38
	7260 R	0.58	0.58	7.62	-9.37	-0.40	-0.40	-5.38	6.17	0.38	0.38	12.12	-14.14	-0.17	-0.17	-7.16	11.15
7269.0	7269 L	-0.13	-0.13	13.27	-14.86	0.24	0.24	16.03	-17.78	-0.22	-0.22	2.82	-3.65	0.42	0.42	24.32	-26.57
	7269 R	0.18	0.18	13.41	-16.00	-0.13	-0.13	11.12	-13.37	0.34	0.34	20.26	-23.89	-0.20	-0.20	2.75	-3.38
7277.0	7277 L	10.17	10.17	10.58	-11.47	10.10	10.10	10.61	-11.52	9.62	9.62	7.75	-6.58	10.88	10.88	15.48	-16.03
	7277 R	11.84	11.84	11.83	-12.93	11.92	11.92	11.80	-12.87	12.80	12.80	17.20	-17.90	11.30	11.30	8.88	-7.42
7287.0	7287 L	11.44	11.44	5.28	-5.99	11.95	11.95	5.00	-5.46	11.42	11.42	1.67	0.75	12.00	12.00	7.96	-10.98
	7287 R	10.20	10.20	4.36	-4.74	9.75	9.75	4.62	-5.20	10.25	10.25	7.21	-9.67	9.73	9.73	1.14	0.81
7295.0	7295 L	-0.32	-0.32	-13.37	17.81	0.18	0.18	-6.90	5.44	0.04	0.04	-15.45	21.81	-0.19	-0.19	-4.99	1.79
	7295 R	0.15	0.15	-5.00	3.99	-0.26	-0.26	-10.60	13.51	-0.15	-0.15	-3.37	1.22	0.04	0.04	-12.39	16.55
7305.0	7305 L	0.09	0.09	-22.93	25.03	-0.20	-0.20	-24.85	28.29	0.04	0.04	-27.82	33.34	-0.14	-0.14	-20.40	20.74
	7305 R	-0.20	-0.20	-24.85	28.29	0.09	0.09	-22.93	25.03	-0.14	-0.14	-20.40	20.74	0.04	0.04	-27.82	33.34
7402.0	7402 L	-14.44	-14.44	-6.16	6.63	-15.24	-15.24	-7.36	7.92	-13.98	-13.98	-13.25	14.27	-15.38	-15.38	-1.61	1.73
	7402 R	-16.14	-16.14	-7.46	7.46	-15.30	-15.30	-6.30	6.30	-16.28	-16.28	-1.64	1.64	-14.81	-14.81	-13.52	13.52
7407.0	7407 L	-15.75	-15.75	1.72	-1.72	-15.26	-15.26	2.66	-2.66	-16.37	-16.37	-0.08	0.08	-14.77	-14.77	6.28	-6.28
	7407 R	-14.51	-14.51	2.62	-2.62	-14.98	-14.98	1.69	-1.69	-14.05	-14.05	6.17	-6.17	-15.56	-15.56	-0.07	0.07
7411.0	7411 L	-14.98	-14.98	1.56	-1.56	-13.55	-13.55	4.11	-4.11	-15.65	-15.65	0.19	-0.19	-14.04	-14.04	6.68	-6.68
	7411 R	-14.24	-14.24	4.18	-4.18	-15.75	-15.75	1.60	-1.60	-14.76	-14.76	6.80	-6.80	-16.46	-16.46	0.20	-0.20
7416.0	7416 L	-15.12	-15.12	-4.25	4.25	-16.53	-16.53	-3.02	3.02	-14.86	-14.86	-9.77	9.77	-16.60	-16.60	0.18	-0.18
	7416 R	-15.61	-15.61	-2.96	3.18	-14.27	-14.27	-4.17	4.49	-15.68	-15.68	0.18	-0.19	-14.03	-14.03	-9.57	10.31
7422.0	7422 L	-12.50	-12.50	-6.56	6.56	-13.48	-13.48	-8.09	8.09	-11.98	-11.98	-13.55	13.55	-13.73	-13.73	-3.33	3.33
	7422 R	-15.83	-15.83	-9.15	9.15	-14.68	-14.68	-7.44	7.44	-16.11	-16.11	-3.77	3.77	-14.07	-14.07	-15.34	15.34
7427.0	7427 L	-15.33	-15.33	3.53	-3.53	-14.11	-14.11	5.04	-5.04	-16.11	-16.11	1.70	-1.70	-14.15	-14.15	8.58	-8.58
	7427 R	-13.34	-13.34	4.97	-4.97	-14.49	-14.49	3.45	-3.45	-13.38	-13.38	8.41	-8.41	-15.22	-15.22	1.66	-1.66
7431.0	7431 L	-14.39	-14.39	3.26	-3.26	-13.09	-13.09	5.10	-5.10	-15.25	-15.25	1.54	-1.54	-13.40	-13.40	8.33	-8.33
	7431 R	-13.84	-13.84	5.17	-5.17	-15.23	-15.23	3.35	-3.35	-14.17	-14.17	8.50	-8.50	-16.14	-16.14	1.57	-1.57
7436.0	7436 L	-15.08	-15.08	-7.64	7.64	-15.72	-15.72	-10.28	10.28	-14.15	-14.15	-16.21	16.21	-15.97	-15.97	-4.73	4.73
	7436 R	-13.39	-13.39	-9.10	9.10	-12.85	-12.85	-6.73	6.73	-13.61	-13.61	-4.18	4.18	-12.04	-12.04	-14.31	14.31

Made By: WME 8/5/11   Checked By: MTB 8/5/11   BackChecked By: WME 8/5/11

ss Values for Web Splice Calculations

Splice Node	Splice Side	SERVICE II																														
		MAX FX			MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ			
		Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
7442.0	7442 L	-11.30	-5.63	5.63	-16.30	-16.30	-2.77	2.77	-14.43	-14.43	-9.09	9.09	-13.56	-13.56	-0.93	0.93	-14.16	-14.16	-2.29	2.29	-14.79	-14.79	-4.70	4.70	-13.37	-13.37	-10.07	10.07	-15.12	-15.12	0.50	-0.50
	7442 R	-19.31	-3.17	3.17	-13.40	-13.40	-6.45	6.45	-16.88	-16.88	-0.03	0.03	-16.51	-16.51	-11.14	11.14	-17.53	-17.53	-5.38	5.38	-16.78	-16.78	-2.63	2.63	-17.91	-17.91	0.57	-0.57	-15.85	-15.85	-11.54	11.54
7447.0	7447 L	-13.49	3.21	-3.21	-19.14	-19.14	0.26	-0.26	-14.96	-14.96	5.22	-5.22	-18.41	-18.41	-1.43	1.43	-17.14	-17.14	0.10	-0.10	-15.80	-15.80	2.50	-2.50	-18.01	-18.01	-1.59	1.59	-15.83	-15.83	5.73	-5.73
	7447 R	-18.08	0.26	-0.26	-12.74	-12.74	3.15	-3.15	-17.43	-17.43	-1.36	1.36	-13.89	-13.89	4.94	-4.94	-14.93	-14.93	2.50	-2.50	-16.18	-16.18	0.06	-0.06	-14.95	-14.95	5.61	-5.61	-17.00	-17.00	-1.56	1.56
7451.0	7451 L	-12.75	3.17	-3.17	-18.11	-18.11	0.36	-0.36	-17.47	-17.47	-1.25	1.25	-13.79	-13.79	4.95	-4.95	-16.25	-16.25	0.24	-0.24	-14.96	-14.96	2.30	-2.30	-17.04	-17.04	-1.49	1.49	-14.95	-14.95	5.67	-5.67
	7451 R	-19.18	0.08	-0.08	-13.49	-13.49	3.24	-3.24	-14.74	-14.74	5.14	-5.14	-18.45	-18.45	-1.32	1.32	-15.84	-15.84	2.35	-2.35	-17.21	-17.21	0.24	-0.24	-15.82	-15.82	5.78	-5.78	-18.04	-18.04	-1.52	1.52
7456.0	7456 L	-13.45	-6.27	6.27	-19.42	-19.42	-2.43	2.43	-17.09	-17.09	0.47	-0.47	-16.50	-16.50	-10.69	10.69	-17.03	-17.03	-2.12	2.12	-17.47	-17.47	-5.51	5.51	-15.87	-15.87	-11.09	11.09	-17.96	-17.96	1.03	-1.03
	7456 R	-16.39	-2.12	2.12	-11.35	-11.35	-5.47	5.47	-14.45	-14.45	-8.72	8.72	-13.68	-13.68	-0.53	0.53	-14.75	-14.75	-4.82	4.82	-14.37	-14.37	-1.85	1.85	-15.17	-15.17	0.90	-0.90	-13.39	-13.39	-9.68	9.68
7462.0	7462 L	-9.54	-7.88	9.08	-15.50	-15.50	-5.10	5.87	-14.04	-14.04	-10.50	12.10	-11.26	-11.26	-4.03	4.64	-11.94	-11.94	-5.47	6.30	-14.09	-14.09	-6.62	7.63	-12.05	-12.05	-12.24	14.10	-13.79	-13.79	-2.01	2.32
	7462 R	-18.29	-6.21	6.21	-11.27	-11.27	-9.59	9.59	-14.18	-14.18	-3.75	3.75	-15.74	-15.74	-13.87	13.87	-16.63	-16.63	-8.08	8.08	-14.09	-14.09	-6.65	6.65	-16.27	-16.27	-2.45	2.45	-14.23	-14.23	-14.90	14.90
7467.0	7467 L	-11.94	5.36	-5.36	-18.67	-18.67	3.78	-3.78	-13.81	-13.81	8.28	-8.28	-17.31	-17.31	1.36	-1.36	-16.27	-16.27	4.12	-4.12	-15.27	-15.27	5.02	-5.02	-16.04	-16.04	0.34	-0.34	-15.26	-15.26	9.61	-9.61
	7467 R	-17.63	3.71	-3.71	-11.29	-11.29	5.25	-5.25	-16.65	-16.65	1.62	-1.62	-12.70	-12.70	7.87	-7.87	-14.43	-14.43	4.82	-4.82	-15.38	-15.38	4.08	-4.08	-14.43	-14.43	9.41	-9.41	-15.15	-15.15	0.34	-0.34
7471.0	7471 L	-11.01	4.68	-4.68	-17.57	-17.57	4.14	-4.14	-16.61	-16.61	1.71	-1.71	-12.32	-12.32	7.28	-7.28	-15.58	-15.58	4.57	-4.57	-13.66	-13.66	5.00	-5.00	-15.23	-15.23	0.28	-0.28	-14.36	-14.36	9.04	-9.04
	7471 R	-18.60	4.23	-4.23	-11.65	-11.65	4.78	-4.78	-13.95	-13.95	8.54	-8.54	-16.86	-16.86	0.68	-0.68	-14.45	-14.45	5.11	-5.11	-16.50	-16.50	4.65	-4.65	-15.19	-15.19	9.23	-9.23	-16.13	-16.13	0.28	-0.28
7476.0	7476 L	-11.15	-9.46	9.46	-18.27	-18.27	-6.82	6.82	-14.08	-14.08	-3.49	3.49	-16.13	-16.13	-13.91	13.91	-15.06	-15.06	-5.79	5.79	-16.03	-16.03	-9.67	9.67	-14.30	-14.30	-15.26	15.26	-16.05	-16.05	-2.07	2.07
	7476 R	-15.48	-5.59	6.44	-9.44	-9.44	-7.77	8.95	-13.94	-13.94	-11.05	12.73	-11.61	-11.61	-3.30	3.81	-13.58	-13.58	-7.92	9.13	-12.76	-12.76	-4.76	5.48	-13.61	-13.61	-1.70	1.96	-12.10	-12.10	-12.53	14.44
7482.0	7482 L	-9.49	-10.29	12.65	-15.75	-15.75	-8.65	10.62	-14.43	-14.43	-13.35	16.40	-11.18	-11.18	-7.24	8.89	-12.65	-12.65	-7.63	9.37	-14.05	-14.05	-10.85	13.33	-12.25	-12.25	-15.13	18.58	-14.08	-14.08	-5.02	6.16
	7482 R	-17.99	-10.38	10.38	-10.84	-10.84	-12.35	12.35	-13.45	-13.45	-7.71	7.71	-16.08	-16.08	-16.57	16.57	-16.03	-16.03	-13.22	13.22	-14.45	-14.45	-9.12	9.12	-16.07	-16.07	-6.02	6.02	-14.01	-14.01	-18.15	18.15
7487.0	7487 L	-11.57	6.36	-6.36	-18.69	-18.69	6.34	-6.34	-14.22	-14.22	10.28	-10.28	-17.28	-17.28	3.29	-3.29	-16.88	-16.88	6.64	-6.64	-14.05	-14.05	6.36	-6.36	-16.06	-16.06	2.66	-2.66	-15.19	-15.19	10.88	-10.88
	7487 R	-17.66	6.21	-6.21	-10.94	-10.94	6.23	-6.23	-16.38	-16.38	3.27	-3.27	-12.68	-12.68	9.44	-9.44	-13.29	-13.29	6.18	-6.18	-15.96	-15.96	6.56	-6.56	-14.36	-14.36	10.66	-10.66	-15.17	-15.17	2.61	-2.61
7491.0	7491 L	-11.53	6.86	-6.86	-17.46	-17.46	6.26	-6.26	-16.38	-16.38	3.33	-3.33	-13.09	-13.09	9.98	-9.98	-15.57	-15.57	6.04	-6.04	-14.16	-14.16	6.80	-6.80	-14.94	-14.94	2.15	-2.15	-14.66	-14.66	11.24	-11.24
	7491 R	-18.48	6.39	-6.39	-12.19	-12.19	7.01	-7.01	-14.47	-14.47	10.58	-10.58	-17.28	-17.28	3.35	-3.35	-14.99	-14.99	6.81	-6.81	-16.47	-16.47	6.22	-6.22	-15.51	-15.51	11.47	-11.47	-15.82	-15.82	2.19	-2.19
7496.0	7496 L	-11.34	-12.44	12.44	-17.88	-17.88	-10.79	10.79	-13.81	-13.81	-7.10	7.10	-15.89	-15.89	-17.39	17.39	-14.22	-14.22	-9.88	9.88	-16.32	-16.32	-12.41	12.41	-14.21	-14.21	-18.60	18.60	-15.58	-15.58	-5.81	5.81
	7496 R	-15.66	-8.99	11.05	-9.93	-9.93	-10.36	12.73	-14.28	-14.28	-14.05	17.26	-11.67	-11.67	-6.43	7.90	-14.29	-14.29	-10.34	12.70	-12.45	-12.45	-8.26	10.14	-13.64	-13.64	-4.84	5.95	-12.43	-12.43	-15.50	19.04
7502.0	7502 L	-9.53	-9.08	9.62	-15.32	-15.32	-6.87	7.28	-13.15	-13.15	-13.30	14.09	-11.79	-11.79	-5.02	5.32	-12.09	-12.09	-7.39	7.83	-13.89	-13.89	-7.72	8.18	-11.90	-11.90	-14.47	15.32	-13.99	-13.99	-3.11	3.29
	7502 R	-16.99	-7.53	7.53	-10.58	-10.58	-9.94	9.94	-14.37	-14.37	-4.05	4.05	-13.87	-13.87	-15.37	15.37	-15.41	-15.41	-8.44	8.44	-13.41	-13.41	-8.09	8.09	-15.51	-15.51	-3.40	3.40	-13.21	-13.21	-15.83	15.83
7507.0	7507 L	-10.62	6.09	-6.09	-16.70	-16.70	3.49	-3.49	-12.53	-12.53	8.95	-8.95	-15.92	-15.92	1.62	-1.62	-14.50	-14.50	3.34	-3.34	-12.78	-12.78	5.52	-5.52	-15.50	-15.50	1.35	-1.35	-13.09	-13.09	9.22	-9.22
	7507 R	-15.91	3.43	-3.43	-10.13	-10.13	5.99	-5.99	-15.22	-15.22	1.64	-1.64	-11.27	-11.27	8.23	-8.23	-12.18	-12.18	5.40	-5.40	-13.82	-13.82	3.30	-3.30	-12.48	-12.48	9.07	-9.07	-14.76	-14.76	1.33	-1.33
7511.0	7511 L	-10.10	5.85	-5.85	-15.89	-15.89	3.40	-3.40	-15.25	-15.25	1.70	-1.70	-11.23	-11.23	8.11	-8.11	-13.47	-13.47	3.59	-3.59	-13.13	-13.13	4.91	-4.91	-14.59	-14.59	1.40	-1.40	-12.50	-12.50	8.99	-8.99
	7511 R	-16.68	3.45	-3.45	-10.60	-10.60	5.95	-5.95	-12.48	-12.48	8.85	-8.85	-15.94	-15.94	1.66	-1.66	-13.77	-13.77	4.98	-4.98	-14.14	-14.14	3.67	-3.67	-13.11	-13.11	9.14	-9.14	-15.32	-15.32	1.42	-1.42
7516.0	7516 L	-10.41	-10.05	10.05	-16.90	-16.90	-6.68	6.68	-14.16	-14.16	-3.59	3.59	-13.89	-13.89	-15.63	15.63	-13.61	-13.61	-7.10	7.10	-14.82	-14.82	-9.47	9.47	-12.99	-12.99	-16.22	16.22	-15.32	-15.32	-2.87	2.87
	7516 R	-15.24	-6.08	6.44	-9.38	-9.38	-9.18	9.73	-13.15	-13.15	-13.56	14.36	-11.93	-11.93	-4.27	4.52	-13.36	-13.36	-8.74	9.26	-12.27	-12.27	-6.45	6.83	-13.82	-13.82	-2.62	2.78	-11.70	-11.70	-14.82	15.70
7522.0	7522 L	-7.19	-16.08	15.27	-12.21	-12.21	-15.08	14.31	-10.79	-10.79	-20.31	19.28	-8.96	-8.96	-12.76	12.11	-10.29	-10.29	-15.75	14.95	-9.88	-9.88	-16.41	15.58	-9.51	-9.51	-21.48	20.39	-10.87	-10.87	-11.18	10.61
	7522 R	-13.55	-15.76	15.76	-7.99	-7.99	-16.79	16.79	-10.89	-10.89	-12.32	12.32	-11.37	-11.37	-21.90	21.90	-10.98	-10.98	-17.13	17.13	-11.43	-11.43	-16.45	16.45	-12.06	-12.06	-11.67	11.67	-10.57	-10.57	-22.42	22.42
7527.0	7527 L	-8.10	8.93	-8.93	-13.34	-13.34	7.22	-7.22	-10.05	-10.05	11.34	-11.34	-12.58	-12.58	5.59	-5.59	-11.45	-11.45	7.35	-7.35	-10.67	-10.67	7.89	-7.89	-12.18	-12.18	5.38	-5.38	-10.46	-10.46	11.51	-11.51
	7527 R	-12.82	7.12	-7.12	-7.79	-7.79	8.81	-8.81	-12.15	-12.15	5.56	-5.56	-8.95	-8.95	10.66	-10.66	-10.26	-10.26	7.80	-7.80	-11.00	-11.00	7.23	-7.23	-10.06	-10.06	11.36	-11.36	-11.70	-11.70	5.30	-5.30
7531.0	7531 L	-7.65	8.89	-8.89	-12.69	-12.69	7.13	-7.13	-12.10	-12.10	5.87	-5.87	-8.77	-8.77	10.81	-10.81	-10.10	-10.10	7.65	-7.65	-11.30	-11.30	8.07	-8.07	-11.56	-11.56	5.55	-5.55	-9.93	-9.93	11.54	-11.54
	7531 R	-13.20	7.23	-7.23	-7.95	-7.95	9.02	-9.02	-9.85	-9.85	11.50	-11.50	-12.52	-12.52	5.90	-5.90	-11.75	-11.75	8.13	-8.13	-10.51	-10.51	7.78	-7.78	-10.32	-10.32	11.69	-11.69	-12.03	-12.03	5.63	-5.63
7536.0	7536 L	-7.62	-14.17	14.17	-13.15	-13.15	-12.83	12.83	-10.48	-10.48	-9.69	9.69	-10.96	-10.96	-18.53	18.53	-8.84	-8.84	-14.27	14.27	-11.97	-11.97	-11.37	11.37	-10.06	-10.06	-19.19	19.19	-11.89	-11.89	-8.80	8.80
	7536 R	-11.85	-12.29	11.67	-6.86	-6.86	-13.57	12.88	-10.48	-10.48	-17.02	16.16	-8.49	-8.49	-10.46	9.93	-10.79	-10.79	-10.94	10.39	-7.95	-7.95	-13.61	12.92	-10.72	-10.72	-8.43	8.01	-9.05	-9.05	-18.38	17.45
7542.0	7542 L	-11.07	-5.39	5.66	-15.32	-15.32	-4.63	4.86	-14.04	-14.04	-9.00	9.45	-12.54	-12.54	-2.80	2.94	-13.75	-13.75	-6.34	6.65	-12.86	-12.86	-3.89	4.08	-13.09	-13.09	-9.82	10.31	-14.19	-14.19	-1.43	1.50
	7542 R	-16.94	-5.01	5.01	-12.25	-12.25	-5.83	5.83	-14.69	-14.69	-2.06	2.06	-15.15	-15.15	-10.18	10.18	-14.22	-14.22	-4.17	4.17	-15.21	-15.21	-6.89	6.89	-15.70	-15.70	-1.54	1.54	-14.49	-14.49	-10.63	10.63
7547.0	7547 L	-12.33	5.12	-5.12	-16.75	-16.75	3.33	-3.33	-14.03	-14.03	7.28	-7.28	-16.04	-16.04	2.06	-2.06	-15.34	-15.34	3.38	-3.38	-14.77	-14.77	4.43	-4.43	-15.63	-15.63	1.79	-1.79	-14.43	-14.43	7.47	-7.47
	7547 R	-16.13	3.29	-3.29	-11.87	-11.87	5.06	-5.06	-15.54	-15.54	2.10	-2.10	-12.86	-12.86	6.71	-6.71	-14.22	-14.22	4.39	-4.39	-14.77	-14.77	3.32	-3.32	-13.90	-13.90	7.37	-7.37	-15.04	-15.04	1.77	-1.77
7551.0	7551 L	-11.97	4.66	-4.66	-16.14	-16.14	3.55	-3.55	-15.54	-15.54	2.18	-2.18	-12.98	-12.98	6.55	-6.55	-14.36	-14.36	2.78	-2.78	-14.96	-14.96	5.20	-5.20	-14.77	-14.77	1.83	-1.83	-14.01	-14.01	7.25	-7.25
	7551 R	-16.77	3.60	-3.60	-12.43	-12.43	4.71	-4.71	-13.91	-13.91	7.02	-7.02	-16.05	-16.05	2.13	-2.13	-15.54	-15.54	5.25	-5.25	-14.92	-14.92	2.82	-2.82	-14.55	-14.55	7.34	-7.34	-15.35	-15.35	1.85	-1.85
7556.0	7556 L	-12.20	-11.02	11.02	-16.68	-16.68	-9.94	9.94	-14.23	-14.23	-5.95	5.95	-15.15	-15.15	-14.93	14.93	-14.80	-14.80	-12.77	12.77	-15.20	-15.20	-8.02	8.02	-14.42	-14.42	-15.52	15.52	-15.17	-15.17	-5.17	5.17
	7556 R	-15.07	-9.19	9.64	-11.01	-11.01	-10.18	10.69	-13.98	-13.98	-13.35	14.02	-12.44	-12.44	-6.13	6.43	-13.73	-13.73	-7.41	7.78	-13.36	-13.36	-11.80	12.38	-13.71	-13.71	-4.78	5.01	-13.01	-13.01	-14.34	15.06
9007.0	9007 L	0.19	-21.57	17.00	-0.10	-0.10	-27.18	26.10	0.14	0.14	-21.65	17.12	-0.09	-0.09	-27.34	26.36	0.13	0.13	-25.67	23.65	-0.05	-0.05	-21.24	16.45	0.11	0.11	-28.51	28.25	-0.04	-0.04	-19.84	14.19
	9007 R	-0.10	-27.18	26.10	0.19	0.19	-21.94	17.59	-0.09	-0.09	-27.14	26.03	0.14	0.14	-23.64	20.35	-0.05	-0.05	-21.24	16.45	0.13	0.13	-25.67	23.65	-0.04	-0.04	-19.84	14.19	0.11	0.11	-28.51	28.25
9015.0	9015 L	0.19	-4.97	3.61	-0.10	-0.10	-8.60	9.50	0.12	0.12	-6.56	6.19	-0.04	-0.04	-9.56	11.06	-0.07	-0.07	-9.64	11.20	0.15	0.15	-1.98	-1.25	0.14	0.14	-11.33	13.94	-0.05	-0.05	-0.36	-3.87
	9015 R	-0.13	-9.53	14.01	0.19	0.19	-5.67	5.63	-0.06	-0.06	-10.21	15.48	0.11	0.11	-7.85	10.35	0.15	0.15	-2.35	-1.59	-0.09	-0.09	-10.53	16.18	-0.07	-0.07	-0.59	-5.41	0.14	0.14	-12.37	20.17
9021.0	9021 L	10.10	4.53	-5.82	7.42	7.42	1.68	-0.28	8.73	8.73	0.41	2.17	9.15	9.15	4.43	-5.63	9.05	9.05	3.35	-3.53	9.06	9.06	3.88	-4.57	8.39	8.39	-0.09	3.14	10.03	10.03	10.86	-11.09
	9021 R	9.63	2.08	-0.24	12.84	12.84	4.91	-6.95	11.68	11.68	5.17	-7.56	11.20	11.20	0.53	3.46	11.60	11.60	4.30	-5.49	11.58	11.58	3.74	-4.17	12.98	12.98	12.33	-13.63	10.80	10.80	0.19	4.25
9035.0	9035 L	12.84	11.13	-13.36	9.63	9.63	10.21	-11.16	11.17	11.17	12.16	-15.79	11.75	11.75	8.21	-6.41	11.44	11.44	10.70	-12.32	11.70	11.70	10.66	-12.24	10.95	10.95	7.53	-4.79	12.76	12.76	18.02	-19.34
	9035 R	7.42	8.76	-8.90	10.10	10.10	9.79	-10.90	9.19	9.19	7.10	-5.67	9.08	9.08	9.47	-10.27	9.15	9.15	9.29	-9.92	8.93	8.93	9.31	-9.96	9.88	9.88	15.64	-15.60	8.51	8.51	6.25	-4.02
9041.0	9041 L	0.93	4.35	-7.80	-0.61	-0.61	4.65	-8.47	0.32	0.32	2.94	-4.75	-0.24	-0.24	3.50	-5.97	0.01	0.01	1.74	-2.15	0.45	0.45	13.71	-15.76	0.27	0.27	0.62	0.29	0.06	0.06	16.28	-18.64
	9041 R	-0.69	4.94	-10.66	1.61	1.61	8.77	-10.79	-0.15	-0.15	4.37	-9.19	0.40	0.40	2.85	-5.35	0.59	0.59	16.92	-20.21	0.04	0.04	1.81	-2.70	0.10	0.10	20.18	-23.97	0.35	0.35	0.57	0.44
9051.0	9051 L	1.13	2.98	-2.09	-0.69	-0.69	4.62	-6.25	0.04	0.04	4.25	-5.32	0.21	0.21	1.05	2.81	-0.03	-0.03	0.71	3.68	0.52	0.52	7.60	-13.81	0.40	0.40	-1.13	8.35	0.12	0.12	18.57	-21.03
	9051 R	-0.68	4.28	-5.68	1.07	1.07	2.70	-1.89	0.10	0.10	1.30	1.45	-0.08	-0.08	3.20	-3.10	0.48	0.48	7.23	-12.74	-0.05	-0.05	0.46	3.47	0.10	0.10	17.13	-19.21	0.37	0.37	-1.34	7.77
9057.0	9057 L	9.44	7.14	-8.71	6.54	6.54	4.85	-4.11	8.11	8.11	3.58	-1.53	8.62	8.62	6.64	-7.70	8.24	8.24	6.17	-6.77	8.50	8.50	6.53	-7.49	7.64	7.64	2.67	0.30	8.86	8.86	9.25	-12.98
	9057 R	6.86	4.91	-4.20	9.85	9.85	7.16	-8.92	8.99	8.99	6.97	-8.52	8.48	8.48	3.43	-1.10	8.88	8.88	6.56	-7.68	8.61	8.61	6.21	-6.93	9.25	9.25	9.28	-13.37	7.99	7.99	2.71	0.41
9071.0	9071 L	9.85	5.87	-6.97	6.86	6.86	3.87	-2.78	8.47	8.47	5.62	-6.44	8.91	8.91	2.27	0.59	8.83	8.83	4.97	-5.07	8.66	8.66	5.19	-5.55	8.05	8.05	1.53	2.13	9.24	9.24	7.88	-11.18
	9071 R	6.54	3.83	-2.73	9.44	9.44	5.87	-6.84	8.53	8.53	2.43	0.10	8.12	8.12	5.30	-5.70	8.29	8.29	5.17	-5.44	8.45	8.45	4.95	-4.99	8.85	8.85	7.87	-10.87	7.70	7.70	1.51	1.95
9077.0	9077 L	1.09	-7.50	6.87	-0.58	-0.58	-6.34	4.07	0.17	0.17	-8.20	8.53	-0.05	-0.05	-7.19	6.12	0.22	0.22	-9.54	11.73	0.32	0.32	2.50	-4.41	0.58	0.58	-11.13	15.54	-0.17	-0.17	7.82	-10.49
	9077 R	-0.53	-5.55	3.30	1.00	1.00	-6.53	5.22	0.05	0.05	-5.76	3.71	0.16	0.16	-7.49	7.12	0.26	0.26	-2.58	-2.54	0.20	0.20	-8.55	9.21	-0.13	-0.13	7.26	-8.30	0.53	0.53	-10.07	12.21
9089.0	9089 L	1.00	1.26	0.38	-0.53	-0.53	4.76	-6.50	-0.07	-0.07	2.78	-2.60	0.36	0.36	0.40	2.08	0.16	0.16	0.02	2.83	0.32	0.32	5.88	-8.71	0.52	0.52	-2.07	6.94	-0.05	-0.05	8.13	-13.14
	9089 R	-0.56	4.57	-7.02	1.00	1.00	1.09	0.54	0.33	0.33	0.50	1.82	-0.09	-0.09	2.18	-1.83	0.31	0.31	5.69	-9.44	0.15	0.15	-0.11	3.13	-0.07	-0.07	7.94	-14.31	0.52	0.52	-2.19	7.64
9095.0	9095 L	10.52	7.58	-8.75	7.70	7.70	6.26	-6.11	9.52	9.52	4.67	-2.89	9.30	9.30	7.68	-8.95	9.50	9.50	7.50	-8.58	9.40	9.40	7.37	-8.32	8.89	8.89	3.70	-0.95	10.44	10.44	14.53	-15.46
	9095 R	8.17	6.08	-5.92	11.11	11.11	7.33	-8.50	9.88	9.88	8.89	-11.74	10.07	10.07	4.33	-2.31	9.94	9.94	7.13	-8.09	10.05	10.05	7.25	-8.35	11.06	11.06	14.07	-15.02	9.42	9.42	3.58	-0.74
9109.0	9109 L	11.11	9.22	-10.96	8.17	8.17	6.94	-6.26	10.15	10.15	9.02	-10.54	9.80	9.80	5.34	-2.94	9.65	9.65	8.22	-8.89	10.36	10.36	8.51	-9.48	9.44	9.44	4.65	-1.51	10.36	10.36	11.23	-15.11
	9109 R	7.70	7.16	-6.48	10.52	10.52	9.53	-11.26	9.26	9.26	5.71	-3.57	9.60	9.60	9.02	-10.22	9.79	9.79	8.79	-9.77	9.12	9.12	8.48	-9.15	9.80	9.80	11.59	-15.41	8.92	8.92	4.81	-1.77
9115.0	9115 L	1.18	2.13	-5.74	-0.60	-0.60	1.07	-3.43	0.60	0.60	-1.28	1.66	-0.30	-0.30	1.03	-3.35	-0.03	-0.03	-1.46	2.04	0.77	0.77	9.94	-11.75	0.50	0.50	-3.36	6.17	0.16	0.16	15.38	-17.84
	9115 R	-0.62	0.70	-3.57	1.78	1.78	6.16	-7.06	-0.22	-0.22	1.39	-5.04	0.68	0.68	-2.04	2.34	0.88	0.88	11.94	-12.91	0.00	0.00	-2.01	2.27	0.20	0.20	18.55	-19.61	0.57	0.57	-4.06	6.69
9127.0	9127 L	1.31	0.37	-1.12	-0.62	-0.62	-0.44	0.63	0.09	0.09	0.72	-1.86	0.27	0.27	-3.00	6.15	0.21	0.21	-1.43	2.77	0.46	0.46	1.48	-3.50	0.45	0.45	-4.51	9.40	0.34	0.34	4.41	-9.81
	9127 R	-0.66	-0.49	0.79	1.35	1.35	0.28	-1.13	0.27	0.27	-2.84	6.62	0.08	0.08	0.23	-1.02	0.47	0.47	1.44	-4.01	0.21	0.21	-1.48	3.24	0.34	0.34	4.40	-11.36	0.47	0.47	-4.59	10.97
9133.0	9133 L	9.37	6.34	-6.89	6.08	6.08	4.46	-3.41	7.96	7.96	3.47	-1.58	8.18	8.18	6.60	-7.37	7.63	7.63	5.58	-5.48	8.33	8.33	5.54	-5.41	7.38	7.38	2.46	0.28	8.45	8.45	8.72	-11.27
	9133 R	7.93	5.34	-4.57	11.85	11.85	7.15	-8.83	10.41	10.41	7.77	-10.28	10.15	10.15	4.05	-1.52	10.61	10.61	6.36	-6.97	9.77	9.77	6.44	-7.15	11.67	11.67	14.70	-16.00	9.49	9.49	3.18	0.51
9147.0	9147 L	11.85	9.42	-11.87	7.93	7.93	6.85	-5.81	10.07	10.07	9.09	-11.09	10.03	10.03	4.88	-1.18	9.60	9.60	8.54	-9.79	10.85	10.85	7.39	-7.09	9.58	9.58	4.14	0.56	10.67	10.67	11.32	-16.33
	9147 R	6.08	5.68	-4.34	9.37	9.37	8.29	-9.14	7.86	7.86	4.04	-1.32	7.88	7.88	7.62	-7.91	8.53	8.53	6.31	-5.50	7.48	7.48	7.36	-7.43	8.38	8.38	10.05	-12.40	7.46	7.46	3.16	0.31
9153.0	9153 L	2.66	5.41	-7.32	-1.04	-1.04	-2.68	1.86	1.00	1.00	-4.06	5.31	-0.58	-0.58	-0.26	-4.14	-0.52	-0.52	-2.13	0.51	1.99	1.99	5.16	-7.03	0.77	0.77	-5.77	9.55	0.34	0.34	15.13	-18.49
	9153 R	-1.05	-3.16	2.09	2.87	2.87	5.65	-7.94	-0.49	-0.49	0.02	-6.36	1.05	1.05	-4.82	6.50	2.15	2.15	5.38	-7.62	-0.51	-0.51	-2.61	0.63	0.38	0.38	16.28	-20.32	0.83	0.83	-6.33	10.53
9163.0	9163 L	2.00	1.28	-1.61	-1.05	-1.05	0.29	1.02	0.14	0.14	1.35	-1.80	0.42	0.42	-0.75	3.78	0.21	0.21	-0.93	4.26	0.80	0.80	3.71	-8.07	1.00	1.00	-3.11	10.07	0.19	0.19	5.91	-13.92
	9163 R	-1.02	0.21	1.00	1.88	1.88	1.20	-1.51	0.39	0.39	-0.56	2.96	0.04	0.04	0.62	-0.05	0.74	0.74	3.51	-7.40	0.17	0.17	-0.93	3.92	0.16	0.16	5.61	-12.74	0.92	0.92	-3.02	9.23
9169.0	9169 L	8.88	6.88	-7.52	5.85	5.85	4.93	-3.91	7.59	7.59	3.24	-0.78	7.48	7.48	6.72	-7.22	7.08	7.08	6.15	-6.17	8.14	8.14	5.60	-5.15	7.33	7.33	2.56	0.50	7.79	7.79	8.76	-11.02
	9169 R	7.73	5.78	-5.44	11.35	11.35	7.66	-10.11	9.67	9.67	7.85	-10.57	9.79	9.79	3.78	-0.45	10.47	10.47	6.37	-6.90	9.20	9.20	6.99	-8.44	10.02	10.02	9.68	-15.12	9.51	9.51	3.24	0.89
9183.0	9183 L	11.35	6.71	-7.60	7.73	7.73	5.29	-4.07	10.13	10.13	7.33	-9.15	9.63	9.63	3.92	-0.67	9.50	9.50	6.02	-5.89	10.13	10.13	6.68	-7.54	9.05	9.05	3.14	1.28	10.47	10.47	9.18	-13.75
	9183 R	5.85	4.42	-2.93	8.88	8.88	5.91	-5.69	7.46	7.46	3.33	-0.90	7.88	7.88	6.19	-6.21	7.86	7.86	5.84	-5.57	7.33	7.33	5.18	-4.34	8.15	8.15	8.25	-10.04	6.95	6.95	2.40	0.82
9189.0	9189 L	1.57	-5.28	1.74	-0.63	-0.63	-5.72	2.87	0.29	0.29	-7.61	7.69	0.17	0.17	-5.18	1.50	0.23	0.23	-7.91	8.45	0.99	0.99	4.19	-6.61	0.56	0.56	-9.50	12.50	0.61	0.61	8.77	-11.91
	9189 R	-0.56	-5.37	2.76	1.49	1.49	-5.04	1.81	0.20	0.20	-4.46	0.16	0.30	0.30	-7.24	8.13	0.97	0.97	3.96	-6.53	0.24	0.24	-7.31	8.32	0.59	0.59	8.25	-11.79	0.54	0.54	-8.71	12.34
9199.0	9199 L	1.71	1.75	-1.36	-0.77	-0.77	2.17	-2.55	-0.12	-0.12	3.19	-5.50	0.73	0.73	-0.07	3.86	0.20	0.20	-0.36	4.70	0.80	0.80	4.53	-9.33	0.84	0.84	-2.31	10.31	0.26	0.26	6.88	-16.07
	9199 R	-0.75	1.98	-1.84	1.61	1.61	1.78	-1.33	0.67	0.67	0.21	2.64	-0.25	-0.25	1.65	-0.99	0.75	0.75	4.45	-8.09	0.17	0.17	-0.33	4.03	0.23	0.23	6.72	-13.83	0.78	0.78	-2.21	8.78
9205.0	9205 L	9.61	6.38	-6.59	6.38	6.38	5.34	-4.46	8.26	8.26	3.81	-1.32	8.21	8.21	7.95	-9.81	7.94	7.94	6.24	-6.29	8.62	8.62	6.66	-7.16	7.82	7.82	3.17	0.00	8.68	8.68	9.15	-12.27
	9205 R	7.64	5.45	-5.01	11.26	11.26	6.32	-7.15	9.69	9.69	8.18	-11.75	10.04	10.04	3.85	-1.07	10.16	10.16	6.65	-7.97	9.40	9.40	6.26	-7.01	10.20	10.20	9.15	-14.14	9.28	9.28	3.18	0.58
9219.0	9219 L	11.26	7.36	-9.64	7.64	7.64	5.23	-4.39	10.10	10.10	8.31	-11.98	9.57	9.57	2.98	1.15	9.92	9.92	5.92	-6.08	9.69	9.69	6.26	-6.92	9.04	9.04	2.50	2.36	10.52	10.52	9.29	-14.41
	9219 R	6.38	5.11	-3.95	9.61	9.61	7.38	-8.61	8.09	8.09	3.14	0.08	8.57	8.57	8.06	-10.00	8.20	8.20	6.22	-6.22	8.41	8.41	5.89	-5.55	8.95	8.95	9.28	-12.49	7.61	7.61	2.45	1.50

ss Values for Web Splice Calculations

SERVICE II

Splice Node	Splice Side	MAX FX			MIN FX				MAX FY				MIN FY				MAX MY				MIN MY				MAX MZ				MIN MZ			
		Stress (ksi)	MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)		Axial Flange Stress (ksi)		MZ Flange Stress (ksi)	
		BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
9225.0	9225 L	1.49	-4.05	3.46	-0.76	-0.76	-1.79	-2.27	0.63	0.63	-4.53	4.66	-0.04	-0.04	-0.74	-4.94	0.36	0.36	-5.58	7.33	0.40	0.40	10.12	-12.10	0.65	0.65	-7.58	12.39	0.01	0.01	15.62	-18.06
	9225 R	-0.70	-1.27	-2.12	1.40	1.40	-3.36	3.12	-0.02	-0.02	0.15	-5.69	0.58	0.58	-4.05	4.85	0.37	0.37	8.98	-11.13	0.34	0.34	-4.79	6.72	0.02	0.02	13.78	-16.60	0.61	0.61	-6.67	11.45
9232.0	9232 L	1.40	-6.57	7.19	-0.70	-0.70	-6.14	6.11	0.29	0.29	-4.90	3.00	0.10	0.10	-7.38	9.23	0.29	0.29	-7.86	10.43	0.34	0.34	-3.34	-0.93	0.87	0.87	-10.08	16.03	-0.02	-0.02	-1.40	-5.82
	9232 R	-0.67	-5.77	5.75	1.33	1.33	-6.17	6.75	0.10	0.10	-6.83	8.44	0.13	0.13	-5.78	5.78	0.32	0.32	-3.15	-0.91	0.28	0.28	-7.37	9.82	-0.02	-0.02	-1.33	-5.53	0.83	0.83	-9.45	15.10
9242.0	9242 L	6.67	1.63	-2.80	3.48	3.48	0.02	0.65	5.39	5.39	-0.98	2.79	5.50	5.50	1.95	-3.49	5.10	5.10	0.23	0.19	5.50	5.50	0.68	-0.76	4.71	4.71	-1.70	4.34	6.03	6.03	3.19	-6.15
	9242 R	3.51	0.03	0.62	6.72	6.72	1.60	-2.65	5.54	5.54	2.19	-3.88	5.44	5.44	-1.06	2.87	5.54	5.54	0.66	-0.71	5.14	5.14	0.22	0.21	6.07	6.07	3.17	-5.90	4.75	4.75	-1.70	4.21
9253.0	9253 L	6.72	3.87	-4.87	3.51	3.51	1.83	-0.64	5.52	5.52	4.24	-5.64	5.39	5.39	0.99	1.10	5.40	5.40	2.20	-1.41	5.60	5.60	3.44	-3.98	4.71	4.71	0.22	2.71	6.10	6.10	5.56	-8.38
	9253 R	3.48	1.81	-0.67	6.67	6.67	3.87	-5.08	5.34	5.34	1.14	0.76	5.49	5.49	4.14	-5.65	5.56	5.56	3.43	-4.14	5.36	5.36	2.19	-1.48	6.06	6.06	5.56	-8.71	4.67	4.67	0.20	2.78
9261.0	9261 L	1.45	-1.87	0.41	-0.74	-0.74	-1.51	-0.51	-0.05	-0.05	-3.08	3.47	0.25	0.25	-1.25	-1.19	0.27	0.27	-4.13	6.15	0.55	0.55	11.01	-13.33	0.45	0.45	-5.72	10.19	0.40	0.40	12.87	-15.45
	9261 R	-0.74	-1.93	-0.40	1.48	1.48	-2.25	0.39	0.27	0.27	-1.26	-2.04	-0.05	-0.05	-3.62	3.72	0.57	0.57	11.93	-13.18	0.28	0.28	-4.58	6.06	0.42	0.42	13.96	-15.27	0.47	0.47	-6.20	10.00
9269.0	9269 L	2.11	12.80	-13.69	-1.34	-1.34	15.58	-16.55	0.14	0.14	12.88	-13.76	0.23	0.23	6.47	-10.49	0.01	0.01	5.92	-9.14	0.83	0.83	18.39	-19.44	0.53	0.53	3.57	-3.44	0.14	0.14	25.56	-26.83
	9269 R	-1.14	12.68	-14.60	1.76	1.76	10.61	-12.28	0.18	0.18	6.12	-10.05	0.14	0.14	6.42	-10.76	0.68	0.68	15.19	-17.41	-0.03	-0.03	5.36	-8.27	0.11	0.11	21.07	-24.03	0.44	0.44	3.18	-3.11
9277.0	9277 L	9.79	7.80	-8.35	6.40	6.40	6.35	-8.04	8.04	8.04	4.46	-4.82	8.44	8.44	10.34	-11.08	8.42	8.42	7.77	-8.32	8.63	8.63	7.90	-8.45	7.54	7.54	3.90	-3.86	8.93	8.93	12.78	-13.70
	9277 R	7.62	8.61	-9.32	11.52	11.52	8.50	-9.20	9.93	9.93	11.80	-12.79	9.38	9.38	4.76	-5.13	10.15	10.15	8.65	-9.36	9.91	9.91	8.52	-9.22	10.50	10.50	13.99	-15.17	8.82	8.82	4.30	-4.27
9287.0	9287 L	10.79	4.58	-6.33	7.82	7.82	1.09	0.08	9.72	9.72	3.75	-4.80	9.50	9.50	0.07	1.95	9.31	9.31	1.93	-1.47	9.95	9.95	3.93	-5.14	9.12	9.12	-0.54	3.08	9.98	9.98	5.91	-8.78
	9287 R	6.62	0.74	0.21	9.25	9.25	4.12	-5.56	8.10	8.10	-0.05	1.55	8.31	8.31	3.14	-3.88	8.50	8.50	3.49	-4.49	7.94	7.94	1.56	-1.19	8.53	8.53	5.40	-7.74	7.77	7.77	-0.82	2.87
9295.0	9295 L	0.60	-12.07	14.79	-0.12	-0.12	-9.55	10.07	0.10	0.10	-13.88	18.18	0.35	0.35	-11.80	14.29	0.09	0.09	-14.95	20.20	0.37	0.37	-5.93	3.29	0.45	0.45	-16.10	22.35	0.01	0.01	-4.99	1.52
	9295 R	-0.11	-7.25	7.57	0.48	0.48	-9.40	11.13	0.28	0.28	-8.88	10.27	0.07	0.07	-11.09	13.95	0.29	0.29	-4.11	2.34	0.07	0.07	-11.91	15.31	0.00	0.00	-3.31	1.01	0.36	0.36	-12.88	16.94
9305.0	9305 L	0.48	-19.40	21.72	-0.11	-0.11	-19.54	21.95	-0.03	-0.03	-21.86	25.80	0.28	0.28	-18.13	19.60	0.35	0.35	-19.01	21.06	0.01	0.01	-19.24	21.45	0.36	0.36	-23.29	28.19	0.01	0.01	-15.89	15.88
	9305 R	-0.11	-19.54	21.95	0.48	0.48	-19.41	21.72	0.31	0.31	-17.71	18.90	0.04	0.04	-22.48	26.84	0.01	0.01	-19.25	21.46	0.35	0.35	-19.01	21.07	0.01	0.01	-15.89	15.88	0.36	0.36	-23.30	28.19
9402.0	9402 L	-10.23	-9.89	10.66	-15.15	-15.15	-7.31	7.87	-13.63	-13.63	-13.56	14.61	-12.87	-12.87	-2.92	3.14	-13.05	-13.05	-5.65	6.09	-13.44	-13.44	-9.59	10.33	-12.27	-12.27	-14.35	15.45	-13.84	-13.84	-2.01	2.17
	9402 R	-16.05	-7.46	7.46	-10.84	-10.84	-10.09	10.09	-13.95	-13.95	-2.52	2.52	-14.28	-14.28	-14.05	14.05	-14.24	-14.24	-9.78	9.78	-13.82	-13.82	-5.77	5.77	-14.65	-14.65	-2.05	2.05	-13.01	-13.01	-14.64	14.64
9407.0	9407 L	-11.32	4.05	-4.05	-16.31	-16.31	2.13	-2.13	-12.86	-12.86	6.24	-6.24	-15.21	-15.21	0.41	-0.41	-14.34	-14.34	1.56	-1.56	-13.70	-13.70	3.59	-3.59	-15.16	-15.16	0.15	-0.15	-13.90	-13.90	6.74	-6.74
	9407 R	-15.51	2.60	-2.60	-10.77	-10.77	3.98	-3.98	-14.89	-14.89	0.40	-0.40	-11.83	-11.83	5.79	-5.79	-13.04	-13.04	3.53	-3.53	-13.64	-13.64	1.53	-1.53	-13.23	-13.23	6.62	-6.62	-14.41	-14.41	0.14	-0.14
9411.0	9411 L	-10.73	4.69	-4.69	-15.50	-15.50	2.86	-2.86	-14.85	-14.85	0.76	-0.76	-11.79	-11.79	6.32	-6.32	-13.47	-13.47	1.46	-1.46	-12.10	-12.10	5.04	-5.04	-14.13	-14.13	0.48	-0.48	-13.15	-13.15	7.17	-7.17
	9411 R	-16.30	2.91	-2.91	-11.28	-11.28	4.78	-4.78	-12.85	-12.85	6.84	-6.84	-15.55	-15.55	0.73	-0.73	-12.72	-12.72	5.13	-5.13	-14.17	-14.17	1.50	-1.50	-13.82	-13.82	7.30	-7.30	-14.87	-14.87	0.49	-0.49
9416.0	9416 L	-10.81	-5.79	5.79	-16.02	-16.02	-4.15	4.15	-13.55	-13.55	-0.84	0.84	-13.99	-13.99	-10.16	10.16	-13.33	-13.33	-4.12	4.12	-14.38	-14.38	-4.47	4.47	-13.41	-13.41	-10.56	10.56	-14.41	-14.41	-0.14	0.14
	9416 R	-15.13	-4.07	4.39	-10.20	-10.20	-5.68	6.12	-13.69	-13.69	-9.34	10.06	-11.99	-11.99	-1.90	2.04	-13.58	-13.58	-4.38	4.72	-12.58	-12.58	-4.04	4.35	-13.61	-13.61	-0.14	0.15	-12.65	-12.65	-10.35	11.15
9422.0	9422 L	-8.62	-9.40	9.40	-13.90	-13.90	-7.48	7.48	-12.49	-12.49	-12.67	12.67	-10.58	-10.58	-5.30	5.30	-11.43	-11.43	-6.87	6.87	-12.09	-12.09	-8.70	8.70	-11.21	-11.21	-13.96	13.96	-12.57	-12.57	-3.24	3.24
	9422 R	-16.32	-8.47	8.47	-10.13	-10.13	-10.64	10.64	-13.41	-13.41	-4.68	4.68	-13.90	-13.90	-15.30	15.30	-14.20	-14.20	-9.84	9.84	-13.42	-13.42	-7.79	7.79	-14.75	-14.75	-3.67	3.67	-13.17	-13.17	-15.81	15.81
9427.0	9427 L	-10.64	5.97	-5.97	-16.57	-16.57	3.60	-3.60	-12.39	-12.39	8.20	-8.20	-15.78	-15.78	1.93	-1.93	-14.43	-14.43	3.09	-3.09	-12.85	-12.85	5.84	-5.84	-14.80	-14.80	1.71	-1.71	-13.58	-13.58	8.86	-8.86
	9427 R	-15.66	3.52	-3.52	-10.06	-10.06	5.85	-5.85	-14.97	-14.97	1.94	-1.94	-11.25	-11.25	7.67	-7.67	-12.16	-12.16	5.75	-5.75	-13.64	-13.64	3.02	-3.02	-12.85	-12.85	8.68	-8.68	-13.99	-13.99	1.68	-1.68
9431.0	9431 L	-10.05	5.77	-5.77	-15.66	-15.66	3.95	-3.95	-14.96	-14.96	1.79	-1.79	-11.25	-11.25	7.59	-7.59	-13.59	-13.59	2.50	-2.50	-11.47	-11.47	6.19	-6.19	-14.10	-14.10	1.56	-1.56	-12.75	-12.75	8.56	-8.56
	9431 R	-16.56	4.03	-4.03	-10.63	-10.63	5.89	-5.89	-12.38	-12.38	8.12	-8.12	-15.76	-15.76	1.78	-1.78	-12.13	-12.13	6.31	-6.31	-14.38	-14.38	2.56	-2.56	-13.48	-13.48	8.74	-8.74	-14.92	-14.92	1.60	-1.60
9436.0	9436 L	-10.05	-11.38	11.38	-16.25	-16.25	-9.40	9.40	-13.42	-13.42	-5.30	5.30	-13.95	-13.95	-16.04	16.04	-13.39	-13.39	-8.34	8.34	-14.10	-14.10	-10.47	10.47	-13.19	-13.19	-16.52	16.52	-14.64	-14.64	-4.51	4.51
	9436 R	-13.84	-8.30	8.30	-8.55	-8.55	-10.05	10.05	-12.43	-12.43	-13.46	13.46	-10.66	-10.66	-5.79	5.79	-12.00	-12.00	-9.34	9.34	-11.40	-11.40	-7.36	7.36	-12.47	-12.47	-3.98	3.98	-11.22	-11.22	-14.59	14.59
9442.0	9442 L	-10.04	-6.01	6.01	-15.47	-15.47	-4.01	4.01	-13.83	-13.83	-9.52	9.52	-12.23	-12.23	-1.37	1.37	-12.89	-12.89	-3.29	3.29	-13.68	-13.68	-4.88	4.88	-12.71	-12.71	-10.58	10.58	-14.11	-14.11	0.52	-0.52
	9442 R	-18.33	-4.59	4.59	-11.90	-11.90	-6.88	6.88	-15.42	-15.42	-0.28	0.28	-15.77	-15.77	-11.69	11.69	-16.22	-16.22	-5.59	5.59	-15.27	-15.27	-3.78	3.78	-16.71	-16.71	0.60	-0.60	-15.08	-15.08	-12.12	12.12
9447.0	9447 L	-12.29	3.36	-3.36	-18.47	-18.47	1.03	-1.03	-14.09	-14.09	5.59	-5.59	-17.65	-17.65	-1.26	1.26	-16.23	-16.23	-0.19	0.19	-14.53	-14.53	3.48	-3.48	-16.80	-16.80	-1.51	1.51	-15.22	-15.22	6.16	-6.16
	9447 R	-17.44	1.01	-1.01	-11.61	-11.61	3.29	-3.29	-16.73	-16.73	-1.18	1.18	-12.83	-12.83	5.11	-5.11	-13.73	-13.73	3.45	-3.45	-15.31	-15.31	-0.24	0.24	-14.38	-14.38	6.03	-6.03	-15.86	-15.86	-1.48	1.48
9451.0	9451 L	-11.59	3.30	-3.30	-17.42	-17.42	0.48	-0.48	-16.73	-16.73	-1.11	1.11	-12.80	-12.80	5.12	-5.12	-15.35	-15.35	0.01	-0.01	-13.22	-13.22	3.26	-3.26	-15.89	-15.89	-1.41	1.41	-14.36	-14.36	6.05	-6.05
	9451 R	-18.45	0.49	-0.49	-12.27	-12.27	3.37	-3.37	-14.04	-14.04	5.60	-5.60	-17.65	-17.65	-1.19	1.19	-14.00	-14.00	3.33	-3.33	-16.25	-16.25	0.00	0.00	-15.20	-15.20	6.17	-6.17	-16.83	-16.83	-1.44	1.44
9456.0	9456 L	-11.78	-6.65	6.65	-18.29	-18.29	-3.85	3.85	-15.43	-15.43	0.30	-0.30	-15.61	-15.61	-11.21	11.21	-15.48	-15.48	-2.80	2.80	-15.67	-15.67	-6.36	6.36	-14.94	-14.94	-11.65	11.65	-16.66	-16.66	1.16	-1.16
	9456 R	-15.44	-3.36	3.36	-9.94	-9.94	-5.81	5.81	-13.69	-13.69	-9.13	9.13	-12.25	-12.25	-0.82	0.82	-13.22	-13.22	-5.56	5.56	-13.06	-13.06	-2.43	2.43	-14.07	-14.07	1.01	-1.01	-12.60	-12.60	-10.17	10.17
9462.0	9462 L	-7.68	-7.28	8.39	-14.05	-14.05	-5.76	6.64	-12.86	-12.86	-10.38	11.96	-9.35	-9.35	-3.22	3.71	-10.59	-10.59	-5.22	6.02	-11.88	-11.88	-6.71	7.73	-10.62	-10.62	-12.07	13.90	-12.04	-12.04	-1.32	1.52
	9462 R	-16.59	-7.03	7.03	-9.07	-9.07	-8.86	8.86	-11.72	-11.72	-2.91	2.91	-14.53	-14.53	-13.61	13.61	-14.02	-14.02	-8.17	8.17	-12.50	-12.50	-6.35	6.35	-14.20	-14.20	-1.61	1.61	-12.55	-12.55	-14.69	14.69
9467.0	9467 L	-8.88	4.03	-4.03	-16.37	-16.37	3.33	-3.33	-10.98	-10.98	7.42	-7.42	-14.99	-14.99	0.61	-0.61	-14.06	-14.06	2.84	-2.84	-12.28	-12.28	4.08	-4.08	-12.94	-12.94	-0.93	0.93	-12.84	-12.84	8.85	-8.85
	9467 R	-15.46	3.27	-3.27	-8.40	-8.40	3.95	-3.95	-14.63	-14.63	1.21	-1.21	-9.81	-9.81	6.65	-6.65	-11.61	-11.61	4.05	-4.05	-13.28	-13.28	2.75	-2.75	-12.13	-12.13	8.68	-8.68	-12.21	-12.21	-0.92	0.92
9471.0	9471 L	-8.64	3.91	-3.91	-14.84	-14.84	3.62	-3.62	-13.88	-13.88	0.51	-0.51	-10.00	-10.00	6.65	-6.65	-13.27	-13.27	3.32	-3.32	-11.12	-11.12	3.72	-3.72	-12.44	-12.44	-0.75	0.75	-11.91	-11.91	8.20	-8.20
	9471 R	-15.71	3.69	-3.69	-9.14	-9.14	3.99	-3.99	-11.02	-11.02	7.11	-7.11	-14.40	-14.40	0.58	-0.58	-11.76	-11.76	3.92	-3.92	-14.05	-14.05	3.30	-3.30	-12.59	-12.59	8.37	-8.37	-13.18	-13.18	-0.76	0.76
9476.0	9476 L	-8.98	-8.88	8.88	-16.01	-16.01	-6.48	6.48	-11.87	-11.87	-2.37	2.37	-14.17	-14.17	-12.83	12.83	-12.60	-12.60	-4.51	4.51	-13.45	-13.45	-9.47	9.47	-12.29	-12.29	-14.64	14.64	-14.05	-14.05	-0.24	0.24
	9476 R	-13.56	-5.33	6.14	-7.60	-7.60	-7.29	8.40	-12.18	-12.18	-10.27	11.84	-9.72	-9.72	-2.43	2.81	-11.38	-11.38	-7.79	8.97	-10.68	-10.68	-3.69	4.25	-11.91	-11.91	-0.20	0.23	-10.40	-10.40	-12.02	13.85
9482.0	9482 L	-7.18	-8.66	10.63	-13.19	-13.19	-7.10	8.72	-11.99	-11.99	-11.43	14.04	-8.88	-8.88	-5.24	6.44	-10.00	-10.00	-6.14	7.54	-11.27	-11.27	-8.84	10.85	-10.10	-10.10	-13.40	16.46	-11.47	-11.47	-2.61	3.21
	9482 R	-15.07	-8.52	8.52	-8.21	-8.21	-10.39	10.39	-10.93	-10.93	-5.15	5.15	-13.18	-13.18	-14.44	14.44	-12.87	-12.87	-10.60	10.60	-11.42	-11.42	-7.37	7.37	-13.09	-13.09	-3.13	3.13	-11.54	-11.54	-16.08	16.08
9487.0	9487 L	-7.97	5.55	-5.55	-14.50	-14.50	4.48	-4.48	-9.84	-9.84	8.47	-8.47	-13.40	-13.40	1.71	-1.71	-13.03	-13.03	4.39	-4.39	-10.34	-10.34	5.01	-5.01	-11.96	-11.96	1.12	-1.12	-11.30	-11.30	9.26	-9.26
	9487 R	-13.70	4.39	-4.39	-7.53	-7.53	5.44	-5.44	-12.72	-12.72	1.72	-1.72	-8.82	-8.82	7.81	-7.81	-9.78	-9.78	4.86	-4.86	-12.31	-12.31	4.36	-4.36	-10.69	-10.69	9.08	-9.08	-11.30	-11.30	1.09	-1.09
9491.0	9491 L	-7.64	5.07	-5.07	-13.94	-13.94	5.04	-5.04	-12.84	-12.84	1.87	-1.87	-9.41	-9.41	8.42	-8.42	-11.84	-11.84	4.25	-4.25	-10.38	-10.38	5.00	-5.00	-10.80	-10.80	0.55	-0.55	-11.28	-11.28	9.58	-9.58
	9491 R	-14.75	5.14	-5.14	-8.08	-8.08	5.17	-5.17	-10.06	-10.06	8.68	-8.68	-13.53	-13.53	1.86	-1.86	-10.98	-10.98	5.20	-5.20	-12.54	-12.54	4.31	-4.31	-11.93	-11.93	9.78	-9.78	-11.44	-11.44	0.56	-0.56
9496.0	9496 L	-8.37	-10.23	10.23	-15.19	-15.19	-9.41	9.41	-10.64	-10.64	-4.95	4.95	-13.58	-13.58	-15.25	15.25	-11.05	-11.05	-8.00	8.00	-13.35	-13.35	-10.74	10.74	-11.66	-11.66	-16.30	16.30	-13.01	-13.01	-3.63	3.63
	9496 R	-13.30	-7.84	9.63	-7.33	-7.33	-8.53	10.48	-12.12	-12.12	-12.40	15.23	-9.01	-9.01	-4.54	5.58	-11.68	-11.68	-8.96	11.01	-9.67	-9.67	-6.66	8.18	-11.40	-11.40	-3.03	3.72	-10.20	-10.20	-13.59	16.69
9502.0	9502 L	-7.72	-8.82	9.34	-13.41	-13.41	-6.71	7.11	-11.47	-11.47	-12.60	13.35	-9.84	-9.84	-4.73	5.02	-10.50	-10.50	-6.97	7.38	-11.78	-11.78	-8.32	8.81	-10.04	-10.04	-13.99	14.82	-12.16	-12.16	-2.57	2.72
	9502 R	-14.87	-7.34	7.34	-8.57	-8.57	-9.65	9.65	-12.18	-12.18	-3.58	3.58	-11.95	-11.95	-14.79	14.79	-13.07	-13.07	-9.01	9.01	-11.65	-11.65	-7.64	7.64	-13.49	-13.49	-2.81	2.81	-11.15	-11.15	-15.31	15.31
9507.0	9507 L	-9.01	6.04	-6.04	-15.15	-15.15	3.60	-3.60	-10.94	-10.94	8.67	-8.67	-14.09	-14.09	1.48	-1.48	-13.12	-13.12	2.57	-2.57	-10.57	-10.57	6.25	-6.25	-13.81	-13.81	1.19	-1.19	-11.58	-11.58	9.08	-9.08
	9507 R	-14.43	3.54	-3.54	-8.59	-8.59	5.94	-5.94	-13.59	-13.59	1.57	-1.57	-10.34	-10.34	8.45	-8.45	-10.08	-10.08	6.17	-6.17	-12.50	-12.50	2.51	-2.51	-11.05	-11.05	8.93	-8.93	-13.16	-13.16	1.17	-1.17
9511.0	9511 L	-8.52	5.69	-5.69	-14.51	-14.51	3.61	-3.61	-13.73	-13.73	1.69	-1.69	-9.79	-9.79	7.86	-7.86	-12.52	-12.52	2.62	-2.62	-10.87	-10.87	5.77	-5.77	-13.02	-13.02	1.26	-1.26	-11.16	-11.16	8.79	-8.79
	9511 R	-15.23	3.67	-3.67	-8.94	-8.94	5.79	-5.79	-10.81	-10.81	8.51	-8.51	-14.31	-14.31	1.63	-1.63	-11.40	-11.40	5.85	-5.85	-13.15	-13.15	2.68	-2.68	-11.70	-11.70	8.94	-8.94	-13.67	-13.67	1.28	-1.28
9516.0	9516 L	-8.34	-10.28	10.28	-15.21	-15.21	-6.56	6.56	-12.26	-12.26	-3.49	3.49	-12.26	-12.26	-15.10	15.10	-12.33	-12.33	-6.44	6.44	-12.71	-12.71	-10.82	10.82	-10.92	-10.92	-16.07	16.07	-13.82	-13.82	-2.42	2.42
	9516 R	-13.71	-5.99	6.35	-7.51	-7.51	-9.39	9.95	-11.70	-11.70	-12.92	13.69	-9.74	-9.74	-4.98	5.27	-11.45	-11.45	-9.90	10.49	-11.12	-11.12	-5.87	6.22	-12.46	-12.46	-2.21	2.34	-9.83	-9.83	-14.69	15.56
9522.0	9522 L	-4.17	-13.16	12.49	-9.18	-9.18	-11.49	10.91	-8.24	-8.24	-16.02	15.21	-4.98	-4.98	-11.68	11.09	-6.54	-6.54	-10.71	10.17	-7.48	-7.48	-14.44	13.71	-6.21	-6.21	-17.41	16.53	-8.07	-8.07	-8.62	8.18
	9522 R	-10.19	-12.01	12.01	-4.63	-4.63	-13.74	13.74	-7.31	-7.31	-10.06	10.06	-8.42	-8.42	-17.55	17.55	-8.31	-8.31	-15.07	15.07	-7.27	-7.27	-11.18	11.18	-8.96	-8.96	-9.00	9.00	-6.90	-6.90	-18.18	18.18
9527.0	9527 L	-5.25	8.04	-8.04	-10.40	-10.40	6.46	-6.46	-7.00	-7.00	10.18	-10.18	-9.59	-9.59	5.08	-5.08	-8.67	-8.67	6.53	-6.53	-7.43	-7.43	7.44	-7.44	-9.32	-9.32	4.87	-4.87	-7.53	-7.53	10.44	-10.44
	9527 R	-10.00	6.38	-6.38	-5.06	-5.06	7.93	-7.93	-9.44	-9.44	5.18	-5.18	-6.21	-6.21	9.64	-9.64	-7.15	-7.15	7.35	-7.35	-8.33	-8.33	6.43	-6.43	-7.24	-7.24	10.30	-10.30	-8.95	-8.95	4.81	-4.81
9531.0	9531 L	-5.06	8.14	-8.14	-10.09	-10.09	6.69	-6.69	-9.57	-9.57	5.56	-5.56	-6.16	-6.16	9.79	-9.79	-8.05	-8.05	6.78	-6.78	-8.21	-8.21	7.46	-7.46	-8.86	-8.86	5.09	-5.09	-7.35	-7.35	10.49	-10.49
	9531 R	-10.51	6.78	-6.78	-5.25	-5.25	8.25	-8.25	-6.93	-6.93	10.34	-10.34	-9.77	-9.77	5.48	-5.48	-8.54	-8.54	7.56	-7.56	-8.38	-8.38	6.87	-6.87	-7.64	-7.64	10.64	-10.64	-9.22	-9.22	5.16	-5.16
9536.0	9536 L	-4.66	-13.23	13.23	-10.21	-10.21	-11.05	11.05	-7.42	-7.42	-9.06	9.06	-8.30	-8.30	-16.84	16.84	-6.39	-6.39	-12.09	12.09	-8.22	-8.22	-10.95	10.95	-6.97	-6.97	-17.51	17.51	-8.94	-8.94	-7.96	7.96
	9536 R	-9.20	-10.56	10.02	-4.19	-4.19	-12.67	12.03	-8.31	-8.31	-15.06	14.29	-5.07	-5.07	-10.87	10.32	-7.41	-7.41	-10.57	10.03	-5.73	-5.73	-11.51	10.93	-8.06	-8.06	-7.63	7.24	-6.27	-6.27	-16.77	15.92
9542.0	9542 L	-8.39	-4.24	4.45	-12.76	-12.76	-3.98	4.18	-12.06	-12.06	-7.66	8.04	-8.76	-8.76	-3.52	3.70	-10.22	-10.22	-3.59	3.77	-11.65	-11.65	-5.46	5.74	-10.47	-10.47	-8.63	9.05	-11.53	-11.53	-0.83	0.87
	9542 R	-14.11	-4.31	4.31	-9.29	-9.29	-4.58	4.58	-11.25	-11.25	-1.85	1.85	-12.98	-12.98	-8.68	8.68	-12.89	-12.89	-5.91	5.91	-11.31	-11.31	-3.89	3.89	-12.75	-12.75	-0.90	0.90	-11.59	-11.59	-9.33	9.33
9547.0	9547 L	-9.75	4.00	-4.00	-14.39	-14.39	3.00	-3.00	-11.49	-11.49	6.27	-6.27	-13.56	-13.56	1.51	-1.51	-13.40	-13.40	2.89	-2.89	-12.12	-12.12	3.23	-3.23	-13.15	-13.15	1.22	-1.22	-11.97	-11.97	6.54	-6.54
	9547 R	-13.85	2.96	-2.96	-9.39	-9.39	3.95	-3.95	-13.12	-13.12	1.55	-1.55	-10.56	-10.56	5.83	-5.83	-11.67	-11.67	3.19	-3.19	-12.90	-12.90	2.85	-2.85	-11.54	-11.54	6.46	-6.46	-12.66	-12.66	1.20	-1.20
9551.0	9551 L	-9.67	3.84	-3.84	-13.85	-13.85	3.24	-3.24	-13.21	-13.21	1.79	-1.79	-10.46	-10.46	5.35	-5.35	-12.43	-12.43	3.07	-3.07	-12.35	-12.35	3.15	-3.15	-12.74	-12.74	1.36	-1.36	-11.65	-11.65	6.37	-6.37
	9551 R	-14.39	3.28	-3.28	-10.04	-10.04	3.89	-3.89	-11.57	-11.57	6.02	-6.02	-13.68	-13.68	1.77	-1.77	-12.83	-12.83	3.19	-3.19	-12.91	-12.91	3.11	-3.11	-12.09	-12.09	6.45	-6.45	-13.23	-13.23	1.38	-1.38
9556.0	9556 L	-9.48	-9.02	9.02	-14.01	-14.01	-6.17	6.17	-11.77	-11.77	-4.31	4.31	-12.72	-12.72	-11.61	11.61	-11.34	-11.34	-8.36	8.36	-12.98	-12.98	-6.61	6.61	-11.48	-11.48	-12.72	12.72	-12.96	-12.96	-3.38	3.38
	9556 R	-12.66	-5.69	5.97	-8.56	-8.56	-8.33	8.75	-11.99	-11.99	-9.98	10.47	-9.71	-9.71	-5.40	5.67	-11.73	-11.73	-6.14	6.45	-10.25	-10.25	-7.64	8.02	-11.71	-11.71	-3.12	3.28	-10.36	-10.36	-11.76	12.34

Field Splice

Type AA

Field Splice - Node 1402

Node 1402

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1402 L	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00
1402 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1402 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.37	-5.30	-32.33	-19.39	-40.51	-7.65	-21.11	-18.78	-38.55	-16.11	-25.75	-15.87	-38.01	5.23	-21.39	-21.47
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	68.99	63.56	59.60
f / ϕf Fnc	0.45	0.09	0.51	0.33	0.64	0.13	0.33	0.32	0.61	0.27	0.41	0.27	0.60	0.08	0.34	0.36
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.99	0.91	0.85
fcf (ksi)	-28.37		-32.33		-40.51		-21.11		-38.55		-25.75		-38.01			-21.47
Fcf (ksi)	-47.67		-48.18		-52.34		-47.67		-51.34		-47.67		-51.07			-44.70
Fcf (kip)	-4505.13		-4553.28		-4945.70		-4505.13		-4851.39		-4505.13		-4825.81			-3755.04
fncf (ksi)		-5.30		-19.39		-7.65		-18.78		-16.11		-15.87		5.23	-21.39	
Rcf		1.18		1.19		1.29		1.18		1.27		1.18		1.26	1.10	
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		51.74	-47.67	
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		3095.31	-4505.13	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.05	-3.73	-23.86	-14.18	-29.78	-5.25	-15.77	-13.90	-28.40	-11.73	-18.94	-11.34	-28.06	3.93	-15.92	-15.84
Fs (ksi)	-21.05	-3.73	-23.86	-14.18	-29.78	-5.25	-15.77	-13.90	-28.40	-11.73	-18.94	-11.34	-28.06	3.93	-15.92	-15.84
Fs (kip)	-1988.78	-313.17	-2254.60	-1191.49	-2814.54	-440.71	-1489.85	-1167.78	-2683.94	-985.39	-1790.23	-952.31	-2651.47	330.09	-1504.81	-1330.17

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3376.57	0.00	330.09
Comp	5202.55	4011.89	2814.54	1330.17

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	408.57	483.61	571.79	355.50	486.62	416.41	546.25	368.20	298.35	351.14	413.67	260.63	353.28	303.90	395.62	269.61
Vuw (kip)	612.85	725.41	857.69	533.24	729.93	624.62	819.37	552.30	---	---	---	---	---	---	---	---
Mv (k*ft)	344.73	408.04	482.45	299.95	410.59	351.35	460.89	310.67	167.82	197.52	232.69	146.60	198.72	170.94	222.54	151.65
Huw (kip)	-1916.22	-2539.85	-2212.60	-2487.16	-2556.32	-2363.83	-1574.65	-2435.76	-891.85	-1369.53	-1261.08	-1068.04	-1444.76	-1090.13	-868.62	-1143.33
Muw (k*ft)	977.89	586.24	1000.87	597.27	724.50	679.49	1366.15	491.00	415.61	232.17	588.89	44.72	400.10	182.57	767.70	2.13
Mu (k*ft)	1322.62	994.29	1483.32	897.22	1135.09	1030.83	1827.04	801.67	583.43	429.69	821.58	191.33	598.81	353.51	990.24	153.78

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.06	27.91	24.31	27.33	28.09	25.98	17.30	26.77	9.80	15.05	13.86	11.74	15.88	11.98	9.55	12.56
PY1 (Vuw)	6.73	7.97	9.43	5.86	8.02	6.86	9.00	6.07	3.28	3.86	4.55	2.86	3.88	3.34	4.35	2.96
PX2 (Mu)	19.38	14.57	21.73	13.15	16.63	15.10	26.77	11.75	8.55	6.30	12.04	2.80	8.77	5.18	14.51	2.25
PY2 (Mu)	9.69	7.28	10.87	6.57	8.32	7.55	13.38	5.87	4.27	3.15	6.02	1.40	4.39	2.59	7.25	1.13
Pu (kip)	43.64	45.14	50.32	42.34	47.61	43.54	49.43	40.32	19.84	22.47	27.97	15.15	26.00	18.15	26.71	15.37

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	1738.43	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	1638.14	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2544.48	2646.00	OK
TF Inside	2658.07	2764.13	OK
BF Inside	2065.53	2457.00	OK
BF Outside	1946.36	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.35	41.81	47.00	39.64	44.39	40.72	46.66	37.50
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	857.69
Rr (kip)	2049.94
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2658.07	24.61	OK	1438.00	13.31	OK
BF	2065.53	24.59	OK	684.84	8.15	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2544.48	23.56	1.47	119.85	OK
TF	5202.55	48.17	1.47	269.66	OK
TF Inside	2658.07	24.61	1.47	134.83	OK
BF Inside	2065.53	24.59	1.47	119.85	OK
BF	4011.89	47.76	1.47	239.70	OK
BF Outside	1946.36	23.17	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.32	25.16	OK	27.97	13.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.32	1.47	137.48	OK
Web SPL	25.16	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.04
TF Inside	NA	1.04
BF Inside	1.03	1.19
BF Outside	1.06	1.19

Bolt	Shear	Slip	Bearing
TF	1.47	1.26	5.09
Web	1.87	1.39	3.99
BF	1.31	2.06	4.53

Plate	Shear	Flexure
Web	2.39	1.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.85	-2.70	-27.07	-14.65	-34.12	-2.56	-18.97	-16.74	-28.76	-7.21	-22.88	-13.40	-33.44	0.64	-19.14	-19.22
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	68.99	63.56	59.60
f / ϕf Fnc	0.39	0.05	0.43	0.25	0.54	0.04	0.30	0.28	0.45	0.12	0.36	0.22	0.53	0.01	0.30	0.32
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.99	0.91	0.85
fcf (ksi)	-24.85		-27.07		-34.12		-18.97		-28.76		-22.88		-33.44			-19.22
Fcf (ksi)	-47.67		-47.67		-49.09		-47.67		-47.67		-47.67		-48.75			-44.70
Fcf (kip)	-4505.13		-4505.13		-4639.15		-4505.13		-4505.13		-4505.13		-4606.54			-3755.04
fncf (ksi)		-2.70		-14.65		-2.56		-16.74		-7.21		-13.40		0.64	-19.14	
Rcf		1.40		1.40		1.44		1.40		1.40		1.40		1.43	1.31	
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		51.74	-47.67	
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		3095.31	-4505.13	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.16133	-2.205053	-19.689	-10.77538	-24.71137	-2.102428	-13.9673	-12.25031	-20.88425	-5.523487	-16.77327	-9.763828	-24.23077	0.1544295	-14.09	-14.01
Fs (ksi)	-18.16	-2.21	-19.69	-10.78	-24.71	-2.10	-13.97	-12.25	-20.88	-5.52	-16.77	-9.76	-24.23	0.15	-14.09	-14.01
Fs (kip)	-1716.25	-185.22	-1860.61	-905.13	-2335.22	-176.60	-1319.91	-1029.03	-1973.56	-463.97	-1585.07	-820.16	-2289.81	12.97	-1331.39	-1176.61

Vu (kip)	408.57	483.61	571.79	355.50	486.62	416.41	546.25	368.20	298.35	351.14	413.67	260.63	353.28	303.90	395.62	269.61
Vuw (kip)	612.85	725.41	857.69	533.24	729.93	624.62	819.37	552.30	---	---	---	---	---	---	---	---
Mv (k*ft)	344.73	408.04	482.45	299.95	410.59	351.35	460.89	310.67	167.82	197.52	232.69	146.60	198.72	170.94	222.54	151.65
Huw (kip)	-1827.54	-2428.30	-1874.38	-2533.31	-2054.40	-2365.68	-1696.92	-2489.08	-733.19	-1096.72	-965.30	-943.83	-950.68	-955.34	-866.75	-1011.46
Muw (k*ft)									382.95	213.93	542.61	41.21	368.66	168.23	585.24	1.96
Mu (k*ft)	344.73	408.04	482.45	299.95	410.59	351.35	460.89	310.67	550.77	411.45	775.31	187.81	567.38	339.17	807.78	153.61

Muw (k*ft)	1037.01	636.50	1072.88	566.50	885.77	678.25	1174.86	455.45	forces matching the Muw results
Pu (add)	248.26	152.38	256.85	135.62	212.06	162.37	281.26	109.04	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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5%	3%	5%	3%	4%	3%	6%	2%	percentage increase in flange force	6%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.08	26.68	20.60	27.84	22.58	26.00	18.65	27.35	8.06	12.05	10.61	10.37	10.45	10.50	9.52	11.11
PY1 (Vuw)	6.73	7.97	9.43	5.86	8.02	6.86	9.00	6.07	3.28	3.86	4.55	2.86	3.88	3.34	4.35	2.96
PX2 (Mu)	5.05	5.98	7.07	4.39	6.02	5.15	6.75	4.55	8.07	6.03	11.36	2.75	8.31	4.97	11.84	2.25
PY2 (Mu)	2.53	2.99	3.53	2.20	3.01	2.57	3.38	2.28	4.03	3.01	5.68	1.38	4.16	2.48	5.92	1.13
Pu (kip)	26.79	34.45	30.55	33.23	30.65	32.54	28.26	32.98	17.71	19.34	24.23	13.79	20.41	16.53	23.70	13.98

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	23.74	30.68	26.55	29.85	27.08	29.10	24.45	29.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 1402**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.45	17.23	OK	24.23	12.12	OK

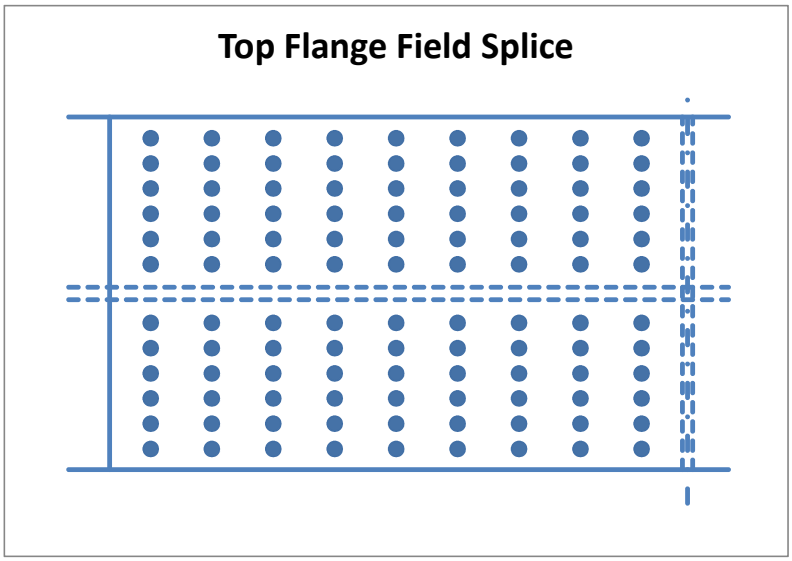
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.45	1.47	137.48	OK
Web SPL	17.23	1.47	114.56	OK

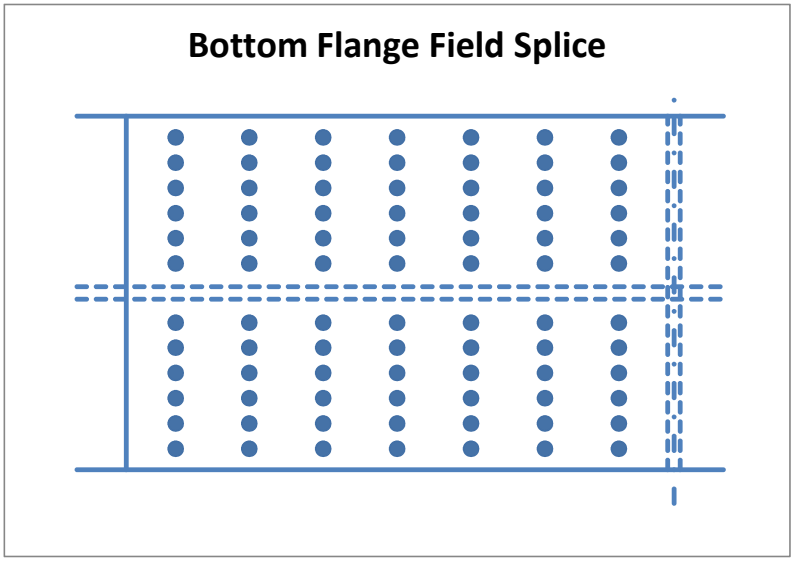
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1402	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1402

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	15	0	15
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
0	34	0	34
0	37	0	37
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	15	3	15
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
3	34	3	34
3	37	3	37
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	15	6	15
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
6	34	6	34
6	37	6	37
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	15	9	15
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
9	34	9	34
9	37	9	37
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	15	12	15
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
12	34	12	34

	Top Flange		Bottom Flange	
No. Bolts =	108.0		84.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	37	12	37
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	15	15	15
15	22	15	22
15	25	15	25
15	28	15	28
15	31	15	31
15	34	15	34
15	37	15	37
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	15	18	15
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
18	34	18	34
18	37	18	37
21	0		
21	3		
21	6		
21	9		
21	12		
21	15		
21	22		
21	25		
21	28		
21	31		
21	34		
21	37		
24	0		
24	3		
24	6		
24	9		
24	12		
24	15		
24	22		
24	25		
24	28		
24	31		
24	34		
24	37		

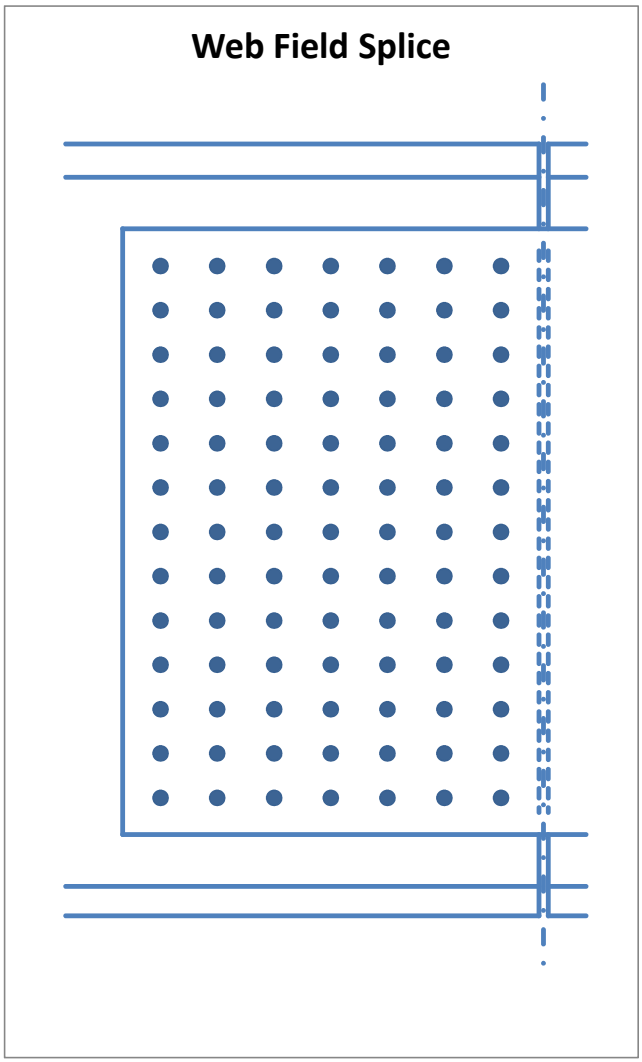
Flange Bolt Pattern Cont. - Node 1402

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1402	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1402

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	81	324
0	3	81	225
0	6	81	144
0	9	81	81
0	12	81	36
0	15	81	9
0	18	81	0
0	21	81	9
0	24	81	36
0	27	81	81
0	30	81	144
0	33	81	225
0	36	81	324
3	0	36	324
3	3	36	225
3	6	36	144
3	9	36	81
3	12	36	36
3	15	36	9
3	18	36	0
3	21	36	9
3	24	36	36
3	27	36	81
3	30	36	144
3	33	36	225
3	36	36	324
6	0	9	324
6	3	9	225
6	6	9	144
6	9	9	81
6	12	9	36
6	15	9	9
6	18	9	0
6	21	9	9
6	24	9	36
6	27	9	81
6	30	9	144
6	33	9	225
6	36	9	324
9	0	0	324
9	3	0	225
9	6	0	144
9	9	0	81
9	12	0	36
9	15	0	9
9	18	0	0
9	21	0	9
9	24	0	36
9	27	0	81
9	30	0	144
9	33	0	225
9	36	0	324
12	0	9	324
12	3	9	225
12	6	9	144
12	9	9	81
12	12	9	36
12	15	9	9
12	18	9	0

No. Bolts =	91.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	6.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	9	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	3276	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	11466	
Σd^2 (in^2) =	14742	



12	21	9	9
12	24	9	36
12	27	9	81
12	30	9	144
12	33	9	225
12	36	9	324
15	0	36	324
15	3	36	225
15	6	36	144
15	9	36	81
15	12	36	36
15	15	36	9
15	18	36	0
15	21	36	9
15	24	36	36
15	27	36	81
15	30	36	144
15	33	36	225
15	36	36	324
18	0	81	324
18	3	81	225
18	6	81	144
18	9	81	81
18	12	81	36
18	15	81	9
18	18	81	0
18	21	81	9
18	24	81	36
18	27	81	81
18	30	81	144
18	33	81	225
18	36	81	324

Web Bolt Pattern Cont. - Node 1402

Web Bolt Pattern Cont. - Node 1402

819	1638	3276	11466

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3402	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 3402

Node 3402

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3402 L	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00
3402 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3402 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.76	-8.09	-32.25	-21.34	-40.86	-7.55	-23.72	-19.34	-39.60	-18.88	-27.38	-17.68	-39.66	-4.57	-24.60	-22.53
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.48	0.14	0.51	0.36	0.64	0.13	0.37	0.32	0.62	0.32	0.43	0.30	0.62	0.08	0.39	0.38
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-30.76		-32.25		-40.86		-23.72		-39.60		-27.38		-39.66		-24.60	
Fcf (ksi)	-47.67		-48.14		-52.51		-47.67		-51.87		-47.67		-51.90		-47.67	
Fcf (kip)	-4505.13		-4549.58		-4962.22		-4505.13		-4902.00		-4505.13		-4904.88		-4505.13	
fncf (ksi)		-8.09		-21.34		-7.55		-19.34		-18.88		-17.68		-4.57		-22.53
Rcf		1.17		1.18		1.29		1.17		1.27		1.17		1.27		1.17
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.72	-5.68	-23.73	-15.57	-30.03	-5.15	-17.60	-14.25	-29.08	-13.70	-20.15	-12.66	-29.21	-3.02	-18.18	-16.53
Fs (ksi)	-22.72	-5.68	-23.73	-15.57	-30.03	-5.15	-17.60	-14.25	-29.08	-13.70	-20.15	-12.66	-29.21	-3.02	-18.18	-16.53
Fs (kip)	-2147.41	-477.19	-2242.50	-1307.66	-2837.56	-432.34	-1662.80	-1196.80	-2747.93	-1150.53	-1904.33	-1063.20	-2760.34	-253.83	-1718.36	-1388.87

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5214.04	4022.07	2837.56	1388.87

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	454.29	508.10	605.22	406.56	523.46	454.26	593.36	420.78	330.79	368.00	437.42	296.26	378.84	330.77	429.04	306.30
Vuw (kip)	681.44	762.15	907.82	609.85	785.18	681.39	890.03	631.17	---	---	---	---	---	---	---	---
Mv (k*ft)	383.31	428.71	510.65	343.04	441.67	383.28	500.64	355.03	186.07	207.00	246.05	166.64	213.10	186.06	241.34	172.29
Huw (kip)	-2031.35	-2613.32	-2212.25	-2503.87	-2703.64	-2434.28	-2050.74	-2637.88	-1022.57	-1414.71	-1266.26	-1146.36	-1539.91	-1181.12	-1160.34	-1249.84
Muw (k*ft)	901.14	535.41	1009.37	586.12	651.63	632.52	1088.33	496.78	409.03	195.90	597.13	80.36	369.16	179.87	628.52	39.59
Mu (k*ft)	1284.45	964.13	1520.02	929.16	1093.30	1015.80	1588.98	851.82	595.10	402.90	843.17	247.00	582.26	365.93	869.85	211.88

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.32	28.72	24.31	27.52	29.71	26.75	22.54	28.99	11.24	15.55	13.91	12.60	16.92	12.98	12.75	13.73
PY1 (Vuw)	7.49	8.38	9.98	6.70	8.63	7.49	9.78	6.94	3.64	4.04	4.81	3.26	4.16	3.63	4.71	3.37
PX2 (Mu)	18.82	14.13	22.27	13.61	16.02	14.88	23.28	12.48	8.72	5.90	12.35	3.62	8.53	5.36	12.75	3.10
PY2 (Mu)	9.41	7.06	11.14	6.81	8.01	7.44	11.64	6.24	4.36	2.95	6.18	1.81	4.27	2.68	6.37	1.55
Pu (kip)	44.48	45.54	51.14	43.29	48.66	44.23	50.58	43.51	21.50	22.56	28.47	16.99	26.81	19.40	27.80	17.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2550.10	2646.00	OK
TF Inside	2663.94	2764.13	OK
BF Inside	2070.77	2457.00	OK
BF Outside	1951.30	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.82	42.01	47.62	40.35	45.11	41.15	47.23	40.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	907.82
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2663.94	24.67	OK	1449.76	13.42	OK
BF	2070.77	24.65	OK	715.06	8.51	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2550.10	23.61	1.47	119.85	OK
TF	5214.04	48.28	1.47	269.66	OK
TF Inside	2663.94	24.67	1.47	134.83	OK
BF Inside	2070.77	24.65	1.47	119.85	OK
BF	4022.07	47.88	1.47	239.70	OK
BF Outside	1951.30	23.23	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.14	25.57	OK	28.47	14.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.14	1.47	137.48	OK
Web SPL	25.57	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.04
TF Inside	NA	1.04
BF Inside	NA	1.19
BF Outside	NA	1.19

Bolt	Shear	Slip	Bearing
TF	1.47	1.25	5.08
Web	1.79	1.32	3.83
BF	1.31	1.98	4.51

Plate	Shear	Flexure
Web	2.26	1.56

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.05	-5.28	-27.93	-17.45	-35.90	-3.91	-21.87	-17.67	-30.50	-10.61	-24.93	-15.61	-35.61	-1.91	-22.21	-20.22
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.43	0.09	0.44	0.29	0.56	0.07	0.34	0.30	0.48	0.18	0.39	0.26	0.56	0.03	0.35	0.34
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-27.05		-27.93		-35.90		-21.87		-30.50		-24.93		-35.61		-22.21	
Fcf (ksi)	-47.67		-47.67		-50.00		-47.67		-47.67		-47.67		-49.85		-47.67	
Fcf (kip)	-4505.13		-4505.13		-4724.68		-4505.13		-4505.13		-4505.13		-4710.40		-4505.13	
fncf (ksi)		-5.28		-17.45		-3.91		-17.67		-10.61		-15.61		-1.91		-20.22
Rcf		1.33		1.33		1.39		1.33		1.33		1.33		1.39		1.33
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.7362	-4.032384	-20.27665	-12.75537	-25.99356	-3.06839	-15.99349	-12.90842	-22.09057	-7.91747	-18.24086	-11.33521	-25.78309	-1.652727	-16.23	-14.71
Fs (ksi)	-19.74	-4.03	-20.28	-12.76	-25.99	-3.07	-15.99	-12.91	-22.09	-7.92	-18.24	-11.34	-25.78	-1.65	-16.23	-14.71
Fs (kip)	-1865.07	-338.72	-1916.14	-1071.45	-2456.39	-257.74	-1511.39	-1084.31	-2087.56	-665.07	-1723.76	-952.16	-2436.50	-138.83	-1533.73	-1235.65

Vu (kip)	454.29	508.10	605.22	406.56	523.46	454.26	593.36	420.78	330.79	368.00	437.42	296.26	378.84	330.77	429.04	306.30
Vuw (kip)	681.44	762.15	907.82	609.85	785.18	681.39	890.03	631.17	---	---	---	---	---	---	---	---
Mv (k*ft)	383.31	428.71	510.65	343.04	441.67	383.28	500.64	355.03	186.07	207.00	246.05	166.64	213.10	186.06	241.34	172.29
Huw (kip)	-1943.83	-2525.79	-1970.16	-2536.14	-2198.48	-2437.91	-1864.07	-2658.04	-855.67	-1189.15	-1046.23	-1040.47	-1080.29	-1064.74	-987.69	-1113.84
Muw (k*ft)									376.89	180.51	550.20	74.04	340.15	165.74	579.13	36.48
Mu (k*ft)	383.31	428.71	510.65	343.04	441.67	383.28	500.64	355.03	562.96	387.51	796.25	240.69	553.25	351.79	820.46	208.77
Muw (k*ft)	959.48	571.51	1051.84	564.61	789.72	630.10	1113.42	483.88								
Pu (add)	229.70	136.82	251.81	135.17	189.06	150.85	267.03	115.71								

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Iterations matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 3% 5% 3% 4% 3% 5% 2% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.36	27.76	21.65	27.87	24.16	26.79	20.48	29.21	9.40	13.07	11.50	11.43	11.87	11.70	10.85	12.24
PY1 (Vuw)	7.49	8.38	9.98	6.70	8.63	7.49	9.78	6.94	3.64	4.04	4.81	3.26	4.16	3.63	4.71	3.37
PX2 (Mu)	5.62	6.28	7.48	5.03	6.47	5.62	7.34	5.20	8.25	5.68	11.67	3.53	8.11	5.15	12.02	3.06
PY2 (Mu)	2.81	3.14	3.74	2.51	3.24	2.81	3.67	2.60	4.12	2.84	5.83	1.76	4.05	2.58	6.01	1.53
Pu (kip)	28.88	35.93	32.20	34.16	32.85	34.00	30.90	35.71	19.28	19.97	25.49	15.78	21.60	17.96	25.26	16.06

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	25.53	31.99	27.97	30.62	29.02	30.35	26.76	32.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.93	17.97	OK	25.49	12.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.93	1.47	137.48	OK
Web SPL	17.97	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5402	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 5402

Node 5402

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5402 L	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00
5402 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5402 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.07	-7.17	-32.63	-21.08	-38.99	-5.93	-26.20	-20.40	-36.36	-20.79	-29.98	-16.11	-38.21	-3.00	-26.75	-23.51
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.47	0.12	0.51	0.35	0.61	0.10	0.41	0.34	0.57	0.35	0.47	0.27	0.60	0.05	0.42	0.39
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-30.07		-32.63		-38.99		-26.20		-36.36		-29.98		-38.21		-26.75	
Fcf (ksi)	-47.67		-48.33		-51.56		-47.67		-50.23		-47.67		-51.17		-47.67	
Fcf (kip)	-4505.13		-4567.59		-4872.65		-4505.13		-4746.62		-4505.13		-4835.40		-4505.13	
fncf (ksi)		-7.17		-21.08		-5.93		-20.40		-20.79		-16.11		-3.00		-23.51
Rcf		1.22		1.24		1.32		1.22		1.29		1.22		1.31		1.22
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.20	-4.97	-23.98	-15.35	-28.67	-3.95	-19.35	-14.95	-26.68	-15.09	-22.07	-11.49	-28.15	-1.85	-19.69	-17.18
Fs (ksi)	-22.20	-4.97	-23.98	-15.35	-28.67	-3.95	-19.35	-14.95	-26.68	-15.09	-22.07	-11.49	-28.15	-1.85	-19.69	-17.18
Fs (kip)	-2097.97	-417.42	-2265.86	-1289.19	-2708.85	-332.06	-1828.27	-1255.52	-2521.18	-1267.49	-2085.38	-965.22	-2660.18	-155.38	-1860.95	-1443.35

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5120.96	4021.13	2708.85	1443.35

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	467.80	523.76	613.73	424.16	509.78	486.81	601.76	438.80	340.35	378.98	443.45	308.61	369.10	353.78	435.00	318.95
Vuw (kip)	701.70	785.65	920.60	636.25	764.67	730.22	902.64	658.20	---	---	---	---	---	---	---	---
Mv (k*ft)	394.71	441.93	517.84	357.89	430.13	410.75	507.74	370.24	191.45	213.18	249.44	173.59	207.62	199.00	244.69	179.41
Huw (kip)	-2007.09	-2655.59	-2111.94	-2589.29	-2746.43	-2400.81	-1957.18	-2726.36	-978.12	-1415.69	-1174.25	-1234.56	-1503.66	-1208.09	-1080.00	-1327.51
Muw (k*ft)	917.31	516.25	1031.40	529.18	545.32	654.83	1115.93	437.80	413.55	207.12	593.09	105.60	278.16	253.84	631.21	60.24
Mu (k*ft)	1312.02	958.17	1549.24	887.07	975.44	1065.58	1623.66	808.04	605.00	420.29	842.53	279.20	485.78	452.85	875.89	239.65

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.06	29.18	23.21	28.45	30.18	26.38	21.51	29.96	10.75	15.56	12.90	13.57	16.52	13.28	11.87	14.59
PY1 (Vuw)	7.71	8.63	10.12	6.99	8.40	8.02	9.92	7.23	3.74	4.16	4.87	3.39	4.06	3.89	4.78	3.50
PX2 (Mu)	19.22	14.04	22.70	13.00	14.29	15.61	23.79	11.84	8.86	6.16	12.34	4.09	7.12	6.64	12.83	3.51
PY2 (Mu)	9.61	7.02	11.35	6.50	7.15	7.81	11.89	5.92	4.43	3.08	6.17	2.05	3.56	3.32	6.42	1.76
Pu (kip)	44.77	45.97	50.68	43.59	47.11	44.88	50.28	43.82	21.25	22.89	27.56	18.48	24.84	21.17	27.12	18.85

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2504.57	2646.00	OK
TF Inside	2616.38	2764.13	OK
BF Inside	2070.29	2457.00	OK
BF Outside	1950.85	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.06	42.32	47.15	40.46	43.51	41.68	46.91	40.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	920.60
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2616.38	24.23	OK	1384.00	12.81	OK
BF	2070.29	24.65	OK	743.11	8.85	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2504.57	23.19	1.47	119.85	OK
TF	5120.96	47.42	1.47	269.66	OK
TF Inside	2616.38	24.23	1.47	134.83	OK
BF Inside	2070.29	24.65	1.47	119.85	OK
BF	4021.13	47.87	1.47	239.70	OK
BF Outside	1950.85	23.22	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.68	25.34	OK	27.56	13.78	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.68	1.47	137.48	OK
Web SPL	25.34	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.06
TF Inside	NA	1.06
BF Inside	NA	1.19
BF Outside	NA	1.19

Bolt	Shear	Slip	Bearing
TF	1.49	1.31	5.17
Web	1.78	1.31	3.79
BF	1.31	1.90	4.52

Plate	Shear	Flexure
Web	2.23	1.55

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.75	-5.76	-28.71	-17.61	-36.25	-4.50	-22.96	-17.39	-28.66	-13.71	-27.34	-14.03	-36.00	-2.18	-23.29	-20.18
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.44	0.10	0.45	0.30	0.57	0.08	0.36	0.29	0.45	0.23	0.43	0.24	0.57	0.04	0.37	0.34
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-27.75		-28.71		-36.25		-22.96		-28.66		-27.34		-36.00		-23.29	
Fcf (ksi)	-47.67		-47.67		-50.17		-47.67		-47.67		-47.67		-50.04		-47.67	
Fcf (kip)	-4505.13		-4505.13		-4741.17		-4505.13		-4505.13		-4505.13		-4729.16		-4505.13	
fncf (ksi)		-5.76		-17.61		-4.50		-17.39		-13.71		-14.03		-2.18		-20.18
Rcf		1.32		1.32		1.38		1.32		1.32		1.32		1.38		1.32
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.22118	-4.343747	-20.82162	-12.86987	-26.22704	-3.456846	-16.76522	-12.71082	-20.78896	-10.10969	-19.93383	-10.18814	-26.0501	-1.816476	-16.99	-14.68
Fs (ksi)	-20.22	-4.34	-20.82	-12.87	-26.23	-3.46	-16.77	-12.71	-20.79	-10.11	-19.93	-10.19	-26.05	-1.82	-16.99	-14.68
Fs (kip)	-1910.90	-364.87	-1967.64	-1081.07	-2478.45	-290.38	-1584.31	-1067.71	-1964.56	-849.21	-1883.75	-855.80	-2461.73	-152.58	-1605.93	-1233.24

Vu (kip)	467.80	523.76	613.73	424.16	509.78	486.81	601.76	438.80	340.35	378.98	443.45	308.61	369.10	353.78	435.00	318.95
Vuw (kip)	701.70	785.65	920.60	636.25	764.67	730.22	902.64	658.20	---	---	---	---	---	---	---	---
Mv (k*ft)	394.71	441.93	517.84	357.89	430.13	410.75	507.74	370.24	191.45	213.18	249.44	173.59	207.62	199.00	244.69	179.41
Huw (kip)	-1964.16	-2525.50	-2004.52	-2514.84	-2340.53	-2355.82	-1884.05	-2646.89	-884.34	-1212.89	-1068.62	-1061.14	-1112.35	-1084.39	-1003.20	-1140.31
Muw (k*ft)									381.06	190.84	546.48	97.31	256.30	233.90	581.61	55.50
Mu (k*ft)	394.71	441.93	517.84	357.89	430.13	410.75	507.74	370.24	572.51	404.02	795.93	270.90	463.92	432.90	826.29	234.91

Muw (k*ft)	945.93	571.71	1037.19	578.81	695.02	684.83	1111.49	498.78	forumlas matching the Muw results
Pu (add)	226.46	136.87	248.30	138.57	166.39	163.95	266.09	117.49	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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5% 3% 5% 3% 3% 3% 5% 2% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.58	27.75	22.03	27.64	25.72	25.89	20.70	29.09	9.72	13.33	11.74	11.66	12.22	11.92	11.02	12.53
PY1 (Vuw)	7.71	8.63	10.12	6.99	8.40	8.02	9.92	7.23	3.74	4.16	4.87	3.39	4.06	3.89	4.78	3.50
PX2 (Mu)	5.78	6.48	7.59	5.24	6.30	6.02	7.44	5.42	8.39	5.92	11.66	3.97	6.80	6.34	12.11	3.44
PY2 (Mu)	2.89	3.24	3.79	2.62	3.15	3.01	3.72	2.71	4.19	2.96	5.83	1.98	3.40	3.17	6.05	1.72
Pu (kip)	29.35	36.23	32.72	34.26	34.04	33.76	31.27	35.92	19.77	20.52	25.74	16.53	20.43	19.58	25.54	16.81

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	25.92	32.21	28.43	30.67	30.20	30.02	27.08	32.17
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
36.23	18.11	OK	25.74	12.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	36.23	1.47	137.48	OK
Web SPL	18.11	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7402	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 7402

Node 7402

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7402 L	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00
7402 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7402 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.88	-5.67	-30.93	-16.71	-38.63	-3.47	-25.47	-18.76	-35.12	-17.88	-33.90	-13.64	-39.08	2.08	-25.56	-21.21
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	68.99	63.56	59.60
f / ϕf Fnc	0.47	0.10	0.49	0.28	0.61	0.06	0.40	0.31	0.55	0.30	0.53	0.23	0.61	0.03	0.40	0.36
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.99	0.91	0.85
fcf (ksi)	-29.88		-30.93		-38.63		-25.47		-35.12		-33.90		-39.08		-25.56	
Fcf (ksi)	-47.67		-47.67		-51.38		-47.67		-49.60		-48.98		-51.61		-47.67	
Fcf (kip)	-4505.13		-4505.13		-4855.52		-4505.13		-4687.14		-4628.52		-4876.91		-4505.13	
fncf (ksi)		-5.67		-16.71		-3.47		-18.76		-17.88		-13.64		2.08		-21.21
Rcf		1.22		1.22		1.31		1.22		1.27		1.25		1.32		1.22
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		51.74		-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		3095.31		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.08	-3.81	-22.80	-12.17	-28.43	-2.10	-18.83	-13.72	-25.82	-12.96	-24.99	-9.63	-28.78	1.70	-18.86	-15.49
Fs (ksi)	-22.08	-3.81	-22.80	-12.17	-28.43	-2.10	-18.83	-13.72	-25.82	-12.96	-24.99	-9.63	-28.78	1.70	-18.86	-15.49
Fs (kip)	-2086.28	-319.90	-2154.95	-1022.26	-2686.88	-176.62	-1779.52	-1152.79	-2439.57	-1088.28	-2361.65	-809.21	-2719.36	143.05	-1781.94	-1301.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3373.46	0.00	143.05
Comp	5155.06	4018.21	2719.36	1301.47

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	462.18	527.50	615.38	419.96	486.45	528.13	604.09	433.98	336.77	381.86	445.00	305.88	352.86	383.36	437.03	315.79
Vuw (kip)	693.28	791.25	923.07	629.94	729.67	792.20	906.14	650.98	---	---	---	---	---	---	---	---
Mv (k*ft)	389.97	445.08	519.23	354.34	410.44	445.61	509.70	366.17	189.43	214.80	250.31	172.06	198.48	215.64	245.83	177.63
Huw (kip)	-1940.42	-2425.16	-1987.36	-2515.21	-2576.71	-2353.17	-1732.40	-2623.17	-931.87	-1259.04	-1099.27	-1171.96	-1395.77	-1246.48	-974.64	-1236.61
Muw (k*ft)	961.76	638.60	1105.88	578.56	628.68	748.36	1286.56	506.59	438.45	255.21	631.92	122.57	308.64	368.58	731.50	80.71
Mu (k*ft)	1351.72	1083.67	1625.11	932.91	1039.12	1193.98	1796.26	872.77	627.88	470.01	882.23	294.63	507.12	584.22	977.33	258.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.32	26.65	21.84	27.64	28.32	25.86	19.04	28.83	10.24	13.84	12.08	12.88	15.34	13.70	10.71	13.59
PY1 (Vuw)	7.62	8.70	10.14	6.92	8.02	8.71	9.96	7.15	3.70	4.20	4.89	3.36	3.88	4.21	4.80	3.47
PX2 (Mu)	19.81	15.88	23.81	13.67	15.23	17.49	26.32	12.79	9.20	6.89	12.93	4.32	7.43	8.56	14.32	3.79
PY2 (Mu)	9.90	7.94	11.91	6.83	7.61	8.75	13.16	6.39	4.60	3.44	6.46	2.16	3.72	4.28	7.16	1.89
Pu (kip)	44.71	45.67	50.70	43.54	46.26	46.73	50.91	43.76	21.14	22.09	27.46	18.06	24.00	23.82	27.74	18.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	1736.83	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	1636.63	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2521.25	2646.00	OK
TF Inside	2633.81	2764.13	OK
BF Inside	2068.78	2457.00	OK
BF Outside	1949.43	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.09	42.23	47.23	40.52	42.94	43.41	47.68	40.54
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	923.07
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2633.81	24.39	OK	1389.37	12.86	OK
BF	2068.78	24.63	OK	670.06	7.98	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2521.25	23.34	1.47	119.85	OK
TF	5155.06	47.73	1.47	269.66	OK
TF Inside	2633.81	24.39	1.47	134.83	OK
BF Inside	2068.78	24.63	1.47	119.85	OK
BF	4018.21	47.84	1.47	239.70	OK
BF Outside	1949.43	23.21	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.91	25.45	OK	27.74	13.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.91	1.47	137.48	OK
Web SPL	25.45	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.05
TF Inside	NA	1.05
BF Inside	1.03	1.19
BF Outside	1.06	1.19

Bolt	Shear	Slip	Bearing
TF	1.48	1.31	5.13
Web	1.83	1.30	3.90
BF	1.31	2.11	4.52

Plate	Shear	Flexure
Web	2.22	1.59

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.52	-4.27	-29.26	-15.60	-36.51	-2.74	-22.78	-16.33	-27.72	-11.16	-30.31	-10.85	-36.25	-0.76	-23.08	-18.91
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	68.99	63.56	59.60
f / ϕf Fnc	0.43	0.07	0.46	0.26	0.57	0.05	0.36	0.27	0.44	0.19	0.48	0.18	0.57	0.01	0.36	0.32
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.99	0.91	0.85
fcf (ksi)	-27.52		-29.26		-36.51		-22.78		-27.72		-30.31		-36.25		-23.08	
Fcf (ksi)	-47.67		-47.67		-50.30		-47.67		-47.67		-47.67		-50.17		-47.67	
Fcf (kip)	-4505.13		-4505.13		-4753.49		-4505.13		-4505.13		-4505.13		-4741.36		-4505.13	
fncf (ksi)		-4.27		-15.60		-2.74		-16.33		-11.16		-10.85		-0.76		-18.91
Rcf		1.31		1.31		1.38		1.31		1.31		1.31		1.37		1.31
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70		-51.74		-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-4346.50		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.07684	-3.243607	-21.23408	-11.43575	-26.42493	-2.163893	-16.65889	-11.95298	-20.14959	-8.300217	-22.04795	-7.897148	-26.24615	-0.763292	-16.87	-13.77
Fs (ksi)	-20.08	-3.24	-21.23	-11.44	-26.42	-2.16	-16.66	-11.95	-20.15	-8.30	-22.05	-7.90	-26.25	-0.76	-16.87	-13.77
Fs (kip)	-1897.26	-272.46	-2006.62	-960.60	-2497.16	-181.77	-1574.26	-1004.05	-1904.14	-697.22	-2083.53	-663.36	-2480.26	-64.12	-1594.40	-1156.97

Vu (kip)	462.18	527.50	615.38	419.96	486.45	528.13	604.09	433.98	336.77	381.86	445.00	305.88	352.86	383.36	437.03	315.79
Vuw (kip)	693.28	791.25	923.07	629.94	729.67	792.20	906.14	650.98	---	---	---	---	---	---	---	---
Mv (k*ft)	389.97	445.08	519.23	354.34	410.44	445.61	509.70	366.17	189.43	214.80	250.31	172.06	198.48	215.64	245.83	177.63
Huw (kip)	-1892.15	-2424.93	-1920.66	-2459.35	-2216.28	-2201.81	-1817.67	-2580.48	-839.54	-1176.11	-1029.20	-1030.03	-1024.19	-1078.02	-972.34	-1103.24
Muw (k*ft)									404.00	235.16	582.27	112.94	284.39	339.62	611.59	74.37
Mu (k*ft)	389.97	445.08	519.23	354.34	410.44	445.61	509.70	366.17	593.43	449.96	832.58	285.00	482.87	555.26	857.42	252.00
Muw (k*ft)	993.94	638.75	1099.27	615.81	777.85	787.50	1161.85	655.08		forumlas matching the Muw results						
Pu (add)	237.95	152.92	263.17	147.43	186.22	188.53	278.15	128.09		additional flange force						

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5%	3%	5%	3%	4%	4%	6%	3%	percentage increase in flange force	6%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.79	26.65	21.11	27.03	24.35	24.20	19.97	28.36	9.23	12.92	11.31	11.32	11.25	11.85	10.69	12.12
PY1 (Vuw)	7.62	8.70	10.14	6.92	8.02	8.71	9.96	7.15	3.70	4.20	4.89	3.36	3.88	4.21	4.80	3.47
PX2 (Mu)	5.71	6.52	7.61	5.19	6.01	6.53	7.47	5.37	8.69	6.59	12.20	4.18	7.07	8.14	12.56	3.69
PY2 (Mu)	2.86	3.26	3.80	2.60	3.01	3.26	3.73	2.68	4.35	3.30	6.10	2.09	3.54	4.07	6.28	1.85
Pu (kip)	28.50	35.26	31.92	33.59	32.31	32.97	30.67	35.13	19.64	20.91	25.95	16.43	19.77	21.63	25.75	16.69

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	25.14	31.28	27.63	30.06	28.65	29.12	26.47	31.45
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.26	17.63	OK	25.95	12.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.26	1.47	137.48	OK
Web SPL	17.63	1.47	114.56	OK

Field Splice - Node 9402

Node 9402

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9402 L	94.50	63.56	6006.84	84.00	68.99	5795.34	72.00	50.00	3600.00
9402 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9402 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.99	3.33	-31.93	-11.53	-36.84	0.91	-25.58	-17.63	-33.50	-17.80	-34.58	-8.15	-37.97	6.02	-24.69	-19.31
ϕf Fnc (ksi)	63.56	68.99	63.56	59.60	63.56	68.99	63.56	59.60	63.56	59.60	63.56	59.60	63.56	68.99	63.56	59.60
f / ϕf Fnc	0.47	0.05	0.50	0.19	0.58	0.01	0.40	0.30	0.53	0.30	0.54	0.14	0.60	0.09	0.39	0.32
α	0.91	0.99	0.91	0.85	0.91	0.99	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.99	0.91	0.85
fcf (ksi)	-29.99		-31.93		-36.84		-25.58		-33.50		-34.58		-37.97		-24.69	
Fcf (ksi)	-47.67		-47.98		-50.47		-47.67		-48.78		-49.32		-51.05		-47.67	
Fcf (kip)	-4505.13		-4534.11		-4769.34		-4505.13		-4609.43		-4661.11		-4823.81		-4505.13	
fncf (ksi)		3.33		-11.53		0.91		-17.63		-17.80		-8.15		6.02		-19.31
Rcf		1.26		1.26		1.33		1.26		1.28		1.30		1.34		1.26
Fncf (ksi)		51.74		-44.70		51.74		-44.70		-44.70		-44.70		51.74		-44.70
Fncf (kip)		3095.31		-3755.04		3095.31		-3755.04		-3755.04		-3755.04		3095.31		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.29	2.50	-23.63	-8.37	-27.43	1.07	-18.95	-12.86	-24.67	-12.87	-25.65	-5.62	-28.14	4.58	-18.28	-14.08
Fs (ksi)	-22.29	2.50	-23.63	-8.37	-27.43	1.07	-18.95	-12.86	-24.67	-12.87	-25.65	-5.62	-28.14	4.58	-18.28	-14.08
Fs (kip)	-2106.81	210.17	-2232.99	-703.17	-2591.74	89.68	-1790.74	-1079.95	-2330.88	-1081.07	-2424.26	-472.12	-2658.81	384.85	-1727.55	-1182.85

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3401.28	0.00	384.85
Comp	5129.78	3985.45	2658.81	1182.85

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	434.31	531.08	603.61	389.71	448.61	520.48	574.53	403.99	318.59	385.00	438.20	285.12	326.74	379.47	417.65	295.21
Vuw (kip)	651.47	796.61	905.41	584.57	672.92	780.72	861.80	605.99	---	---	---	---	---	---	---	---
Mv (k*ft)	366.45	448.09	509.29	328.82	378.52	439.16	484.76	340.87	179.20	216.56	246.49	160.38	183.79	213.45	234.93	166.06
Huw (kip)	-1541.11	-2226.77	-1747.19	-2488.32	-2553.91	-2131.28	-1519.80	-2564.38	-712.52	-1152.02	-948.90	-1145.02	-1351.27	-1125.86	-847.94	-1165.05
Muw (k*ft)	1227.97	785.37	1222.85	596.49	604.98	912.61	1401.71	545.78	595.11	366.20	683.84	146.23	283.09	480.79	785.21	100.78
Mu (k*ft)	1594.42	1233.46	1732.14	925.31	983.50	1351.76	1886.47	886.65	774.31	582.77	930.33	306.62	466.88	694.24	1020.14	266.84

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9402	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.94	24.47	19.20	27.34	28.06	23.42	16.70	28.18	7.83	12.66	10.43	12.58	14.85	12.37	9.32	12.80
PY1 (Vuw)	7.16	8.75	9.95	6.42	7.39	8.58	9.47	6.66	3.50	4.23	4.82	3.13	3.59	4.17	4.59	3.24
PX2 (Mu)	23.36	18.07	25.38	13.56	14.41	19.81	27.64	12.99	11.35	8.54	13.63	4.49	6.84	10.17	14.95	3.91
PY2 (Mu)	11.68	9.04	12.69	6.78	7.21	9.90	13.82	6.50	5.67	4.27	6.82	2.25	3.42	5.09	7.47	1.95
Pu (kip)	44.48	46.11	50.00	42.98	44.91	47.01	50.09	43.22	21.26	22.84	26.72	17.90	22.79	24.37	27.10	17.50

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	1751.16	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	1650.13	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2508.89	2646.00	OK
TF Inside	2620.89	2764.13	OK
BF Inside	2051.91	2457.00	OK
BF Outside	1933.54	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.35	42.86	46.72	40.13	41.77	43.95	47.15	40.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	905.41
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9402**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2620.89	24.27	OK	1358.43	12.58	OK
BF	2051.91	24.43	OK	608.99	7.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2508.89	23.23	1.47	119.85	OK
TF	5129.78	47.50	1.47	269.66	OK
TF Inside	2620.89	24.27	1.47	134.83	OK
BF Inside	2051.91	24.43	1.47	119.85	OK
BF	3985.45	47.45	1.47	239.70	OK
BF Outside	1933.54	23.02	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.09	25.04	OK	27.10	13.55	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.09	1.47	137.48	OK
Web SPL	25.04	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.05
TF Inside	NA	1.05
BF Inside	1.02	1.20
BF Outside	1.05	1.20

Bolt	Shear	Slip	Bearing
TF	1.49	1.34	5.16
Web	1.93	1.31	4.12
BF	1.32	2.32	4.56

Plate	Shear	Flexure
Web	2.26	1.67

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.43	-0.24	-30.19	-10.60	-36.06	0.12	-21.21	-13.57	-25.04	-9.97	-30.58	-5.21	-35.16	3.16	-21.39	-16.22
ϕf Fnc (ksi)	63.56	68.99	63.56	59.60	63.56	68.99	63.56	59.60	63.56	59.60	63.56	59.60	63.56	68.99	63.56	59.60
f / ϕf Fnc	0.42	0.00	0.47	0.18	0.57	0.00	0.33	0.23	0.39	0.17	0.48	0.09	0.55	0.05	0.34	0.27
α	0.91	0.99	0.91	0.85	0.91	0.99	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.99	0.91	0.85
fcf (ksi)	-26.43		-30.19		-36.06		-21.21		-25.04		-30.58		-35.16		-21.39	
Fcf (ksi)	-47.67		-47.67		-50.07		-47.67		-47.67		-47.67		-49.62		-47.67	
Fcf (kip)	-4505.13		-4505.13		-4732.07		-4505.13		-4505.13		-4505.13		-4688.97		-4505.13	
fncf (ksi)		-0.24		-10.60		0.12		-13.57		-9.97		-5.21		3.16		-16.22
Rcf		1.32		1.32		1.39		1.32		1.32		1.32		1.38		1.32
Fncf (ksi)		-51.74		-44.70		51.74		-44.70		-44.70		-44.70		51.74		-44.70
Fncf (kip)		-4346.50		-3755.04		3095.31		-3755.04		-3755.04		-3755.04		3095.31		-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.39115	-0.355641	-21.91961	-7.860098	-26.1942	-0.105674	-15.5729	-9.958569	-18.28104	-7.412413	-22.32674	-3.867923	-25.55893	2.0444257	-15.70	-11.83
Fs (ksi)	-19.39	-0.36	-21.92	-7.86	-26.19	-0.11	-15.57	-9.96	-18.28	-7.41	-22.33	-3.87	-25.56	2.04	-15.70	-11.83
Fs (kip)	-1832.46	-29.87	-2071.40	-660.25	-2475.35	-8.88	-1471.64	-836.52	-1727.56	-622.64	-2109.88	-324.91	-2415.32	171.73	-1483.65	-993.77

Vu (kip)	434.31	531.08	603.61	389.71	448.61	520.48	574.53	403.99	318.59	385.00	438.20	285.12	326.74	379.47	417.65	295.21
Vuw (kip)	651.47	796.61	905.41	584.57	672.92	780.72	861.80	605.99	---	---	---	---	---	---	---	---
Mv (k*ft)	366.45	448.09	509.29	328.82	378.52	439.16	484.76	340.87	179.20	216.56	246.49	160.38	183.79	213.45	234.93	166.06
Huw (kip)	-1702.78	-2196.01	-1770.87	-2337.38	-2165.85	-1939.39	-1603.98	-2463.49	-710.88	-1072.07	-946.80	-919.13	-924.96	-943.01	-846.52	-991.10
Muw (k*ft)									456.85	337.43	626.12	134.74	260.85	443.01	662.48	92.87
Mu (k*ft)	366.45	448.09	509.29	328.82	378.52	439.16	484.76	340.87	636.06	553.99	872.61	295.13	444.64	656.46	897.41	258.92
Muw (k*ft)	1120.19	791.36	1188.41	697.12	811.47	962.44	1278.08	813.04								
Pu (add)	268.17	189.45	284.51	166.89	194.27	230.41	305.98	146.76								

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forces matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 3% 5% 3% 3% 4% 5% 3% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.71	24.13	19.46	25.69	23.80	21.31	17.63	27.07	7.81	11.78	10.40	10.10	10.16	10.36	9.30	10.89
PY1 (Vuw)	7.16	8.75	9.95	6.42	7.39	8.58	9.47	6.66	3.50	4.23	4.82	3.13	3.59	4.17	4.59	3.24
PX2 (Mu)	5.37	6.57	7.46	4.82	5.55	6.43	7.10	4.99	9.32	8.12	12.79	4.32	6.51	9.62	13.15	3.79
PY2 (Mu)	2.68	3.28	3.73	2.41	2.77	3.22	3.55	2.50	4.66	4.06	6.39	2.16	3.26	4.81	6.57	1.90
Pu (kip)	26.02	32.97	30.20	31.76	31.06	30.15	27.95	33.35	18.98	21.56	25.76	15.37	18.03	21.91	25.07	15.56

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.89	29.10	26.00	28.44	27.62	26.44	23.95	29.87
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9402	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.35	16.67	OK	25.76	12.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.35	1.47	137.48	OK
Web SPL	16.67	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1407	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1407

Node 1407

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1407 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
1407 R	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1407 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.81	-23.09	-12.11	-19.97	-23.21	-20.31	-11.19	-23.50	-23.71	-28.05	-23.34	-26.61	-12.09	-26.60	-23.19	-19.66
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.34	0.36	0.19	0.31	0.36	0.32	0.18	0.37	0.37	0.44	0.37	0.42	0.19	0.42	0.36	0.31
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-23.09		-19.97	-23.21			-23.50		-28.05		-26.61		-26.60	-23.19	
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-21.81		-12.11			-20.31	-11.19		-23.71		-23.34		-12.09			-19.66
Rcf	1.70		1.70			1.70	1.70		1.70		1.70		1.70			1.70
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.56	-17.50	-9.82	-15.71	-17.61	-15.47	-9.10	-18.28	-15.71	-16.05	-12.35	-17.53	-9.70	-20.50	-17.62	-15.00
Fs (ksi)	-16.56	-17.50	-9.82	-15.71	-17.61	-15.47	-9.10	-18.28	-15.71	-16.05	-12.35	-17.53	-9.70	-20.50	-17.62	-15.00
Fs (kip)	-1564.90	-1653.44	-928.25	-1484.44	-1664.58	-1461.76	-860.28	-1727.36	-1484.14	-1516.33	-1166.63	-1656.25	-917.04	-1937.24	-1664.65	-1417.21

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4650.41	4650.41	1664.65	1937.24

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	354.40	141.03	394.13	106.08	230.92	221.26	132.33	386.33	258.47	105.71	286.54	81.02	226.23	148.47	99.56	281.03
Vuw (kip)	531.60	211.54	591.19	159.12	346.38	331.89	198.49	579.49	---	---	---	---	---	---	---	---
Mv (k*ft)	299.03	118.99	332.54	89.51	194.84	186.69	111.65	325.96	145.39	59.46	161.18	45.57	127.25	83.51	56.00	158.08
Huw (kip)	-2534.57	-2038.57	-2458.29	-1991.58	-2631.71	-2613.09	-2037.56	-2424.90	-1021.70	-765.93	-992.49	-821.47	-952.53	-896.15	-906.12	-978.37
Muw (k*ft)	202.75	533.42	253.60	564.74	137.99	150.40	534.09	275.86	18.74	117.71	42.93	183.51	6.81	103.62	215.92	52.37
Mu (k*ft)	501.77	652.41	586.15	654.25	332.83	337.09	645.74	601.83	164.13	177.17	204.10	229.08	134.07	187.14	271.92	210.45

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1407	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.85	22.40	27.01	21.89	28.92	28.72	22.39	26.65	11.23	8.42	10.91	9.03	10.47	9.85	9.96	10.75
PY1 (Vuw)	5.84	2.32	6.50	1.75	3.81	3.65	2.18	6.37	2.84	1.16	3.15	0.89	2.49	1.63	1.09	3.09
PX2 (Mu)	7.35	9.56	8.59	9.59	4.88	4.94	9.46	8.82	2.40	2.60	2.99	3.36	1.96	2.74	3.98	3.08
PY2 (Mu)	3.68	4.78	4.29	4.79	2.44	2.47	4.73	4.41	1.20	1.30	1.50	1.68	0.98	1.37	1.99	1.54
Pu (kip)	36.47	32.74	37.20	32.14	34.37	34.21	32.59	37.07	14.22	11.28	14.65	12.65	12.91	12.94	14.28	14.59

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2274.44	2646.00	OK
TF Inside	2375.97	2764.13	OK
BF Inside	2394.27	2457.00	OK
BF Outside	2256.14	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.32	31.07	34.03	30.64	31.38	31.27	30.94	33.97
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	591.19
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2375.97	22.00	OK	850.50	7.87	OK
BF	2394.27	28.50	OK	997.39	11.87	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2274.44	21.06	1.47	119.85	OK
TF	4650.41	43.06	1.47	269.66	OK
TF Inside	2375.97	22.00	1.47	134.83	OK
BF Inside	2394.27	28.50	1.47	119.85	OK
BF	4650.41	55.36	1.47	269.66	OK
BF Outside	2256.14	26.86	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.20	18.60	OK	14.65	7.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.20	1.47	114.56	OK
Web SPL	18.60	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.65	2.14	5.69
Web	2.12	2.47	3.36
BF	1.27	1.42	3.90

Plate	Shear	Flexure
Web	3.47	1.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.79	-22.01	-10.92	-18.38	-21.90	-19.15	-10.30	-22.00	-14.78	-18.90	-14.09	-17.19	-11.12	-24.91	-21.58	-18.22
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.33	0.35	0.17	0.29	0.34	0.30	0.16	0.35	0.23	0.30	0.22	0.27	0.17	0.39	0.34	0.29
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-22.01		-18.38	-21.90			-22.00		-18.90		-17.19		-24.91	-21.58	
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-20.79		-10.92			-19.15	-10.30		-14.78		-14.09		-11.12			-18.22
Rcf	1.92		1.92			1.92	1.92		1.92		1.92		1.92			1.92
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.1983	-16.05057	-8.139262	-13.49268	-15.98058	-14.02837	-7.701247	-16.04711	-13.54742	-13.85719	-9.908653	-14.62132	-8.284757	-18.10447	-15.76	-13.37
Fs (ksi)	-15.20	-16.05	-8.14	-13.49	-15.98	-14.03	-7.70	-16.05	-13.55	-13.86	-9.91	-14.62	-8.28	-18.10	-15.76	-13.37
Fs (kip)	-1436.24	-1516.78	-769.16	-1275.06	-1510.17	-1325.68	-727.77	-1516.45	-1280.23	-1309.50	-936.37	-1381.71	-782.91	-1710.87	-1488.91	-1263.85

Vu (kip)	354.40	141.03	394.13	106.08	230.92	221.26	132.33	386.33	258.47	105.71	286.54	81.02	226.23	148.47	99.56	281.03
Vuw (kip)	531.60	211.54	591.19	159.12	346.38	331.89	198.49	579.49	---	---	---	---	---	---	---	---
Mv (k*ft)	299.03	118.99	332.54	89.51	194.84	186.69	111.65	325.96	145.39	59.46	161.18	45.57	127.25	83.51	56.00	158.08
Huw (kip)	-2616.56	-2048.06	-2522.11	-2012.36	-2270.30	-2230.67	-2059.92	-2468.78	-937.47	-648.96	-900.27	-712.45	-822.14	-735.90	-791.68	-873.89
Muw (k*ft)									17.05	107.07	39.04	166.92	6.20	94.25	196.39	47.63
Mu (k*ft)	299.03	118.99	332.54	89.51	194.84	186.69	111.65	325.96	162.44	166.53	200.22	212.49	133.45	177.77	252.40	205.71

Muw (k*ft)	148.09	527.09	211.05	550.89	378.93	405.35	319.16	248.67	forces/ratios matching the Muw results
Pu (add)	35.36	125.87	50.40	131.56	90.49	96.80	123.98	58.89	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

1% 2% 1% 2% 2% 2% 2% 1% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.75	22.51	27.72	22.11	24.95	24.51	22.64	27.13	10.30	7.13	9.89	7.83	9.03	8.09	8.70	9.60
PY1 (Vuw)	5.84	2.32	6.50	1.75	3.81	3.65	2.18	6.37	2.84	1.16	3.15	0.89	2.49	1.63	1.09	3.09
PX2 (Mu)	4.38	1.74	4.87	1.31	2.85	2.74	1.64	4.78	2.38	2.44	2.93	3.11	1.96	2.60	3.70	3.01
PY2 (Mu)	2.19	0.87	2.44	0.66	1.43	1.37	0.82	2.39	1.19	1.22	1.47	1.56	0.98	1.30	1.85	1.51
Pu (kip)	34.09	24.46	33.79	23.55	28.29	27.71	24.46	33.09	13.31	9.86	13.63	11.21	11.52	11.09	12.74	13.43

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.65	22.02	30.30	21.17	25.49	24.96	22.01	29.67
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.09	17.05	OK	13.63	6.82	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.09	1.47	114.56	OK
Web SPL	17.05	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3407	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 3407

Node 3407

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3407 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
3407 R	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3407 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.84	-24.31	-13.08	-21.88	-23.47	-21.97	-11.94	-25.28	-24.72	-30.16	-24.86	-29.34	-12.31	-27.27	-23.38	-21.37
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.34	0.38	0.21	0.34	0.37	0.34	0.19	0.40	0.39	0.47	0.39	0.46	0.19	0.43	0.37	0.34
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-24.31		-21.88	-23.47			-25.28		-30.16		-29.34		-27.27	-23.38	
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-21.84		-13.08			-21.97	-11.94		-24.72		-24.86		-12.31			-21.37
Rcf	1.59		1.59			1.59	1.59		1.59		1.59		1.59			1.59
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.16	-18.01	-10.02	-16.65	-17.46	-16.38	-9.14	-19.12	-15.94	-18.30	-14.32	-18.67	-9.38	-20.55	-17.41	-15.95
Fs (ksi)	-16.16	-18.01	-10.02	-16.65	-17.46	-16.38	-9.14	-19.12	-15.94	-18.30	-14.32	-18.67	-9.38	-20.55	-17.41	-15.95
Fs (kip)	-1526.67	-1701.81	-947.06	-1573.41	-1649.89	-1548.30	-864.12	-1807.03	-1506.46	-1729.71	-1353.69	-1764.48	-886.52	-1942.23	-1645.05	-1507.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4643.84	4643.84	1649.89	1942.23

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	369.88	171.19	410.99	137.18	246.01	248.00	152.51	402.95	268.91	126.27	297.95	102.24	229.83	193.83	113.07	292.27
Vuw (kip)	554.82	256.78	616.48	205.77	369.02	372.00	228.77	604.42	---	---	---	---	---	---	---	---
Mv (k*ft)	312.09	144.44	346.77	115.75	207.57	209.25	128.68	339.99	151.26	71.03	167.60	57.51	129.28	109.03	63.60	164.40
Huw (kip)	-2458.06	-2041.65	-2464.50	-1987.37	-2594.99	-2601.91	-2005.04	-2435.96	-1024.91	-800.15	-1015.30	-847.98	-1027.36	-989.89	-898.01	-1000.80
Muw (k*ft)	253.76	531.36	249.46	567.55	162.47	157.85	555.77	268.49	37.07	132.56	21.50	199.56	47.25	86.94	223.43	29.12
Mu (k*ft)	565.84	675.80	596.23	683.30	370.04	367.10	684.45	608.48	188.33	203.59	189.10	257.07	176.53	195.97	287.04	193.52

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.01	22.44	27.08	21.84	28.52	28.59	22.03	26.77	11.26	8.79	11.16	9.32	11.29	10.88	9.87	11.00
PY1 (Vuw)	6.10	2.82	6.77	2.26	4.06	4.09	2.51	6.64	2.96	1.39	3.27	1.12	2.53	2.13	1.24	3.21
PX2 (Mu)	8.29	9.90	8.74	10.01	5.42	5.38	10.03	8.92	2.76	2.98	2.77	3.77	2.59	2.87	4.21	2.84
PY2 (Mu)	4.15	4.95	4.37	5.01	2.71	2.69	5.01	4.46	1.38	1.49	1.39	1.88	1.29	1.44	2.10	1.42
Pu (kip)	36.76	33.26	37.51	32.67	34.61	34.64	32.93	37.37	14.68	12.12	14.69	13.43	14.39	14.20	14.47	14.59

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2271.22	2646.00	OK
TF Inside	2372.62	2764.13	OK
BF Inside	2390.89	2457.00	OK
BF Outside	2252.95	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.68	31.50	34.26	31.10	31.66	31.67	31.29	34.19
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	616.48
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2372.62	21.97	OK	842.96	7.81	OK
BF	2390.89	28.46	OK	999.96	11.90	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2271.22	21.03	1.47	119.85	OK
TF	4643.84	43.00	1.47	269.66	OK
TF Inside	2372.62	21.97	1.47	134.83	OK
BF Inside	2390.89	28.46	1.47	119.85	OK
BF	4643.84	55.28	1.47	269.66	OK
BF Outside	2252.95	26.82	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.51	18.76	OK	14.69	7.34	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.51	1.47	114.56	OK
Web SPL	18.76	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.17
TF Inside	NA	1.17
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.65	2.16	5.70
Web	2.09	2.34	3.31
BF	1.27	1.41	3.91

Plate	Shear	Flexure
Web	3.33	1.61

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.72	-24.07	-12.54	-20.90	-22.67	-21.25	-11.71	-24.37	-15.59	-20.77	-15.72	-19.98	-12.27	-26.48	-22.43	-20.51
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.34	0.38	0.20	0.33	0.36	0.33	0.18	0.38	0.24	0.33	0.25	0.31	0.19	0.42	0.35	0.32
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-24.07		-20.90	-22.67			-24.37		-20.77		-19.98		-26.48	-22.43	
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-21.72		-12.54			-21.25	-11.71		-15.59		-15.72		-12.27			-20.51
Rcf	1.81		1.81			1.81	1.81		1.81		1.81		1.81			1.81
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.83529	-17.52103	-9.263739	-15.29245	-16.50826	-15.53044	-8.673305	-17.74906	-13.93249	-16.08134	-12.28343	-16.2374	-9.071985	-19.23344	-16.34	-15.01
Fs (ksi)	-15.84	-17.52	-9.26	-15.29	-16.51	-15.53	-8.67	-17.75	-13.93	-16.08	-12.28	-16.24	-9.07	-19.23	-16.34	-15.01
Fs (kip)	-1496.44	-1655.74	-875.42	-1445.14	-1560.03	-1467.63	-819.63	-1677.29	-1316.62	-1519.69	-1160.78	-1534.43	-857.30	-1817.56	-1543.70	-1418.56

Vu (kip)	369.88	171.19	410.99	137.18	246.01	248.00	152.51	402.95	268.91	126.27	297.95	102.24	229.83	193.83	113.07	292.27
Vuw (kip)	554.82	256.78	616.48	205.77	369.02	372.00	228.77	604.42	---	---	---	---	---	---	---	---
Mv (k*ft)	312.09	144.44	346.77	115.75	207.57	209.25	128.68	339.99	151.26	71.03	167.60	57.51	129.28	109.03	63.60	164.40
Huw (kip)	-2596.08	-2098.89	-2570.74	-2053.61	-2264.32	-2271.32	-2084.19	-2530.92	-1000.69	-736.69	-961.16	-792.67	-900.41	-855.63	-849.16	-940.40
Muw (k*ft)									33.71	120.57	19.56	181.52	42.98	79.08	203.23	26.49
Mu (k*ft)	312.09	144.44	346.77	115.75	207.57	209.25	128.68	339.99	184.98	191.60	187.15	239.03	172.25	188.11	266.83	190.89

Muw (k*ft)	161.75	493.20	178.64	523.39	382.92	378.25	503.00	205.18	formulas matching the Muw results
Pu (add)	38.63	117.78	42.66	124.99	91.44	90.33	120.12	49.00	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

1% 2% 1% 2% 2% 1% 2% 1% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.53	23.06	28.25	22.57	24.88	24.96	22.90	27.81	11.00	8.10	10.56	8.71	9.89	9.40	9.33	10.33
PY1 (Vuw)	6.10	2.82	6.77	2.26	4.06	4.09	2.51	6.64	2.96	1.39	3.27	1.12	2.53	2.13	1.24	3.21
PX2 (Mu)	4.57	2.12	5.08	1.70	3.04	3.07	1.89	4.98	2.71	2.81	2.74	3.50	2.52	2.76	3.91	2.80
PY2 (Mu)	2.29	1.06	2.54	0.85	1.52	1.53	0.94	2.49	1.36	1.40	1.37	1.75	1.26	1.38	1.95	1.40
Pu (kip)	34.15	25.48	34.61	24.46	28.48	28.58	25.03	34.04	14.37	11.25	14.09	12.55	12.98	12.65	13.62	13.92

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.67	22.95	31.02	22.02	25.65	25.74	22.54	30.52
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.61	17.30	OK	14.37	7.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.61	1.47	114.56	OK
Web SPL	17.30	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5407	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 5407

Node 5407

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5407 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
5407 R	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5407 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.85	-25.16	-13.22	-22.47	-23.14	-22.69	-12.24	-26.12	-24.74	-30.37	-24.43	-30.28	-12.50	-28.00	-22.75	-21.75
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.34	0.39	0.21	0.35	0.36	0.36	0.19	0.41	0.39	0.48	0.38	0.47	0.20	0.44	0.36	0.34
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-25.16		-22.47	-23.14			-26.12		-30.37		-30.28		-28.00	-22.75	
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-21.85		-13.22			-22.69	-12.24		-24.74		-24.43		-12.50			-21.75
Rcf	1.57		1.57			1.57	1.57		1.57		1.57		1.57			1.57
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.86	-18.34	-9.53	-16.54	-16.81	-16.51	-8.76	-19.20	-15.62	-19.00	-13.75	-18.21	-8.92	-20.55	-16.54	-15.84
Fs (ksi)	-15.86	-18.34	-9.53	-16.54	-16.81	-16.51	-8.76	-19.20	-15.62	-19.00	-13.75	-18.21	-8.92	-20.55	-16.54	-15.84
Fs (kip)	-1498.82	-1733.41	-900.42	-1563.27	-1588.48	-1560.34	-828.00	-1814.30	-1476.45	-1795.88	-1299.19	-1721.01	-842.97	-1942.09	-1562.81	-1496.67

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4644.01	4644.01	1588.48	1942.09

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	378.90	184.95	415.77	146.29	256.53	251.43	158.64	406.54	275.17	135.66	301.22	108.35	233.52	201.67	117.08	294.70
Vuw (kip)	568.35	277.42	623.65	219.43	384.79	377.15	237.96	609.81	---	---	---	---	---	---	---	---
Mv (k*ft)	319.70	156.05	350.80	123.43	216.45	212.15	133.85	343.02	154.78	76.31	169.44	60.95	131.36	113.44	65.86	165.77
Huw (kip)	-2451.23	-2043.70	-2491.01	-1997.35	-2587.77	-2573.03	-2009.64	-2446.54	-1026.10	-782.12	-999.63	-838.82	-1038.83	-958.80	-884.15	-971.26
Muw (k*ft)	258.31	529.99	231.79	560.89	167.28	177.11	552.70	261.44	49.65	140.29	5.95	208.74	67.60	89.27	232.62	14.00
Mu (k*ft)	578.01	686.04	582.60	684.32	383.73	389.26	686.55	604.45	204.43	216.60	175.39	269.69	198.96	202.71	298.47	179.77

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.94	22.46	27.37	21.95	28.44	28.28	22.08	26.89	11.28	8.59	10.98	9.22	11.42	10.54	9.72	10.67
PY1 (Vuw)	6.25	3.05	6.85	2.41	4.23	4.14	2.61	6.70	3.02	1.49	3.31	1.19	2.57	2.22	1.29	3.24
PX2 (Mu)	8.47	10.05	8.54	10.03	5.62	5.70	10.06	8.86	3.00	3.17	2.57	3.95	2.92	2.97	4.37	2.63
PY2 (Mu)	4.23	5.03	4.27	5.01	2.81	2.85	5.03	4.43	1.50	1.59	1.28	1.98	1.46	1.49	2.19	1.32
Pu (kip)	36.92	33.50	37.59	32.83	34.78	34.69	33.04	37.43	14.97	12.16	14.31	13.54	14.89	14.00	14.51	14.07

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2271.31	2646.00	OK
TF Inside	2372.70	2764.13	OK
BF Inside	2390.98	2457.00	OK
BF Outside	2253.03	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.82	31.69	34.28	31.21	31.82	31.77	31.37	34.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	623.65
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2372.70	21.97	OK	811.58	7.51	OK
BF	2390.98	28.46	OK	999.89	11.90	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2271.31	21.03	1.47	119.85	OK
TF	4644.01	43.00	1.47	269.66	OK
TF Inside	2372.70	21.97	1.47	134.83	OK
BF Inside	2390.98	28.46	1.47	119.85	OK
BF	4644.01	55.29	1.47	269.66	OK
BF Outside	2253.03	26.82	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.59	18.80	OK	14.97	7.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.59	1.47	114.56	OK
Web SPL	18.80	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.65	2.24	5.70
Web	2.07	2.27	3.27
BF	1.27	1.41	3.91

Plate	Shear	Flexure
Web	3.29	1.59

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5407**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.78	-24.93	-12.96	-21.75	-22.74	-22.32	-11.94	-25.14	-15.88	-21.24	-15.73	-21.29	-12.33	-27.06	-22.49	-21.54
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.34	0.39	0.20	0.34	0.36	0.35	0.19	0.39	0.25	0.33	0.25	0.33	0.19	0.42	0.35	0.34
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-24.93		-21.75	-22.74			-25.14		-21.24		-21.29		-27.06	-22.49	
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-21.78		-12.96			-22.32	-11.94		-15.88		-15.73		-12.33			-21.54
Rcf	1.77		1.77			1.77	1.77		1.77		1.77		1.77			1.77
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.87229	-18.13026	-9.531152	-15.91123	-16.55236	-16.28154	-8.810637	-18.30392	-14.01268	-17.08729	-12.38865	-16.44879	-9.082009	-19.6612	-16.37	-15.73
Fs (ksi)	-15.87	-18.13	-9.53	-15.91	-16.55	-16.28	-8.81	-18.30	-14.01	-17.09	-12.39	-16.45	-9.08	-19.66	-16.37	-15.73
Fs (kip)	-1499.93	-1713.31	-900.69	-1503.61	-1564.20	-1538.61	-832.61	-1729.72	-1324.20	-1614.75	-1170.73	-1554.41	-858.25	-1857.98	-1546.87	-1486.71

Vu (kip)	378.90	184.95	415.77	146.29	256.53	251.43	158.64	406.54	275.17	135.66	301.22	108.35	233.52	201.67	117.08	294.70
Vuw (kip)	568.35	277.42	623.65	219.43	384.79	377.15	237.96	609.81	---	---	---	---	---	---	---	---
Mv (k*ft)	319.70	156.05	350.80	123.43	216.45	212.15	133.85	343.02	154.78	76.31	169.44	60.95	131.36	113.44	65.86	165.77
Huw (kip)	-2574.21	-2106.61	-2602.46	-2052.55	-2261.51	-2253.35	-2072.91	-2561.25	-1020.08	-763.27	-985.02	-813.44	-933.00	-865.12	-862.30	-963.04
Muw (k*ft)									45.16	127.60	5.42	189.87	61.49	81.20	211.58	12.73
Mu (k*ft)	319.70	156.05	350.80	123.43	216.45	212.15	133.85	343.02	199.94	203.91	174.85	250.81	192.85	194.64	277.44	178.50

Muw (k*ft)	176.32	488.05	157.49	524.10	384.79	390.23	310.92	184.91	forces matching the Muw results
Pu (add)	42.11	116.55	37.61	125.16	91.89	93.19	121.92	44.17	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

1% 2% 1% 2% 2% 2% 2% 1% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.29	23.15	28.60	22.56	24.85	24.76	22.78	28.15	11.21	8.39	10.82	8.94	10.25	9.51	9.48	10.58
PY1 (Vuw)	6.25	3.05	6.85	2.41	4.23	4.14	2.61	6.70	3.02	1.49	3.31	1.19	2.57	2.22	1.29	3.24
PX2 (Mu)	4.68	2.29	5.14	1.81	3.17	3.11	1.96	5.03	2.93	2.99	2.56	3.67	2.83	2.85	4.07	2.62
PY2 (Mu)	2.34	1.14	2.57	0.90	1.59	1.55	0.98	2.51	1.46	1.49	1.28	1.84	1.41	1.43	2.03	1.31
Pu (kip)	34.07	25.78	35.03	24.59	28.62	28.45	25.00	34.43	14.83	11.76	14.15	12.97	13.67	12.88	13.94	13.96

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.59	23.23	31.40	22.14	25.77	25.62	22.52	30.86
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.03	17.51	OK	14.83	7.42	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.03	1.47	114.56	OK
Web SPL	17.51	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7407	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 7407

Node 7407

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7407 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
7407 R	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7407 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.98	-24.82	-12.21	-22.43	-22.27	-22.53	-11.07	-25.89	-23.77	-30.20	-23.99	-30.54	-11.48	-27.96	-22.23	-21.96
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.33	0.39	0.19	0.35	0.35	0.35	0.17	0.41	0.37	0.47	0.38	0.48	0.18	0.44	0.35	0.34
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-24.82		-22.43		-22.53		-25.89		-30.20		-30.54		-27.96	-22.23	
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-20.98		-12.21		-22.27		-11.07		-23.77		-23.99		-11.48			-21.96
Rcf	1.57		1.57		1.57		1.57		1.57		1.57		1.57			1.57
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.45	-18.33	-9.26	-17.04	-16.51	-16.75	-8.39	-19.57	-14.47	-19.74	-15.58	-18.98	-8.65	-21.06	-16.49	-16.35
Fs (ksi)	-15.45	-18.33	-9.26	-17.04	-16.51	-16.75	-8.39	-19.57	-14.47	-19.74	-15.58	-18.98	-8.65	-21.06	-16.49	-16.35
Fs (kip)	-1459.77	-1732.07	-875.44	-1610.73	-1560.45	-1583.15	-792.41	-1848.97	-1367.59	-1864.98	-1472.53	-1793.72	-817.28	-1989.73	-1558.72	-1544.66

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4653.36	4653.36	1560.45	1989.73

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	359.03	155.80	392.25	121.46	228.78	232.22	136.85	384.09	260.86	114.52	284.33	90.25	192.44	221.01	101.13	278.56
Vuw (kip)	538.55	233.70	588.37	182.18	343.18	348.32	205.28	576.13	---	---	---	---	---	---	---	---
Mv (k*ft)	302.93	131.45	330.96	102.48	193.04	195.93	115.47	324.07	146.73	64.42	159.94	50.77	108.24	124.32	56.89	156.69
Huw (kip)	-2404.97	-1992.82	-2465.27	-1939.21	-2536.00	-2546.47	-1958.45	-2451.03	-1013.28	-789.26	-997.97	-838.53	-1026.22	-1036.91	-891.11	-985.20
Muw (k*ft)	289.15	563.92	248.95	599.65	201.80	194.82	586.83	258.44	57.63	155.62	4.81	223.61	105.27	67.98	248.14	2.98
Mu (k*ft)	592.08	695.37	579.91	702.13	394.83	390.75	702.30	582.51	204.36	220.03	164.74	274.38	213.51	192.29	305.02	159.67

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.43	21.90	27.09	21.31	27.87	27.98	21.52	26.93	11.13	8.67	10.97	9.21	11.28	11.39	9.79	10.83
PY1 (Vuw)	5.92	2.57	6.47	2.00	3.77	3.83	2.26	6.33	2.87	1.26	3.12	0.99	2.11	2.43	1.11	3.06
PX2 (Mu)	8.68	10.19	8.50	10.29	5.79	5.73	10.29	8.53	2.99	3.22	2.41	4.02	3.13	2.82	4.47	2.34
PY2 (Mu)	4.34	5.09	4.25	5.14	2.89	2.86	5.15	4.27	1.50	1.61	1.21	2.01	1.56	1.41	2.23	1.17
Pu (kip)	36.57	32.99	37.17	32.40	34.31	34.37	32.66	37.02	14.79	12.24	14.06	13.57	14.87	14.72	14.65	13.83

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2275.88	2646.00	OK
TF Inside	2377.48	2764.13	OK
BF Inside	2395.79	2457.00	OK
BF Outside	2257.57	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.61	31.36	33.99	30.95	31.51	31.54	31.14	33.89
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	588.37
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2377.48	22.01	OK	797.26	7.38	OK
BF	2395.79	28.52	OK	1024.41	12.20	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2275.88	21.07	1.47	119.85	OK
TF	4653.36	43.09	1.47	269.66	OK
TF Inside	2377.48	22.01	1.47	134.83	OK
BF Inside	2395.79	28.52	1.47	119.85	OK
BF	4653.36	55.40	1.47	269.66	OK
BF Outside	2257.57	26.88	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.17	18.58	OK	14.87	7.43	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.17	1.47	114.56	OK
Web SPL	18.58	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.64	2.28	5.69
Web	2.11	2.32	3.34
BF	1.27	1.38	3.90

Plate	Shear	Flexure
Web	3.48	1.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7407**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.89	-24.54	-11.70	-21.41	-21.70	-21.95	-10.84	-24.92	-14.63	-20.74	-14.89	-21.11	-11.40	-27.07	-21.45	-21.20
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.33	0.38	0.18	0.34	0.34	0.34	0.17	0.39	0.23	0.33	0.23	0.33	0.18	0.42	0.34	0.33
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-24.54		-21.41		-21.95		-24.92		-20.74		-21.11		-27.07	-21.45	
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	-47.82	
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	-4518.85	
fncf (ksi)	-20.89		-11.70		-21.70		-10.84		-14.63		-14.89		-11.40			-21.20
Rcf	1.77		1.77		1.77		1.77		1.77		1.77		1.77			1.77
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82			-47.82
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85			-4518.85

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.23378	-17.85472	-8.614451	-15.69171	-15.80513	-16.02368	-8.007331	-18.17701	-12.11847	-16.90596	-13.4323	-16.52379	-8.406871	-19.69192	-15.63	-15.49
Fs (ksi)	-15.23	-17.85	-8.61	-15.69	-15.81	-16.02	-8.01	-18.18	-12.12	-16.91	-13.43	-16.52	-8.41	-19.69	-15.63	-15.49
Fs (kip)	-1439.59	-1687.27	-814.07	-1482.87	-1493.58	-1514.24	-756.69	-1717.73	-1145.20	-1597.61	-1269.35	-1561.50	-794.45	-1860.89	-1476.96	-1464.17

Vu (kip)	359.03	155.80	392.25	121.46	228.78	232.22	136.85	384.09	260.86	114.52	284.33	90.25	192.44	221.01	101.13	278.56
Vuw (kip)	538.55	233.70	588.37	182.18	343.18	348.32	205.28	576.13	---	---	---	---	---	---	---	---
Mv (k*ft)	302.93	131.45	330.96	102.48	193.04	195.93	115.47	324.07	146.73	64.42	159.94	50.77	108.24	124.32	56.89	156.69
Huw (kip)	-2526.36	-2039.34	-2569.22	-1993.80	-2194.85	-2208.69	-2023.77	-2542.65	-992.65	-729.18	-954.86	-785.53	-870.73	-898.68	-842.96	-933.69
Muw (k*ft)									52.42	141.55	4.37	203.39	95.75	61.83	225.70	2.71
Mu (k*ft)	302.93	131.45	330.96	102.48	193.04	195.93	115.47	324.07	199.15	205.96	164.31	254.16	203.99	186.15	282.59	159.40
Muw (k*ft)	208.22	532.90	179.65	563.26	429.23	420.00	343.26	197.56	forces matching the Muw results							
Pu (add)	49.73	127.26	42.90	134.51	102.50	100.30	129.74	47.13	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

1% 2% 1% 2% 2% 2% 2% 1% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.76	22.41	28.23	21.91	24.12	24.27	22.24	27.94	10.91	8.01	10.49	8.63	9.57	9.88	9.26	10.26
PY1 (Vuw)	5.92	2.57	6.47	2.00	3.77	3.83	2.26	6.33	2.87	1.26	3.12	0.99	2.11	2.43	1.11	3.06
PX2 (Mu)	4.44	1.93	4.85	1.50	2.83	2.87	1.69	4.75	2.92	3.02	2.41	3.72	2.99	2.73	4.14	2.34
PY2 (Mu)	2.22	0.96	2.42	0.75	1.41	1.44	0.85	2.37	1.46	1.51	1.20	1.86	1.49	1.36	2.07	1.17
Pu (kip)	33.21	24.59	34.26	23.57	27.44	27.65	24.13	33.83	14.49	11.37	13.61	12.68	13.07	13.16	13.78	13.29

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.84	22.15	30.74	21.21	24.72	24.91	21.72	30.36
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.26	17.13	OK	14.49	7.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.26	1.47	114.56	OK
Web SPL	17.13	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9407	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 9407

Node 9407

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9407 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
9407 R	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9407 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.29	-25.01	-9.38	-20.14	-21.33	-22.33	-9.54	-24.95	-21.59	-28.37	-22.11	-29.48	-10.75	-28.42	-21.50	-21.80
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.29	0.39	0.15	0.32	0.33	0.35	0.15	0.39	0.34	0.45	0.35	0.46	0.17	0.45	0.34	0.34
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-25.01		-20.14		-22.33		-24.95		-28.37		-29.48		-28.42		-21.80
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85
fncf (ksi)	-18.29		-9.38		-21.33		-9.54		-21.59		-22.11		-10.75		-21.50	
Rcf	1.62		1.62		1.62		1.62		1.62		1.62		1.62		1.62	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.10	-19.33	-7.54	-15.54	-16.14	-16.94	-7.78	-19.43	-12.79	-19.88	-14.83	-17.91	-8.60	-21.92	-16.26	-16.55
Fs (ksi)	-14.10	-19.33	-7.54	-15.54	-16.14	-16.94	-7.78	-19.43	-12.79	-19.88	-14.83	-17.91	-8.60	-21.92	-16.26	-16.55
Fs (kip)	-1332.51	-1826.89	-712.28	-1468.99	-1525.04	-1600.43	-735.37	-1835.93	-1208.22	-1878.82	-1401.23	-1692.13	-812.53	-2071.04	-1536.94	-1564.32

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4669.39	4669.39	1536.94	2071.04

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	290.65	106.29	348.48	70.15	184.80	193.62	97.26	340.44	210.00	82.09	253.20	54.20	141.16	196.60	73.36	247.52
Vuw (kip)	435.98	159.44	522.72	105.22	277.20	290.43	145.89	510.65	---	---	---	---	---	---	---	---
Mv (k*ft)	245.24	89.68	294.03	59.18	155.93	163.37	82.06	287.24	118.12	46.17	142.43	30.49	79.40	110.59	41.27	139.23
Huw (kip)	-2309.34	-1875.73	-2457.51	-1883.55	-2470.08	-2495.08	-1942.24	-2465.44	-1002.99	-692.47	-992.21	-816.29	-980.01	-982.02	-915.42	-984.53
Muw (k*ft)	352.90	641.98	254.12	636.77	245.74	229.07	597.64	248.84	104.63	160.15	15.95	232.92	141.93	61.56	266.35	5.79
Mu (k*ft)	598.14	731.66	548.16	695.95	401.67	392.44	679.70	536.08	222.76	206.33	158.38	263.41	221.33	172.15	307.62	145.02

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.38	20.61	27.01	20.70	27.14	27.42	21.34	27.09	11.02	7.61	10.90	8.97	10.77	10.79	10.06	10.82
PY1 (Vuw)	4.79	1.75	5.74	1.16	3.05	3.19	1.60	5.61	2.31	0.90	2.78	0.60	1.55	2.16	0.81	2.72
PX2 (Mu)	8.76	10.72	8.03	10.20	5.89	5.75	9.96	7.85	3.26	3.02	2.32	3.86	3.24	2.52	4.51	2.12
PY2 (Mu)	4.38	5.36	4.02	5.10	2.94	2.88	4.98	3.93	1.63	1.51	1.16	1.93	1.62	1.26	2.25	1.06
Pu (kip)	35.35	32.13	36.37	31.52	33.57	33.72	31.99	36.23	14.82	10.90	13.80	13.08	14.37	13.75	14.88	13.49

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2283.72	2646.00	OK
TF Inside	2385.67	2764.13	OK
BF Inside	2404.04	2457.00	OK
BF Outside	2265.35	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.78	30.84	33.37	30.30	30.98	31.07	30.59	33.24
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	522.72
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9407**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2385.67	22.09	OK	785.25	7.27	OK
BF	2404.04	28.62	OK	1066.28	12.69	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2283.72	21.15	1.47	119.85	OK
TF	4669.39	43.24	1.47	269.66	OK
TF Inside	2385.67	22.09	1.47	134.83	OK
BF Inside	2404.04	28.62	1.47	119.85	OK
BF	4669.39	55.59	1.47	269.66	OK
BF Outside	2265.35	26.97	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
36.37	18.19	OK	14.88	7.44	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	36.37	1.47	114.56	OK
Web SPL	18.19	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.64	2.31	5.67
Web	2.21	2.42	3.50
BF	1.26	1.33	3.89

Plate	Shear	Flexure
Web	3.92	1.70

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9407**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.07	-24.46	-9.44	-19.66	-19.91	-20.86	-8.73	-23.37	-12.42	-18.86	-13.21	-20.21	-9.64	-26.43	-19.57	-19.85
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.28	0.38	0.15	0.31	0.31	0.33	0.14	0.37	0.19	0.30	0.21	0.32	0.15	0.41	0.31	0.31
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-24.46		-19.66		-20.86		-23.37		-18.86		-20.21		-26.43		-19.85
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85
fncf (ksi)	-18.07		-9.44		-19.91		-8.73		-12.42		-13.21		-9.64		-19.57	
Rcf	1.81		1.81		1.81		1.81		1.81		1.81		1.81		1.81	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.13233	-17.89088	-7.123999	-14.40755	-14.52517	-15.25075	-6.531943	-17.12511	-9.808115	-16.26281	-12.23915	-15.03906	-7.173623	-19.28708	-14.28	-14.54
Fs (ksi)	-13.13	-17.89	-7.12	-14.41	-14.53	-15.25	-6.53	-17.13	-9.81	-16.26	-12.24	-15.04	-7.17	-19.29	-14.28	-14.54
Fs (kip)	-1241.00	-1690.69	-673.22	-1361.51	-1372.63	-1441.20	-617.27	-1618.32	-926.87	-1536.84	-1156.60	-1421.19	-677.91	-1822.63	-1349.43	-1374.33

Vu (kip)	290.65	106.29	348.48	70.15	184.80	193.62	97.26	340.44	210.00	82.09	253.20	54.20	141.16	196.60	73.36	247.52
Vuw (kip)	435.98	159.44	522.72	105.22	277.20	290.43	145.89	510.65	---	---	---	---	---	---	---	---
Mv (k*ft)	245.24	89.68	294.03	59.18	155.93	163.37	82.06	287.24	118.12	46.17	142.43	30.49	79.40	110.59	41.27	139.23
Huw (kip)	-2400.14	-1931.51	-2500.02	-1893.14	-2093.43	-2136.12	-1942.43	-2481.16	-930.70	-645.95	-893.28	-709.71	-782.13	-818.35	-793.82	-864.69
Muw (k*ft)									95.17	145.67	14.51	211.86	129.09	56.00	242.27	5.27
Mu (k*ft)	245.24	89.68	294.03	59.18	155.93	163.37	82.06	287.24	213.29	191.85	156.94	242.35	208.49	166.58	283.53	144.50
Muw (k*ft)	292.37	604.79	225.78	630.37	496.84	468.38	397.91	258.56	forces/mas matching the Muw results							
Pu (add)	69.82	144.43	53.92	150.54	118.65	111.85	142.69	56.92	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9407	Backchk'd	WME	Date	8/5/2011	Sheet No.	

1% 2% 1% 2% 2% 2% 2% 1% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.38	21.23	27.47	20.80	23.00	23.47	21.35	27.27	10.23	7.10	9.82	7.80	8.59	8.99	8.72	9.50
PY1 (Vuw)	4.79	1.75	5.74	1.16	3.05	3.19	1.60	5.61	2.31	0.90	2.78	0.60	1.55	2.16	0.81	2.72
PX2 (Mu)	3.59	1.31	4.31	0.87	2.28	2.39	1.20	4.21	3.13	2.81	2.30	3.55	3.05	2.44	4.15	2.12
PY2 (Mu)	1.80	0.66	2.15	0.43	1.14	1.20	0.60	2.10	1.56	1.41	1.15	1.78	1.53	1.22	2.08	1.06
Pu (kip)	30.68	22.67	32.75	21.73	25.63	26.24	22.66	32.41	13.90	10.17	12.74	11.60	12.05	11.92	13.20	12.22

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	27.62	20.38	29.43	19.48	23.10	23.64	20.36	29.13
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.75	16.37	OK	13.90	6.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.75	1.47	114.56	OK
Web SPL	16.37	1.47	114.56	OK

Field Splice - Node 1411

Node 1411

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1411 L	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00
1411 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1411 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.68	-20.00	-20.64	-24.04	-22.41	-20.92	-9.74	-23.67	-22.19	-27.19	-23.31	-28.89	-21.87	-19.37	-10.52	-26.67
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.17	0.31	0.32	0.38	0.35	0.33	0.15	0.37	0.35	0.43	0.37	0.45	0.34	0.30	0.16	0.42
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-20.00		-24.04	-22.41			-23.67		-27.19		-28.89	-21.87			-26.67
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82	-47.82			-47.82
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85	-4518.85			-4518.85
fncf (ksi)	-10.68		-20.64			-20.92	-9.74		-22.19		-23.31			-19.37	-10.52	
Rcf	1.66		1.66			1.66	1.66		1.66		1.66			1.66	1.66	
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82			-47.82	-47.82	
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85			-4518.85	-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.74	-15.77	-15.66	-18.22	-16.99	-15.94	-8.01	-18.44	-10.49	-17.53	-15.02	-17.19	-16.63	-14.83	-8.52	-20.59
Fs (ksi)	-8.74	-15.77	-15.66	-18.22	-16.99	-15.94	-8.01	-18.44	-10.49	-17.53	-15.02	-17.19	-16.63	-14.83	-8.52	-20.59
Fs (kip)	-826.33	-1490.29	-1480.03	-1722.18	-1605.58	-1506.76	-757.07	-1742.34	-990.88	-1656.91	-1419.57	-1624.38	-1571.17	-1401.75	-805.38	-1945.93

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4661.37	4661.37	1605.58	1945.93

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	183.98	375.61	427.04	152.57	257.95	266.19	404.15	172.46	137.22	275.08	311.42	115.02	165.25	255.57	295.24	129.08
Vuw (kip)	275.97	563.42	640.56	228.85	386.93	399.28	606.22	258.69	---	---	---	---	---	---	---	---
Mv (k*ft)	155.23	316.92	360.32	128.73	217.65	224.59	341.00	145.51	77.18	154.73	175.17	64.70	92.95	143.76	166.07	72.61
Huw (kip)	-1949.71	-2444.17	-2458.47	-1903.29	-2521.22	-2577.15	-2381.48	-1941.68	-735.43	-1016.57	-988.04	-793.46	-840.57	-966.33	-943.78	-873.43
Muw (k*ft)	592.66	263.02	253.48	623.61	211.65	174.36	304.81	598.01	140.52	51.25	20.91	208.52	140.96	43.35	35.86	241.39
Mu (k*ft)	747.89	579.94	613.80	752.33	429.30	398.96	645.81	743.52	217.71	205.98	196.09	273.22	233.91	187.10	201.93	313.99

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.43	26.86	27.02	20.92	27.71	28.32	26.17	21.34	8.08	11.17	10.86	8.72	9.24	10.62	10.37	9.60
PY1 (Vuw)	3.03	6.19	7.04	2.51	4.25	4.39	6.66	2.84	1.51	3.02	3.42	1.26	1.82	2.81	3.24	1.42
PX2 (Mu)	10.96	8.50	8.99	11.02	6.29	5.85	9.46	10.89	3.19	3.02	2.87	4.00	3.43	2.74	2.96	4.60
PY2 (Mu)	5.48	4.25	4.50	5.51	3.15	2.92	4.73	5.45	1.59	1.51	1.44	2.00	1.71	1.37	1.48	2.30
Pu (kip)	33.48	36.87	37.81	32.93	34.79	34.94	37.41	33.28	11.69	14.90	14.56	13.14	13.15	14.00	14.14	14.68

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2279.79	2646.00	OK
TF Inside	2381.57	2764.13	OK
BF Inside	2399.91	2457.00	OK
BF Outside	2261.45	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.83	33.78	34.50	31.46	31.95	31.98	34.30	31.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	640.56
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2381.57	22.05	OK	820.32	7.60	OK
BF	2399.91	28.57	OK	1001.87	11.93	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2279.79	21.11	1.47	119.85	OK
TF	4661.37	43.16	1.47	269.66	OK
TF Inside	2381.57	22.05	1.47	134.83	OK
BF Inside	2399.91	28.57	1.47	119.85	OK
BF	4661.37	55.49	1.47	269.66	OK
BF Outside	2261.45	26.92	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.81	18.91	OK	14.90	7.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.81	1.47	114.56	OK
Web SPL	18.91	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.64	2.22	5.68
Web	2.10	2.41	3.32
BF	1.27	1.41	3.90

Plate	Shear	Flexure
Web	3.20	1.62

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1411**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.01	-18.86	-19.69	-22.93	-21.15	-19.74	-9.31	-22.55	-13.17	-17.92	-13.98	-19.27	-20.53	-18.16	-10.14	-25.49
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.16	0.30	0.31	0.36	0.33	0.31	0.15	0.35	0.21	0.28	0.22	0.30	0.32	0.28	0.16	0.40
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-18.86		-22.93	-21.15			-22.55		-17.92		-19.27	-20.53			-25.49
Fcf (ksi)		-47.82		-47.82	-47.82			-47.82		-47.82		-47.82	-47.82			-47.82
Fcf (kip)		-4518.85		-4518.85	-4518.85			-4518.85		-4518.85		-4518.85	-4518.85			-4518.85
fncf (ksi)	-10.01		-19.69			-19.74	-9.31		-13.17		-13.98			-18.16	-10.14	
Rcf	1.88		1.88			1.88	1.88		1.88		1.88			1.88	1.88	
Fncf (ksi)	-47.82		-47.82			-47.82	-47.82		-47.82		-47.82			-47.82	-47.82	
Fncf (kip)	-4518.85		-4518.85			-4518.85	-4518.85		-4518.85		-4518.85			-4518.85	-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.464832	-13.85559	-14.39491	-16.72566	-15.4224	-14.47125	-6.976942	-16.46038	-8.670726	-15.08136	-12.87704	-14.84839	-14.9872	-13.35652	-7.56	-18.54
Fs (ksi)	-7.46	-13.86	-14.39	-16.73	-15.42	-14.47	-6.98	-16.46	-8.67	-15.08	-12.88	-14.85	-14.99	-13.36	-7.56	-18.54
Fs (kip)	-705.43	-1309.35	-1360.32	-1580.57	-1457.42	-1367.53	-659.32	-1555.51	-819.38	-1425.19	-1216.88	-1403.17	-1416.29	-1262.19	-714.63	-1752.06

Vu (kip)	183.98	375.61	427.04	152.57	257.95	266.19	404.15	172.46	137.22	275.08	311.42	115.02	165.25	255.57	295.24	129.08
Vuw (kip)	275.97	563.42	640.56	228.85	386.93	399.28	606.22	258.69	---	---	---	---	---	---	---	---
Mv (k*ft)	155.23	316.92	360.32	128.73	217.65	224.59	341.00	145.51	77.18	154.73	175.17	64.70	92.95	143.76	166.07	72.61
Huw (kip)	-1982.39	-2527.64	-2530.16	-1943.53	-2160.35	-2206.00	-2441.37	-1990.15	-639.61	-933.62	-896.81	-703.12	-712.56	-831.76	-850.31	-783.08
Muw (k*ft)									127.82	46.61	19.02	189.67	128.21	39.43	32.61	219.56
Mu (k*ft)	155.23	316.92	360.32	128.73	217.65	224.59	341.00	145.51	205.00	201.35	194.19	254.37	221.17	183.18	198.69	292.17

Muw (k*ft)	570.87	207.37	205.69	596.78	452.23	421.79	264.86	565.76	Values matching the Muw results
Pu (add)	136.33	49.52	49.12	142.51	108.00	100.73	63.26	135.09	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2%	1%	1%	2%	2%	2%	1%	2%	percentage increase in flange force	2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.78	27.78	27.80	21.36	23.74	24.24	26.83	21.87	7.03	10.26	9.86	7.73	7.83	9.14	9.34	8.61
PY1 (Vuw)	3.03	6.19	7.04	2.51	4.25	4.39	6.66	2.84	1.51	3.02	3.42	1.26	1.82	2.81	3.24	1.42
PX2 (Mu)	2.27	4.64	5.28	1.89	3.19	3.29	5.00	2.13	3.00	2.95	2.85	3.73	3.24	2.68	2.91	4.28
PY2 (Mu)	1.14	2.32	2.64	0.94	1.59	1.65	2.50	1.07	1.50	1.48	1.42	1.86	1.62	1.34	1.46	2.14
Pu (kip)	24.42	33.52	34.47	23.50	27.56	28.19	33.12	24.32	10.47	13.95	13.59	11.87	11.59	12.53	13.13	13.37

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.00	30.09	30.86	21.17	24.81	25.37	29.66	21.91
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.47	17.24	OK	13.95	6.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.47	1.47	114.56	OK
Web SPL	17.24	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3411	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 3411

Node 3411

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3411 L	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00
3411 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3411 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.84	-22.23	-22.11	-25.75	-23.23	-23.28	-10.71	-25.58	-23.88	-29.89	-24.51	-31.09	-23.15	-22.03	-11.24	-27.80
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.19	0.35	0.35	0.40	0.36	0.37	0.17	0.40	0.37	0.47	0.38	0.49	0.36	0.35	0.18	0.44
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-22.23		-25.75		-23.28		-25.58		-29.89		-31.09	-23.15			-27.80
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	-47.82			-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	-4518.85			-4518.85
fncf (ksi)	-11.84		-22.11		-23.23		-10.71		-23.88		-24.51			-22.03	-11.24	
Rcf	1.54		1.54		1.54		1.54		1.54		1.54			1.54	1.54	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82			-47.82	-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85			-4518.85	-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.06	-16.91	-16.37	-19.15	-17.23	-17.35	-8.19	-19.35	-12.18	-18.50	-15.25	-19.19	-17.18	-16.45	-8.42	-20.82
Fs (ksi)	-9.06	-16.91	-16.37	-19.15	-17.23	-17.35	-8.19	-19.35	-12.18	-18.50	-15.25	-19.19	-17.18	-16.45	-8.42	-20.82
Fs (kip)	-856.01	-1598.09	-1547.42	-1809.30	-1628.00	-1639.63	-773.97	-1828.28	-1151.34	-1748.07	-1441.26	-1813.53	-1623.89	-1554.36	-795.52	-1967.70

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4653.18	4653.18	1628.00	1967.70

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	213.71	407.38	437.62	180.86	284.13	281.37	430.13	195.80	157.60	296.79	318.15	134.39	207.72	263.34	312.86	144.95
Vuw (kip)	320.56	611.08	656.43	271.29	426.19	422.06	645.20	293.70	---	---	---	---	---	---	---	---
Mv (k*ft)	180.31	343.73	369.24	152.60	239.73	237.41	362.92	165.20	88.65	166.94	178.96	75.60	116.84	148.13	175.98	81.53
Huw (kip)	-1965.61	-2439.54	-2491.54	-1913.50	-2521.56	-2550.54	-2436.10	-1938.22	-779.08	-1065.63	-1037.34	-826.11	-920.45	-1033.27	-1008.97	-877.21
Muw (k*ft)	582.06	266.10	231.44	616.80	211.42	192.10	268.40	600.32	157.05	55.42	2.46	223.13	126.29	78.79	14.72	248.08
Mu (k*ft)	762.37	609.84	600.68	769.40	451.15	429.51	631.32	765.52	245.70	222.37	181.42	298.73	243.14	226.91	190.70	329.61

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.60	26.81	27.38	21.03	27.71	28.03	26.77	21.30	8.56	11.71	11.40	9.08	10.11	11.35	11.09	9.64
PY1 (Vuw)	3.52	6.72	7.21	2.98	4.68	4.64	7.09	3.23	1.73	3.26	3.50	1.48	2.28	2.89	3.44	1.59
PX2 (Mu)	11.17	8.94	8.80	11.27	6.61	6.29	9.25	11.22	3.60	3.26	2.66	4.38	3.56	3.32	2.79	4.83
PY2 (Mu)	5.59	4.47	4.40	5.64	3.31	3.15	4.63	5.61	1.80	1.63	1.33	2.19	1.78	1.66	1.40	2.41
Pu (kip)	34.01	37.45	38.00	33.43	35.24	35.19	37.88	33.69	12.66	15.75	14.86	13.95	14.27	15.37	14.70	15.01

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2275.79	2646.00	OK
TF Inside	2377.39	2764.13	OK
BF Inside	2395.70	2457.00	OK
BF Outside	2257.48	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.24	34.25	34.60	31.85	32.33	32.24	34.58	32.02
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	656.43
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2377.39	22.01	OK	831.77	7.70	OK
BF	2395.70	28.52	OK	1013.08	12.06	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2275.79	21.07	1.47	119.85	OK
TF	4653.18	43.08	1.47	269.66	OK
TF Inside	2377.39	22.01	1.47	134.83	OK
BF Inside	2395.70	28.52	1.47	119.85	OK
BF	4653.18	55.39	1.47	269.66	OK
BF Outside	2257.48	26.87	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.00	19.00	OK	15.75	7.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.00	1.47	114.56	OK
Web SPL	19.00	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.64	2.19	5.69
Web	2.05	2.25	3.25
BF	1.27	1.40	3.90

Plate	Shear	Flexure
Web	3.12	1.58

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 3411**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.72	-21.59	-21.15	-24.61	-22.18	-22.23	-10.91	-25.04	-14.98	-20.68	-15.01	-21.25	-22.12	-21.06	-11.47	-27.20
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.18	0.34	0.33	0.39	0.35	0.35	0.17	0.39	0.23	0.32	0.24	0.33	0.35	0.33	0.18	0.43
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-21.59		-24.61		-22.23		-25.04		-20.68		-21.25	-22.12			-27.20
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	-47.82			-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	-4518.85			-4518.85
fncf (ksi)	-11.72		-21.15		-22.18		-10.91		-14.98		-15.01			-21.06	-11.47	
Rcf	1.76		1.76		1.76		1.76		1.76		1.76			1.76	1.76	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82			-47.82	-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85			-4518.85	-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.652774	-15.79544	-15.41328	-17.93392	-16.13679	-16.24877	-8.083127	-18.23106	-11.03405	-16.77776	-13.54704	-17.13018	-16.09665	-15.42738	-8.48	-19.76
Fs (ksi)	-8.65	-15.80	-15.41	-17.93	-16.14	-16.25	-8.08	-18.23	-11.03	-16.78	-13.55	-17.13	-16.10	-15.43	-8.48	-19.76
Fs (kip)	-817.69	-1492.67	-1456.55	-1694.76	-1524.93	-1535.51	-763.86	-1722.83	-1042.72	-1585.50	-1280.19	-1618.80	-1521.13	-1457.89	-800.92	-1867.12

Vu (kip)	213.71	407.38	437.62	180.86	284.13	281.37	430.13	195.80	157.60	296.79	318.15	134.39	207.72	263.34	312.86	144.95
Vuw (kip)	320.56	611.08	656.43	271.29	426.19	422.06	645.20	293.70	---	---	---	---	---	---	---	---
Mv (k*ft)	180.31	343.73	369.24	152.60	239.73	237.41	362.92	165.20	88.65	166.94	178.96	75.60	116.84	148.13	175.98	81.53
Huw (kip)	-2037.47	-2535.04	-2589.05	-1994.95	-2209.29	-2210.93	-2530.24	-2024.23	-733.45	-1000.42	-971.57	-789.43	-834.35	-920.32	-945.72	-847.00
Muw (k*ft)									142.85	50.41	2.24	202.96	114.87	71.66	13.39	225.65
Mu (k*ft)	180.31	343.73	369.24	152.60	239.73	237.41	362.92	165.20	231.50	217.36	181.20	278.56	231.72	219.79	189.37	307.18
Muw (k*ft)	534.15	202.43	166.43	562.50	419.60	418.51	203.04	542.58								
Pu (add)	127.56	48.34	39.74	134.33	100.20	99.94	49.11	129.67								

\\hcnas00\Jobs\49683\Bridges\Design\Final Design\Unit 2\Walsh GW Check\Field Splice Legs.xlsm\Type AA

reiginuas matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2%	1%	1%	2%	2%	2%	1%	2%	percentage increase in flange force	2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.39	27.86	28.45	21.92	24.28	24.30	27.80	22.24	8.06	10.99	10.68	8.68	9.17	10.11	10.39	9.31
PY1 (Vuw)	3.52	6.72	7.21	2.98	4.68	4.64	7.09	3.23	1.73	3.26	3.50	1.48	2.28	2.89	3.44	1.59
PX2 (Mu)	2.64	5.04	5.41	2.24	3.51	3.48	5.32	2.42	3.39	3.18	2.65	4.08	3.40	3.22	2.77	4.50
PY2 (Mu)	1.32	2.52	2.71	1.12	1.76	1.74	2.66	1.21	1.70	1.59	1.33	2.04	1.70	1.61	1.39	2.25
Pu (kip)	25.50	34.17	35.28	24.50	28.53	28.50	34.53	25.06	11.95	14.99	14.18	13.23	13.18	14.07	14.02	14.33

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.97	30.62	31.59	22.08	25.66	25.64	30.90	22.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.28	17.64	OK	14.99	7.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.28	1.47	114.56	OK
Web SPL	17.64	1.47	114.56	OK

Field Splice - Node 5411

Node 5411

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5411 L	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00
5411 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5411 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.40	-22.95	-21.26	-25.89	-22.64	-23.23	-11.32	-26.43	-24.01	-31.12	-24.19	-30.71	-22.54	-22.23	-11.58	-28.44
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.19	0.36	0.33	0.41	0.36	0.36	0.18	0.41	0.38	0.49	0.38	0.48	0.35	0.35	0.18	0.45
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-22.95		-25.89		-23.23		-26.43		-31.12		-30.71	-22.54			-28.44
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	-47.82			-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	-4518.85			-4518.85
fncf (ksi)	-12.40		-21.26		-22.64		-11.32		-24.01		-24.19			-22.23	-11.58	
Rcf	1.54		1.54		1.54		1.54		1.54		1.54			1.54	1.54	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82			-47.82	-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85			-4518.85	-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.94	-16.95	-15.40	-18.91	-16.44	-16.97	-8.10	-19.47	-12.85	-19.07	-13.13	-18.60	-16.38	-16.25	-8.26	-20.92
Fs (ksi)	-8.94	-16.95	-15.40	-18.91	-16.44	-16.97	-8.10	-19.47	-12.85	-19.07	-13.13	-18.60	-16.38	-16.25	-8.26	-20.92
Fs (kip)	-844.65	-1601.35	-1455.69	-1786.66	-1553.48	-1603.30	-765.47	-1840.33	-1214.12	-1802.39	-1240.49	-1757.38	-1548.31	-1535.22	-780.27	-1976.95

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4651.67	4651.67	1553.48	1976.95

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	219.73	401.89	434.56	183.35	279.94	285.14	427.34	197.28	161.47	292.46	315.55	135.76	226.48	232.46	310.44	145.60
Vuw (kip)	329.60	602.83	651.84	275.02	419.91	427.71	641.00	295.92	---	---	---	---	---	---	---	---
Mv (k*ft)	185.40	339.09	366.66	154.70	236.20	240.59	360.57	166.45	90.83	164.51	177.49	76.37	127.40	130.76	174.62	81.90
Huw (kip)	-1991.22	-2399.69	-2463.07	-1941.23	-2526.44	-2534.76	-2444.38	-1953.25	-776.51	-1029.32	-1002.15	-827.24	-957.62	-951.71	-978.90	-875.31
Muw (k*ft)	564.98	292.67	250.41	598.31	208.17	202.62	262.88	590.30	160.15	70.05	10.54	227.48	124.50	109.39	2.77	253.27
Mu (k*ft)	750.38	631.76	617.07	753.01	444.37	443.21	623.44	756.75	250.97	234.56	188.04	303.85	251.90	240.15	177.40	335.17

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.88	26.37	27.07	21.33	27.76	27.85	26.86	21.46	8.53	11.31	11.01	9.09	10.52	10.46	10.76	9.62
PY1 (Vuw)	3.62	6.62	7.16	3.02	4.61	4.70	7.04	3.25	1.77	3.21	3.47	1.49	2.49	2.55	3.41	1.60
PX2 (Mu)	10.99	9.26	9.04	11.03	6.51	6.49	9.13	11.09	3.68	3.44	2.76	4.45	3.69	3.52	2.60	4.91
PY2 (Mu)	5.50	4.63	4.52	5.52	3.26	3.25	4.57	5.54	1.84	1.72	1.38	2.23	1.85	1.76	1.30	2.46
Pu (kip)	34.12	37.36	37.95	33.47	35.17	35.26	37.82	33.72	12.73	15.55	14.60	14.04	14.86	14.63	14.16	15.08

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2275.05	2646.00	OK
TF Inside	2376.62	2764.13	OK
BF Inside	2394.92	2457.00	OK
BF Outside	2256.75	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.28	34.24	34.60	31.84	32.26	32.32	34.53	32.02
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	651.84
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2376.62	22.01	OK	793.70	7.35	OK
BF	2394.92	28.51	OK	1017.83	12.12	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2275.05	21.07	1.47	119.85	OK
TF	4651.67	43.07	1.47	269.66	OK
TF Inside	2376.62	22.01	1.47	134.83	OK
BF Inside	2394.92	28.51	1.47	119.85	OK
BF	4651.67	55.38	1.47	269.66	OK
BF Outside	2256.75	26.87	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.95	18.98	OK	15.55	7.78	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.95	1.47	114.56	OK
Web SPL	18.98	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.64	2.29	5.69
Web	2.06	2.19	3.27
BF	1.27	1.39	3.90

Plate	Shear	Flexure
Web	3.14	1.59

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.30	-22.33	-21.21	-25.60	-22.38	-22.94	-11.34	-25.69	-15.16	-21.90	-15.45	-21.64	-22.31	-22.02	-11.78	-27.80
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.19	0.35	0.33	0.40	0.35	0.36	0.18	0.40	0.24	0.34	0.24	0.34	0.35	0.35	0.18	0.44
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-22.33		-25.60		-22.94		-25.69		-21.90		-21.64	-22.31			-27.80
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	-47.82			-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	-4518.85			-4518.85
fncf (ksi)	-12.30		-21.21		-22.38		-11.34		-15.16		-15.45			-22.02	-11.78	
Rcf	1.72		1.72		1.72		1.72		1.72		1.72			1.72	1.72	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82			-47.82	-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85			-4518.85	-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.045872	-16.32934	-15.44072	-18.62631	-16.26912	-16.74868	-8.363206	-18.709	-12.25716	-17.91947	-12.40708	-17.38224	-16.22146	-16.09542	-8.68	-20.20
Fs (ksi)	-9.05	-16.33	-15.44	-18.63	-16.27	-16.75	-8.36	-18.71	-12.26	-17.92	-12.41	-17.38	-16.22	-16.10	-8.68	-20.20
Fs (kip)	-854.83	-1543.12	-1459.15	-1760.19	-1537.43	-1582.75	-790.32	-1768.00	-1158.30	-1693.39	-1172.47	-1642.62	-1532.93	-1521.02	-820.11	-1908.59

Vu (kip)	219.73	401.89	434.56	183.35	279.94	285.14	427.34	197.28	161.47	292.46	315.55	135.76	226.48	232.46	310.44	145.60
Vuw (kip)	329.60	602.83	651.84	275.02	419.91	427.71	641.00	295.92	---	---	---	---	---	---	---	---
Mv (k*ft)	185.40	339.09	366.66	154.70	236.20	240.59	360.57	166.45	90.83	164.51	177.49	76.37	127.40	130.76	174.62	81.90
Huw (kip)	-2054.28	-2513.69	-2574.20	-2004.42	-2201.41	-2216.43	-2555.61	-2027.44	-761.26	-1022.01	-990.53	-812.17	-905.30	-893.68	-969.51	-866.26
Muw (k*ft)									145.67	63.71	9.59	206.92	113.25	99.50	2.52	230.37
Mu (k*ft)	185.40	339.09	366.66	154.70	236.20	240.59	360.57	166.45	236.49	228.22	187.09	283.28	240.64	230.26	177.14	312.27

Muw (k*ft)	522.95	216.67	176.33	556.19	424.86	414.85	168.72	340.84
Pu (add)	124.88	51.74	42.11	132.82	101.46	99.07	45.07	129.15

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh GW Check\Field Splice Legs.xlsm\Type AA
forces matching the Muw results
additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5411**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 1% 1% 2% 2% 2% 1% 2% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.57	27.62	28.29	22.03	24.19	24.36	28.08	22.28	8.37	11.23	10.88	8.92	9.95	9.82	10.65	9.52
PY1 (Vuw)	3.62	6.62	7.16	3.02	4.61	4.70	7.04	3.25	1.77	3.21	3.47	1.49	2.49	2.55	3.41	1.60
PX2 (Mu)	2.72	4.97	5.37	2.27	3.46	3.53	5.28	2.44	3.47	3.34	2.74	4.15	3.53	3.37	2.60	4.58
PY2 (Mu)	1.36	2.48	2.69	1.13	1.73	1.76	2.64	1.22	1.73	1.67	1.37	2.08	1.76	1.69	1.30	2.29
Pu (kip)	25.78	33.84	35.07	24.65	28.37	28.62	34.74	25.12	12.34	15.37	14.46	13.55	14.13	13.86	14.06	14.62

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	23.22	30.33	31.40	22.21	25.52	25.75	31.11	22.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.07	17.54	OK	15.37	7.69	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.07	1.47	114.56	OK
Web SPL	17.54	1.47	114.56	OK

Field Splice - Node 7411

Node 7411

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7411 L	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00
7411 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7411 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.55	-23.10	-20.35	-26.09	-22.02	-23.05	-10.46	-26.55	-23.44	-31.26	-23.31	-30.61	-21.97	-22.36	-10.90	-28.74
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.18	0.36	0.32	0.41	0.35	0.36	0.16	0.42	0.37	0.49	0.37	0.48	0.34	0.35	0.17	0.45
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-23.10		-26.09		-23.05		-26.55		-31.26		-30.61		-22.36		-28.74
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85
fncf (ksi)	-11.55		-20.35		-22.02		-10.46		-23.44		-23.31		-21.97		-10.90	
Rcf	1.53		1.53		1.53		1.53		1.53		1.53		1.53		1.53	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.79	-17.58	-15.05	-19.39	-16.31	-17.17	-7.94	-20.09	-14.93	-18.06	-11.19	-19.46	-16.29	-16.68	-8.23	-21.66
Fs (ksi)	-8.79	-17.58	-15.05	-19.39	-16.31	-17.17	-7.94	-20.09	-14.93	-18.06	-11.19	-19.46	-16.29	-16.68	-8.23	-21.66
Fs (kip)	-830.64	-1661.56	-1422.40	-1832.43	-1541.00	-1622.51	-750.77	-1898.62	-1410.76	-1706.60	-1057.78	-1839.41	-1539.01	-1575.92	-777.64	-2047.16

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4660.71	4660.71	1541.00	2047.16

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	191.55	368.91	409.77	158.66	259.62	258.36	403.22	173.59	141.16	268.72	297.59	117.92	253.28	175.49	292.96	128.47
Vuw (kip)	287.32	553.36	614.66	237.99	389.43	387.54	604.83	260.39	---	---	---	---	---	---	---	---
Mv (k*ft)	161.62	311.26	345.74	133.87	219.06	217.99	340.22	146.47	79.40	151.15	167.39	66.33	142.47	98.71	164.79	72.26
Huw (kip)	-1949.40	-2352.98	-2429.68	-1899.15	-2495.13	-2489.11	-2427.66	-1919.40	-791.18	-1033.28	-1004.29	-841.08	-989.64	-919.74	-988.87	-896.76
Muw (k*ft)	592.86	323.81	272.67	626.36	229.04	233.05	274.02	612.86	175.86	86.78	17.25	242.93	62.61	165.43	7.81	268.68
Mu (k*ft)	754.48	635.07	618.42	760.23	448.10	451.04	614.24	759.33	255.26	237.93	184.65	309.26	205.08	264.14	172.60	340.95

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.42	25.86	26.70	20.87	27.42	27.35	26.68	21.09	8.69	11.35	11.04	9.24	10.88	10.11	10.87	9.85
PY1 (Vuw)	3.16	6.08	6.75	2.62	4.28	4.26	6.65	2.86	1.55	2.95	3.27	1.30	2.78	1.93	3.22	1.41
PX2 (Mu)	11.05	9.31	9.06	11.14	6.57	6.61	9.00	11.13	3.74	3.49	2.71	4.53	3.00	3.87	2.53	5.00
PY2 (Mu)	5.53	4.65	4.53	5.57	3.28	3.30	4.50	5.56	1.87	1.74	1.35	2.27	1.50	1.94	1.26	2.50
Pu (kip)	33.62	36.76	37.50	33.04	34.82	34.79	37.38	33.30	12.90	15.57	14.50	14.23	14.53	14.50	14.13	15.36

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2279.47	2646.00	OK
TF Inside	2381.24	2764.13	OK
BF Inside	2399.57	2457.00	OK
BF Outside	2261.14	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.94	33.84	34.30	31.55	32.02	32.01	34.21	31.74
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	614.66
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2381.24	22.05	OK	787.32	7.29	OK
BF	2399.57	28.57	OK	1053.99	12.55	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2279.47	21.11	1.47	119.85	OK
TF	4660.71	43.15	1.47	269.66	OK
TF Inside	2381.24	22.05	1.47	134.83	OK
BF Inside	2399.57	28.57	1.47	119.85	OK
BF	4660.71	55.48	1.47	269.66	OK
BF Outside	2261.14	26.92	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.50	18.75	OK	15.57	7.78	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.50	1.47	114.56	OK
Web SPL	18.75	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.64	2.31	5.68
Web	2.12	2.24	3.35
BF	1.27	1.34	3.90

Plate	Shear	Flexure
Web	3.34	1.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7411**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.02	-22.00	-20.00	-25.45	-21.43	-22.41	-10.20	-25.49	-14.29	-21.72	-14.21	-21.14	-21.27	-21.64	-10.74	-27.69
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.17	0.35	0.31	0.40	0.34	0.35	0.16	0.40	0.22	0.34	0.22	0.33	0.33	0.34	0.17	0.43
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-22.00		-25.45		-22.41		-25.49		-21.72		-21.14		-21.64		-27.69
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85
fncf (ksi)	-11.02		-20.00		-21.43		-10.20		-14.29		-14.21		-21.27		-10.74	
Rcf	1.73		1.73		1.73		1.73		1.73		1.73		1.73		1.73	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.125897	-16.12373	-14.57564	-18.52224	-15.58953	-16.37409	-7.54349	-18.59177	-13.55776	-16.40527	-9.786834	-17.31023	-15.47215	-15.82748	-7.93	-20.15
Fs (ksi)	-8.13	-16.12	-14.58	-18.52	-15.59	-16.37	-7.54	-18.59	-13.56	-16.41	-9.79	-17.31	-15.47	-15.83	-7.93	-20.15
Fs (kip)	-767.90	-1523.69	-1377.40	-1750.35	-1473.21	-1547.35	-712.86	-1756.92	-1281.21	-1550.30	-924.86	-1635.82	-1462.12	-1495.70	-749.15	-1903.88

Vu (kip)	191.55	368.91	409.77	158.66	259.62	258.36	403.22	173.59	141.16	268.72	297.59	117.92	253.28	175.49	292.96	128.47
Vuw (kip)	287.32	553.36	614.66	237.99	389.43	387.54	604.83	260.39	---	---	---	---	---	---	---	---
Mv (k*ft)	161.62	311.26	345.74	133.87	219.06	217.99	340.22	146.47	79.40	151.15	167.39	66.33	142.47	98.71	164.79	72.26
Huw (kip)	-1990.33	-2455.32	-2529.65	-1947.63	-2159.74	-2155.41	-2521.05	-1975.78	-727.49	-992.94	-958.91	-784.06	-898.89	-812.91	-938.99	-842.23
Muw (k*ft)									159.96	78.93	15.69	220.97	56.95	150.47	7.11	244.39
Mu (k*ft)	161.62	311.26	345.74	133.87	219.06	217.99	340.22	146.47	239.36	230.09	183.09	287.30	199.42	249.18	171.90	316.65
Muw (k*ft)	565.58	255.58	206.03	594.04	452.64	455.52	211.76	673.21	forces matching the Muw results							
Pu (add)	135.06	61.04	49.20	141.86	108.09	108.78	50.57	137.38	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 1% 1% 2% 2% 2% 1% 2% percentage increase in flange force 2%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.87	26.98	27.80	21.40	23.73	23.69	27.70	21.71	7.99	10.91	10.54	8.62	9.88	8.93	10.32	9.26
PY1 (Vuw)	3.16	6.08	6.75	2.62	4.28	4.26	6.65	2.86	1.55	2.95	3.27	1.30	2.78	1.93	3.22	1.41
PX2 (Mu)	2.37	4.56	5.07	1.96	3.21	3.19	4.98	2.15	3.51	3.37	2.68	4.21	2.92	3.65	2.52	4.64
PY2 (Mu)	1.18	2.28	2.53	0.98	1.60	1.60	2.49	1.07	1.75	1.69	1.34	2.10	1.46	1.83	1.26	2.32
Pu (kip)	24.63	32.63	34.15	23.64	27.58	27.51	33.94	24.18	11.97	15.02	14.00	13.27	13.49	13.13	13.60	14.39

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.19	29.29	30.60	21.29	24.82	24.76	30.42	21.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
34.15	17.08	OK	15.02	7.51	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	34.15	1.47	114.56	OK
Web SPL	17.08	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9411	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 9411

Node 9411

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9411 L	94.50	63.76	6025.13	94.50	63.76	6025.13	60.00	50.00	3000.00
9411 R	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9411 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	42.00	2.25	---	94.50	65.81	67.30	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.03	-22.41	-18.36	-25.97	-20.61	-22.52	-9.14	-25.95	-21.32	-30.16	-21.03	-28.85	-19.86	-21.01	-9.93	-29.05
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.16	0.35	0.29	0.41	0.32	0.35	0.14	0.41	0.33	0.47	0.33	0.45	0.31	0.33	0.16	0.46
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-22.41		-25.97		-22.52		-25.95		-30.16		-28.85		-21.01		-29.05
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85
fncf (ksi)	-10.03		-18.36		-20.61		-9.14		-21.32		-21.03		-19.86		-9.93	
Rcf	1.59		1.59		1.59		1.59		1.59		1.59		1.59		1.59	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.17	-17.61	-13.91	-19.65	-15.59	-17.12	-7.48	-20.19	-14.03	-16.97	-9.73	-19.87	-15.07	-16.04	-8.00	-22.41
Fs (ksi)	-8.17	-17.61	-13.91	-19.65	-15.59	-17.12	-7.48	-20.19	-14.03	-16.97	-9.73	-19.87	-15.07	-16.04	-8.00	-22.41
Fs (kip)	-772.36	-1664.11	-1314.23	-1856.92	-1473.17	-1618.09	-706.55	-1907.49	-1325.57	-1603.46	-919.69	-1878.11	-1424.31	-1515.77	-755.62	-2117.72

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4677.00	4677.00	1473.17	2117.72

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	144.08	320.17	372.67	112.88	220.93	214.95	352.27	131.93	108.03	233.91	271.00	85.98	221.48	133.40	256.59	99.44
Vuw (kip)	216.12	480.25	559.00	169.32	331.40	322.42	528.40	197.90	---	---	---	---	---	---	---	---
Mv (k*ft)	121.57	270.14	314.44	95.24	186.41	181.36	297.22	111.32	60.77	131.58	152.44	48.36	124.58	75.04	144.33	55.94
Huw (kip)	-1896.37	-2292.75	-2399.96	-1854.18	-2433.76	-2419.56	-2364.33	-1891.59	-773.48	-1006.71	-981.35	-829.86	-929.85	-888.19	-933.36	-912.17
Muw (k*ft)	628.22	363.96	292.49	656.34	269.95	279.42	316.24	631.40	188.73	114.85	30.67	254.17	58.81	202.84	19.36	288.27
Mu (k*ft)	749.79	634.10	606.93	751.59	456.37	460.78	613.47	742.72	249.50	246.43	183.11	302.53	183.40	277.87	163.69	344.21

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.84	25.20	26.37	20.38	26.74	26.59	25.98	20.79	8.50	11.06	10.78	9.12	10.22	9.76	10.26	10.02
PY1 (Vuw)	2.37	5.28	6.14	1.86	3.64	3.54	5.81	2.17	1.19	2.57	2.98	0.94	2.43	1.47	2.82	1.09
PX2 (Mu)	10.99	9.29	8.89	11.01	6.69	6.75	8.99	10.88	3.66	3.61	2.68	4.43	2.69	4.07	2.40	5.04
PY2 (Mu)	5.49	4.65	4.45	5.51	3.34	3.38	4.49	5.44	1.83	1.81	1.34	2.22	1.34	2.04	1.20	2.52
Pu (kip)	32.78	35.89	36.82	32.24	34.15	34.05	36.46	32.57	12.52	15.31	14.14	13.92	13.45	14.27	13.28	15.49

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2287.44	2646.00	OK
TF Inside	2389.56	2764.13	OK
BF Inside	2407.96	2457.00	OK
BF Outside	2269.04	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.35	33.23	33.81	30.97	31.56	31.50	33.58	31.18
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	559.00
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9411**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2389.56	22.13	OK	752.67	6.97	OK
BF	2407.96	28.67	OK	1090.31	12.98	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2287.44	21.18	1.47	119.85	OK
TF	4677.00	43.31	1.47	269.66	OK
TF Inside	2389.56	22.13	1.47	134.83	OK
BF Inside	2407.96	28.67	1.47	119.85	OK
BF	4677.00	55.68	1.47	269.66	OK
BF Outside	2269.04	27.01	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
36.82	18.41	OK	15.49	7.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	36.82	1.47	114.56	OK
Web SPL	18.41	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.64	2.41	5.66
Web	2.22	2.35	3.51
BF	1.26	1.30	3.88

Plate	Shear	Flexure
Web	3.67	1.71

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.62	-20.38	-17.63	-24.86	-19.42	-21.24	-8.02	-24.00	-12.45	-20.85	-11.81	-19.24	-18.78	-19.86	-8.84	-27.01
ϕf Fnc (ksi)	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76	63.76
f / ϕf Fnc	0.14	0.32	0.28	0.39	0.30	0.33	0.13	0.38	0.20	0.33	0.19	0.30	0.29	0.31	0.14	0.42
α	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
fcf (ksi)		-20.38		-24.86		-21.24		-24.00		-20.85		-19.24		-19.86		-27.01
Fcf (ksi)		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82
Fcf (kip)		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85
fncf (ksi)	-8.62		-17.63		-19.42		-8.02		-12.45		-11.81		-18.78		-8.84	
Rcf	1.77		1.77		1.77		1.77		1.77		1.77		1.77		1.77	
Fncf (ksi)	-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82		-47.82	
Fncf (kip)	-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85		-4518.85	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.4341	-15.01741	-12.88745	-18.11091	-14.15247	-15.54738	-6.013983	-17.57329	-12.13298	-14.80768	-7.491743	-16.71671	-13.69459	-14.57498	-6.59	-19.70
Fs (ksi)	-6.43	-15.02	-12.89	-18.11	-14.15	-15.55	-6.01	-17.57	-12.13	-14.81	-7.49	-16.72	-13.69	-14.57	-6.59	-19.70
Fs (kip)	-608.02	-1419.15	-1217.86	-1711.48	-1337.41	-1469.23	-568.32	-1660.68	-1146.57	-1399.33	-707.97	-1579.73	-1294.14	-1377.34	-623.08	-1862.02

Vu (kip)	144.08	320.17	372.67	112.88	220.93	214.95	352.27	131.93	108.03	233.91	271.00	85.98	221.48	133.40	256.59	99.44
Vuw (kip)	216.12	480.25	559.00	169.32	331.40	322.42	528.40	197.90	---	---	---	---	---	---	---	---
Mv (k*ft)	121.57	270.14	314.44	95.24	186.41	181.36	297.22	111.32	60.77	131.58	152.44	48.36	124.58	75.04	144.33	55.94
Huw (kip)	-1876.92	-2355.81	-2450.90	-1845.34	-2080.79	-2046.34	-2416.48	-1888.89	-643.55	-929.95	-891.00	-707.62	-808.22	-726.25	-848.09	-788.92
Muw (k*ft)									171.67	104.47	27.90	231.19	53.49	184.50	17.61	262.21
Mu (k*ft)	121.57	270.14	314.44	95.24	186.41	181.36	297.22	111.32	232.43	236.05	180.34	279.55	178.08	259.53	161.94	318.15

Muw (k*ft)	641.18	321.92	258.53	662.24	505.27	528.23	261.47	653.26	forces matching the Muw results
Pu (add)	153.12	76.88	61.74	158.15	120.66	126.15	67.22	151.21	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 1% 1% 3% 2% 2% 1% 3% percentage increase in flange force 3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.63	25.89	26.93	20.28	22.87	22.49	26.55	20.76	7.07	10.22	9.79	7.78	8.88	7.98	9.32	8.67
PY1 (Vuw)	2.37	5.28	6.14	1.86	3.64	3.54	5.81	2.17	1.19	2.57	2.98	0.94	2.43	1.47	2.82	1.09
PX2 (Mu)	1.78	3.96	4.61	1.40	2.73	2.66	4.35	1.63	3.41	3.46	2.64	4.10	2.61	3.80	2.37	4.66
PY2 (Mu)	0.89	1.98	2.30	0.70	1.37	1.33	2.18	0.82	1.70	1.73	1.32	2.05	1.30	1.90	1.19	2.33
Pu (kip)	22.64	30.72	32.65	21.82	26.08	25.61	31.92	22.59	10.87	14.34	13.16	12.24	12.08	12.26	12.36	13.76

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	20.39	27.61	29.30	19.64	23.49	23.07	28.67	20.34
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9411	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.65	16.33	OK	14.34	7.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.65	1.47	114.56	OK
Web SPL	16.33	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1416	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 1416

Node 1416

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1416 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
1416 R	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 1416 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.51	-22.78	-19.78	-10.31	-29.69	-9.59	-15.91	-19.20	-25.23	-21.99	-30.30	-24.41	-16.75	-24.55	-30.17	-7.67
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.42	0.38	0.31	0.17	0.47	0.16	0.25	0.32	0.40	0.37	0.48	0.41	0.26	0.41	0.47	0.13
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-26.51		-19.78		-29.69			-19.20	-25.23		-30.30			-24.55	-30.17	
Fcf (ksi)	-47.67		-47.67		-47.67			-44.70	-47.67		-47.67			-44.70	-47.67	
Fcf (kip)	-4505.13		-4505.13		-4505.13			-3755.04	-4505.13		-4505.13			-3755.04	-4505.13	
fncf (ksi)		-22.78		-10.31		-9.59	-15.91			-21.99		-24.41	-16.75			-7.67
Rcf		1.57		1.57		1.57	1.48			1.57		1.57	1.48			1.57
Fncf (ksi)		-44.70		-44.70		-44.70	-47.67			-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.17	-16.74	-14.36	-7.43	-21.91	-7.16	-11.58	-14.31	-18.20	-16.13	-22.12	-17.83	-12.09	-18.16	-22.29	-5.77
Fs (ksi)	-19.17	-16.74	-14.36	-7.43	-21.91	-7.16	-11.58	-14.31	-18.20	-16.13	-22.12	-17.83	-12.09	-18.16	-22.29	-5.77
Fs (kip)	-1811.84	-1406.19	-1357.16	-623.92	-2070.91	-601.21	-1094.05	-1202.20	-1720.11	-1355.22	-2090.72	-1497.31	-1142.97	-1525.34	-2106.36	-484.38

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4715.08	3964.99	2106.36	1525.34

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	447.98	346.09	513.49	319.08	382.04	415.80	337.64	502.62	324.30	252.69	370.96	233.24	277.72	301.94	246.35	363.28
Vuw (kip)	671.97	519.14	770.23	478.62	573.06	623.71	506.46	753.93	---	---	---	---	---	---	---	---
Mv (k*ft)	377.98	292.02	433.25	269.22	322.35	350.83	284.88	424.09	182.42	142.14	208.66	131.19	156.22	169.84	138.57	204.35
Huw (kip)	-2981.45	-2275.44	-2234.68	-2431.24	-2937.16	-3073.85	-2475.51	-2125.89	-1292.88	-784.41	-1046.58	-932.01	-1236.09	-1438.17	-1089.13	-1010.01
Muw (k*ft)	267.74	738.41	765.58	494.02	297.27	206.14	464.50	838.11	58.38	166.41	354.17	65.63	49.65	103.17	145.53	396.55
Mu (k*ft)	645.72	1030.43	1198.84	763.24	619.62	556.97	749.39	1262.20	240.80	308.55	562.83	196.83	205.86	273.02	284.11	600.90

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.76	25.00	24.56	26.72	32.28	33.78	27.20	23.36	14.21	8.62	11.50	10.24	13.58	15.80	11.97	11.10
PY1 (Vuw)	7.38	5.70	8.46	5.26	6.30	6.85	5.57	8.28	3.56	2.78	4.08	2.56	3.05	3.32	2.71	3.99
PX2 (Mu)	9.46	15.10	17.57	11.18	9.08	8.16	10.98	18.49	3.53	4.52	8.25	2.88	3.02	4.00	4.16	8.80
PY2 (Mu)	4.73	7.55	8.78	5.59	4.54	4.08	5.49	9.25	1.76	2.26	4.12	1.44	1.51	2.00	2.08	4.40
Pu (kip)	43.93	42.24	45.52	39.42	42.75	43.34	39.75	45.38	18.52	14.07	21.38	13.72	17.21	20.51	16.83	21.60

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2306.07	2646.00	OK
TF Inside	2409.02	2764.13	OK
BF Inside	2041.38	2457.00	OK
BF Outside	1923.61	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.15	39.85	42.34	36.80	39.27	39.53	36.99	42.37
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	770.23
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2409.02	22.31	OK	1076.17	9.96	OK
BF	2041.38	24.30	OK	785.32	9.35	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2306.07	21.35	1.47	119.85	OK
TF	4715.08	43.66	1.47	269.66	OK
TF Inside	2409.02	22.31	1.47	134.83	OK
BF Inside	2041.38	24.30	1.47	119.85	OK
BF	3964.99	47.20	1.47	239.70	OK
BF Outside	1923.61	22.90	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.52	22.76	OK	21.60	10.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.52	1.47	137.48	OK
Web SPL	22.76	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.15
TF Inside	NA	1.15
BF Inside	NA	1.20
BF Outside	NA	1.20

Bolt	Shear	Slip	Bearing
TF	1.62	1.69	5.61
Web	1.67	1.68	3.57
BF	1.33	1.80	4.58

Plate	Shear	Flexure
Web	2.66	1.45

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1416**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.74	-19.16	-18.22	-9.12	-27.85	-8.55	-15.36	-18.51	-18.76	-15.65	-21.43	-15.77	-15.25	-22.75	-27.71	-6.10
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.36	0.32	0.29	0.15	0.44	0.14	0.24	0.31	0.30	0.26	0.34	0.26	0.24	0.38	0.44	0.10
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-22.74		-18.22		-27.85			-18.51	-18.76		-21.43			-22.75	-27.71	
Fcf (ksi)	-47.67		-47.67		-47.67			-44.70	-47.67		-47.67			-44.70	-47.67	
Fcf (kip)	-4505.13		-4505.13		-4505.13			-3755.04	-4505.13		-4505.13			-3755.04	-4505.13	
fncf (ksi)		-19.16		-9.12		-8.55	-15.36			-15.65		-15.77	-15.25			-6.10
Rcf		1.71		1.71		1.71	1.61			1.71		1.71	1.61			1.71
Fncf (ksi)		-44.70		-44.70		-44.70	-47.67			-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.43161	-14.19026	-13.29854	-6.909552	-20.10352	-6.505973	-11.21537	-13.73517	-13.6166	-11.71056	-15.56968	-11.60859	-11.13857	-16.726	-20.00	-4.78
Fs (ksi)	-16.43	-14.19	-13.30	-6.91	-20.10	-6.51	-11.22	-13.74	-13.62	-11.71	-15.57	-11.61	-11.14	-16.73	-20.00	-4.78
Fs (kip)	-1552.79	-1191.98	-1256.71	-580.40	-1899.78	-546.50	-1059.85	-1153.75	-1286.77	-983.69	-1471.33	-975.12	-1052.59	-1404.98	-1890.15	-401.26

Vu (kip)	447.98	346.09	513.49	319.08	382.04	415.80	337.64	502.62	324.30	252.69	370.96	233.24	277.72	301.94	246.35	363.28
Vuw (kip)	671.97	519.14	770.23	478.62	573.06	623.71	506.46	753.93	---	---	---	---	---	---	---	---
Mv (k*ft)	377.98	292.02	433.25	269.22	322.35	350.83	284.88	424.09	182.42	142.14	208.66	131.19	156.22	169.84	138.57	204.35
Huw (kip)	-2872.10	-2253.58	-2218.37	-2473.59	-2655.82	-2663.43	-2467.31	-2067.57	-1102.39	-727.49	-957.94	-898.22	-911.78	-978.42	-1003.12	-892.03
Muw (k*ft)									53.79	153.34	326.34	60.48	45.74	95.07	134.10	365.39
Mu (k*ft)	377.98	292.02	433.25	269.22	322.35	350.83	284.88	424.09	236.21	295.47	535.00	191.67	201.96	264.91	272.67	569.74

Muw (k*ft)	340.64	752.99	776.46	465.78	484.82	479.75	469.97	877.06	Values matching the Muw results
Pu (add)	81.55	180.27	185.88	111.51	116.07	114.85	112.51	209.95	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1416	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 4% 4% 2% 2% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.56	24.76	24.38	27.18	29.18	29.27	27.11	22.72	12.11	7.99	10.53	9.87	10.02	10.75	11.02	9.80
PY1 (Vuw)	7.38	5.70	8.46	5.26	6.30	6.85	5.57	8.28	3.56	2.78	4.08	2.56	3.05	3.32	2.71	3.99
PX2 (Mu)	5.54	4.28	6.35	3.94	4.72	5.14	4.17	6.21	3.46	4.33	7.84	2.81	2.96	3.88	4.00	8.35
PY2 (Mu)	2.77	2.14	3.17	1.97	2.36	2.57	2.09	3.11	1.73	2.16	3.92	1.40	1.48	1.94	2.00	4.17
Pu (kip)	38.46	30.08	32.86	31.96	35.00	35.68	32.21	31.10	16.45	13.28	20.03	13.29	13.75	15.55	15.74	19.90

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.50	26.99	29.07	28.75	31.43	32.00	28.95	27.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.46	19.23	OK	20.03	10.02	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.46	1.47	137.48	OK
Web SPL	19.23	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3416	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 3416

Node 3416

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3416 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
3416 R	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 3416 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.37	-21.06	-22.27	-10.54	-32.24	-10.63	-22.31	-21.90	-29.70	-21.49	-32.45	-26.88	-21.60	-25.39	-32.24	-7.96
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.41	0.35	0.35	0.18	0.51	0.18	0.35	0.37	0.47	0.36	0.51	0.45	0.34	0.43	0.51	0.13
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-26.37		-22.27		-32.24			-21.90	-29.70		-32.45			-25.39	-32.24	
Fcf (ksi)	-47.67		-47.67		-48.14			-44.70	-47.67		-48.24			-44.70	-48.14	
Fcf (kip)	-4505.13		-4505.13		-4548.81			-3755.04	-4505.13		-4558.85			-3755.04	-4548.79	
fncf (ksi)		-21.06		-10.54		-10.63	-22.31			-21.49		-26.88	-21.60			-7.96
Rcf		1.47		1.47		1.48	1.38			1.47		1.49	1.38			1.48
Fncf (ksi)		-44.70		-44.70		-44.70	-47.67			-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.12	-15.45	-16.52	-7.90	-23.74	-7.84	-16.18	-16.11	-21.48	-15.68	-23.63	-19.55	-15.60	-18.64	-23.78	-5.92
Fs (ksi)	-19.12	-15.45	-16.52	-7.90	-23.74	-7.84	-16.18	-16.11	-21.48	-15.68	-23.63	-19.55	-15.60	-18.64	-23.78	-5.92
Fs (kip)	-1806.55	-1297.79	-1561.33	-663.69	-2243.17	-658.85	-1528.56	-1353.55	-2030.17	-1317.43	-2233.24	-1642.35	-1474.52	-1565.62	-2247.12	-497.30

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4753.83	3960.07	2247.12	1642.35

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	495.51	413.28	563.92	390.38	460.98	456.68	406.46	551.98	357.98	300.13	406.56	283.70	333.58	330.79	295.06	398.12
Vuw (kip)	743.26	619.91	845.88	585.57	691.47	685.01	609.69	827.97	---	---	---	---	---	---	---	---
Mv (k*ft)	418.09	348.70	475.81	329.38	388.95	385.32	342.95	465.74	201.36	168.82	228.69	159.58	187.64	186.07	165.97	223.94
Huw (kip)	-2805.43	-2248.91	-2275.54	-2692.90	-2828.36	-3150.56	-2657.41	-2132.97	-1244.40	-879.23	-1136.91	-1162.40	-1338.01	-1554.62	-1232.70	-1069.17
Muw (k*ft)	385.09	756.10	760.21	319.58	369.80	181.89	343.24	855.25	88.01	206.90	381.45	1.48	139.19	97.93	72.84	428.61
Mu (k*ft)	803.17	1104.80	1236.02	648.96	758.75	567.21	686.19	1320.99	289.37	375.72	610.14	161.06	326.83	284.00	238.81	652.56

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.83	24.71	25.01	29.59	31.08	34.62	29.20	23.44	13.67	9.66	12.49	12.77	14.70	17.08	13.55	11.75
PY1 (Vuw)	8.17	6.81	9.30	6.43	7.60	7.53	6.70	9.10	3.93	3.30	4.47	3.12	3.67	3.64	3.24	4.37
PX2 (Mu)	11.77	16.19	18.11	9.51	11.12	8.31	10.05	19.36	4.24	5.51	8.94	2.36	4.79	4.16	3.50	9.56
PY2 (Mu)	5.88	8.09	9.06	4.75	5.56	4.16	5.03	9.68	2.12	2.75	4.47	1.18	2.39	2.08	1.75	4.78
Pu (kip)	44.85	43.53	46.86	40.67	44.20	44.49	40.97	46.73	18.91	16.33	23.22	15.73	20.41	22.00	17.76	23.19

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2325.02	2646.00	OK
TF Inside	2428.81	2764.13	OK
BF Inside	2038.85	2457.00	OK
BF Outside	1921.22	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.13	40.87	43.38	37.39	40.59	40.46	37.68	43.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	845.88
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2428.81	22.49	OK	1148.09	10.63	OK
BF	2038.85	24.27	OK	845.57	10.07	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2325.02	21.53	1.47	119.85	OK
TF	4753.83	44.02	1.47	269.66	OK
TF Inside	2428.81	22.49	1.47	134.83	OK
BF Inside	2038.85	24.27	1.47	119.85	OK
BF	3960.07	47.14	1.47	239.70	OK
BF Outside	1921.22	22.87	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.86	23.43	OK	23.22	11.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.86	1.47	137.48	OK
Web SPL	23.43	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	NA	1.21
BF Outside	NA	1.21

Bolt	Shear	Slip	Bearing
TF	1.61	1.58	5.57
Web	1.65	1.53	3.53
BF	1.33	1.67	4.59

Plate	Shear	Flexure
Web	2.42	1.44

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 3416**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.51	-20.41	-21.97	-10.71	-30.63	-9.88	-19.76	-19.37	-23.77	-15.89	-23.94	-18.59	-19.85	-23.49	-30.57	-7.26
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.40	0.34	0.35	0.18	0.48	0.17	0.31	0.32	0.37	0.27	0.38	0.31	0.31	0.39	0.48	0.12
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-25.51		-21.97		-30.63			-19.37	-23.77		-23.94			-23.49	-30.57	
Fcf (ksi)	-47.67		-47.67		-47.67			-44.70	-47.67		-47.67			-44.70	-47.67	
Fcf (kip)	-4505.13		-4505.13		-4505.13			-3755.04	-4505.13		-4505.13			-3755.04	-4505.13	
fncf (ksi)		-20.41		-10.71		-9.88	-19.76			-15.89		-18.59	-19.85			-7.26
Rcf		1.56		1.56		1.56	1.46			1.56		1.56	1.46			1.56
Fncf (ksi)		-44.70		-44.70		-44.70	-47.67			-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.41848	-15.03958	-15.95481	-8.011331	-22.07166	-7.426783	-14.35842	-14.30165	-17.19077	-11.84688	-17.34368	-13.58391	-14.41694	-17.21337	-22.03	-5.58
Fs (ksi)	-18.42	-15.04	-15.95	-8.01	-22.07	-7.43	-14.36	-14.30	-17.19	-11.85	-17.34	-13.58	-14.42	-17.21	-22.03	-5.58
Fs (kip)	-1740.55	-1263.32	-1507.73	-672.95	-2085.77	-623.85	-1356.87	-1201.34	-1624.53	-995.14	-1638.98	-1141.05	-1362.40	-1445.92	-2082.15	-468.53

Vu (kip)	495.51	413.28	563.92	390.38	460.98	456.68	406.46	551.98	357.98	300.13	406.56	283.70	333.58	330.79	295.06	398.12
Vuw (kip)	743.26	619.91	845.88	585.57	691.47	685.01	609.69	827.97	---	---	---	---	---	---	---	---
Mv (k*ft)	418.09	348.70	475.81	329.38	388.95	385.32	342.95	465.74	201.36	168.82	228.69	159.58	187.64	186.07	165.97	223.94
Huw (kip)	-2835.35	-2291.39	-2245.03	-2624.64	-2582.13	-2733.37	-2629.00	-2098.38	-1204.49	-862.78	-1061.94	-1031.76	-1045.36	-1113.39	-1138.69	-994.00
Muw (k*ft)									81.09	190.64	351.48	1.36	128.25	90.23	67.11	394.93
Mu (k*ft)	418.09	348.70	475.81	329.38	388.95	385.32	342.95	465.74	282.45	359.46	580.17	160.94	315.89	276.30	233.08	618.88
Muw (k*ft)	365.14	727.78	758.68	365.08	533.95	433.13	362.16	856.45								
Pu (add)	87.42	174.23	181.63	87.40	127.83	103.69	86.71	205.04								

Huw values matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3416	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 3% 4% 2% 3% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.16	25.18	24.67	28.84	28.38	30.04	28.89	23.06	13.24	9.48	11.67	11.34	11.49	12.24	12.51	10.92
PY1 (Vuw)	8.17	6.81	9.30	6.43	7.60	7.53	6.70	9.10	3.93	3.30	4.47	3.12	3.67	3.64	3.24	4.37
PX2 (Mu)	6.13	5.11	6.97	4.83	5.70	5.65	5.02	6.82	4.14	5.27	8.50	2.36	4.63	4.05	3.42	9.07
PY2 (Mu)	3.06	2.55	3.49	2.41	2.85	2.82	2.51	3.41	2.07	2.63	4.25	1.18	2.31	2.02	1.71	4.53
Pu (kip)	38.94	31.70	34.13	34.81	35.64	37.15	35.14	32.40	18.38	15.90	21.97	14.35	17.19	17.24	16.68	21.89

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.82	28.33	30.05	31.25	31.86	33.27	31.52	28.45
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
38.94	19.47	OK	21.97	10.99	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	38.94	1.47	137.48	OK
Web SPL	19.47	1.47	114.56	OK

Field Splice - Node 5416

Node 5416

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5416 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
5416 R	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 5416 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.89	-21.20	-24.67	-11.80	-33.40	-11.53	-21.49	-17.44	-29.87	-23.18	-33.38	-24.77	-22.48	-24.25	-32.55	-7.28
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.42	0.36	0.39	0.20	0.53	0.19	0.34	0.29	0.47	0.39	0.53	0.42	0.35	0.41	0.51	0.12
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-26.89		-24.67		-33.40		-21.49		-29.87		-33.38			-24.25	-32.55	
Fcf (ksi)	-47.67		-47.67		-48.73		-47.67		-47.67		-48.72			-44.70	-48.29	
Fcf (kip)	-4505.13		-4505.13		-4604.57		-4505.13		-4505.13		-4603.84			-3755.04	-4563.82	
fncf (ksi)		-21.20		-11.80		-11.53		-17.44		-23.18		-24.77	-22.48			-7.28
Rcf		1.43		1.43		1.46		1.43		1.43		1.46	1.34			1.45
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.48	-15.47	-18.27	-8.76	-24.57	-8.45	-15.64	-12.84	-21.61	-16.88	-24.35	-17.99	-16.24	-17.74	-24.02	-5.40
Fs (ksi)	-19.48	-15.47	-18.27	-8.76	-24.57	-8.45	-15.64	-12.84	-21.61	-16.88	-24.35	-17.99	-16.24	-17.74	-24.02	-5.40
Fs (kip)	-1840.62	-1299.88	-1726.08	-736.22	-2322.00	-709.52	-1478.15	-1078.79	-2042.46	-1417.85	-2301.23	-1510.86	-1535.05	-1489.93	-2270.31	-453.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4783.20	3962.48	2322.00	1510.86

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	509.17	431.38	579.36	411.92	463.63	496.05	433.55	565.47	367.64	313.29	417.84	298.93	335.46	358.97	314.21	408.02
Vuw (kip)	763.76	647.07	869.04	617.88	695.44	744.07	650.33	848.20	---	---	---	---	---	---	---	---
Mv (k*ft)	429.61	363.98	488.83	347.56	391.18	418.54	365.81	477.11	206.80	176.22	235.03	168.15	188.70	201.92	176.75	229.51
Huw (kip)	-2780.87	-2297.75	-2334.22	-2587.49	-2882.80	-3029.08	-2669.43	-2092.48	-1258.28	-973.08	-1188.65	-1025.44	-1385.73	-1524.17	-1223.32	-1059.22
Muw (k*ft)	401.46	723.54	749.01	530.38	333.50	285.40	335.22	889.77	96.07	228.02	386.99	67.18	113.62	152.76	35.84	447.02
Mu (k*ft)	831.07	1087.51	1237.84	877.93	724.69	703.94	701.03	1366.88	302.86	404.24	622.02	235.32	302.32	354.69	212.59	676.53

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.56	25.25	25.65	28.43	31.68	33.29	29.33	22.99	13.83	10.69	13.06	11.27	15.23	16.75	13.44	11.64
PY1 (Vuw)	8.39	7.11	9.55	6.79	7.64	8.18	7.15	9.32	4.04	3.44	4.59	3.28	3.69	3.94	3.45	4.48
PX2 (Mu)	12.18	15.93	18.14	12.86	10.62	10.31	10.27	20.03	4.44	5.92	9.11	3.45	4.43	5.20	3.11	9.91
PY2 (Mu)	6.09	7.97	9.07	6.43	5.31	5.16	5.14	10.01	2.22	2.96	4.56	1.72	2.21	2.60	1.56	4.96
Pu (kip)	45.12	43.86	47.58	43.36	44.24	45.59	41.47	47.17	19.31	17.81	23.99	15.55	20.52	22.90	17.30	23.53

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2339.38	2646.00	OK
TF Inside	2443.82	2764.13	OK
BF Inside	2040.09	2457.00	OK
BF Outside	1922.39	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.37	41.05	43.98	40.29	40.54	41.61	38.05	43.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	869.04
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2443.82	22.63	OK	1186.35	10.98	OK
BF	2040.09	24.29	OK	777.87	9.26	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2339.38	21.66	1.47	119.85	OK
TF	4783.20	44.29	1.47	269.66	OK
TF Inside	2443.82	22.63	1.47	134.83	OK
BF Inside	2040.09	24.29	1.47	119.85	OK
BF	3962.48	47.17	1.47	239.70	OK
BF Outside	1922.39	22.89	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.58	23.79	OK	23.99	11.99	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.58	1.47	137.48	OK
Web SPL	23.79	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.13
TF Inside	NA	1.13
BF Inside	NA	1.20
BF Outside	NA	1.20

Bolt	Shear	Slip	Bearing
TF	1.60	1.53	5.53
Web	1.65	1.49	3.52
BF	1.33	1.82	4.58

Plate	Shear	Flexure
Web	2.36	1.43

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5416**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.30	-20.83	-23.16	-10.79	-31.60	-10.60	-21.32	-17.42	-24.08	-17.66	-25.80	-17.52	-21.62	-23.32	-31.53	-7.27
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.41	0.35	0.36	0.18	0.50	0.18	0.34	0.29	0.38	0.30	0.41	0.29	0.34	0.39	0.50	0.12
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-26.30		-23.16		-31.60		-21.32		-24.08		-25.80			-23.32	-31.53	
Fcf (ksi)	-47.67		-47.67		-47.81		-47.67		-47.67		-47.67			-44.70	-47.78	
Fcf (kip)	-4505.13		-4505.13		-4518.47		-4505.13		-4505.13		-4505.13			-3755.04	-4515.15	
fncf (ksi)		-20.83		-10.79		-10.60		-17.42		-17.66		-17.52	-21.62			-7.27
Rcf		1.51		1.51		1.51		1.51		1.51		1.51	1.41			1.51
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.98368	-15.29544	-16.81617	-8.061904	-22.78378	-7.926144	-15.46037	-12.8813	-17.41112	-13.04894	-18.6822	-12.81719	-15.67647	-17.05248	-22.73	-5.57
Fs (ksi)	-18.98	-15.30	-16.82	-8.06	-22.78	-7.93	-15.46	-12.88	-17.41	-13.05	-18.68	-12.82	-15.68	-17.05	-22.73	-5.57
Fs (kip)	-1793.96	-1284.82	-1589.13	-677.20	-2153.07	-665.80	-1461.00	-1082.03	-1645.35	-1096.11	-1765.47	-1076.64	-1481.43	-1432.41	-2148.44	-468.09

Vu (kip)	509.17	431.38	579.36	411.92	463.63	496.05	433.55	565.47	367.64	313.29	417.84	298.93	335.46	358.97	314.21	408.02
Vuw (kip)	763.76	647.07	869.04	617.88	695.44	744.07	650.33	848.20	---	---	---	---	---	---	---	---
Mv (k*ft)	429.61	363.98	488.83	347.56	391.18	418.54	365.81	477.11	206.80	176.22	235.03	168.15	188.70	201.92	176.75	229.51
Huw (kip)	-2823.00	-2277.56	-2273.84	-2637.44	-2650.33	-2643.07	-2687.14	-2090.85	-1234.05	-895.61	-1105.56	-1020.30	-1096.56	-1133.98	-1178.24	-1019.06
Muw (k*ft)									88.52	210.10	356.58	61.90	104.69	140.76	33.02	411.90
Mu (k*ft)	429.61	363.98	488.83	347.56	391.18	418.54	365.81	477.11	295.31	386.33	591.62	230.04	293.39	342.68	209.77	641.41
Muw (k*ft)	373.37	737.00	746.16	497.08	488.49	493.33	323.42	866.48	forces matching the Muw results							
Pu (add)	89.39	176.44	178.63	119.00	116.94	118.10	77.43	207.44	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5416	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 4% 4% 2% 2% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.02	25.03	24.99	28.98	29.12	29.04	29.53	22.98	13.56	9.84	12.15	11.21	12.05	12.46	12.95	11.20
PY1 (Vuw)	8.39	7.11	9.55	6.79	7.64	8.18	7.15	9.32	4.04	3.44	4.59	3.28	3.69	3.94	3.45	4.48
PX2 (Mu)	6.29	5.33	7.16	5.09	5.73	6.13	5.36	6.99	4.33	5.66	8.67	3.37	4.30	5.02	3.07	9.40
PY2 (Mu)	3.15	2.67	3.58	2.55	2.87	3.07	2.68	3.50	2.16	2.83	4.33	1.69	2.15	2.51	1.54	4.70
Pu (kip)	39.06	31.90	34.73	35.33	36.41	36.93	36.25	32.59	18.93	16.72	22.65	15.41	17.36	18.64	16.78	22.55

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	34.90	28.46	30.56	31.69	32.56	32.96	32.48	28.57
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5416	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
39.06	19.53	OK	22.65	11.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	39.06	1.47	137.48	OK
Web SPL	19.53	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7416	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 7416

Node 7416

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7416 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
7416 R	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 7416 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.30	-19.17	-25.77	-11.38	-33.29	-9.08	-22.65	-17.66	-31.15	-22.60	-33.23	-21.50	-21.50	-21.83	-33.76	-6.71
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.45	0.32	0.41	0.19	0.52	0.15	0.36	0.30	0.49	0.38	0.52	0.36	0.34	0.37	0.53	0.11
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-28.30		-25.77		-33.29		-22.65		-31.15		-33.23			-21.83	-33.76	
Fcf (ksi)	-47.67		-47.67		-48.67		-47.67		-47.67		-48.64			-44.70	-48.91	
Fcf (kip)	-4505.13		-4505.13		-4599.35		-4505.13		-4505.13		-4596.70			-3755.04	-4621.93	
fncf (ksi)		-19.17		-11.38		-9.08		-17.66		-22.60		-21.50	-21.50			-6.71
Rcf		1.41		1.41		1.44		1.41		1.41		1.44	1.32			1.45
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.55	-13.95	-19.12	-8.45	-24.58	-6.68	-16.07	-13.26	-22.55	-16.38	-24.35	-15.64	-15.59	-15.96	-24.96	-4.97
Fs (ksi)	-20.55	-13.95	-19.12	-8.45	-24.58	-6.68	-16.07	-13.26	-22.55	-16.38	-24.35	-15.64	-15.59	-15.96	-24.96	-4.97
Fs (kip)	-1942.15	-1171.67	-1806.56	-709.87	-2323.05	-561.42	-1518.97	-1113.61	-2131.41	-1376.09	-2300.76	-1313.44	-1473.67	-1340.93	-2358.73	-417.44

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4843.39	3976.50	2358.73	1376.09

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	511.47	424.79	577.80	404.87	477.81	469.26	423.58	565.23	369.33	309.13	417.23	294.11	345.55	340.55	307.24	408.35
Vuw (kip)	767.20	637.19	866.70	607.30	716.72	703.90	635.38	847.84	---	---	---	---	---	---	---	---
Mv (k*ft)	431.55	358.42	487.52	341.60	403.15	395.94	357.40	476.91	207.75	173.89	234.69	165.43	194.37	191.56	172.82	229.70
Huw (kip)	-2665.79	-2270.22	-2198.01	-2589.37	-2840.30	-2841.14	-2610.83	-2085.21	-1242.01	-992.44	-1125.58	-1055.92	-1401.72	-1439.38	-1136.08	-1077.47
Muw (k*ft)	478.18	741.89	837.20	529.13	361.84	407.12	374.29	923.70	158.48	255.99	429.57	67.60	148.14	209.05	8.86	479.77
Mu (k*ft)	909.73	1100.31	1324.72	870.73	764.99	803.07	731.69	1400.61	366.23	429.87	664.27	233.03	342.52	400.61	181.68	709.47

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.29	24.95	24.15	28.45	31.21	31.22	28.69	22.91	13.65	10.91	12.37	11.60	15.40	15.82	12.48	11.84
PY1 (Vuw)	8.43	7.00	9.52	6.67	7.88	7.74	6.98	9.32	4.06	3.40	4.58	3.23	3.80	3.74	3.38	4.49
PX2 (Mu)	13.33	16.12	19.41	12.76	11.21	11.77	10.72	20.52	5.37	6.30	9.73	3.41	5.02	5.87	2.66	10.40
PY2 (Mu)	6.66	8.06	9.70	6.38	5.60	5.88	5.36	10.26	2.68	3.15	4.87	1.71	2.51	2.93	1.33	5.20
Pu (kip)	45.22	43.74	47.62	43.23	44.51	45.09	41.30	47.64	20.17	18.41	24.04	15.81	21.37	22.69	15.86	24.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2368.82	2646.00	OK
TF Inside	2474.57	2764.13	OK
BF Inside	2047.30	2457.00	OK
BF Outside	1929.19	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.59	41.00	44.14	40.18	40.82	41.48	38.01	44.34
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	866.70
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2474.57	22.91	OK	1205.11	11.16	OK
BF	2047.30	24.37	OK	708.48	8.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2368.82	21.93	1.47	119.85	OK
TF	4843.39	44.85	1.47	269.66	OK
TF Inside	2474.57	22.91	1.47	134.83	OK
BF Inside	2047.30	24.37	1.47	119.85	OK
BF	3976.50	47.34	1.47	239.70	OK
BF Outside	1929.19	22.97	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.64	23.82	OK	24.25	12.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.64	1.47	137.48	OK
Web SPL	23.82	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.20
BF Outside	NA	1.20

Bolt	Shear	Slip	Bearing
TF	1.58	1.51	5.46
Web	1.71	1.48	3.66
BF	1.32	2.00	4.57

Plate	Shear	Flexure
Web	2.37	1.49

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7416**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.06	-18.29	-23.01	-9.20	-31.76	-8.51	-21.17	-16.38	-25.37	-17.16	-24.97	-13.71	-21.37	-21.69	-31.71	-5.73
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.43	0.31	0.36	0.15	0.50	0.14	0.33	0.27	0.40	0.29	0.39	0.23	0.34	0.36	0.50	0.10
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-27.06		-23.01		-31.76		-21.17		-25.37		-24.97			-21.69	-31.71	
Fcf (ksi)	-47.67		-47.67		-47.89		-47.67		-47.67		-47.67			-44.70	-47.87	
Fcf (kip)	-4505.13		-4505.13		-4525.97		-4505.13		-4505.13		-4505.13			-3755.04	-4523.50	
fncf (ksi)		-18.29		-9.20		-8.51		-16.38		-17.16		-13.71	-21.37			-5.73
Rcf		1.50		1.50		1.51		1.50		1.50		1.50	1.41			1.51
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.53634	-13.45182	-16.75417	-6.926084	-22.93247	-6.440003	-15.30667	-12.71143	-18.34482	-12.65725	-18.13812	-10.11209	-15.51336	-15.85342	-22.90	-4.48
Fs (ksi)	-19.54	-13.45	-16.75	-6.93	-22.93	-6.44	-15.31	-12.71	-18.34	-12.66	-18.14	-10.11	-15.51	-15.85	-22.90	-4.48
Fs (kip)	-1846.18	-1129.95	-1583.27	-581.79	-2167.12	-540.96	-1446.48	-1067.76	-1733.59	-1063.21	-1714.05	-849.42	-1466.01	-1331.69	-2163.67	-376.01

Vu (kip)	511.47	424.79	577.80	404.87	477.81	469.26	423.58	565.23	369.33	309.13	417.23	294.11	345.55	340.55	307.24	408.35
Vuw (kip)	767.20	637.19	866.70	607.30	716.72	703.90	635.38	847.84	---	---	---	---	---	---	---	---
Mv (k*ft)	431.55	358.42	487.52	341.60	403.15	395.94	357.40	476.91	207.75	173.89	234.69	165.43	194.37	191.56	172.82	229.70
Huw (kip)	-2679.72	-2188.50	-2161.27	-2576.51	-2618.95	-2432.18	-2668.82	-2009.28	-1187.57	-852.49	-1057.41	-1008.65	-1116.07	-1017.01	-1129.20	-985.40
Muw (k*ft)									146.03	235.87	395.82	62.29	136.50	192.62	8.16	442.07
Mu (k*ft)	431.55	358.42	487.52	341.60	403.15	395.94	357.40	476.91	353.78	409.76	630.51	227.72	330.87	384.18	180.98	671.77

Muw (k*ft)	468.89	796.37	824.96	537.70	509.41	633.92	393.66	823.04	Moments matching the Muw results
Pu (add)	112.25	190.65	197.50	128.73	121.95	151.76	80.35	221.46	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7416	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 4% 4% 3% 2% 3% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.45	24.05	23.75	28.31	28.78	26.73	29.33	22.08	13.05	9.37	11.62	11.08	12.26	11.18	12.41	10.83
PY1 (Vuw)	8.43	7.00	9.52	6.67	7.88	7.74	6.98	9.32	4.06	3.40	4.58	3.23	3.80	3.74	3.38	4.49
PX2 (Mu)	6.32	5.25	7.14	5.01	5.91	5.80	5.24	6.99	5.18	6.00	9.24	3.34	4.85	5.63	2.65	9.84
PY2 (Mu)	3.16	2.63	3.57	2.50	2.95	2.90	2.62	3.49	2.59	3.00	4.62	1.67	2.42	2.81	1.33	4.92
Pu (kip)	37.60	30.84	33.55	34.56	36.34	34.22	35.87	31.77	19.41	16.65	22.80	15.23	18.21	18.04	15.78	22.71

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	33.54	27.49	29.44	30.99	32.46	30.51	32.16	27.77
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
37.60	18.80	OK	22.80	11.40	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	37.60	1.47	137.48	OK
Web SPL	18.80	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9416	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type AA

Field Splice - Node 9416

Node 9416

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	108
Web	91
BF	84

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9416 L	94.50	63.86	6034.56	94.50	63.86	6034.56	48.00	50.00	2400.00
9416 R	94.50	63.56	6006.84	84.00	59.60	5006.72	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 9416 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	2.25	---	94.50	65.81	67.30	70	85
	Web	48.00	1.50	---	72.00	51.28	---	50	65
	BF	42.00	2.00	---	84.00	58.50	59.82	70	85
Splice Plates	TF Outside	42.00	1.000	56.50	42.00	29.25	---	70	85
	TF Inside	19.50	1.125	56.50	43.88	29.53	---	70	85
	BF Inside	19.50	1.000	44.50	39.00	26.25	---	70	85
	BF Outside	42.00	0.875	44.50	36.75	25.59	---	70	85
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.926186

N.A. (from I 27.0950599 in
Outer to Inr 0.91055435
Outer to Inr 0.92618581

Outer to Mi 0.95527717
Outer to Mi 0.9630929

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.77	-16.21	-25.24	-9.35	-32.83	-6.56	-20.43	-14.39	-30.90	-18.46	-31.11	-19.86	-19.23	-18.83	-32.07	-2.93
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.44	0.27	0.40	0.16	0.52	0.11	0.32	0.24	0.49	0.31	0.49	0.33	0.30	0.32	0.50	0.05
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-27.77		-25.24		-32.83		-20.43		-30.90		-31.11			-18.83	-32.07	
Fcf (ksi)	-47.67		-47.67		-48.44		-47.67		-47.67		-47.67			-44.70	-48.05	
Fcf (kip)	-4505.13		-4505.13		-4577.44		-4505.13		-4505.13		-4505.13			-3755.04	-4540.88	
fncf (ksi)		-16.21		-9.35		-6.56		-14.39		-18.46		-19.86	-19.23			-2.93
Rcf		1.45		1.45		1.48		1.45		1.45		1.45	1.36			1.46
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.28	-11.78	-18.79	-6.94	-24.32	-4.82	-14.75	-10.79	-22.51	-13.36	-22.86	-14.42	-14.07	-13.78	-23.83	-2.21
Fs (ksi)	-20.28	-11.78	-18.79	-6.94	-24.32	-4.82	-14.75	-10.79	-22.51	-13.36	-22.86	-14.42	-14.07	-13.78	-23.83	-2.21
Fs (kip)	-1916.49	-989.56	-1775.89	-582.67	-2298.21	-404.92	-1393.80	-906.35	-2127.34	-1121.98	-2160.74	-1211.69	-1329.38	-1157.42	-2251.57	-185.79

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4797.45	4000.77	2298.21	1211.69

$\phi_v V_n$ (kip) = 2088.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	499.09	390.69	562.43	367.26	461.60	436.89	389.50	549.94	361.66	286.26	407.60	269.88	335.17	318.90	284.23	398.77
Vuw (kip)	748.64	586.03	843.65	550.89	692.41	655.34	584.25	824.91	---	---	---	---	---	---	---	---
Mv (k*ft)	421.11	329.64	474.55	309.88	389.48	368.63	328.64	464.01	203.43	161.02	229.28	151.81	188.54	179.38	159.88	224.31
Huw (kip)	-2538.91	-2180.28	-2067.15	-2443.60	-2656.47	-2729.50	-2528.66	-1859.11	-1154.19	-926.24	-1049.05	-919.41	-1291.26	-1342.44	-1002.47	-937.37
Muw (k*ft)	562.76	801.85	913.47	626.31	484.39	435.71	429.07	1033.86	204.00	284.54	467.98	95.02	219.71	202.56	6.93	518.75
Mu (k*ft)	983.87	1131.49	1388.03	936.18	873.87	804.34	757.71	1497.87	407.43	445.56	697.26	246.83	408.25	381.95	166.81	743.05

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.90	23.96	22.72	26.85	29.19	29.99	27.79	20.43	12.68	10.18	11.53	10.10	14.19	14.75	11.02	10.30
PY1 (Vuw)	8.23	6.44	9.27	6.05	7.61	7.20	6.42	9.06	3.97	3.15	4.48	2.97	3.68	3.50	3.12	4.38
PX2 (Mu)	14.42	16.58	20.34	13.72	12.80	11.79	11.10	21.95	5.97	6.53	10.22	3.62	5.98	5.60	2.44	10.89
PY2 (Mu)	7.21	8.29	10.17	6.86	6.40	5.89	5.55	10.97	2.98	3.26	5.11	1.81	2.99	2.80	1.22	5.44
Pu (kip)	45.04	43.13	47.24	42.57	44.27	43.78	40.69	46.88	19.91	17.89	23.76	14.53	21.25	21.30	14.14	23.36

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2793.00	1989.00	52.00	33.94	25.31	3059.75	1989.00	OK
TF Inside	0.00	2917.69	2008.13	117.00	76.36	21.80	4493.80	2008.13	OK
BF Inside	0.00	2593.50	1785.00	80.00	52.38	19.38	3383.17	1785.00	OK
BF Outside	0.00	2443.88	1740.38	35.00	22.91	22.15	2409.82	1740.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2346.35	2646.00	OK
TF Inside	2451.10	2764.13	OK
BF Inside	2059.80	2457.00	OK
BF Outside	1940.97	2315.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.63	40.66	43.95	39.88	40.89	40.41	37.65	43.80
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	843.65
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9416**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.89	1.0	32.18
BF	0.25	0.89	1.0	32.26

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2451.10	22.70	OK	1174.19	10.87	OK
BF	2059.80	24.52	OK	623.84	7.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2346.35	21.73	1.47	119.85	OK
TF	4797.45	44.42	1.47	269.66	OK
TF Inside	2451.10	22.70	1.47	134.83	OK
BF Inside	2059.80	24.52	1.47	119.85	OK
BF	4000.77	47.63	1.47	239.70	OK
BF Outside	1940.97	23.11	1.47	104.87	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.24	23.62	OK	23.76	11.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.24	1.47	137.48	OK
Web SPL	23.62	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.13
TF Inside	NA	1.13
BF Inside	NA	1.19
BF Outside	NA	1.19

Bolt	Shear	Slip	Bearing
TF	1.59	1.55	5.52
Web	1.80	1.51	3.85
BF	1.32	2.27	4.54

Plate	Shear	Flexure
Web	2.43	1.57

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9416**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.07	-14.98	-21.12	-5.86	-30.86	-5.63	-18.84	-13.03	-24.29	-12.34	-22.34	-11.54	-18.77	-18.38	-30.72	-2.73
ϕf Fnc (ksi)	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60	63.56	59.60
f / ϕf Fnc	0.41	0.25	0.33	0.10	0.49	0.09	0.30	0.22	0.38	0.21	0.35	0.19	0.30	0.31	0.48	0.05
α	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85	0.91	0.85
fcf (ksi)	-26.07		-21.12		-30.86		-18.84		-24.29		-22.34			-18.38	-30.72	
Fcf (ksi)	-47.67		-47.67		-47.67		-47.67		-47.67		-47.67			-44.70	-47.67	
Fcf (kip)	-4505.13		-4505.13		-4505.13		-4505.13		-4505.13		-4505.13			-3755.04	-4505.13	
fncf (ksi)		-14.98		-5.86		-5.63		-13.03		-12.34		-11.54	-18.77			-2.73
Rcf		1.54		1.54		1.54		1.54		1.54		1.54	1.45			1.54
Fncf (ksi)		-44.70		-44.70		-44.70		-44.70		-44.70		-44.70	-47.67			-44.70
Fncf (kip)		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04		-3755.04	-4505.13			-3755.04

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.89702	-11.0651	-15.46293	-4.538564	-22.34043	-4.373427	-13.74859	-10.10042	-17.63658	-9.201278	-16.32604	-8.549149	-13.73746	-13.47143	-22.24	-2.33
Fs (ksi)	-18.90	-11.07	-15.46	-4.54	-22.34	-4.37	-13.75	-10.10	-17.64	-9.20	-16.33	-8.55	-13.74	-13.47	-22.24	-2.33
Fs (kip)	-1785.77	-929.47	-1461.25	-381.24	-2111.17	-367.37	-1299.24	-848.44	-1666.66	-772.91	-1542.81	-718.13	-1298.19	-1131.60	-2101.85	-195.37

Vu (kip)	499.09	390.69	562.43	367.26	461.60	436.89	389.50	549.94	361.66	286.26	407.60	269.88	335.17	318.90	284.23	398.77
Vuw (kip)	748.64	586.03	843.65	550.89	692.41	655.34	584.25	824.91	---	---	---	---	---	---	---	---
Mv (k*ft)	421.11	329.64	474.55	309.88	389.48	368.63	328.64	464.01	203.43	161.02	229.28	151.81	188.54	179.38	159.88	224.31
Huw (kip)	-2524.55	-2017.61	-2004.61	-2416.36	-2377.83	-2333.33	-2565.06	-1843.42	-1078.64	-720.05	-961.70	-858.56	-966.16	-895.51	-979.52	-884.44
Muw (k*ft)									187.97	262.18	431.21	87.56	202.45	186.65	6.38	477.98
Mu (k*ft)	421.11	329.64	474.55	309.88	389.48	368.63	328.64	464.01	391.40	423.20	660.48	239.36	390.98	366.03	166.26	702.29

Muw (k*ft)	572.34	910.30	918.97	644.47	670.15	699.82	404.80	1026.42	forces matching the Muw results
Pu (add)	137.02	217.93	220.00	154.29	160.44	167.54	96.91	245.73	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9416	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 4% 4% 3% 3% 3% 2% 5% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.74	22.17	22.03	26.55	26.13	25.64	28.19	20.26	11.85	7.91	10.57	9.43	10.62	9.84	10.76	9.72
PY1 (Vuw)	8.23	6.44	9.27	6.05	7.61	7.20	6.42	9.06	3.97	3.15	4.48	2.97	3.68	3.50	3.12	4.38
PX2 (Mu)	6.17	4.83	6.95	4.54	5.71	5.40	4.82	6.80	5.73	6.20	9.68	3.51	5.73	5.36	2.44	10.29
PY2 (Mu)	3.09	2.41	3.48	2.27	2.85	2.70	2.41	3.40	2.87	3.10	4.84	1.75	2.86	2.68	1.22	5.14
Pu (kip)	35.75	28.42	31.66	32.19	33.51	32.58	34.16	29.79	18.87	15.43	22.29	13.78	17.61	16.41	13.90	22.16

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.84	25.33	27.69	28.88	29.87	29.08	30.66	25.93
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
35.75	17.87	OK	22.29	11.14	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	35.75	1.47	137.48	OK
Web SPL	17.87	1.47	114.56	OK

Field Splice

Type BB

Field Splice - Node 1422

Node 1422

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1422 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
1422 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 1422 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.81	1.22	-30.26	-13.14	-36.15	3.44	-20.39	-9.23	-34.69	-13.12	-27.07	-12.25	-36.22	6.36	-21.09	-15.77
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.48	0.02	0.61	0.26	0.72	0.07	0.41	0.18	0.69	0.26	0.54	0.24	0.72	0.13	0.42	0.32
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.81		-30.26		-36.15		-20.39		-34.69		-27.07		-36.22		-21.09	
Fcf (ksi)	-37.50		-40.13		-43.08		-37.50		-42.34		-38.53		-43.11		-37.50	
Fcf (kip)	-3375.00		-3611.80		-3876.84		-3375.00		-3811.01		-3467.93		-3879.96		-3375.00	
fncf (ksi)		1.22		-13.14		3.44		-9.23		-13.12		-12.25		6.36		-15.77
Rcf		1.04		1.11		1.19		1.04		1.17		1.06		1.19		1.04
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2604.28		-3375.00		2604.28		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.97	1.26	-22.26	-9.40	-26.85	3.00	-14.97	-7.43	-25.62	-9.15	-19.86	-8.70	-26.95	5.10	-15.57	-11.46
Fs (ksi)	-17.97	1.26	-22.26	-9.40	-26.85	3.00	-14.97	-7.43	-25.62	-9.15	-19.86	-8.70	-26.95	5.10	-15.57	-11.46
Fs (kip)	-1616.87	113.10	-2003.40	-846.10	-2416.92	269.60	-1347.26	-668.84	-2305.49	-823.82	-1787.16	-783.38	-2425.42	459.04	-1401.56	-1031.78

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2832.44	0.00	459.04
Comp	4108.13	3538.60	2425.42	1031.78

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	369.16	471.19	533.90	341.98	439.82	400.12	522.47	362.82	270.33	341.75	386.72	251.00	320.25	291.54	378.64	265.18
Vuw (kip)	553.75	706.79	800.84	512.97	659.73	600.19	783.70	544.23	---	---	---	---	---	---	---	---
Mv (k*ft)	311.48	397.57	450.48	288.54	371.10	337.60	440.83	306.13	152.06	192.23	217.53	141.19	180.14	163.99	212.99	149.16
Huw (kip)	-1195.88	-1804.84	-1286.36	-1552.79	-1903.67	-1701.49	-1172.90	-1776.36	-551.38	-1044.82	-787.35	-739.24	-1147.41	-942.53	-721.01	-892.22
Muw (k*ft)	852.75	562.54	1037.77	614.81	594.05	561.10	1114.94	465.76	422.88	282.89	656.70	165.84	362.18	245.37	705.09	90.39
Mu (k*ft)	1164.23	960.11	1488.25	903.35	965.15	898.71	1555.77	771.89	574.94	475.13	874.23	307.02	542.33	409.36	918.08	239.55

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.33	23.14	16.49	19.91	24.41	21.81	15.04	22.77	7.07	13.40	10.09	9.48	14.71	12.08	9.24	11.44
PY1 (Vuw)	7.10	9.06	10.27	6.58	8.46	7.69	10.05	6.98	3.47	4.38	4.96	3.22	4.11	3.74	4.85	3.40
PX2 (Mu)	21.18	17.46	27.07	16.43	17.55	16.35	28.30	14.04	10.46	8.64	15.90	5.58	9.86	7.45	16.70	4.36
PY2 (Mu)	8.82	7.28	11.28	6.85	7.31	6.81	11.79	5.85	4.36	3.60	6.63	2.33	4.11	3.10	6.96	1.82
Pu (kip)	39.83	43.77	48.60	38.74	44.83	40.82	48.53	38.98	19.19	23.44	28.46	16.05	25.91	20.69	28.50	16.63

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1429.21	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1403.23	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2054.06	2227.50	OK
TF Inside	2054.06	2227.50	OK
BF Inside	1785.53	1856.25	OK
BF Outside	1753.07	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.52	42.57	47.56	38.28	43.88	40.00	47.62	38.19
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	800.84
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1422	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2054.06	20.54	OK	1212.71	12.13	OK
BF	1785.53	25.51	OK	520.62	7.44	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2054.06	20.54	1.47	126.02	OK
TF	4108.13	41.08	1.47	229.13	OK
TF Inside	2054.06	20.54	1.47	137.48	OK
BF Inside	1785.53	25.51	1.47	114.56	OK
BF	3538.60	50.55	1.47	229.13	OK
BF Outside	1753.07	25.04	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.60	24.30	OK	28.50	14.25	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.60	1.47	126.02	OK
Web SPL	24.30	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.08
TF Inside	NA	1.08
BF Inside	1.02	1.04
BF Outside	1.06	1.04

Bolt	Shear	Slip	Bearing
TF	1.62	1.39	5.58
Web	2.31	1.33	4.02
BF	1.29	2.26	4.12

Plate	Shear	Flexure
Web	2.05	1.72

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1422**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.45	0.00	-26.85	-10.68	-32.00	-0.51	-19.39	-8.85	-26.02	-5.65	-22.34	-8.34	-31.82	2.14	-19.39	-14.37
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.45	0.00	0.54	0.21	0.64	0.01	0.39	0.18	0.52	0.11	0.45	0.17	0.64	0.04	0.39	0.29
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-22.45		-26.85		-32.00		-19.39		-26.02		-22.34		-31.82		-19.39	
Fcf (ksi)	-37.50		-38.42		-41.00		-37.50		-38.01		-37.50		-40.91		-37.50	
Fcf (kip)	-3375.00		-3458.03		-3690.08		-3375.00		-3421.03		-3375.00		-3682.00		-3375.00	
fncf (ksi)		0.00		-10.68		-0.51		-8.85		-5.65		-8.34		2.14		-14.37
Rcf		1.17		1.20		1.28		1.17		1.19		1.17		1.28		1.17
Fncf (ksi)		37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.45046	-0.157817	-19.48524	-7.909341	-23.19755	-0.518609	-14.07365	-7.287752	-18.97325	-4.152817	-16.30223	-6.261848	-23.07065	1.3529882	-14.22	-10.52
Fs (ksi)	-16.45	-0.16	-19.49	-7.91	-23.20	-0.52	-14.07	-7.29	-18.97	-4.15	-16.30	-6.26	-23.07	1.35	-14.22	-10.52
Fs (kip)	-1480.54	-14.20	-1753.67	-711.84	-2087.78	-46.67	-1266.63	-655.90	-1707.59	-373.75	-1467.20	-563.57	-2076.36	121.77	-1279.72	-946.84

Vu (kip)	369.16	471.19	533.90	341.98	439.82	400.12	522.47	362.82	270.33	341.75	386.72	251.00	320.25	291.54	378.64	265.18
Vuw (kip)	553.75	706.79	800.84	512.97	659.73	600.19	783.70	544.23	---	---	---	---	---	---	---	---
Mv (k*ft)	311.48	397.57	450.48	288.54	371.10	337.60	440.83	306.13	152.06	192.23	217.53	141.19	180.14	163.99	212.99	149.16
Huw (kip)	-1237.48	-1690.91	-1374.60	-1579.73	-1476.00	-1560.14	-1259.84	-1793.22	-548.07	-904.02	-782.63	-704.93	-763.16	-744.61	-716.68	-816.40
Muw (k*ft)									358.44	254.67	498.94	149.29	326.05	220.89	537.32	81.37
Mu (k*ft)	311.48	397.57	450.48	288.54	371.10	337.60	440.83	306.13	510.50	446.90	716.47	290.48	506.19	384.88	750.31	230.53

Muw (k*ft)	825.01	563.32	887.64	596.85	688.50	609.91	960.20	454.82	Iterations matching the Muw results
Pu (add)	196.04	133.86	210.92	141.83	163.60	144.93	228.17	108.00	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

4%	3%	5%	3%	4%	3%	5%	2%	percentage increase in flange force	5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.87	21.68	17.62	20.25	18.92	20.00	16.15	22.99	7.03	11.59	10.03	9.04	9.78	9.55	9.19	10.47
PY1 (Vuw)	7.10	9.06	10.27	6.58	8.46	7.69	10.05	6.98	3.47	4.38	4.96	3.22	4.11	3.74	4.85	3.40
PX2 (Mu)	5.67	7.23	8.19	5.25	6.75	6.14	8.02	5.57	9.29	8.13	13.03	5.28	9.21	7.00	13.65	4.19
PY2 (Mu)	2.36	3.01	3.41	2.19	2.81	2.56	3.34	2.32	3.87	3.39	5.43	2.20	3.84	2.92	5.69	1.75
Pu (kip)	23.52	31.33	29.22	26.96	28.04	28.08	27.63	30.03	17.89	21.19	25.30	15.31	20.58	17.83	25.15	15.54

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	21.76	29.14	26.41	25.44	25.95	26.26	24.80	28.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.33	15.66	OK	25.30	12.65	OK

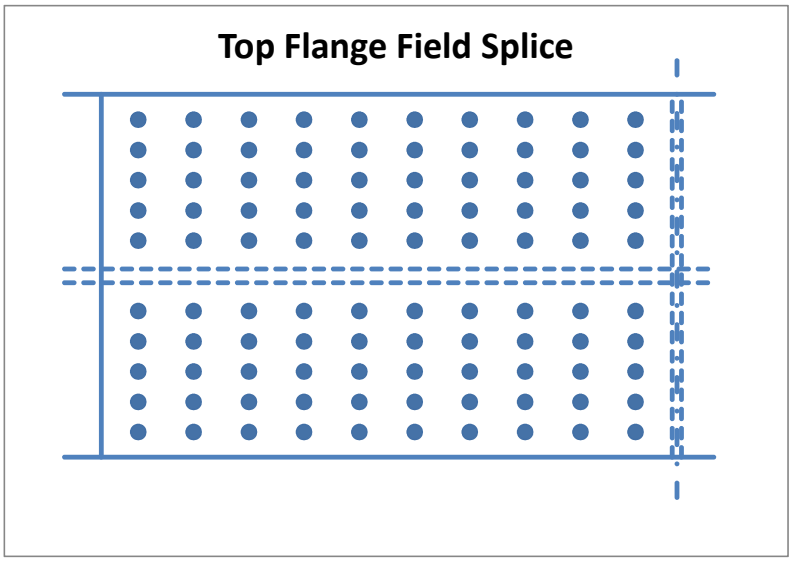
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.33	1.47	126.02	OK
Web SPL	15.66	1.47	91.65	OK

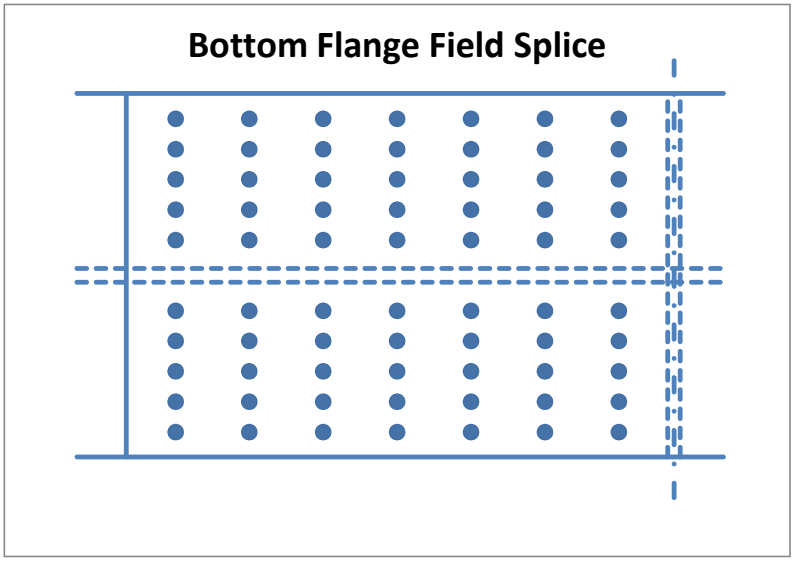
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1422	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1422

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	19	0	19
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	19	3	19
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	19	6	19
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	19	9	19
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	19	12	19
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	19	15	19
15	22	15	22
15	25	15	25
15	28	15	28

	Top Flange		Bottom Flange	
No. Bolts =	100.0		70.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





15	31	15	31
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	19	18	19
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
21	0		
21	3		
21	6		
21	9		
21	12		
21	19		
21	22		
21	25		
21	28		
21	31		
24	0		
24	3		
24	6		
24	9		
24	12		
24	19		
24	22		
24	25		
24	28		
24	31		
27	0		
27	3		
27	6		
27	9		
27	12		
27	19		
27	22		
27	25		
27	28		
27	31		

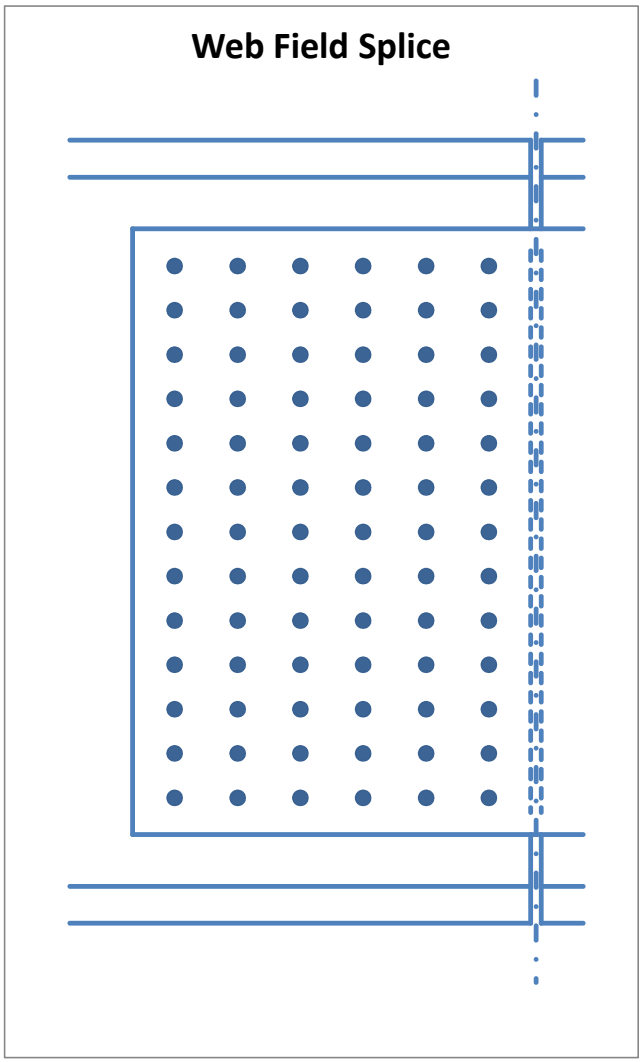
Flange Bolt Pattern Cont. - Node 1422

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1422	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1422

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	56.25	324
0	3	56.25	225
0	6	56.25	144
0	9	56.25	81
0	12	56.25	36
0	15	56.25	9
0	18	56.25	0
0	21	56.25	9
0	24	56.25	36
0	27	56.25	81
0	30	56.25	144
0	33	56.25	225
0	36	56.25	324
3	0	20.25	324
3	3	20.25	225
3	6	20.25	144
3	9	20.25	81
3	12	20.25	36
3	15	20.25	9
3	18	20.25	0
3	21	20.25	9
3	24	20.25	36
3	27	20.25	81
3	30	20.25	144
3	33	20.25	225
3	36	20.25	324
6	0	2.25	324
6	3	2.25	225
6	6	2.25	144
6	9	2.25	81
6	12	2.25	36
6	15	2.25	9
6	18	2.25	0
6	21	2.25	9
6	24	2.25	36
6	27	2.25	81
6	30	2.25	144
6	33	2.25	225
6	36	2.25	324
9	0	2.25	324
9	3	2.25	225
9	6	2.25	144
9	9	2.25	81
9	12	2.25	36
9	15	2.25	9
9	18	2.25	0
9	21	2.25	9
9	24	2.25	36
9	27	2.25	81
9	30	2.25	144
9	33	2.25	225
9	36	2.25	324
12	0	20.25	324
12	3	20.25	225
12	6	20.25	144
12	9	20.25	81
12	12	20.25	36
12	15	20.25	9
12	18	20.25	0

No. Bolts =	78.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	5.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	7.5	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2047.5	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	9828	
Σd^2 (in^2) =	11875.5	



12	21	20.25	9
12	24	20.25	36
12	27	20.25	81
12	30	20.25	144
12	33	20.25	225
12	36	20.25	324
15	0	56.25	324
15	3	56.25	225
15	6	56.25	144
15	9	56.25	81
15	12	56.25	36
15	15	56.25	9
15	18	56.25	0
15	21	56.25	9
15	24	56.25	36
15	27	56.25	81
15	30	56.25	144
15	33	56.25	225
15	36	56.25	324

Web Bolt Pattern Cont. - Node 1422

Web Bolt Pattern Cont. - Node 1422

585	1404	2047.5	9828

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3422	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3422

Node 3422

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3422 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
3422 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 3422 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.07	-2.29	-31.31	-15.63	-36.67	-3.57	-22.84	-11.56	-36.16	-15.20	-28.94	-14.23	-36.12	3.41	-24.00	-16.63
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.52	0.05	0.63	0.31	0.73	0.07	0.46	0.23	0.72	0.30	0.58	0.28	0.72	0.07	0.48	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.07		-31.31		-36.67		-22.84		-36.16		-28.94		-36.12		-24.00	
Fcf (ksi)	-38.03		-40.66		-43.34		-37.50		-43.08		-39.47		-43.06		-37.50	
Fcf (kip)	-3423.15		-3659.14		-3900.26		-3375.00		-3877.42		-3552.37		-3875.40		-3375.00	
fncf (ksi)		-2.29		-15.63		-3.57		-11.56		-15.20		-14.23		3.41		-16.63
Rcf		1.04		1.11		1.18		1.02		1.17		1.08		1.17		1.02
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.52	-1.45	-22.96	-11.13	-27.18	-2.20	-16.90	-8.34	-26.61	-10.63	-21.22	-10.11	-26.83	2.98	-17.65	-11.99
Fs (ksi)	-19.52	-1.45	-22.96	-11.13	-27.18	-2.20	-16.90	-8.34	-26.61	-10.63	-21.22	-10.11	-26.83	2.98	-17.65	-11.99
Fs (kip)	-1757.14	-130.73	-2066.52	-1002.06	-2445.89	-197.96	-1520.64	-750.26	-2394.63	-956.55	-1909.64	-910.30	-2414.83	268.40	-1588.64	-1078.69

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2825.46	0.00	268.40
Comp	4104.42	3579.16	2445.89	1078.69

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	410.51	490.23	558.90	390.44	476.37	436.55	547.12	407.24	299.03	355.10	403.87	284.59	345.56	317.17	395.55	296.46
Vuw (kip)	615.77	735.35	838.35	585.66	714.56	654.83	820.69	610.86	---	---	---	---	---	---	---	---
Mv (k*ft)	346.37	413.63	471.57	329.43	401.94	368.34	461.64	343.61	168.21	199.74	227.18	160.08	194.38	178.41	222.50	166.76
Huw (kip)	-1333.37	-1913.41	-1569.38	-1627.55	-2011.11	-1807.97	-1288.73	-1798.60	-692.22	-1125.14	-969.41	-832.66	-1228.77	-1033.98	-787.02	-978.02
Muw (k*ft)	784.63	513.31	860.54	564.97	554.89	531.40	1035.49	450.93	397.57	260.20	549.49	188.31	351.53	244.28	655.90	124.65
Mu (k*ft)	1131.00	926.94	1332.12	894.40	956.82	899.74	1497.12	794.54	565.77	459.94	776.67	348.40	545.91	422.69	878.40	291.41

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.09	24.53	20.12	20.87	25.78	23.18	16.52	23.06	8.87	14.42	12.43	10.68	15.75	13.26	10.09	12.54
PY1 (Vuw)	7.89	9.43	10.75	7.51	9.16	8.40	10.52	7.83	3.83	4.55	5.18	3.65	4.43	4.07	5.07	3.80
PX2 (Mu)	20.57	16.86	24.23	16.27	17.40	16.37	27.23	14.45	10.29	8.37	14.13	6.34	9.93	7.69	15.98	5.30
PY2 (Mu)	8.57	7.02	10.10	6.78	7.25	6.82	11.35	6.02	4.29	3.49	5.89	2.64	4.14	3.20	6.66	2.21
Pu (kip)	41.11	44.54	49.00	39.79	46.20	42.37	48.91	39.99	20.82	24.17	28.77	18.14	27.07	22.17	28.58	18.82

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1425.69	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1399.77	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2052.21	2227.50	OK
TF Inside	2052.21	2227.50	OK
BF Inside	1806.00	1856.25	OK
BF Outside	1773.16	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.48	43.19	47.67	39.00	45.02	41.32	47.78	38.95
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	838.35
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2052.21	20.52	OK	1222.94	12.23	OK
BF	1806.00	25.80	OK	544.29	7.78	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2052.21	20.52	1.47	126.02	OK
TF	4104.42	41.04	1.47	229.13	OK
TF Inside	2052.21	20.52	1.47	137.48	OK
BF Inside	1806.00	25.80	1.47	114.56	OK
BF	3579.16	51.13	1.47	229.13	OK
BF Outside	1773.16	25.33	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.00	24.50	OK	28.77	14.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.00	1.47	126.02	OK
Web SPL	24.50	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.09
TF Inside	NA	1.09
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.62	1.38	5.58
Web	2.20	1.28	3.84
BF	1.28	2.16	4.07

Plate	Shear	Flexure
Web	1.96	1.64

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 3422**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.60	-2.13	-27.74	-12.93	-33.37	-2.11	-21.91	-11.26	-28.14	-8.34	-24.43	-10.53	-33.11	0.60	-22.30	-15.33
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.49	0.04	0.55	0.26	0.67	0.04	0.44	0.23	0.56	0.17	0.49	0.21	0.66	0.01	0.45	0.31
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.60		-27.74		-33.37		-21.91		-28.14		-24.43		-33.11		-22.30	
Fcf (ksi)	-37.50		-38.87		-41.69		-37.50		-39.07		-37.50		-41.56		-37.50	
Fcf (kip)	-3375.00		-3498.52		-3751.74		-3375.00		-3516.23		-3375.00		-3740.16		-3375.00	
fncf (ksi)		-2.13		-12.93		-2.11		-11.26		-8.34		-10.53		0.60		-15.33
Rcf		1.12		1.16		1.25		1.12		1.17		1.12		1.25		1.12
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.94383	-1.675592	-20.12935	-9.482063	-24.14444	-1.659425	-16.00601	-8.300317	-20.44685	-6.062406	-17.78713	-7.791164	-23.96271	0.2565519	-16.28	-11.18
Fs (ksi)	-17.94	-1.68	-20.13	-9.48	-24.14	-1.66	-16.01	-8.30	-20.45	-6.06	-17.79	-7.79	-23.96	0.26	-16.28	-11.18
Fs (kip)	-1614.94	-150.80	-1811.64	-853.39	-2173.00	-149.35	-1440.54	-747.03	-1840.22	-545.62	-1600.84	-701.20	-2156.64	23.09	-1465.13	-1006.06

Vu (kip)	410.51	490.23	558.90	390.44	476.37	436.55	547.12	407.24	299.03	355.10	403.87	284.59	345.56	317.17	395.55	296.46
Vuw (kip)	615.77	735.35	838.35	585.66	714.56	654.83	820.69	610.86	---	---	---	---	---	---	---	---
Mv (k*ft)	346.37	413.63	471.57	329.43	401.94	368.34	461.64	343.61	168.21	199.74	227.18	160.08	194.38	178.41	222.50	166.76
Huw (kip)	-1316.51	-1779.73	-1462.52	-1654.87	-1611.48	-1628.15	-1346.57	-1805.93	-647.44	-977.18	-851.53	-802.11	-874.81	-844.08	-782.30	-906.10
Muw (k*ft)									357.90	234.24	494.67	169.53	316.46	219.91	532.82	112.22
Mu (k*ft)	346.37	413.63	471.57	329.43	401.94	368.34	461.64	343.61	526.11	433.98	721.85	329.61	510.84	398.32	755.32	278.98

Muw (k*ft)	772.33	523.90	859.17	546.75	644.73	564.57	930.81	446.05	formulas matching the Muw results
Pu (add)	183.52	124.49	204.16	129.92	153.20	134.16	221.18	105.99	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

4% 3% 5% 3% 3% 3% 5% 2% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.88	22.82	18.75	21.22	20.66	20.87	17.26	23.15	8.30	12.53	10.92	10.28	11.22	10.82	10.03	11.62
PY1 (Vuw)	7.89	9.43	10.75	7.51	9.16	8.40	10.52	7.83	3.83	4.55	5.18	3.65	4.43	4.07	5.07	3.80
PX2 (Mu)	6.30	7.52	8.58	5.99	7.31	6.70	8.40	6.25	9.57	7.89	13.13	6.00	9.29	7.24	13.74	5.07
PY2 (Mu)	2.63	3.13	3.57	2.50	3.05	2.79	3.50	2.60	3.99	3.29	5.47	2.50	3.87	3.02	5.72	2.11
Pu (kip)	25.45	32.84	30.85	28.99	30.52	29.76	29.24	31.20	19.51	21.88	26.30	17.40	22.12	19.41	26.10	17.71

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	23.47	30.56	27.93	27.24	28.26	27.74	26.31	29.38
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.84	16.42	OK	26.30	13.15	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.84	1.47	126.02	OK
Web SPL	16.42	1.47	91.65	OK

Field Splice - Node 5422

Node 5422

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5422 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
5422 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 5422 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.19	-2.62	-29.78	-15.07	-35.52	-3.07	-23.76	-11.01	-33.43	-16.20	-30.41	-13.06	-34.77	1.20	-24.95	-16.63
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.52	0.05	0.60	0.30	0.71	0.06	0.48	0.22	0.67	0.32	0.61	0.26	0.70	0.02	0.50	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.19		-29.78		-35.52		-23.76		-33.43		-30.41		-34.77		-24.95	
Fcf (ksi)	-38.09		-39.89		-42.76		-37.50		-41.71		-40.20		-42.39		-37.50	
Fcf (kip)	-3428.40		-3590.27		-3848.48		-3375.00		-3754.30		-3618.40		-3814.66		-3375.00	
fncf (ksi)		-2.62		-15.07		-3.07		-11.01		-16.20		-13.06		1.20		-16.63
Rcf		1.07		1.12		1.20		1.06		1.17		1.13		1.19		1.06
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.58	-1.69	-21.85	-10.70	-26.33	-1.85	-17.56	-7.87	-24.59	-11.39	-22.32	-9.23	-25.85	1.38	-18.32	-11.92
Fs (ksi)	-19.58	-1.69	-21.85	-10.70	-26.33	-1.85	-17.56	-7.87	-24.59	-11.39	-22.32	-9.23	-25.85	1.38	-18.32	-11.92
Fs (kip)	-1762.26	-152.01	-1966.12	-963.13	-2369.75	-166.78	-1580.19	-708.45	-2212.86	-1025.48	-2009.17	-830.90	-2326.47	123.93	-1648.67	-1072.46

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2822.19	0.00	123.93
Comp	4047.40	3573.93	2369.75	1072.46

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	420.26	494.15	565.12	402.77	469.23	448.81	551.27	421.39	305.86	357.90	408.21	293.34	340.46	325.86	398.42	306.50
Vuw (kip)	630.39	741.23	847.68	604.16	703.85	673.21	826.91	632.09	---	---	---	---	---	---	---	---
Mv (k*ft)	354.59	416.94	476.82	339.84	395.92	378.68	465.13	355.55	172.04	201.32	229.62	165.00	191.51	183.30	224.11	172.40
Huw (kip)	-1349.87	-1874.81	-1533.18	-1621.17	-2004.48	-1814.72	-1351.56	-1816.81	-701.90	-1074.06	-930.06	-839.17	-1187.39	-1041.36	-807.60	-997.75
Muw (k*ft)	776.19	505.37	859.36	569.22	499.12	559.19	963.90	438.79	393.62	245.17	538.50	213.09	290.25	288.02	598.99	140.85
Mu (k*ft)	1130.79	922.31	1336.18	909.06	895.03	937.87	1429.04	794.34	565.66	446.50	768.12	378.10	481.76	471.32	823.10	313.26

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.31	24.04	19.66	20.78	25.70	23.27	17.33	23.29	9.00	13.77	11.92	10.76	15.22	13.35	10.35	12.79
PY1 (Vuw)	8.08	9.50	10.87	7.75	9.02	8.63	10.60	8.10	3.92	4.59	5.23	3.76	4.36	4.18	5.11	3.93
PX2 (Mu)	20.57	16.78	24.30	16.53	16.28	17.06	25.99	14.45	10.29	8.12	13.97	6.88	8.76	8.57	14.97	5.70
PY2 (Mu)	8.57	6.99	10.13	6.89	6.78	7.11	10.83	6.02	4.29	3.38	5.82	2.87	3.65	3.57	6.24	2.37
Pu (kip)	41.37	44.02	48.72	40.09	44.86	43.29	48.33	40.30	20.96	23.30	28.16	18.84	25.29	23.25	27.75	19.53

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1424.04	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1398.15	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2023.70	2227.50	OK
TF Inside	2023.70	2227.50	OK
BF Inside	1803.36	1856.25	OK
BF Outside	1770.57	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.68	42.62	47.31	39.24	43.61	42.22	47.09	39.17
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	847.68
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2023.70	20.24	OK	1184.87	11.85	OK
BF	1803.36	25.76	OK	541.15	7.73	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2023.70	20.24	1.47	126.02	OK
TF	4047.40	40.47	1.47	229.13	OK
TF Inside	2023.70	20.24	1.47	137.48	OK
BF Inside	1803.36	25.76	1.47	114.56	OK
BF	3573.93	51.06	1.47	229.13	OK
BF Outside	1770.57	25.29	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.72	24.36	OK	28.16	14.08	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.72	1.47	126.02	OK
Web SPL	24.36	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.64	1.42	5.66
Web	2.17	1.27	3.78
BF	1.28	2.18	4.08

Plate	Shear	Flexure
Web	1.93	1.61

The HNTB Companies Engineers Architects Planners	Made WME	Date 8/5/2011	Job Number 49633
	Checked MTB	Date 8/5/2011	
For **Cleveland InnerBelt : Field Splice - Node 5422**	Backchk'd WME	Date 8/5/2011	Sheet No.

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.10	-2.84	-27.81	-13.91	-33.71	-3.06	-22.79	-10.74	-26.93	-10.66	-25.71	-9.33	-33.37	0.00	-23.20	-15.35
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.50	0.06	0.56	0.28	0.67	0.06	0.46	0.21	0.54	0.21	0.51	0.19	0.67	0.00	0.46	0.31
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.10		-27.81		-33.71		-22.79		-26.93		-25.71		-33.37		-23.20	
Fcf (ksi)	-37.55		-38.91		-41.86		-37.50		-38.46		-37.86		-41.69		-37.50	
Fcf (kip)	-3379.57		-3501.46		-3767.07		-3375.00		-3461.77		-3407.09		-3751.70		-3375.00	
fncf (ksi)		-2.84		-13.91		-3.06		-10.74		-10.66		-9.33		0.00		-15.35
Rcf		1.11		1.15		1.24		1.11		1.14		1.12		1.24		1.11
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.29969	-2.193043	-20.17694	-10.14451	-24.38349	-2.348205	-16.62787	-7.908193	-19.59014	-7.713258	-18.69526	-6.909484	-24.14223	-0.183742	-16.92	-11.16
Fs (ksi)	-18.30	-2.19	-20.18	-10.14	-24.38	-2.35	-16.63	-7.91	-19.59	-7.71	-18.70	-6.91	-24.14	-0.18	-16.92	-11.16
Fs (kip)	-1646.97	-197.37	-1815.92	-913.01	-2194.51	-211.34	-1496.51	-711.74	-1763.11	-694.19	-1682.57	-621.85	-2172.80	-16.54	-1523.02	-1004.29

Vu (kip)	420.26	494.15	565.12	402.77	469.23	448.81	551.27	421.39	305.86	357.90	408.21	293.34	340.46	325.86	398.42	306.50
Vuw (kip)	630.39	741.23	847.68	604.16	703.85	673.21	826.91	632.09	---	---	---	---	---	---	---	---
Mv (k*ft)	354.59	416.94	476.82	339.84	395.92	378.68	465.13	355.55	172.04	201.32	229.62	165.00	191.51	183.30	224.11	172.40
Huw (kip)	-1343.73	-1813.60	-1506.80	-1631.91	-1670.59	-1595.05	-1375.64	-1800.80	-676.26	-1000.61	-882.15	-809.69	-901.01	-844.96	-802.76	-926.68
Muw (k*ft)									354.35	220.71	484.78	191.83	261.29	259.29	527.09	126.80
Mu (k*ft)	354.59	416.94	476.82	339.84	395.92	378.68	465.13	355.55	526.39	422.03	714.39	356.84	452.80	442.59	751.20	299.20

Muw (k*ft)	756.42	502.76	837.15	562.06	578.69	602.32	917.07	449.47	formulas matching the Muw results
Pu (add)	179.74	119.47	198.93	133.56	137.51	143.13	217.92	106.80	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

4%	3%	4%	3%	3%	3%	5%	2%	percentage increase in flange force	5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.23	23.25	19.32	20.92	21.42	20.45	17.64	23.09	8.67	12.83	11.31	10.38	11.55	10.83	10.29	11.88
PY1 (Vuw)	8.08	9.50	10.87	7.75	9.02	8.63	10.60	8.10	3.92	4.59	5.23	3.76	4.36	4.18	5.11	3.93
PX2 (Mu)	6.45	7.58	8.67	6.18	7.20	6.89	8.46	6.47	9.57	7.68	12.99	6.49	8.24	8.05	13.66	5.44
PY2 (Mu)	2.69	3.16	3.61	2.58	3.00	2.87	3.53	2.69	3.99	3.20	5.41	2.70	3.43	3.35	5.69	2.27
Pu (kip)	26.01	33.33	31.51	29.00	31.04	29.66	29.67	31.47	19.89	21.93	26.53	18.07	21.27	20.33	26.28	18.40

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	23.98	31.05	28.59	27.18	28.85	27.56	26.74	29.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.33	16.67	OK	26.53	13.27	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.33	1.47	126.02	OK
Web SPL	16.67	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type BB

Field Splice - Node 7422

Node 7422

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7422 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
7422 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 7422 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.74	-2.61	-30.00	-13.12	-35.00	-1.59	-24.28	-11.52	-31.53	-14.30	-34.37	-12.81	-34.88	1.87	-23.61	-14.98
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.05	0.60	0.26	0.70	0.03	0.49	0.23	0.63	0.29	0.69	0.26	0.70	0.04	0.47	0.30
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.74		-30.00		-35.00		-24.28		-31.53		-34.37		-34.88		-23.61	
Fcf (ksi)	-38.37		-40.00		-42.50		-37.50		-40.76		-42.19		-42.44		-37.50	
Fcf (kip)	-3453.38		-3600.01		-3824.99		-3375.00		-3668.79		-3796.84		-3819.67		-3375.00	
fncf (ksi)		-2.61		-13.12		-1.59		-11.52		-14.30		-12.81		1.87		-14.98
Rcf		1.10		1.14		1.21		1.07		1.16		1.21		1.21		1.07
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.98	-1.67	-22.06	-9.25	-25.85	-0.65	-17.93	-8.18	-23.24	-10.05	-25.24	-8.95	-25.94	1.84	-17.39	-10.69
Fs (ksi)	-19.98	-1.67	-22.06	-9.25	-25.85	-0.65	-17.93	-8.18	-23.24	-10.05	-25.24	-8.95	-25.94	1.84	-17.39	-10.69
Fs (kip)	-1798.20	-149.97	-1985.82	-832.77	-2326.21	-58.64	-1613.54	-736.00	-2091.78	-904.18	-2271.27	-805.89	-2334.65	165.73	-1564.90	-962.19

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2826.97	0.00	165.73
Comp	4042.36	3579.66	2334.65	962.19

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	415.82	499.94	566.05	399.11	445.65	485.91	553.76	416.61	302.92	362.32	409.06	291.08	324.00	352.41	400.38	303.45
Vuw (kip)	623.73	749.90	849.07	598.67	668.48	728.86	830.64	624.92	---	---	---	---	---	---	---	---
Mv (k*ft)	350.85	421.82	477.60	336.75	376.02	409.98	467.24	351.52	170.39	203.80	230.09	163.73	182.25	198.23	225.21	170.69
Huw (kip)	-1360.74	-1814.67	-1466.08	-1644.92	-1894.97	-1901.65	-1325.58	-1767.11	-714.33	-1033.48	-874.44	-861.50	-1098.52	-1128.29	-795.27	-926.60
Muw (k*ft)	781.16	550.23	892.61	553.39	530.32	588.46	983.68	471.93	402.90	281.86	554.29	214.51	290.30	358.20	611.20	147.33
Mu (k*ft)	1132.01	972.05	1370.21	890.14	906.34	998.45	1450.91	823.44	573.29	485.66	784.39	378.24	472.55	556.43	836.41	318.02

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7422	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.45	23.26	18.80	21.09	24.29	24.38	16.99	22.66	9.16	13.25	11.21	11.04	14.08	14.47	10.20	11.88
PY1 (Vuw)	8.00	9.61	10.89	7.68	8.57	9.34	10.65	8.01	3.88	4.65	5.24	3.73	4.15	4.52	5.13	3.89
PX2 (Mu)	20.59	17.68	24.92	16.19	16.49	18.16	26.39	14.98	10.43	8.83	14.27	6.88	8.60	10.12	15.21	5.78
PY2 (Mu)	8.58	7.37	10.38	6.75	6.87	7.57	11.00	6.24	4.34	3.68	5.94	2.87	3.58	4.22	6.34	2.41
Pu (kip)	41.49	44.33	48.62	39.97	43.60	45.78	48.48	40.24	21.24	23.60	27.83	19.10	23.96	26.09	27.88	18.75

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1426.45	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1400.51	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2021.18	2227.50	OK
TF Inside	2021.18	2227.50	OK
BF Inside	1806.25	1856.25	OK
BF Outside	1773.41	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.84	42.95	47.22	39.12	42.52	44.57	47.24	39.18
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	849.07
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2021.18	20.21	OK	1167.33	11.67	OK
BF	1806.25	25.80	OK	485.51	6.94	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2021.18	20.21	1.47	126.02	OK
TF	4042.36	40.42	1.47	229.13	OK
TF Inside	2021.18	20.21	1.47	137.48	OK
BF Inside	1806.25	25.80	1.47	114.56	OK
BF	3579.66	51.14	1.47	229.13	OK
BF Outside	1773.41	25.33	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.62	24.31	OK	27.88	13.94	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.62	1.47	126.02	OK
Web SPL	24.31	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.64	1.44	5.67
Web	2.20	1.26	3.83
BF	1.28	2.43	4.07

Plate	Shear	Flexure
Web	1.93	1.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.90	-2.11	-28.37	-12.42	-33.76	-2.20	-22.52	-10.47	-25.28	-9.01	-28.68	-8.31	-33.50	0.69	-22.92	-14.76
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.50	0.04	0.57	0.25	0.68	0.04	0.45	0.21	0.51	0.18	0.57	0.17	0.67	0.01	0.46	0.30
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.90		-28.37		-33.76		-22.52		-25.28		-28.68		-33.50		-22.92	
Fcf (ksi)	-37.50		-39.18		-41.88		-37.50		-37.64		-39.34		-41.75		-37.50	
Fcf (kip)	-3375.00		-3526.59		-3769.27		-3375.00		-3387.80		-3540.46		-3757.37		-3375.00	
fncf (ksi)		-2.11		-12.42		-2.20		-10.47		-9.01		-8.31		0.69		-14.76
Rcf		1.11		1.16		1.24		1.11		1.11		1.17		1.24		1.11
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.17024	-1.683753	-20.59067	-9.057122	-24.43217	-1.75072	-16.45837	-7.680726	-18.44292	-6.563841	-20.80838	-6.150839	-24.24525	0.2905575	-16.74	-10.71
Fs (ksi)	-18.17	-1.68	-20.59	-9.06	-24.43	-1.75	-16.46	-7.68	-18.44	-6.56	-20.81	-6.15	-24.25	0.29	-16.74	-10.71
Fs (kip)	-1635.32	-151.54	-1853.16	-815.14	-2198.89	-157.56	-1481.25	-691.27	-1659.86	-590.75	-1872.75	-553.58	-2182.07	26.15	-1506.63	-964.06

Vu (kip)	415.82	499.94	566.05	399.11	445.65	485.91	553.76	416.61	302.92	362.32	409.06	291.08	324.00	352.41	400.38	303.45
Vuw (kip)	623.73	749.90	849.07	598.67	668.48	728.86	830.64	624.92	---	---	---	---	---	---	---	---
Mv (k*ft)	350.85	421.82	477.60	336.75	376.02	409.98	467.24	351.52	170.39	203.80	230.09	163.73	182.25	198.23	225.21	170.69
Huw (kip)	-1314.75	-1768.82	-1472.23	-1621.38	-1573.88	-1617.61	-1349.68	-1778.63	-655.18	-978.38	-864.04	-796.59	-825.22	-889.65	-790.50	-905.92
Muw (k*ft)									362.70	253.74	498.99	193.11	261.34	322.47	539.79	132.63
Mu (k*ft)	350.85	421.82	477.60	336.75	376.02	409.98	467.24	351.52	533.09	457.54	729.09	356.84	443.59	520.69	765.00	303.32
Muw (k*ft)	773.50	544.90	861.27	569.08	607.01	652.48	887.15	484.25								
Pu (add)	183.80	129.48	204.66	135.23	144.24	155.05	222.69	110.32								

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forces matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

4% 3% 5% 3% 3% 3% 5% 2% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.86	22.68	18.87	20.79	20.18	20.74	17.30	22.80	8.40	12.54	11.08	10.21	10.58	11.41	10.13	11.61
PY1 (Vuw)	8.00	9.61	10.89	7.68	8.57	9.34	10.65	8.01	3.88	4.65	5.24	3.73	4.15	4.52	5.13	3.89
PX2 (Mu)	6.38	7.67	8.69	6.13	6.84	7.46	8.50	6.39	9.70	8.32	13.26	6.49	8.07	9.47	13.91	5.52
PY2 (Mu)	2.66	3.20	3.62	2.55	2.85	3.11	3.54	2.66	4.04	3.47	5.53	2.70	3.36	3.95	5.80	2.30
Pu (kip)	25.56	32.94	31.15	28.79	29.33	30.82	29.45	31.09	19.75	22.39	26.61	17.90	20.11	22.53	26.42	18.21

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	23.55	30.60	28.18	26.98	27.25	28.51	26.47	29.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.94	16.47	OK	26.61	13.31	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.94	1.47	126.02	OK
Web SPL	16.47	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9422

Node 9422

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9422 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
9422 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 9422 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.37	2.96	-29.41	-9.65	-34.85	0.49	-23.92	-9.35	-31.25	-13.22	-33.33	-10.24	-34.77	4.00	-22.40	-14.13
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.06	0.59	0.19	0.70	0.01	0.48	0.19	0.62	0.26	0.67	0.20	0.70	0.08	0.45	0.28
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.37		-29.41		-34.85		-23.92		-31.25		-33.33		-34.77		-22.40	
Fcf (ksi)	-38.18		-39.71		-42.42		-37.50		-40.62		-41.66		-42.39		-37.50	
Fcf (kip)	-3436.53		-3573.66		-3818.13		-3375.00		-3656.14		-3749.68		-3814.70		-3375.00	
fncf (ksi)		2.96		-9.65		0.49		-9.35		-13.22		-10.24		4.00		-14.13
Rcf		1.10		1.14		1.22		1.08		1.17		1.20		1.22		1.08
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2604.28		-3375.00		2604.28		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.75	2.41	-21.76	-6.71	-25.84	0.71	-17.83	-7.16	-23.08	-9.27	-24.58	-7.07	-25.79	3.24	-16.58	-10.06
Fs (ksi)	-19.75	2.41	-21.76	-6.71	-25.84	0.71	-17.83	-7.16	-23.08	-9.27	-24.58	-7.07	-25.79	3.24	-16.58	-10.06
Fs (kip)	-1777.77	216.53	-1957.97	-604.16	-2325.45	63.83	-1604.99	-644.37	-2077.34	-833.90	-2211.89	-636.49	-2320.67	291.49	-1492.42	-905.37

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2836.18	0.00	291.49
Comp	4046.60	3543.02	2325.45	905.37

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	386.64	497.95	555.75	368.10	428.10	467.95	542.51	391.12	282.96	361.99	402.83	270.60	312.25	340.80	393.09	286.52
Vuw (kip)	579.96	746.92	833.62	552.14	642.15	701.93	813.77	586.68	---	---	---	---	---	---	---	---
Mv (k*ft)	326.23	420.14	468.91	310.58	361.21	394.83	457.75	330.01	159.16	203.62	226.59	152.21	175.64	191.70	221.11	161.16
Huw (kip)	-1153.07	-1673.22	-1380.47	-1569.39	-1849.20	-1778.92	-1238.03	-1739.19	-572.45	-939.45	-829.26	-824.77	-1067.45	-1044.41	-744.03	-879.19
Muw (k*ft)	911.37	631.64	946.33	603.74	554.65	647.23	1039.61	490.54	487.49	330.93	584.05	234.82	303.95	385.10	638.53	143.50
Mu (k*ft)	1237.59	1051.78	1415.24	914.32	915.86	1042.06	1497.36	820.55	646.66	534.55	810.64	387.03	479.59	576.80	859.64	304.67

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.78	21.45	17.70	20.12	23.71	22.81	15.87	22.30	7.34	12.04	10.63	10.57	13.69	13.39	9.54	11.27
PY1 (Vuw)	7.44	9.58	10.69	7.08	8.23	9.00	10.43	7.52	3.63	4.64	5.16	3.47	4.00	4.37	5.04	3.67
PX2 (Mu)	22.51	19.13	25.74	16.63	16.66	18.95	27.23	14.92	11.76	9.72	14.74	7.04	8.72	10.49	15.64	5.54
PY2 (Mu)	9.38	7.97	10.73	6.93	6.94	7.90	11.35	6.22	4.90	4.05	6.14	2.93	3.63	4.37	6.51	2.31
Pu (kip)	40.91	44.21	48.43	39.33	43.12	45.05	48.30	39.68	20.92	23.44	27.78	18.74	23.67	25.43	27.70	17.85

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1431.10	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1405.08	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2023.30	2227.50	OK
TF Inside	2023.30	2227.50	OK
BF Inside	1787.76	1856.25	OK
BF Outside	1755.26	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.57	42.93	47.14	38.72	42.16	44.01	47.17	38.78
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	833.62
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9422**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2023.30	20.23	OK	1162.73	11.63	OK
BF	1787.76	25.54	OK	456.84	6.53	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2023.30	20.23	1.47	126.02	OK
TF	4046.60	40.47	1.47	229.13	OK
TF Inside	2023.30	20.23	1.47	137.48	OK
BF Inside	1787.76	25.54	1.47	114.56	OK
BF	3543.02	50.61	1.47	229.13	OK
BF Outside	1755.26	25.08	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.43	24.22	OK	27.78	13.89	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.43	1.47	126.02	OK
Web SPL	24.22	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	1.02	1.04
BF Outside	1.06	1.04

Bolt	Shear	Slip	Bearing
TF	1.64	1.45	5.66
Web	2.28	1.29	3.96
BF	1.29	2.58	4.11

Plate	Shear	Flexure
Web	1.97	1.70

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.39	0.12	-28.41	-9.75	-33.06	-1.09	-21.05	-7.28	-24.12	-7.09	-27.41	-5.61	-32.90	2.32	-21.10	-13.29
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.47	0.00	0.57	0.19	0.66	0.02	0.42	0.15	0.48	0.14	0.55	0.11	0.66	0.05	0.42	0.27
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.39		-28.41		-33.06		-21.05		-24.12		-27.41		-32.90		-21.10	
Fcf (ksi)	-37.50		-39.21		-41.53		-37.50		-37.50		-38.71		-41.45		-37.50	
Fcf (kip)	-3375.00		-3528.57		-3737.87		-3375.00		-3375.00		-3483.63		-3730.63		-3375.00	
fncf (ksi)		0.12		-9.75		-1.09		-7.28		-7.09		-5.61		2.32		-13.29
Rcf		1.13		1.19		1.26		1.13		1.13		1.17		1.25		1.13
Fncf (ksi)		37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28		-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.13209	-0.111011	-20.67384	-7.132308	-23.95997	-1.018553	-15.38866	-5.780064	-17.64598	-5.208305	-19.96828	-4.210218	-23.85257	1.4412472	-15.51	-9.63
Fs (ksi)	-17.13	-0.11	-20.67	-7.13	-23.96	-1.02	-15.39	-5.78	-17.65	-5.21	-19.97	-4.21	-23.85	1.44	-15.51	-9.63
Fs (kip)	-1541.89	-9.99	-1860.65	-641.91	-2156.40	-91.67	-1384.98	-520.21	-1588.14	-468.75	-1797.15	-378.92	-2146.73	129.71	-1395.58	-867.10

Vu (kip)	386.64	497.95	555.75	368.10	428.10	467.95	542.51	391.12	282.96	361.99	402.83	270.60	312.25	340.80	393.09	286.52
Vuw (kip)	579.96	746.92	833.62	552.14	642.15	701.93	813.77	586.68	---	---	---	---	---	---	---	---
Mv (k*ft)	326.23	420.14	468.91	310.58	361.21	394.83	457.75	330.01	159.16	203.62	226.59	152.21	175.64	191.70	221.11	161.16
Huw (kip)	-1232.91	-1675.15	-1415.81	-1509.98	-1502.93	-1494.03	-1271.92	-1734.79	-569.02	-917.60	-824.29	-698.57	-754.19	-797.89	-739.57	-829.65
Muw (k*ft)									374.46	297.91	504.71	211.39	273.63	346.68	556.46	129.18
Mu (k*ft)	326.23	420.14	468.91	310.58	361.21	394.83	457.75	330.01	533.63	501.53	731.30	363.60	449.27	538.38	777.57	290.35

Muw (k*ft)	828.06	608.32	883.53	643.35	648.05	707.09	973.91	493.41	forces matching the Muw results
Pu (add)	196.77	144.55	209.95	152.87	153.99	168.02	231.90	117.26	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9422	Backchk'd	WME	Date	8/5/2011	Sheet No.	

4% 3% 5% 3% 3% 4% 5% 3% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.81	21.48	18.15	19.36	19.27	19.15	16.31	22.24	7.30	11.76	10.57	8.96	9.67	10.23	9.48	10.64
PY1 (Vuw)	7.44	9.58	10.69	7.08	8.23	9.00	10.43	7.52	3.63	4.64	5.16	3.47	4.00	4.37	5.04	3.67
PX2 (Mu)	5.93	7.64	8.53	5.65	6.57	7.18	8.33	6.00	9.71	9.12	13.30	6.61	8.17	9.79	14.14	5.28
PY2 (Mu)	2.47	3.18	3.55	2.35	2.74	2.99	3.47	2.50	4.04	3.80	5.54	2.76	3.40	4.08	5.89	2.20
Pu (kip)	23.89	31.79	30.24	26.73	28.07	28.94	28.28	29.97	18.65	22.53	26.16	16.77	19.32	21.73	26.03	16.97

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.02	29.43	27.31	25.07	26.06	26.68	25.31	28.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.79	15.90	OK	26.16	13.08	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.79	1.47	126.02	OK
Web SPL	15.90	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type BB

Field Splice - Node 1436

Node 1436

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1436 L	81.00	68.18	5522.41	81.00	69.30	5613.54	48.00	50.00	2400.00
1436 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 1436 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-34.54	-14.60	-25.43	2.80	-38.16	5.12	-21.93	-10.81	-27.25	-9.89	-37.21	-14.91	-23.90	-16.52	-38.01	7.87
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.69	0.29	0.51	0.06	0.76	0.10	0.44	0.22	0.54	0.20	0.74	0.30	0.48	0.33	0.76	0.16
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-34.54		-25.43		-38.16		-21.93		-27.25		-37.21		-23.90		-38.01	
Fcf (ksi)	-42.27		-37.71		-44.08		-37.50		-38.62		-43.60		-37.50		-44.01	
Fcf (kip)	-3804.11		-3394.26		-3967.27		-3375.00		-3476.22		-3924.42		-3375.00		-3960.57	
fncf (ksi)		-14.60		2.80		5.12		-10.81		-9.89		-14.91		-16.52		7.87
Rcf		1.11		1.00		1.16		1.00		1.01		1.14		1.00		1.15
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		2604.28		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.50	-10.42	-19.20	2.44	-28.36	4.25	-16.44	-7.89	-20.06	-6.67	-27.43	-10.60	-17.76	-11.99	-28.30	6.24
Fs (ksi)	-25.50	-10.42	-19.20	2.44	-28.36	4.25	-16.44	-7.89	-20.06	-6.67	-27.43	-10.60	-17.76	-11.99	-28.30	6.24
Fs (kip)	-2294.81	-937.72	-1727.71	219.86	-2552.28	382.33	-1479.71	-710.06	-1805.03	-599.88	-2468.50	-953.89	-1598.71	-1079.46	-2546.86	561.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2839.11	0.00	561.27
Comp	4195.40	3541.24	2552.28	1079.46

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	482.05	376.73	542.27	349.80	406.83	445.84	368.33	530.88	349.77	275.98	392.94	256.34	297.25	324.19	269.43	384.89
Vuw (kip)	723.07	565.09	813.40	524.70	610.24	668.76	552.50	796.32	---	---	---	---	---	---	---	---
Mv (k*ft)	406.73	317.86	457.54	295.14	343.26	376.18	310.78	447.93	196.75	155.24	221.03	144.19	167.20	182.36	151.55	216.50
Huw (kip)	-1928.57	-1152.06	-1259.34	-1594.08	-1604.82	-2001.33	-1782.74	-1152.54	-1185.26	-552.88	-795.65	-802.92	-881.80	-1254.88	-982.00	-728.05
Muw (k*ft)	574.08	891.38	1099.99	587.28	629.60	584.38	461.51	1167.92	331.73	476.07	717.35	188.14	294.59	370.24	126.93	759.76
Mu (k*ft)	980.80	1209.24	1557.53	882.43	972.86	960.56	772.29	1615.85	528.48	631.31	938.38	332.32	461.79	552.60	278.48	976.26

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.73	14.77	16.15	20.44	20.57	25.66	22.86	14.78	15.20	7.09	10.20	10.29	11.31	16.09	12.59	9.33
PY1 (Vuw)	9.27	7.24	10.43	6.73	7.82	8.57	7.08	10.21	4.48	3.54	5.04	3.29	3.81	4.16	3.45	4.93
PX2 (Mu)	17.84	21.99	28.33	16.05	17.70	17.47	14.05	29.39	9.61	11.48	17.07	6.04	8.40	10.05	5.07	17.76
PY2 (Mu)	7.43	9.16	11.80	6.69	7.37	7.28	5.85	12.25	4.01	4.78	7.11	2.52	3.50	4.19	2.11	7.40
Pu (kip)	45.72	40.26	49.72	38.87	41.18	45.95	39.10	49.55	26.22	20.35	29.85	17.34	21.02	27.44	18.51	29.77

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1432.58	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1406.53	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2097.70	2227.50	OK
TF Inside	2097.70	2227.50	OK
BF Inside	1786.86	1856.25	OK
BF Outside	1754.38	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.52	39.95	48.71	38.34	40.41	44.98	38.28	48.66
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	813.40
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2097.70	20.98	OK	1276.14	12.76	OK
BF	1786.86	25.53	OK	544.68	7.78	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2097.70	20.98	1.47	126.02	OK
TF	4195.40	41.95	1.47	229.13	OK
TF Inside	2097.70	20.98	1.47	137.48	OK
BF Inside	1786.86	25.53	1.47	114.56	OK
BF	3541.24	50.59	1.47	229.13	OK
BF Outside	1754.38	25.06	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.72	24.86	OK	29.85	14.93	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.72	1.47	126.02	OK
Web SPL	24.86	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.06
TF Inside	NA	1.06
BF Inside	1.02	1.04
BF Outside	1.06	1.04

Bolt	Shear	Slip	Bearing
TF	1.58	1.32	5.46
Web	2.32	1.29	4.04
BF	1.29	2.16	4.11

Plate	Shear	Flexure
Web	2.02	1.73

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1436**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.15	-9.33	-23.33	0.84	-33.00	0.16	-19.97	-9.46	-23.36	-6.97	-26.69	-5.63	-20.30	-13.33	-32.77	2.82
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.56	0.19	0.47	0.02	0.66	0.00	0.40	0.19	0.47	0.14	0.53	0.11	0.41	0.27	0.66	0.06
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-28.15		-23.33		-33.00		-19.97		-23.36		-26.69		-20.30		-32.77	
Fcf (ksi)	-39.08		-37.50		-41.50		-37.50		-37.50		-38.35		-37.50		-41.39	
Fcf (kip)	-3516.96		-3375.00		-3734.88		-3375.00		-3375.00		-3451.08		-3375.00		-3724.85	
fncf (ksi)		-9.33		0.84		0.16		-9.46		-6.97		-5.63		-13.33		2.82
Rcf		1.18		1.14		1.26		1.14		1.14		1.16		1.14		1.25
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		2604.28		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.4636	-6.889257	-17.09716	0.443716	-23.92943	-0.036568	-14.67981	-6.981362	-17.12389	-5.069292	-19.42922	-4.27921	-14.91216	-9.718334	-23.77	1.84
Fs (ksi)	-20.46	-6.89	-17.10	0.44	-23.93	-0.04	-14.68	-6.98	-17.12	-5.07	-19.43	-4.28	-14.91	-9.72	-23.77	1.84
Fs (kip)	-1841.72	-620.03	-1538.74	39.93	-2153.65	-3.29	-1321.18	-628.32	-1541.15	-456.24	-1748.63	-385.13	-1342.09	-874.65	-2139.48	165.80

Vu (kip)	482.05	376.73	542.27	349.80	406.83	445.84	368.33	530.88	349.77	275.98	392.94	256.34	297.25	324.19	269.43	384.89
Vuw (kip)	723.07	565.09	813.40	524.70	610.24	668.76	552.50	796.32	---	---	---	---	---	---	---	---
Mv (k*ft)	406.73	317.86	457.54	295.14	343.26	376.18	310.78	447.93	196.75	155.24	221.03	144.19	167.20	182.36	151.55	216.50
Huw (kip)	-1654.06	-1206.08	-1362.90	-1592.18	-1498.72	-1481.41	-1737.46	-1249.17	-902.64	-549.56	-790.88	-714.82	-732.37	-782.38	-812.81	-723.68
Muw (k*ft)									298.64	385.90	525.64	169.37	265.20	333.30	114.26	563.51
Mu (k*ft)	406.73	317.86	457.54	295.14	343.26	376.18	310.78	447.93	495.38	541.14	746.67	313.55	432.40	515.66	265.82	780.01
Muw (k*ft)	616.70	845.95	917.34	588.55	650.85	699.59	491.69	988.26								
Pu (add)	146.54	201.02	217.98	139.85	154.66	166.24	116.84	234.83								

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forces matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1436	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 4% 5% 3% 3% 4% 3% 5% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.21	15.46	17.47	20.41	19.21	18.99	22.28	16.02	11.57	7.05	10.14	9.16	9.39	10.03	10.42	9.28
PY1 (Vuw)	9.27	7.24	10.43	6.73	7.82	8.57	7.08	10.21	4.48	3.54	5.04	3.29	3.81	4.16	3.45	4.93
PX2 (Mu)	7.40	5.78	8.32	5.37	6.24	6.84	5.65	8.15	9.01	9.84	13.58	5.70	7.86	9.38	4.83	14.19
PY2 (Mu)	3.08	2.41	3.47	2.24	2.60	2.85	2.36	3.39	3.75	4.10	5.66	2.38	3.28	3.91	2.01	5.91
Pu (kip)	31.16	23.33	29.30	27.29	27.51	28.25	29.48	27.73	22.17	18.54	26.02	15.91	18.65	21.02	16.21	25.85

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.88	21.52	26.42	25.74	25.63	26.12	27.84	24.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.16	15.58	OK	26.02	13.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.16	1.47	126.02	OK
Web SPL	15.58	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3436	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3436

Node 3436

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3436 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
3436 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 3436 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3436	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-33.47	-14.54	-28.06	-2.31	-39.12	3.30	-25.16	-12.24	-29.29	-12.20	-38.84	-16.18	-25.68	-16.06	-38.06	5.12
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.67	0.29	0.56	0.05	0.78	0.07	0.50	0.24	0.59	0.24	0.78	0.32	0.51	0.32	0.76	0.10
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-33.47		-28.06		-39.12		-25.16		-29.29		-38.84		-25.68		-38.06	
Fcf (ksi)	-41.73		-39.03		-44.56		-37.58		-39.64		-44.42		-37.84		-44.03	
Fcf (kip)	-3755.96		-3512.58		-4010.18		-3382.40		-3568.00		-3997.73		-3405.57		-3962.87	
fncf (ksi)		-14.54		-2.31		3.30		-12.24		-12.20		-16.18		-16.06		5.12
Rcf		1.07		1.00		1.14		1.00		1.01		1.14		1.00		1.13
Fncf (ksi)		-37.50		-37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		-3375.00		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.70	-10.35	-21.01	-1.43	-28.99	2.93	-18.73	-8.83	-21.50	-8.34	-28.56	-11.44	-19.03	-11.58	-28.29	4.26
Fs (ksi)	-24.70	-10.35	-21.01	-1.43	-28.99	2.93	-18.73	-8.83	-21.50	-8.34	-28.56	-11.44	-19.03	-11.58	-28.29	4.26
Fs (kip)	-2222.68	-931.44	-1891.24	-128.80	-2609.44	264.13	-1685.45	-794.34	-1935.26	-750.31	-2570.15	-1029.98	-1713.02	-1042.40	-2546.33	383.12

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2833.72	0.00	383.12
Comp	4224.08	3564.99	2609.44	1042.40

$\phi v Vn$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	507.28	422.98	572.13	401.26	445.82	489.14	416.52	560.06	367.43	308.24	413.62	292.53	324.38	354.62	303.31	405.09
Vuw (kip)	760.91	634.46	858.19	601.88	668.73	733.70	624.78	840.09	---	---	---	---	---	---	---	---
Mv (k*ft)	428.01	356.89	482.73	338.56	376.16	412.71	351.44	472.55	206.68	173.38	232.66	164.55	182.46	199.47	170.61	227.86
Huw (kip)	-1889.21	-1364.23	-1346.18	-1644.10	-1716.29	-2072.33	-1778.65	-1262.97	-1156.51	-740.68	-859.95	-909.26	-984.71	-1320.05	-1010.32	-793.18
Muw (k*ft)	576.78	807.77	1063.08	557.55	600.16	572.89	479.18	1095.43	315.64	430.82	702.43	217.83	289.65	376.48	163.93	716.09
Mu (k*ft)	1004.79	1164.66	1545.81	896.11	976.32	985.60	830.62	1567.97	522.32	604.20	935.09	382.37	472.12	575.96	334.54	943.95

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.22	17.49	17.26	21.08	22.00	26.57	22.80	16.19	14.83	9.50	11.02	11.66	12.62	16.92	12.95	10.17
PY1 (Vuw)	9.76	8.13	11.00	7.72	8.57	9.41	8.01	10.77	4.71	3.95	5.30	3.75	4.16	4.55	3.89	5.19
PX2 (Mu)	18.28	21.18	28.12	16.30	17.76	17.93	15.11	28.52	9.50	10.99	17.01	6.95	8.59	10.48	6.08	17.17
PY2 (Mu)	7.61	8.83	11.72	6.79	7.40	7.47	6.29	11.88	3.96	4.58	7.09	2.90	3.58	4.36	2.54	7.15
Pu (kip)	45.91	42.23	50.74	40.09	42.85	47.59	40.52	50.12	25.83	22.19	30.65	19.76	22.58	28.81	20.09	30.00

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1429.86	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1403.86	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2112.04	2227.50	OK
TF Inside	2112.04	2227.50	OK
BF Inside	1798.85	1856.25	OK
BF Outside	1766.14	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.56	41.58	49.52	39.24	41.84	46.38	39.48	48.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	858.19
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2112.04	21.12	OK	1304.72	13.05	OK
BF	1798.85	25.70	OK	525.98	7.51	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2112.04	21.12	1.47	126.02	OK
TF	4224.08	42.24	1.47	229.13	OK
TF Inside	2112.04	21.12	1.47	137.48	OK
BF Inside	1798.85	25.70	1.47	114.56	OK
BF	3564.99	50.93	1.47	229.13	OK
BF Outside	1766.14	25.23	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.74	25.37	OK	30.65	15.32	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.74	1.47	126.02	OK
Web SPL	25.37	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.05
TF Inside	NA	1.05
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.57	1.29	5.42
Web	2.21	1.24	3.85
BF	1.28	2.24	4.09

Plate	Shear	Flexure
Web	1.91	1.65

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 3436**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.25	-11.38	-25.68	-1.37	-34.51	-1.09	-22.85	-10.64	-25.43	-9.29	-29.14	-7.74	-23.15	-14.06	-34.21	1.46
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.59	0.23	0.51	0.03	0.69	0.02	0.46	0.21	0.51	0.19	0.58	0.15	0.46	0.28	0.68	0.03
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-29.25		-25.68		-34.51		-22.85		-25.43		-29.14		-23.15		-34.21	
Fcf (ksi)	-39.63		-37.84		-42.25		-37.50		-37.72		-39.57		-37.50		-42.11	
Fcf (kip)	-3566.33		-3405.75		-3802.76		-3375.00		-3394.51		-3561.15		-3375.00		-3789.53	
fncf (ksi)		-11.38		-1.37		-1.09		-10.64		-9.29		-7.74		-14.06		1.46
Rcf		1.15		1.10		1.22		1.09		1.09		1.15		1.09		1.22
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.23401	-8.318271	-18.74672	-1.117807	-24.97997	-0.922744	-16.71222	-7.798825	-18.57024	-6.717699	-21.15278	-5.747183	-16.9195	-10.21162	-24.77	0.88
Fs (ksi)	-21.23	-8.32	-18.75	-1.12	-24.98	-0.92	-16.71	-7.80	-18.57	-6.72	-21.15	-5.75	-16.92	-10.21	-24.77	0.88
Fs (kip)	-1911.06	-748.64	-1687.20	-100.60	-2248.20	-83.05	-1504.10	-701.89	-1671.32	-604.59	-1903.75	-517.25	-1522.75	-919.05	-2229.50	79.26

Vu (kip)	507.28	422.98	572.13	401.26	445.82	489.14	416.52	560.06	367.43	308.24	413.62	292.53	324.38	354.62	303.31	405.09
Vuw (kip)	760.91	634.46	858.19	601.88	668.73	733.70	624.78	840.09	---	---	---	---	---	---	---	---
Mv (k*ft)	428.01	356.89	482.73	338.56	376.16	412.71	351.44	472.55	206.68	173.38	232.66	164.55	182.46	199.47	170.61	227.86
Huw (kip)	-1738.86	-1298.22	-1438.39	-1619.20	-1579.83	-1598.63	-1741.68	-1330.60	-975.23	-655.53	-854.79	-808.86	-834.50	-887.70	-895.33	-788.42
Muw (k*ft)									284.15	387.84	529.26	196.09	260.76	338.92	147.57	564.36
Mu (k*ft)	428.01	356.89	482.73	338.56	376.16	412.71	351.44	472.55	490.83	561.22	761.92	360.64	443.22	538.40	318.19	792.23
Muw (k*ft)	584.30	799.56	900.20	570.53	606.32	675.26	488.88	985.88								
Pu (add)	138.84	189.99	213.91	135.57	144.08	160.46	116.17	229.45								

Iterations matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 3436**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	4%	5%	3%	3%	4%	3%	5%	percentage increase in flange force	5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.29	16.64	18.44	20.76	20.25	20.50	22.33	17.06	12.50	8.40	10.96	10.37	10.70	11.38	11.48	10.11
PY1 (Vuw)	9.76	8.13	11.00	7.72	8.57	9.41	8.01	10.77	4.71	3.95	5.30	3.75	4.16	4.55	3.89	5.19
PX2 (Mu)	7.79	6.49	8.78	6.16	6.84	7.51	6.39	8.60	8.93	10.21	13.86	6.56	8.06	9.79	5.79	14.41
PY2 (Mu)	3.24	2.70	3.66	2.57	2.85	3.13	2.66	3.58	3.72	4.25	5.77	2.73	3.36	4.08	2.41	6.00
Pu (kip)	32.77	25.55	30.92	28.81	29.41	30.68	30.64	29.40	23.03	20.34	27.18	18.13	20.21	22.86	18.38	26.95

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.37	23.47	27.88	27.00	27.32	28.33	28.77	26.35
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.77	16.38	OK	27.18	13.59	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.77	1.47	126.02	OK
Web SPL	16.38	1.47	91.65	OK

Field Splice - Node 5436

Node 5436

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5436 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
5436 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 5436 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.18	-14.07	-29.27	-3.71	-38.11	-3.27	-26.73	-12.49	-30.87	-10.11	-36.46	-17.43	-27.66	-17.06	-37.39	3.37
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.64	0.28	0.59	0.07	0.76	0.07	0.53	0.25	0.62	0.20	0.73	0.35	0.55	0.34	0.75	0.07
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-32.18		-29.27		-38.11		-26.73		-30.87		-36.46		-27.66		-37.39	
Fcf (ksi)	-41.09		-39.64		-44.05		-38.37		-40.44		-43.23		-38.83		-43.70	
Fcf (kip)	-3698.17		-3567.34		-3964.75		-3453.07		-3639.20		-3890.66		-3494.74		-3932.72	
fncf (ksi)		-14.07		-3.71		-3.27		-12.49		-10.11		-17.43		-17.06		3.37
Rcf		1.08		1.04		1.16		1.01		1.06		1.13		1.02		1.15
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.78	-10.00	-21.85	-2.41	-28.25	-1.94	-19.86	-8.95	-22.69	-6.81	-26.81	-12.36	-20.45	-12.25	-27.79	3.00
Fs (ksi)	-23.78	-10.00	-21.85	-2.41	-28.25	-1.94	-19.86	-8.95	-22.69	-6.81	-26.81	-12.36	-20.45	-12.25	-27.79	3.00
Fs (kip)	-2139.78	-900.13	-1966.58	-216.88	-2542.63	-174.39	-1787.40	-805.86	-2041.92	-613.09	-2413.21	-1112.75	-1840.58	-1102.28	-2501.44	270.09

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2830.27	0.00	270.09
Comp	4173.92	3584.17	2542.63	1112.75

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	508.01	430.28	574.41	410.91	457.12	475.84	427.88	561.76	367.96	313.18	415.01	299.36	332.15	345.23	311.35	406.08
Vuw (kip)	762.01	645.41	861.61	616.37	685.68	713.76	641.82	842.64	---	---	---	---	---	---	---	---
Mv (k*ft)	428.63	363.04	484.66	346.71	385.70	401.49	361.02	473.98	206.98	176.17	233.45	168.39	186.83	194.19	175.13	228.42
Huw (kip)	-1856.63	-1435.21	-1578.30	-1681.16	-1688.46	-2079.29	-1855.19	-1314.56	-1114.63	-800.60	-996.24	-950.86	-973.51	-1292.85	-1079.05	-818.16
Muw (k*ft)	570.24	787.23	886.12	567.40	653.52	515.91	471.75	1046.29	303.03	427.70	578.90	239.93	349.27	317.89	180.47	677.48
Mu (k*ft)	998.87	1150.27	1370.77	914.11	1039.22	917.40	832.77	1520.27	510.01	603.87	812.35	408.32	536.10	512.09	355.61	905.90

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.80	18.40	20.23	21.55	21.65	26.66	23.78	16.85	14.29	10.26	12.77	12.19	12.48	16.58	13.83	10.49
PY1 (Vuw)	9.77	8.27	11.05	7.90	8.79	9.15	8.23	10.80	4.72	4.02	5.32	3.84	4.26	4.43	3.99	5.21
PX2 (Mu)	18.17	20.92	24.93	16.63	18.90	16.69	15.15	27.65	9.28	10.98	14.78	7.43	9.75	9.31	6.47	16.48
PY2 (Mu)	7.57	8.72	10.39	6.93	7.88	6.95	6.31	11.52	3.87	4.58	6.16	3.09	4.06	3.88	2.70	6.87
Pu (kip)	45.41	42.84	50.00	40.96	43.84	46.24	41.56	49.79	25.08	22.92	29.84	20.81	23.74	27.19	21.37	29.55

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1428.12	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1402.15	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2086.96	2227.50	OK
TF Inside	2086.96	2227.50	OK
BF Inside	1808.53	1856.25	OK
BF Outside	1775.65	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.03	42.14	48.60	40.08	42.85	45.00	40.46	48.59
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	861.61
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2086.96	20.87	OK	1271.32	12.71	OK
BF	1808.53	25.84	OK	561.48	8.02	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2086.96	20.87	1.47	126.02	OK
TF	4173.92	41.74	1.47	229.13	OK
TF Inside	2086.96	20.87	1.47	137.48	OK
BF Inside	1808.53	25.84	1.47	114.56	OK
BF	3584.17	51.20	1.47	229.13	OK
BF Outside	1775.65	25.37	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.00	25.00	OK	29.84	14.92	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.00	1.47	126.02	OK
Web SPL	25.00	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.07
TF Inside	NA	1.07
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.59	1.32	5.49
Web	2.18	1.23	3.80
BF	1.27	2.10	4.06

Plate	Shear	Flexure
Web	1.90	1.62

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5436**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.43	-12.32	-26.30	-2.15	-34.92	-2.01	-23.79	-10.34	-27.02	-7.41	-27.92	-9.95	-24.24	-14.23	-34.59	0.77
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.59	0.25	0.53	0.04	0.70	0.04	0.48	0.21	0.54	0.15	0.56	0.20	0.48	0.28	0.69	0.02
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-29.43		-26.30		-34.92		-23.79		-27.02		-27.92		-24.24		-34.59	
Fcf (ksi)	-39.71		-38.15		-42.46		-37.50		-38.51		-38.96		-37.50		-42.30	
Fcf (kip)	-3574.33		-3433.59		-3821.44		-3375.00		-3465.88		-3506.38		-3375.00		-3806.70	
fncf (ksi)		-12.32		-2.15		-2.01		-10.34		-7.41		-9.95		-14.23		0.77
Rcf		1.14		1.09		1.22		1.07		1.10		1.12		1.07		1.21
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.36607	-8.966317	-19.17623	-1.674758	-25.26571	-1.577255	-17.38373	-7.565829	-19.68322	-5.391313	-20.29917	-7.291185	-17.69889	-10.31399	-25.03	0.39
Fs (ksi)	-21.37	-8.97	-19.18	-1.67	-25.27	-1.58	-17.38	-7.57	-19.68	-5.39	-20.30	-7.29	-17.70	-10.31	-25.03	0.39
Fs (kip)	-1922.95	-806.97	-1725.86	-150.73	-2273.91	-141.95	-1564.54	-680.92	-1771.49	-485.22	-1826.93	-656.21	-1592.90	-928.26	-2253.07	35.11

Vu (kip)	508.01	430.28	574.41	410.91	457.12	475.84	427.88	561.76	367.96	313.18	415.01	299.36	332.15	345.23	311.35	406.08
Vuw (kip)	762.01	645.41	861.61	616.37	685.68	713.76	641.82	842.64	---	---	---	---	---	---	---	---
Mv (k*ft)	428.63	363.04	484.66	346.71	385.70	401.49	361.02	473.98	206.98	176.17	233.45	168.39	186.83	194.19	175.13	228.42
Huw (kip)	-1773.02	-1336.55	-1481.99	-1603.90	-1540.55	-1652.02	-1741.74	-1364.97	-1000.97	-688.08	-885.82	-823.34	-827.46	-910.48	-924.42	-813.25
Muw (k*ft)									272.79	385.03	521.15	215.99	314.42	286.18	162.47	559.33
Mu (k*ft)	428.63	363.04	484.66	346.71	385.70	401.49	361.02	473.98	479.77	561.20	754.59	384.39	501.26	480.37	337.60	787.75

Muw (k*ft)	565.44	787.61	880.27	580.74	667.40	612.88	488.84	851.07	forces matching the Muw results
Pu (add)	134.36	187.15	209.17	138.00	158.59	145.64	116.16	226.00	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5436	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	4%	5%	3%	4%	3%	3%	5%	percentage increase in flange force	5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.73	17.14	19.00	20.56	19.75	21.18	22.33	17.50	12.83	8.82	11.36	10.56	10.61	11.67	11.85	10.43
PY1 (Vuw)	9.77	8.27	11.05	7.90	8.79	9.15	8.23	10.80	4.72	4.02	5.32	3.84	4.26	4.43	3.99	5.21
PX2 (Mu)	7.80	6.60	8.82	6.31	7.02	7.30	6.57	8.62	8.73	10.21	13.73	6.99	9.12	8.74	6.14	14.33
PY2 (Mu)	3.25	2.75	3.67	2.63	2.92	3.04	2.74	3.59	3.64	4.25	5.72	2.91	3.80	3.64	2.56	5.97
Pu (kip)	33.19	26.17	31.47	28.86	29.22	30.98	30.91	29.82	23.12	20.75	27.40	18.80	21.31	21.95	19.15	27.16

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.80	24.07	28.45	26.98	27.05	28.74	28.97	26.80
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.19	16.59	OK	27.40	13.70	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.19	1.47	126.02	OK
Web SPL	16.59	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7436	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type BB

Field Splice - Node 7436

Node 7436

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7436 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
7436 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 7436 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.60	-10.66	-29.60	-3.57	-37.08	0.76	-26.57	-12.14	-34.65	-10.62	-34.26	-16.53	-26.58	-15.77	-37.63	4.42
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.61	0.21	0.59	0.07	0.74	0.02	0.53	0.24	0.69	0.21	0.69	0.33	0.53	0.32	0.75	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-30.60		-29.60		-37.08		-26.57		-34.65		-34.26		-26.58		-37.63	
Fcf (ksi)	-40.30		-39.80		-43.54		-38.28		-42.33		-42.13		-38.29		-43.82	
Fcf (kip)	-3627.03		-3582.06		-3918.47		-3445.49		-3809.44		-3791.62		-3445.90		-3943.56	
fncf (ksi)		-10.66		-3.57		0.76		-12.14		-10.62		-16.53		-15.77		4.42
Rcf		1.07		1.06		1.16		1.02		1.12		1.12		1.02		1.16
Fncf (ksi)		-37.50		-37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		-3375.00		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.71	-7.54	-22.08	-2.30	-27.56	1.04	-19.74	-8.55	-25.44	-7.13	-25.26	-11.72	-19.71	-11.30	-27.97	3.74
Fs (ksi)	-22.71	-7.54	-22.08	-2.30	-27.56	1.04	-19.74	-8.55	-25.44	-7.13	-25.26	-11.72	-19.71	-11.30	-27.97	3.74
Fs (kip)	-2043.86	-678.33	-1987.52	-206.61	-2480.15	93.67	-1776.39	-769.72	-2289.26	-641.41	-2272.99	-1054.48	-1773.64	-1017.05	-2517.36	336.51

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2834.94	0.00	336.51
Comp	4174.23	3565.80	2517.36	1054.48

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	511.78	424.39	574.57	406.25	493.76	450.91	422.03	562.11	371.06	309.13	415.43	296.32	358.15	328.06	307.66	406.44
Vuw (kip)	767.67	636.59	861.85	609.37	740.64	676.37	633.04	843.17	---	---	---	---	---	---	---	---
Mv (k*ft)	431.81	358.08	484.79	342.77	416.61	380.46	356.09	474.28	208.72	173.89	233.68	166.68	201.46	184.53	173.06	228.62
Huw (kip)	-1706.77	-1437.94	-1407.87	-1670.81	-1790.79	-2000.75	-1792.83	-1276.32	-998.14	-804.52	-875.05	-933.58	-1074.58	-1220.07	-1023.25	-799.65
Muw (k*ft)	635.37	792.60	977.12	570.59	668.54	519.85	489.44	1077.09	333.80	435.33	629.16	246.07	402.81	297.86	184.94	697.61
Mu (k*ft)	1067.18	1150.68	1461.91	913.36	1085.15	900.31	845.52	1551.37	542.52	609.22	862.83	412.75	604.26	482.39	358.00	926.23

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.88	18.44	18.05	21.42	22.96	25.65	22.99	16.36	12.80	10.31	11.22	11.97	13.78	15.64	13.12	10.25
PY1 (Vuw)	9.84	8.16	11.05	7.81	9.50	8.67	8.12	10.81	4.76	3.96	5.33	3.80	4.59	4.21	3.94	5.21
PX2 (Mu)	19.41	20.93	26.59	16.61	19.74	16.38	15.38	28.22	9.87	11.08	15.69	7.51	10.99	8.77	6.51	16.85
PY2 (Mu)	8.09	8.72	11.08	6.92	8.22	6.82	6.41	11.76	4.11	4.62	6.54	3.13	4.58	3.66	2.71	7.02
Pu (kip)	45.02	42.83	49.82	40.79	46.23	44.79	41.02	49.97	24.34	23.05	29.41	20.67	26.41	25.65	20.73	29.73

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1430.47	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1404.47	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2087.11	2227.50	OK
TF Inside	2087.11	2227.50	OK
BF Inside	1799.26	1856.25	OK
BF Outside	1766.54	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.67	42.18	48.48	39.94	45.08	43.68	39.97	48.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	861.85
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2087.11	20.87	OK	1258.68	12.59	OK
BF	1799.26	25.70	OK	532.08	7.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2087.11	20.87	1.47	126.02	OK
TF	4174.23	41.74	1.47	229.13	OK
TF Inside	2087.11	20.87	1.47	137.48	OK
BF Inside	1799.26	25.70	1.47	114.56	OK
BF	3565.80	50.94	1.47	229.13	OK
BF Outside	1766.54	25.24	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.97	24.98	OK	29.73	14.87	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.97	1.47	126.02	OK
Web SPL	24.98	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.07
TF Inside	NA	1.07
BF Inside	1.02	1.03
BF Outside	1.06	1.03

Bolt	Shear	Slip	Bearing
TF	1.59	1.34	5.49
Web	2.21	1.23	3.84
BF	1.28	2.21	4.09

Plate	Shear	Flexure
Web	1.90	1.65

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7436	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.83	-11.00	-25.94	-1.35	-34.86	-1.25	-23.46	-9.84	-29.76	-7.06	-25.96	-9.21	-23.76	-13.56	-34.55	1.53
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.60	0.22	0.52	0.03	0.70	0.02	0.47	0.20	0.60	0.14	0.52	0.18	0.48	0.27	0.69	0.03
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-29.83		-25.94		-34.86		-23.46		-29.76		-25.96		-23.76		-34.55	
Fcf (ksi)	-39.91		-37.97		-42.43		-37.50		-39.88		-37.98		-37.50		-42.27	
Fcf (kip)	-3592.22		-3417.28		-3818.48		-3375.00		-3589.42		-3418.19		-3375.00		-3804.55	
fncf (ksi)		-11.00		-1.35		-1.25		-9.84		-7.06		-9.21		-13.56		1.53
Rcf		1.15		1.09		1.22		1.08		1.14		1.09		1.08		1.21
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.67626	-8.017446	-18.92599	-1.112326	-25.22861	-1.128935	-17.17605	-7.106775	-21.62864	-5.145958	-18.94393	-6.755698	-17.39292	-9.825079	-25.01	0.92
Fs (ksi)	-21.68	-8.02	-18.93	-1.11	-25.23	-1.13	-17.18	-7.11	-21.63	-5.15	-18.94	-6.76	-17.39	-9.83	-25.01	0.92
Fs (kip)	-1950.86	-721.57	-1703.34	-100.11	-2270.57	-101.60	-1545.84	-639.61	-1946.58	-463.14	-1704.95	-608.01	-1565.36	-884.26	-2250.57	82.79

Vu (kip)	511.78	424.39	574.57	406.25	493.76	450.91	422.03	562.11	371.06	309.13	415.43	296.32	358.15	328.06	307.66	406.44
Vuw (kip)	767.67	636.59	861.85	609.37	740.64	676.37	633.04	843.17	---	---	---	---	---	---	---	---
Mv (k*ft)	431.81	358.08	484.79	342.77	416.61	380.46	356.09	474.28	208.72	173.89	233.68	166.68	201.46	184.53	173.06	228.62
Huw (kip)	-1732.72	-1301.56	-1450.21	-1586.69	-1582.70	-1584.56	-1718.79	-1333.94	-979.89	-661.26	-869.80	-801.33	-883.56	-848.09	-898.19	-794.85
Muw (k*ft)									300.49	391.90	530.19	221.52	362.62	268.14	166.49	570.38
Mu (k*ft)	431.81	358.08	484.79	342.77	416.61	380.46	356.09	474.28	509.22	565.79	763.87	388.20	564.08	452.68	339.55	799.00
Muw (k*ft)	601.05	802.96	900.00	592.21	699.69	614.74	504.14	976.76								
Pu (add)	142.82	190.80	213.86	140.72	166.26	146.08	119.80	230.66								

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Iterations matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7436	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	4%	5%	3%	4%	3%	3%	5%	percentage increase in flange force	5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.21	16.69	18.59	20.34	20.29	20.31	22.04	17.10	12.56	8.48	11.15	10.27	11.33	10.87	11.52	10.19
PY1 (Vuw)	9.84	8.16	11.05	7.81	9.50	8.67	8.12	10.81	4.76	3.96	5.33	3.80	4.59	4.21	3.94	5.21
PX2 (Mu)	7.85	6.51	8.82	6.23	7.58	6.92	6.48	8.63	9.26	10.29	13.89	7.06	10.26	8.23	6.18	14.53
PY2 (Mu)	3.27	2.71	3.67	2.60	3.16	2.88	2.70	3.59	3.86	4.29	5.79	2.94	4.27	3.43	2.57	6.06
Pu (kip)	32.80	25.62	31.11	28.54	30.61	29.58	30.49	29.49	23.46	20.50	27.40	18.60	23.34	20.58	18.85	27.17

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.38	23.54	28.07	26.69	28.22	27.47	28.59	26.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.80	16.40	OK	27.40	13.70	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.80	1.47	126.02	OK
Web SPL	16.40	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9436	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9436

Node 9436

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	100
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9436 L	81.00	68.22	5526.09	81.00	69.30	5613.54	48.00	50.00	2400.00
9436 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 9436 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	63.44	69.45	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	63.44	69.45	50	65
Splice Plates	TF Outside	36.00	1.375	62.50	49.50	34.89	---	50	65
	TF Inside	16.50	1.500	62.50	49.50	33.56	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.125	44.50	40.50	28.55	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.44	-8.53	-28.76	5.53	-35.96	1.81	-26.17	-10.29	-33.24	-8.58	-33.66	-14.31	-24.28	-14.10	-35.88	5.06
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.61	0.17	0.58	0.11	0.72	0.04	0.52	0.21	0.66	0.17	0.67	0.29	0.49	0.28	0.72	0.10
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-30.44		-28.76		-35.96		-26.17		-33.24		-33.66		-24.28		-35.88	
Fcf (ksi)	-40.22		-39.38		-42.98		-38.08		-41.62		-41.83		-37.50		-42.94	
Fcf (kip)	-3619.89		-3544.10		-3868.23		-3427.50		-3745.61		-3764.63		-3375.00		-3864.52	
fncf (ksi)		-8.53		5.53		1.81		-10.29		-8.58		-14.31		-14.10		5.06
Rcf		1.12		1.10		1.20		1.06		1.16		1.16		1.04		1.19
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		2604.28		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.67	-5.96	-21.53	4.32	-26.81	1.81	-19.43	-7.78	-24.48	-5.69	-24.90	-10.09	-18.12	-10.10	-26.77	4.20
Fs (ksi)	-22.67	-5.96	-21.53	4.32	-26.81	1.81	-19.43	-7.78	-24.48	-5.69	-24.90	-10.09	-18.12	-10.10	-26.77	4.20
Fs (kip)	-2040.47	-536.69	-1937.47	388.46	-2413.27	163.03	-1749.11	-700.03	-2203.49	-511.76	-2240.99	-907.84	-1630.38	-909.01	-2409.49	377.73

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2842.70	0.00	388.46
Comp	4102.94	3550.31	2413.27	909.01

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	507.04	393.76	564.42	374.91	474.26	432.00	397.35	551.14	368.83	288.26	409.37	276.23	345.13	315.81	291.33	399.45
Vuw (kip)	760.57	590.64	846.63	562.37	711.39	648.00	596.03	826.70	---	---	---	---	---	---	---	---
Mv (k*ft)	427.82	332.23	476.23	316.33	400.16	364.50	335.26	465.02	207.47	162.15	230.27	155.38	194.14	177.64	163.87	224.69
Huw (kip)	-1642.20	-1099.72	-1346.79	-1616.42	-1701.12	-1929.49	-1722.67	-1217.72	-944.96	-567.97	-825.09	-898.02	-995.59	-1154.57	-931.11	-744.98
Muw (k*ft)	674.93	999.53	993.28	598.06	697.11	554.16	501.55	1077.50	367.59	568.56	629.76	256.44	413.53	325.88	176.34	681.32
Mu (k*ft)	1102.75	1331.76	1469.51	914.39	1097.26	918.66	836.82	1542.53	575.05	730.71	860.03	411.82	607.67	503.53	340.21	906.01

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.05	14.10	17.27	20.72	21.81	24.74	22.09	15.61	12.11	7.28	10.58	11.51	12.76	14.80	11.94	9.55
PY1 (Vuw)	9.75	7.57	10.85	7.21	9.12	8.31	7.64	10.60	4.73	3.70	5.25	3.54	4.42	4.05	3.73	5.12
PX2 (Mu)	20.06	24.22	26.73	16.63	19.96	16.71	15.22	28.06	10.46	13.29	15.64	7.49	11.05	9.16	6.19	16.48
PY2 (Mu)	8.36	10.09	11.14	6.93	8.32	6.96	6.34	11.69	4.36	5.54	6.52	3.12	4.61	3.82	2.58	6.87
Pu (kip)	44.92	42.20	49.19	39.94	45.26	44.17	39.84	49.03	24.33	22.55	28.74	20.14	25.47	25.22	19.19	28.66

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2351.25	1814.31	79.75	51.99	29.48	3100.87	1814.31	OK
TF Inside	0.00	2351.25	1745.25	174.00	113.44	23.25	4630.28	1745.25	OK
BF Inside	1434.39	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1408.31	1923.75	1484.44	45.00	29.46	24.12	2142.64	1484.44	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2051.47	2227.50	OK
TF Inside	2051.47	2227.50	OK
BF Inside	1791.44	1856.25	OK
BF Outside	1758.87	1822.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.64	41.93	47.90	39.29	44.24	43.20	38.93	47.88
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	846.63
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9436**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.18
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.93

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2051.47	20.51	OK	1206.64	12.07	OK
BF	1791.44	25.59	OK	458.68	6.55	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2051.47	20.51	1.47	126.02	OK
TF	4102.94	41.03	1.47	229.13	OK
TF Inside	2051.47	20.51	1.47	137.48	OK
BF Inside	1791.44	25.59	1.47	114.56	OK
BF	3550.31	50.72	1.47	229.13	OK
BF Outside	1758.87	25.13	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.19	24.59	OK	28.74	14.37	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.19	1.47	126.02	OK
Web SPL	24.59	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.09
TF Inside	NA	1.09
BF Inside	1.01	1.04
BF Outside	1.05	1.04

Bolt	Shear	Slip	Bearing
TF	1.62	1.39	5.58
Web	2.29	1.25	3.99
BF	1.29	2.57	4.10

Plate	Shear	Flexure
Web	1.94	1.71

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9436	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.31	-8.62	-24.10	1.01	-33.93	-0.01	-21.73	-6.74	-28.06	-4.78	-24.66	-6.38	-21.85	-12.23	-33.69	3.05
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.59	0.17	0.48	0.02	0.68	0.00	0.43	0.13	0.56	0.10	0.49	0.13	0.44	0.24	0.67	0.06
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-29.31		-24.10		-33.93		-21.73		-28.06		-24.66		-21.85		-33.69	
Fcf (ksi)	-39.66		-37.50		-41.96		-37.50		-39.03		-37.50		-37.50		-41.84	
Fcf (kip)	-3569.08		-3375.00		-3776.73		-3375.00		-3512.90		-3375.00		-3375.00		-3765.94	
fncf (ksi)		-8.62		1.01		-0.01		-6.74		-4.78		-6.38		-12.23		3.05
Rcf		1.17		1.11		1.24		1.11		1.15		1.11		1.11		1.23
Fncf (ksi)		-37.50		37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3375.00		2604.28		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		2604.28

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.35646	-6.314873	-17.65739	0.549277	-24.61665	-0.236125	-15.90779	-5.414271	-20.45995	-3.538297	-18.0692	-4.734229	-16.08237	-8.866813	-24.43	1.99
Fs (ksi)	-21.36	-6.31	-17.66	0.55	-24.62	-0.24	-15.91	-5.41	-20.46	-3.54	-18.07	-4.73	-16.08	-8.87	-24.43	1.99
Fs (kip)	-1922.08	-568.34	-1589.17	49.43	-2215.50	-21.25	-1431.70	-487.28	-1841.40	-318.45	-1626.23	-426.08	-1447.41	-798.01	-2198.96	179.38

Vu (kip)	507.04	393.76	564.42	374.91	474.26	432.00	397.35	551.14	368.83	288.26	409.37	276.23	345.13	315.81	291.33	399.45
Vuw (kip)	760.57	590.64	846.63	562.37	711.39	648.00	596.03	826.70	---	---	---	---	---	---	---	---
Mv (k*ft)	427.82	332.23	476.23	316.33	400.16	364.50	335.26	465.02	207.47	162.15	230.27	155.38	194.14	177.64	163.87	224.69
Huw (kip)	-1641.09	-1200.74	-1385.39	-1483.18	-1469.45	-1470.25	-1683.60	-1256.65	-913.15	-564.57	-820.14	-703.63	-791.94	-752.51	-823.32	-740.51
Muw (k*ft)									330.91	400.55	536.37	230.86	372.28	293.37	158.74	581.37
Mu (k*ft)	427.82	332.23	476.23	316.33	400.16	364.50	335.26	465.02	538.38	562.69	766.64	386.24	566.41	471.01	322.61	806.06

Muw (k*ft)	650.82	849.51	922.81	661.21	737.78	669.84	527.00	1053.56	formulas matching the Muw results
Pu (add)	154.65	201.86	219.28	157.12	175.31	159.17	125.37	238.42	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For	Cleveland InnerBelt : Field Splice - Node 9436	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 4% 5% 3% 4% 4% 3% 5% percentage increase in flange force 5%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.04	15.39	17.76	19.02	18.84	18.85	21.58	16.11	11.71	7.24	10.51	9.02	10.15	9.65	10.56	9.49
PY1 (Vuw)	9.75	7.57	10.85	7.21	9.12	8.31	7.64	10.60	4.73	3.70	5.25	3.54	4.42	4.05	3.73	5.12
PX2 (Mu)	7.78	6.04	8.66	5.75	7.28	6.63	6.10	8.46	9.79	10.23	13.94	7.03	10.30	8.57	5.87	14.66
PY2 (Mu)	3.24	2.52	3.61	2.40	3.03	2.76	2.54	3.52	4.08	4.26	5.81	2.93	4.29	3.57	2.44	6.11
Pu (kip)	31.61	23.69	30.12	26.57	28.81	27.78	29.50	28.34	23.23	19.20	26.84	17.30	22.24	19.74	17.55	26.64

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.18	21.76	27.09	24.86	26.49	25.74	27.71	25.28
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.61	15.81	OK	26.84	13.42	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.61	1.47	126.02	OK
Web SPL	15.81	1.47	91.65	OK

Field Splice

Type CC

Field Splice - Node 1427

Node 1427

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1427 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
1427 R	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1427 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.66	-25.18	-5.90	-20.97	-19.11	-22.22	-4.86	-24.84	-21.31	-32.34	-20.63	-30.52	-5.81	-28.34	-18.14	-20.56
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.26	0.37	0.09	0.31	0.28	0.33	0.07	0.37	0.31	0.48	0.30	0.45	0.09	0.42	0.27	0.30
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.18		-20.97		-22.22		-24.84		-32.34		-30.52		-28.34		-20.56
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-17.66		-5.90		-19.11		-4.86		-21.31		-20.63		-5.81		-18.14	
Rcf	1.57		1.57		1.57		1.57		1.57		1.57		1.57		1.57	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.11	-18.79	-4.25	-15.73	-13.93	-16.37	-3.82	-18.93	-13.54	-18.26	-8.08	-19.50	-4.30	-21.29	-13.26	-15.19
Fs (ksi)	-13.11	-18.79	-4.25	-15.73	-13.93	-16.37	-3.82	-18.93	-13.54	-18.26	-8.08	-19.50	-4.30	-21.29	-13.26	-15.19
Fs (kip)	-1061.92	-1522.36	-344.04	-1274.41	-1128.64	-1325.80	-309.69	-1532.94	-1096.40	-1478.96	-654.13	-1579.31	-348.13	-1724.46	-1074.16	-1230.09

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4313.68	4313.68	1128.64	1724.46

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	265.95	50.86	296.93	22.14	141.00	130.69	41.17	275.08	194.18	38.74	216.06	18.45	167.40	68.52	31.89	200.63
Vuw (kip)	398.93	76.29	445.39	33.21	211.50	196.04	61.75	412.62	---	---	---	---	---	---	---	---
Mv (k*ft)	224.40	42.92	250.53	18.68	118.97	110.27	34.74	232.10	109.22	21.79	121.53	10.38	94.16	38.54	17.94	112.85
Huw (kip)	-2340.51	-1785.47	-2408.59	-1736.68	-2512.60	-2480.54	-1781.23	-2363.05	-957.14	-599.43	-909.05	-682.46	-953.84	-827.20	-767.63	-853.42
Muw (k*ft)	449.29	819.31	403.90	851.84	334.55	355.93	822.14	434.26	113.69	229.72	48.68	302.04	94.46	228.44	339.83	38.50
Mu (k*ft)	673.68	862.22	654.43	870.52	453.52	466.20	856.88	666.36	222.91	251.51	170.21	312.41	188.62	266.98	357.77	151.36

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	36.01	27.47	37.06	26.72	38.66	38.16	27.40	36.35	14.73	9.22	13.99	10.50	14.67	12.73	11.81	13.13
PY1 (Vuw)	6.14	1.17	6.85	0.51	3.25	3.02	0.95	6.35	2.99	0.60	3.32	0.28	2.58	1.05	0.49	3.09
PX2 (Mu)	15.55	19.90	15.10	20.09	10.47	10.76	19.77	15.38	5.14	5.80	3.93	7.21	4.35	6.16	8.26	3.49
PY2 (Mu)	5.18	6.63	5.03	6.70	3.49	3.59	6.59	5.13	1.71	1.93	1.31	2.40	1.45	2.05	2.75	1.16
Pu (kip)	52.78	48.01	53.49	47.36	49.58	49.36	47.78	52.99	20.42	15.24	18.50	17.91	19.45	19.14	20.33	17.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2250.61	2268.00	OK
TF Inside	2063.06	2079.00	OK
BF Inside	2063.06	2079.00	OK
BF Outside	2250.61	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.11	45.99	49.59	45.51	46.12	45.98	45.80	49.24
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	445.39
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2250.61	28.13	OK	588.86	7.36	OK
BF	2250.61	28.13	OK	899.72	11.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2250.61	28.13	1.47	119.85	OK
TF	4313.68	53.92	1.47	269.66	OK
TF Inside	2063.06	25.79	1.47	119.85	OK
BF Inside	2063.06	25.79	1.47	119.85	OK
BF	4313.68	53.92	1.47	269.66	OK
BF Outside	2250.61	28.13	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.49	26.75	OK	20.42	10.21	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.49	1.47	114.56	OK
Web SPL	26.75	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.29	4.26
Web	1.59	1.72	2.51
BF	1.29	1.50	4.26

Plate	Shear	Flexure
Web	3.22	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.34	-24.48	-5.84	-20.15	-18.49	-21.44	-5.19	-24.15	-10.51	-20.98	-9.71	-19.10	-6.08	-27.47	-17.52	-19.81
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.26	0.36	0.09	0.30	0.27	0.32	0.08	0.36	0.15	0.31	0.14	0.28	0.09	0.41	0.26	0.29
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-24.48		-20.15		-21.44		-24.15		-20.98		-19.10		-27.47		-19.81
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-17.34		-5.84		-18.49		-5.19		-10.51		-9.71		-6.08		-17.52	
Rcf	1.85		1.85		1.85		1.85		1.85		1.85		1.85		1.85	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.68655	-17.85266	-4.380972	-14.81949	-13.49869	-15.71071	-3.922762	-17.64739	-11.17519	-15.46734	-5.7775	-16.15777	-4.550725	-19.99286	-12.81	-14.56
Fs (ksi)	-12.69	-17.85	-4.38	-14.82	-13.50	-15.71	-3.92	-17.65	-11.18	-15.47	-5.78	-16.16	-4.55	-19.99	-12.81	-14.56
Fs (kip)	-1027.61	-1446.07	-354.86	-1200.38	-1093.39	-1272.57	-317.74	-1429.44	-905.19	-1252.85	-467.98	-1308.78	-368.61	-1619.42	-1037.54	-1179.25

Vu (kip)	265.95	50.86	296.93	22.14	141.00	130.69	41.17	275.08	194.18	38.74	216.06	18.45	167.40	68.52	31.89	200.63
Vuw (kip)	398.93	76.29	445.39	33.21	211.50	196.04	61.75	412.62	---	---	---	---	---	---	---	---
Mv (k*ft)	224.40	42.92	250.53	18.68	118.97	110.27	34.74	232.10	109.22	21.79	121.53	10.38	94.16	38.54	17.94	112.85
Huw (kip)	-2470.57	-1831.67	-2534.41	-1795.64	-2090.87	-2046.38	-1845.01	-2480.20	-916.18	-576.01	-876.28	-647.10	-799.28	-658.06	-736.31	-821.03
Muw (k*ft)									103.32	208.77	44.24	274.49	85.84	207.61	308.84	34.99
Mu (k*ft)	224.40	42.92	250.53	18.68	118.97	110.27	34.74	232.10	212.55	230.56	165.77	284.87	180.00	246.15	326.78	147.84
Muw (k*ft)	362.58	788.51	320.01	812.53	615.71	645.37	779.62	836.18	formulas matching the AMW results							
Pu (add)	86.59	188.30	76.42	194.04	147.04	154.12	186.18	85.05	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 3% 1% 4% 3% 3% 3% 2% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.01	28.18	38.99	27.63	32.17	31.48	28.38	38.16	14.10	8.86	13.48	9.96	12.30	10.12	11.33	12.63
PY1 (Vuw)	6.14	1.17	6.85	0.51	3.25	3.02	0.95	6.35	2.99	0.60	3.32	0.28	2.58	1.05	0.49	3.09
PX2 (Mu)	5.18	0.99	5.78	0.43	2.75	2.54	0.80	5.36	4.90	5.32	3.83	6.57	4.15	5.68	7.54	3.41
PY2 (Mu)	1.73	0.33	1.93	0.14	0.92	0.85	0.27	1.79	1.63	1.77	1.28	2.19	1.38	1.89	2.51	1.14
Pu (kip)	43.90	29.21	45.63	28.06	35.16	34.25	29.21	44.27	19.55	14.38	17.91	16.71	16.92	16.08	19.11	16.59

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.93	26.58	41.45	25.48	32.05	31.22	26.56	40.25
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 1427**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.63	22.81	OK	19.55	9.78	OK

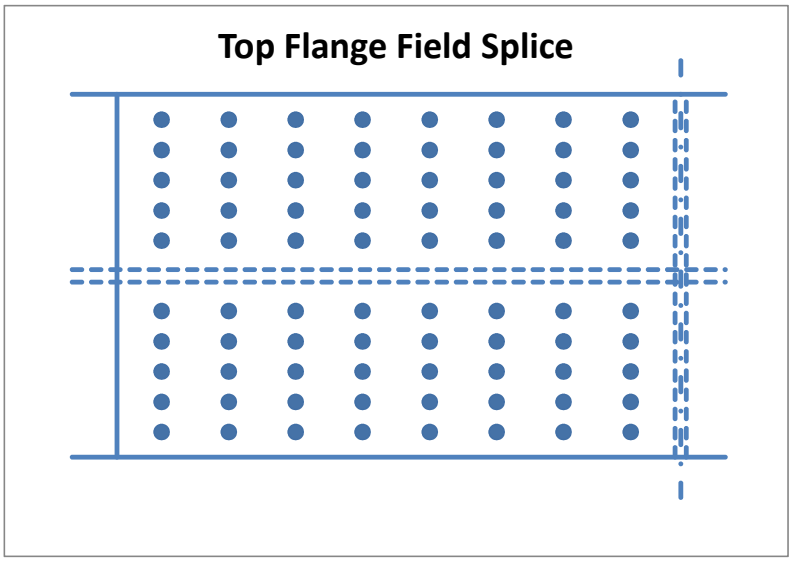
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.63	1.47	114.56	OK
Web SPL	22.81	1.47	80.19	OK

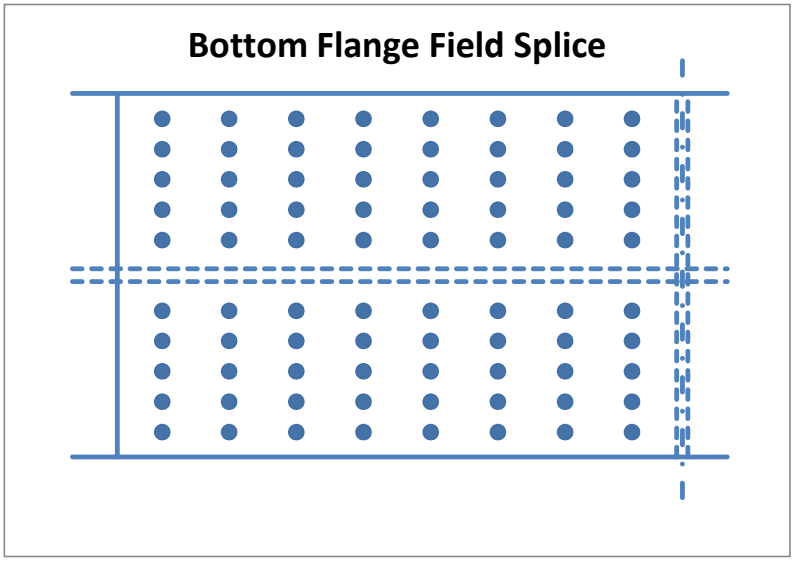
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1427**	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1427

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	19	0	19
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	19	3	19
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	19	6	19
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	19	9	19
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	19	12	19
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	19	15	19
15	22	15	22
15	25	15	25
15	28	15	28

	Top Flange		Bottom Flange	
No. Bolts =	80.0		80.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	7.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





15	31	15	31
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	19	18	19
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
21	0	21	0
21	3	21	3
21	6	21	6
21	9	21	9
21	12	21	12
21	19	21	19
21	22	21	22
21	25	21	25
21	28	21	28
21	31	21	31

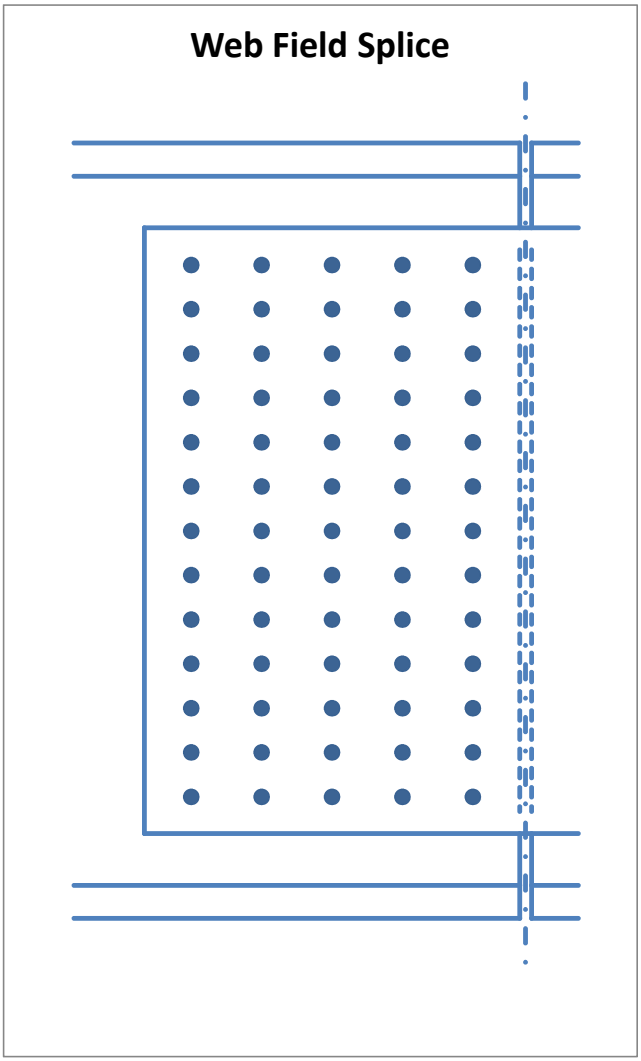
Flange Bolt Pattern Cont. - Node 1427

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1427	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1427

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1427

Web Bolt Pattern Cont. - Node 1427

390	1170	1170	8190

Field Splice - Node 3427

Node 3427

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3427 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
3427 R	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3427 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.82	-26.25	-7.70	-23.12	-19.60	-23.60	-6.50	-26.76	-22.52	-33.61	-22.18	-33.00	-7.19	-29.40	-19.69	-23.04
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.28	0.39	0.11	0.34	0.29	0.35	0.10	0.39	0.33	0.50	0.33	0.49	0.11	0.43	0.29	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.25		-23.12		-23.60		-26.76		-33.61		-33.00		-29.40		-23.04
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.92		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4124.46		-4119.64		-4119.64		-4119.64
fncf (ksi)	-18.82		-7.70		-19.60		-6.50		-22.52		-22.18		-7.19		-19.69	
Rcf	1.51		1.51		1.51		1.51		1.51		1.51		1.51		1.51	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.83	-19.51	-5.35	-17.08	-14.49	-17.64	-4.81	-20.11	-13.60	-19.83	-10.18	-20.37	-5.21	-21.95	-14.03	-16.71
Fs (ksi)	-13.83	-19.51	-5.35	-17.08	-14.49	-17.64	-4.81	-20.11	-13.60	-19.83	-10.18	-20.37	-5.21	-21.95	-14.03	-16.71
Fs (kip)	-1120.38	-1580.53	-433.21	-1383.54	-1173.80	-1429.17	-389.24	-1629.30	-1101.93	-1606.31	-824.25	-1649.69	-421.71	-1778.00	-1136.44	-1353.20

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4301.20	4301.20	1173.80	1778.00

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	287.67	80.84	310.46	51.74	159.25	154.77	66.28	302.19	208.57	59.82	224.66	39.26	171.39	110.38	49.53	218.82
Vuw (kip)	431.51	121.26	465.69	77.61	238.87	232.16	99.42	453.29	---	---	---	---	---	---	---	---
Mv (k*ft)	242.73	68.21	261.95	43.65	134.36	130.59	55.92	254.98	117.32	33.65	126.37	22.08	96.41	62.09	27.86	123.09
Huw (kip)	-2361.60	-1856.77	-2397.15	-1802.08	-2532.68	-2514.23	-1833.58	-2400.99	-1000.34	-672.87	-964.06	-747.61	-1003.05	-916.27	-814.71	-922.09
Muw (k*ft)	435.22	771.78	411.52	808.24	323.52	333.47	787.24	408.96	113.62	234.65	63.05	306.19	124.54	203.81	334.89	53.52
Mu (k*ft)	677.95	839.99	673.47	851.89	457.88	464.06	843.16	663.94	230.94	268.30	189.43	328.27	220.95	265.90	362.75	176.61

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	36.33	28.57	36.88	27.72	38.96	38.68	28.21	36.94	15.39	10.35	14.83	11.50	15.43	14.10	12.53	14.19
PY1 (Vuw)	6.64	1.87	7.16	1.19	3.67	3.57	1.53	6.97	3.21	0.92	3.46	0.60	2.64	1.70	0.76	3.37
PX2 (Mu)	15.64	19.38	15.54	19.66	10.57	10.71	19.46	15.32	5.33	6.19	4.37	7.58	5.10	6.14	8.37	4.08
PY2 (Mu)	5.21	6.46	5.18	6.55	3.52	3.57	6.49	5.11	1.78	2.06	1.46	2.53	1.70	2.05	2.79	1.36
Pu (kip)	53.31	48.67	53.85	48.01	50.05	49.90	48.34	53.64	21.31	16.81	19.82	19.33	20.98	20.58	21.20	18.86

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2244.10	2268.00	OK
TF Inside	2057.09	2079.00	OK
BF Inside	2057.09	2079.00	OK
BF Outside	2244.10	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.51	46.44	49.89	45.97	46.51	46.40	46.19	49.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	465.69
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2244.10	28.05	OK	612.42	7.66	OK
BF	2244.10	28.05	OK	927.65	11.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2244.10	28.05	1.47	119.85	OK
TF	4301.20	53.76	1.47	269.66	OK
TF Inside	2057.09	25.71	1.47	119.85	OK
BF Inside	2057.09	25.71	1.47	119.85	OK
BF	4301.20	53.76	1.47	269.66	OK
BF Outside	2244.10	28.05	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.85	26.93	OK	21.31	10.66	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.85	1.47	114.56	OK
Web SPL	26.93	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.20	4.27
Web	1.57	1.63	2.48
BF	1.29	1.45	4.27

Plate	Shear	Flexure
Web	3.08	1.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.75	-25.80	-7.71	-22.35	-19.49	-23.28	-6.89	-26.13	-11.72	-22.25	-11.46	-21.72	-7.58	-28.67	-19.18	-22.36
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.28	0.38	0.11	0.33	0.29	0.34	0.10	0.39	0.17	0.33	0.17	0.32	0.11	0.42	0.28	0.33
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.80		-22.35		-23.28		-26.13		-22.25		-21.72		-28.67		-22.36
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-18.75		-7.71		-19.49		-6.89		-11.72		-11.46		-7.58		-19.18	
Rcf	1.77		1.77		1.77		1.77		1.77		1.77		1.77		1.77	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.63682	-18.79962	-5.710466	-16.37298	-14.15861	-17.02377	-5.132124	-19.04532	-11.54696	-17.20596	-8.32061	-17.58193	-5.620963	-20.83832	-13.94	-16.38
Fs (ksi)	-13.64	-18.80	-5.71	-16.37	-14.16	-17.02	-5.13	-19.05	-11.55	-17.21	-8.32	-17.58	-5.62	-20.84	-13.94	-16.38
Fs (kip)	-1104.58	-1522.77	-462.55	-1326.21	-1146.85	-1378.93	-415.70	-1542.67	-935.30	-1393.68	-673.97	-1424.14	-455.30	-1687.90	-1129.45	-1326.44

Vu (kip)	287.67	80.84	310.46	51.74	159.25	154.77	66.28	302.19	208.57	59.82	224.66	39.26	171.39	110.38	49.53	218.82
Vuw (kip)	431.51	121.26	465.69	77.61	238.87	232.16	99.42	453.29	---	---	---	---	---	---	---	---
Mv (k*ft)	242.73	68.21	261.95	43.65	134.36	130.59	55.92	254.98	117.32	33.65	126.37	22.08	96.41	62.09	27.86	123.09
Huw (kip)	-2505.10	-1917.61	-2544.41	-1874.04	-2131.23	-2117.00	-1910.87	-2528.23	-973.09	-662.50	-935.47	-725.32	-862.59	-777.08	-793.78	-909.59
Muw (k*ft)									103.26	213.25	57.30	278.26	113.18	185.23	304.35	48.64
Mu (k*ft)	242.73	68.21	261.95	43.65	134.36	130.59	55.92	254.98	220.57	246.90	183.68	300.34	209.59	247.31	332.21	171.73

Muw (k*ft)	339.56	731.21	313.35	760.26	588.81	598.29	755.71	824.74	formulas matching the Muw results
Pu (add)	81.09	174.62	74.83	181.55	140.61	142.88	175.69	77.41	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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1% 3% 1% 3% 3% 3% 3% 1% percentage increase in flange force 3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.54	29.50	39.14	28.83	32.79	32.57	29.40	38.90	14.97	10.19	14.39	11.16	13.27	11.96	12.21	13.99
PY1 (Vuw)	6.64	1.87	7.16	1.19	3.67	3.57	1.53	6.97	3.21	0.92	3.46	0.60	2.64	1.70	0.76	3.37
PX2 (Mu)	5.60	1.57	6.05	1.01	3.10	3.01	1.29	5.88	5.09	5.70	4.24	6.93	4.84	5.71	7.67	3.96
PY2 (Mu)	1.87	0.52	2.02	0.34	1.03	1.00	0.43	1.96	1.70	1.90	1.41	2.31	1.61	1.90	2.56	1.32
Pu (kip)	44.95	31.17	46.11	29.88	36.20	35.88	30.75	45.66	20.65	16.14	19.26	18.32	18.60	18.03	20.15	18.56

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.86	28.40	41.87	27.19	32.99	32.70	28.00	41.48
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 3427**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.11	23.06	OK	20.65	10.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.11	1.47	114.56	OK
Web SPL	23.06	1.47	80.19	OK

Field Splice - Node 5427

Node 5427

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5427 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
5427 R	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5427 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.87	-27.42	-8.84	-24.16	-19.97	-24.77	-7.90	-28.02	-22.70	-34.24	-22.39	-33.28	-8.22	-30.22	-19.75	-23.70
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.28	0.40	0.13	0.36	0.29	0.37	0.12	0.41	0.33	0.50	0.33	0.49	0.12	0.45	0.29	0.35
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-27.42		-24.16		-24.77		-28.02		-34.24		-33.28		-30.22		-23.70
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-51.24		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4150.25		-4119.64		-4119.64		-4119.64
fncf (ksi)	-18.87		-8.84		-19.97		-7.90		-22.70		-22.39		-8.22		-19.75	
Rcf	1.49		1.49		1.49		1.49		1.50		1.49		1.49		1.49	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.53	-20.08	-6.30	-17.95	-14.41	-18.19	-5.56	-20.75	-12.94	-20.77	-10.03	-19.28	-5.75	-22.33	-14.23	-17.38
Fs (ksi)	-13.53	-20.08	-6.30	-17.95	-14.41	-18.19	-5.56	-20.75	-12.94	-20.77	-10.03	-19.28	-5.75	-22.33	-14.23	-17.38
Fs (kip)	-1096.30	-1626.60	-509.99	-1453.90	-1167.50	-1473.12	-450.05	-1680.67	-1048.29	-1682.30	-812.14	-1561.38	-465.71	-1809.05	-1152.78	-1407.84

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4296.67	4296.67	1167.50	1809.05

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	284.91	95.33	314.53	62.63	161.01	166.97	77.28	305.44	206.20	70.14	227.13	47.05	163.48	123.35	57.39	220.71
Vuw (kip)	427.36	142.99	471.80	93.95	241.51	250.45	115.91	458.17	---	---	---	---	---	---	---	---
Mv (k*ft)	240.39	80.43	265.39	52.85	135.85	140.88	65.20	257.72	115.99	39.46	127.76	26.46	91.96	69.38	32.28	124.15
Huw (kip)	-2348.10	-1901.16	-2397.25	-1859.25	-2537.27	-2505.09	-1873.31	-2387.52	-1008.48	-727.37	-978.01	-789.16	-1011.33	-879.08	-842.50	-948.38
Muw (k*ft)	444.22	742.18	411.46	770.12	333.04	339.56	760.75	417.95	130.94	233.07	75.46	303.86	156.55	185.00	331.69	62.98
Mu (k*ft)	684.61	822.61	676.84	822.97	468.89	480.44	825.95	675.67	246.93	272.52	203.22	330.32	248.50	254.38	363.97	187.13

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	36.12	29.25	36.88	28.60	39.03	38.54	28.82	36.73	15.52	11.19	15.05	12.14	15.56	13.52	12.96	14.59
PY1 (Vuw)	6.57	2.20	7.26	1.45	3.72	3.85	1.78	7.05	3.17	1.08	3.49	0.72	2.52	1.90	0.88	3.40
PX2 (Mu)	15.80	18.98	15.62	18.99	10.82	11.09	19.06	15.59	5.70	6.29	4.69	7.62	5.73	5.87	8.40	4.32
PY2 (Mu)	5.27	6.33	5.21	6.33	3.61	3.70	6.35	5.20	1.90	2.10	1.56	2.54	1.91	1.96	2.80	1.44
Pu (kip)	53.26	48.98	53.96	48.23	50.39	50.20	48.57	53.74	21.81	17.77	20.37	20.03	21.75	19.77	21.68	19.52

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2241.74	2268.00	OK
TF Inside	2054.93	2079.00	OK
BF Inside	2054.93	2079.00	OK
BF Outside	2241.74	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.48	46.63	49.98	46.06	46.84	46.67	46.32	49.81
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	471.80
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2241.74	28.02	OK	609.13	7.61	OK
BF	2241.74	28.02	OK	943.85	11.80	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2241.74	28.02	1.47	119.85	OK
TF	4296.67	53.71	1.47	269.66	OK
TF Inside	2054.93	25.69	1.47	119.85	OK
BF Inside	2054.93	25.69	1.47	119.85	OK
BF	4296.67	53.71	1.47	269.66	OK
BF Outside	2241.74	28.02	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.96	26.98	OK	21.81	10.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.96	1.47	114.56	OK
Web SPL	26.98	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.21	4.28
Web	1.57	1.58	2.48
BF	1.29	1.43	4.28

Plate	Shear	Flexure
Web	3.04	1.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.72	-26.84	-8.48	-23.02	-19.80	-24.35	-7.53	-26.63	-11.88	-22.84	-12.21	-22.54	-8.18	-29.07	-19.56	-23.31
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.28	0.40	0.13	0.34	0.29	0.36	0.11	0.39	0.18	0.34	0.18	0.33	0.12	0.43	0.29	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.84		-23.02		-24.35		-26.63		-22.84		-22.54		-29.07		-23.31
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-18.72		-8.48		-19.80		-7.53		-11.88		-12.21		-8.18		-19.56	
Rcf	1.75		1.75		1.75		1.75		1.75		1.75		1.75		1.75	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.59418	-19.54408	-6.260778	-16.85137	-14.35434	-17.78329	-5.590434	-19.39772	-11.35983	-18.47337	-8.95551	-17.36181	-6.05205	-21.12401	-14.19	-17.05
Fs (ksi)	-13.59	-19.54	-6.26	-16.85	-14.35	-17.78	-5.59	-19.40	-11.36	-18.47	-8.96	-17.36	-6.05	-21.12	-14.19	-17.05
Fs (kip)	-1101.13	-1583.07	-507.12	-1364.96	-1162.70	-1440.45	-452.83	-1571.22	-920.15	-1496.34	-725.40	-1406.31	-490.22	-1711.05	-1149.21	-1381.01

Vu (kip)	284.91	95.33	314.53	62.63	161.01	166.97	77.28	305.44	206.20	70.14	227.13	47.05	163.48	123.35	57.39	220.71
Vuw (kip)	427.36	142.99	471.80	93.95	241.51	250.45	115.91	458.17	---	---	---	---	---	---	---	---
Mv (k*ft)	240.39	80.43	265.39	52.85	135.85	140.88	65.20	257.72	115.99	39.46	127.76	26.46	91.96	69.38	32.28	124.15
Huw (kip)	-2489.94	-1952.25	-2546.41	-1902.46	-2130.62	-2147.93	-1936.75	-2534.04	-994.15	-693.36	-964.13	-749.64	-895.00	-789.52	-815.28	-937.12
Muw (k*ft)									119.00	211.81	68.58	276.15	142.27	168.13	301.44	57.23
Mu (k*ft)	240.39	80.43	265.39	52.85	135.85	140.88	65.20	257.72	234.98	251.27	196.34	302.61	234.23	237.51	333.72	181.38
Muw (k*ft)	349.66	708.12	312.01	741.32	589.21	577.67	718.46	820.26	formulas matching the Muw results							
Pu (add)	83.50	169.10	74.51	177.03	140.71	137.95	171.57	76.48	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2%	3%	1%	3%	3%	3%	3%	1%	percentage increase in flange force	3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.31	30.03	39.18	29.27	32.78	33.05	29.80	38.99	15.29	10.67	14.83	11.53	13.77	12.15	12.54	14.42
PY1 (Vuw)	6.57	2.20	7.26	1.45	3.72	3.85	1.78	7.05	3.17	1.08	3.49	0.72	2.52	1.90	0.88	3.40
PX2 (Mu)	5.55	1.86	6.12	1.22	3.14	3.25	1.50	5.95	5.42	5.80	4.53	6.98	5.41	5.48	7.70	4.19
PY2 (Mu)	1.85	0.62	2.04	0.41	1.05	1.08	0.50	1.98	1.81	1.93	1.51	2.33	1.80	1.83	2.57	1.40
Pu (kip)	44.66	32.02	46.24	30.54	36.23	36.63	31.38	45.83	21.31	16.74	20.00	18.77	19.65	18.02	20.54	19.21

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.59	29.18	41.99	27.81	33.02	33.38	28.59	41.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 5427**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.24	23.12	OK	21.31	10.65	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.24	1.47	114.56	OK
Web SPL	23.12	1.47	80.19	OK

Field Splice - Node 7427

Node 7427

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7427 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
7427 R	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7427 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.34	-27.54	-7.89	-23.47	-19.83	-24.81	-6.82	-27.27	-22.48	-33.64	-22.03	-33.65	-7.50	-29.98	-19.01	-23.16
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.27	0.41	0.12	0.35	0.29	0.37	0.10	0.40	0.33	0.50	0.32	0.50	0.11	0.44	0.28	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-27.54		-23.47		-24.81		-27.27		-33.64		-33.65		-29.98		-23.16
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.93		-50.94		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4125.57		-4125.88		-4119.64		-4119.64
fncf (ksi)	-18.34		-7.89		-19.83		-6.82		-22.48		-22.03		-7.50		-19.01	
Rcf	1.51		1.51		1.51		1.51		1.51		1.51		1.51		1.51	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.55	-20.62	-5.35	-17.18	-14.67	-18.63	-4.70	-20.12	-10.95	-20.95	-13.10	-20.04	-5.03	-21.95	-14.10	-17.45
Fs (ksi)	-13.55	-20.62	-5.35	-17.18	-14.67	-18.63	-4.70	-20.12	-10.95	-20.95	-13.10	-20.04	-5.03	-21.95	-14.10	-17.45
Fs (kip)	-1097.45	-1670.02	-433.11	-1391.37	-1188.09	-1508.96	-380.35	-1629.43	-886.74	-1697.14	-1061.47	-1623.37	-407.73	-1778.08	-1142.36	-1413.33

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4300.91	4300.91	1188.09	1778.08

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	270.16	81.69	303.02	51.99	154.65	153.51	66.04	294.45	195.29	60.75	218.51	39.77	117.19	164.36	49.69	212.45
Vuw (kip)	405.23	122.53	454.53	77.99	231.98	230.27	99.06	441.68	---	---	---	---	---	---	---	---
Mv (k*ft)	227.94	68.93	255.67	43.87	130.49	129.53	55.72	248.44	109.85	34.17	122.91	22.37	65.92	92.45	27.95	119.50
Huw (kip)	-2338.92	-1864.88	-2406.50	-1816.36	-2530.50	-2510.21	-1847.50	-2369.42	-1024.99	-675.73	-998.91	-744.36	-957.00	-994.39	-809.56	-946.55
Muw (k*ft)	450.34	766.37	405.29	798.72	325.51	339.19	777.96	430.01	141.38	236.61	79.23	308.42	200.10	138.74	338.36	66.91
Mu (k*ft)	678.29	835.30	660.96	842.59	456.00	468.72	833.68	678.45	251.23	270.78	202.14	330.78	266.02	231.19	366.31	186.41

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	35.98	28.69	37.02	27.94	38.93	38.62	28.42	36.45	15.77	10.40	15.37	11.45	14.72	15.30	12.45	14.56
PY1 (Vuw)	6.23	1.89	6.99	1.20	3.57	3.54	1.52	6.80	3.00	0.93	3.36	0.61	1.80	2.53	0.76	3.27
PX2 (Mu)	15.65	19.28	15.25	19.44	10.52	10.82	19.24	15.66	5.80	6.25	4.66	7.63	6.14	5.34	8.45	4.30
PY2 (Mu)	5.22	6.43	5.08	6.48	3.51	3.61	6.41	5.22	1.93	2.08	1.55	2.54	2.05	1.78	2.82	1.43
Pu (kip)	52.89	48.68	53.65	48.01	49.96	49.95	48.32	53.48	22.12	16.92	20.63	19.34	21.21	21.08	21.21	19.44

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2243.95	2268.00	OK
TF Inside	2056.96	2079.00	OK
BF Inside	2056.96	2079.00	OK
BF Outside	2243.95	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.20	46.44	49.72	45.94	46.43	46.46	46.15	49.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	454.53
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2243.95	28.05	OK	619.87	7.75	OK
BF	2243.95	28.05	OK	927.69	11.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2243.95	28.05	1.47	119.85	OK
TF	4300.91	53.76	1.47	269.66	OK
TF Inside	2056.96	25.71	1.47	119.85	OK
BF Inside	2056.96	25.71	1.47	119.85	OK
BF	4300.91	53.76	1.47	269.66	OK
BF Outside	2243.95	28.05	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.65	26.83	OK	22.12	11.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.65	1.47	114.56	OK
Web SPL	26.83	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.17	4.27
Web	1.59	1.59	2.51
BF	1.29	1.45	4.27

Plate	Shear	Flexure
Web	3.16	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7427**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.04	-26.76	-7.82	-22.61	-19.26	-23.99	-7.00	-26.41	-11.44	-22.03	-11.60	-22.62	-7.65	-28.99	-18.90	-22.84
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.27	0.39	0.12	0.33	0.28	0.35	0.10	0.39	0.17	0.32	0.17	0.33	0.11	0.43	0.28	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.76		-22.61		-23.99		-26.41		-22.03		-22.62		-28.99		-22.84
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-18.04		-7.82		-19.26		-7.00		-11.44		-11.60		-7.65		-18.90	
Rcf	1.75		1.75		1.75		1.75		1.75		1.75		1.75		1.75	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.08521	-19.50943	-5.809853	-16.56141	-13.94931	-17.54941	-5.234444	-19.24889	-8.793784	-17.88631	-11.33982	-17.64413	-5.691484	-21.06657	-13.70	-16.74
Fs (ksi)	-13.09	-19.51	-5.81	-16.56	-13.95	-17.55	-5.23	-19.25	-8.79	-17.89	-11.34	-17.64	-5.69	-21.07	-13.70	-16.74
Fs (kip)	-1059.90	-1580.26	-470.60	-1341.47	-1129.89	-1421.50	-423.99	-1559.16	-712.30	-1448.79	-918.53	-1429.17	-461.01	-1706.39	-1109.64	-1355.90

Vu (kip)	270.16	81.69	303.02	51.99	154.65	153.51	66.04	294.45	195.29	60.75	218.51	39.77	117.19	164.36	49.69	212.45
Vuw (kip)	405.23	122.53	454.53	77.99	231.98	230.27	99.06	441.68	---	---	---	---	---	---	---	---
Mv (k*ft)	227.94	68.93	255.67	43.87	130.49	129.53	55.72	248.44	109.85	34.17	122.91	22.37	65.92	92.45	27.95	119.50
Huw (kip)	-2456.54	-1918.72	-2520.92	-1875.85	-2109.43	-2117.64	-1909.90	-2502.29	-977.84	-671.14	-944.96	-734.50	-800.40	-869.52	-802.74	-913.16
Muw (k*ft)									128.48	215.03	72.00	280.29	181.85	126.09	307.50	60.81
Mu (k*ft)	227.94	68.93	255.67	43.87	130.49	129.53	55.72	248.44	238.33	249.20	194.91	302.66	247.77	218.54	335.45	180.31

Muw (k*ft)	371.93	730.48	329.01	759.06	603.34	597.86	756.06	841.43	formulas matching the Muw results
Pu (add)	88.82	174.44	78.57	181.27	144.08	142.77	175.85	81.54	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2%	3%	1%	3%	3%	3%	3%	1%	percentage increase in flange force	3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.79	29.52	38.78	28.86	32.45	32.58	29.38	38.50	15.04	10.33	14.54	11.30	12.31	13.38	12.35	14.05
PY1 (Vuw)	6.23	1.89	6.99	1.20	3.57	3.54	1.52	6.80	3.00	0.93	3.36	0.61	1.80	2.53	0.76	3.27
PX2 (Mu)	5.26	1.59	5.90	1.01	3.01	2.99	1.29	5.73	5.50	5.75	4.50	6.98	5.72	5.04	7.74	4.16
PY2 (Mu)	1.75	0.53	1.97	0.34	1.00	1.00	0.43	1.91	1.83	1.92	1.50	2.33	1.91	1.68	2.58	1.39
Pu (kip)	43.79	31.20	45.57	29.91	35.76	35.86	30.73	45.08	21.11	16.33	19.65	18.52	18.41	18.90	20.37	18.80

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.82	28.43	41.39	27.22	32.59	32.68	27.98	40.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.57	22.79	OK	21.11	10.55	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.57	1.47	114.56	OK
Web SPL	22.79	1.47	80.19	OK

Field Splice - Node 9427

Node 9427

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9427 L	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00
9427 R	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9427 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.12	-26.28	-6.35	-21.89	-18.33	-23.17	-5.47	-25.96	-20.90	-32.20	-21.21	-32.84	-7.76	-30.97	-18.52	-22.68
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.25	0.39	0.09	0.32	0.27	0.34	0.08	0.38	0.31	0.47	0.31	0.48	0.11	0.46	0.27	0.33
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.28		-21.89		-23.17		-25.96		-32.20		-32.84		-30.97		-22.68
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-17.12		-6.35		-18.33		-5.47		-20.90		-21.21		-7.76		-18.52	
Rcf	1.55		1.55		1.55		1.55		1.55		1.55		1.55		1.55	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.11	-20.20	-4.46	-16.24	-13.85	-17.76	-3.90	-19.33	-9.64	-21.21	-13.07	-19.14	-6.27	-23.73	-13.85	-17.23
Fs (ksi)	-13.11	-20.20	-4.46	-16.24	-13.85	-17.76	-3.90	-19.33	-9.64	-21.21	-13.07	-19.14	-6.27	-23.73	-13.85	-17.23
Fs (kip)	-1061.72	-1636.04	-361.44	-1315.37	-1121.91	-1438.24	-315.95	-1565.55	-780.80	-1717.71	-1058.33	-1550.36	-508.10	-1922.28	-1121.89	-1395.57

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4312.17	4312.17	1121.91	1922.28

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	255.58	52.96	285.25	24.46	126.28	139.77	43.92	262.82	185.02	40.97	205.98	20.84	83.78	158.79	35.47	189.25
Vuw (kip)	383.38	79.44	427.87	36.69	189.42	209.66	65.87	394.23	---	---	---	---	---	---	---	---
Mv (k*ft)	215.65	44.69	240.68	20.64	106.55	117.93	37.05	221.76	104.07	23.05	115.86	11.72	47.12	89.32	19.95	106.45
Huw (kip)	-2302.62	-1802.31	-2358.80	-1761.49	-2478.46	-2492.56	-1867.65	-2367.84	-999.17	-621.04	-948.21	-696.85	-925.38	-966.18	-900.14	-932.39
Muw (k*ft)	474.55	808.09	437.09	835.30	357.32	347.92	764.52	431.06	141.81	235.54	78.11	308.54	231.34	121.49	349.18	67.58
Mu (k*ft)	690.19	852.77	677.77	855.94	463.87	465.85	801.58	652.82	245.88	258.58	193.97	320.26	278.46	210.81	369.13	174.03

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	35.42	27.73	36.29	27.10	38.13	38.35	28.73	36.43	15.37	9.55	14.59	10.72	14.24	14.86	13.85	14.34
PY1 (Vuw)	5.90	1.22	6.58	0.56	2.91	3.23	1.01	6.07	2.85	0.63	3.17	0.32	1.29	2.44	0.55	2.91
PX2 (Mu)	15.93	19.68	15.64	19.75	10.70	10.75	18.50	15.07	5.67	5.97	4.48	7.39	6.43	4.86	8.52	4.02
PY2 (Mu)	5.31	6.56	5.21	6.58	3.57	3.58	6.17	5.02	1.89	1.99	1.49	2.46	2.14	1.62	2.84	1.34
Pu (kip)	52.56	48.04	53.25	47.39	49.26	49.57	47.77	52.67	21.57	15.74	19.63	18.32	20.95	20.14	22.62	18.85

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2249.83	2268.00	OK
TF Inside	2062.34	2079.00	OK
BF Inside	2062.34	2079.00	OK
BF Outside	2249.83	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.98	45.99	49.46	45.50	45.90	46.14	45.65	48.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	427.87
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9427**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2249.83	28.12	OK	585.35	7.32	OK
BF	2249.83	28.12	OK	1002.93	12.54	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2249.83	28.12	1.47	119.85	OK
TF	4312.17	53.90	1.47	269.66	OK
TF Inside	2062.34	25.78	1.47	119.85	OK
BF Inside	2062.34	25.78	1.47	119.85	OK
BF	4312.17	53.90	1.47	269.66	OK
BF Outside	2249.83	28.12	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.25	26.63	OK	22.62	11.31	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.25	1.47	114.56	OK
Web SPL	26.63	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.30	4.26
Web	1.63	1.65	2.57
BF	1.29	1.34	4.26

Plate	Shear	Flexure
Web	3.35	1.24

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.12	-25.81	-6.23	-20.98	-18.20	-22.80	-5.57	-25.01	-9.63	-20.36	-10.77	-21.82	-6.48	-28.51	-17.20	-21.15
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.25	0.38	0.09	0.31	0.27	0.34	0.08	0.37	0.14	0.30	0.16	0.32	0.10	0.42	0.25	0.31
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.81		-20.98		-22.80		-25.01		-20.36		-21.82		-28.51		-21.15
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-17.12		-6.23		-18.20		-5.57		-9.63		-10.77		-6.48		-17.20	
Rcf	1.78		1.78		1.78		1.78		1.78		1.78		1.78		1.78	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.4346	-18.87828	-4.708116	-15.41095	-13.19795	-16.74711	-4.237329	-18.25765	-6.899218	-17.41119	-10.87671	-16.3971	-4.915257	-20.78208	-12.45	-15.52
Fs (ksi)	-12.43	-18.88	-4.71	-15.41	-13.20	-16.75	-4.24	-18.26	-6.90	-17.41	-10.88	-16.40	-4.92	-20.78	-12.45	-15.52
Fs (kip)	-1007.20	-1529.14	-381.36	-1248.29	-1069.03	-1356.52	-343.22	-1478.87	-558.84	-1410.31	-881.01	-1328.17	-398.14	-1683.35	-1008.80	-1257.52

Vu (kip)	255.58	52.96	285.25	24.46	126.28	139.77	43.92	262.82	185.02	40.97	205.98	20.84	83.78	158.79	35.47	189.25
Vuw (kip)	383.38	79.44	427.87	36.69	189.42	209.66	65.87	394.23	---	---	---	---	---	---	---	---
Mv (k*ft)	215.65	44.69	240.68	20.64	106.55	117.93	37.05	221.76	104.07	23.05	115.86	11.72	47.12	89.32	19.95	106.45
Huw (kip)	-2423.52	-1840.75	-2481.34	-1805.08	-2022.85	-2083.89	-1853.89	-2427.56	-939.39	-603.57	-898.35	-674.85	-729.31	-818.21	-770.92	-839.38
Muw (k*ft)									128.87	214.06	70.98	280.41	210.24	110.41	317.34	61.41
Mu (k*ft)	215.65	44.69	240.68	20.64	106.55	117.93	37.05	221.76	232.95	237.10	186.85	292.13	257.36	199.73	337.29	167.86
Muw (k*ft)	393.95	782.46	355.39	806.23	661.06	620.36	771.70	891.23	formulas matching the Muw results							
Pu (add)	94.08	186.86	84.87	192.53	157.86	148.15	184.76	93.43	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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2% 3% 2% 4% 3% 3% 3% 2% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.28	28.32	38.17	27.77	31.12	32.06	28.52	37.35	14.45	9.29	13.82	10.38	11.22	12.59	11.86	12.91
PY1 (Vuw)	5.90	1.22	6.58	0.56	2.91	3.23	1.01	6.07	2.85	0.63	3.17	0.32	1.29	2.44	0.55	2.91
PX2 (Mu)	4.98	1.03	5.55	0.48	2.46	2.72	0.86	5.12	5.38	5.47	4.31	6.74	5.94	4.61	7.78	3.87
PY2 (Mu)	1.66	0.34	1.85	0.16	0.82	0.91	0.29	1.71	1.79	1.82	1.44	2.25	1.98	1.54	2.59	1.29
Pu (kip)	42.93	29.39	44.53	28.26	33.79	35.03	29.41	43.17	20.36	14.96	18.71	17.32	17.47	17.65	19.89	17.31

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.06	26.75	40.47	25.66	30.80	31.93	26.75	39.26
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9427	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.53	22.27	OK	20.36	10.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.53	1.47	114.56	OK
Web SPL	22.27	1.47	80.19	OK

Field Splice - Node 1431

Node 1431

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1431 L	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00
1431 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1431 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.21	-20.93	-16.87	-25.54	-19.26	-21.93	-5.19	-24.89	-20.97	-30.68	-21.48	-32.03	-18.21	-20.24	-6.22	-28.46
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.09	0.31	0.25	0.38	0.28	0.32	0.08	0.37	0.31	0.45	0.32	0.47	0.27	0.30	0.09	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.93		-25.54		-21.93		-24.89		-30.68		-32.03		-20.24		-28.46
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-6.21		-16.87		-19.26		-5.19		-20.97		-21.48		-18.21		-6.22	
Rcf	1.59		1.59		1.59		1.59		1.59		1.59		1.59		1.59	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.32	-15.55	-12.91	-19.42	-14.18	-16.26	-3.84	-18.74	-8.77	-19.63	-13.46	-18.24	-13.64	-15.26	-4.26	-21.03
Fs (ksi)	-4.32	-15.55	-12.91	-19.42	-14.18	-16.26	-3.84	-18.74	-8.77	-19.63	-13.46	-18.24	-13.64	-15.26	-4.26	-21.03
Fs (kip)	-350.25	-1259.41	-1045.84	-1572.80	-1148.49	-1317.07	-310.83	-1517.54	-710.74	-1590.10	-1090.60	-1477.25	-1105.22	-1236.09	-344.71	-1703.54

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4312.00	4312.00	1148.49	1703.54

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	45.61	237.28	289.89	15.92	126.30	133.29	269.46	36.02	34.91	173.50	210.67	13.93	69.48	157.47	196.24	28.13
Vuw (kip)	68.42	355.92	434.84	23.87	189.45	199.94	404.19	54.03	---	---	---	---	---	---	---	---
Mv (k*ft)	38.49	200.21	244.60	13.43	106.57	112.46	227.36	30.39	19.64	97.59	118.50	7.84	39.08	88.58	110.38	15.83
Huw (kip)	-1803.09	-2310.97	-2424.93	-1754.34	-2506.04	-2530.68	-2374.52	-1803.37	-596.17	-969.87	-913.17	-677.17	-852.16	-951.05	-867.15	-758.61
Muw (k*ft)	807.56	468.98	393.00	840.06	338.93	322.50	426.61	807.38	224.48	130.11	41.63	297.95	217.12	95.47	32.31	335.51
Mu (k*ft)	846.05	669.18	637.60	853.49	445.50	434.97	653.97	837.77	244.12	227.71	160.13	305.79	256.21	184.05	142.70	351.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.74	35.55	37.31	26.99	38.55	38.93	36.53	27.74	9.17	14.92	14.05	10.42	13.11	14.63	13.34	11.67
PY1 (Vuw)	1.05	5.48	6.69	0.37	2.91	3.08	6.22	0.83	0.54	2.67	3.24	0.21	1.07	2.42	3.02	0.43
PX2 (Mu)	19.52	15.44	14.71	19.70	10.28	10.04	15.09	19.33	5.63	5.25	3.70	7.06	5.91	4.25	3.29	8.11
PY2 (Mu)	6.51	5.15	4.90	6.57	3.43	3.35	5.03	6.44	1.88	1.75	1.23	2.35	1.97	1.42	1.10	2.70
Pu (kip)	47.86	52.09	53.30	47.20	49.25	49.39	52.83	47.64	15.00	20.65	18.30	17.66	19.26	19.27	17.14	20.03

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2249.74	2268.00	OK
TF Inside	2062.26	2079.00	OK
BF Inside	2062.26	2079.00	OK
BF Outside	2249.74	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.84	48.59	49.40	45.34	45.83	45.92	49.10	45.64
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	434.84
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2249.74	28.12	OK	599.21	7.49	OK
BF	2249.74	28.12	OK	888.81	11.11	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2249.74	28.12	1.47	119.85	OK
TF	4312.00	53.90	1.47	269.66	OK
TF Inside	2062.26	25.78	1.47	119.85	OK
BF Inside	2062.26	25.78	1.47	119.85	OK
BF	4312.00	53.90	1.47	269.66	OK
BF Outside	2249.74	28.12	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.30	26.65	OK	20.65	10.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.30	1.47	114.56	OK
Web SPL	26.65	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.25	4.26
Web	1.58	1.72	2.51
BF	1.29	1.51	4.26

Plate	Shear	Flexure
Web	3.30	1.20

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.05	-20.02	-16.85	-25.07	-18.73	-21.26	-5.36	-24.06	-9.87	-19.10	-10.71	-20.72	-17.80	-19.74	-6.25	-27.37
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.09	0.30	0.25	0.37	0.28	0.31	0.08	0.35	0.15	0.28	0.16	0.31	0.26	0.29	0.09	0.40
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.02		-25.07		-21.26		-24.06		-19.10		-20.72		-19.74		-27.37
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-6.05		-16.85		-18.73		-5.36		-9.87		-10.71		-17.80		-6.25	
Rcf	1.86		1.86		1.86		1.86		1.86		1.86		1.86		1.86	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.53033	-14.7309	-12.3488	-18.2612	-13.67696	-15.56849	-4.046678	-17.58574	-6.241864	-16.10806	-11.0354	-15.37356	-13.02502	-14.49337	-4.68	-19.92
Fs (ksi)	-4.53	-14.73	-12.35	-18.26	-13.68	-15.57	-4.05	-17.59	-6.24	-16.11	-11.04	-15.37	-13.03	-14.49	-4.68	-19.92
Fs (kip)	-366.96	-1193.20	-1000.25	-1479.16	-1107.83	-1261.05	-327.78	-1424.44	-505.59	-1304.75	-893.87	-1245.26	-1055.03	-1173.96	-378.76	-1613.67

Vu (kip)	45.61	237.28	289.89	15.92	126.30	133.29	269.46	36.02	34.91	173.50	210.67	13.93	69.48	157.47	196.24	28.13
Vuw (kip)	68.42	355.92	434.84	23.87	189.45	199.94	404.19	54.03	---	---	---	---	---	---	---	---
Mv (k*ft)	38.49	200.21	244.60	13.43	106.57	112.46	227.36	30.39	19.64	97.59	118.50	7.84	39.08	88.58	110.38	15.83
Huw (kip)	-1844.33	-2446.51	-2551.31	-1806.16	-2057.70	-2104.49	-2499.87	-1855.83	-577.84	-918.30	-877.36	-648.97	-670.50	-792.27	-825.55	-737.94
Muw (k*ft)									204.01	118.25	37.83	270.78	197.32	86.76	29.37	304.92
Mu (k*ft)	38.49	200.21	244.60	13.43	106.57	112.46	227.36	30.39	223.65	215.84	156.33	278.62	236.40	175.34	139.75	320.74
Muw (k*ft)	780.07	378.62	308.75	805.51	637.82	606.63	343.04	572.40	formulas matching the Muw results							
Pu (add)	186.29	90.42	73.73	192.36	152.32	144.87	81.92	184.45	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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3% 2% 1% 4% 3% 3% 1% 3% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.37	37.64	39.25	27.79	31.66	32.38	38.46	28.55	8.89	14.13	13.50	9.98	10.32	12.19	12.70	11.35
PY1 (Vuw)	1.05	5.48	6.69	0.37	2.91	3.08	6.22	0.83	0.54	2.67	3.24	0.21	1.07	2.42	3.02	0.43
PX2 (Mu)	0.89	4.62	5.64	0.31	2.46	2.60	5.25	0.70	5.16	4.98	3.61	6.43	5.46	4.05	3.23	7.40
PY2 (Mu)	0.30	1.54	1.88	0.10	0.82	0.87	1.75	0.23	1.72	1.66	1.20	2.14	1.82	1.35	1.08	2.47
Pu (kip)	29.29	42.84	45.71	28.10	34.32	35.19	44.43	29.27	14.23	19.59	17.67	16.58	16.03	16.67	16.44	18.98

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.65	39.00	41.54	25.50	31.29	32.08	40.41	26.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.71	22.85	OK	19.59	9.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.71	1.47	114.56	OK
Web SPL	22.85	1.47	80.19	OK

Field Splice - Node 3431

Node 3431

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3431 L	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00
3431 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3431 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.22	-23.47	-19.19	-26.30	-19.95	-23.53	-7.14	-27.18	-22.80	-33.51	-22.49	-33.20	-19.46	-22.52	-7.67	-29.66
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.12	0.35	0.28	0.39	0.29	0.35	0.11	0.40	0.34	0.49	0.33	0.49	0.29	0.33	0.11	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-23.47		-26.30		-23.53		-27.18		-33.51		-33.20		-22.52		-29.66
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.87		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4120.20		-4119.64		-4119.64		-4119.64
fncf (ksi)	-8.22		-19.19		-19.95		-7.14		-22.80		-22.49		-19.46		-7.67	
Rcf	1.52		1.52		1.52		1.52		1.52		1.52		1.52		1.52	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.53	-17.14	-14.28	-19.70	-14.87	-17.69	-4.70	-19.84	-10.76	-20.67	-13.27	-19.42	-14.53	-16.97	-5.05	-21.63
Fs (ksi)	-5.53	-17.14	-14.28	-19.70	-14.87	-17.69	-4.70	-19.84	-10.76	-20.67	-13.27	-19.42	-14.53	-16.97	-5.05	-21.63
Fs (kip)	-448.07	-1388.41	-1156.57	-1595.71	-1204.60	-1432.58	-380.58	-1607.10	-871.46	-1674.50	-1074.94	-1573.18	-1176.74	-1374.28	-408.71	-1752.26

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4299.53	4299.53	1204.60	1752.26

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	75.80	279.43	302.12	45.43	148.54	151.70	294.38	59.86	56.07	202.32	218.35	34.61	107.52	162.36	212.88	44.80
Vuw (kip)	113.71	419.14	453.17	68.15	222.82	227.55	441.56	89.78	---	---	---	---	---	---	---	---
Mv (k*ft)	63.96	235.77	254.91	38.33	125.33	127.99	248.38	50.50	31.54	113.80	122.82	19.47	60.48	91.33	119.74	25.20
Huw (kip)	-1881.32	-2381.22	-2415.86	-1832.47	-2545.62	-2531.30	-2393.18	-1856.25	-680.18	-1019.36	-976.73	-736.18	-942.95	-980.78	-944.83	-800.36
Muw (k*ft)	755.41	422.14	399.05	787.98	312.82	322.09	414.17	772.12	232.18	108.43	56.29	302.85	198.28	123.02	48.78	331.74
Mu (k*ft)	819.37	657.91	653.96	826.31	438.15	450.08	662.55	822.62	263.72	222.23	179.11	322.31	258.76	214.35	168.52	356.94

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.94	36.63	37.17	28.19	39.16	38.94	36.82	28.56	10.46	15.68	15.03	11.33	14.51	15.09	14.54	12.31
PY1 (Vuw)	1.75	6.45	6.97	1.05	3.43	3.50	6.79	1.38	0.86	3.11	3.36	0.53	1.65	2.50	3.28	0.69
PX2 (Mu)	18.91	15.18	15.09	19.07	10.11	10.39	15.29	18.98	6.09	5.13	4.13	7.44	5.97	4.95	3.89	8.24
PY2 (Mu)	6.30	5.06	5.03	6.36	3.37	3.46	5.10	6.33	2.03	1.71	1.38	2.48	1.99	1.65	1.30	2.75
Pu (kip)	48.52	53.08	53.62	47.84	49.74	49.82	53.45	48.16	16.80	21.36	19.74	19.00	20.80	20.46	18.98	20.84

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2243.24	2268.00	OK
TF Inside	2056.30	2079.00	OK
BF Inside	2056.30	2079.00	OK
BF Outside	2243.24	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.27	49.29	49.68	45.76	46.20	46.30	49.57	46.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	453.17
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2243.24	28.04	OK	628.49	7.86	OK
BF	2243.24	28.04	OK	914.22	11.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2243.24	28.04	1.47	119.85	OK
TF	4299.53	53.74	1.47	269.66	OK
TF Inside	2056.30	25.70	1.47	119.85	OK
BF Inside	2056.30	25.70	1.47	119.85	OK
BF	4299.53	53.74	1.47	269.66	OK
BF Outside	2243.24	28.04	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.62	26.81	OK	21.36	10.68	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.62	1.47	114.56	OK
Web SPL	26.81	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.14	4.27
Web	1.57	1.65	2.48
BF	1.29	1.47	4.27

Plate	Shear	Flexure
Web	3.17	1.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.86	-22.34	-18.92	-25.67	-19.70	-23.09	-7.07	-26.09	-11.55	-21.72	-11.90	-22.07	-19.35	-22.26	-7.72	-28.60
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.12	0.33	0.28	0.38	0.29	0.34	0.10	0.38	0.17	0.32	0.18	0.33	0.29	0.33	0.11	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.34		-25.67		-23.09		-26.09		-21.72		-22.07		-22.26		-28.60
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-7.86		-18.92		-19.70		-7.07		-11.55		-11.90		-19.35		-7.72	
Rcf	1.78		1.78		1.78		1.78		1.78		1.78		1.78		1.78	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.817915	-16.36832	-13.76823	-18.69528	-14.31649	-16.87439	-5.261896	-19.02324	-8.560311	-17.57026	-11.47709	-17.06725	-14.06854	-16.28492	-5.72	-20.79
Fs (ksi)	-5.82	-16.37	-13.77	-18.70	-14.32	-16.87	-5.26	-19.02	-8.56	-17.57	-11.48	-17.07	-14.07	-16.28	-5.72	-20.79
Fs (kip)	-471.25	-1325.83	-1115.23	-1514.32	-1159.64	-1366.83	-426.21	-1540.88	-693.39	-1423.19	-929.64	-1382.45	-1139.55	-1319.08	-463.13	-1684.16

Vu (kip)	75.80	279.43	302.12	45.43	148.54	151.70	294.38	59.86	56.07	202.32	218.35	34.61	107.52	162.36	212.88	44.80
Vuw (kip)	113.71	419.14	453.17	68.15	222.82	227.55	441.56	89.78	---	---	---	---	---	---	---	---
Mv (k*ft)	63.96	235.77	254.91	38.33	125.33	127.99	248.38	50.50	31.54	113.80	122.82	19.47	60.48	91.33	119.74	25.20
Huw (kip)	-1926.47	-2516.75	-2558.15	-1884.48	-2123.41	-2142.14	-2539.43	-1918.90	-665.59	-973.91	-935.73	-728.55	-783.92	-856.33	-910.60	-795.29
Muw (k*ft)									211.01	98.54	51.16	275.23	180.20	111.80	44.33	301.49
Mu (k*ft)	63.96	235.77	254.91	38.33	125.33	127.99	248.38	50.50	242.55	212.34	173.98	294.70	240.68	203.13	164.07	326.69
Muw (k*ft)	725.31	331.79	304.19	753.30	594.02	581.53	316.07	736.83	formulas matching the Muw results							
Pu (add)	173.21	79.23	72.64	179.89	141.86	138.87	75.62	174.41	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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3%	1%	1%	3%	3%	3%	1%	3%	percentage increase in flange force	3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.64	38.72	39.36	28.99	32.67	32.96	39.07	29.52	10.24	14.98	14.40	11.21	12.06	13.17	14.01	12.24
PY1 (Vuw)	1.75	6.45	6.97	1.05	3.43	3.50	6.79	1.38	0.86	3.11	3.36	0.53	1.65	2.50	3.28	0.69
PX2 (Mu)	1.48	5.44	5.88	0.88	2.89	2.95	5.73	1.17	5.60	4.90	4.01	6.80	5.55	4.69	3.79	7.54
PY2 (Mu)	0.49	1.81	1.96	0.29	0.96	0.98	1.91	0.39	1.87	1.63	1.34	2.27	1.85	1.56	1.26	2.51
Pu (kip)	31.19	44.93	46.11	29.91	35.83	36.19	45.64	30.74	16.07	20.44	19.00	18.23	17.96	18.32	18.36	20.03

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.42	40.85	41.89	27.20	32.66	32.99	41.47	27.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
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Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.11	23.06	OK	20.44	10.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.11	1.47	114.56	OK
Web SPL	23.06	1.47	80.19	OK

Field Splice - Node 5431

Node 5431

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5431 L	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00
5431 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5431 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.67	-23.68	-19.01	-27.25	-20.42	-24.85	-7.63	-27.43	-23.02	-33.73	-22.56	-33.67	-20.08	-23.66	-7.99	-29.71
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.13	0.35	0.28	0.40	0.30	0.37	0.11	0.40	0.34	0.50	0.33	0.50	0.30	0.35	0.12	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-23.68		-27.25		-24.85		-27.43		-33.73		-33.67		-23.66		-29.71
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.98		-50.95		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4129.25		-4126.87		-4119.64		-4119.64
fncf (ksi)	-8.67		-19.01		-20.42		-7.63		-23.02		-22.56		-20.08		-7.99	
Rcf	1.51		1.51		1.51		1.51		1.51		1.51		1.51		1.51	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.15	-17.58	-13.67	-19.96	-14.73	-18.20	-5.34	-20.30	-11.69	-19.98	-11.56	-19.60	-14.50	-17.35	-5.56	-21.94
Fs (ksi)	-6.15	-17.58	-13.67	-19.96	-14.73	-18.20	-5.34	-20.30	-11.69	-19.98	-11.56	-19.60	-14.50	-17.35	-5.56	-21.94
Fs (kip)	-498.16	-1423.58	-1107.39	-1616.47	-1193.15	-1474.53	-432.67	-1643.95	-946.55	-1618.69	-936.06	-1587.57	-1174.67	-1405.12	-450.65	-1777.37

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4294.16	4294.16	1193.15	1777.37

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	93.26	279.64	309.70	59.84	163.08	157.12	301.82	71.59	68.54	202.20	223.43	44.92	141.81	141.22	217.87	53.23
Vuw (kip)	139.89	419.46	464.55	89.76	244.62	235.68	452.73	107.39	---	---	---	---	---	---	---	---
Mv (k*ft)	78.69	235.95	261.31	50.49	137.60	132.57	254.66	60.41	38.55	113.74	125.68	25.27	79.77	79.43	122.55	29.94
Huw (kip)	-1899.27	-2367.12	-2431.07	-1852.31	-2554.62	-2532.17	-2415.61	-1868.47	-711.75	-1008.84	-988.03	-769.12	-950.09	-934.68	-955.48	-825.19
Muw (k*ft)	743.44	431.54	388.91	774.75	311.23	325.03	399.22	763.98	228.50	125.70	69.48	299.08	165.96	160.87	56.90	327.59
Mu (k*ft)	822.13	667.49	650.22	825.24	448.83	457.60	653.88	824.39	267.05	239.43	195.16	324.35	245.73	240.30	179.45	357.53

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.22	36.42	37.40	28.50	39.30	38.96	37.16	28.75	10.95	15.52	15.20	11.83	14.62	14.38	14.70	12.70
PY1 (Vuw)	2.15	6.45	7.15	1.38	3.76	3.63	6.97	1.65	1.05	3.11	3.44	0.69	2.18	2.17	3.35	0.82
PX2 (Mu)	18.97	15.40	15.00	19.04	10.36	10.56	15.09	19.02	6.16	5.53	4.50	7.48	5.67	5.55	4.14	8.25
PY2 (Mu)	6.32	5.13	5.00	6.35	3.45	3.52	5.03	6.34	2.05	1.84	1.50	2.49	1.89	1.85	1.38	2.75
Pu (kip)	48.93	53.10	53.80	48.17	50.18	50.03	53.61	48.43	17.39	21.62	20.31	19.58	20.69	20.33	19.43	21.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2240.43	2268.00	OK
TF Inside	2053.73	2079.00	OK
BF Inside	2053.73	2079.00	OK
BF Outside	2240.43	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.59	49.33	49.80	46.01	46.59	46.49	49.67	46.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	464.55
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2240.43	28.01	OK	622.51	7.78	OK
BF	2240.43	28.01	OK	927.32	11.59	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2240.43	28.01	1.47	119.85	OK
TF	4294.16	53.68	1.47	269.66	OK
TF Inside	2053.73	25.67	1.47	119.85	OK
BF Inside	2053.73	25.67	1.47	119.85	OK
BF	4294.16	53.68	1.47	269.66	OK
BF Outside	2240.43	28.01	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.80	26.90	OK	21.62	10.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.80	1.47	114.56	OK
Web SPL	26.90	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.16	4.28
Web	1.56	1.59	2.47
BF	1.29	1.45	4.28

Plate	Shear	Flexure
Web	3.09	1.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5431**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.73	-22.98	-18.91	-26.73	-19.98	-24.19	-7.78	-26.58	-12.35	-22.51	-12.11	-22.66	-19.80	-23.19	-8.27	-28.89
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.13	0.34	0.28	0.39	0.29	0.36	0.11	0.39	0.18	0.33	0.18	0.33	0.29	0.34	0.12	0.43
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.98		-26.73		-24.19		-26.58		-22.51		-22.66		-23.19		-28.89
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-8.73		-18.91		-19.98		-7.78		-12.35		-12.11		-19.80		-8.27	
Rcf	1.76		1.76		1.76		1.76		1.76		1.76		1.76		1.76	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.436122	-16.81918	-13.73387	-19.44565	-14.49441	-17.6514	-5.770238	-19.36062	-10.38792	-17.92925	-10.3405	-17.65028	-14.36475	-16.95041	-6.11	-21.00
Fs (ksi)	-6.44	-16.82	-13.73	-19.45	-14.49	-17.65	-5.77	-19.36	-10.39	-17.93	-10.34	-17.65	-14.36	-16.95	-6.11	-21.00
Fs (kip)	-521.33	-1362.35	-1112.44	-1575.10	-1174.05	-1429.76	-467.39	-1568.21	-841.42	-1452.27	-837.58	-1429.67	-1163.54	-1372.98	-495.02	-1700.75

Vu (kip)	93.26	279.64	309.70	59.84	163.08	157.12	301.82	71.59	68.54	202.20	223.43	44.92	141.81	141.22	217.87	53.23
Vuw (kip)	139.89	419.46	464.55	89.76	244.62	235.68	452.73	107.39	---	---	---	---	---	---	---	---
Mv (k*ft)	78.69	235.95	261.31	50.49	137.60	132.57	254.66	60.41	38.55	113.74	125.68	25.27	79.77	79.43	122.55	29.94
Huw (kip)	-1968.02	-2505.64	-2562.49	-1918.24	-2159.32	-2146.68	-2552.80	-1943.74	-697.66	-995.39	-964.37	-753.93	-849.52	-839.72	-939.45	-813.25
Muw (k*ft)									207.66	114.24	63.14	271.81	150.83	146.20	51.71	297.71
Mu (k*ft)	78.69	235.95	261.31	50.49	137.60	132.57	254.66	60.41	246.21	227.97	188.82	297.07	230.59	225.63	174.26	327.65
Muw (k*ft)	697.61	339.20	301.30	730.79	570.08	578.50	307.76	513.73	formulas matching the Muw results							
Pu (add)	166.59	81.00	71.95	174.52	136.14	138.15	73.49	170.46	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 1% 1% 3% 2% 3% 1% 3% percentage increase in flange force 3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.28	38.55	39.42	29.51	33.22	33.03	39.27	29.90	10.73	15.31	14.84	11.60	13.07	12.92	14.45	12.51
PY1 (Vuw)	2.15	6.45	7.15	1.38	3.76	3.63	6.97	1.65	1.05	3.11	3.44	0.69	2.18	2.17	3.35	0.82
PX2 (Mu)	1.82	5.44	6.03	1.17	3.18	3.06	5.88	1.39	5.68	5.26	4.36	6.86	5.32	5.21	4.02	7.56
PY2 (Mu)	0.61	1.81	2.01	0.39	1.06	1.02	1.96	0.46	1.89	1.75	1.45	2.29	1.77	1.74	1.34	2.52
Pu (kip)	32.21	44.76	46.37	30.73	36.71	36.38	46.02	31.37	16.68	21.14	19.81	18.69	18.81	18.54	19.06	20.35

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.35	40.70	42.11	27.97	33.46	33.16	41.81	28.57
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.37	23.18	OK	21.14	10.57	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.37	1.47	114.56	OK
Web SPL	23.18	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7431	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type CC

Field Splice - Node 7431

Node 7431

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7431 L	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00
7431 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7431 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.01	-23.40	-18.78	-27.53	-19.80	-24.36	-6.83	-27.03	-22.43	-33.92	-22.67	-33.41	-19.23	-23.09	-7.43	-29.68
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.12	0.35	0.28	0.41	0.29	0.36	0.10	0.40	0.33	0.50	0.33	0.49	0.28	0.34	0.11	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-23.40		-27.53		-24.36		-27.03		-33.92		-33.41		-23.09		-29.68
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-51.08		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4137.28		-4119.64		-4119.64		-4119.64
fncf (ksi)	-8.01		-18.78		-19.80		-6.83		-22.43		-22.67		-19.23		-7.43	
Rcf	1.50		1.50		1.50		1.50		1.51		1.50		1.50		1.50	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.48	-17.17	-13.91	-20.62	-14.70	-18.31	-4.97	-20.21	-13.11	-19.67	-10.40	-20.65	-14.31	-17.40	-5.31	-22.06
Fs (ksi)	-5.48	-17.17	-13.91	-20.62	-14.70	-18.31	-4.97	-20.21	-13.11	-19.67	-10.40	-20.65	-14.31	-17.40	-5.31	-22.06
Fs (kip)	-444.13	-1390.92	-1126.45	-1670.35	-1190.56	-1483.19	-402.58	-1636.99	-1061.82	-1593.25	-842.14	-1672.72	-1158.74	-1409.75	-429.74	-1786.85

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4299.24	4299.24	1190.56	1786.85

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	75.69	259.92	294.33	45.08	145.13	147.66	286.27	58.55	56.22	187.78	212.08	34.59	157.44	104.35	206.39	44.11
Vuw (kip)	113.54	389.89	441.49	67.62	217.70	221.49	429.41	87.83	---	---	---	---	---	---	---	---
Mv (k*ft)	63.87	219.31	248.34	38.04	122.45	124.59	241.54	49.40	31.63	105.62	119.30	19.46	88.56	58.70	116.10	24.81
Huw (kip)	-1867.61	-2351.71	-2397.88	-1814.39	-2526.61	-2526.86	-2372.18	-1841.44	-679.65	-1035.85	-990.28	-755.40	-983.36	-931.43	-951.29	-820.96
Muw (k*ft)	764.55	441.82	411.03	800.03	333.82	325.05	428.17	781.99	233.78	134.30	72.26	304.79	131.22	205.08	61.98	335.09
Mu (k*ft)	828.42	661.13	659.37	838.07	456.28	449.64	669.71	831.40	265.40	239.92	191.55	324.25	219.78	263.78	178.07	359.90

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.73	36.18	36.89	27.91	38.87	38.87	36.50	28.33	10.46	15.94	15.24	11.62	15.13	14.33	14.64	12.63
PY1 (Vuw)	1.75	6.00	6.79	1.04	3.35	3.41	6.61	1.35	0.86	2.89	3.26	0.53	2.42	1.61	3.18	0.68
PX2 (Mu)	19.12	15.26	15.22	19.34	10.53	10.38	15.45	19.19	6.12	5.54	4.42	7.48	5.07	6.09	4.11	8.31
PY2 (Mu)	6.37	5.09	5.07	6.45	3.51	3.46	5.15	6.40	2.04	1.85	1.47	2.49	1.69	2.03	1.37	2.77
Pu (kip)	48.53	52.62	53.44	47.84	49.87	49.73	53.26	48.14	16.83	21.99	20.22	19.34	20.61	20.74	19.29	21.22

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2243.08	2268.00	OK
TF Inside	2056.16	2079.00	OK
BF Inside	2056.16	2079.00	OK
BF Outside	2243.08	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.31	48.96	49.56	45.80	46.38	46.22	49.45	46.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	441.49
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0
Ks	0.33 (Class A)
Ns	1.0
Pt	51.0
Rr	16.83

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2243.08	28.04	OK	621.16	7.76	OK
BF	2243.08	28.04	OK	932.27	11.65	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2243.08	28.04	1.47	119.85	OK
TF	4299.24	53.74	1.47	269.66	OK
TF Inside	2056.16	25.70	1.47	119.85	OK
BF Inside	2056.16	25.70	1.47	119.85	OK
BF	4299.24	53.74	1.47	269.66	OK
BF Outside	2243.08	28.04	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.44	26.72	OK	21.99	10.99	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.44	1.47	114.56	OK
Web SPL	26.72	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.17	4.27
Web	1.59	1.61	2.51
BF	1.29	1.44	4.27

Plate	Shear	Flexure
Web	3.25	1.21

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.97	-22.58	-18.28	-26.59	-19.49	-23.81	-7.18	-26.36	-11.69	-22.61	-11.66	-21.86	-19.08	-22.74	-7.79	-28.91
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.12	0.33	0.27	0.39	0.29	0.35	0.11	0.39	0.17	0.33	0.17	0.32	0.28	0.34	0.11	0.43
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.58		-26.59		-23.81		-26.36		-22.61		-21.86		-22.74		-28.91
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-7.97		-18.28		-19.49		-7.18		-11.69		-11.66		-19.08		-7.79	
Rcf	1.76		1.76		1.76		1.76		1.76		1.76		1.76		1.76	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.916586	-16.5394	-13.27161	-19.3741	-14.12833	-17.41162	-5.359815	-19.2097	-11.40738	-17.37001	-8.429606	-17.74862	-13.84117	-16.65745	-5.79	-21.01
Fs (ksi)	-5.92	-16.54	-13.27	-19.37	-14.13	-17.41	-5.36	-19.21	-11.41	-17.37	-8.43	-17.75	-13.84	-16.66	-5.79	-21.01
Fs (kip)	-479.24	-1339.69	-1075.00	-1569.30	-1144.39	-1410.34	-434.15	-1555.99	-924.00	-1406.97	-682.80	-1437.64	-1121.13	-1349.25	-468.68	-1702.03

Vu (kip)	75.69	259.92	294.33	45.08	145.13	147.66	286.27	58.55	56.22	187.78	212.08	34.59	157.44	104.35	206.39	44.11
Vuw (kip)	113.54	389.89	441.49	67.62	217.70	221.49	429.41	87.83	---	---	---	---	---	---	---	---
Mv (k*ft)	63.87	219.31	248.34	38.04	122.45	124.59	241.54	49.40	31.63	105.62	119.30	19.46	88.56	58.70	116.10	24.81
Huw (kip)	-1927.92	-2471.81	-2535.81	-1886.33	-2124.22	-2122.80	-2514.36	-1918.18	-673.68	-979.37	-946.20	-737.09	-863.32	-785.35	-914.96	-803.97
Muw (k*ft)									212.46	122.05	65.67	277.00	119.25	186.38	56.33	304.53
Mu (k*ft)	63.87	219.31	248.34	38.04	122.45	124.59	241.54	49.40	244.08	227.67	184.96	296.46	207.81	245.08	172.42	329.34
Muw (k*ft)	724.34	361.75	319.09	752.07	593.48	594.42	383.09	736.84	formulas matching the Muw results							
Pu (add)	172.98	86.39	76.20	179.60	141.73	141.95	79.61	174.53	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	2%	1%	3%	3%	3%	1%	3%	percentage increase in flange force	3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.66	38.03	39.01	29.02	32.68	32.66	38.68	29.51	10.36	15.07	14.56	11.34	13.28	12.08	14.08	12.37
PY1 (Vuw)	1.75	6.00	6.79	1.04	3.35	3.41	6.61	1.35	0.86	2.89	3.26	0.53	2.42	1.61	3.18	0.68
PX2 (Mu)	1.47	5.06	5.73	0.88	2.83	2.88	5.57	1.14	5.63	5.25	4.27	6.84	4.80	5.66	3.98	7.60
PY2 (Mu)	0.49	1.69	1.91	0.29	0.94	0.96	1.86	0.38	1.88	1.75	1.42	2.28	1.60	1.89	1.33	2.53
Pu (kip)	31.21	43.77	45.58	29.93	35.76	35.80	45.06	30.70	16.23	20.84	19.40	18.40	18.52	18.08	18.61	20.23

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.43	39.82	41.42	27.22	32.60	32.64	40.96	27.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 7431**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.58	22.79	OK	20.84	10.42	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.58	1.47	114.56	OK
Web SPL	22.79	1.47	80.19	OK

Field Splice - Node 9431

Node 9431

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9431 L	81.00	67.81	5492.85	81.00	67.81	5492.85	60.00	50.00	3000.00
9431 R	81.00	68.13	5518.71	81.00	68.13	5518.71	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9431 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.25	---	81.00	57.09	58.38	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.25	---	81.00	57.09	58.38	70	85
Splice Plates	TF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	TF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Inside	16.50	1.000	50.50	33.00	22.38	---	70	85
	BF Outside	36.00	1.000	50.50	36.00	25.38	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.914286

N.A. (from I 26.25 in
Outer to Inr 0.91428571
Outer to Inr 0.91428571

Outer to Mi 0.95714286
Outer to Mi 0.95714286

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.62	-21.94	-16.55	-26.91	-18.47	-22.95	-5.54	-25.80	-21.44	-32.89	-21.00	-31.83	-17.48	-21.34	-6.65	-29.58
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.10	0.32	0.24	0.40	0.27	0.34	0.08	0.38	0.32	0.48	0.31	0.47	0.26	0.31	0.10	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-21.94		-26.91		-22.95		-25.80		-32.89		-31.83		-21.34		-29.58
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-6.62		-16.55		-18.47		-5.54		-21.44		-21.00		-17.48		-6.65	
Rcf	1.55		1.55		1.55		1.55		1.55		1.55		1.55		1.55	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.42	-16.04	-12.72	-20.66	-14.01	-17.62	-4.02	-19.29	-13.31	-18.34	-8.23	-20.69	-13.48	-16.63	-4.33	-21.56
Fs (ksi)	-4.42	-16.04	-12.72	-20.66	-14.01	-17.62	-4.02	-19.29	-13.31	-18.34	-8.23	-20.69	-13.48	-16.63	-4.33	-21.56
Fs (kip)	-358.31	-1298.87	-1030.22	-1673.77	-1134.60	-1426.97	-325.92	-1562.39	-1077.86	-1485.46	-666.55	-1675.51	-1092.07	-1346.84	-351.05	-1746.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4310.90	4310.90	1134.60	1746.47

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	48.42	226.61	277.57	18.20	131.22	119.95	257.33	36.85	37.45	164.44	200.44	16.10	154.75	61.17	186.14	29.27
Vuw (kip)	72.63	339.91	416.35	27.30	196.82	179.92	385.99	55.28	---	---	---	---	---	---	---	---
Mv (k*ft)	40.86	191.20	234.20	15.36	110.71	101.21	217.12	31.09	21.06	92.49	112.75	9.05	87.05	34.41	104.70	16.47
Huw (kip)	-1814.58	-2274.88	-2363.93	-1764.14	-2502.07	-2481.44	-2318.31	-1815.85	-613.77	-1001.48	-948.73	-699.37	-949.38	-867.43	-903.30	-776.86
Muw (k*ft)	799.91	493.04	433.67	833.53	341.58	355.33	464.09	799.06	232.24	158.90	72.19	305.30	100.64	249.13	62.90	344.55
Mu (k*ft)	840.76	684.24	667.87	848.89	452.29	456.54	681.21	830.15	253.30	251.40	184.94	314.36	187.69	283.53	167.61	361.01

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.92	35.00	36.37	27.14	38.49	38.18	35.67	27.94	9.44	15.41	14.60	10.76	14.61	13.35	13.90	11.95
PY1 (Vuw)	1.12	5.23	6.41	0.42	3.03	2.77	5.94	0.85	0.58	2.53	3.08	0.25	2.38	0.94	2.86	0.45
PX2 (Mu)	19.40	15.79	15.41	19.59	10.44	10.54	15.72	19.16	5.85	5.80	4.27	7.25	4.33	6.54	3.87	8.33
PY2 (Mu)	6.47	5.26	5.14	6.53	3.48	3.51	5.24	6.39	1.95	1.93	1.42	2.42	1.44	2.18	1.29	2.78
Pu (kip)	47.92	51.86	53.05	47.24	49.36	49.11	52.59	47.65	15.50	21.67	19.39	18.21	19.32	20.13	18.24	20.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK
TF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Inside	0.00	2194.50	1521.50	92.00	60.13	15.50	3425.33	1521.50	OK
BF Outside	0.00	2394.00	1725.50	46.00	30.06	21.44	2643.42	1725.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2249.17	2268.00	OK
TF Inside	2061.74	2079.00	OK
BF Inside	2061.74	2079.00	OK
BF Outside	2249.17	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.87	48.45	49.29	45.36	45.94	45.76	48.98	45.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	416.35
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9431**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2249.17	28.11	OK	591.97	7.40	OK
BF	2249.17	28.11	OK	911.20	11.39	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2249.17	28.11	1.47	119.85	OK
TF	4310.90	53.89	1.47	269.66	OK
TF Inside	2061.74	25.77	1.47	119.85	OK
BF Inside	2061.74	25.77	1.47	119.85	OK
BF	4310.90	53.89	1.47	269.66	OK
BF Outside	2249.17	28.11	1.47	119.85	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.05	26.53	OK	21.67	10.84	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.05	1.47	114.56	OK
Web SPL	26.53	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.01
TF Inside	NA	1.01
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.29	2.27	4.26
Web	1.62	1.65	2.57
BF	1.29	1.48	4.26

Plate	Shear	Flexure
Web	3.45	1.23

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.33	-20.86	-16.55	-26.38	-18.34	-22.60	-5.67	-24.91	-10.83	-21.70	-9.81	-20.09	-17.43	-21.10	-6.53	-28.29
ϕf Fnc (ksi)	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81	67.81
f / ϕf Fnc	0.09	0.31	0.24	0.39	0.27	0.33	0.08	0.37	0.16	0.32	0.14	0.30	0.26	0.31	0.10	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.86		-26.38		-22.60		-24.91		-21.70		-20.09		-21.10		-28.29
Fcf (ksi)		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86
Fcf (kip)		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64
fncf (ksi)	-6.33		-16.55		-18.34		-5.67		-10.83		-9.81		-17.43		-6.53	
Rcf	1.80		1.80		1.80		1.80		1.80		1.80		1.80		1.80	
Fncf (ksi)	-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86		-50.86	
Fncf (kip)	-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64		-4119.64	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.773886	-15.3268	-12.04524	-19.26578	-13.31502	-16.59539	-4.310339	-18.18337	-11.29853	-15.87178	-5.810743	-17.13116	-12.67333	-15.53174	-4.92	-20.58
Fs (ksi)	-4.77	-15.33	-12.05	-19.27	-13.32	-16.60	-4.31	-18.18	-11.30	-15.87	-5.81	-17.13	-12.67	-15.53	-4.92	-20.58
Fs (kip)	-386.68	-1241.47	-975.66	-1560.53	-1078.52	-1344.23	-349.14	-1472.85	-915.18	-1285.61	-470.67	-1387.62	-1026.54	-1258.07	-398.41	-1666.58

Vu (kip)	48.42	226.61	277.57	18.20	131.22	119.95	257.33	36.85	37.45	164.44	200.44	16.10	154.75	61.17	186.14	29.27
Vuw (kip)	72.63	339.91	416.35	27.30	196.82	179.92	385.99	55.28	---	---	---	---	---	---	---	---
Mv (k*ft)	40.86	191.20	234.20	15.36	110.71	101.21	217.12	31.09	21.06	92.49	112.75	9.05	87.05	34.41	104.70	16.47
Huw (kip)	-1848.45	-2399.52	-2496.45	-1813.06	-2091.43	-2036.22	-2447.46	-1859.50	-603.02	-939.33	-897.31	-674.81	-815.11	-688.26	-846.15	-764.81
Muw (k*ft)									211.06	144.41	65.61	277.46	91.47	226.41	57.17	313.13
Mu (k*ft)	40.86	191.20	234.20	15.36	110.71	101.21	217.12	31.09	232.12	236.91	178.35	286.51	178.51	260.81	161.87	329.59
Muw (k*ft)	777.32	409.94	345.33	800.91	615.33	652.14	317.98	789.36	formulas matching the RMW results							
Pu (add)	185.63	97.90	82.47	191.26	146.95	155.74	90.26	183.87	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9431	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	2%	2%	3%	3%	3%	2%	3%	percentage increase in flange force	3%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.44	36.92	38.41	27.89	32.18	31.33	37.65	28.61	9.28	14.45	13.80	10.38	12.54	10.59	13.02	11.77
PY1 (Vuw)	1.12	5.23	6.41	0.42	3.03	2.77	5.94	0.85	0.58	2.53	3.08	0.25	2.38	0.94	2.86	0.45
PX2 (Mu)	0.94	4.41	5.40	0.35	2.55	2.34	5.01	0.72	5.36	5.47	4.12	6.61	4.12	6.02	3.74	7.61
PY2 (Mu)	0.31	1.47	1.80	0.12	0.85	0.78	1.67	0.24	1.79	1.82	1.37	2.20	1.37	2.01	1.25	2.54
Pu (kip)	29.42	41.87	44.57	28.25	34.95	33.85	43.34	29.35	14.82	20.39	18.47	17.17	17.08	16.87	17.25	19.60

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	26.76	38.12	40.53	25.65	31.86	30.86	39.43	26.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 9431**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.57	22.29	OK	20.39	10.19	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.57	1.47	114.56	OK
Web SPL	22.29	1.47	80.19	OK

Field Splice

Type DD

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1442	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type DD

Field Splice - Node 1442

Node 1442

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1442 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
1442 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 1442 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.62	-7.97	-29.03	-20.81	-32.38	-9.00	-17.01	-17.36	-29.68	-20.67	-24.49	-17.84	-32.00	-6.18	-18.61	-23.05
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.43	0.16	0.58	0.42	0.65	0.18	0.34	0.35	0.59	0.41	0.49	0.36	0.64	0.12	0.37	0.46
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-21.62		-29.03		-32.38			-17.36	-29.68		-24.49		-32.00			-23.05
Fcf (ksi)	-37.50		-39.52		-41.19			-37.50	-39.84		-37.50		-41.00			-37.50
Fcf (kip)	-3375.00		-3556.37		-3706.92			-3375.00	-3585.47		-3375.00		-3690.06			-3375.00
fncf (ksi)		-7.97		-20.81		-9.00	-17.01			-20.67		-17.84		-6.18	-18.61	
Rcf		1.16		1.22		1.27	1.16			1.23		1.16		1.27	1.16	
Fncf (ksi)		-37.50		-37.50		-37.50	-37.50			-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.07	-5.64	-21.14	-15.23	-23.88	-6.24	-12.40	-12.84	-21.62	-15.12	-17.97	-12.73	-23.66	-4.20	-13.56	-17.04
Fs (ksi)	-16.07	-5.64	-21.14	-15.23	-23.88	-6.24	-12.40	-12.84	-21.62	-15.12	-17.97	-12.73	-23.66	-4.20	-13.56	-17.04
Fs (kip)	-1446.26	-507.49	-1903.01	-1371.03	-2149.29	-561.63	-1116.02	-1155.48	-1945.35	-1360.98	-1617.26	-1145.97	-2129.29	-378.28	-1220.45	-1533.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3861.96	3546.90	2149.29	1533.23

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	345.44	453.38	512.45	319.34	410.77	382.69	501.04	339.19	253.22	328.50	371.21	233.80	298.40	279.54	363.16	247.82
Vuw (kip)	518.15	680.07	768.67	479.01	616.16	574.04	751.57	508.79	---	---	---	---	---	---	---	---
Mv (k*ft)	291.46	382.54	432.38	269.44	346.59	322.90	422.76	286.19	142.43	184.78	208.81	131.51	167.85	157.24	204.28	139.40
Huw (kip)	-1542.28	-2142.20	-1737.03	-1887.79	-2154.09	-1919.49	-1611.15	-1948.73	-716.37	-1200.48	-994.00	-832.88	-1212.32	-1013.18	-919.44	-1009.68
Muw (k*ft)	621.81	310.54	654.26	391.47	316.83	370.34	729.93	350.84	229.48	130.04	388.09	9.65	142.85	115.20	428.02	76.46
Mu (k*ft)	913.27	693.07	1086.63	660.92	663.42	693.24	1152.69	637.04	371.91	314.82	596.90	141.16	310.70	272.44	632.30	215.86

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.73	32.96	26.72	29.04	33.14	29.53	24.79	29.98	11.02	18.47	15.29	12.81	18.65	15.59	14.15	15.53
PY1 (Vuw)	7.97	10.46	11.83	7.37	9.48	8.83	11.56	7.83	3.90	5.05	5.71	3.60	4.59	4.30	5.59	3.81
PX2 (Mu)	21.08	15.99	25.08	15.25	15.31	16.00	26.60	14.70	8.58	7.27	13.77	3.26	7.17	6.29	14.59	4.98
PY2 (Mu)	7.03	5.33	8.36	5.08	5.10	5.33	8.87	4.90	2.86	2.42	4.59	1.09	2.39	2.10	4.86	1.66
Pu (kip)	47.25	51.44	55.59	46.01	50.60	47.68	55.30	46.46	20.74	26.80	30.84	16.74	26.75	22.79	30.58	21.23

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1948.74	2160.00	OK
TF Inside	1913.22	2120.63	OK
BF Inside	1770.67	1794.38	OK
BF Outside	1776.22	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.85	46.82	50.81	42.49	46.26	43.72	50.67	42.75
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	768.67
Rr (kip)	1434.96
Check	OK

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		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1948.74	24.36	OK	1084.53	13.56	OK
BF	1776.22	27.75	OK	767.81	12.00	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1948.74	24.36	1.47	137.48	OK
TF	3861.96	48.27	1.47	229.13	OK
TF Inside	1913.22	23.92	1.47	148.93	OK
BF Inside	1770.67	27.67	1.47	126.02	OK
BF	3546.90	55.42	1.47	229.13	OK
BF Outside	1776.22	27.75	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.59	27.80	OK	30.84	15.42	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.59	1.47	126.02	OK
Web SPL	27.80	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.11
TF Inside	NA	1.11
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.49	1.24	4.75
Web	1.76	1.18	3.06
BF	1.30	1.40	4.13

Plate	Shear	Flexure
Web	1.87	1.36

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For	Cleveland InnerBelt : Field Splice - Node 1442	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.03	-7.14	-25.09	-17.32	-29.79	-7.71	-16.79	-17.12	-23.10	-14.59	-20.48	-14.20	-29.56	-5.16	-17.09	-21.29
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.40	0.14	0.50	0.35	0.60	0.15	0.34	0.34	0.46	0.29	0.41	0.28	0.59	0.10	0.34	0.43
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-20.03		-25.09		-29.79			-17.12	-23.10		-20.48		-29.56			-21.29
Fcf (ksi)	-37.50		-37.54		-39.89			-37.50	-37.50		-37.50		-39.78			-37.50
Fcf (kip)	-3375.00		-3378.96		-3590.46			-3375.00	-3375.00		-3375.00		-3580.04			-3375.00
fncf (ksi)		-7.14		-17.32		-7.71	-16.79			-14.59		-14.20		-5.16	-17.09	
Rcf		1.26		1.26		1.34	1.26			1.26		1.26		1.34	1.26	
Fncf (ksi)		-37.50		-37.50		-37.50	-37.50			-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.71131	-5.321206	-18.1696	-12.84838	-21.60511	-5.724473	-12.30644	-12.70113	-16.76417	-10.9189	-15.02615	-10.31209	-21.44154	-3.926999	-12.52	-15.65
Fs (ksi)	-14.71	-5.32	-18.17	-12.85	-21.61	-5.72	-12.31	-12.70	-16.76	-10.92	-15.03	-10.31	-21.44	-3.93	-12.52	-15.65
Fs (kip)	-1324.02	-478.91	-1635.26	-1156.35	-1944.46	-515.20	-1107.58	-1143.10	-1508.78	-982.70	-1352.35	-928.09	-1929.74	-353.43	-1126.73	-1408.30

Vu (kip)	345.44	453.38	512.45	319.34	410.77	382.69	501.04	339.19	253.22	328.50	371.21	233.80	298.40	279.54	363.16	247.82
Vuw (kip)	518.15	680.07	768.67	479.01	616.16	574.04	751.57	508.79	---	---	---	---	---	---	---	---
Mv (k*ft)	291.46	382.54	432.38	269.44	346.59	322.90	422.76	286.19	142.43	184.78	208.81	131.51	167.85	157.24	204.28	139.40
Huw (kip)	-1534.03	-1959.52	-1657.19	-1934.99	-1843.77	-1827.49	-1540.26	-1947.50	-661.07	-1023.59	-901.88	-825.25	-913.54	-836.16	-837.16	-929.51
Muw (k*ft)									206.58	117.07	349.37	8.68	128.60	103.71	385.32	68.83
Mu (k*ft)	291.46	382.54	432.38	269.44	346.59	322.90	422.76	286.19	349.02	301.85	558.18	140.19	296.44	260.95	589.60	208.23
Muw (k*ft)	627.31	345.59	650.54	360.01	420.82	431.67	723.40	301.67	formulas matching the KNW results							
Pu (add)	149.06	82.12	154.58	85.55	100.00	102.58	171.90	83.56	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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3% 2% 3% 2% 2% 2% 4% 2% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.60	30.15	25.50	29.77	28.37	28.12	23.70	29.96	10.17	15.75	13.88	12.70	14.05	12.86	12.88	14.30
PY1 (Vuw)	7.97	10.46	11.83	7.37	9.48	8.83	11.56	7.83	3.90	5.05	5.71	3.60	4.59	4.30	5.59	3.81
PX2 (Mu)	6.73	8.83	9.98	6.22	8.00	7.45	9.76	6.60	8.05	6.97	12.88	3.24	6.84	6.02	13.61	4.81
PY2 (Mu)	2.24	2.94	3.33	2.07	2.67	2.48	3.25	2.20	2.68	2.32	4.29	1.08	2.28	2.01	4.54	1.60
Pu (kip)	32.00	41.22	38.57	37.21	38.34	37.32	36.59	37.92	19.38	23.88	28.57	16.60	22.00	19.91	28.35	19.86

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.51	36.67	33.68	33.56	34.18	33.37	31.81	34.15
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1442	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.22	20.61	OK	28.57	14.28	OK

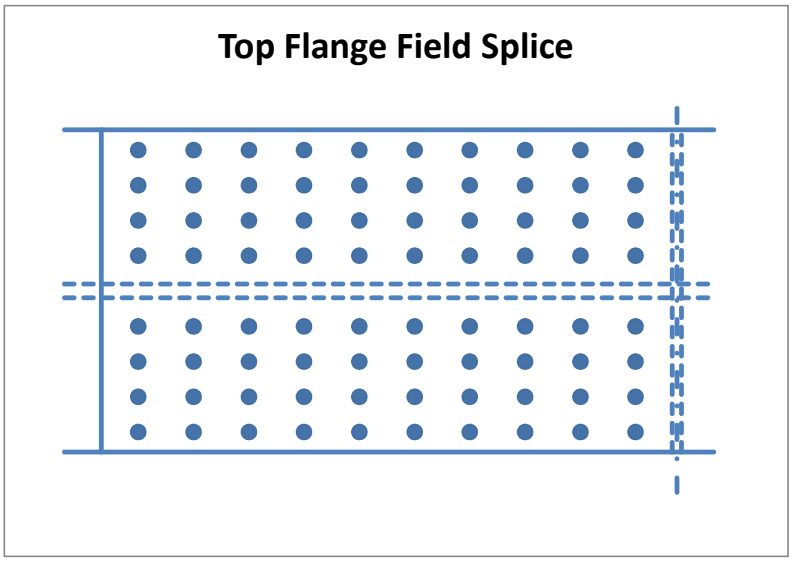
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.22	1.47	126.02	OK
Web SPL	20.61	1.47	80.19	OK

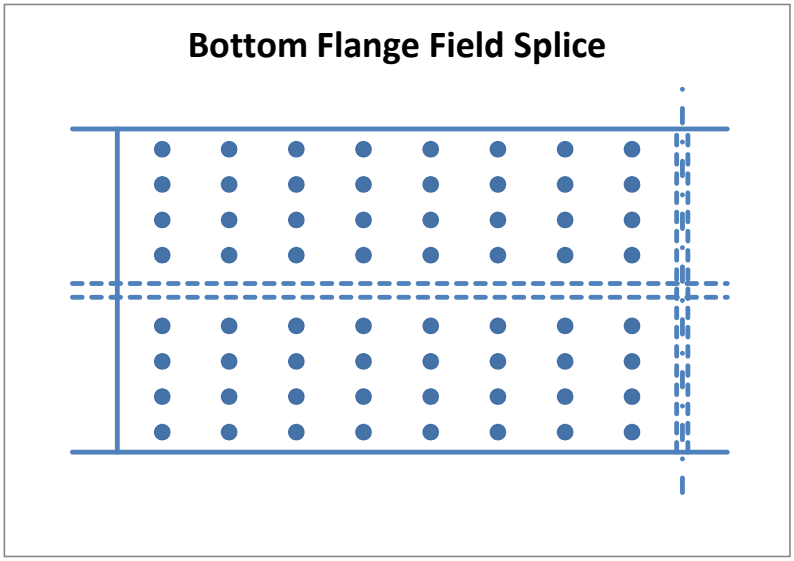
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1442	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1442

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0	21	0
21	3.5	21	3.5
21	7	21	7

	Top Flange		Bottom Flange	
No. Bolts =	80.0		64.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		7.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5	21	10.5
21	17.5	21	17.5
21	21	21	21
21	24.5	21	24.5
21	28	21	28
24	0		
24	3.5		
24	7		
24	10.5		
24	17.5		
24	21		
24	24.5		
24	28		
27	0		
27	3.5		
27	7		
27	10.5		
27	17.5		
27	21		
27	24.5		
27	28		

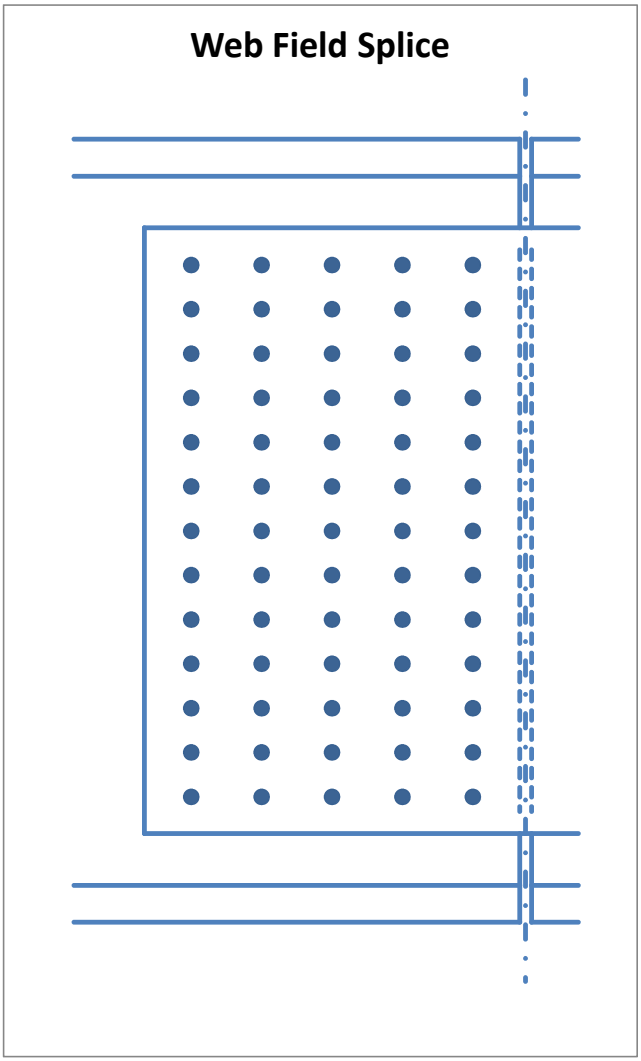
Flange Bolt Pattern Cont. - Node 1442

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1442	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1442

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1442

Web Bolt Pattern Cont. - Node 1442

390	1170	1170	8190

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type DD

Field Splice - Node 3442

Node 3442

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3442 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
3442 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 3442 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.70	-8.85	-29.04	-22.45	-33.17	-9.70	-19.77	-18.81	-31.48	-21.58	-25.82	-19.78	-32.29	-6.49	-20.95	-23.55
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.45	0.18	0.58	0.45	0.66	0.19	0.40	0.38	0.63	0.43	0.52	0.40	0.65	0.13	0.42	0.47
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-22.70		-29.04		-33.17		-19.77		-31.48		-25.82		-32.29			-23.55
Fcf (ksi)	-37.50		-39.52		-41.58		-37.50		-40.74		-37.91		-41.15			-37.50
Fcf (kip)	-3375.00		-3556.88		-3742.47		-3375.00		-3666.57		-3411.87		-3703.19			-3375.00
fncf (ksi)		-8.85		-22.45		-9.70		-18.81		-21.58		-19.78		-6.49	-20.95	
Rcf		1.13		1.19		1.25		1.13		1.23		1.14		1.24	1.13	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.84	-6.25	-21.10	-16.40	-24.42	-6.70	-14.45	-13.92	-22.88	-15.73	-18.91	-14.11	-23.84	-4.39	-15.22	-17.33
Fs (ksi)	-16.84	-6.25	-21.10	-16.40	-24.42	-6.70	-14.45	-13.92	-22.88	-15.73	-18.91	-14.11	-23.84	-4.39	-15.22	-17.33
Fs (kip)	-1515.99	-562.59	-1898.62	-1476.02	-2197.67	-603.09	-1300.25	-1252.93	-2058.79	-1415.31	-1701.83	-1269.84	-2145.82	-395.12	-1369.67	-1560.06

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3894.23	3543.20	2197.67	1560.06

$\phi v Vn$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	382.98	466.05	531.53	359.80	446.61	409.18	519.97	376.25	279.35	337.04	384.31	261.97	323.31	297.86	376.14	273.60
Vuw (kip)	574.46	699.07	797.30	539.69	669.92	613.77	779.96	564.37	---	---	---	---	---	---	---	---
Mv (k*ft)	323.14	393.23	448.48	303.58	376.83	345.25	438.73	317.46	157.13	189.58	216.17	147.36	181.86	167.55	211.58	153.90
Huw (kip)	-1567.80	-2187.07	-1773.71	-1939.17	-2219.12	-1997.21	-1623.54	-2019.17	-762.15	-1237.37	-1026.95	-936.17	-1273.84	-1089.61	-931.68	-1074.24
Muw (k*ft)	604.80	280.87	647.18	357.22	313.13	336.55	728.09	303.89	233.05	103.30	389.78	11.57	157.30	105.60	427.95	46.54
Mu (k*ft)	927.94	674.10	1095.66	660.80	689.96	681.80	1166.81	621.35	390.19	292.89	605.96	158.93	339.16	273.15	639.53	200.44

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.12	33.65	27.29	29.83	34.14	30.73	24.98	31.06	11.73	19.04	15.80	14.40	19.60	16.76	14.33	16.53
PY1 (Vuw)	8.84	10.75	12.27	8.30	10.31	9.44	12.00	8.68	4.30	5.19	5.91	4.03	4.97	4.58	5.79	4.21
PX2 (Mu)	21.41	15.56	25.28	15.25	15.92	15.73	26.93	14.34	9.00	6.76	13.98	3.67	7.83	6.30	14.76	4.63
PY2 (Mu)	7.14	5.19	8.43	5.08	5.31	5.24	8.98	4.78	3.00	2.25	4.66	1.22	2.61	2.10	4.92	1.54
Pu (kip)	48.26	51.72	56.50	47.03	52.44	48.73	55.98	47.36	21.98	26.85	31.60	18.82	28.45	24.02	31.00	21.92

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1965.03	2160.00	OK
TF Inside	1929.21	2120.63	OK
BF Inside	1768.83	1794.38	OK
BF Outside	1774.37	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.56	46.98	51.54	43.20	47.82	44.52	51.19	43.35
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	797.30
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1965.03	24.56	OK	1108.94	13.86	OK
BF	1774.37	27.72	OK	781.25	12.21	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1965.03	24.56	1.47	137.48	OK
TF	3894.23	48.68	1.47	229.13	OK
TF Inside	1929.21	24.12	1.47	148.93	OK
BF Inside	1768.83	27.64	1.47	126.02	OK
BF	3543.20	55.36	1.47	229.13	OK
BF Outside	1774.37	27.72	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.50	28.25	OK	31.60	15.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.50	1.47	126.02	OK
Web SPL	28.25	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.47	1.21	4.71
Web	1.70	1.14	2.96
BF	1.31	1.38	4.13

Plate	Shear	Flexure
Web	1.80	1.32

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 3442**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.03	-8.95	-25.54	-19.32	-30.87	-8.71	-19.17	-18.26	-25.31	-15.95	-22.08	-16.38	-30.59	-6.22	-19.55	-22.00
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.44	0.18	0.51	0.39	0.62	0.17	0.38	0.37	0.51	0.32	0.44	0.33	0.61	0.12	0.39	0.44
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-22.03		-25.54		-30.87		-19.17		-25.31		-22.08		-30.59			-22.00
Fcf (ksi)	-37.50		-37.77		-40.43		-37.50		-37.65		-37.50		-40.30			-37.50
Fcf (kip)	-3375.00		-3399.48		-3638.99		-3375.00		-3388.77		-3375.00		-3626.65			-3375.00
fncf (ksi)		-8.95		-19.32		-8.71		-18.26		-15.95		-16.38		-6.22	-19.55	
Rcf		1.21		1.22		1.31		1.21		1.22		1.21		1.31	1.21	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.11643	-6.580008	-18.47577	-14.24874	-22.35957	-6.409735	-13.9708	-13.49741	-18.30771	-11.8712	-16.15305	-11.83204	-22.16571	-4.654171	-14.24	-16.14
Fs (ksi)	-16.12	-6.58	-18.48	-14.25	-22.36	-6.41	-13.97	-13.50	-18.31	-11.87	-16.15	-11.83	-22.17	-4.65	-14.24	-16.14
Fs (kip)	-1450.48	-592.20	-1662.82	-1282.39	-2012.36	-576.88	-1257.37	-1214.77	-1647.69	-1068.41	-1453.77	-1064.88	-1994.91	-418.88	-1281.39	-1452.79

Vu (kip)	382.98	466.05	531.53	359.80	446.61	409.18	519.97	376.25	279.35	337.04	384.31	261.97	323.31	297.86	376.14	273.60
Vuw (kip)	574.46	699.07	797.30	539.69	669.92	613.77	779.96	564.37	---	---	---	---	---	---	---	---
Mv (k*ft)	323.14	393.23	448.48	303.58	376.83	345.25	438.73	317.46	157.13	189.58	216.17	147.36	181.86	167.55	211.58	153.90
Huw (kip)	-1596.18	-2026.66	-1710.62	-1969.43	-1884.81	-1894.21	-1597.76	-2021.11	-748.98	-1079.91	-949.39	-906.45	-995.90	-923.51	-885.06	-1002.53
Muw (k*ft)									209.80	92.99	350.90	10.41	141.60	95.06	385.25	41.90
Mu (k*ft)	323.14	393.23	448.48	303.58	376.83	345.25	438.73	317.46	366.93	282.58	567.07	157.77	323.46	262.61	596.83	195.79
Muw (k*ft)	585.88	310.86	638.65	337.04	400.19	387.19	707.69	302.89	formulas matching the Muw results							
Pu (add)	139.22	73.87	151.76	80.09	95.09	92.01	168.20	71.90	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3442	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	2%	3%	2%	2%	2%	4%	2%	percentage increase in flange force	4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.56	31.18	26.32	30.30	29.00	29.14	24.58	31.09	11.52	16.61	14.61	13.95	15.32	14.21	13.62	15.42
PY1 (Vuw)	8.84	10.75	12.27	8.30	10.31	9.44	12.00	8.68	4.30	5.19	5.91	4.03	4.97	4.58	5.79	4.21
PX2 (Mu)	7.46	9.07	10.35	7.01	8.70	7.97	10.12	7.33	8.47	6.52	13.09	3.64	7.46	6.06	13.77	4.52
PY2 (Mu)	2.49	3.02	3.45	2.34	2.90	2.66	3.37	2.44	2.82	2.17	4.36	1.21	2.49	2.02	4.59	1.51
Pu (kip)	33.96	42.55	39.89	38.79	39.94	39.03	37.96	40.00	21.22	24.28	29.54	18.35	23.98	21.32	29.29	20.74

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.16	37.87	34.82	34.88	35.49	34.85	33.01	35.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 3442**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.55	21.27	OK	29.54	14.77	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.55	1.47	126.02	OK
Web SPL	21.27	1.47	80.19	OK

Field Splice - Node 5442

Node 5442

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5442 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
5442 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 5442 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.53	-9.46	-26.86	-20.64	-32.07	-9.06	-20.63	-18.26	-28.63	-21.64	-27.49	-20.00	-31.90	-6.18	-21.22	-22.75
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.47	0.19	0.54	0.41	0.64	0.18	0.41	0.37	0.57	0.43	0.55	0.40	0.64	0.12	0.42	0.46
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.53		-26.86		-32.07		-20.63		-28.63		-27.49		-31.90			-22.75
Fcf (ksi)	-37.50		-38.43		-41.04		-37.50		-39.31		-38.75		-40.95			-37.50
Fcf (kip)	-3375.00		-3458.53		-3693.28		-3375.00		-3538.16		-3487.11		-3685.40			-3375.00
fncf (ksi)		-9.46		-20.64		-9.06		-18.26		-21.64		-20.00		-6.18	-21.22	
Rcf		1.17		1.20		1.28		1.17		1.23		1.21		1.28	1.17	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.44	-6.66	-19.53	-15.11	-23.63	-6.22	-15.06	-13.49	-20.79	-15.80	-20.14	-14.23	-23.57	-4.15	-15.42	-16.73
Fs (ksi)	-17.44	-6.66	-19.53	-15.11	-23.63	-6.22	-15.06	-13.49	-20.79	-15.80	-20.14	-14.23	-23.57	-4.15	-15.42	-16.73
Fs (kip)	-1569.66	-599.09	-1757.79	-1359.47	-2127.15	-559.78	-1355.77	-1214.33	-1871.52	-1421.90	-1812.28	-1280.63	-2120.97	-373.50	-1387.42	-1505.95

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3852.10	3541.70	2127.15	1505.95

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	393.25	470.67	536.19	371.64	434.00	424.34	523.23	389.11	286.61	340.26	387.60	270.30	314.36	308.58	378.45	282.64
Vuw (kip)	589.88	706.00	804.28	557.46	651.01	636.50	784.84	583.67	---	---	---	---	---	---	---	---
Mv (k*ft)	331.81	397.12	452.41	313.57	366.19	358.03	441.47	328.31	161.22	191.40	218.03	152.04	176.83	173.57	212.88	158.99
Huw (kip)	-1602.36	-2084.19	-1736.65	-1942.13	-2172.66	-2075.95	-1611.82	-2056.33	-795.21	-1143.00	-985.21	-942.37	-1207.59	-1134.06	-914.64	-1060.90
Muw (k*ft)	581.76	301.37	647.84	355.25	281.33	320.84	727.20	279.11	237.25	97.37	383.13	34.57	109.91	129.96	427.16	28.98
Mu (k*ft)	913.57	698.50	1100.24	668.82	647.52	678.88	1168.67	607.42	398.47	288.77	601.16	186.62	286.73	303.53	640.04	187.96

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.65	32.06	26.72	29.88	33.43	31.94	24.80	31.64	12.23	17.58	15.16	14.50	18.58	17.45	14.07	16.32
PY1 (Vuw)	9.08	10.86	12.37	8.58	10.02	9.79	12.07	8.98	4.41	5.23	5.96	4.16	4.84	4.75	5.82	4.35
PX2 (Mu)	21.08	16.12	25.39	15.43	14.94	15.67	26.97	14.02	9.20	6.66	13.87	4.31	6.62	7.00	14.77	4.34
PY2 (Mu)	7.03	5.37	8.46	5.14	4.98	5.22	8.99	4.67	3.07	2.22	4.62	1.44	2.21	2.33	4.92	1.45
Pu (kip)	48.49	50.85	56.12	47.35	50.64	49.92	55.89	47.65	22.70	25.37	30.90	19.62	26.16	25.46	30.78	21.46

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1943.77	2160.00	OK
TF Inside	1908.33	2120.63	OK
BF Inside	1768.08	1794.38	OK
BF Outside	1773.62	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.69	46.14	51.13	43.44	46.13	45.55	51.07	43.53
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	804.28
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1943.77	24.30	OK	1073.36	13.42	OK
BF	1773.62	27.71	OK	754.15	11.78	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1943.77	24.30	1.47	137.48	OK
TF	3852.10	48.15	1.47	229.13	OK
TF Inside	1908.33	23.85	1.47	148.93	OK
BF Inside	1768.08	27.63	1.47	126.02	OK
BF	3541.70	55.34	1.47	229.13	OK
BF Outside	1773.62	27.71	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.12	28.06	OK	30.90	15.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.12	1.47	126.02	OK
Web SPL	28.06	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.11
TF Inside	NA	1.11
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.49	1.25	4.76
Web	1.68	1.13	2.93
BF	1.31	1.43	4.13

Plate	Shear	Flexure
Web	1.78	1.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5442	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.71	-9.42	-25.77	-19.90	-31.21	-9.47	-20.02	-17.78	-23.97	-17.37	-23.41	-16.34	-30.89	-6.60	-20.44	-21.89
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.45	0.19	0.52	0.40	0.62	0.19	0.40	0.36	0.48	0.35	0.47	0.33	0.62	0.13	0.41	0.44
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-22.71		-25.77		-31.21		-20.02		-23.97		-23.41		-30.89			-21.89
Fcf (ksi)	-37.50		-37.88		-40.61		-37.50		-37.50		-37.50		-40.45			-37.50
Fcf (kip)	-3375.00		-3409.53		-3654.50		-3375.00		-3375.00		-3375.00		-3640.15			-3375.00
fncf (ksi)		-9.42		-19.90		-9.47		-17.78		-17.37		-16.34		-6.60	-20.44	
Rcf		1.20		1.21		1.30		1.20		1.20		1.20		1.30	1.20	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.60245	-6.894274	-18.63247	-14.64821	-22.6101	-6.932454	-14.56998	-13.15519	-17.36467	-12.86733	-17.10104	-11.78316	-22.38489	-4.905687	-14.87	-16.05
Fs (ksi)	-16.60	-6.89	-18.63	-14.65	-22.61	-6.93	-14.57	-13.16	-17.36	-12.87	-17.10	-11.78	-22.38	-4.91	-14.87	-16.05
Fs (kip)	-1494.22	-620.48	-1676.92	-1318.34	-2034.91	-623.92	-1311.30	-1183.97	-1562.82	-1158.06	-1539.09	-1060.48	-2014.64	-441.51	-1338.17	-1444.88

Vu (kip)	393.25	470.67	536.19	371.64	434.00	424.34	523.23	389.11	286.61	340.26	387.60	270.30	314.36	308.58	378.45	282.64
Vuw (kip)	589.88	706.00	804.28	557.46	651.01	636.50	784.84	583.67	---	---	---	---	---	---	---	---
Mv (k*ft)	331.81	397.12	452.41	313.57	366.19	358.03	441.47	328.31	161.22	191.40	218.03	152.04	176.83	173.57	212.88	158.99
Huw (kip)	-1610.96	-2047.07	-1746.69	-1942.56	-1926.40	-1885.32	-1617.16	-2047.93	-775.39	-1098.26	-974.90	-914.93	-997.66	-953.18	-900.59	-1020.45
Muw (k*ft)									213.58	87.65	344.91	31.13	98.94	116.99	384.54	26.08
Mu (k*ft)	331.81	397.12	452.41	313.57	366.19	358.03	441.47	328.31	374.80	279.05	562.93	183.17	275.77	290.57	597.42	185.07

Muw (k*ft)	576.03	302.16	622.18	354.96	365.73	393.12	701.59	284.70	formulas matching the Muw results
Pu (add)	136.88	71.80	147.85	84.35	86.91	93.41	166.70	67.65	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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3%	2%	3%	2%	2%	2%	4%	2%	percentage increase in flange force	4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.78	31.49	26.87	29.89	29.64	29.00	24.88	31.51	11.93	16.90	15.00	14.08	15.35	14.66	13.86	15.70
PY1 (Vuw)	9.08	10.86	12.37	8.58	10.02	9.79	12.07	8.98	4.41	5.23	5.96	4.16	4.84	4.75	5.82	4.35
PX2 (Mu)	7.66	9.16	10.44	7.24	8.45	8.26	10.19	7.58	8.65	6.44	12.99	4.23	6.36	6.71	13.79	4.27
PY2 (Mu)	2.55	3.05	3.48	2.41	2.82	2.75	3.40	2.53	2.88	2.15	4.33	1.41	2.12	2.24	4.60	1.42
Pu (kip)	34.46	42.97	40.54	38.71	40.19	39.32	38.33	40.74	21.83	24.48	29.82	19.13	22.80	22.48	29.54	20.79

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.57	38.25	35.42	34.75	35.81	35.04	33.34	36.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.97	21.49	OK	29.82	14.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.97	1.47	126.02	OK
Web SPL	21.49	1.47	80.19	OK

Field Splice - Node 7442

Node 7442

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7442 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
7442 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 7442 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.71	-8.97	-27.78	-20.03	-33.09	-8.94	-20.77	-18.01	-26.92	-20.47	-31.18	-18.97	-31.87	-5.08	-20.58	-21.70
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.47	0.18	0.56	0.40	0.66	0.18	0.42	0.36	0.54	0.41	0.62	0.38	0.64	0.10	0.41	0.43
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.71		-27.78		-33.09		-20.77		-26.92		-31.18		-31.87			-21.70
Fcf (ksi)	-37.50		-38.89		-41.55		-37.50		-38.46		-40.59		-40.94			-37.50
Fcf (kip)	-3375.00		-3499.88		-3739.16		-3375.00		-3461.20		-3653.05		-3684.34			-3375.00
fncf (ksi)		-8.97		-20.03		-8.94		-18.01		-20.47		-18.97		-5.08	-20.58	
Rcf		1.13		1.18		1.26		1.13		1.16		1.23		1.24	1.13	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.59	-6.27	-20.17	-14.60	-24.41	-6.11	-15.18	-13.30	-19.58	-14.97	-22.85	-13.40	-23.58	-3.32	-14.93	-15.93
Fs (ksi)	-17.59	-6.27	-20.17	-14.60	-24.41	-6.11	-15.18	-13.30	-19.58	-14.97	-22.85	-13.40	-23.58	-3.32	-14.93	-15.93
Fs (kip)	-1583.15	-564.46	-1815.34	-1313.71	-2196.80	-549.84	-1365.95	-1197.12	-1762.41	-1347.72	-2056.46	-1206.00	-2122.45	-298.87	-1344.04	-1433.91

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3894.11	3548.15	2196.80	1433.91

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	388.18	472.80	538.07	367.73	413.50	458.09	526.04	384.89	283.35	341.96	389.25	267.72	300.06	332.75	380.76	279.84
Vuw (kip)	582.27	709.21	807.10	551.60	620.25	687.13	789.06	577.34	---	---	---	---	---	---	---	---
Mv (k*ft)	327.52	398.93	453.99	310.28	348.89	386.51	443.85	324.75	159.38	192.35	218.95	150.59	168.78	187.17	214.18	157.41
Huw (kip)	-1573.06	-2059.96	-1741.47	-1911.08	-2054.19	-2107.16	-1558.14	-2007.14	-787.46	-1147.32	-1007.10	-939.79	-1140.38	-1196.24	-887.82	-1018.58
Muw (k*ft)	601.29	337.75	667.05	375.95	322.68	381.17	762.48	311.90	249.01	122.62	402.59	41.27	101.37	207.89	445.76	21.97
Mu (k*ft)	928.82	736.68	1121.04	686.22	671.57	767.68	1206.32	636.66	408.40	314.97	621.54	191.86	270.15	395.06	659.94	179.38

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7442	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.20	31.69	26.79	29.40	31.60	32.42	23.97	30.88	12.11	17.65	15.49	14.46	17.54	18.40	13.66	15.67
PY1 (Vuw)	8.96	10.91	12.42	8.49	9.54	10.57	12.14	8.88	4.36	5.26	5.99	4.12	4.62	5.12	5.86	4.31
PX2 (Mu)	21.43	17.00	25.87	15.84	15.50	17.72	27.84	14.69	9.42	7.27	14.34	4.43	6.23	9.12	15.23	4.14
PY2 (Mu)	7.14	5.67	8.62	5.28	5.17	5.91	9.28	4.90	3.14	2.42	4.78	1.48	2.08	3.04	5.08	1.38
Pu (kip)	48.39	51.44	56.71	47.28	49.34	52.77	56.06	47.61	22.81	26.08	31.72	19.70	24.70	28.70	30.89	20.61

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1964.97	2160.00	OK
TF Inside	1929.15	2120.63	OK
BF Inside	1771.30	1794.38	OK
BF Outside	1776.85	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.66	46.74	51.71	43.43	45.07	48.16	51.24	43.56
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	807.10
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1964.97	24.56	OK	1108.50	13.86	OK
BF	1776.85	27.76	OK	718.07	11.22	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1964.97	24.56	1.47	137.48	OK
TF	3894.11	48.68	1.47	229.13	OK
TF Inside	1929.15	24.11	1.47	148.93	OK
BF Inside	1771.30	27.68	1.47	126.02	OK
BF	3548.15	55.44	1.47	229.13	OK
BF Outside	1776.85	27.76	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.71	28.35	OK	31.72	15.86	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.71	1.47	126.02	OK
Web SPL	28.35	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.47	1.21	4.71
Web	1.71	1.12	2.97
BF	1.30	1.50	4.13

Plate	Shear	Flexure
Web	1.78	1.33

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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.39	-8.48	-26.00	-18.69	-31.27	-8.46	-19.76	-17.16	-22.36	-16.28	-26.14	-14.61	-31.01	-5.70	-20.14	-21.20
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.45	0.17	0.52	0.37	0.63	0.17	0.40	0.34	0.45	0.33	0.52	0.29	0.62	0.11	0.40	0.42
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-22.39		-26.00		-31.27		-19.76		-22.36		-26.14		-31.01			-21.20
Fcf (ksi)	-37.50		-38.00		-40.64		-37.50		-37.50		-38.07		-40.51			-37.50
Fcf (kip)	-3375.00		-3420.21		-3657.26		-3375.00		-3375.00		-3426.47		-3645.54			-3375.00
fncf (ksi)		-8.48		-18.69		-8.46		-17.16		-16.28		-14.61		-5.70	-20.14	
Rcf		1.20		1.22		1.30		1.20		1.20		1.22		1.30	1.20	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.39687	-6.207361	-18.81127	-13.79369	-22.66934	-6.195555	-14.40245	-12.71372	-16.23802	-12.09005	-19.04588	-10.53903	-22.48527	-4.244793	-14.67	-15.57
Fs (ksi)	-16.40	-6.21	-18.81	-13.79	-22.67	-6.20	-14.40	-12.71	-16.24	-12.09	-19.05	-10.54	-22.49	-4.24	-14.67	-15.57
Fs (kip)	-1475.72	-558.66	-1693.01	-1241.43	-2040.24	-557.60	-1296.22	-1144.24	-1461.42	-1088.10	-1714.13	-948.51	-2023.67	-382.03	-1320.38	-1401.28

Vu (kip)	388.18	472.80	538.07	367.73	413.50	458.09	526.04	384.89	283.35	341.96	389.25	267.72	300.06	332.75	380.76	279.84
Vuw (kip)	582.27	709.21	807.10	551.60	620.25	687.13	789.06	577.34	---	---	---	---	---	---	---	---
Mv (k*ft)	327.52	398.93	453.99	310.28	348.89	386.51	443.85	324.75	159.38	192.35	218.95	150.59	168.78	187.17	214.18	157.41
Huw (kip)	-1573.00	-2003.47	-1703.84	-1916.50	-1881.57	-1843.30	-1580.36	-2034.65	-745.94	-1075.96	-952.54	-894.83	-934.83	-976.30	-882.09	-997.94
Muw (k*ft)									224.17	110.39	362.42	37.15	91.26	187.15	401.29	19.78
Mu (k*ft)	327.52	398.93	453.99	310.28	348.89	386.51	443.85	324.75	383.55	302.74	581.38	187.74	260.04	374.32	615.47	177.19
Muw (k*ft)	601.33	336.45	652.10	372.33	395.62	446.30	728.09	293.07	formulas matching the Muw results							
Pu (add)	142.89	79.95	154.96	88.47	94.01	106.05	173.15	69.76	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7442	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 2% 3% 2% 2% 2% 4% 2% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.20	30.82	26.21	29.48	28.95	28.36	24.31	31.30	11.48	16.55	14.65	13.77	14.38	15.02	13.57	15.35
PY1 (Vuw)	8.96	10.91	12.42	8.49	9.54	10.57	12.14	8.88	4.36	5.26	5.99	4.12	4.62	5.12	5.86	4.31
PX2 (Mu)	7.56	9.21	10.48	7.16	8.05	8.92	10.24	7.49	8.85	6.99	13.42	4.33	6.00	8.64	14.20	4.09
PY2 (Mu)	2.52	3.07	3.49	2.39	2.68	2.97	3.41	2.50	2.95	2.33	4.47	1.44	2.00	2.88	4.73	1.36
Pu (kip)	33.77	42.40	39.99	38.22	38.97	39.66	37.89	40.43	21.60	24.73	29.96	18.93	21.43	24.97	29.72	20.25

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.94	37.69	34.86	34.30	34.76	35.15	32.89	36.31
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 7442**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.40	21.20	OK	29.96	14.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.40	1.47	126.02	OK
Web SPL	21.20	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type DD

Field Splice - Node 9442

Node 9442

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9442 L	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00
9442 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 9442 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.64	-7.96	-28.87	-17.81	-32.66	-7.45	-20.29	-15.46	-26.90	-17.78	-30.10	-17.48	-32.17	-4.09	-19.12	-20.35
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.47	0.16	0.58	0.36	0.65	0.15	0.41	0.31	0.54	0.36	0.60	0.35	0.64	0.08	0.38	0.41
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.64		-28.87		-32.66		-20.29		-26.90		-30.10		-32.17			-20.35
Fcf (ksi)	-37.50		-39.44		-41.33		-37.50		-38.45		-40.05		-41.09			-37.50
Fcf (kip)	-3375.00		-3549.33		-3719.59		-3375.00		-3460.56		-3604.46		-3697.69			-3375.00
fncf (ksi)		-7.96		-17.81		-7.45		-15.46		-17.78		-17.48		-4.09	-19.12	
Rcf		1.15		1.21		1.27		1.15		1.18		1.23		1.26	1.15	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.60	-5.51	-21.05	-12.98	-24.17	-5.02	-14.73	-11.97	-19.64	-13.02	-22.15	-12.33	-23.88	-2.59	-13.94	-14.99
Fs (ksi)	-17.60	-5.51	-21.05	-12.98	-24.17	-5.02	-14.73	-11.97	-19.64	-13.02	-22.15	-12.33	-23.88	-2.59	-13.94	-14.99
Fs (kip)	-1584.05	-496.27	-1894.44	-1168.45	-2175.58	-451.82	-1325.74	-1077.28	-1768.01	-1171.41	-1993.20	-1109.61	-2149.13	-233.52	-1254.74	-1349.17

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3882.53	3557.54	2175.58	1349.17

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	361.64	475.72	531.67	340.35	401.96	438.96	519.43	362.84	265.55	344.70	385.68	249.57	292.59	320.18	377.03	264.95
Vuw (kip)	542.46	713.58	797.51	510.52	602.93	658.44	779.14	544.26	---	---	---	---	---	---	---	---
Mv (k*ft)	305.13	401.39	448.60	287.17	339.15	370.37	438.27	306.14	149.37	193.90	216.94	140.38	164.58	180.10	212.08	149.03
Huw (kip)	-1539.31	-2011.13	-1674.90	-1823.42	-1959.54	-2029.17	-1525.45	-1961.88	-762.78	-1123.06	-963.38	-881.11	-1077.79	-1137.70	-873.64	-954.77
Muw (k*ft)	623.79	394.48	701.86	434.39	385.47	409.40	790.80	342.08	265.90	177.47	421.36	60.73	145.83	215.99	468.26	23.08
Mu (k*ft)	928.93	795.86	1150.46	721.56	724.62	779.78	1229.06	648.23	415.27	371.36	638.31	201.12	310.41	396.09	680.34	172.12

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9442	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.68	30.94	25.77	28.05	30.15	31.22	23.47	30.18	11.74	17.28	14.82	13.56	16.58	17.50	13.44	14.69
PY1 (Vuw)	8.35	10.98	12.27	7.85	9.28	10.13	11.99	8.37	4.09	5.30	5.93	3.84	4.50	4.93	5.80	4.08
PX2 (Mu)	21.44	18.37	26.55	16.65	16.72	17.99	28.36	14.96	9.58	8.57	14.73	4.64	7.16	9.14	15.70	3.97
PY2 (Mu)	7.15	6.12	8.85	5.55	5.57	6.00	9.45	4.99	3.19	2.86	4.91	1.55	2.39	3.05	5.23	1.32
Pu (kip)	47.70	52.19	56.42	46.67	49.16	51.79	56.09	47.08	22.53	27.11	31.48	18.98	24.72	27.81	31.16	19.43

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1959.12	2160.00	OK
TF Inside	1923.41	2120.63	OK
BF Inside	1775.99	1794.38	OK
BF Outside	1781.55	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.19	47.51	51.50	43.07	45.05	47.37	51.34	43.21
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	797.51
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9442**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1959.12	24.49	OK	1097.80	13.72	OK
BF	1781.55	27.84	OK	675.64	10.56	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1959.12	24.49	1.47	137.48	OK
TF	3882.53	48.53	1.47	229.13	OK
TF Inside	1923.41	24.04	1.47	148.93	OK
BF Inside	1775.99	27.75	1.47	126.02	OK
BF	3557.54	55.59	1.47	229.13	OK
BF Outside	1781.55	27.84	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.42	28.21	OK	31.48	15.74	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.42	1.47	126.02	OK
Web SPL	28.21	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.48	1.23	4.72
Web	1.76	1.13	3.06
BF	1.30	1.59	4.12

Plate	Shear	Flexure
Web	1.80	1.37

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9442**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.04	-6.23	-26.37	-15.92	-30.90	-7.09	-18.57	-14.01	-21.80	-13.18	-24.75	-12.83	-30.68	-4.15	-18.63	-19.79
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.42	0.12	0.53	0.32	0.62	0.14	0.37	0.28	0.44	0.26	0.49	0.26	0.61	0.08	0.37	0.40
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-21.04		-26.37		-30.90		-18.57		-21.80		-24.75		-30.68			-19.79
Fcf (ksi)	-37.50		-38.19		-40.45		-37.50		-37.50		-37.50		-40.34			-37.50
Fcf (kip)	-3375.00		-3436.69		-3640.67		-3375.00		-3375.00		-3375.00		-3630.64			-3375.00
fncf (ksi)		-6.23		-15.92		-7.09		-14.01		-13.18		-12.83		-4.15	-18.63	
Rcf		1.21		1.24		1.31		1.21		1.21		1.21		1.31	1.21	
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50	
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.47978	-4.599158	-19.10344	-11.84162	-22.45183	-5.209794	-13.46849	-10.98325	-15.87392	-9.90644	-18.10347	-9.265267	-22.29445	-3.133396	-13.63	-14.58
Fs (ksi)	-15.48	-4.60	-19.10	-11.84	-22.45	-5.21	-13.47	-10.98	-15.87	-9.91	-18.10	-9.27	-22.29	-3.13	-13.63	-14.58
Fs (kip)	-1393.18	-413.92	-1719.31	-1065.75	-2020.66	-468.88	-1212.16	-988.49	-1428.65	-891.58	-1629.31	-833.87	-2006.50	-282.01	-1227.10	-1312.10

Vu (kip)	361.64	475.72	531.67	340.35	401.96	438.96	519.43	362.84	265.55	344.70	385.68	249.57	292.59	320.18	377.03	264.95
Vuw (kip)	542.46	713.58	797.51	510.52	602.93	658.44	779.14	544.26	---	---	---	---	---	---	---	---
Mv (k*ft)	305.13	401.39	448.60	287.17	339.15	370.37	438.27	306.14	149.37	193.90	216.94	140.38	164.58	180.10	212.08	149.03
Huw (kip)	-1486.92	-1909.27	-1641.30	-1798.42	-1765.32	-1751.39	-1510.19	-1983.52	-662.61	-1021.19	-912.83	-806.91	-850.75	-903.17	-839.12	-931.04
Muw (k*ft)									239.37	159.76	379.32	54.68	131.28	194.44	421.54	20.78
Mu (k*ft)	305.13	401.39	448.60	287.17	339.15	370.37	438.27	306.14	388.74	353.66	596.27	195.06	295.86	374.54	633.62	169.81
Muw (k*ft)	658.72	407.31	685.68	451.05	473.12	482.41	768.19	527.69	formulas matching the Muw results							
Pu (add)	156.53	96.79	162.93	107.18	112.43	114.63	182.54	77.86	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9442	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	2%	4%	2%	2%	3%	4%	2%	percentage increase in flange force	4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.88	29.37	25.25	27.67	27.16	26.94	23.23	30.52	10.19	15.71	14.04	12.41	13.09	13.89	12.91	14.32
PY1 (Vuw)	8.35	10.98	12.27	7.85	9.28	10.13	11.99	8.37	4.09	5.30	5.93	3.84	4.50	4.93	5.80	4.08
PX2 (Mu)	7.04	9.26	10.35	6.63	7.83	8.55	10.11	7.06	8.97	8.16	13.76	4.50	6.83	8.64	14.62	3.92
PY2 (Mu)	2.35	3.09	3.45	2.21	2.61	2.85	3.37	2.35	2.99	2.72	4.59	1.50	2.28	2.88	4.87	1.31
Pu (kip)	31.77	41.12	38.92	35.74	36.95	37.79	36.71	39.08	20.43	25.18	29.73	17.74	21.04	23.85	29.53	19.02

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.19	36.43	33.85	32.09	32.90	33.47	31.77	35.14
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 9442**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.12	20.56	OK	29.73	14.86	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.12	1.47	126.02	OK
Web SPL	20.56	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1456	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type DD

Field Splice - Node 1456

Node 1456

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1456 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
1456 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 1456 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.72	-19.88	-20.79	-7.75	-31.70	-9.62	-16.48	-18.11	-23.21	-20.11	-29.63	-17.91	-16.77	-23.04	-31.76	-7.12
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.51	0.40	0.42	0.15	0.63	0.19	0.33	0.36	0.46	0.40	0.59	0.36	0.34	0.46	0.64	0.14
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.72		-20.79		-31.70		-18.11		-23.21		-29.63		-23.04		-31.76	
Fcf (ksi)	-37.86		-37.50		-40.85		-37.50		-37.50		-39.81		-37.50		-40.88	
Fcf (kip)	-3407.20		-3375.00		-3676.49		-3375.00		-3375.00		-3583.17		-3375.00		-3678.99	
fncf (ksi)		-19.88		-7.75		-9.62	-16.48			-20.11		-17.91	-16.77			-7.12
Rcf		1.19		1.18		1.29	1.18			1.18		1.25	1.18			1.29
Fncf (ksi)		-37.50		-37.50		-37.50	-37.50			-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.76	-14.61	-15.45	-5.61	-23.31	-6.78	-12.00	-13.39	-16.92	-14.46	-21.63	-13.12	-12.23	-17.06	-23.40	-4.97
Fs (ksi)	-18.76	-14.61	-15.45	-5.61	-23.31	-6.78	-12.00	-13.39	-16.92	-14.46	-21.63	-13.12	-12.23	-17.06	-23.40	-4.97
Fs (kip)	-1688.47	-1315.21	-1390.52	-505.03	-2098.27	-610.03	-1080.32	-1204.88	-1523.15	-1301.15	-1946.32	-1180.71	-1100.86	-1535.27	-2105.80	-447.46

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3845.32	3541.32	2105.80	1535.27

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	443.90	343.26	506.40	313.69	373.31	419.13	333.66	494.80	321.80	251.14	366.40	229.80	272.37	304.30	243.92	358.20
Vuw (kip)	665.85	514.89	759.60	470.53	559.96	628.70	500.49	742.19	---	---	---	---	---	---	---	---
Mv (k*ft)	374.54	289.63	427.28	264.67	314.98	353.64	281.53	417.48	181.01	141.26	206.10	129.26	153.21	171.17	137.20	201.49
Huw (kip)	-2031.49	-1539.33	-1756.37	-1879.79	-2021.08	-2054.88	-1891.11	-1651.63	-1101.35	-695.03	-993.04	-837.91	-1035.58	-1146.58	-966.58	-936.20
Muw (k*ft)	311.41	623.78	626.48	396.81	302.61	381.85	389.26	697.54	91.24	216.45	363.79	30.45	54.27	187.15	106.19	405.37
Mu (k*ft)	685.95	913.41	1053.76	661.48	617.59	735.49	670.79	1115.02	272.25	357.72	569.89	159.71	207.47	358.32	243.39	606.86

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.25	23.68	27.02	28.92	31.09	31.61	29.09	25.41	16.94	10.69	15.28	12.89	15.93	17.64	14.87	14.40
PY1 (Vuw)	10.24	7.92	11.69	7.24	8.61	9.67	7.70	11.42	4.95	3.86	5.64	3.54	4.19	4.68	3.75	5.51
PX2 (Mu)	15.83	21.08	24.32	15.26	14.25	16.97	15.48	25.73	6.28	8.26	13.15	3.69	4.79	8.27	5.62	14.00
PY2 (Mu)	5.28	7.03	8.11	5.09	4.75	5.66	5.16	8.58	2.09	2.75	4.38	1.23	1.60	2.76	1.87	4.67
Pu (kip)	49.58	47.19	55.02	45.87	47.27	50.95	46.39	54.91	24.27	20.07	30.14	17.25	21.51	26.96	21.25	30.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1940.34	2160.00	OK
TF Inside	1904.97	2120.63	OK
BF Inside	1767.89	1794.38	OK
BF Outside	1773.43	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.10	43.81	50.27	42.39	43.28	46.64	42.77	50.31
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	759.60
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1940.34	24.25	OK	1062.59	13.28	OK
BF	1773.43	27.71	OK	768.83	12.01	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1940.34	24.25	1.47	137.48	OK
TF	3845.32	48.07	1.47	229.13	OK
TF Inside	1904.97	23.81	1.47	148.93	OK
BF Inside	1767.89	27.62	1.47	126.02	OK
BF	3541.32	55.33	1.47	229.13	OK
BF Outside	1773.43	27.71	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.02	27.51	OK	30.18	15.09	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.02	1.47	126.02	OK
Web SPL	27.51	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.11
TF Inside	NA	1.11
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.49	1.27	4.77
Web	1.73	1.21	3.01
BF	1.31	1.40	4.13

Plate	Shear	Flexure
Web	1.89	1.34

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1456**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.95	-18.44	-19.68	-7.36	-29.09	-8.23	-16.11	-17.65	-19.34	-16.42	-23.67	-12.60	-16.32	-22.24	-28.89	-5.63
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.48	0.37	0.39	0.15	0.58	0.16	0.32	0.35	0.39	0.33	0.47	0.25	0.33	0.44	0.58	0.11
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.95		-19.68		-29.09			-17.65	-19.34		-23.67			-22.24	-28.89	
Fcf (ksi)	-37.50		-37.50		-39.54			-37.50	-37.50		-37.50			-37.50	-39.45	
Fcf (kip)	-3375.00		-3375.00		-3558.97			-3375.00	-3375.00		-3375.00			-3375.00	-3550.06	
fncf (ksi)		-18.44		-7.36		-8.23	-16.11			-16.42		-12.60	-16.32			-5.63
Rcf		1.29		1.29		1.36	1.29			1.29		1.29	1.29			1.36
Fncf (ksi)		-37.50		-37.50		-37.50	-37.50			-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.36674	-13.63323	-14.39972	-5.542574	-21.04399	-6.157716	-11.82812	-13.07404	-14.16011	-11.93952	-17.16719	-9.509119	-11.97301	-16.31816	-20.90	-4.32
Fs (ksi)	-17.37	-13.63	-14.40	-5.54	-21.04	-6.16	-11.83	-13.07	-14.16	-11.94	-17.17	-9.51	-11.97	-16.32	-20.90	-4.32
Fs (kip)	-1563.01	-1226.99	-1295.97	-498.83	-1893.96	-554.19	-1064.53	-1176.66	-1274.41	-1074.56	-1545.05	-855.82	-1077.57	-1468.63	-1881.36	-388.46

Vu (kip)	443.90	343.26	506.40	313.69	373.31	419.13	333.66	494.80	321.80	251.14	366.40	229.80	272.37	304.30	243.92	358.20
Vuw (kip)	665.85	514.89	759.60	470.53	559.96	628.70	500.49	742.19	---	---	---	---	---	---	---	---
Mv (k*ft)	374.54	289.63	427.28	264.67	314.98	353.64	281.53	417.48	181.01	141.26	206.10	129.26	153.21	171.17	137.20	201.49
Huw (kip)	-2022.05	-1550.70	-1674.29	-1922.95	-1935.88	-1773.72	-1931.67	-1553.46	-1023.00	-658.10	-897.66	-821.77	-861.29	-880.32	-933.61	-832.27
Muw (k*ft)									82.14	194.86	327.50	27.41	48.85	168.48	95.59	364.93
Mu (k*ft)	374.54	289.63	427.28	264.67	314.98	353.64	281.53	417.48	263.15	336.12	533.60	156.67	202.06	339.65	232.80	566.42
Muw (k*ft)	301.97	616.20	623.75	368.03	359.41	467.52	362.22	699.83	formulas matching the Muw results							
Pu (add)	71.75	146.42	148.22	87.45	85.40	111.09	86.07	166.32	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1456**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 3% 3% 2% 2% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.11	23.86	25.76	29.58	29.78	27.29	29.72	23.90	15.74	10.12	13.81	12.64	13.25	13.54	14.36	12.80
PY1 (Vuw)	10.24	7.92	11.69	7.24	8.61	9.67	7.70	11.42	4.95	3.86	5.64	3.54	4.19	4.68	3.75	5.51
PX2 (Mu)	8.64	6.68	9.86	6.11	7.27	8.16	6.50	9.63	6.07	7.76	12.31	3.62	4.66	7.84	5.37	13.07
PY2 (Mu)	2.88	2.23	3.29	2.04	2.42	2.72	2.17	3.21	2.02	2.59	4.10	1.21	1.55	2.61	1.79	4.36
Pu (kip)	41.86	32.18	38.64	36.88	38.66	37.55	37.53	36.59	22.90	19.01	27.88	16.94	18.81	22.59	20.50	27.69

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.35	28.70	33.79	33.28	34.69	33.38	33.81	31.87
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 1456**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.86	20.93	OK	27.88	13.94	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.86	1.47	126.02	OK
Web SPL	20.93	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3456	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type DD

Field Splice - Node 3456

Node 3456

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3456 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
3456 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 3456 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.91	-21.65	-22.97	-9.49	-32.38	-10.18	-18.96	-19.18	-25.11	-21.58	-30.98	-19.76	-19.08	-23.14	-32.00	-7.25
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.52	0.43	0.46	0.19	0.65	0.20	0.38	0.38	0.50	0.43	0.62	0.40	0.38	0.46	0.64	0.14
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.91		-22.97		-32.38			-19.18	-25.11		-30.98			-23.14	-32.00	
Fcf (ksi)	-37.96		-37.50		-41.19			-37.50	-37.55		-40.49			-37.50	-41.00	
Fcf (kip)	-3416.05		-3375.00		-3707.18			-3375.00	-3379.75		-3644.11			-3375.00	-3690.00	
fncf (ksi)		-21.65		-9.49		-10.18	-18.96			-21.58		-19.76	-19.08			-7.25
Rcf		1.17		1.16		1.27	1.16			1.16		1.25	1.16			1.27
Fncf (ksi)		-37.50		-37.50		-37.50	-37.50			-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.85	-15.86	-16.98	-6.80	-23.78	-7.14	-13.79	-14.13	-18.28	-15.49	-22.55	-14.41	-13.81	-16.99	-23.55	-5.02
Fs (ksi)	-18.85	-15.86	-16.98	-6.80	-23.78	-7.14	-13.79	-14.13	-18.28	-15.49	-22.55	-14.41	-13.81	-16.99	-23.55	-5.02
Fs (kip)	-1696.58	-1427.76	-1527.81	-612.31	-2139.78	-642.54	-1241.53	-1271.85	-1645.03	-1393.90	-2029.73	-1296.79	-1243.07	-1529.54	-2119.49	-452.19

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3853.00	3538.01	2139.78	1529.54

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	458.37	382.65	527.74	357.11	404.41	452.59	372.75	516.21	331.75	278.53	381.04	260.22	293.91	327.68	271.26	372.89
Vuw (kip)	687.55	573.97	791.62	535.67	606.62	678.89	559.12	774.31	---	---	---	---	---	---	---	---
Mv (k*ft)	386.75	322.86	445.28	301.31	341.22	381.88	314.50	435.55	186.61	156.67	214.34	146.37	165.32	184.32	152.58	209.75
Huw (kip)	-2090.04	-1600.06	-1786.51	-1962.14	-2065.06	-2151.65	-1966.68	-1655.77	-1145.59	-784.71	-1020.18	-921.57	-1114.27	-1219.72	-1016.62	-942.95
Muw (k*ft)	276.71	583.29	621.39	341.90	275.61	347.13	338.88	700.15	65.71	223.79	365.99	7.41	61.39	179.16	70.03	407.56
Mu (k*ft)	663.45	906.15	1066.68	643.22	616.84	729.01	653.39	1135.70	252.32	380.46	580.33	153.78	226.71	363.48	222.61	617.31

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.15	24.62	27.48	30.19	31.77	33.10	30.26	25.47	17.62	12.07	15.70	14.18	17.14	18.76	15.64	14.51
PY1 (Vuw)	10.58	8.83	12.18	8.24	9.33	10.44	8.60	11.91	5.10	4.29	5.86	4.00	4.52	5.04	4.17	5.74
PX2 (Mu)	15.31	20.91	24.62	14.84	14.23	16.82	15.08	26.21	5.82	8.78	13.39	3.55	5.23	8.39	5.14	14.25
PY2 (Mu)	5.10	6.97	8.21	4.95	4.74	5.61	5.03	8.74	1.94	2.93	4.46	1.18	1.74	2.80	1.71	4.75
Pu (kip)	49.99	48.19	55.95	46.92	48.11	52.44	47.34	55.65	24.48	22.06	30.87	18.47	23.24	28.26	21.60	30.60

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1944.22	2160.00	OK
TF Inside	1908.78	2120.63	OK
BF Inside	1766.23	1794.38	OK
BF Outside	1771.77	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.37	44.48	51.01	43.09	43.88	47.83	43.40	50.87
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	791.62
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1944.22	24.30	OK	1079.73	13.50	OK
BF	1771.77	27.68	OK	765.97	11.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1944.22	24.30	1.47	137.48	OK
TF	3853.00	48.16	1.47	229.13	OK
TF Inside	1908.78	23.86	1.47	148.93	OK
BF Inside	1766.23	27.60	1.47	126.02	OK
BF	3538.01	55.28	1.47	229.13	OK
BF Outside	1771.77	27.68	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.95	27.97	OK	30.87	15.43	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.95	1.47	126.02	OK
Web SPL	27.97	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.11
TF Inside	NA	1.11
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.49	1.25	4.76
Web	1.68	1.16	2.93
BF	1.31	1.41	4.14

Plate	Shear	Flexure
Web	1.81	1.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3456	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.58	-20.55	-21.90	-9.17	-30.38	-9.41	-18.71	-18.92	-21.39	-18.06	-25.66	-15.06	-18.95	-22.78	-30.11	-6.73
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.49	0.41	0.44	0.18	0.61	0.19	0.37	0.38	0.43	0.36	0.51	0.30	0.38	0.46	0.60	0.13
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.58		-21.90		-30.38			-18.92	-21.39		-25.66			-22.78	-30.11	
Fcf (ksi)	-37.50		-37.50		-40.19			-37.50	-37.50		-37.83			-37.50	-40.06	
Fcf (kip)	-3375.00		-3375.00		-3617.22			-3375.00	-3375.00		-3404.48			-3375.00	-3605.05	
fncf (ksi)		-20.55		-9.17		-9.41	-18.71			-18.06		-15.06	-18.95			-6.73
Rcf		1.23		1.23		1.32	1.23			1.23		1.25	1.23			1.32
Fncf (ksi)		-37.50		-37.50		-37.50	-37.50			-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.80544	-15.11649	-15.95932	-6.801977	-21.94983	-6.97363	-13.65813	-13.96142	-15.59386	-13.08193	-18.56679	-11.23554	-13.827	-16.69243	-21.76	-5.08
Fs (ksi)	-17.81	-15.12	-15.96	-6.80	-21.95	-6.97	-13.66	-13.96	-15.59	-13.08	-18.57	-11.24	-13.83	-16.69	-21.76	-5.08
Fs (kip)	-1602.49	-1360.48	-1436.34	-612.18	-1975.48	-627.63	-1229.23	-1256.53	-1403.45	-1177.37	-1671.01	-1011.20	-1244.43	-1502.32	-1958.29	-457.33

Vu (kip)	458.37	382.65	527.74	357.11	404.41	452.59	372.75	516.21	331.75	278.53	381.04	260.22	293.91	327.68	271.26	372.89
Vuw (kip)	687.55	573.97	791.62	535.67	606.62	678.89	559.12	774.31	---	---	---	---	---	---	---	---
Mv (k*ft)	386.75	322.86	445.28	301.31	341.22	381.88	314.50	435.55	186.61	156.67	214.34	146.37	165.32	184.32	152.58	209.75
Huw (kip)	-2074.63	-1610.88	-1737.09	-1999.46	-1972.91	-1867.06	-2009.20	-1614.73	-1086.42	-751.12	-954.47	-911.44	-946.30	-983.48	-1007.14	-885.73
Muw (k*ft)									59.16	201.46	329.48	6.67	55.26	161.29	63.04	366.90
Mu (k*ft)	386.75	322.86	445.28	301.31	341.22	381.88	314.50	435.55	245.77	358.14	543.81	153.04	220.59	345.61	215.62	576.65
Muw (k*ft)	266.91	576.08	610.36	317.03	334.73	419.70	319.64	685.86	formulas matching the Muw results							
Pu (add)	63.42	136.89	145.04	75.33	79.54	99.73	73.79	163.01	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3456	Backchk'd	WME	Date	8/5/2011	Sheet No.	

1% 3% 3% 2% 2% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.92	24.78	26.72	30.76	30.35	28.72	30.91	24.84	16.71	11.56	14.68	14.02	14.56	15.13	15.49	13.63
PY1 (Vuw)	10.58	8.83	12.18	8.24	9.33	10.44	8.60	11.91	5.10	4.29	5.86	4.00	4.52	5.04	4.17	5.74
PX2 (Mu)	8.92	7.45	10.28	6.95	7.87	8.81	7.26	10.05	5.67	8.26	12.55	3.53	5.09	7.98	4.98	13.31
PY2 (Mu)	2.97	2.48	3.43	2.32	2.62	2.94	2.42	3.35	1.89	2.75	4.18	1.18	1.70	2.66	1.66	4.44
Pu (kip)	43.03	34.16	40.16	39.16	40.05	39.85	39.73	38.09	23.45	21.03	29.03	18.30	20.61	24.36	21.28	28.79

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.38	30.35	35.11	35.24	35.85	35.37	35.70	33.17
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.03	21.52	OK	29.03	14.51	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.03	1.47	126.02	OK
Web SPL	21.52	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5456	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type DD

Field Splice - Node 5456

Node 5456

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5456 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
5456 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 5456 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.60	-21.48	-22.82	-9.43	-31.43	-9.58	-19.73	-18.29	-26.63	-20.43	-27.73	-21.66	-20.61	-23.41	-31.38	-6.75
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.51	0.43	0.46	0.19	0.63	0.19	0.39	0.37	0.53	0.41	0.55	0.43	0.41	0.47	0.63	0.14
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.60		-22.82		-31.43		-19.73		-26.63		-27.73			-23.41	-31.38	
Fcf (ksi)	-37.80		-37.50		-40.71		-37.50		-38.32		-38.87			-37.50	-40.69	
Fcf (kip)	-3402.16		-3375.00		-3664.28		-3375.00		-3448.56		-3497.94			-3375.00	-3662.22	
fncf (ksi)		-21.48		-9.43		-9.58		-18.29		-20.43		-21.66	-20.61			-6.75
Rcf		1.20		1.19		1.30		1.19		1.22		1.24	1.19			1.29
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.62	-15.73	-16.84	-6.71	-23.09	-6.69	-14.42	-13.52	-19.41	-14.61	-20.16	-15.82	-14.97	-17.21	-23.08	-4.63
Fs (ksi)	-18.62	-15.73	-16.84	-6.71	-23.09	-6.69	-14.42	-13.52	-19.41	-14.61	-20.16	-15.82	-14.97	-17.21	-23.08	-4.63
Fs (kip)	-1675.87	-1415.34	-1515.61	-604.15	-2077.68	-602.22	-1298.10	-1216.58	-1746.85	-1314.98	-1814.26	-1423.77	-1347.51	-1548.64	-2077.59	-416.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3823.95	3536.72	2077.68	1548.64

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	462.92	390.44	531.78	368.42	420.70	432.73	386.52	518.28	334.92	283.96	383.83	268.16	305.34	313.59	280.95	374.29
Vuw (kip)	694.38	585.66	797.67	552.63	631.05	649.09	579.78	777.42	---	---	---	---	---	---	---	---
Mv (k*ft)	390.59	329.43	448.69	310.86	354.96	365.11	326.13	437.30	188.39	159.73	215.90	150.84	171.75	176.40	158.03	210.54
Huw (kip)	-2100.03	-1608.85	-1753.31	-1957.58	-2086.57	-2166.51	-2049.01	-1631.34	-1133.45	-777.24	-982.63	-922.05	-1122.67	-1187.28	-1061.92	-914.41
Muw (k*ft)	263.26	577.43	622.55	344.95	294.92	265.76	283.99	702.86	63.68	222.80	360.67	19.93	105.57	95.45	49.17	406.10
Mu (k*ft)	653.85	906.87	1071.25	655.80	649.88	630.87	610.12	1140.16	252.08	382.53	576.57	170.77	277.32	271.85	207.20	616.64

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.31	24.75	26.97	30.12	32.10	33.33	31.52	25.10	17.44	11.96	15.12	14.19	17.27	18.27	16.34	14.07
PY1 (Vuw)	10.68	9.01	12.27	8.50	9.71	9.99	8.92	11.96	5.15	4.37	5.91	4.13	4.70	4.82	4.32	5.76
PX2 (Mu)	15.09	20.93	24.72	15.13	15.00	14.56	14.08	26.31	5.82	8.83	13.31	3.94	6.40	6.27	4.78	14.23
PY2 (Mu)	5.03	6.98	8.24	5.04	5.00	4.85	4.69	8.77	1.94	2.94	4.44	1.31	2.13	2.09	1.59	4.74
Pu (kip)	49.93	48.40	55.62	47.23	49.34	50.14	47.59	55.43	24.31	22.03	30.25	18.92	24.64	25.50	21.93	30.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1929.56	2160.00	OK
TF Inside	1894.39	2120.63	OK
BF Inside	1765.59	1794.38	OK
BF Outside	1771.13	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.27	44.62	50.66	43.33	44.99	45.64	43.49	50.64
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	797.67
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1929.56	24.12	OK	1048.39	13.10	OK
BF	1771.13	27.67	OK	775.53	12.12	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1929.56	24.12	1.47	137.48	OK
TF	3823.95	47.80	1.47	229.13	OK
TF Inside	1894.39	23.68	1.47	148.93	OK
BF Inside	1765.59	27.59	1.47	126.02	OK
BF	3536.72	55.26	1.47	229.13	OK
BF Outside	1771.13	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.62	27.81	OK	30.25	15.12	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.62	1.47	126.02	OK
Web SPL	27.81	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.50	1.28	4.79
Web	1.67	1.15	2.91
BF	1.31	1.39	4.14

Plate	Shear	Flexure
Web	1.80	1.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.86	-20.97	-22.32	-9.68	-30.66	-10.02	-19.56	-18.20	-22.88	-17.02	-23.64	-17.91	-19.99	-22.63	-30.30	-7.03
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.50	0.42	0.45	0.19	0.61	0.20	0.39	0.36	0.46	0.34	0.47	0.36	0.40	0.45	0.61	0.14
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.86		-22.32		-30.66		-19.56		-22.88		-23.64			-22.63	-30.30	
Fcf (ksi)	-37.50		-37.50		-40.33		-37.50		-37.50		-37.50			-37.50	-40.15	
Fcf (kip)	-3375.00		-3375.00		-3629.50		-3375.00		-3375.00		-3375.00			-3375.00	-3613.40	
fncf (ksi)		-20.97		-9.68		-10.02		-18.20		-17.02		-17.91	-19.99			-7.03
Rcf		1.22		1.22		1.32		1.22		1.22		1.22	1.22			1.31
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.00472	-15.39878	-16.25251	-7.135543	-22.1386	-7.38022	-14.25681	-13.44132	-16.64615	-12.32629	-17.143	-13.23713	-14.56112	-16.57295	-21.89	-5.27
Fs (ksi)	-18.00	-15.40	-16.25	-7.14	-22.14	-7.38	-14.26	-13.44	-16.65	-12.33	-17.14	-13.24	-14.56	-16.57	-21.89	-5.27
Fs (kip)	-1620.42	-1385.89	-1462.73	-642.20	-1992.47	-664.22	-1283.11	-1209.72	-1498.15	-1109.37	-1542.87	-1191.34	-1310.50	-1491.57	-1969.74	-474.16

Vu (kip)	462.92	390.44	531.78	368.42	420.70	432.73	386.52	518.28	334.92	283.96	383.83	268.16	305.34	313.59	280.95	374.29
Vuw (kip)	694.38	585.66	797.67	552.63	631.05	649.09	579.78	777.42	---	---	---	---	---	---	---	---
Mv (k*ft)	390.59	329.43	448.69	310.86	354.96	365.11	326.13	437.30	188.39	159.73	215.90	150.84	171.75	176.40	158.03	210.54
Huw (kip)	-2083.91	-1628.15	-1765.96	-1972.07	-1924.73	-1960.40	-2044.40	-1628.95	-1102.32	-771.81	-974.12	-914.04	-956.09	-1002.54	-1027.42	-896.10
Muw (k*ft)									57.33	200.57	324.68	17.94	95.04	85.93	44.26	365.58
Mu (k*ft)	390.59	329.43	448.69	310.86	354.96	365.11	326.13	437.30	245.72	360.30	540.59	168.78	266.79	262.32	202.29	576.12
Muw (k*ft)	260.73	564.57	597.12	335.29	366.85	343.06	267.07	636.89	formulas matching the Huw results							
Pu (add)	61.95	134.15	141.89	79.67	87.17	81.52	68.21	161.72	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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1% 3% 3% 2% 2% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.06	25.05	27.17	30.34	29.61	30.16	31.45	25.06	16.96	11.87	14.99	14.06	14.71	15.42	15.81	13.79
PY1 (Vuw)	10.68	9.01	12.27	8.50	9.71	9.99	8.92	11.96	5.15	4.37	5.91	4.13	4.70	4.82	4.32	5.76
PX2 (Mu)	9.01	7.60	10.35	7.17	8.19	8.43	7.53	10.09	5.67	8.31	12.48	3.89	6.16	6.05	4.67	13.30
PY2 (Mu)	3.00	2.53	3.45	2.39	2.73	2.81	2.51	3.36	1.89	2.77	4.16	1.30	2.05	2.02	1.56	4.43
Pu (kip)	43.29	34.63	40.68	39.06	39.80	40.65	40.62	38.35	23.70	21.41	29.25	18.76	21.93	22.54	21.30	28.93

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.60	30.75	35.59	35.09	35.51	36.26	36.48	33.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5456	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
43.29	21.65	OK	29.25	14.62	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	43.29	1.47	126.02	OK
Web SPL	21.65	1.47	80.19	OK

Field Splice - Node 7456

Node 7456

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7456 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
7456 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 7456 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.33	-20.37	-22.90	-8.38	-32.34	-9.00	-20.02	-18.38	-31.10	-18.36	-26.18	-20.98	-20.08	-22.33	-31.96	-6.03
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.41	0.46	0.17	0.65	0.18	0.40	0.37	0.62	0.37	0.52	0.42	0.40	0.45	0.64	0.12
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.33		-22.90		-32.34		-20.02		-31.10		-26.18			-22.33	-31.96	
Fcf (ksi)	-38.16		-37.50		-41.17		-37.50		-40.55		-38.09			-37.50	-40.98	
Fcf (kip)	-3434.71		-3375.00		-3705.27		-3375.00		-3649.49		-3428.14			-3375.00	-3688.32	
fncf (ksi)		-20.37		-8.38		-9.00		-18.38		-18.36		-20.98	-20.08			-6.03
Rcf		1.18		1.16		1.27		1.16		1.25		1.18	1.16			1.27
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.13	-14.86	-16.96	-5.95	-23.78	-6.22	-14.64	-13.57	-22.72	-13.02	-19.06	-15.35	-14.62	-16.43	-23.56	-4.08
Fs (ksi)	-19.13	-14.86	-16.96	-5.95	-23.78	-6.22	-14.64	-13.57	-22.72	-13.02	-19.06	-15.35	-14.62	-16.43	-23.56	-4.08
Fs (kip)	-1721.90	-1337.17	-1526.74	-535.45	-2139.93	-560.12	-1317.79	-1221.69	-2044.53	-1171.89	-1715.25	-1381.11	-1315.74	-1478.92	-2120.03	-367.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3857.22	3543.90	2139.93	1478.92

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	462.66	385.05	530.67	361.90	457.56	408.75	377.80	519.22	334.84	280.52	383.40	263.65	331.74	296.75	274.89	375.31
Vuw (kip)	693.99	577.58	796.01	542.85	686.34	613.12	566.70	778.84	---	---	---	---	---	---	---	---
Mv (k*ft)	390.37	324.89	447.76	305.35	386.07	344.88	318.77	438.10	188.35	157.79	215.66	148.30	186.61	166.92	154.62	211.11
Huw (kip)	-2052.50	-1558.22	-1736.67	-1940.96	-2097.84	-2072.38	-2005.93	-1604.54	-1121.66	-756.14	-990.02	-931.14	-1179.35	-1135.33	-1024.71	-912.00
Muw (k*ft)	310.86	611.19	653.68	356.03	385.63	294.39	312.71	733.48	94.05	242.31	386.18	23.49	213.31	81.68	39.89	428.46
Mu (k*ft)	701.22	936.08	1101.44	661.38	771.70	639.27	631.48	1171.58	282.39	400.10	601.84	171.79	399.92	248.60	194.51	639.57

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.58	23.97	26.72	29.86	32.27	31.88	30.86	24.69	17.26	11.63	15.23	14.33	18.14	17.47	15.76	14.03
PY1 (Vuw)	10.68	8.89	12.25	8.35	10.56	9.43	8.72	11.98	5.15	4.32	5.90	4.06	5.10	4.57	4.23	5.77
PX2 (Mu)	16.18	21.60	25.42	15.26	17.81	14.75	14.57	27.04	6.52	9.23	13.89	3.96	9.23	5.74	4.49	14.76
PY2 (Mu)	5.39	7.20	8.47	5.09	5.94	4.92	4.86	9.01	2.17	3.08	4.63	1.32	3.08	1.91	1.50	4.92
Pu (kip)	50.39	48.33	56.10	47.08	52.73	48.79	47.42	55.82	24.88	22.14	30.96	19.06	28.57	24.09	21.05	30.71

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1946.35	2160.00	OK
TF Inside	1910.87	2120.63	OK
BF Inside	1769.18	1794.38	OK
BF Outside	1774.72	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.77	44.63	51.16	43.24	48.13	44.53	43.41	51.04
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	796.01
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1946.35	24.33	OK	1079.81	13.50	OK
BF	1774.72	27.73	OK	740.62	11.57	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1946.35	24.33	1.47	137.48	OK
TF	3857.22	48.22	1.47	229.13	OK
TF Inside	1910.87	23.89	1.47	148.93	OK
BF Inside	1769.18	27.64	1.47	126.02	OK
BF	3543.90	55.37	1.47	229.13	OK
BF Outside	1774.72	27.73	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.10	28.05	OK	30.96	15.48	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.10	1.47	126.02	OK
Web SPL	28.05	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.11
TF Inside	NA	1.11
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.49	1.25	4.75
Web	1.70	1.14	2.96
BF	1.31	1.45	4.13

Plate	Shear	Flexure
Web	1.80	1.32

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.28	-19.65	-22.36	-8.64	-30.91	-8.87	-19.40	-17.85	-26.32	-14.29	-22.07	-17.15	-19.67	-21.79	-30.63	-6.14
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.51	0.39	0.45	0.17	0.62	0.18	0.39	0.36	0.53	0.29	0.44	0.34	0.39	0.44	0.61	0.12
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.28		-22.36		-30.91		-19.40		-26.32		-22.07			-21.79	-30.63	
Fcf (ksi)	-37.64		-37.50		-40.46		-37.50		-38.16		-37.50			-37.50	-40.32	
Fcf (kip)	-3387.54		-3375.00		-3641.04		-3375.00		-3434.49		-3375.00			-3375.00	-3628.51	
fncf (ksi)		-19.65		-8.64		-8.87		-17.85		-14.29		-17.15	-19.67			-6.14
Rcf		1.22		1.21		1.31		1.21		1.23		1.21	1.21			1.30
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.3133	-14.46498	-16.3088	-6.393414	-22.3527	-6.55052	-14.15846	-13.19724	-19.10977	-10.38109	-16.04312	-12.70081	-14.34908	-15.98135	-22.16	-4.62
Fs (ksi)	-18.31	-14.46	-16.31	-6.39	-22.35	-6.55	-14.16	-13.20	-19.11	-10.38	-16.04	-12.70	-14.35	-15.98	-22.16	-4.62
Fs (kip)	-1648.20	-1301.85	-1467.79	-575.41	-2011.74	-589.55	-1274.26	-1187.75	-1719.88	-934.30	-1443.88	-1143.07	-1291.42	-1438.32	-1994.04	-416.12

Vu (kip)	462.66	385.05	530.67	361.90	457.56	408.75	377.80	519.22	334.84	280.52	383.40	263.65	331.74	296.75	274.89	375.31
Vuw (kip)	693.99	577.58	796.01	542.85	686.34	613.12	566.70	778.84	---	---	---	---	---	---	---	---
Mv (k*ft)	390.37	324.89	447.76	305.35	386.07	344.88	318.77	438.10	188.35	157.79	215.66	148.30	186.61	166.92	154.62	211.11
Huw (kip)	-2031.60	-1583.58	-1718.01	-1952.25	-1841.42	-1924.12	-2024.86	-1594.71	-1081.68	-749.17	-953.81	-902.74	-973.20	-948.55	-1000.90	-883.73
Muw (k*ft)									84.66	218.14	347.65	21.15	192.03	73.53	35.91	385.71
Mu (k*ft)	390.37	324.89	447.76	305.35	386.07	344.88	318.77	438.10	273.01	375.93	563.31	169.45	378.64	240.45	190.53	596.83
Muw (k*ft)	301.73	594.28	634.73	348.50	451.47	367.25	309.09	518.80	formulas matching the Muw results							
Pu (add)	71.70	141.22	150.83	82.81	107.28	87.27	71.31	168.90	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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2%	3%	3%	2%	2%	2%	2%	4%	percentage increase in flange force	4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.26	24.36	26.43	30.03	28.33	29.60	31.15	24.53	16.64	11.53	14.67	13.89	14.97	14.59	15.40	13.60
PY1 (Vuw)	10.68	8.89	12.25	8.35	10.56	9.43	8.72	11.98	5.15	4.32	5.90	4.06	5.10	4.57	4.23	5.77
PX2 (Mu)	9.01	7.50	10.33	7.05	8.91	7.96	7.36	10.11	6.30	8.68	13.00	3.91	8.74	5.55	4.40	13.77
PY2 (Mu)	3.00	2.50	3.44	2.35	2.97	2.65	2.45	3.37	2.10	2.89	4.33	1.30	2.91	1.85	1.47	4.59
Pu (kip)	42.52	33.83	39.97	38.59	39.62	39.46	40.10	37.89	24.06	21.45	29.50	18.59	25.03	21.14	20.60	29.27

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.87	30.02	34.90	34.68	35.11	35.26	36.02	32.95
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7456	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.52	21.26	OK	29.50	14.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.52	1.47	126.02	OK
Web SPL	21.26	1.47	80.19	OK

Field Splice - Node 9456

Node 9456

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	80
Web	65
BF	64

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9456 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
9456 R	90.00	50.00	4500.00	90.00	50.00	4500.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 9456 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.50	---	90.00	68.75	75.26	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.50	---	90.00	68.75	75.26	50	65
Splice Plates	TF Outside	32.00	1.500	62.50	48.00	35.25	---	50	65
	TF Inside	14.50	1.625	62.50	47.13	33.31	---	50	65
	BF Inside	14.50	1.375	50.50	39.88	28.19	---	50	65
	BF Outside	32.00	1.250	50.50	40.00	29.38	---	50	65
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.56	-17.28	-21.51	-6.18	-32.15	-7.82	-19.21	-15.73	-30.21	-15.55	-25.61	-18.85	-18.21	-20.80	-32.19	-5.03
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.35	0.43	0.12	0.64	0.16	0.38	0.31	0.60	0.31	0.51	0.38	0.36	0.42	0.64	0.10
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.56		-21.51		-32.15		-19.21		-30.21		-25.61			-20.80	-32.19	
Fcf (ksi)	-38.28		-37.50		-41.08		-37.50		-40.11		-37.80			-37.50	-41.09	
Fcf (kip)	-3445.06		-3375.00		-3696.89		-3375.00		-3609.57		-3402.23			-3375.00	-3698.51	
fncf (ksi)		-17.28		-6.18		-7.82		-15.73		-15.55		-18.85	-18.21			-5.03
Rcf		1.19		1.16		1.28		1.16		1.25		1.17	1.16			1.28
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.38	-12.62	-16.04	-4.35	-23.72	-5.35	-14.07	-12.42	-22.18	-10.99	-18.69	-13.80	-13.31	-15.34	-23.79	-3.34
Fs (ksi)	-19.38	-12.62	-16.04	-4.35	-23.72	-5.35	-14.07	-12.42	-22.18	-10.99	-18.69	-13.80	-13.31	-15.34	-23.79	-3.34
Fs (kip)	-1744.42	-1136.01	-1443.21	-391.88	-2134.43	-481.83	-1266.35	-1117.93	-1995.91	-988.85	-1682.51	-1241.89	-1197.71	-1381.03	-2141.14	-300.17

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	3877.23	3553.72	2141.14	1381.03

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	466.22	358.85	525.19	334.29	440.88	394.78	356.49	512.89	338.00	263.06	380.58	245.77	321.02	287.52	260.47	371.90
Vuw (kip)	699.33	538.27	787.78	501.43	661.32	592.16	534.73	769.34	---	---	---	---	---	---	---	---
Mv (k*ft)	393.37	302.78	443.13	282.05	371.99	333.09	300.79	432.75	190.13	147.97	214.08	138.25	180.57	161.73	146.51	209.19
Huw (kip)	-1941.39	-1475.24	-1684.70	-1842.27	-1962.97	-1977.82	-1937.61	-1568.00	-1056.16	-672.87	-959.30	-874.24	-1094.41	-1072.28	-945.54	-895.15
Muw (k*ft)	390.00	666.50	684.24	421.82	456.03	344.76	358.26	762.83	148.72	256.99	403.97	36.28	246.17	107.71	44.81	450.02
Mu (k*ft)	783.37	969.28	1127.36	703.87	828.03	677.85	659.05	1195.58	338.85	404.96	618.05	174.53	426.74	269.44	191.33	659.21

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.87	22.70	25.92	28.34	30.20	30.43	29.81	24.12	16.25	10.35	14.76	13.45	16.84	16.50	14.55	13.77
PY1 (Vuw)	10.76	8.28	12.12	7.71	10.17	9.11	8.23	11.84	5.20	4.05	5.86	3.78	4.94	4.42	4.01	5.72
PX2 (Mu)	18.08	22.37	26.02	16.24	19.11	15.64	15.21	27.59	7.82	9.35	14.26	4.03	9.85	6.22	4.42	15.21
PY2 (Mu)	6.03	7.46	8.67	5.41	6.37	5.21	5.07	9.20	2.61	3.12	4.75	1.34	3.28	2.07	1.47	5.07
Pu (kip)	50.80	47.73	55.94	46.48	52.01	48.25	46.94	55.83	25.30	20.96	30.90	18.21	27.92	23.63	19.74	30.93

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2280.00	1833.00	87.00	56.72	30.84	3314.51	1833.00	OK
TF Inside	0.00	2238.44	1732.25	188.50	122.89	23.77	4942.19	1732.25	OK
BF Inside	0.00	1894.06	1465.75	126.50	82.67	20.11	3539.07	1465.75	OK
BF Outside	0.00	1900.00	1527.50	57.50	37.58	25.70	2469.92	1527.50	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1956.45	2160.00	OK
TF Inside	1920.79	2120.63	OK
BF Inside	1774.08	1794.38	OK
BF Outside	1779.64	1800.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.23	44.28	51.07	42.90	47.62	44.16	43.14	51.12
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	787.78
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9456**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	1956.45	24.46	OK	1080.42	13.51	OK
BF	1779.64	27.81	OK	691.60	10.81	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1956.45	24.46	1.47	137.48	OK
TF	3877.23	48.47	1.47	229.13	OK
TF Inside	1920.79	24.01	1.47	148.93	OK
BF Inside	1774.08	27.72	1.47	126.02	OK
BF	3553.72	55.53	1.47	229.13	OK
BF Outside	1779.64	27.81	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.94	27.97	OK	30.93	15.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.94	1.47	126.02	OK
Web SPL	27.97	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	NA	1.01
BF Outside	NA	1.01

Bolt	Shear	Slip	Bearing
TF	1.48	1.25	4.73
Web	1.76	1.16	3.06
BF	1.30	1.56	4.12

Plate	Shear	Flexure
Web	1.82	1.37

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9456	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.48	-16.72	-20.72	-6.25	-30.28	-7.30	-17.89	-14.60	-25.05	-11.20	-20.94	-14.55	-17.94	-20.39	-30.08	-4.43
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.51	0.33	0.41	0.12	0.61	0.15	0.36	0.29	0.50	0.22	0.42	0.29	0.36	0.41	0.60	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.48		-20.72		-30.28		-17.89		-25.05		-20.94			-20.39	-30.08	
Fcf (ksi)	-37.74		-37.50		-40.14		-37.50		-37.52		-37.50			-37.50	-40.04	
Fcf (kip)	-3396.66		-3375.00		-3612.67		-3375.00		-3377.24		-3375.00			-3375.00	-3603.53	
fncf (ksi)		-16.72		-6.25		-7.30		-14.60		-11.20		-14.55	-17.94			-4.43
Rcf		1.25		1.24		1.33		1.24		1.24		1.24	1.24			1.32
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50	-37.50			-37.50
Fncf (kip)		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00		-3375.00	-3375.00			-3375.00

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.47804	-12.39239	-15.195	-4.678954	-21.95084	-5.420583	-12.99457	-11.50998	-18.25444	-8.181233	-15.26859	-10.86121	-13.15201	-14.98564	-21.81	-3.39
Fs (ksi)	-18.48	-12.39	-15.19	-4.68	-21.95	-5.42	-12.99	-11.51	-18.25	-8.18	-15.27	-10.86	-13.15	-14.99	-21.81	-3.39
Fs (kip)	-1663.02	-1115.31	-1367.55	-421.11	-1975.58	-487.85	-1169.51	-1035.90	-1642.90	-736.31	-1374.17	-977.51	-1183.68	-1348.71	-1962.66	-305.36

Vu (kip)	466.22	358.85	525.19	334.29	440.88	394.78	356.49	512.89	338.00	263.06	380.58	245.77	321.02	287.52	260.47	371.90
Vuw (kip)	699.33	538.27	787.78	501.43	661.32	592.16	534.73	769.34	---	---	---	---	---	---	---	---
Mv (k*ft)	393.37	302.78	443.13	282.05	371.99	333.09	300.79	432.75	190.13	147.97	214.08	138.25	180.57	161.73	146.51	209.19
Huw (kip)	-1933.16	-1492.74	-1643.78	-1834.25	-1696.44	-1832.27	-1970.76	-1514.39	-1018.72	-655.84	-903.26	-808.65	-872.38	-862.28	-928.54	-831.61
Muw (k*ft)									133.88	231.35	363.67	32.66	221.61	96.96	40.34	405.12
Mu (k*ft)	393.37	302.78	443.13	282.05	371.99	333.09	300.79	432.75	324.01	379.32	577.74	170.91	402.18	258.69	186.85	614.31

Muw (k*ft)	371.82	654.84	670.34	427.17	520.13	428.49	336.46	752.73	formulas matching the Muw results
Pu (add)	88.35	155.61	159.29	101.50	123.60	101.82	79.88	178.72	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9456	Backchk'd	WME	Date	8/5/2011	Sheet No.	

2% 3% 4% 2% 3% 2% 2% 4% percentage increase in flange force 4%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.74	22.97	25.29	28.22	26.10	28.19	30.32	23.30	15.67	10.09	13.90	12.44	13.42	13.27	14.29	12.79
PY1 (Vuw)	10.76	8.28	12.12	7.71	10.17	9.11	8.23	11.84	5.20	4.05	5.86	3.78	4.94	4.42	4.01	5.72
PX2 (Mu)	9.08	6.99	10.23	6.51	8.58	7.69	6.94	9.99	7.48	8.75	13.33	3.94	9.28	5.97	4.31	14.18
PY2 (Mu)	3.03	2.33	3.41	2.17	2.86	2.56	2.31	3.33	2.49	2.92	4.44	1.31	3.09	1.99	1.44	4.73
Pu (kip)	41.19	31.78	38.76	36.11	37.05	37.73	38.72	36.58	24.39	20.09	29.11	17.16	24.08	20.28	19.38	28.92

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	36.57	28.22	33.76	32.47	32.75	33.69	34.83	31.70
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
41.19	20.60	OK	29.11	14.56	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	41.19	1.47	126.02	OK
Web SPL	20.60	1.47	80.19	OK

Field Splice

Type EE

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 1467

Node 1467

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1467 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
1467 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1467 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.18	-25.69	-7.17	-19.07	-19.61	-21.81	-5.29	-24.77	-13.45	-22.57	-14.33	-22.77	-6.07	-28.84	-19.23	-17.57
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.27	0.39	0.11	0.29	0.29	0.33	0.08	0.37	0.20	0.34	0.21	0.34	0.09	0.43	0.29	0.26
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.69		-19.07		-21.81		-24.77		-22.57		-22.77		-28.84	-19.23	
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-18.18		-7.17		-19.61		-5.29		-13.45		-14.33		-6.07			-17.57
Rcf	1.73		1.73		1.73		1.73		1.73		1.73		1.73			1.73
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.20	-19.42	-5.13	-13.82	-14.30	-16.59	-3.67	-17.97	-11.83	-16.30	-8.21	-18.42	-4.38	-21.91	-13.89	-12.52
Fs (ksi)	-13.20	-19.42	-5.13	-13.82	-14.30	-16.59	-3.67	-17.97	-11.83	-16.30	-8.21	-18.42	-4.38	-21.91	-13.89	-12.52
Fs (kip)	-1055.84	-1553.64	-410.47	-1105.29	-1144.29	-1326.97	-293.60	-1437.65	-946.21	-1303.67	-656.66	-1473.22	-350.33	-1753.10	-1110.84	-1001.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1144.29	1753.10

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	289.39	57.79	321.96	24.29	151.41	149.50	51.54	286.47	212.83	43.27	235.84	19.60	189.16	95.38	44.79	204.83
Vuw (kip)	434.09	86.69	482.94	36.44	227.11	224.25	77.32	429.70	---	---	---	---	---	---	---	---
Mv (k*ft)	244.17	48.76	271.65	20.50	127.75	126.14	43.49	241.71	119.72	24.34	132.66	11.03	106.40	53.65	25.19	115.22
Huw (kip)	-2428.58	-1855.75	-2503.17	-1757.90	-2182.24	-2228.25	-1798.66	-2396.87	-978.56	-568.41	-926.72	-649.22	-843.70	-798.71	-788.78	-792.04
Muw (k*ft)	357.66	739.55	307.93	804.78	521.89	491.21	777.61	378.80	124.45	173.70	45.67	286.01	89.36	204.14	350.69	27.39
Mu (k*ft)	601.84	788.31	579.58	825.28	649.64	617.35	821.10	620.51	244.17	198.04	178.33	297.04	195.77	257.79	375.89	142.61

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1467	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.36	28.55	38.51	27.04	33.57	34.28	27.67	36.87	15.05	8.74	14.26	9.99	12.98	12.29	12.14	12.19
PY1 (Vuw)	6.68	1.33	7.43	0.56	3.49	3.45	1.19	6.61	3.27	0.67	3.63	0.30	2.91	1.47	0.69	3.15
PX2 (Mu)	13.89	18.19	13.38	19.04	14.99	14.25	18.95	14.32	5.63	4.57	4.12	6.85	4.52	5.95	8.67	3.29
PY2 (Mu)	4.63	6.06	4.46	6.35	5.00	4.75	6.32	4.77	1.88	1.52	1.37	2.28	1.51	1.98	2.89	1.10
Pu (kip)	52.48	47.32	53.23	46.60	49.30	49.22	47.22	52.44	21.32	13.49	19.04	17.04	18.05	18.56	21.12	16.05

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.58	45.16	49.07	44.70	46.31	46.17	45.16	48.59
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	482.94
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	577.68	8.02	OK
BF	2008.27	25.10	OK	879.58	10.99	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.23	26.61	OK	21.32	10.66	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.23	1.47	114.56	OK
Web SPL	26.61	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.10	4.35
Web	1.36	1.62	2.15
BF	1.44	1.53	5.41

Plate	Shear	Flexure
Web	2.97	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1467	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.08	-25.22	-6.23	-17.55	-19.47	-21.56	-4.70	-23.21	-10.88	-19.55	-10.23	-18.26	-5.69	-27.33	-18.43	-16.86
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.27	0.38	0.09	0.26	0.29	0.32	0.07	0.35	0.16	0.29	0.15	0.27	0.09	0.41	0.28	0.25
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.22		-17.55		-21.56		-23.21		-19.55		-18.26		-27.33	-18.43	
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-18.08		-6.23		-19.47		-4.70		-10.88		-10.23		-5.69			-16.86
Rcf	1.83		1.83		1.83		1.83		1.83		1.83		1.83			1.83
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.18047	-18.81597	-4.700866	-12.56673	-14.15967	-16.22772	-3.615918	-16.56739	-11.79507	-15.84178	-7.252321	-16.49636	-4.426529	-20.30691	-13.32	-12.08
Fs (ksi)	-13.18	-18.82	-4.70	-12.57	-14.16	-16.23	-3.62	-16.57	-11.80	-15.84	-7.25	-16.50	-4.43	-20.31	-13.32	-12.08
Fs (kip)	-1054.44	-1505.28	-376.07	-1005.34	-1132.77	-1298.22	-289.27	-1325.39	-943.61	-1267.34	-580.19	-1319.71	-354.12	-1624.55	-1065.45	-966.22

Vu (kip)	289.39	57.79	321.96	24.29	151.41	149.50	51.54	286.47	212.83	43.27	235.84	19.60	189.16	95.38	44.79	204.83
Vuw (kip)	434.09	86.69	482.94	36.44	227.11	224.25	77.32	429.70	---	---	---	---	---	---	---	---
Mv (k*ft)	244.17	48.76	271.65	20.50	127.75	126.14	43.49	241.71	119.72	24.34	132.66	11.03	106.40	53.65	25.19	115.22
Huw (kip)	-2475.53	-1824.90	-2551.63	-1740.57	-2079.90	-2044.51	-1795.16	-2408.15	-959.89	-518.03	-911.62	-605.50	-829.11	-712.46	-742.00	-761.88
Muw (k*ft)	326.36	760.11	275.63	816.33	590.11	613.70	779.94	371.28	112.71	157.32	41.36	259.03	80.93	184.88	317.61	24.81
Mu (k*ft)	570.54	808.88	547.28	836.83	717.86	739.84	823.43	612.99	232.43	181.66	174.02	270.06	187.34	238.53	342.80	140.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1467**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.09	28.08	39.26	26.78	32.00	31.45	27.62	37.05	14.77	7.97	14.02	9.32	12.76	10.96	11.42	11.72
PY1 (Vuw)	6.68	1.33	7.43	0.56	3.49	3.45	1.19	6.61	3.27	0.67	3.63	0.30	2.91	1.47	0.69	3.15
PX2 (Mu)	13.17	18.67	12.63	19.31	16.57	17.07	19.00	14.15	5.36	4.19	4.02	6.23	4.32	5.50	7.91	3.23
PY2 (Mu)	4.39	6.22	4.21	6.44	5.52	5.69	6.33	4.72	1.79	1.40	1.34	2.08	1.44	1.83	2.64	1.08
Pu (kip)	52.43	47.35	53.17	46.62	49.39	49.38	47.22	52.43	20.76	12.34	18.71	15.73	17.62	16.79	19.61	15.54

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.47	45.23	48.96	44.74	46.56	46.60	45.17	48.57
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.17	26.59	OK	20.76	10.38	OK

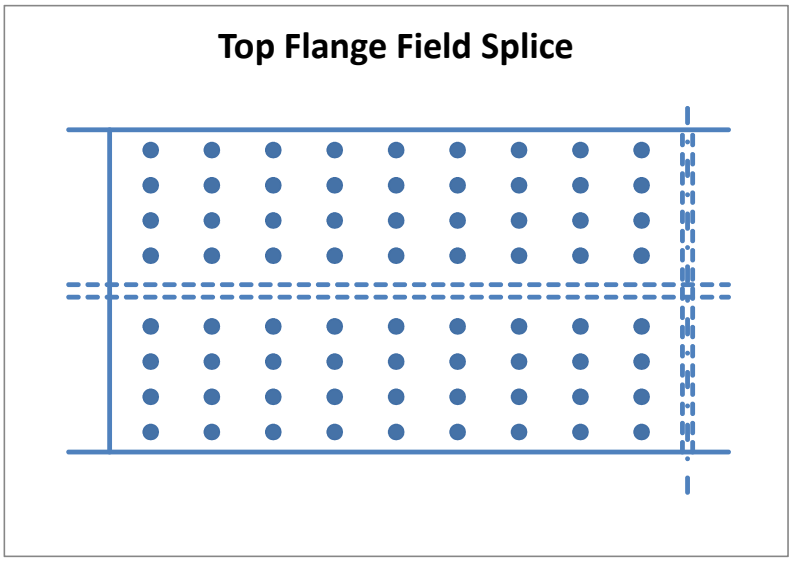
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.17	1.47	114.56	OK
Web SPL	26.59	1.47	80.19	OK

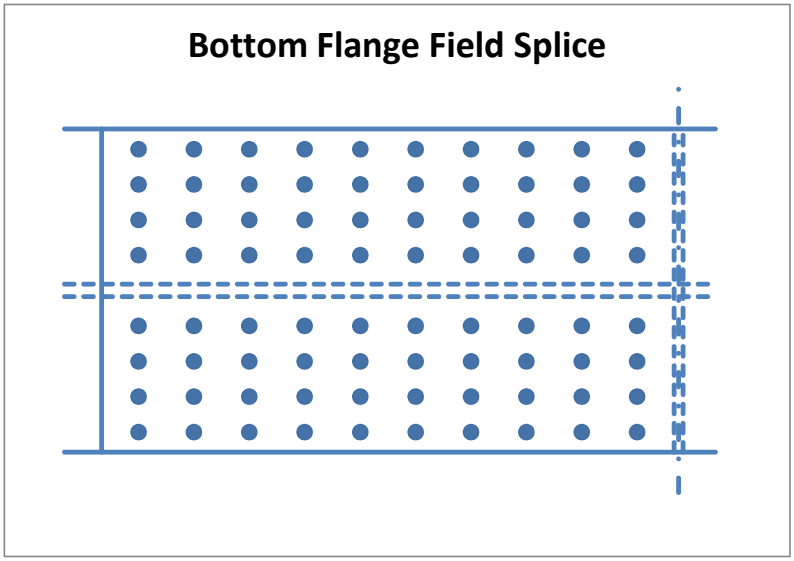
HNTB	The HNTB Companies Engineers Architects Planners						
		Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1467	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1467

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0	21	0
21	3.5	21	3.5
21	7	21	7

	Top Flange		Bottom Flange	
No. Bolts =	72.0		80.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		9.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5	21	10.5
21	17.5	21	17.5
21	21	21	21
21	24.5	21	24.5
21	28	21	28
24	0	24	0
24	3.5	24	3.5
24	7	24	7
24	10.5	24	10.5
24	17.5	24	17.5
24	21	24	21
24	24.5	24	24.5
24	28	24	28
		27	0
		27	3.5
		27	7
		27	10.5
		27	17.5
		27	21
		27	24.5
		27	28

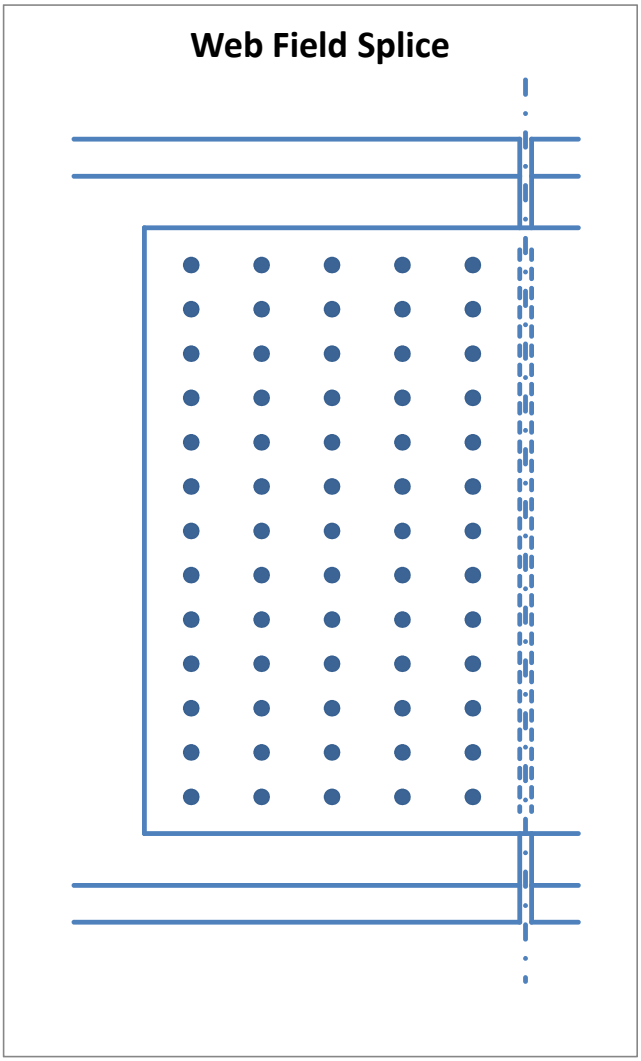
Flange Bolt Pattern Cont. - Node 1467

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1467	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1467

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1467

Web Bolt Pattern Cont. - Node 1467

390	1170	1170	8190

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3467	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 3467

Node 3467

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3467 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
3467 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3467 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.57	-29.15	-8.24	-22.75	-22.04	-25.41	-6.77	-28.29	-16.48	-27.39	-15.74	-26.32	-7.54	-31.83	-21.07	-22.09
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.31	0.44	0.12	0.34	0.33	0.38	0.10	0.42	0.25	0.41	0.24	0.39	0.11	0.48	0.32	0.33
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-29.15		-22.75		-25.41		-28.29		-27.39		-26.32		-31.83		-22.09
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-20.57		-8.24		-22.04		-6.77		-16.48		-15.74		-7.54		-21.07	
Rcf	1.57		1.57		1.57		1.57		1.57		1.57		1.57		1.57	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.66	-21.77	-6.00	-16.71	-15.80	-19.04	-4.84	-20.75	-13.90	-19.48	-8.12	-20.56	-5.19	-23.94	-15.30	-16.01
Fs (ksi)	-14.66	-21.77	-6.00	-16.71	-15.80	-19.04	-4.84	-20.75	-13.90	-19.48	-8.12	-20.56	-5.19	-23.94	-15.30	-16.01
Fs (kip)	-1172.89	-1741.95	-479.91	-1337.17	-1263.69	-1523.10	-387.07	-1660.32	-1111.74	-1558.19	-649.43	-1644.52	-414.91	-1915.18	-1224.15	-1280.85

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1263.69	1915.18

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	281.41	66.58	313.01	31.49	145.51	153.67	48.56	290.42	204.86	48.82	227.18	24.03	175.75	85.59	40.34	206.97
Vuw (kip)	422.12	99.86	469.51	47.23	218.27	230.51	72.84	435.63	---	---	---	---	---	---	---	---
Mv (k*ft)	237.44	56.17	264.10	26.57	122.78	129.66	40.97	245.04	115.23	27.46	127.79	13.52	98.86	48.15	22.69	116.42
Huw (kip)	-2452.50	-1871.03	-2522.17	-1801.76	-2259.54	-2224.94	-1838.36	-2476.28	-1093.07	-681.40	-1045.05	-767.77	-1001.23	-860.23	-873.78	-939.38
Muw (k*ft)	341.71	729.36	295.27	775.54	470.35	493.42	751.14	325.86	142.26	214.32	64.85	318.31	111.61	248.77	375.07	14.18
Mu (k*ft)	579.15	785.53	559.37	802.11	593.13	623.08	792.11	570.90	257.50	241.78	192.64	331.83	210.47	296.92	397.76	130.60

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.73	28.79	38.80	27.72	34.76	34.23	28.28	38.10	16.82	10.48	16.08	11.81	15.40	13.23	13.44	14.45
PY1 (Vuw)	6.49	1.54	7.22	0.73	3.36	3.55	1.12	6.70	3.15	0.75	3.50	0.37	2.70	1.32	0.62	3.18
PX2 (Mu)	13.37	18.13	12.91	18.51	13.69	14.38	18.28	13.17	5.94	5.58	4.45	7.66	4.86	6.85	9.18	3.01
PY2 (Mu)	4.46	6.04	4.30	6.17	4.56	4.79	6.09	4.39	1.98	1.86	1.48	2.55	1.62	2.28	3.06	1.00
Pu (kip)	52.26	47.52	52.98	46.74	49.09	49.32	47.12	52.46	23.33	16.27	21.12	19.69	20.72	20.41	22.92	17.96

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.36	45.30	48.84	44.74	46.01	46.26	45.01	48.49
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	469.51
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	637.96	8.86	OK
BF	2008.27	25.10	OK	960.90	12.01	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.98	26.49	OK	23.33	11.67	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.98	1.47	114.56	OK
Web SPL	26.49	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.90	4.35
Web	1.37	1.49	2.16
BF	1.44	1.40	5.41

Plate	Shear	Flexure
Web	3.06	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.19	-28.35	-8.57	-22.36	-21.41	-24.60	-7.24	-27.70	-12.79	-23.16	-12.66	-22.71	-7.99	-31.07	-20.64	-21.60
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.30	0.42	0.13	0.34	0.32	0.37	0.11	0.42	0.19	0.35	0.19	0.34	0.12	0.47	0.31	0.32
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-28.35		-22.36		-24.60		-27.70		-23.16		-22.71		-31.07		-21.60
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-20.19		-8.57		-21.41		-7.24		-12.79		-12.66		-7.99		-20.64	
Rcf	1.61		1.61		1.61		1.61		1.61		1.61		1.61		1.61	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.59243	-21.03458	-6.45296	-16.15783	-15.45055	-18.3872	-5.512365	-19.92651	-13.21631	-18.27046	-8.248835	-19.51396	-5.967977	-22.95217	-14.98	-15.62
Fs (ksi)	-14.59	-21.03	-6.45	-16.16	-15.45	-18.39	-5.51	-19.93	-13.22	-18.27	-8.25	-19.51	-5.97	-22.95	-14.98	-15.62
Fs (kip)	-1167.39	-1682.77	-516.24	-1292.63	-1236.04	-1470.98	-440.99	-1594.12	-1057.31	-1461.64	-659.91	-1561.12	-477.44	-1836.17	-1198.32	-1249.67

Vu (kip)	281.41	66.58	313.01	31.49	145.51	153.67	48.56	290.42	204.86	48.82	227.18	24.03	175.75	85.59	40.34	206.97
Vuw (kip)	422.12	99.86	469.51	47.23	218.27	230.51	72.84	435.63	---	---	---	---	---	---	---	---
Mv (k*ft)	237.44	56.17	264.10	26.57	122.78	129.66	40.97	245.04	115.23	27.46	127.79	13.52	98.86	48.15	22.69	116.42
Huw (kip)	-2458.19	-1896.55	-2516.88	-1832.22	-2100.73	-2094.10	-1868.38	-2479.63	-1068.81	-678.32	-1015.13	-763.17	-944.60	-832.88	-867.60	-918.00
Muw (k*ft)	337.92	712.35	298.79	755.23	576.23	580.65	731.12	323.63	128.84	194.10	58.73	288.28	101.08	225.30	339.68	12.84
Mu (k*ft)	575.36	768.52	562.89	781.80	699.01	710.31	772.10	568.67	244.08	221.56	186.52	301.80	199.94	273.45	362.38	129.26

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For	Cleveland InnerBelt : Field Splice - Node 3467	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.82	29.18	38.72	28.19	32.32	32.22	28.74	38.15	16.44	10.44	15.62	11.74	14.53	12.81	13.35	14.12
PY1 (Vuw)	6.49	1.54	7.22	0.73	3.36	3.55	1.12	6.70	3.15	0.75	3.50	0.37	2.70	1.32	0.62	3.18
PX2 (Mu)	13.28	17.74	12.99	18.04	16.13	16.39	17.82	13.12	5.63	5.11	4.30	6.96	4.61	6.31	8.36	2.98
PY2 (Mu)	4.43	5.91	4.33	6.01	5.38	5.46	5.94	4.37	1.88	1.70	1.43	2.32	1.54	2.10	2.79	0.99
Pu (kip)	52.25	47.50	52.99	46.72	49.23	49.44	47.09	52.45	22.64	15.74	20.52	18.90	19.61	19.43	21.98	17.61

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.34	45.24	48.86	44.67	46.39	46.57	44.94	48.48
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 3467**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.99	26.49	OK	22.64	11.32	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.99	1.47	114.56	OK
Web SPL	26.49	1.47	80.19	OK

Field Splice - Node 5467

Node 5467

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5467 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
5467 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5467 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 5467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.54	-26.77	-8.43	-21.23	-20.99	-22.91	-6.89	-26.52	-15.69	-24.50	-16.08	-25.50	-7.37	-29.53	-20.52	-20.03
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.29	0.40	0.13	0.32	0.31	0.34	0.10	0.40	0.24	0.37	0.24	0.38	0.11	0.44	0.31	0.30
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-26.77		-21.23		-22.91		-26.52		-24.50		-25.50		-29.53	-20.52	
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-19.54		-8.43		-20.99		-6.89		-15.69		-16.08		-7.37			-20.03
Rcf	1.69		1.69		1.69		1.69		1.69		1.69		1.69			1.69
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.92	-19.88	-6.12	-15.52	-15.03	-17.06	-4.91	-19.38	-11.63	-16.41	-9.34	-20.60	-5.06	-22.09	-14.89	-14.44
Fs (ksi)	-13.92	-19.88	-6.12	-15.52	-15.03	-17.06	-4.91	-19.38	-11.63	-16.41	-9.34	-20.60	-5.06	-22.09	-14.89	-14.44
Fs (kip)	-1113.55	-1590.25	-489.65	-1241.74	-1202.67	-1364.41	-392.97	-1550.17	-930.39	-1312.99	-747.24	-1647.85	-404.78	-1767.05	-1191.55	-1154.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1202.67	1767.05

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	326.99	121.59	358.25	85.64	196.23	199.58	102.36	336.80	239.06	89.35	261.15	63.95	183.36	147.53	80.36	241.40
Vuw (kip)	490.48	182.38	537.38	128.46	294.34	299.37	153.54	505.20	---	---	---	---	---	---	---	---
Mv (k*ft)	275.90	102.59	302.28	72.26	165.57	168.40	86.37	284.17	134.47	50.26	146.90	35.97	103.14	82.99	45.20	135.79
Huw (kip)	-2475.88	-1910.98	-2549.33	-1832.64	-2279.91	-2299.88	-1857.30	-2500.55	-1013.93	-649.27	-962.66	-728.68	-841.27	-898.16	-814.44	-879.95
Muw (k*ft)	326.13	702.73	277.16	754.96	456.77	443.46	738.51	309.68	119.17	188.02	40.44	289.30	95.65	225.15	340.57	9.14
Mu (k*ft)	602.02	805.32	579.43	827.22	622.34	611.86	824.88	593.86	253.65	238.28	187.33	325.27	198.79	308.14	385.77	144.93

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.09	29.40	39.22	28.19	35.08	35.38	28.57	38.47	15.60	9.99	14.81	11.21	12.94	13.82	12.53	13.54
PY1 (Vuw)	7.55	2.81	8.27	1.98	4.53	4.61	2.36	7.77	3.68	1.37	4.02	0.98	2.82	2.27	1.24	3.71
PX2 (Mu)	13.89	18.58	13.37	19.09	14.36	14.12	19.04	13.70	5.85	5.50	4.32	7.51	4.59	7.11	8.90	3.34
PY2 (Mu)	4.63	6.19	4.46	6.36	4.79	4.71	6.35	4.57	1.95	1.83	1.44	2.50	1.53	2.37	2.97	1.11
Pu (kip)	53.39	48.82	54.11	48.01	50.31	50.37	48.40	53.61	22.18	15.82	19.90	19.04	18.06	21.44	21.84	17.56

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.24	46.34	49.71	45.79	47.01	47.03	46.07	49.39
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	537.38
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	607.15	8.43	OK
BF	2008.27	25.10	OK	886.58	11.08	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.11	27.05	OK	22.18	11.09	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.11	1.47	114.56	OK
Web SPL	27.05	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.00	4.35
Web	1.34	1.56	2.12
BF	1.44	1.52	5.41

Plate	Shear	Flexure
Web	2.67	1.01

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5467	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.29	-26.17	-8.60	-20.77	-20.66	-22.49	-7.12	-25.78	-12.44	-20.82	-12.32	-21.27	-7.65	-28.71	-20.17	-19.71
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.29	0.39	0.13	0.31	0.31	0.34	0.11	0.39	0.19	0.31	0.18	0.32	0.11	0.43	0.30	0.30
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-26.17		-20.77		-22.49		-25.78		-20.82		-21.27		-28.71	-20.17	
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-19.29		-8.60		-20.66		-7.12		-12.44		-12.32		-7.65			-19.71
Rcf	1.74		1.74		1.74		1.74		1.74		1.74		1.74			1.74
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.87924	-19.27579	-6.457951	-14.97216	-14.84716	-16.67824	-5.4124	-18.51273	-11.42371	-15.75511	-8.976076	-19.17169	-5.649975	-21.07189	-14.64	-14.22
Fs (ksi)	-13.88	-19.28	-6.46	-14.97	-14.85	-16.68	-5.41	-18.51	-11.42	-15.76	-8.98	-19.17	-5.65	-21.07	-14.64	-14.22
Fs (kip)	-1110.34	-1542.06	-516.64	-1197.77	-1187.77	-1334.26	-432.99	-1481.02	-913.90	-1260.41	-718.09	-1533.73	-452.00	-1685.75	-1170.94	-1137.82

Vu (kip)	326.99	121.59	358.25	85.64	196.23	199.58	102.36	336.80	239.06	89.35	261.15	63.95	183.36	147.53	80.36	241.40
Vuw (kip)	490.48	182.38	537.38	128.46	294.34	299.37	153.54	505.20	---	---	---	---	---	---	---	---
Mv (k*ft)	275.90	102.59	302.28	72.26	165.57	168.40	86.37	284.17	134.47	50.26	146.90	35.97	103.14	82.99	45.20	135.79
Huw (kip)	-2491.33	-1932.06	-2562.96	-1854.68	-2132.78	-2126.54	-1882.33	-2513.00	-994.65	-642.90	-945.76	-717.75	-815.36	-844.43	-801.66	-865.79
Muw (k*ft)	315.83	688.67	268.07	740.26	554.86	559.02	721.83	301.38	107.93	170.28	36.62	262.01	86.63	203.91	308.44	8.28
Mu (k*ft)	591.72	791.26	570.35	812.52	720.43	727.42	808.20	585.56	242.40	220.54	183.52	297.98	189.77	286.90	353.64	144.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.33	29.72	39.43	28.53	32.81	32.72	28.96	38.66	15.30	9.89	14.55	11.04	12.54	12.99	12.33	13.32
PY1 (Vuw)	7.55	2.81	8.27	1.98	4.53	4.61	2.36	7.77	3.68	1.37	4.02	0.98	2.82	2.27	1.24	3.71
PX2 (Mu)	13.66	18.26	13.16	18.75	16.63	16.79	18.65	13.51	5.59	5.09	4.24	6.88	4.38	6.62	8.16	3.32
PY2 (Mu)	4.55	6.09	4.39	6.25	5.54	5.60	6.22	4.50	1.86	1.70	1.41	2.29	1.46	2.21	2.72	1.11
Pu (kip)	53.37	48.80	54.09	47.99	50.45	50.54	48.38	53.60	21.62	15.29	19.55	18.22	17.46	20.12	20.87	17.33

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.20	46.29	49.68	45.74	47.36	47.44	46.02	49.36
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.09	27.05	OK	21.62	10.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.09	1.47	114.56	OK
Web SPL	27.05	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 7467

Node 7467

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7467 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
7467 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7467 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.33	-29.18	-8.58	-22.89	-21.69	-24.92	-7.22	-28.60	-15.35	-26.10	-16.66	-27.31	-7.92	-32.16	-20.84	-21.89
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.30	0.44	0.13	0.34	0.33	0.37	0.11	0.43	0.23	0.39	0.25	0.41	0.12	0.48	0.31	0.33
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-29.18		-22.89		-24.92		-28.60		-26.10		-27.31		-32.16		-21.89
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-20.33		-8.58		-21.69		-7.22		-15.35		-16.66		-7.92		-20.84	
Rcf	1.56		1.56		1.56		1.56		1.56		1.56		1.56		1.56	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.46	-21.88	-6.27	-16.77	-15.52	-18.77	-5.18	-20.93	-9.89	-19.53	-12.37	-20.54	-5.43	-24.25	-15.16	-15.83
Fs (ksi)	-14.46	-21.88	-6.27	-16.77	-15.52	-18.77	-5.18	-20.93	-9.89	-19.53	-12.37	-20.54	-5.43	-24.25	-15.16	-15.83
Fs (kip)	-1156.98	-1750.33	-501.42	-1341.52	-1241.87	-1501.41	-414.44	-1674.31	-791.21	-1562.18	-989.25	-1642.84	-434.03	-1940.39	-1212.57	-1266.58

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1241.87	1940.39

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	276.19	70.26	308.25	34.65	152.14	147.37	50.30	287.74	200.66	51.74	223.32	26.58	122.92	147.56	41.07	205.39
Vuw (kip)	414.28	105.39	462.38	51.97	228.21	221.05	75.46	431.61	---	---	---	---	---	---	---	---
Mv (k*ft)	233.03	59.28	260.09	29.23	128.37	124.34	42.44	242.78	112.87	29.10	125.61	14.95	69.14	83.00	23.10	115.53
Huw (kip)	-2431.13	-1883.04	-2494.72	-1819.39	-2199.10	-2259.96	-1851.96	-2454.93	-1090.24	-691.10	-1028.73	-783.28	-882.52	-987.03	-890.41	-929.68
Muw (k*ft)	355.96	721.36	313.57	763.79	510.65	470.07	742.07	340.09	148.34	210.02	64.88	314.97	192.74	163.40	376.59	13.50
Mu (k*ft)	588.99	780.64	573.65	793.02	639.01	594.41	784.52	582.87	261.21	239.13	190.50	329.92	261.88	246.40	399.69	129.03

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.40	28.97	38.38	27.99	33.83	34.77	28.49	37.77	16.77	10.63	15.83	12.05	13.58	15.19	13.70	14.30
PY1 (Vuw)	6.37	1.62	7.11	0.80	3.51	3.40	1.16	6.64	3.09	0.80	3.44	0.41	1.89	2.27	0.63	3.16
PX2 (Mu)	13.59	18.01	13.24	18.30	14.75	13.72	18.10	13.45	6.03	5.52	4.40	7.61	6.04	5.69	9.22	2.98
PY2 (Mu)	4.53	6.00	4.41	6.10	4.92	4.57	6.03	4.48	2.01	1.84	1.47	2.54	2.01	1.90	3.07	0.99
Pu (kip)	52.15	47.60	52.89	46.80	49.30	49.14	47.15	52.41	23.36	16.36	20.81	19.88	20.01	21.28	23.22	17.77

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.30	45.35	48.81	44.77	46.29	46.05	45.01	48.48
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	462.38
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	626.94	8.71	OK
BF	2008.27	25.10	OK	973.55	12.17	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.89	26.44	OK	23.36	11.68	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.89	1.47	114.56	OK
Web SPL	26.44	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.93	4.35
Web	1.37	1.49	2.17
BF	1.44	1.38	5.41

Plate	Shear	Flexure
Web	3.10	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7467	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.81	-28.22	-8.65	-22.25	-21.09	-24.15	-7.28	-27.61	-12.46	-22.67	-12.80	-22.92	-7.95	-31.00	-20.41	-21.42
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.30	0.42	0.13	0.33	0.32	0.36	0.11	0.41	0.19	0.34	0.19	0.34	0.12	0.46	0.31	0.32
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-28.22		-22.25		-24.15		-27.61		-22.67		-22.92		-31.00		-21.42
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-19.81		-8.65		-21.09		-7.28		-12.46		-12.80		-7.95		-20.41	
Rcf	1.61		1.61		1.61		1.61		1.61		1.61		1.61		1.61	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.27481	-20.99193	-6.533618	-16.04417	-15.17966	-18.11783	-5.568771	-19.83149	-10.07066	-18.79863	-11.67583	-19.07495	-5.899982	-22.95307	-14.85	-15.46
Fs (ksi)	-14.27	-20.99	-6.53	-16.04	-15.18	-18.12	-5.57	-19.83	-10.07	-18.80	-11.68	-19.07	-5.90	-22.95	-14.85	-15.46
Fs (kip)	-1141.98	-1679.35	-522.69	-1283.53	-1214.37	-1449.43	-445.50	-1586.52	-805.65	-1503.89	-934.07	-1526.00	-472.00	-1836.25	-1187.63	-1236.54

Vu (kip)	276.19	70.26	308.25	34.65	152.14	147.37	50.30	287.74	200.66	51.74	223.32	26.58	122.92	147.56	41.07	205.39
Vuw (kip)	414.28	105.39	462.38	51.97	228.21	221.05	75.46	431.61	---	---	---	---	---	---	---	---
Mv (k*ft)	233.03	59.28	260.09	29.23	128.37	124.34	42.44	242.78	112.87	29.10	125.61	14.95	69.14	83.00	23.10	115.53
Huw (kip)	-2441.58	-1901.39	-2503.60	-1835.27	-2086.06	-2102.21	-1867.60	-2471.06	-1058.00	-677.33	-998.92	-762.01	-866.08	-922.52	-865.59	-909.07
Muw (k*ft)	348.99	709.12	307.65	753.20	586.01	575.24	731.65	329.34	134.34	190.21	58.76	285.25	174.56	147.98	341.06	12.23
Mu (k*ft)	582.02	768.40	567.73	782.43	714.37	699.58	774.09	572.12	247.21	219.31	184.38	300.20	243.70	230.99	364.16	127.76

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7467**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.56	29.25	38.52	28.23	32.09	32.34	28.73	38.02	16.28	10.42	15.37	11.72	13.32	14.19	13.32	13.99
PY1 (Vuw)	6.37	1.62	7.11	0.80	3.51	3.40	1.16	6.64	3.09	0.80	3.44	0.41	1.89	2.27	0.63	3.16
PX2 (Mu)	13.43	17.73	13.10	18.06	16.49	16.14	17.86	13.20	5.70	5.06	4.25	6.93	5.62	5.33	8.40	2.95
PY2 (Mu)	4.48	5.91	4.37	6.02	5.50	5.38	5.95	4.40	1.90	1.69	1.42	2.31	1.87	1.78	2.80	0.98
Pu (kip)	52.14	47.58	52.88	46.79	49.41	49.27	47.14	52.40	22.54	15.68	20.21	18.85	19.32	19.94	21.99	17.43

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.27	45.31	48.79	44.73	46.56	46.42	44.98	48.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.88	26.44	OK	22.54	11.27	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.88	1.47	114.56	OK
Web SPL	26.44	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 9467

Node 9467

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9467 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
9467 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9467 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.21	-24.95	-7.14	-18.14	-18.81	-20.99	-5.31	-23.60	-13.96	-21.95	-13.41	-21.91	-5.62	-27.95	-18.86	-16.75
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.26	0.37	0.11	0.27	0.28	0.31	0.08	0.35	0.21	0.33	0.20	0.33	0.08	0.42	0.28	0.25
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-24.95		-18.14		-20.99		-23.60		-21.95		-21.91		-27.95	-18.86	
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-17.21		-7.14		-18.81		-5.31		-13.96		-13.41		-5.62			-16.75
Rcf	1.79		1.79		1.79		1.79		1.79		1.79		1.79			1.79
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.40	-18.93	-5.18	-13.07	-13.63	-16.04	-3.76	-17.06	-8.86	-16.97	-10.86	-16.36	-3.96	-21.31	-13.69	-11.86
Fs (ksi)	-12.40	-18.93	-5.18	-13.07	-13.63	-16.04	-3.76	-17.06	-8.86	-16.97	-10.86	-16.36	-3.96	-21.31	-13.69	-11.86
Fs (kip)	-991.69	-1514.28	-414.39	-1045.87	-1090.21	-1283.11	-300.43	-1364.84	-709.16	-1357.56	-868.54	-1309.16	-316.41	-1704.41	-1095.17	-948.65

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1095.17	1704.41

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	274.37	60.84	309.45	26.37	146.51	148.89	51.55	279.42	201.21	45.88	226.00	21.52	109.78	170.42	43.79	200.31
Vuw (kip)	411.55	91.26	464.17	39.55	219.76	223.34	77.33	419.12	---	---	---	---	---	---	---	---
Mv (k*ft)	231.50	51.33	261.10	22.25	123.62	125.63	43.50	235.76	113.18	25.81	127.12	12.11	61.75	95.86	24.63	112.67
Huw (kip)	-2406.65	-1866.04	-2492.87	-1767.46	-2232.50	-2202.54	-1784.37	-2381.97	-939.74	-547.60	-889.99	-624.48	-775.02	-816.64	-757.81	-766.43
Muw (k*ft)	372.28	732.69	314.80	798.41	488.38	508.35	787.13	388.74	130.65	157.87	48.22	266.10	162.10	110.16	347.00	36.63
Mu (k*ft)	603.78	784.02	575.90	820.65	611.99	633.98	830.63	624.49	243.83	183.68	175.35	278.21	223.85	206.02	371.63	149.30

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9467**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.03	28.71	38.35	27.19	34.35	33.89	27.45	36.65	14.46	8.42	13.69	9.61	11.92	12.56	11.66	11.79
PY1 (Vuw)	6.33	1.40	7.14	0.61	3.38	3.44	1.19	6.45	3.10	0.71	3.48	0.33	1.69	2.62	0.67	3.08
PX2 (Mu)	13.93	18.09	13.29	18.94	14.12	14.63	19.17	14.41	5.63	4.24	4.05	6.42	5.17	4.75	8.58	3.45
PY2 (Mu)	4.64	6.03	4.43	6.31	4.71	4.88	6.39	4.80	1.88	1.41	1.35	2.14	1.72	1.58	2.86	1.15
Pu (kip)	52.13	47.39	52.92	46.65	49.14	49.22	47.23	52.28	20.69	12.84	18.38	16.22	17.43	17.82	20.54	15.81

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.32	45.20	48.84	44.72	46.09	46.21	45.20	48.48
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	464.17
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9467	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	552.88	7.68	OK
BF	2008.27	25.10	OK	855.15	10.69	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.92	26.46	OK	20.69	10.35	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.92	1.47	114.56	OK
Web SPL	26.46	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.19	4.35
Web	1.37	1.67	2.17
BF	1.44	1.57	5.41

Plate	Shear	Flexure
Web	3.09	1.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9467	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.24	-24.59	-6.34	-16.80	-18.69	-20.77	-4.88	-22.28	-10.00	-17.59	-10.70	-18.79	-5.59	-26.81	-17.98	-15.97
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.26	0.37	0.10	0.25	0.28	0.31	0.07	0.33	0.15	0.26	0.16	0.28	0.08	0.40	0.27	0.24
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-24.59		-16.80		-20.77		-22.28		-17.59		-18.79		-26.81	-17.98	
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-17.24		-6.34		-18.69		-4.88		-10.00		-10.70		-5.59			-15.97
Rcf	1.87		1.87		1.87		1.87		1.87		1.87		1.87			1.87
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.5034	-18.41943	-4.820812	-11.96972	-13.53364	-15.71732	-3.787394	-15.83731	-7.936405	-15.27675	-10.78437	-15.77256	-4.276795	-19.99005	-13.04	-11.39
Fs (ksi)	-12.50	-18.42	-4.82	-11.97	-13.53	-15.72	-3.79	-15.84	-7.94	-15.28	-10.78	-15.77	-4.28	-19.99	-13.04	-11.39
Fs (kip)	-1000.27	-1473.55	-385.66	-957.58	-1082.69	-1257.39	-302.99	-1266.99	-634.91	-1222.14	-862.75	-1261.80	-342.14	-1599.20	-1043.55	-910.85

Vu (kip)	274.37	60.84	309.45	26.37	146.51	148.89	51.55	279.42	201.21	45.88	226.00	21.52	109.78	170.42	43.79	200.31
Vuw (kip)	411.55	91.26	464.17	39.55	219.76	223.34	77.33	419.12	---	---	---	---	---	---	---	---
Mv (k*ft)	231.50	51.33	261.10	22.25	123.62	125.63	43.50	235.76	113.18	25.81	127.12	12.11	61.75	95.86	24.63	112.67
Huw (kip)	-2447.36	-1837.66	-2528.98	-1755.79	-2042.19	-2081.63	-1795.57	-2376.74	-927.68	-503.72	-877.53	-588.74	-696.39	-796.71	-728.01	-732.90
Muw (k*ft)	345.14	751.60	290.72	806.19	615.25	588.96	779.67	392.22	118.32	142.98	43.67	241.00	146.81	99.76	314.27	33.17
Mu (k*ft)	576.64	802.94	551.82	828.44	738.87	714.59	823.16	627.98	231.50	168.78	170.80	253.10	208.56	195.63	338.90	145.85

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9467	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.65	28.27	38.91	27.01	31.42	32.03	27.62	36.57	14.27	7.75	13.50	9.06	10.71	12.26	11.20	11.28
PY1 (Vuw)	6.33	1.40	7.14	0.61	3.38	3.44	1.19	6.45	3.10	0.71	3.48	0.33	1.69	2.62	0.67	3.08
PX2 (Mu)	13.31	18.53	12.73	19.12	17.05	16.49	19.00	14.49	5.34	3.90	3.94	5.84	4.81	4.51	7.82	3.37
PY2 (Mu)	4.44	6.18	4.24	6.37	5.68	5.50	6.33	4.83	1.78	1.30	1.31	1.95	1.60	1.50	2.61	1.12
Pu (kip)	52.08	47.41	52.88	46.66	49.31	49.33	47.22	52.29	20.21	11.82	18.09	15.07	15.87	17.27	19.30	15.23

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.22	45.26	48.75	44.75	46.55	46.50	45.17	48.50
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.88	26.44	OK	20.21	10.11	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.88	1.47	114.56	OK
Web SPL	26.44	1.47	80.19	OK

Field Splice - Node 1471

Node 1471

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1471 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
1471 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1471 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.11	-18.94	-17.06	-25.71	-19.79	-20.29	-5.22	-24.61	-14.51	-22.46	-13.43	-22.57	-19.64	-17.59	-6.54	-28.53
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.11	0.28	0.26	0.39	0.30	0.30	0.08	0.37	0.22	0.34	0.20	0.34	0.29	0.26	0.10	0.43
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-18.94		-25.71		-20.29		-24.61		-22.46		-22.57	-19.64			-28.53
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-7.11		-17.06		-19.79		-5.22		-14.51		-13.43			-17.59	-6.54	
Rcf	1.75		1.75		1.75		1.75		1.75		1.75			1.75	1.75	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.93	-14.18	-12.62	-18.75	-14.69	-14.78	-3.46	-18.32	-8.68	-16.73	-10.58	-16.86	-14.62	-12.83	-4.35	-21.13
Fs (ksi)	-4.93	-14.18	-12.62	-18.75	-14.69	-14.78	-3.46	-18.32	-8.68	-16.73	-10.58	-16.86	-14.62	-12.83	-4.35	-21.13
Fs (kip)	-394.21	-1134.64	-1009.30	-1499.79	-1174.90	-1182.40	-277.11	-1465.25	-694.15	-1338.69	-846.34	-1348.43	-1169.81	-1026.20	-348.03	-1690.39

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1174.90	1690.39

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	65.68	260.79	327.55	22.82	148.55	159.29	302.16	54.18	51.19	189.53	236.70	20.90	97.75	180.16	218.76	43.06
Vuw (kip)	98.52	391.19	491.32	34.23	222.83	238.93	453.24	81.27	---	---	---	---	---	---	---	---
Mv (k*ft)	55.42	220.04	276.37	19.26	125.34	134.40	254.95	45.71	28.79	106.61	133.14	11.76	54.99	101.34	123.05	24.22
Huw (kip)	-1856.49	-2380.44	-2524.00	-1757.30	-2246.00	-2189.23	-2408.22	-1826.71	-573.32	-940.91	-883.99	-653.39	-762.31	-823.04	-823.50	-764.41
Muw (k*ft)	739.05	389.75	294.05	805.18	479.38	517.23	371.24	758.90	185.11	122.62	1.88	297.03	161.13	125.52	35.90	335.59
Mu (k*ft)	794.47	609.79	570.42	824.43	604.72	651.63	626.19	804.62	213.90	229.23	135.02	308.79	216.12	226.86	158.96	359.81

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.56	36.62	38.83	27.04	34.55	33.68	37.05	28.10	8.82	14.48	13.60	10.05	11.73	12.66	12.67	11.76
PY1 (Vuw)	1.52	6.02	7.56	0.53	3.43	3.68	6.97	1.25	0.79	2.92	3.64	0.32	1.50	2.77	3.37	0.66
PX2 (Mu)	18.33	14.07	13.16	19.03	13.96	15.04	14.45	18.57	4.94	5.29	3.12	7.13	4.99	5.24	3.67	8.30
PY2 (Mu)	6.11	4.69	4.39	6.34	4.65	5.01	4.82	6.19	1.65	1.76	1.04	2.38	1.66	1.75	1.22	2.77
Pu (kip)	47.51	51.81	53.35	46.57	49.18	49.49	52.83	47.26	13.97	20.31	17.36	17.39	17.01	18.46	16.97	20.35

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.32	48.10	49.14	44.67	46.10	46.46	48.89	45.15
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	491.32
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	593.13	8.24	OK
BF	2008.27	25.10	OK	848.12	10.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.35	26.67	OK	20.35	10.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.35	1.47	114.56	OK
Web SPL	26.67	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.04	4.35
Web	1.36	1.72	2.15
BF	1.44	1.59	5.41

Plate	Shear	Flexure
Web	2.92	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1471	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.28	-17.54	-16.72	-24.94	-19.10	-19.57	-4.62	-23.04	-10.18	-17.74	-10.75	-19.44	-18.63	-16.68	-6.05	-26.95
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.09	0.26	0.25	0.37	0.29	0.29	0.07	0.35	0.15	0.27	0.16	0.29	0.28	0.25	0.09	0.40
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-17.54		-24.94		-19.57		-23.04		-17.74		-19.44	-18.63			-26.95
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-6.28		-16.72		-19.10		-4.62		-10.18		-10.75			-16.68	-6.05	
Rcf	1.86		1.86		1.86		1.86		1.86		1.86			1.86	1.86	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.636605	-13.01879	-12.35743	-17.91011	-14.03537	-14.12037	-3.459943	-16.91053	-7.635967	-14.93261	-10.7748	-16.4589	-13.70231	-12.07653	-4.47	-19.67
Fs (ksi)	-4.64	-13.02	-12.36	-17.91	-14.04	-14.12	-3.46	-16.91	-7.64	-14.93	-10.77	-16.46	-13.70	-12.08	-4.47	-19.67
Fs (kip)	-370.93	-1041.50	-988.59	-1432.81	-1122.83	-1129.63	-276.80	-1352.84	-610.88	-1194.61	-861.98	-1316.71	-1096.18	-966.12	-357.68	-1573.40

Vu (kip)	65.68	260.79	327.55	22.82	148.55	159.29	302.16	54.18	51.19	189.53	236.70	20.90	97.75	180.16	218.76	43.06
Vuw (kip)	98.52	391.19	491.32	34.23	222.83	238.93	453.24	81.27	---	---	---	---	---	---	---	---
Mv (k*ft)	55.42	220.04	276.37	19.26	125.34	134.40	254.95	45.71	28.79	106.61	133.14	11.76	54.99	101.34	123.05	24.22
Huw (kip)	-1832.60	-2414.09	-2546.38	-1739.83	-2049.85	-2081.42	-2411.72	-1819.54	-529.66	-908.03	-844.67	-611.11	-677.06	-817.01	-773.37	-724.16
Muw (k*ft)	754.98	367.32	279.13	816.83	610.15	589.10	368.90	763.69	167.64	111.05	1.70	269.01	145.93	113.68	32.52	303.93
Mu (k*ft)	810.40	587.36	555.50	836.09	735.49	723.50	623.85	809.40	196.44	217.66	134.84	280.77	200.92	215.02	155.57	328.15

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1471	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.19	37.14	39.18	26.77	31.54	32.02	37.10	27.99	8.15	13.97	12.99	9.40	10.42	12.57	11.90	11.14
PY1 (Vuw)	1.52	6.02	7.56	0.53	3.43	3.68	6.97	1.25	0.79	2.92	3.64	0.32	1.50	2.77	3.37	0.66
PX2 (Mu)	18.70	13.55	12.82	19.29	16.97	16.70	14.40	18.68	4.53	5.02	3.11	6.48	4.64	4.96	3.59	7.57
PY2 (Mu)	6.23	4.52	4.27	6.43	5.66	5.57	4.80	6.23	1.51	1.67	1.04	2.16	1.55	1.65	1.20	2.52
Pu (kip)	47.53	51.78	53.32	46.58	49.35	49.59	52.83	47.27	12.89	19.54	16.77	16.07	15.36	18.08	16.15	18.98

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.38	48.02	49.09	44.71	46.57	46.72	48.88	45.17
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 1471**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.32	26.66	OK	19.54	9.77	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.32	1.47	114.56	OK
Web SPL	26.66	1.47	80.19	OK

Field Splice - Node 3471

Node 3471

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3471 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
3471 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3471 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.71	-22.08	-19.46	-29.74	-21.42	-24.67	-6.98	-27.42	-16.10	-25.97	-16.25	-28.05	-21.05	-22.17	-7.77	-31.47
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.13	0.33	0.29	0.45	0.32	0.37	0.10	0.41	0.24	0.39	0.24	0.42	0.32	0.33	0.12	0.47
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-22.08		-29.74		-24.67		-27.42		-25.97		-28.05		-22.17		-31.47
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-8.71		-19.46		-21.42		-6.98		-16.10		-16.25		-21.05		-7.77	
Rcf	1.59		1.59		1.59		1.59		1.59		1.59		1.59		1.59	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.46	-15.97	-13.85	-22.22	-15.36	-18.51	-5.12	-19.87	-8.68	-19.06	-12.29	-20.68	-15.34	-15.76	-5.36	-23.68
Fs (ksi)	-6.46	-15.97	-13.85	-22.22	-15.36	-18.51	-5.12	-19.87	-8.68	-19.06	-12.29	-20.68	-15.34	-15.76	-5.36	-23.68
Fs (kip)	-516.90	-1277.47	-1108.21	-1777.24	-1228.80	-1480.64	-409.35	-1589.21	-694.57	-1524.60	-983.47	-1654.29	-1227.12	-1260.87	-428.79	-1894.13

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1228.80	1894.13

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	73.79	273.33	320.84	31.56	154.65	151.35	306.31	53.23	55.68	196.89	230.46	25.84	89.09	163.76	219.96	41.38
Vuw (kip)	110.68	409.99	481.26	47.34	231.97	227.03	459.47	79.84	---	---	---	---	---	---	---	---
Mv (k*ft)	62.26	230.62	270.71	26.63	130.48	127.70	258.45	44.91	31.32	110.75	129.63	14.54	50.11	92.11	123.73	23.28
Huw (kip)	-1897.83	-2410.55	-2504.00	-1815.42	-2250.37	-2257.67	-2486.39	-1853.15	-672.89	-1082.04	-1016.04	-749.46	-832.19	-989.16	-932.99	-871.09
Muw (k*ft)	711.49	369.68	307.38	766.43	476.46	471.60	319.12	741.28	190.14	167.26	62.96	294.97	207.51	167.71	8.44	366.33
Mu (k*ft)	773.75	600.30	578.09	793.06	606.95	599.30	577.57	786.19	221.46	278.01	192.59	309.50	257.62	259.82	132.17	389.61

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.20	37.09	38.52	27.93	34.62	34.73	38.25	28.51	10.35	16.65	15.63	11.53	12.80	15.22	14.35	13.40
PY1 (Vuw)	1.70	6.31	7.40	0.73	3.57	3.49	7.07	1.23	0.86	3.03	3.55	0.40	1.37	2.52	3.38	0.64
PX2 (Mu)	17.86	13.85	13.34	18.30	14.01	13.83	13.33	18.14	5.11	6.42	4.44	7.14	5.95	6.00	3.05	8.99
PY2 (Mu)	5.95	4.62	4.45	6.10	4.67	4.61	4.44	6.05	1.70	2.14	1.48	2.38	1.98	2.00	1.02	3.00
Pu (kip)	47.67	52.10	53.20	46.73	49.32	49.23	52.85	47.22	15.67	23.63	20.70	18.88	19.05	21.69	17.95	22.69

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.39	48.29	49.05	44.71	46.22	46.13	48.79	45.07
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	481.26
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	620.34	8.62	OK
BF	2008.27	25.10	OK	950.34	11.88	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.20	26.60	OK	23.63	11.82	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.20	1.47	114.56	OK
Web SPL	26.60	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.95	4.35
Web	1.36	1.47	2.15
BF	1.44	1.42	5.41

Plate	Shear	Flexure
Web	2.98	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3471	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.92	-21.63	-19.33	-29.10	-21.22	-24.31	-7.41	-26.84	-12.71	-22.09	-12.63	-23.84	-20.89	-21.96	-8.28	-30.81
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.13	0.32	0.29	0.44	0.32	0.36	0.11	0.40	0.19	0.33	0.19	0.36	0.31	0.33	0.12	0.46
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.63		-29.10		-24.31		-26.84		-22.09		-23.84		-21.96		-30.81
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-8.92		-19.33		-21.22		-7.41		-12.71		-12.63		-20.89		-8.28	
Rcf	1.62		1.62		1.62		1.62		1.62		1.62		1.62		1.62	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.796764	-15.40695	-13.93589	-21.50982	-15.27407	-18.12511	-5.733171	-19.09014	-8.682211	-18.07872	-12.02813	-19.62232	-15.25792	-15.64	-6.13	-22.71
Fs (ksi)	-6.80	-15.41	-13.94	-21.51	-15.27	-18.13	-5.73	-19.09	-8.68	-18.08	-12.03	-19.62	-15.26	-15.64	-6.13	-22.71
Fs (kip)	-543.74	-1232.56	-1114.87	-1720.79	-1221.93	-1450.01	-458.65	-1527.21	-694.58	-1446.30	-962.25	-1569.79	-1220.63	-1251.20	-490.09	-1817.18

Vu (kip)	73.79	273.33	320.84	31.56	154.65	151.35	306.31	53.23	55.68	196.89	230.46	25.84	89.09	163.76	219.96	41.38
Vuw (kip)	110.68	409.99	481.26	47.34	231.97	227.03	459.47	79.84	---	---	---	---	---	---	---	---
Mv (k*ft)	62.26	230.62	270.71	26.63	130.48	127.70	258.45	44.91	31.32	110.75	129.63	14.54	50.11	92.11	123.73	23.28
Huw (kip)	-1917.11	-2424.38	-2516.67	-1843.76	-2101.82	-2097.77	-2500.63	-1885.78	-666.11	-1063.37	-1001.98	-744.70	-802.83	-949.51	-926.94	-865.23
Muw (k*ft)	698.64	360.46	298.94	747.54	575.50	578.20	309.63	719.52	172.20	151.48	57.02	267.14	187.93	151.88	7.64	331.77
Mu (k*ft)	760.89	591.08	569.65	774.16	705.98	705.90	568.08	764.43	203.52	262.23	186.65	281.68	238.04	244.00	131.37	355.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.49	37.30	38.72	28.37	32.34	32.27	38.47	29.01	10.25	16.36	15.42	11.46	12.35	14.61	14.26	13.31
PY1 (Vuw)	1.70	6.31	7.40	0.73	3.57	3.49	7.07	1.23	0.86	3.03	3.55	0.40	1.37	2.52	3.38	0.64
PX2 (Mu)	17.56	13.64	13.15	17.87	16.29	16.29	13.11	17.64	4.70	6.05	4.31	6.50	5.49	5.63	3.03	8.19
PY2 (Mu)	5.85	4.55	4.38	5.96	5.43	5.43	4.37	5.88	1.57	2.02	1.44	2.17	1.83	1.88	1.01	2.73
Pu (kip)	47.66	52.08	53.19	46.71	49.45	49.38	52.83	47.19	15.14	22.97	20.34	18.14	18.13	20.71	17.84	21.77

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.34	48.26	49.02	44.64	46.57	46.51	48.76	44.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.19	26.59	OK	22.97	11.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.19	1.47	114.56	OK
Web SPL	26.59	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 5471

Node 5471

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5471 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
5471 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5471 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.62	-20.00	-19.06	-26.50	-20.60	-23.09	-6.85	-24.92	-16.07	-24.61	-15.88	-25.25	-20.40	-20.02	-7.56	-28.73
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.13	0.30	0.29	0.40	0.31	0.35	0.10	0.37	0.24	0.37	0.24	0.38	0.31	0.30	0.11	0.43
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-20.00		-26.50		-23.09		-24.92		-24.61		-25.25	-20.40			-28.73
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-8.62		-19.06		-20.60		-6.85		-16.07		-15.88			-20.02	-7.56	
Rcf	1.74		1.74		1.74		1.74		1.74		1.74			1.74	1.74	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.31	-14.26	-13.56	-19.73	-14.74	-17.22	-4.95	-17.85	-9.21	-16.71	-10.54	-17.94	-14.87	-14.09	-5.21	-21.56
Fs (ksi)	-6.31	-14.26	-13.56	-19.73	-14.74	-17.22	-4.95	-17.85	-9.21	-16.71	-10.54	-17.94	-14.87	-14.09	-5.21	-21.56
Fs (kip)	-504.79	-1140.61	-1084.84	-1578.07	-1178.91	-1377.94	-395.86	-1427.77	-736.92	-1336.64	-843.36	-1435.06	-1189.60	-1127.36	-417.14	-1724.41

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1189.60	1724.41

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	125.12	332.04	365.72	82.85	198.93	201.57	348.14	103.61	92.92	240.76	264.55	63.05	136.80	176.65	250.48	79.36
Vuw (kip)	187.68	498.06	548.58	124.28	298.39	302.36	522.21	155.41	---	---	---	---	---	---	---	---
Mv (k*ft)	105.57	280.16	308.57	69.91	167.85	170.08	293.74	87.42	52.26	135.43	148.81	35.47	76.95	99.37	140.90	44.64
Huw (kip)	-1932.63	-2478.09	-2558.62	-1840.58	-2322.00	-2312.16	-2528.25	-1877.48	-617.03	-998.59	-958.82	-683.86	-777.59	-854.41	-868.86	-803.08
Muw (k*ft)	688.29	324.65	270.96	749.66	428.71	435.27	291.22	725.06	158.96	123.31	49.76	257.98	149.93	147.92	15.56	326.82
Mu (k*ft)	793.87	604.81	579.54	819.57	596.56	605.35	584.96	812.47	211.22	258.73	198.57	293.44	226.88	247.29	156.46	371.46

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 5471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.73	38.12	39.36	28.32	35.72	35.57	38.90	28.88	9.49	15.36	14.75	10.52	11.96	13.14	13.37	12.36
PY1 (Vuw)	2.89	7.66	8.44	1.91	4.59	4.65	8.03	2.39	1.43	3.70	4.07	0.97	2.10	2.72	3.85	1.22
PX2 (Mu)	18.32	13.96	13.37	18.91	13.77	13.97	13.50	18.75	4.87	5.97	4.58	6.77	5.24	5.71	3.61	8.57
PY2 (Mu)	6.11	4.65	4.46	6.30	4.59	4.66	4.50	6.25	1.62	1.99	1.53	2.26	1.75	1.90	1.20	2.86
Pu (kip)	48.89	53.52	54.29	47.94	50.33	50.41	53.87	48.41	14.69	22.08	20.13	17.59	17.62	19.41	17.71	21.32

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.37	49.34	49.84	45.71	46.96	47.04	49.55	46.05
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	548.58
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	600.55	8.34	OK
BF	2008.27	25.10	OK	865.19	10.81	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.29	27.15	OK	22.08	11.04	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.29	1.47	114.56	OK
Web SPL	27.15	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.02	4.35
Web	1.33	1.55	2.11
BF	1.44	1.56	5.41

Plate	Shear	Flexure
Web	2.62	1.00

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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.88	-19.70	-19.18	-26.26	-20.57	-22.93	-7.28	-24.45	-12.40	-20.52	-12.30	-21.21	-20.21	-19.85	-7.99	-28.12
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.13	0.30	0.29	0.39	0.31	0.34	0.11	0.37	0.19	0.31	0.18	0.32	0.30	0.30	0.12	0.42
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-19.70		-26.26		-22.93		-24.45		-20.52		-21.21	-20.21			-28.12
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-8.88		-19.18		-20.57		-7.28		-12.40		-12.30			-19.85	-7.99	
Rcf	1.78		1.78		1.78		1.78		1.78		1.78			1.78	1.78	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.684756	-13.88273	-13.81572	-19.39945	-14.79633	-17.04957	-5.555612	-17.23758	-9.023584	-15.81283	-10.41568	-17.11413	-14.69186	-13.98724	-5.91	-20.71
Fs (ksi)	-6.68	-13.88	-13.82	-19.40	-14.80	-17.05	-5.56	-17.24	-9.02	-15.81	-10.42	-17.11	-14.69	-13.99	-5.91	-20.71
Fs (kip)	-534.78	-1110.62	-1105.26	-1551.96	-1183.71	-1363.97	-444.45	-1379.01	-721.89	-1265.03	-833.25	-1369.13	-1175.35	-1118.98	-473.07	-1657.01

Vu (kip)	125.12	332.04	365.72	82.85	198.93	201.57	348.14	103.61	92.92	240.76	264.55	63.05	136.80	176.65	250.48	79.36
Vuw (kip)	187.68	498.06	548.58	124.28	298.39	302.36	522.21	155.41	---	---	---	---	---	---	---	---
Mv (k*ft)	105.57	280.16	308.57	69.91	167.85	170.08	293.74	87.42	52.26	135.43	148.81	35.47	76.95	99.37	140.90	44.64
Huw (kip)	-1956.42	-2506.38	-2580.47	-1871.11	-2144.64	-2139.26	-2541.99	-1909.28	-617.02	-996.45	-955.38	-683.80	-745.09	-825.89	-860.37	-798.78
Muw (k*ft)	672.43	305.79	256.40	729.31	546.95	550.54	282.06	703.86	143.96	111.67	45.06	233.64	135.78	133.97	14.09	295.99
Mu (k*ft)	778.00	585.95	564.97	799.22	714.80	720.62	575.80	791.28	196.22	247.10	193.87	269.11	212.73	233.34	154.99	340.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5471**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.10	38.56	39.70	28.79	32.99	32.91	39.11	29.37	9.49	15.33	14.70	10.52	11.46	12.71	13.24	12.29
PY1 (Vuw)	2.89	7.66	8.44	1.91	4.59	4.65	8.03	2.39	1.43	3.70	4.07	0.97	2.10	2.72	3.85	1.22
PX2 (Mu)	17.95	13.52	13.04	18.44	16.50	16.63	13.29	18.26	4.53	5.70	4.47	6.21	4.91	5.38	3.58	7.86
PY2 (Mu)	5.98	4.51	4.35	6.15	5.50	5.54	4.43	6.09	1.51	1.90	1.49	2.07	1.64	1.79	1.19	2.62
Pu (kip)	48.86	53.48	54.27	47.91	50.51	50.58	53.86	48.38	14.33	21.77	19.96	17.00	16.79	18.65	17.55	20.51

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.31	49.27	49.79	45.64	47.39	47.45	49.52	45.98
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.27	27.13	OK	21.77	10.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.27	1.47	114.56	OK
Web SPL	27.13	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7471

Node 7471

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7471 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
7471 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7471 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.91	-22.05	-19.57	-29.77	-21.36	-24.99	-7.35	-27.49	-16.57	-28.10	-15.64	-25.46	-21.09	-22.35	-8.19	-31.59
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.13	0.33	0.29	0.45	0.32	0.37	0.11	0.41	0.25	0.42	0.23	0.38	0.32	0.33	0.12	0.47
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-22.05		-29.77		-24.99		-27.49		-28.10		-25.46		-22.35		-31.59
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-8.91		-19.57		-21.36		-7.35		-16.57		-15.64		-21.09		-8.19	
Rcf	1.58		1.58		1.58		1.58		1.58		1.58		1.58		1.58	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.54	-15.91	-13.94	-22.23	-15.32	-18.74	-5.32	-19.88	-11.92	-21.06	-8.84	-18.84	-15.35	-15.91	-5.67	-23.75
Fs (ksi)	-6.54	-15.91	-13.94	-22.23	-15.32	-18.74	-5.32	-19.88	-11.92	-21.06	-8.84	-18.84	-15.35	-15.91	-5.67	-23.75
Fs (kip)	-523.36	-1272.82	-1115.57	-1778.10	-1225.73	-1498.90	-425.82	-1590.08	-953.46	-1684.50	-707.34	-1506.81	-1228.37	-1272.91	-453.82	-1900.00

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1228.37	1900.00

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	74.16	270.48	316.06	32.47	151.79	152.45	300.82	54.06	55.27	195.27	227.47	25.81	149.94	100.43	215.41	42.37
Vuw (kip)	111.24	405.72	474.09	48.70	227.68	228.68	451.23	81.09	---	---	---	---	---	---	---	---
Mv (k*ft)	62.57	228.22	266.67	27.40	128.07	128.63	253.82	45.61	31.09	109.84	127.95	14.52	84.34	56.49	121.17	23.83
Huw (kip)	-1905.65	-2412.25	-2497.12	-1831.89	-2269.65	-2225.40	-2484.26	-1871.56	-673.57	-1085.13	-1021.73	-755.96	-989.23	-830.31	-937.98	-882.68
Muw (k*ft)	706.28	368.55	311.97	755.45	463.61	493.11	320.54	729.01	187.36	165.63	68.29	291.06	182.76	199.87	11.14	361.54
Mu (k*ft)	768.85	596.76	578.64	782.85	591.69	621.75	574.36	774.62	218.45	275.47	196.25	305.58	267.10	256.36	132.30	385.37

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.32	37.11	38.42	28.18	34.92	34.24	38.22	28.79	10.36	16.69	15.72	11.63	15.22	12.77	14.43	13.58
PY1 (Vuw)	1.71	6.24	7.29	0.75	3.50	3.52	6.94	1.25	0.85	3.00	3.50	0.40	2.31	1.55	3.31	0.65
PX2 (Mu)	17.74	13.77	13.35	18.07	13.65	14.35	13.25	17.88	5.04	6.36	4.53	7.05	6.16	5.92	3.05	8.89
PY2 (Mu)	5.91	4.59	4.45	6.02	4.55	4.78	4.42	5.96	1.68	2.12	1.51	2.35	2.05	1.97	1.02	2.96
Pu (kip)	47.67	52.02	53.09	46.74	49.24	49.29	52.71	47.22	15.61	23.61	20.86	18.88	21.82	19.02	18.01	22.76

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.38	48.23	48.97	44.69	46.11	46.23	48.68	45.04
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	474.09
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	620.12	8.61	OK
BF	2008.27	25.10	OK	953.29	11.92	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.09	26.54	OK	23.61	11.81	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.09	1.47	114.56	OK
Web SPL	26.54	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.95	4.35
Web	1.36	1.48	2.16
BF	1.44	1.41	5.41

Plate	Shear	Flexure
Web	3.03	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7471	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.93	-21.42	-19.14	-28.83	-20.90	-24.35	-7.46	-26.61	-12.63	-23.59	-12.57	-21.91	-20.55	-21.75	-8.32	-30.57
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.13	0.32	0.29	0.43	0.31	0.37	0.11	0.40	0.19	0.35	0.19	0.33	0.31	0.33	0.12	0.46
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.42		-28.83		-24.35		-26.61		-23.59		-21.91		-21.75		-30.57
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-8.93		-19.14		-20.90		-7.46		-12.63		-12.57		-20.55		-8.32	
Rcf	1.64		1.64		1.64		1.64		1.64		1.64		1.64		1.64	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.766463	-15.2509	-13.82166	-21.32201	-15.06532	-18.15782	-5.731813	-18.9121	-11.44633	-19.72219	-9.135116	-18.18563	-14.98082	-15.48515	-6.18	-22.55
Fs (ksi)	-6.77	-15.25	-13.82	-21.32	-15.07	-18.16	-5.73	-18.91	-11.45	-19.72	-9.14	-18.19	-14.98	-15.49	-6.18	-22.55
Fs (kip)	-541.32	-1220.07	-1105.73	-1705.76	-1205.23	-1452.63	-458.55	-1512.97	-915.71	-1577.78	-730.81	-1454.85	-1198.47	-1238.81	-494.21	-1803.95

Vu (kip)	74.16	270.48	316.06	32.47	151.79	152.45	300.82	54.06	55.27	195.27	227.47	25.81	149.94	100.43	215.41	42.37
Vuw (kip)	111.24	405.72	474.09	48.70	227.68	228.68	451.23	81.09	---	---	---	---	---	---	---	---
Mv (k*ft)	62.57	228.22	266.67	27.40	128.07	128.63	253.82	45.61	31.09	109.84	127.95	14.52	84.34	56.49	121.17	23.83
Huw (kip)	-1920.95	-2422.39	-2508.83	-1849.04	-2102.89	-2099.88	-2491.85	-1891.13	-660.52	-1054.31	-996.69	-739.32	-935.06	-819.62	-913.98	-861.81
Muw (k*ft)	696.08	361.78	304.16	744.02	574.78	576.79	315.48	715.96	169.69	150.01	61.85	263.61	165.52	181.01	10.09	327.44
Mu (k*ft)	758.65	590.00	570.84	771.41	702.86	705.43	569.29	761.57	200.78	259.85	189.80	278.13	249.86	237.50	131.25	351.27

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7471**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.55	37.27	38.60	28.45	32.35	32.31	38.34	29.09	10.16	16.22	15.33	11.37	14.39	12.61	14.06	13.26
PY1 (Vuw)	1.71	6.24	7.29	0.75	3.50	3.52	6.94	1.25	0.85	3.00	3.50	0.40	2.31	1.55	3.31	0.65
PX2 (Mu)	17.51	13.62	13.17	17.80	16.22	16.28	13.14	17.57	4.63	6.00	4.38	6.42	5.77	5.48	3.03	8.11
PY2 (Mu)	5.84	4.54	4.39	5.93	5.41	5.43	4.38	5.86	1.54	2.00	1.46	2.14	1.92	1.83	1.01	2.70
Pu (kip)	47.66	52.01	53.07	46.73	49.38	49.40	52.70	47.21	14.99	22.77	20.33	17.97	20.59	18.40	17.63	21.63

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.34	48.20	48.94	44.65	46.51	46.53	48.66	45.00
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.07	26.54	OK	22.77	11.39	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.07	1.47	114.56	OK
Web SPL	26.54	1.47	80.19	OK

Field Splice - Node 9471

Node 9471

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9471 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
9471 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9471 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.96	-17.80	-16.05	-25.22	-18.68	-19.47	-5.09	-23.31	-13.78	-22.70	-13.81	-21.46	-18.32	-16.59	-5.91	-27.44
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.10	0.27	0.24	0.38	0.28	0.29	0.08	0.35	0.21	0.34	0.21	0.32	0.27	0.25	0.09	0.41
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-17.80		-25.22		-19.47		-23.31		-22.70		-21.46	-18.32			-27.44
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-6.96		-16.05		-18.68		-5.09		-13.78		-13.81			-16.59	-5.91	
Rcf	1.82		1.82		1.82		1.82		1.82		1.82			1.82	1.82	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.33	-13.16	-11.45	-18.69	-13.45	-14.48	-3.89	-17.18	-10.48	-17.12	-8.34	-15.78	-13.59	-12.09	-3.94	-20.35
Fs (ksi)	-5.33	-13.16	-11.45	-18.69	-13.45	-14.48	-3.89	-17.18	-10.48	-17.12	-8.34	-15.78	-13.59	-12.09	-3.94	-20.35
Fs (kip)	-426.79	-1052.79	-915.93	-1495.05	-1076.34	-1158.25	-311.02	-1374.35	-838.31	-1369.34	-667.15	-1262.47	-1086.81	-967.11	-315.44	-1627.95

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1086.81	1627.95

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	65.07	253.26	316.27	23.78	156.01	145.13	286.81	53.98	49.92	184.40	228.92	20.75	166.77	102.63	206.58	43.61
Vuw (kip)	97.60	379.89	474.40	35.67	234.01	217.70	430.21	80.97	---	---	---	---	---	---	---	---
Mv (k*ft)	54.90	213.69	266.85	20.06	131.63	122.45	241.99	45.54	28.08	103.73	128.77	11.67	93.81	57.73	116.20	24.53
Huw (kip)	-1862.95	-2360.38	-2504.26	-1760.90	-2236.46	-2238.10	-2390.13	-1805.71	-554.84	-904.12	-837.97	-632.01	-827.87	-723.61	-770.22	-728.77
Muw (k*ft)	734.74	403.13	307.21	802.78	485.74	484.64	383.29	772.91	156.50	144.78	20.48	265.83	132.76	148.83	29.93	328.13
Mu (k*ft)	789.64	616.82	574.06	822.84	617.37	607.10	625.29	818.45	184.58	248.51	149.25	277.50	226.56	206.56	146.13	352.65

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.66	36.31	38.53	27.09	34.41	34.43	36.77	27.78	8.54	13.91	12.89	9.72	12.74	11.13	11.85	11.21
PY1 (Vuw)	1.50	5.84	7.30	0.55	3.60	3.35	6.62	1.25	0.77	2.84	3.52	0.32	2.57	1.58	3.18	0.67
PX2 (Mu)	18.22	14.23	13.25	18.99	14.25	14.01	14.43	18.89	4.26	5.73	3.44	6.40	5.23	4.77	3.37	8.14
PY2 (Mu)	6.07	4.74	4.42	6.33	4.75	4.67	4.81	6.30	1.42	1.91	1.15	2.13	1.74	1.59	1.12	2.71
Pu (kip)	47.49	51.65	53.08	46.59	49.37	49.10	52.46	47.27	12.98	20.21	16.99	16.31	18.47	16.21	15.82	19.64

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.29	47.99	48.95	44.68	46.28	46.05	48.62	45.20
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	474.40
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9471**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	548.66	7.62	OK
BF	2008.27	25.10	OK	816.79	10.21	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.08	26.54	OK	20.21	10.11	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.08	1.47	114.56	OK
Web SPL	26.54	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.21	4.35
Web	1.36	1.71	2.16
BF	1.44	1.65	5.41

Plate	Shear	Flexure
Web	3.02	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9471	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.53	-16.84	-16.04	-24.76	-18.66	-19.41	-4.96	-22.27	-10.58	-19.05	-10.01	-17.28	-17.90	-16.25	-6.01	-26.48
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.10	0.25	0.24	0.37	0.28	0.29	0.07	0.33	0.16	0.29	0.15	0.26	0.27	0.24	0.09	0.40
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-16.84		-24.76		-19.41		-22.27		-19.05		-17.28	-17.90			-26.48
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-6.53		-16.04		-18.66		-4.96		-10.58		-10.01			-16.25	-6.01	
Rcf	1.89		1.89		1.89		1.89		1.89		1.89			1.89	1.89	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.093428	-12.1802	-11.56391	-18.12008	-13.41311	-14.34046	-3.980059	-16.01783	-10.26843	-16.28018	-7.753034	-14.4925	-13.12176	-11.76658	-4.48	-19.33
Fs (ksi)	-5.09	-12.18	-11.56	-18.12	-13.41	-14.34	-3.98	-16.02	-10.27	-16.28	-7.75	-14.49	-13.12	-11.77	-4.48	-19.33
Fs (kip)	-407.47	-974.42	-925.11	-1449.61	-1073.05	-1147.24	-318.40	-1281.43	-821.47	-1302.41	-620.24	-1159.40	-1049.74	-941.33	-358.08	-1546.76

Vu (kip)	65.07	253.26	316.27	23.78	156.01	145.13	286.81	53.98	49.92	184.40	228.92	20.75	166.77	102.63	206.58	43.61
Vuw (kip)	97.60	379.89	474.40	35.67	234.01	217.70	430.21	80.97	---	---	---	---	---	---	---	---
Mv (k*ft)	54.90	213.69	266.85	20.06	131.63	122.45	241.99	45.54	28.08	103.73	128.77	11.67	93.81	57.73	116.20	24.53
Huw (kip)	-1852.83	-2391.98	-2540.34	-1763.50	-2082.06	-2049.79	-2403.84	-1823.33	-518.21	-890.52	-832.61	-599.94	-796.46	-667.37	-746.65	-714.31
Muw (k*ft)	741.49	382.06	283.15	801.04	588.67	610.19	374.15	761.16	141.74	131.12	18.55	240.76	120.24	134.79	27.10	297.17
Mu (k*ft)	796.39	595.75	550.00	821.11	720.30	732.64	616.15	806.70	169.81	234.85	147.31	252.43	214.04	192.52	143.31	321.70

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9471**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.51	36.80	39.08	27.13	32.03	31.54	36.98	28.05	7.97	13.70	12.81	9.23	12.25	10.27	11.49	10.99
PY1 (Vuw)	1.50	5.84	7.30	0.55	3.60	3.35	6.62	1.25	0.77	2.84	3.52	0.32	2.57	1.58	3.18	0.67
PX2 (Mu)	18.38	13.75	12.69	18.95	16.62	16.91	14.22	18.62	3.92	5.42	3.40	5.83	4.94	4.44	3.31	7.42
PY2 (Mu)	6.13	4.58	4.23	6.32	5.54	5.64	4.74	6.21	1.31	1.81	1.13	1.94	1.65	1.48	1.10	2.47
Pu (kip)	47.50	51.61	53.04	46.59	49.51	49.27	52.45	47.26	12.07	19.68	16.86	15.22	17.70	15.02	15.40	18.68

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.32	47.92	48.87	44.68	46.65	46.50	48.58	45.16
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.04	26.52	OK	19.68	9.84	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.04	1.47	114.56	OK
Web SPL	26.52	1.47	80.19	OK

Field Splice - Node 1487

Node 1487

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1487 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
1487 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1487 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.09	-25.99	-4.49	-19.43	-16.46	-21.03	-3.04	-24.31	-9.17	-21.57	-12.09	-22.89	-4.08	-28.73	-15.81	-18.62
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.21	0.39	0.07	0.29	0.25	0.32	0.05	0.36	0.14	0.32	0.18	0.34	0.06	0.43	0.24	0.28
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.99		-19.43		-21.03		-24.31		-21.57		-22.89		-28.73		-18.62
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-14.09		-4.49		-16.46		-3.04		-9.17		-12.09		-4.08		-15.81	
Rcf	1.74		1.74		1.74		1.74		1.74		1.74		1.74		1.74	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.47	-19.00	-2.87	-14.59	-12.27	-15.37	-1.73	-18.15	-8.45	-16.64	-6.30	-17.18	-2.41	-21.32	-11.85	-13.63
Fs (ksi)	-10.47	-19.00	-2.87	-14.59	-12.27	-15.37	-1.73	-18.15	-8.45	-16.64	-6.30	-17.18	-2.41	-21.32	-11.85	-13.63
Fs (kip)	-837.25	-1520.09	-229.67	-1166.84	-981.58	-1229.27	-138.64	-1451.81	-675.70	-1330.96	-503.76	-1374.21	-193.06	-1706.00	-947.60	-1090.55

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	981.58	1706.00

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	193.46	0.40	247.64	33.95	95.82	89.11	7.54	214.90	140.61	2.28	178.89	21.99	140.44	38.59	3.33	155.76
Vuw (kip)	290.19	0.60	371.46	50.92	143.73	133.66	11.31	322.35	---	---	---	---	---	---	---	---
Mv (k*ft)	163.23	0.34	208.95	28.64	80.85	75.18	6.36	181.32	79.09	1.28	100.62	12.37	79.00	21.71	1.87	87.61
Huw (kip)	-2218.53	-1717.20	-2342.47	-1641.25	-1961.76	-2114.13	-1695.91	-2308.78	-884.00	-523.69	-829.07	-596.42	-752.50	-704.24	-712.15	-764.31
Muw (k*ft)	497.69	831.91	415.07	882.55	668.87	567.30	846.10	437.53	170.71	234.29	61.92	328.29	163.82	217.61	378.23	35.74
Mu (k*ft)	660.92	832.25	624.02	911.19	749.72	642.48	852.46	618.85	249.80	235.58	162.55	340.66	242.82	239.32	380.10	123.35

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.13	26.42	36.04	25.25	30.18	32.53	26.09	35.52	13.60	8.06	12.75	9.18	11.58	10.83	10.96	11.76
PY1 (Vuw)	4.46	0.01	5.71	0.78	2.21	2.06	0.17	4.96	2.16	0.04	2.75	0.34	2.16	0.59	0.05	2.40
PX2 (Mu)	15.25	19.21	14.40	21.03	17.30	14.83	19.67	14.28	5.76	5.44	3.75	7.86	5.60	5.52	8.77	2.85
PY2 (Mu)	5.08	6.40	4.80	7.01	5.77	4.94	6.56	4.76	1.92	1.81	1.25	2.62	1.87	1.84	2.92	0.95
Pu (kip)	50.30	46.07	51.52	46.93	48.15	47.87	46.26	50.74	19.79	13.62	16.98	17.29	17.65	16.54	19.95	14.98

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.10	44.30	47.92	45.18	45.69	45.19	44.50	47.32
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	371.46
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	495.54	6.88	OK
BF	2008.27	25.10	OK	855.95	10.70	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.52	25.76	OK	19.95	9.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.52	1.47	114.56	OK
Web SPL	25.76	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.45	4.35
Web	1.41	1.83	2.22
BF	1.44	1.57	5.41

Plate	Shear	Flexure
Web	3.86	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.12	-24.43	-2.84	-17.04	-15.26	-19.60	-1.64	-21.87	-7.33	-19.11	-7.03	-17.30	-2.71	-26.14	-14.14	-16.80
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.20	0.37	0.04	0.26	0.23	0.29	0.02	0.33	0.11	0.29	0.11	0.26	0.04	0.39	0.21	0.25
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-24.43		-17.04		-19.60		-21.87		-19.11		-17.30		-26.14		-16.80
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-13.12		-2.84		-15.26		-1.64		-7.33		-7.03		-2.71		-14.14	
Rcf	1.91		1.91		1.91		1.91		1.91		1.91		1.91		1.91	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.754552	-17.48485	-2.038904	-12.64845	-11.26519	-14.06924	-1.195351	-16.06149	-8.488823	-15.90695	-4.633919	-14.48808	-1.950109	-19.07766	-10.48	-12.09
Fs (ksi)	-9.75	-17.48	-2.04	-12.65	-11.27	-14.07	-1.20	-16.06	-8.49	-15.91	-4.63	-14.49	-1.95	-19.08	-10.48	-12.09
Fs (kip)	-780.36	-1398.79	-163.11	-1011.88	-901.22	-1125.54	-95.63	-1284.92	-679.11	-1272.56	-370.71	-1159.05	-156.01	-1526.21	-838.14	-967.60

Vu (kip)	193.46	0.40	247.64	33.95	95.82	89.11	7.54	214.90	140.61	2.28	178.89	21.99	140.44	38.59	3.33	155.76
Vuw (kip)	290.19	0.60	371.46	50.92	143.73	133.66	11.31	322.35	---	---	---	---	---	---	---	---
Mv (k*ft)	163.23	0.34	208.95	28.64	80.85	75.18	6.36	181.32	79.09	1.28	100.62	12.37	79.00	21.71	1.87	87.61
Huw (kip)	-2235.85	-1645.54	-2358.64	-1576.97	-1903.48	-1886.54	-1638.32	-2294.55	-817.18	-440.62	-760.03	-517.71	-731.87	-573.66	-630.83	-677.15
Muw (k*ft)	486.15	879.69	404.29	925.40	707.72	719.02	884.50	447.02	154.61	212.19	56.08	297.32	148.36	197.08	342.55	32.37
Mu (k*ft)	649.38	880.03	613.24	954.04	788.57	794.21	890.86	628.34	233.70	213.48	156.71	309.69	227.36	218.79	344.42	119.98

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.40	25.32	36.29	24.26	29.28	29.02	25.20	35.30	12.57	6.78	11.69	7.96	11.26	8.83	9.71	10.42
PY1 (Vuw)	4.46	0.01	5.71	0.78	2.21	2.06	0.17	4.96	2.16	0.04	2.75	0.34	2.16	0.59	0.05	2.40
PX2 (Mu)	14.99	20.31	14.15	22.02	18.20	18.33	20.56	14.50	5.39	4.93	3.62	7.15	5.25	5.05	7.95	2.77
PY2 (Mu)	5.00	6.77	4.72	7.34	6.07	6.11	6.85	4.83	1.80	1.64	1.21	2.38	1.75	1.68	2.65	0.92
Pu (kip)	50.28	46.13	51.51	46.98	48.20	48.05	46.30	50.75	18.40	11.82	15.81	15.35	16.96	14.06	17.86	13.60

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.06	44.47	47.88	45.33	45.83	45.73	44.64	47.36
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.51	25.75	OK	18.40	9.20	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.51	1.47	114.56	OK
Web SPL	25.75	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3487

Node 3487

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3487 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
3487 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3487 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.42	-32.02	-6.82	-24.27	-18.41	-27.40	-5.15	-29.86	-13.39	-29.69	-14.36	-28.53	-5.89	-33.90	-17.72	-24.83
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.25	0.48	0.10	0.36	0.28	0.41	0.08	0.45	0.20	0.45	0.22	0.43	0.09	0.51	0.27	0.37
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-32.02		-24.27		-27.40		-29.86		-29.69		-28.53		-33.90		-24.83
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.52		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4041.27		-4002.70
fncf (ksi)	-16.42		-6.82		-18.41		-5.15		-13.39		-14.36		-5.89		-17.72	
Rcf	1.48		1.48		1.48		1.48		1.48		1.48		1.49		1.48	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.42	-23.96	-5.08	-17.61	-13.42	-19.67	-3.30	-22.59	-10.32	-21.94	-7.37	-21.42	-3.76	-25.51	-12.96	-17.82
Fs (ksi)	-11.42	-23.96	-5.08	-17.61	-13.42	-19.67	-3.30	-22.59	-10.32	-21.94	-7.37	-21.42	-3.76	-25.51	-12.96	-17.82
Fs (kip)	-913.51	-1917.11	-406.76	-1408.98	-1073.98	-1573.93	-263.96	-1807.52	-825.39	-1755.31	-589.46	-1713.80	-301.07	-2040.45	-1037.17	-1425.87

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4041.27	1073.98	2040.45

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	209.79	15.34	250.35	20.62	96.25	100.47	1.17	230.19	149.43	13.44	179.48	13.36	124.33	48.60	0.39	165.24
Vuw (kip)	314.68	23.01	375.52	30.93	144.37	150.70	1.75	345.28	---	---	---	---	---	---	---	---
Mv (k*ft)	177.01	12.95	211.23	17.40	81.21	84.77	0.98	194.22	84.05	7.56	100.96	7.52	69.93	27.34	0.22	92.95
Huw (kip)	-2209.43	-1784.45	-2297.89	-1710.54	-2075.59	-2118.24	-1760.02	-2266.99	-1061.48	-680.90	-992.97	-776.81	-967.76	-863.72	-878.07	-923.64
Muw (k*ft)	503.76	787.08	444.79	836.36	592.99	564.55	822.41	465.39	250.90	250.56	124.99	385.89	232.48	281.08	434.84	97.18
Mu (k*ft)	680.77	800.03	656.02	853.76	674.20	649.32	823.39	659.61	334.96	258.12	225.94	393.40	302.41	308.42	435.06	190.12

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.99	27.45	35.35	26.32	31.93	32.59	27.08	34.88	16.33	10.48	15.28	11.95	14.89	13.29	13.51	14.21
PY1 (Vuw)	4.84	0.35	5.78	0.48	2.22	2.32	0.03	5.31	2.30	0.21	2.76	0.21	1.91	0.75	0.01	2.54
PX2 (Mu)	15.71	18.46	15.14	19.70	15.56	14.98	19.00	15.22	7.73	5.96	5.21	9.08	6.98	7.12	10.04	4.39
PY2 (Mu)	5.24	6.15	5.05	6.57	5.19	4.99	6.33	5.07	2.58	1.99	1.74	3.03	2.33	2.37	3.35	1.46
Pu (kip)	50.71	46.37	51.64	46.55	48.06	48.13	46.52	51.16	24.55	16.58	20.98	21.28	22.27	20.64	23.79	19.02

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2027.63	2283.75	OK
BF Outside	2013.64	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.46	44.45	48.08	44.74	45.43	45.41	44.68	47.74
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	375.52
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	542.18	7.53	OK
BF	2027.63	25.35	OK	1023.76	12.80	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2027.63	25.35	1.47	149.81	OK
BF	4041.27	50.52	1.47	299.63	OK
BF Outside	2013.64	25.17	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.64	25.82	OK	24.55	12.27	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.64	1.47	114.56	OK
Web SPL	25.82	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.13
BF Outside	NA	1.13

Bolt	Shear	Slip	Bearing
TF	1.29	2.23	4.35
Web	1.40	1.41	2.22
BF	1.43	1.32	5.36

Plate	Shear	Flexure
Web	3.82	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.72	-31.55	-6.56	-23.15	-18.44	-26.99	-5.21	-28.69	-10.37	-25.86	-10.53	-24.00	-6.04	-32.67	-17.64	-24.40
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.25	0.47	0.10	0.35	0.28	0.40	0.08	0.43	0.16	0.39	0.16	0.36	0.09	0.49	0.26	0.37
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-31.55		-23.15		-26.99		-28.69		-25.86		-24.00		-32.67		-24.40
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-16.72		-6.56		-18.44		-5.21		-10.37		-10.53		-6.04		-17.64	
Rcf	1.53		1.53		1.53		1.53		1.53		1.53		1.53		1.53	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.96966	-23.3312	-5.120163	-16.46608	-13.51797	-19.1778	-3.838216	-21.31246	-10.48608	-21.01346	-7.04359	-19.77187	-4.429184	-24.12026	-12.95	-17.35
Fs (ksi)	-11.97	-23.33	-5.12	-16.47	-13.52	-19.18	-3.84	-21.31	-10.49	-21.01	-7.04	-19.77	-4.43	-24.12	-12.95	-17.35
Fs (kip)	-957.57	-1866.50	-409.61	-1317.29	-1081.44	-1534.22	-307.06	-1705.00	-838.89	-1681.08	-563.49	-1581.75	-354.33	-1929.62	-1036.14	-1388.18

Vu (kip)	209.79	15.34	250.35	20.62	96.25	100.47	1.17	230.19	149.43	13.44	179.48	13.36	124.33	48.60	0.39	165.24
Vuw (kip)	314.68	23.01	375.52	30.93	144.37	150.70	1.75	345.28	---	---	---	---	---	---	---	---
Mv (k*ft)	177.01	12.95	211.23	17.40	81.21	84.77	0.98	194.22	84.05	7.56	100.96	7.52	69.93	27.34	0.22	92.95
Huw (kip)	-2250.61	-1783.82	-2329.98	-1721.78	-1959.12	-1966.37	-1760.21	-2293.16	-1059.03	-647.59	-980.87	-754.52	-944.99	-804.46	-856.48	-909.12
Muw (k*ft)	476.30	787.50	423.39	828.86	670.63	665.80	803.24	447.94	227.23	226.92	113.20	349.48	210.55	254.57	393.82	88.01
Mu (k*ft)	653.32	800.44	634.62	846.26	751.84	750.57	804.22	642.16	311.29	234.48	214.15	357.00	280.48	281.90	394.04	180.95

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.62	27.44	35.85	26.49	30.14	30.25	27.08	35.28	16.29	9.96	15.09	11.61	14.54	12.38	13.18	13.99
PY1 (Vuw)	4.84	0.35	5.78	0.48	2.22	2.32	0.03	5.31	2.30	0.21	2.76	0.21	1.91	0.75	0.01	2.54
PX2 (Mu)	15.08	18.47	14.65	19.53	17.35	17.32	18.56	14.82	7.18	5.41	4.94	8.24	6.47	6.51	9.09	4.18
PY2 (Mu)	5.03	6.16	4.88	6.51	5.78	5.77	6.19	4.94	2.39	1.80	1.65	2.75	2.16	2.17	3.03	1.39
Pu (kip)	50.67	46.37	51.60	46.55	48.16	48.26	46.06	51.14	23.94	15.50	20.51	20.06	21.40	19.11	22.48	18.58

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.36	44.45	48.01	44.71	45.71	45.78	44.22	47.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.60	25.80	OK	23.94	11.97	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.60	1.47	114.56	OK
Web SPL	25.80	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5487

Node 5487

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5487 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
5487 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5487 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.34	-30.03	-6.55	-21.96	-18.31	-25.42	-4.96	-27.34	-13.32	-27.12	-14.30	-27.01	-5.69	-31.17	-17.54	-22.80
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.24	0.45	0.10	0.33	0.27	0.38	0.07	0.41	0.20	0.41	0.21	0.40	0.09	0.47	0.26	0.34
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-30.03		-21.96		-25.42		-27.34		-27.12		-27.01		-31.17		-22.80
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-16.34		-6.55		-18.31		-4.96		-13.32		-14.30		-5.69		-17.54	
Rcf	1.61		1.61		1.61		1.61		1.61		1.61		1.61		1.61	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.43	-22.42	-4.81	-15.76	-13.27	-18.06	-3.24	-20.67	-8.89	-18.74	-8.13	-20.59	-3.70	-23.43	-12.75	-16.17
Fs (ksi)	-11.43	-22.42	-4.81	-15.76	-13.27	-18.06	-3.24	-20.67	-8.89	-18.74	-8.13	-20.59	-3.70	-23.43	-12.75	-16.17
Fs (kip)	-914.31	-1793.20	-385.04	-1260.74	-1061.56	-1444.76	-258.85	-1653.56	-710.80	-1499.00	-650.75	-1647.06	-295.89	-1874.18	-1020.26	-1293.72

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1061.56	1874.18

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	265.71	72.61	303.31	36.46	151.26	151.40	57.62	278.89	191.45	55.36	218.35	29.48	140.43	109.86	44.44	201.10
Vuw (kip)	398.57	108.92	454.96	54.69	226.89	227.10	86.43	418.34	---	---	---	---	---	---	---	---
Mv (k*ft)	224.19	61.27	255.92	30.76	127.63	127.75	48.62	235.31	107.69	31.14	122.82	16.58	78.99	61.80	24.99	113.12
Huw (kip)	-2269.45	-1797.92	-2364.40	-1721.37	-2124.16	-2171.34	-1756.63	-2327.01	-1015.32	-617.17	-939.87	-717.15	-828.68	-861.68	-813.78	-867.74
Muw (k*ft)	463.75	778.10	400.44	829.13	560.61	529.16	805.63	425.37	219.72	218.92	95.80	348.68	197.05	249.08	394.57	68.37
Mu (k*ft)	687.94	839.37	656.36	859.89	688.23	656.90	854.25	660.68	327.41	250.07	218.62	365.26	276.04	310.87	419.57	181.49

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.91	27.66	36.38	26.48	32.68	33.41	27.03	35.80	15.62	9.49	14.46	11.03	12.75	13.26	12.52	13.35
PY1 (Vuw)	6.13	1.68	7.00	0.84	3.49	3.49	1.33	6.44	2.95	0.85	3.36	0.45	2.16	1.69	0.68	3.09
PX2 (Mu)	15.88	19.37	15.15	19.84	15.88	15.16	19.71	15.25	7.56	5.77	5.05	8.43	6.37	7.17	9.68	4.19
PY2 (Mu)	5.29	6.46	5.05	6.61	5.29	5.05	6.57	5.08	2.52	1.92	1.68	2.81	2.12	2.39	3.23	1.40
Pu (kip)	52.06	47.73	52.91	46.92	49.35	49.31	47.40	52.33	23.81	15.52	20.15	19.73	19.59	20.83	22.54	18.10

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.47	45.60	49.02	45.04	46.45	46.34	45.39	48.60
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	454.96
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	535.91	7.44	OK
BF	2008.27	25.10	OK	940.33	11.75	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.91	26.46	OK	23.81	11.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.91	1.47	114.56	OK
Web SPL	26.46	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.26	4.35
Web	1.37	1.46	2.17
BF	1.44	1.43	5.41

Plate	Shear	Flexure
Web	3.15	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.21	-29.22	-6.65	-21.30	-17.99	-24.75	-5.21	-26.48	-10.14	-23.25	-10.36	-22.44	-5.96	-30.17	-17.18	-22.18
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.24	0.44	0.10	0.32	0.27	0.37	0.08	0.40	0.15	0.35	0.16	0.34	0.09	0.45	0.26	0.33
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-29.22		-21.30		-24.75		-26.48		-23.25		-22.44		-30.17		-22.18
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-16.21		-6.65		-17.99		-5.21		-10.14		-10.36		-5.96		-17.18	
Rcf	1.66		1.66		1.66		1.66		1.66		1.66		1.66		1.66	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.60878	-21.55846	-5.104264	-15.01784	-13.11244	-17.45056	-3.837125	-19.62636	-9.059935	-17.98293	-7.800285	-19.0793	-4.366201	-22.23357	-12.54	-15.64
Fs (ksi)	-11.61	-21.56	-5.10	-15.02	-13.11	-17.45	-3.84	-19.63	-9.06	-17.98	-7.80	-19.08	-4.37	-22.23	-12.54	-15.64
Fs (kip)	-928.70	-1724.68	-408.34	-1201.43	-1049.00	-1396.04	-306.97	-1570.11	-724.79	-1438.63	-624.02	-1526.34	-349.30	-1778.69	-1003.42	-1251.08

Vu (kip)	265.71	72.61	303.31	36.46	151.26	151.40	57.62	278.89	191.45	55.36	218.35	29.48	140.43	109.86	44.44	201.10
Vuw (kip)	398.57	108.92	454.96	54.69	226.89	227.10	86.43	418.34	---	---	---	---	---	---	---	---
Mv (k*ft)	224.19	61.27	255.92	30.76	127.63	127.75	48.62	235.31	107.69	31.14	122.82	16.58	78.99	61.80	24.99	113.12
Huw (kip)	-2288.77	-1813.56	-2377.43	-1741.56	-1987.22	-1997.82	-1778.81	-2337.31	-995.02	-603.66	-916.89	-703.90	-811.29	-806.39	-797.99	-845.44
Muw (k*ft)	450.87	767.67	391.76	815.67	651.90	644.83	790.84	418.51	198.99	198.27	86.76	315.78	178.46	225.58	357.35	61.92
Mu (k*ft)	675.06	828.94	647.68	846.43	779.53	772.58	839.46	653.82	306.69	229.41	209.59	332.37	257.45	287.38	382.34	175.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	35.21	27.90	36.58	26.79	30.57	30.74	27.37	35.96	15.31	9.29	14.11	10.83	12.48	12.41	12.28	13.01
PY1 (Vuw)	6.13	1.68	7.00	0.84	3.49	3.49	1.33	6.44	2.95	0.85	3.36	0.45	2.16	1.69	0.68	3.09
PX2 (Mu)	15.58	19.13	14.95	19.53	17.99	17.83	19.37	15.09	7.08	5.29	4.84	7.67	5.94	6.63	8.82	4.04
PY2 (Mu)	5.19	6.38	4.98	6.51	6.00	5.94	6.46	5.03	2.36	1.76	1.61	2.56	1.98	2.21	2.94	1.35
Pu (kip)	52.04	47.71	52.90	46.91	49.48	49.47	47.38	52.32	23.01	14.81	19.58	18.74	18.88	19.43	21.41	17.61

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.42	45.56	48.99	44.99	46.78	46.75	45.34	48.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.90	26.45	OK	23.01	11.50	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.90	1.47	114.56	OK
Web SPL	26.45	1.47	80.19	OK

Field Splice - Node 7487

Node 7487

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7487 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
7487 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7487 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.00	-32.56	-6.54	-23.73	-18.63	-27.84	-5.20	-29.47	-13.77	-27.92	-14.32	-30.23	-6.05	-33.63	-17.64	-25.07
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.25	0.49	0.10	0.36	0.28	0.42	0.08	0.44	0.21	0.42	0.21	0.45	0.09	0.50	0.26	0.38
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-32.56		-23.73		-27.84		-29.47		-27.92		-30.23		-33.63		-25.07
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.38		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4030.46		-4002.70
fncf (ksi)	-17.00		-6.54		-18.63		-5.20		-13.77		-14.32		-6.05		-17.64	
Rcf	1.49		1.49		1.49		1.49		1.49		1.49		1.50		1.49	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.92	-24.33	-4.78	-17.23	-13.46	-20.00	-3.43	-22.30	-7.48	-19.84	-10.31	-23.42	-3.97	-25.30	-12.79	-18.01
Fs (ksi)	-11.92	-24.33	-4.78	-17.23	-13.46	-20.00	-3.43	-22.30	-7.48	-19.84	-10.31	-23.42	-3.97	-25.30	-12.79	-18.01
Fs (kip)	-953.40	-1946.64	-382.01	-1378.79	-1076.64	-1599.84	-274.22	-1784.35	-598.16	-1587.01	-824.59	-1873.79	-317.95	-2023.90	-1023.17	-1440.66

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4030.46	1076.64	2023.90

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	211.84	22.09	250.47	13.13	103.40	101.29	5.98	229.01	151.31	17.86	179.21	7.65	61.00	116.32	5.86	164.05
Vuw (kip)	317.76	33.14	375.70	19.70	155.10	151.93	8.97	343.51	---	---	---	---	---	---	---	---
Mv (k*ft)	178.74	18.64	211.33	11.08	87.24	85.46	5.05	193.22	85.11	10.04	100.81	4.30	34.31	65.43	3.30	92.28
Huw (kip)	-2241.28	-1774.30	-2314.00	-1714.59	-2097.18	-2121.85	-1764.93	-2269.80	-1087.52	-660.30	-1003.68	-771.96	-819.44	-1011.90	-878.19	-923.93
Muw (k*ft)	482.53	793.85	434.05	833.65	578.59	562.15	813.80	463.51	248.31	249.20	130.80	377.53	247.21	262.30	426.49	104.37
Mu (k*ft)	661.27	812.49	645.38	844.73	665.83	647.61	818.85	656.74	333.42	259.24	231.60	381.83	281.52	327.73	429.78	196.65

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.48	27.30	35.60	26.38	32.26	32.64	27.15	34.92	16.73	10.16	15.44	11.88	12.61	15.57	13.51	14.21
PY1 (Vuw)	4.89	0.51	5.78	0.30	2.39	2.34	0.14	5.28	2.33	0.27	2.76	0.12	0.94	1.79	0.09	2.52
PX2 (Mu)	15.26	18.75	14.89	19.49	15.37	14.94	18.90	15.16	7.69	5.98	5.34	8.81	6.50	7.56	9.92	4.54
PY2 (Mu)	5.09	6.25	4.96	6.50	5.12	4.98	6.30	5.05	2.56	1.99	1.78	2.94	2.17	2.52	3.31	1.51
Pu (kip)	50.73	46.54	51.62	46.37	48.22	48.15	46.50	51.13	24.91	16.30	21.28	20.91	19.35	23.53	23.67	19.18

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2022.20	2283.75	OK
BF Outside	2008.26	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.42	44.61	48.05	44.57	45.53	45.42	44.64	47.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	375.70
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	543.53	7.55	OK
BF	2022.20	25.28	OK	1015.45	12.69	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2022.20	25.28	1.47	149.81	OK
BF	4030.46	50.38	1.47	299.63	OK
BF Outside	2008.26	25.10	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.62	25.81	OK	24.91	12.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.62	1.47	114.56	OK
Web SPL	25.81	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.13
BF Outside	NA	1.13

Bolt	Shear	Slip	Bearing
TF	1.29	2.23	4.35
Web	1.40	1.41	2.22
BF	1.43	1.33	5.37

Plate	Shear	Flexure
Web	3.82	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.77	-31.56	-6.87	-23.21	-18.36	-27.12	-5.57	-28.64	-10.64	-24.09	-10.62	-25.74	-6.39	-32.60	-17.49	-24.56
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.25	0.47	0.10	0.35	0.28	0.41	0.08	0.43	0.16	0.36	0.16	0.39	0.10	0.49	0.26	0.37
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-31.56		-23.21		-27.12		-28.64		-24.09		-25.74		-32.60		-24.56
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-16.77		-6.87		-18.36		-5.57		-10.64		-10.62		-6.39		-17.49	
Rcf	1.53		1.53		1.53		1.53		1.53		1.53		1.53		1.53	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.04036	-23.28455	-5.299486	-16.58388	-13.42131	-19.34432	-4.130479	-21.22626	-7.697179	-18.89167	-10.01879	-21.89653	-4.707679	-24.02037	-12.81	-17.53
Fs (ksi)	-12.04	-23.28	-5.30	-16.58	-13.42	-19.34	-4.13	-21.23	-7.70	-18.89	-10.02	-21.90	-4.71	-24.02	-12.81	-17.53
Fs (kip)	-963.23	-1862.76	-423.96	-1326.71	-1073.70	-1547.55	-330.44	-1698.10	-615.77	-1511.33	-801.50	-1751.72	-376.61	-1921.63	-1024.58	-1402.68

Vu (kip)	211.84	22.09	250.47	13.13	103.40	101.29	5.98	229.01	151.31	17.86	179.21	7.65	61.00	116.32	5.86	164.05
Vuw (kip)	317.76	33.14	375.70	19.70	155.10	151.93	8.97	343.51	---	---	---	---	---	---	---	---
Mv (k*ft)	178.74	18.64	211.33	11.08	87.24	85.46	5.05	193.22	85.11	10.04	100.81	4.30	34.31	65.43	3.30	92.28
Huw (kip)	-2254.55	-1798.69	-2328.00	-1739.06	-1972.61	-1971.53	-1776.67	-2287.98	-1059.75	-656.50	-982.97	-760.70	-797.67	-957.46	-861.84	-910.22
Muw (k*ft)	473.68	777.59	424.71	817.34	661.64	662.36	792.26	451.39	224.88	225.69	118.46	341.92	223.89	237.55	386.25	94.53
Mu (k*ft)	652.42	796.23	636.05	828.42	748.88	747.82	797.31	644.62	309.99	235.73	219.27	346.22	258.20	302.98	389.55	186.80

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7487**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.69	27.67	35.82	26.75	30.35	30.33	27.33	35.20	16.30	10.10	15.12	11.70	12.27	14.73	13.26	14.00
PY1 (Vuw)	4.89	0.51	5.78	0.30	2.39	2.34	0.14	5.28	2.33	0.27	2.76	0.12	0.94	1.79	0.09	2.52
PX2 (Mu)	15.06	18.37	14.68	19.12	17.28	17.26	18.40	14.88	7.15	5.44	5.06	7.99	5.96	6.99	8.99	4.31
PY2 (Mu)	5.02	6.12	4.89	6.37	5.76	5.75	6.13	4.96	2.38	1.81	1.69	2.66	1.99	2.33	3.00	1.44
Pu (kip)	50.72	46.52	51.61	46.36	48.32	48.27	46.16	51.11	23.93	15.68	20.67	19.89	18.46	22.11	22.46	18.74

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.39	44.56	48.01	44.51	45.82	45.78	44.28	47.67
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.61	25.80	OK	23.93	11.96	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.61	1.47	114.56	OK
Web SPL	25.80	1.47	80.19	OK

Field Splice - Node 9487

Node 9487

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9487 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
9487 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9487 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.03	-25.02	-4.29	-18.30	-15.43	-20.21	-2.72	-23.14	-11.54	-21.93	-10.47	-22.32	-3.60	-27.43	-14.79	-17.88
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.20	0.38	0.06	0.27	0.23	0.30	0.04	0.35	0.17	0.33	0.16	0.33	0.05	0.41	0.22	0.27
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.02		-18.30		-20.21		-23.14		-21.93		-22.32		-27.43		-17.88
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-13.03		-4.29		-15.43		-2.72		-11.54		-10.47		-3.60		-14.79	
Rcf	1.82		1.82		1.82		1.82		1.82		1.82		1.82		1.82	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.57	-18.36	-2.81	-13.68	-11.39	-14.84	-1.59	-17.21	-6.33	-16.04	-8.33	-17.04	-2.15	-20.31	-10.97	-13.16
Fs (ksi)	-9.57	-18.36	-2.81	-13.68	-11.39	-14.84	-1.59	-17.21	-6.33	-16.04	-8.33	-17.04	-2.15	-20.31	-10.97	-13.16
Fs (kip)	-765.99	-1468.89	-224.41	-1094.70	-911.56	-1186.84	-126.81	-1377.07	-506.14	-1283.00	-666.31	-1363.54	-172.11	-1624.43	-877.53	-1052.69

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	911.56	1624.43

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	195.57	13.86	247.97	20.58	95.99	102.98	4.82	212.75	141.67	12.39	178.69	11.95	56.30	134.58	6.00	153.81
Vuw (kip)	293.35	20.80	371.95	30.87	143.99	154.47	7.23	319.13	---	---	---	---	---	---	---	---
Mv (k*ft)	165.01	11.70	209.22	17.37	80.99	86.89	4.07	179.51	79.69	6.97	100.51	6.72	31.67	75.70	3.38	86.52
Huw (kip)	-2195.64	-1717.08	-2326.79	-1631.27	-2114.06	-2055.56	-1679.74	-2291.56	-838.08	-494.67	-786.90	-563.95	-670.93	-761.19	-673.70	-723.83
Muw (k*ft)	512.95	831.99	425.52	889.20	567.34	606.34	856.88	449.01	175.72	217.57	68.82	312.56	194.22	174.31	363.08	43.79
Mu (k*ft)	677.96	843.69	634.74	906.57	648.34	693.23	860.95	628.52	255.41	224.54	169.34	319.29	225.88	250.01	366.46	130.31

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.78	26.42	35.80	25.10	32.52	31.62	25.84	35.25	12.89	7.61	12.11	8.68	10.32	11.71	10.36	11.14
PY1 (Vuw)	4.51	0.32	5.72	0.47	2.22	2.38	0.11	4.91	2.18	0.19	2.75	0.18	0.87	2.07	0.09	2.37
PX2 (Mu)	15.65	19.47	14.65	20.92	14.96	16.00	19.87	14.50	5.89	5.18	3.91	7.37	5.21	5.77	8.46	3.01
PY2 (Mu)	5.22	6.49	4.88	6.97	4.99	5.33	6.62	4.83	1.96	1.73	1.30	2.46	1.74	1.92	2.82	1.00
Pu (kip)	50.37	46.39	51.55	46.62	48.03	48.24	46.20	50.70	19.24	12.94	16.52	16.26	15.75	17.93	19.05	14.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.19	44.58	47.96	44.92	45.33	45.62	44.48	47.32
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	371.95
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9487**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	460.19	6.39	OK
BF	2008.27	25.10	OK	815.03	10.19	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.55	25.77	OK	19.24	9.62	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.55	1.47	114.56	OK
Web SPL	25.77	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.63	4.35
Web	1.41	1.81	2.22
BF	1.44	1.65	5.41

Plate	Shear	Flexure
Web	3.86	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.16	-24.56	-3.55	-16.87	-15.20	-19.75	-2.33	-21.74	-7.37	-17.25	-7.72	-18.98	-3.35	-26.00	-13.99	-16.94
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.20	0.37	0.05	0.25	0.23	0.30	0.03	0.33	0.11	0.26	0.12	0.28	0.05	0.39	0.21	0.25
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-24.56		-16.87		-19.75		-21.74		-17.25		-18.98		-26.00		-16.94
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-13.16		-3.55		-15.20		-2.33		-7.37		-7.72		-3.35		-13.99	
Rcf	1.92		1.92		1.92		1.92		1.92		1.92		1.92		1.92	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.717907	-17.67527	-2.606175	-12.45854	-11.16167	-14.2781	-1.740752	-15.89463	-5.380259	-14.17491	-8.361846	-16.25504	-2.465458	-18.90679	-10.31	-12.29
Fs (ksi)	-9.72	-17.68	-2.61	-12.46	-11.16	-14.28	-1.74	-15.89	-5.38	-14.17	-8.36	-16.26	-2.47	-18.91	-10.31	-12.29
Fs (kip)	-777.43	-1414.02	-208.49	-996.68	-892.93	-1142.25	-139.26	-1271.57	-430.42	-1133.99	-668.95	-1300.40	-197.24	-1512.54	-824.45	-983.09

Vu (kip)	195.57	13.86	247.97	20.58	95.99	102.98	4.82	212.75	141.67	12.39	178.69	11.95	56.30	134.58	6.00	153.81
Vuw (kip)	293.35	20.80	371.95	30.87	143.99	154.47	7.23	319.13	---	---	---	---	---	---	---	---
Mv (k*ft)	165.01	11.70	209.22	17.37	80.99	86.89	4.07	179.51	79.69	6.97	100.51	6.72	31.67	75.70	3.38	86.52
Huw (kip)	-2242.29	-1687.60	-2360.25	-1616.89	-1908.09	-1928.44	-1676.10	-2290.30	-821.80	-451.94	-763.19	-529.06	-586.66	-738.51	-641.17	-677.83
Muw (k*ft)	481.85	851.65	403.21	898.79	704.65	691.09	859.31	449.84	159.15	197.05	62.33	283.08	175.89	157.86	328.83	39.66
Mu (k*ft)	646.86	863.34	612.43	916.15	785.64	777.98	863.38	629.35	238.84	204.02	162.84	289.80	207.56	233.57	332.20	126.18

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9487	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.50	25.96	36.31	24.88	29.36	29.67	25.79	35.24	12.64	6.95	11.74	8.14	9.03	11.36	9.86	10.43
PY1 (Vuw)	4.51	0.32	5.72	0.47	2.22	2.38	0.11	4.91	2.18	0.19	2.75	0.18	0.87	2.07	0.09	2.37
PX2 (Mu)	14.93	19.92	14.13	21.14	18.13	17.95	19.92	14.52	5.51	4.71	3.76	6.69	4.79	5.39	7.67	2.91
PY2 (Mu)	4.98	6.64	4.71	7.05	6.04	5.98	6.64	4.84	1.84	1.57	1.25	2.23	1.60	1.80	2.56	0.97
Pu (kip)	50.33	46.41	51.51	46.63	48.20	48.35	46.21	50.71	18.59	11.79	16.01	15.02	14.03	17.19	17.73	13.75

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.08	44.65	47.88	44.96	45.82	45.92	44.49	47.32
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.51	25.76	OK	18.59	9.30	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.51	1.47	114.56	OK
Web SPL	25.76	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 1491

Node 1491

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1491 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
1491 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1491 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.38	-19.09	-13.25	-25.84	-16.15	-20.23	-2.31	-24.55	-11.34	-22.72	-9.66	-21.47	-15.48	-17.23	-2.90	-28.34
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.07	0.29	0.20	0.39	0.24	0.30	0.03	0.37	0.17	0.34	0.14	0.32	0.23	0.26	0.04	0.42
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-19.09		-25.84		-20.23		-24.55		-22.72		-21.47		-17.23		-28.34
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-4.38		-13.25		-16.15		-2.31		-11.34		-9.66		-15.48		-2.90	
Rcf	1.77		1.77		1.77		1.77		1.77		1.77		1.77		1.77	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.96	-13.85	-9.57	-19.59	-11.76	-15.48	-1.36	-17.83	-6.55	-17.39	-7.58	-15.89	-11.02	-12.31	-2.03	-21.58
Fs (ksi)	-2.96	-13.85	-9.57	-19.59	-11.76	-15.48	-1.36	-17.83	-6.55	-17.39	-7.58	-15.89	-11.02	-12.31	-2.03	-21.58
Fs (kip)	-236.72	-1107.71	-765.42	-1566.94	-940.98	-1238.25	-109.09	-1426.70	-523.75	-1391.32	-606.77	-1271.47	-881.91	-984.69	-162.20	-1726.11

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	940.98	1726.11

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	4.59	187.09	242.20	33.19	89.68	89.04	209.69	9.36	2.49	139.94	178.87	24.21	61.41	117.75	147.40	1.14
Vuw (kip)	6.89	280.64	363.29	49.79	134.52	133.55	314.53	14.04	---	---	---	---	---	---	---	---
Mv (k*ft)	3.87	157.86	204.35	28.01	75.67	75.12	176.93	7.90	1.40	78.71	100.61	13.62	34.54	66.23	82.91	0.64
Huw (kip)	-1714.79	-2184.37	-2337.75	-1605.05	-2082.96	-1994.35	-2302.44	-1635.92	-504.16	-874.64	-817.21	-575.92	-718.15	-704.34	-699.97	-708.12
Muw (k*ft)	833.52	520.47	418.21	906.68	588.07	647.15	441.76	886.10	217.75	200.38	74.32	329.40	216.89	166.17	25.69	390.98
Mu (k*ft)	837.40	678.32	622.57	934.69	663.74	722.27	618.68	893.99	219.15	279.09	174.93	343.02	251.43	232.41	108.60	391.62

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.38	33.61	35.97	24.69	32.05	30.68	35.42	25.17	7.76	13.46	12.57	8.86	11.05	10.84	10.77	10.89
PY1 (Vuw)	0.11	4.32	5.59	0.77	2.07	2.05	4.84	0.22	0.04	2.15	2.75	0.37	0.94	1.81	2.27	0.02
PX2 (Mu)	19.32	15.65	14.37	21.57	15.32	16.67	14.28	20.63	5.06	6.44	4.04	7.92	5.80	5.36	2.51	9.04
PY2 (Mu)	6.44	5.22	4.79	7.19	5.11	5.56	4.76	6.88	1.69	2.15	1.35	2.64	1.93	1.79	0.84	3.01
Pu (kip)	46.17	50.17	51.39	46.94	47.90	47.96	50.62	46.34	12.93	20.36	17.11	17.04	17.09	16.59	13.63	20.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.39	47.05	47.82	45.25	45.28	45.47	47.23	44.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	363.29
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	475.04	6.60	OK
BF	2008.27	25.10	OK	866.04	10.83	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.39	25.70	OK	20.36	10.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.39	1.47	114.56	OK
Web SPL	25.70	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.55	4.35
Web	1.41	1.74	2.23
BF	1.44	1.55	5.41

Plate	Shear	Flexure
Web	3.95	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.16	-17.13	-12.90	-24.87	-15.36	-19.24	-1.56	-22.69	-6.96	-17.78	-7.47	-18.70	-14.24	-15.91	-2.32	-26.50
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.05	0.26	0.19	0.37	0.23	0.29	0.02	0.34	0.10	0.27	0.11	0.28	0.21	0.24	0.03	0.40
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-17.13		-24.87		-19.24		-22.69		-17.78		-18.70		-15.91		-26.50
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-3.16		-12.90		-15.36		-1.56		-6.96		-7.47		-14.24		-2.32	
Rcf	1.89		1.89		1.89		1.89		1.89		1.89		1.89		1.89	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.365419	-12.22564	-9.455013	-18.52883	-11.1888	-14.55413	-1.234319	-16.1507	-5.336071	-15.15757	-7.973758	-15.49862	-10.19806	-11.36159	-1.98	-19.68
Fs (ksi)	-2.37	-12.23	-9.46	-18.53	-11.19	-14.55	-1.23	-16.15	-5.34	-15.16	-7.97	-15.50	-10.20	-11.36	-1.98	-19.68
Fs (kip)	-189.23	-978.05	-756.40	-1482.31	-895.10	-1164.33	-98.75	-1292.06	-426.89	-1212.61	-637.90	-1239.89	-815.84	-908.93	-158.26	-1574.63

Vu (kip)	4.59	187.09	242.20	33.19	89.68	89.04	209.69	9.36	2.49	139.94	178.87	24.21	61.41	117.75	147.40	1.14
Vuw (kip)	6.89	280.64	363.29	49.79	134.52	133.55	314.53	14.04	---	---	---	---	---	---	---	---
Mv (k*ft)	3.87	157.86	204.35	28.01	75.67	75.12	176.93	7.90	1.40	78.71	100.61	13.62	34.54	66.23	82.91	0.64
Huw (kip)	-1661.35	-2213.32	-2352.30	-1570.68	-1876.51	-1905.77	-2289.22	-1613.98	-437.73	-839.52	-772.29	-521.55	-614.81	-704.17	-646.79	-649.83
Muw (k*ft)	869.15	501.17	408.51	929.59	725.70	706.20	450.57	900.73	197.20	181.48	67.31	298.33	196.43	150.50	23.27	354.09
Mu (k*ft)	873.02	659.03	612.87	957.60	801.37	781.32	627.49	908.62	198.60	260.19	167.92	311.94	230.97	216.73	106.18	354.73

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.56	34.05	36.19	24.16	28.87	29.32	35.22	24.83	6.73	12.92	11.88	8.02	9.46	10.83	9.95	10.00
PY1 (Vuw)	0.11	4.32	5.59	0.77	2.07	2.05	4.84	0.22	0.04	2.15	2.75	0.37	0.94	1.81	2.27	0.02
PX2 (Mu)	20.15	15.21	14.14	22.10	18.49	18.03	14.48	20.97	4.58	6.00	3.88	7.20	5.33	5.00	2.45	8.19
PY2 (Mu)	6.72	5.07	4.71	7.37	6.16	6.01	4.83	6.99	1.53	2.00	1.29	2.40	1.78	1.67	0.82	2.73
Pu (kip)	46.21	50.15	51.38	46.97	48.07	48.03	50.63	46.36	11.43	19.37	16.27	15.47	15.04	16.21	12.78	18.39

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.52	46.98	47.78	45.33	45.77	45.68	47.26	44.73
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.38	25.69	OK	19.37	9.69	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.38	1.47	114.56	OK
Web SPL	25.69	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 3491

Node 3491

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3491 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
3491 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3491 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.43	-25.25	-16.43	-31.89	-18.59	-26.38	-4.42	-31.39	-13.63	-29.02	-13.83	-29.26	-17.80	-23.57	-5.00	-34.39
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.10	0.38	0.25	0.48	0.28	0.40	0.07	0.47	0.20	0.44	0.21	0.44	0.27	0.35	0.07	0.52
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.25		-31.89		-26.38		-31.39		-29.02		-29.26		-23.57		-34.39
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.76
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4061.19
fncf (ksi)	-6.43		-16.43		-18.59		-4.42		-13.63		-13.83		-17.80		-5.00	
Rcf	1.45		1.45		1.45		1.45		1.45		1.45		1.45		1.48	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.47	-18.52	-11.58	-23.93	-13.24	-19.91	-2.91	-23.00	-7.15	-21.87	-10.36	-21.77	-12.78	-17.15	-3.29	-25.98
Fs (ksi)	-4.47	-18.52	-11.58	-23.93	-13.24	-19.91	-2.91	-23.00	-7.15	-21.87	-10.36	-21.77	-12.78	-17.15	-3.29	-25.98
Fs (kip)	-357.79	-1481.41	-926.30	-1914.72	-1058.95	-1593.04	-232.71	-1840.39	-572.10	-1749.74	-828.54	-1741.50	-1022.58	-1372.00	-263.06	-2078.28

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4061.19	1058.95	2078.28

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	22.10	198.83	248.60	19.61	101.64	93.74	228.73	4.40	14.92	145.92	181.08	14.55	58.96	112.31	160.90	2.32
Vuw (kip)	33.15	298.25	372.91	29.41	152.47	140.61	343.09	6.60	---	---	---	---	---	---	---	---
Mv (k*ft)	18.65	167.77	209.76	16.54	85.76	79.09	192.99	3.71	8.39	82.08	101.86	8.18	33.17	63.17	90.51	1.31
Huw (kip)	-1763.20	-2199.82	-2293.98	-1675.43	-2077.44	-2086.18	-2259.54	-1725.57	-689.70	-1065.38	-994.50	-777.41	-870.69	-963.76	-897.97	-878.00
Muw (k*ft)	801.25	510.17	447.39	859.76	591.75	585.92	470.35	855.22	280.91	247.11	133.52	401.92	294.41	228.24	87.36	453.81
Mu (k*ft)	819.89	677.94	657.15	876.30	677.52	665.02	663.34	858.93	289.30	329.18	235.38	410.11	327.58	291.41	177.86	455.11

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.13	33.84	35.29	25.78	31.96	32.10	34.76	26.55	10.61	16.39	15.30	11.96	13.40	14.83	13.81	13.51
PY1 (Vuw)	0.51	4.59	5.74	0.45	2.35	2.16	5.28	0.10	0.23	2.24	2.79	0.22	0.91	1.73	2.48	0.04
PX2 (Mu)	18.92	15.64	15.17	20.22	15.63	15.35	15.31	19.82	6.68	7.60	5.43	9.46	7.56	6.72	4.10	10.50
PY2 (Mu)	6.31	5.21	5.06	6.74	5.21	5.12	5.10	6.61	2.23	2.53	1.81	3.15	2.52	2.24	1.37	3.50
Pu (kip)	46.55	50.45	51.60	46.56	48.19	48.00	51.13	46.85	17.46	24.46	21.24	21.69	21.23	21.91	18.33	24.27

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2037.62	2283.75	OK
BF Outside	2023.57	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.64	47.25	48.06	44.80	45.54	45.35	47.73	45.07
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	372.91
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	534.60	7.42	OK
BF	2037.62	25.47	OK	1042.74	13.03	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2037.62	25.47	1.47	149.81	OK
BF	4061.19	50.76	1.47	299.63	OK
BF Outside	2023.57	25.29	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.60	25.80	OK	24.46	12.23	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.60	1.47	114.56	OK
Web SPL	25.80	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.12
BF Outside	NA	1.12

Bolt	Shear	Slip	Bearing
TF	1.29	2.27	4.35
Web	1.40	1.42	2.22
BF	1.42	1.29	5.33

Plate	Shear	Flexure
Web	3.85	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.58	-24.46	-16.49	-31.17	-18.58	-25.99	-4.95	-30.59	-10.35	-24.99	-10.52	-25.18	-17.90	-23.38	-5.66	-33.59
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.10	0.37	0.25	0.47	0.28	0.39	0.07	0.46	0.16	0.37	0.16	0.38	0.27	0.35	0.08	0.50
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-24.46		-31.17		-25.99		-30.59		-24.99		-25.18		-23.38		-33.59
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.36
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4029.00
fncf (ksi)	-6.58		-16.49		-18.58		-4.95		-10.35		-10.52		-17.90		-5.66	
Rcf	1.49		1.49		1.49		1.49		1.49		1.49		1.49		1.50	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.93405	-17.65436	-11.9442	-23.1339	-13.4268	-19.47309	-3.784449	-21.98463	-7.169127	-20.50084	-10.20678	-20.54217	-12.93516	-16.8909	-4.29	-24.84
Fs (ksi)	-4.93	-17.65	-11.94	-23.13	-13.43	-19.47	-3.78	-21.98	-7.17	-20.50	-10.21	-20.54	-12.94	-16.89	-4.29	-24.84
Fs (kip)	-394.72	-1412.35	-955.54	-1850.71	-1074.14	-1557.85	-302.76	-1758.77	-573.53	-1640.07	-816.54	-1643.37	-1034.81	-1351.27	-343.59	-1987.56

Vu (kip)	22.10	198.83	248.60	19.61	101.64	93.74	228.73	4.40	14.92	145.92	181.08	14.55	58.96	112.31	160.90	2.32
Vuw (kip)	33.15	298.25	372.91	29.41	152.47	140.61	343.09	6.60	---	---	---	---	---	---	---	---
Mv (k*ft)	18.65	167.77	209.76	16.54	85.76	79.09	192.99	3.71	8.39	82.08	101.86	8.18	33.17	63.17	90.51	1.31
Huw (kip)	-1776.45	-2219.12	-2312.88	-1703.75	-1945.13	-1952.58	-2282.44	-1746.78	-677.65	-1052.34	-987.00	-773.07	-830.10	-922.47	-894.78	-874.18
Muw (k*ft)	792.41	497.30	434.80	840.88	679.96	674.99	455.09	825.18	254.41	223.79	120.93	364.00	266.63	206.71	79.11	410.99
Mu (k*ft)	811.06	665.07	644.56	857.42	765.72	754.09	648.07	828.90	262.80	305.87	222.78	372.19	299.80	269.88	169.62	412.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.33	34.14	35.58	26.21	29.93	30.04	35.11	26.87	10.43	16.19	15.18	11.89	12.77	14.19	13.77	13.45
PY1 (Vuw)	0.51	4.59	5.74	0.45	2.35	2.16	5.28	0.10	0.23	2.24	2.79	0.22	0.91	1.73	2.48	0.04
PX2 (Mu)	18.72	15.35	14.87	19.79	17.67	17.40	14.96	19.13	6.06	7.06	5.14	8.59	6.92	6.23	3.91	9.51
PY2 (Mu)	6.24	5.12	4.96	6.60	5.89	5.80	4.99	6.38	2.02	2.35	1.71	2.86	2.31	2.08	1.30	3.17
Pu (kip)	46.54	50.43	51.58	46.54	48.30	48.11	51.11	46.46	16.64	23.70	20.82	20.71	19.95	20.77	18.08	23.19

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.61	47.21	48.01	44.73	45.85	45.67	47.67	44.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.58	25.79	OK	23.70	11.85	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.58	1.47	114.56	OK
Web SPL	25.79	1.47	80.19	OK

Field Splice - Node 5491

Node 5491

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5491 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
5491 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5491 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.70	-23.38	-15.99	-29.09	-18.11	-24.11	-4.73	-29.29	-13.49	-27.18	-13.97	-27.09	-17.51	-21.51	-5.28	-31.93
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.10	0.35	0.24	0.44	0.27	0.36	0.07	0.44	0.20	0.41	0.21	0.41	0.26	0.32	0.08	0.48
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-23.38		-29.09		-24.11		-29.29		-27.18		-27.09		-21.51		-31.93
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-6.70		-15.99		-18.11		-4.73		-13.49		-13.97		-17.51		-5.28	
Rcf	1.57		1.57		1.57		1.57		1.57		1.57		1.57		1.57	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.74	-17.17	-11.26	-21.64	-12.88	-18.00	-3.22	-21.49	-8.25	-18.67	-9.06	-20.66	-12.60	-15.63	-3.45	-23.89
Fs (ksi)	-4.74	-17.17	-11.26	-21.64	-12.88	-18.00	-3.22	-21.49	-8.25	-18.67	-9.06	-20.66	-12.60	-15.63	-3.45	-23.89
Fs (kip)	-379.45	-1373.55	-900.61	-1731.16	-1030.29	-1439.69	-257.21	-1719.00	-659.94	-1493.69	-724.68	-1652.69	-1008.28	-1250.10	-276.09	-1910.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1030.29	1910.81

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	82.39	257.53	300.76	39.17	153.34	148.44	278.35	55.39	59.48	189.69	220.24	28.94	125.18	132.05	197.93	46.87
Vuw (kip)	123.58	386.29	451.14	58.76	230.01	222.66	417.52	83.08	---	---	---	---	---	---	---	---
Mv (k*ft)	69.52	217.29	253.77	33.05	129.38	125.25	234.86	46.73	33.46	106.70	123.88	16.28	70.42	74.28	111.33	26.37
Huw (kip)	-1797.59	-2234.29	-2333.88	-1705.11	-2116.75	-2139.33	-2305.82	-1730.67	-657.37	-986.91	-926.24	-741.08	-807.61	-891.51	-846.89	-820.09
Muw (k*ft)	778.32	487.19	420.79	839.98	565.54	550.49	439.50	822.94	248.53	207.64	102.35	365.45	208.44	232.00	60.46	408.68
Mu (k*ft)	847.84	704.47	674.56	873.03	694.92	675.74	674.35	869.67	281.98	314.34	226.23	381.73	278.85	306.28	171.79	435.05

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.66	34.37	35.91	26.23	32.57	32.91	35.47	26.63	10.11	15.18	14.25	11.40	12.42	13.72	13.03	12.62
PY1 (Vuw)	1.90	5.94	6.94	0.90	3.54	3.43	6.42	1.28	0.92	2.92	3.39	0.45	1.93	2.03	3.05	0.72
PX2 (Mu)	19.57	16.26	15.57	20.15	16.04	15.59	15.56	20.07	6.51	7.25	5.22	8.81	6.44	7.07	3.96	10.04
PY2 (Mu)	6.52	5.42	5.19	6.72	5.35	5.20	5.19	6.69	2.17	2.42	1.74	2.94	2.15	2.36	1.32	3.35
Pu (kip)	47.97	51.89	52.88	47.00	49.41	49.27	52.34	47.37	16.90	23.06	20.13	20.49	19.29	21.24	17.55	23.02

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.80	48.38	49.04	45.13	46.51	46.36	48.64	45.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	451.14
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	520.12	7.22	OK
BF	2008.27	25.10	OK	958.71	11.98	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.88	26.44	OK	23.06	11.53	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.88	1.47	114.56	OK
Web SPL	26.44	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.33	4.35
Web	1.37	1.50	2.17
BF	1.44	1.40	5.41

Plate	Shear	Flexure
Web	3.18	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.85	-22.70	-16.14	-28.59	-18.16	-23.86	-5.03	-28.38	-10.25	-23.26	-10.31	-22.78	-17.59	-21.38	-5.61	-30.95
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.10	0.34	0.24	0.43	0.27	0.36	0.08	0.43	0.15	0.35	0.15	0.34	0.26	0.32	0.08	0.46
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-22.70		-28.59		-23.86		-28.38		-23.26		-22.78		-21.38		-30.95
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-6.85		-16.14		-18.16		-5.03		-10.25		-10.31		-17.59		-5.61	
Rcf	1.62		1.62		1.62		1.62		1.62		1.62		1.62		1.62	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.118498	-16.37251	-11.6282	-21.0307	-13.05447	-17.6892	-3.833708	-20.38223	-8.23428	-17.67297	-8.835204	-19.34099	-12.70513	-15.44272	-4.19	-22.70
Fs (ksi)	-5.12	-16.37	-11.63	-21.03	-13.05	-17.69	-3.83	-20.38	-8.23	-17.67	-8.84	-19.34	-12.71	-15.44	-4.19	-22.70
Fs (kip)	-409.48	-1309.80	-930.26	-1682.46	-1044.36	-1415.14	-306.70	-1630.58	-658.74	-1413.84	-706.82	-1547.28	-1016.41	-1235.42	-335.32	-1815.82

Vu (kip)	82.39	257.53	300.76	39.17	153.34	148.44	278.35	55.39	59.48	189.69	220.24	28.94	125.18	132.05	197.93	46.87
Vuw (kip)	123.58	386.29	451.14	58.76	230.01	222.66	417.52	83.08	---	---	---	---	---	---	---	---
Mv (k*ft)	69.52	217.29	253.77	33.05	129.38	125.25	234.86	46.73	33.46	106.70	123.88	16.28	70.42	74.28	111.33	26.37
Huw (kip)	-1814.78	-2265.31	-2363.23	-1726.57	-1979.58	-1982.54	-2335.63	-1754.75	-644.73	-979.77	-922.31	-726.48	-777.22	-845.29	-844.44	-806.68
Muw (k*ft)	766.86	466.50	401.23	825.67	657.00	655.02	419.63	806.88	225.08	188.05	92.69	330.97	188.77	210.12	54.75	370.13
Mu (k*ft)	836.38	683.79	654.99	858.72	786.37	780.26	654.48	853.62	258.54	294.75	216.58	347.25	259.19	284.39	166.09	396.49

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5491**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.92	34.85	36.36	26.56	30.46	30.50	35.93	27.00	9.92	15.07	14.19	11.18	11.96	13.00	12.99	12.41
PY1 (Vuw)	1.90	5.94	6.94	0.90	3.54	3.43	6.42	1.28	0.92	2.92	3.39	0.45	1.93	2.03	3.05	0.72
PX2 (Mu)	19.30	15.78	15.12	19.82	18.15	18.01	15.10	19.70	5.97	6.80	5.00	8.01	5.98	6.56	3.83	9.15
PY2 (Mu)	6.43	5.26	5.04	6.61	6.05	6.00	5.03	6.57	1.99	2.27	1.67	2.67	1.99	2.19	1.28	3.05
Pu (kip)	47.95	51.86	52.85	46.98	49.54	49.41	52.31	47.35	16.15	22.48	19.84	19.44	18.36	20.02	17.37	21.89

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.76	48.31	48.97	45.08	46.84	46.73	48.57	45.35
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.85	26.42	OK	22.48	11.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.85	1.47	114.56	OK
Web SPL	26.42	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 7491

Node 7491

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7491 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
7491 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7491 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.06	-25.46	-15.98	-31.66	-18.45	-26.23	-5.02	-31.81	-13.67	-29.56	-14.14	-28.68	-18.11	-23.79	-5.53	-34.62
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.11	0.38	0.24	0.47	0.28	0.39	0.08	0.48	0.20	0.44	0.21	0.43	0.27	0.36	0.08	0.52
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.46		-31.66		-26.23		-31.81		-29.56		-28.68		-23.79		-34.62
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.88
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4070.70
fncf (ksi)	-7.06		-15.98		-18.45		-5.02		-13.67		-14.14		-18.11		-5.53	
Rcf	1.45		1.45		1.45		1.45		1.45		1.45		1.45		1.47	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.99	-18.72	-11.25	-23.77	-13.13	-19.80	-3.40	-23.35	-9.96	-22.04	-8.22	-21.81	-13.02	-17.32	-3.63	-26.10
Fs (ksi)	-4.99	-18.72	-11.25	-23.77	-13.13	-19.80	-3.40	-23.35	-9.96	-22.04	-8.22	-21.81	-13.02	-17.32	-3.63	-26.10
Fs (kip)	-399.38	-1497.51	-899.70	-1901.95	-1050.17	-1583.73	-272.32	-1868.37	-796.87	-1763.46	-657.22	-1744.72	-1041.74	-1385.60	-290.14	-2088.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4070.70	1050.17	2088.23

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	32.26	194.92	248.04	12.02	102.51	100.90	230.16	1.97	22.73	142.50	180.03	8.56	118.14	67.48	162.55	6.18
Vuw (kip)	48.38	292.38	372.06	18.04	153.76	151.36	345.24	2.96	---	---	---	---	---	---	---	---
Mv (k*ft)	27.22	164.46	209.28	10.15	86.49	85.14	194.20	1.67	12.79	80.16	101.27	4.81	66.46	37.96	91.44	3.48
Huw (kip)	-1788.44	-2175.39	-2282.32	-1700.00	-2075.30	-2095.41	-2267.48	-1751.52	-711.33	-1050.62	-987.71	-802.76	-960.12	-900.73	-910.25	-891.89
Muw (k*ft)	784.42	526.45	455.17	843.38	593.18	579.77	465.06	842.62	274.53	250.56	133.39	399.01	241.65	271.88	85.97	449.52
Mu (k*ft)	811.63	690.92	664.45	853.52	679.67	664.91	659.26	844.28	287.32	330.72	234.66	403.82	308.10	309.83	177.40	453.00

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.51	33.47	35.11	26.15	31.93	32.24	34.88	26.95	10.94	16.16	15.20	12.35	14.77	13.86	14.00	13.72
PY1 (Vuw)	0.74	4.50	5.72	0.28	2.37	2.33	5.31	0.05	0.35	2.19	2.77	0.13	1.82	1.04	2.50	0.10
PX2 (Mu)	18.73	15.94	15.33	19.70	15.68	15.34	15.21	19.48	6.63	7.63	5.42	9.32	7.11	7.15	4.09	10.45
PY2 (Mu)	6.24	5.31	5.11	6.57	5.23	5.11	5.07	6.49	2.21	2.54	1.81	3.11	2.37	2.38	1.36	3.48
Pu (kip)	46.77	50.38	51.60	46.36	48.21	48.16	51.16	46.89	17.76	24.26	21.11	21.91	22.28	21.28	18.51	24.44

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2042.39	2283.75	OK
BF Outside	2028.31	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.79	47.23	48.07	44.58	45.56	45.48	47.74	45.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	372.06
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	530.16	7.36	OK
BF	2042.39	25.53	OK	1047.73	13.10	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2042.39	25.53	1.47	149.81	OK
BF	4070.70	50.88	1.47	299.63	OK
BF Outside	2028.31	25.35	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.60	25.80	OK	24.44	12.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.60	1.47	114.56	OK
Web SPL	25.80	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.12
BF Outside	NA	1.12

Bolt	Shear	Slip	Bearing
TF	1.29	2.29	4.35
Web	1.40	1.42	2.22
BF	1.42	1.29	5.32

Plate	Shear	Flexure
Web	3.86	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.08	-24.56	-16.30	-31.20	-18.53	-25.93	-5.30	-30.77	-10.70	-25.80	-10.54	-24.36	-17.95	-23.35	-5.97	-33.62
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.11	0.37	0.24	0.47	0.28	0.39	0.08	0.46	0.16	0.39	0.16	0.37	0.27	0.35	0.09	0.50
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-24.56		-31.20		-25.93		-30.77		-25.80		-24.36		-23.35		-33.62
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.38
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4030.12
fncf (ksi)	-7.08		-16.30		-18.53		-5.30		-10.70		-10.54		-17.95		-5.97	
Rcf	1.49		1.49		1.49		1.49		1.49		1.49		1.49		1.50	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.311883	-17.74357	-11.78542	-23.13165	-13.36416	-19.40445	-4.057709	-22.12613	-10.09377	-21.03629	-8.002754	-20.3141	-12.99549	-16.88827	-4.49	-24.84
Fs (ksi)	-5.31	-17.74	-11.79	-23.13	-13.36	-19.40	-4.06	-22.13	-10.09	-21.04	-8.00	-20.31	-13.00	-16.89	-4.49	-24.84
Fs (kip)	-424.95	-1419.49	-942.83	-1850.53	-1069.13	-1552.36	-324.62	-1770.09	-807.50	-1682.90	-640.22	-1625.13	-1039.64	-1351.06	-358.83	-1987.29

Vu (kip)	32.26	194.92	248.04	12.02	102.51	100.90	230.16	1.97	22.73	142.50	180.03	8.56	118.14	67.48	162.55	6.18
Vuw (kip)	48.38	292.38	372.06	18.04	153.76	151.36	345.24	2.96	---	---	---	---	---	---	---	---
Mv (k*ft)	27.22	164.46	209.28	10.15	86.49	85.14	194.20	1.67	12.79	80.16	101.27	4.81	66.46	37.96	91.44	3.48
Huw (kip)	-1798.40	-2210.24	-2310.00	-1719.15	-1960.13	-1952.86	-2283.91	-1760.95	-691.66	-1047.51	-983.06	-785.52	-933.90	-849.51	-896.51	-879.80
Muw (k*ft)	777.78	503.22	436.72	830.61	669.96	674.80	454.11	816.29	248.63	226.92	120.81	361.37	218.85	246.23	77.86	407.12
Mu (k*ft)	805.00	667.68	646.00	840.76	756.45	759.94	648.30	817.95	261.42	307.08	222.07	366.18	285.31	284.18	169.29	410.59

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7491**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.67	34.00	35.54	26.45	30.16	30.04	35.14	27.09	10.64	16.12	15.12	12.08	14.37	13.07	13.79	13.54
PY1 (Vuw)	0.74	4.50	5.72	0.28	2.37	2.33	5.31	0.05	0.35	2.19	2.77	0.13	1.82	1.04	2.50	0.10
PX2 (Mu)	18.58	15.41	14.91	19.40	17.46	17.54	14.96	18.88	6.03	7.09	5.12	8.45	6.58	6.56	3.91	9.48
PY2 (Mu)	6.19	5.14	4.97	6.47	5.82	5.85	4.99	6.29	2.01	2.36	1.71	2.82	2.19	2.19	1.30	3.16
Pu (kip)	46.76	50.34	51.57	46.34	48.31	48.28	51.15	46.40	16.84	23.64	20.74	20.75	21.33	19.89	18.10	23.24

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.77	47.15	48.01	44.54	45.83	45.82	47.70	44.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 7491**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.57	25.78	OK	23.64	11.82	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.57	1.47	114.56	OK
Web SPL	25.78	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 9491

Node 9491

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9491 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
9491 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9491 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.875	32.50	71.75	47.58	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.9056604
Outer to Inr 0.9056604

Outer to Mi 0.9528302
Outer to Mi 0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.26	-19.02	-13.14	-25.75	-16.08	-20.14	-2.90	-25.69	-10.04	-21.43	-11.72	-22.69	-15.61	-17.18	-4.02	-28.86
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.08	0.29	0.20	0.39	0.24	0.30	0.04	0.39	0.15	0.32	0.18	0.34	0.23	0.26	0.06	0.43
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-19.02		-25.75		-20.14		-25.69		-21.43		-22.69		-17.18		-28.86
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-5.26		-13.14		-16.08		-2.90		-10.04		-11.72		-15.61		-4.02	
Rcf	1.73		1.73		1.73		1.73		1.73		1.73		1.73		1.73	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.68	-13.81	-9.42	-19.50	-11.65	-15.39	-1.86	-18.69	-7.60	-16.10	-7.02	-17.01	-11.20	-12.30	-2.76	-21.92
Fs (ksi)	-3.68	-13.81	-9.42	-19.50	-11.65	-15.39	-1.86	-18.69	-7.60	-16.10	-7.02	-17.01	-11.20	-12.30	-2.76	-21.92
Fs (kip)	-294.35	-1105.17	-753.61	-1560.06	-932.00	-1230.89	-148.51	-1494.93	-608.05	-1288.21	-561.21	-1360.81	-896.23	-984.32	-220.74	-1753.31

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	932.00	1753.31

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	22.27	185.63	242.04	19.13	96.95	97.11	211.11	2.01	16.22	137.66	177.52	13.03	117.51	71.07	149.64	7.93
Vuw (kip)	33.41	278.45	363.07	28.69	145.42	145.67	316.67	3.02	---	---	---	---	---	---	---	---
Mv (k*ft)	18.79	156.63	204.23	16.14	81.80	81.94	178.13	1.70	9.12	77.44	99.86	7.33	66.10	39.98	84.17	4.46
Huw (kip)	-1756.09	-2165.85	-2318.97	-1633.53	-2004.73	-2091.89	-2294.18	-1691.33	-524.82	-867.63	-811.09	-616.29	-711.10	-720.76	-705.21	-740.27
Muw (k*ft)	805.99	532.81	430.73	887.69	640.23	582.12	447.26	849.16	202.70	201.61	74.72	336.61	170.04	199.90	22.02	383.14
Mu (k*ft)	824.78	689.44	634.96	903.83	722.03	664.06	625.39	850.86	211.83	279.05	174.58	343.93	236.14	239.87	106.19	387.60

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.02	33.32	35.68	25.13	30.84	32.18	35.30	26.02	8.07	13.35	12.48	9.48	10.94	11.09	10.85	11.39
PY1 (Vuw)	0.51	4.28	5.59	0.44	2.24	2.24	4.87	0.05	0.25	2.12	2.73	0.20	1.81	1.09	2.30	0.12
PX2 (Mu)	19.03	15.91	14.65	20.86	16.66	15.32	14.43	19.64	4.89	6.44	4.03	7.94	5.45	5.54	2.45	8.94
PY2 (Mu)	6.34	5.30	4.88	6.95	5.55	5.11	4.81	6.55	1.63	2.15	1.34	2.65	1.82	1.85	0.82	2.98
Pu (kip)	46.56	50.16	51.41	46.58	48.14	48.07	50.66	46.13	13.10	20.24	17.00	17.65	16.79	16.88	13.66	20.57

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.66	47.06	47.86	44.89	45.61	45.41	47.28	44.40
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 490.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	363.07
Rr (kip)	1434.96
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9491**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	470.51	6.53	OK
BF	2008.27	25.10	OK	879.69	11.00	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.41	25.70	OK	20.57	10.28	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.41	1.47	114.56	OK
Web SPL	25.70	1.47	80.19	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	2.58	4.35
Web	1.41	1.74	2.23
BF	1.44	1.53	5.41

Plate	Shear	Flexure
Web	3.95	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.06	-17.14	-12.85	-24.83	-15.37	-19.22	-2.28	-23.93	-7.86	-18.69	-7.34	-17.77	-14.32	-15.82	-3.27	-26.89
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.06	0.26	0.19	0.37	0.23	0.29	0.03	0.36	0.12	0.28	0.11	0.27	0.21	0.24	0.05	0.40
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-17.14		-24.83		-19.22		-23.93		-18.69		-17.77		-15.82		-26.89
Fcf (ksi)		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03
Fcf (kip)		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70
fncf (ksi)	-4.06		-12.85		-15.37		-2.28		-7.86		-7.34		-14.32		-3.27	
Rcf	1.86		1.86		1.86		1.86		1.86		1.86		1.86		1.86	
Fncf (ksi)	-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03		-50.03	
Fncf (kip)	-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70		-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.053	-12.23206	-9.37245	-18.50207	-11.15121	-14.53486	-1.792068	-17.03456	-7.994826	-15.69469	-5.850919	-14.90294	-10.30418	-11.30146	-2.60	-19.95
Fs (ksi)	-3.05	-12.23	-9.37	-18.50	-11.15	-14.53	-1.79	-17.03	-7.99	-15.69	-5.85	-14.90	-10.30	-11.30	-2.60	-19.95
Fs (kip)	-244.24	-978.57	-749.80	-1480.17	-892.10	-1162.79	-143.37	-1362.76	-639.59	-1255.58	-468.07	-1192.24	-824.33	-904.12	-208.33	-1596.32

Vu (kip)	22.27	185.63	242.04	19.13	96.95	97.11	211.11	2.01	16.22	137.66	177.52	13.03	117.51	71.07	149.64	7.93
Vuw (kip)	33.41	278.45	363.07	28.69	145.42	145.67	316.67	3.02	---	---	---	---	---	---	---	---
Mv (k*ft)	18.79	156.63	204.23	16.14	81.80	81.94	178.13	1.70	9.12	77.44	99.86	7.33	66.10	39.98	84.17	4.46
Huw (kip)	-1709.23	-2199.90	-2340.44	-1609.60	-1921.15	-1892.52	-2282.13	-1665.15	-458.55	-836.24	-770.58	-564.80	-710.69	-622.62	-648.17	-676.74
Muw (k*ft)	837.23	510.11	416.42	903.64	695.94	715.03	455.29	866.61	183.58	182.59	67.67	304.85	154.00	181.04	19.95	347.00
Mu (k*ft)	856.02	666.74	620.65	919.78	777.74	796.97	633.42	868.31	192.70	260.03	167.53	312.18	220.10	221.02	104.12	351.46

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.30	33.84	36.01	24.76	29.56	29.12	35.11	25.62	7.05	12.87	11.86	8.69	10.93	9.58	9.97	10.41
PY1 (Vuw)	0.51	4.28	5.59	0.44	2.24	2.24	4.87	0.05	0.25	2.12	2.73	0.20	1.81	1.09	2.30	0.12
PX2 (Mu)	19.75	15.39	14.32	21.23	17.95	18.39	14.62	20.04	4.45	6.00	3.87	7.20	5.08	5.10	2.40	8.11
PY2 (Mu)	6.58	5.13	4.77	7.08	5.98	6.13	4.87	6.68	1.48	2.00	1.29	2.40	1.69	1.70	0.80	2.70
Pu (kip)	46.59	50.12	51.38	46.60	48.21	48.24	50.67	46.15	11.63	19.31	16.23	16.10	16.39	14.94	12.76	18.74

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.77	46.98	47.81	44.95	45.81	45.88	47.31	44.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9491	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.38	25.69	OK	19.31	9.66	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.38	1.47	114.56	OK
Web SPL	25.69	1.47	80.19	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	Cleveland InnerBelt : Field Splice - Node 9447	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE

Field Splice - Node 9447

Node 9447

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9447 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
9447 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9447 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.883	32.50	72.37	47.99	---	62.6	82.3

* Nodes 9447 and 9451 checked using measured Web splice plate thickness, Say OK

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.90	-25.79	-13.60	-22.13	-25.24	-22.20	-12.79	-26.26	-26.77	-30.86	-26.38	-30.77	-14.00	-29.97	-24.24	-20.38
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.34	0.39	0.20	0.33	0.38	0.33	0.19	0.39	0.40	0.46	0.40	0.46	0.21	0.45	0.36	0.31
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.79		-22.13	-25.24			-26.26		-30.86		-30.77		-29.97	-24.24	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-22.90		-13.60			-22.20	-12.79		-26.77		-26.38		-14.00			-20.38
Rcf	1.62		1.62			1.62	1.62		1.62		1.62		1.62			1.62
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.24	-19.27	-10.51	-17.13	-18.99	-16.62	-9.85	-20.14	-13.37	-20.32	-17.24	-16.77	-10.66	-22.80	-18.30	-15.32
Fs (ksi)	-17.24	-19.27	-10.51	-17.13	-18.99	-16.62	-9.85	-20.14	-13.37	-20.32	-17.24	-16.77	-10.66	-22.80	-18.30	-15.32
Fs (kip)	-1379.18	-1541.33	-840.72	-1370.78	-1519.46	-1329.97	-788.28	-1611.19	-1069.60	-1625.60	-1379.38	-1341.45	-852.93	-1824.34	-1464.24	-1225.81

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1519.46	1824.34

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	350.17	161.18	400.23	134.17	231.46	248.48	153.84	382.22	257.70	117.85	293.06	98.76	154.92	248.42	112.66	280.34
Vuw (kip)	525.26	241.78	600.34	201.26	347.20	372.72	230.76	573.32	---	---	---	---	---	---	---	---
Mv (k*ft)	295.46	136.00	337.69	113.21	195.30	209.66	129.80	322.49	144.96	66.29	164.85	55.55	87.14	139.74	63.37	157.69
Huw (kip)	-2596.53	-2143.86	-2562.34	-2104.64	-2784.63	-2765.60	-2163.27	-2473.69	-1095.19	-829.31	-1068.54	-899.80	-1010.70	-1020.31	-1003.97	-1008.77
Muw (k*ft)	245.69	547.47	268.49	573.62	120.29	132.98	534.54	327.59	40.54	132.51	47.37	205.73	139.00	9.48	242.85	59.61
Mu (k*ft)	541.15	683.47	606.18	686.82	315.59	342.64	664.34	650.08	185.49	198.80	212.22	261.28	226.14	149.22	306.22	217.30

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	39.95	32.98	39.42	32.38	42.84	42.55	33.28	38.06	16.85	12.76	16.44	13.84	15.55	15.70	15.45	15.52
PY1 (Vuw)	8.08	3.72	9.24	3.10	5.34	5.73	3.55	8.82	3.96	1.81	4.51	1.52	2.38	3.82	1.73	4.31
PX2 (Mu)	12.49	15.77	13.99	15.85	7.28	7.91	15.33	15.00	4.28	4.59	4.90	6.03	5.22	3.44	7.07	5.01
PY2 (Mu)	4.16	5.26	4.66	5.28	2.43	2.64	5.11	5.00	1.43	1.53	1.63	2.01	1.74	1.15	2.36	1.67
Pu (kip)	53.85	49.57	55.19	48.95	50.72	51.14	49.38	54.83	21.81	17.67	22.20	20.18	21.17	19.78	22.88	21.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	49.01	46.21	50.12	45.75	46.14	46.53	46.02	49.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 494.5

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	600.34
Rr (kip)	1832.45
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	767.08	10.65	OK
BF	2008.27	25.10	OK	915.32	11.44	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.19	27.59	OK	22.88	11.44	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.19	1.47	114.56	OK
Web SPL	27.59	1.47	102.41	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.58	4.35
Web	1.31	1.59	2.08
BF	1.44	1.47	5.41

Plate	Shear	Flexure
Web	3.05	1.25

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.48	-25.21	-11.74	-19.79	-24.28	-21.41	-11.14	-23.85	-15.13	-18.99	-16.43	-20.57	-12.15	-27.23	-23.44	-19.79
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.34	0.38	0.18	0.30	0.36	0.32	0.17	0.36	0.23	0.28	0.25	0.31	0.18	0.41	0.35	0.30
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.21		-19.79	-24.28			-23.85		-18.99		-20.57		-27.23	-23.44	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-22.48		-11.74			-21.41	-11.14		-15.13		-16.43		-12.15			-19.79
Rcf	1.84		1.84			1.84	1.84		1.84		1.84		1.84			1.84
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.52625	-18.34953	-8.629807	-14.58996	-17.79478	-15.66408	-8.204821	-17.45796	-10.60163	-16.85361	-15.52793	-15.10141	-8.922399	-19.84535	-17.20	-14.52
Fs (ksi)	-16.53	-18.35	-8.63	-14.59	-17.79	-15.66	-8.20	-17.46	-10.60	-16.85	-15.53	-15.10	-8.92	-19.85	-17.20	-14.52
Fs (kip)	-1322.10	-1467.96	-690.38	-1167.20	-1423.58	-1253.13	-656.39	-1396.64	-848.13	-1348.29	-1242.23	-1208.11	-713.79	-1587.63	-1376.25	-1161.76

Vu (kip)	350.17	161.18	400.23	134.17	231.46	248.48	153.84	382.22	257.70	117.85	293.06	98.76	154.92	248.42	112.66	280.34
Vuw (kip)	525.26	241.78	600.34	201.26	347.20	372.72	230.76	573.32	---	---	---	---	---	---	---	---
Mv (k*ft)	295.46	136.00	337.69	113.21	195.30	209.66	129.80	322.49	144.96	66.29	164.85	55.55	87.14	139.74	63.37	157.69
Huw (kip)	-2721.83	-2129.67	-2662.70	-2096.51	-2316.52	-2388.38	-2152.50	-2573.58	-1046.27	-696.59	-1003.77	-769.88	-823.66	-918.88	-863.03	-951.75
Muw (k*ft)	162.16	556.93	201.58	579.04	432.37	384.46	541.71	260.99	36.47	119.20	42.61	185.06	125.04	8.53	218.46	53.62
Mu (k*ft)	457.62	692.93	539.27	692.25	627.66	594.12	671.51	583.49	181.42	185.49	207.46	240.62	212.18	148.27	281.83	211.31

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9447**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	41.87	32.76	40.96	32.25	35.64	36.74	33.12	39.59	16.10	10.72	15.44	11.84	12.67	14.14	13.28	14.64
PY1 (Vuw)	8.08	3.72	9.24	3.10	5.34	5.73	3.55	8.82	3.96	1.81	4.51	1.52	2.38	3.82	1.73	4.31
PX2 (Mu)	10.56	15.99	12.44	15.97	14.48	13.71	15.50	13.47	4.19	4.28	4.79	5.55	4.90	3.42	6.50	4.88
PY2 (Mu)	3.52	5.33	4.15	5.32	4.83	4.57	5.17	4.49	1.40	1.43	1.60	1.85	1.63	1.14	2.17	1.63
Pu (kip)	53.70	49.59	55.06	48.96	51.14	51.50	49.39	54.70	20.98	15.34	21.13	17.72	18.02	18.25	20.16	20.40

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	48.72	46.25	49.88	45.77	47.24	47.42	46.04	49.72
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.06	27.53	OK	21.13	10.57	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.06	1.47	114.56	OK
Web SPL	27.53	1.47	102.41	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

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Field Splice - Node 9451

Node 9451

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9451 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
9451 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9451 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	0.883	32.50	72.37	47.99	---	62.6	82.3

* Nodes 9447 and 9451 checked using measured Web splice plate thickness, Say OK

Max Outer to Inner stress ratio
0.90566

N.A. (from I	26.5 in
Outer to Inr	0.9056604
Outer to Inr	0.9056604
Outer to Mi	0.9528302
Outer to Mi	0.9528302

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.22	-21.77	-24.07	-25.52	-25.41	-22.55	-12.23	-25.71	-26.55	-31.13	-26.18	-30.24	-24.41	-20.72	-13.42	-29.42
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.20	0.33	0.36	0.38	0.38	0.34	0.18	0.39	0.40	0.47	0.39	0.45	0.37	0.31	0.20	0.44
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.77		-25.52	-25.41			-25.71		-31.13		-30.24	-24.41			-29.42
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-13.22		-24.07			-22.55	-12.23		-26.55		-26.18			-20.72	-13.42	
Rcf	1.61		1.61			1.61	1.61		1.61		1.61			1.61	1.61	
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.23	-16.88	-18.10	-19.06	-19.12	-16.89	-9.45	-19.75	-17.48	-17.49	-12.93	-19.49	-18.43	-15.58	-10.24	-22.42
Fs (ksi)	-10.23	-16.88	-18.10	-19.06	-19.12	-16.89	-9.45	-19.75	-17.48	-17.49	-12.93	-19.49	-18.43	-15.58	-10.24	-22.42
Fs (kip)	-818.64	-1350.69	-1448.30	-1524.84	-1529.98	-1351.18	-755.77	-1580.38	-1398.16	-1399.35	-1034.49	-1559.47	-1474.18	-1246.68	-819.32	-1793.35

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1529.98	1793.35

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	160.34	372.54	401.91	132.63	249.64	230.87	385.83	154.01	117.72	273.30	294.05	98.14	246.01	151.54	282.69	113.25
Vuw (kip)	240.50	558.81	602.86	198.94	374.46	346.31	578.75	231.01	---	---	---	---	---	---	---	---
Mv (k*ft)	135.28	314.33	339.11	111.91	210.63	194.80	325.55	129.94	66.22	153.73	165.40	55.20	138.38	85.24	159.01	63.70
Huw (kip)	-2120.03	-2643.26	-2569.91	-2072.24	-2762.88	-2744.80	-2481.75	-2129.43	-813.50	-1114.93	-1080.43	-876.06	-1049.07	-972.74	-1020.33	-979.75
Muw (k*ft)	563.36	214.54	263.44	595.22	134.80	146.84	322.21	557.09	133.01	19.14	44.70	206.15	0.30	131.25	56.87	243.51
Mu (k*ft)	698.65	528.87	602.54	707.12	345.43	341.64	647.76	687.03	199.23	172.87	210.10	261.36	138.68	216.49	215.89	307.21

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.62	40.67	39.54	31.88	42.51	42.23	38.18	32.76	12.52	17.15	16.62	13.48	16.14	14.97	15.70	15.07
PY1 (Vuw)	3.70	8.60	9.27	3.06	5.76	5.33	8.90	3.55	1.81	4.20	4.52	1.51	3.78	2.33	4.35	1.74
PX2 (Mu)	16.12	12.20	13.90	16.32	7.97	7.88	14.95	15.85	4.60	3.99	4.85	6.03	3.20	5.00	4.98	7.09
PY2 (Mu)	5.37	4.07	4.63	5.44	2.66	2.63	4.98	5.28	1.53	1.33	1.62	2.01	1.07	1.67	1.66	2.36
Pu (kip)	49.58	54.37	55.22	48.94	51.17	50.74	54.91	49.41	17.44	21.85	22.33	19.82	19.94	20.36	21.53	22.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.25	49.36	50.14	45.80	46.56	46.22	50.01	46.10
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 494.5

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	602.86
Rr (kip)	1832.45
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/24/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	6/18/2012
For	**Cleveland InnerBelt : Field Splice - Node 9451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	6/18/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	772.39	10.73	OK
BF	2008.27	25.10	OK	899.78	11.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.22	27.61	OK	22.54	11.27	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.22	1.47	114.56	OK
Web SPL	27.61	1.47	102.41	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.57	4.35
Web	1.31	1.60	2.08
BF	1.44	1.50	5.41

Plate	Shear	Flexure
Web	3.04	1.25

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.71	-19.77	-23.15	-24.51	-24.20	-21.50	-11.09	-23.81	-16.34	-20.66	-15.06	-18.89	-23.39	-19.92	-12.11	-27.21
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.18	0.30	0.35	0.37	0.36	0.32	0.17	0.36	0.24	0.31	0.23	0.28	0.35	0.30	0.18	0.41
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-19.77		-24.51	-24.20			-23.81		-20.66		-18.89	-23.39			-27.21
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-11.71		-23.15			-21.50	-11.09		-16.34		-15.06			-19.92	-12.11	
Rcf	1.84		1.84			1.84	1.84		1.84		1.84			1.84	1.84	
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.601133	-14.58368	-16.99448	-17.8552	-17.74014	-15.72962	-8.163048	-17.43536	-15.34028	-15.35366	-10.26914	-16.17226	-17.16807	-14.60997	-8.89	-19.84
Fs (ksi)	-8.60	-14.58	-16.99	-17.86	-17.74	-15.73	-8.16	-17.44	-15.34	-15.35	-10.27	-16.17	-17.17	-14.61	-8.89	-19.84
Fs (kip)	-688.09	-1166.69	-1359.56	-1428.42	-1419.21	-1258.37	-653.04	-1394.83	-1227.22	-1228.29	-821.53	-1293.78	-1373.45	-1168.80	-710.91	-1587.11

Vu (kip)	160.34	372.54	401.91	132.63	249.64	230.87	385.83	154.01	117.72	273.30	294.05	98.14	246.01	151.54	282.69	113.25
Vuw (kip)	240.50	558.81	602.86	198.94	374.46	346.31	578.75	231.01	---	---	---	---	---	---	---	---
Mv (k*ft)	135.28	314.33	339.11	111.91	210.63	194.80	325.55	129.94	66.22	153.73	165.40	55.20	138.38	85.24	159.01	63.70
Huw (kip)	-2128.28	-2759.21	-2668.51	-2094.08	-2383.84	-2313.11	-2581.10	-2150.55	-695.54	-1045.49	-1004.09	-767.95	-920.82	-793.24	-953.34	-861.76
Muw (k*ft)	557.86	137.24	197.71	580.66	387.48	434.64	255.98	543.01	119.65	17.21	40.21	185.45	0.27	118.06	51.16	219.05
Mu (k*ft)	693.14	451.57	536.81	692.57	598.12	629.44	581.53	672.96	185.87	170.94	205.61	240.65	138.65	203.30	210.17	282.75

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9451**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.74	42.45	41.05	32.22	36.67	35.59	39.71	33.09	10.70	16.08	15.45	11.81	14.17	12.20	14.67	13.26
PY1 (Vuw)	3.70	8.60	9.27	3.06	5.76	5.33	8.90	3.55	1.81	4.20	4.52	1.51	3.78	2.33	4.35	1.74
PX2 (Mu)	16.00	10.42	12.39	15.98	13.80	14.53	13.42	15.53	4.29	3.94	4.74	5.55	3.20	4.69	4.85	6.52
PY2 (Mu)	5.33	3.47	4.13	5.33	4.60	4.84	4.47	5.18	1.43	1.31	1.58	1.85	1.07	1.56	1.62	2.17
Pu (kip)	49.57	54.23	55.10	48.92	51.53	51.13	54.79	49.39	15.34	20.78	21.10	17.69	18.03	17.34	20.41	20.17

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.23	49.09	49.90	45.74	47.46	47.24	49.78	46.05
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.10	27.55	OK	21.10	10.55	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.10	1.47	114.56	OK
Web SPL	27.55	1.47	102.41	OK

Field Splice

Type EE2

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1447

Node 1447

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1447 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
1447 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1447 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.61	-25.85	-13.26	-20.37	-27.80	-22.33	-12.23	-24.29	-28.79	-30.90	-26.16	-29.09	-13.31	-27.68	-26.77	-20.49
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.38	0.39	0.20	0.31	0.42	0.33	0.18	0.36	0.43	0.46	0.39	0.44	0.20	0.41	0.40	0.31
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.85		-20.37	-27.80			-24.29		-30.90		-29.09		-27.68	-26.77	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-25.61		-13.26			-22.33	-12.23		-28.79		-26.16		-13.31			-20.49
Rcf	1.62		1.62			1.62	1.62		1.62		1.62		1.62			1.62
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.29	-19.31	-10.39	-15.86	-20.93	-16.73	-9.58	-18.71	-19.06	-17.55	-12.56	-17.57	-10.30	-21.15	-20.22	-15.41
Fs (ksi)	-19.29	-19.31	-10.39	-15.86	-20.93	-16.73	-9.58	-18.71	-19.06	-17.55	-12.56	-17.57	-10.30	-21.15	-20.22	-15.41
Fs (kip)	-1542.82	-1545.12	-831.43	-1268.64	-1674.35	-1338.17	-766.43	-1496.96	-1525.19	-1403.85	-1004.91	-1405.40	-823.83	-1691.95	-1617.34	-1232.90

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1674.35	1691.95

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	370.55	172.39	420.94	145.18	265.45	241.54	165.39	403.24	272.28	126.81	307.88	107.59	259.96	157.39	121.86	295.37
Vuw (kip)	555.82	258.58	631.41	217.77	398.18	362.31	248.08	604.85	---	---	---	---	---	---	---	---
Mv (k*ft)	312.65	145.45	355.17	122.50	223.97	203.80	139.54	340.23	153.16	71.33	173.18	60.52	146.23	88.53	68.55	166.15
Huw (kip)	-2726.78	-2126.87	-2567.41	-2076.91	-2881.11	-2753.30	-2129.02	-2477.90	-1157.97	-787.53	-1129.69	-848.77	-1098.39	-903.87	-943.42	-1068.84
Muw (k*ft)	158.86	558.80	265.11	592.11	55.97	141.18	557.37	324.78	0.58	109.30	84.04	182.63	30.33	100.12	217.03	96.11
Mu (k*ft)	471.51	704.25	620.27	714.61	279.95	344.97	696.91	665.01	153.73	180.63	257.23	243.15	176.56	188.65	285.58	262.26

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	41.95	32.72	39.50	31.95	44.32	42.36	32.75	38.12	17.81	12.12	17.38	13.06	16.90	13.91	14.51	16.44
PY1 (Vuw)	8.55	3.98	9.71	3.35	6.13	5.57	3.82	9.31	4.19	1.95	4.74	1.66	4.00	2.42	1.87	4.54
PX2 (Mu)	10.88	16.25	14.31	16.49	6.46	7.96	16.08	15.35	3.55	4.17	5.94	5.61	4.07	4.35	6.59	6.05
PY2 (Mu)	3.63	5.42	4.77	5.50	2.15	2.65	5.36	5.12	1.18	1.39	1.98	1.87	1.36	1.45	2.20	2.02
Pu (kip)	54.22	49.87	55.73	49.24	51.46	50.99	49.69	55.38	22.03	16.62	24.26	19.00	21.65	18.67	21.49	23.43

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.35	41.02	44.59	40.63	41.13	40.96	40.89	44.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	631.41
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	845.27	11.74	OK
BF	2008.27	25.10	OK	848.90	10.61	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.73	27.86	OK	24.26	12.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.73	1.47	114.56	OK
Web SPL	27.86	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.43	4.35
Web	1.30	1.52	2.06
BF	1.44	1.59	5.41

Plate	Shear	Flexure
Web	2.60	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.76	-23.99	-12.32	-19.03	-25.45	-20.29	-11.71	-23.09	-17.51	-19.50	-15.56	-18.33	-12.80	-26.37	-24.63	-18.70
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.36	0.36	0.18	0.29	0.38	0.30	0.18	0.35	0.26	0.29	0.23	0.27	0.19	0.40	0.37	0.28
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-23.99		-19.03	-25.45			-23.09		-19.50		-18.33		-26.37	-24.63	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-23.76		-12.32			-20.29	-11.71		-17.51		-15.56		-12.80			-18.70
Rcf	1.90		1.90			1.90	1.90		1.90		1.90		1.90			1.90
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.44137	-17.46724	-9.096025	-14.01217	-18.63384	-14.85371	-8.664938	-16.87933	-16.34855	-14.98416	-10.52046	-15.02381	-9.431772	-19.19331	-18.06	-13.74
Fs (ksi)	-17.44	-17.47	-9.10	-14.01	-18.63	-14.85	-8.66	-16.88	-16.35	-14.98	-10.52	-15.02	-9.43	-19.19	-18.06	-13.74
Fs (kip)	-1395.31	-1397.38	-727.68	-1120.97	-1490.71	-1188.30	-693.20	-1350.35	-1307.88	-1198.73	-841.64	-1201.91	-754.54	-1535.46	-1444.65	-1098.82

Vu (kip)	370.55	172.39	420.94	145.18	265.45	241.54	165.39	403.24	272.28	126.81	307.88	107.59	259.96	157.39	121.86	295.37
Vuw (kip)	555.82	258.58	631.41	217.77	398.18	362.31	248.08	604.85	---	---	---	---	---	---	---	---
Mv (k*ft)	312.65	145.45	355.17	122.50	223.97	203.80	139.54	340.23	153.16	71.33	173.18	60.52	146.23	88.53	68.55	166.15
Huw (kip)	-2835.02	-2184.05	-2637.38	-2149.31	-2479.08	-2368.53	-2211.10	-2547.26	-1047.26	-693.25	-1004.63	-766.33	-939.98	-766.33	-858.75	-953.80
Muw (k*ft)	86.70	520.68	218.46	543.84	323.99	397.69	502.65	278.54	0.52	98.32	75.60	164.29	27.29	90.07	195.23	86.46
Mu (k*ft)	399.35	666.13	573.63	666.33	547.97	601.49	642.19	618.77	153.67	169.65	248.79	224.81	173.52	178.60	263.78	252.60

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1447**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	43.62	33.60	40.58	33.07	38.14	36.44	34.02	39.19	16.11	10.67	15.46	11.79	14.46	11.79	13.21	14.67
PY1 (Vuw)	8.55	3.98	9.71	3.35	6.13	5.57	3.82	9.31	4.19	1.95	4.74	1.66	4.00	2.42	1.87	4.54
PX2 (Mu)	9.22	15.37	13.24	15.38	12.65	13.88	14.82	14.28	3.55	3.92	5.74	5.19	4.00	4.12	6.09	5.83
PY2 (Mu)	3.07	5.12	4.41	5.13	4.22	4.63	4.94	4.76	1.18	1.31	1.91	1.73	1.33	1.37	2.03	1.94
Pu (kip)	54.09	49.81	55.64	49.18	51.83	51.34	49.62	55.29	20.38	14.94	22.22	17.31	19.22	16.36	19.69	21.51

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.13	40.90	44.45	40.48	41.97	41.77	40.72	44.32
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.64	27.82	OK	22.22	11.11	OK

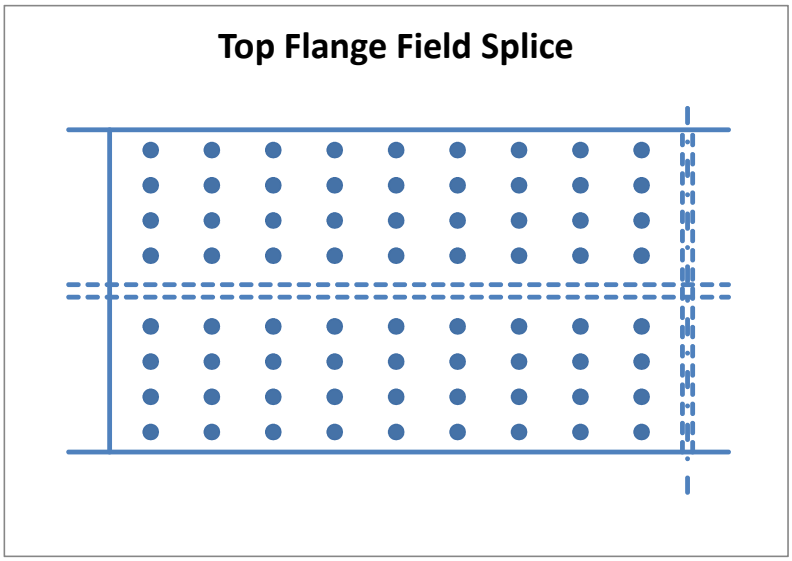
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.64	1.47	114.56	OK
Web SPL	27.82	1.47	91.65	OK

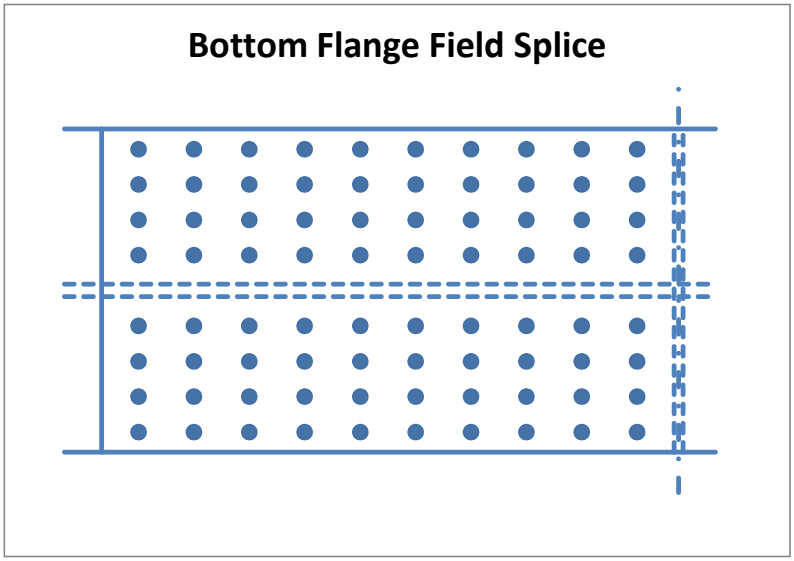
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1447	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1447

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0	21	0
21	3.5	21	3.5
21	7	21	7

	Top Flange		Bottom Flange	
No. Bolts =	72.0		80.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		9.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5	21	10.5
21	17.5	21	17.5
21	21	21	21
21	24.5	21	24.5
21	28	21	28
24	0	24	0
24	3.5	24	3.5
24	7	24	7
24	10.5	24	10.5
24	17.5	24	17.5
24	21	24	21
24	24.5	24	24.5
24	28	24	28
		27	0
		27	3.5
		27	7
		27	10.5
		27	17.5
		27	21
		27	24.5
		27	28

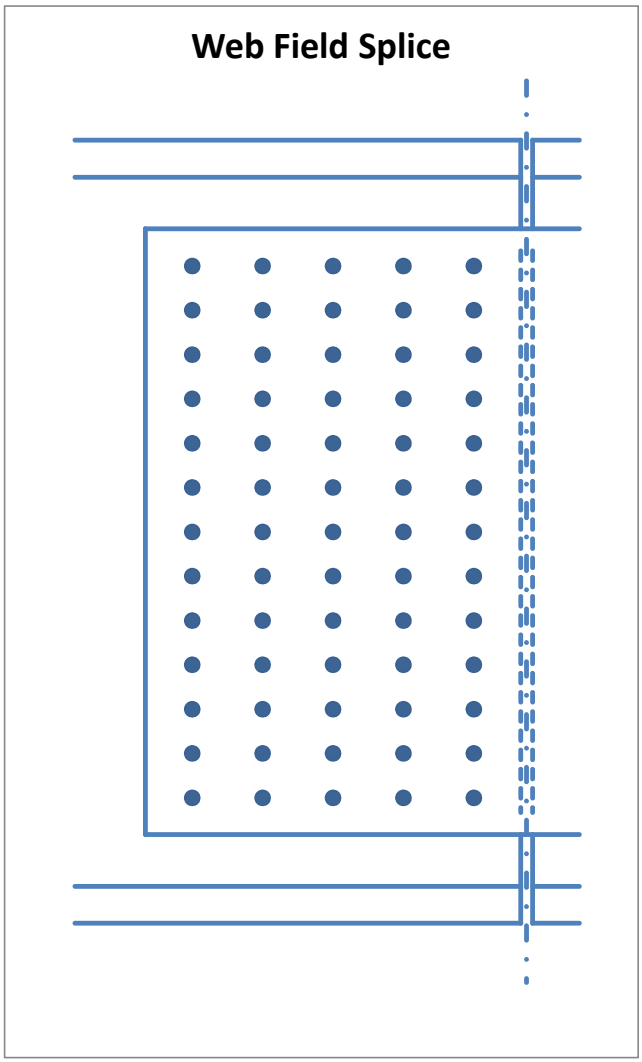
Flange Bolt Pattern Cont. - Node 1447

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1447	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1447

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1447

Web Bolt Pattern Cont. - Node 1447

390	1170	1170	8190

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3447	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE2

Field Splice - Node 3447

Node 3447

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3447 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
3447 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3447 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.65	-25.37	-14.43	-21.96	-27.19	-22.50	-13.40	-25.80	-29.02	-31.67	-27.76	-31.16	-13.94	-28.05	-26.99	-21.76
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.38	0.38	0.22	0.33	0.41	0.34	0.20	0.39	0.44	0.47	0.42	0.47	0.21	0.42	0.40	0.33
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)	-25.65			-21.96	-27.19			-25.80		-31.67		-31.16		-28.05	-26.99	
Fcf (ksi)	-50.03			-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)	-4002.70			-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)		-25.37	-14.43			-22.50	-13.40		-29.02		-27.76		-13.94			-21.76
Rcf		1.58	1.58			1.58	1.58		1.58		1.58		1.58			1.58
Fncf (ksi)		-50.03	-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)		-4002.70	-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.05	-18.72	-10.82	-16.61	-20.21	-16.61	-10.00	-19.41	-18.44	-18.56	-14.77	-18.45	-10.35	-21.03	-20.08	-16.08
Fs (ksi)	-19.05	-18.72	-10.82	-16.61	-20.21	-16.61	-10.00	-19.41	-18.44	-18.56	-14.77	-18.45	-10.35	-21.03	-20.08	-16.08
Fs (kip)	-1523.76	-1497.46	-865.24	-1328.64	-1616.80	-1329.16	-800.03	-1552.58	-1474.88	-1485.11	-1181.28	-1476.04	-828.35	-1682.20	-1606.23	-1286.67

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1616.80	1682.20

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	396.18	196.69	430.28	169.29	275.15	263.52	183.31	422.72	289.86	143.29	313.95	123.93	257.48	196.72	133.84	308.61
Vuw (kip)	594.27	295.04	645.42	253.93	412.73	395.28	274.97	634.08	---	---	---	---	---	---	---	---
Mv (k*ft)	334.28	165.96	363.05	142.83	232.16	222.34	154.67	356.67	163.05	80.60	176.60	69.71	144.83	110.65	75.29	173.59
Huw (kip)	-2685.11	-2166.58	-2549.10	-2117.56	-2858.19	-2798.38	-2143.30	-2514.09	-1132.96	-822.70	-1104.74	-882.23	-1110.00	-996.50	-941.46	-1084.84
Muw (k*ft)	186.64	532.33	277.31	565.01	71.26	111.13	547.85	300.65	6.57	115.85	71.91	188.14	2.56	73.69	213.46	79.89
Mu (k*ft)	520.92	698.29	640.36	707.84	303.41	333.47	702.52	657.32	169.62	196.45	248.51	257.85	147.39	184.34	288.75	253.48

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	41.31	33.33	39.22	32.58	43.97	43.05	32.97	38.68	17.43	12.66	17.00	13.57	17.08	15.33	14.48	16.69
PY1 (Vuw)	9.14	4.54	9.93	3.91	6.35	6.08	4.23	9.76	4.46	2.20	4.83	1.91	3.96	3.03	2.06	4.75
PX2 (Mu)	12.02	16.11	14.78	16.33	7.00	7.70	16.21	15.17	3.91	4.53	5.73	5.95	3.40	4.25	6.66	5.85
PY2 (Mu)	4.01	5.37	4.93	5.44	2.33	2.57	5.40	5.06	1.30	1.51	1.91	1.98	1.13	1.42	2.22	1.95
Pu (kip)	54.93	50.43	56.00	49.80	51.71	51.48	50.12	55.85	22.11	17.59	23.71	19.91	21.10	20.08	21.58	23.51

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.90	41.38	44.80	40.98	41.35	41.27	41.18	44.74
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	645.42
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	816.22	11.34	OK
BF	2008.27	25.10	OK	844.01	10.55	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.00	28.00	OK	23.71	11.85	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.00	1.47	114.56	OK
Web SPL	28.00	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.48	4.35
Web	1.30	1.48	2.05
BF	1.44	1.60	5.41

Plate	Shear	Flexure
Web	2.54	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.97	-24.70	-13.87	-20.98	-26.15	-21.72	-13.19	-24.90	-18.17	-20.67	-17.20	-20.41	-13.90	-27.22	-25.80	-20.86
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.37	0.37	0.21	0.31	0.39	0.33	0.20	0.37	0.27	0.31	0.26	0.31	0.21	0.41	0.39	0.31
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)	-24.97			-20.98	-26.15			-24.90		-20.67		-20.41		-27.22	-25.80	
Fcf (ksi)	-50.03			-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)	-4002.70			-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)		-24.70	-13.87			-21.72	-13.19		-18.17		-17.20		-13.90			-20.86
Rcf		1.84	1.84			1.84	1.84		1.84		1.84		1.84			1.84
Fncf (ksi)		-50.03	-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)		-4002.70	-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.28058	-17.98489	-10.16496	-15.37556	-19.11329	-15.87894	-9.681633	-18.14371	-16.32331	-16.43832	-12.95197	-16.26641	-10.18086	-19.78202	-18.86	-15.27
Fs (ksi)	-18.28	-17.98	-10.16	-15.38	-19.11	-15.88	-9.68	-18.14	-16.32	-16.44	-12.95	-16.27	-10.18	-19.78	-18.86	-15.27
Fs (kip)	-1462.45	-1438.79	-813.20	-1230.04	-1529.06	-1270.32	-774.53	-1451.50	-1305.86	-1315.07	-1036.16	-1301.31	-814.47	-1582.56	-1509.09	-1221.64

Vu (kip)	396.18	196.69	430.28	169.29	275.15	263.52	183.31	422.72	289.86	143.29	313.95	123.93	257.48	196.72	133.84	308.61
Vuw (kip)	594.27	295.04	645.42	253.93	412.73	395.28	274.97	634.08	---	---	---	---	---	---	---	---
Mv (k*ft)	334.28	165.96	363.05	142.83	232.16	222.34	154.67	356.67	163.05	80.60	176.60	69.71	144.83	110.65	75.29	173.59
Huw (kip)	-2844.96	-2247.65	-2680.56	-2209.92	-2484.81	-2430.98	-2248.89	-2633.06	-1087.96	-766.22	-1049.77	-834.76	-982.85	-876.55	-898.89	-1024.02
Muw (k*ft)	80.08	478.28	189.67	503.44	320.18	356.06	477.46	221.34	5.91	104.21	64.69	169.24	2.30	66.29	192.02	71.86
Mu (k*ft)	414.35	644.24	552.72	646.27	552.33	578.40	632.13	578.01	168.96	184.81	241.28	238.95	147.13	176.94	267.31	245.46

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	43.77	34.58	41.24	34.00	38.23	37.40	34.60	40.51	16.74	11.79	16.15	12.84	15.12	13.49	13.83	15.75
PY1 (Vuw)	9.14	4.54	9.93	3.91	6.35	6.08	4.23	9.76	4.46	2.20	4.83	1.91	3.96	3.03	2.06	4.75
PX2 (Mu)	9.56	14.87	12.76	14.91	12.75	13.35	14.59	13.34	3.90	4.26	5.57	5.51	3.40	4.08	6.17	5.66
PY2 (Mu)	3.19	4.96	4.25	4.97	4.25	4.45	4.86	4.45	1.30	1.42	1.86	1.84	1.13	1.36	2.06	1.89
Pu (kip)	54.74	50.35	55.83	49.71	52.06	51.83	50.02	55.69	21.43	16.46	22.72	18.73	19.20	18.11	20.42	22.42

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.57	41.21	44.53	40.79	42.13	42.03	40.96	44.49
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.83	27.91	OK	22.72	11.36	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.83	1.47	114.56	OK
Web SPL	27.91	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5447	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5447

Node 5447

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5447 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
5447 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5447 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.53	-25.74	-15.07	-22.62	-26.39	-22.62	-14.18	-26.44	-29.13	-32.10	-27.70	-31.54	-14.65	-28.69	-26.33	-21.84
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.38	0.39	0.23	0.34	0.40	0.34	0.21	0.40	0.44	0.48	0.42	0.47	0.22	0.43	0.39	0.33
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.74		-22.62	-26.39			-26.44		-32.10		-31.54		-28.69	-26.33	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-25.53		-15.07			-22.62	-14.18		-29.13		-27.70		-14.65			-21.84
Rcf	1.56		1.56			1.56	1.56		1.56		1.56		1.56			1.56
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.71	-18.75	-10.83	-16.65	-19.35	-16.45	-10.12	-19.43	-15.62	-20.22	-16.01	-17.52	-10.42	-21.06	-19.35	-15.92
Fs (ksi)	-18.71	-18.75	-10.83	-16.65	-19.35	-16.45	-10.12	-19.43	-15.62	-20.22	-16.01	-17.52	-10.42	-21.06	-19.35	-15.92
Fs (kip)	-1496.46	-1500.23	-866.63	-1332.39	-1548.05	-1316.27	-809.77	-1554.78	-1249.65	-1617.42	-1280.99	-1401.28	-833.68	-1684.61	-1548.14	-1273.42

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1548.14	1684.61

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	399.68	206.29	429.37	175.91	276.70	268.31	189.06	420.33	292.16	149.69	313.14	128.23	211.50	232.90	137.52	306.75
Vuw (kip)	599.52	309.43	644.06	263.87	415.05	402.46	283.59	630.49	---	---	---	---	---	---	---	---
Mv (k*ft)	337.23	174.05	362.28	148.43	233.46	226.39	159.52	354.65	164.34	84.20	176.14	72.13	118.97	131.01	77.36	172.55
Huw (kip)	-2676.43	-2187.37	-2540.30	-2145.75	-2844.62	-2777.81	-2167.58	-2503.88	-1123.76	-824.63	-1074.12	-886.71	-1075.15	-1005.85	-944.36	-1058.08
Muw (k*ft)	192.43	518.47	283.18	546.21	80.30	124.84	531.66	307.46	0.94	116.44	57.94	186.25	91.94	30.07	212.73	68.68
Mu (k*ft)	529.66	692.52	645.46	694.64	313.77	351.22	691.18	662.11	165.28	200.64	234.08	258.38	210.91	161.08	290.09	241.23

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	41.18	33.65	39.08	33.01	43.76	42.74	33.35	38.52	17.29	12.69	16.52	13.64	16.54	15.47	14.53	16.28
PY1 (Vuw)	9.22	4.76	9.91	4.06	6.39	6.19	4.36	9.70	4.49	2.30	4.82	1.97	3.25	3.58	2.12	4.72
PX2 (Mu)	12.22	15.98	14.90	16.03	7.24	8.11	15.95	15.28	3.81	4.63	5.40	5.96	4.87	3.72	6.69	5.57
PY2 (Mu)	4.07	5.33	4.97	5.34	2.41	2.70	5.32	5.09	1.27	1.54	1.80	1.99	1.62	1.24	2.23	1.86
Pu (kip)	55.03	50.65	55.99	49.94	51.76	51.61	50.24	55.80	21.88	17.74	22.90	20.00	21.96	19.79	21.66	22.81

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.98	41.51	44.80	41.04	41.41	41.40	41.24	44.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	644.06
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	781.56	10.85	OK
BF	2008.27	25.10	OK	845.22	10.57	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.99	27.99	OK	22.90	11.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.99	1.47	114.56	OK
Web SPL	27.99	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.55	4.35
Web	1.30	1.49	2.05
BF	1.44	1.59	5.41

Plate	Shear	Flexure
Web	2.55	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.07	-25.27	-14.46	-21.58	-26.10	-22.54	-13.57	-25.13	-18.23	-21.03	-17.67	-21.29	-14.26	-27.51	-25.85	-21.61
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.38	0.38	0.22	0.32	0.39	0.34	0.20	0.38	0.27	0.32	0.26	0.32	0.21	0.41	0.39	0.32
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.27		-21.58	-26.10			-25.13		-21.03		-21.29		-27.51	-25.85	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-25.07		-14.46			-22.54	-13.57		-18.23		-17.67		-14.26			-21.61
Rcf	1.82		1.82			1.82	1.82		1.82		1.82		1.82			1.82
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.34045	-18.38285	-10.56343	-15.80059	-19.06703	-16.46087	-9.932686	-18.30989	-14.05639	-18.1918	-14.86876	-16.22134	-10.42142	-19.98966	-18.89	-15.80
Fs (ksi)	-18.34	-18.38	-10.56	-15.80	-19.07	-16.46	-9.93	-18.31	-14.06	-18.19	-14.87	-16.22	-10.42	-19.99	-18.89	-15.80
Fs (kip)	-1467.24	-1470.63	-845.07	-1264.05	-1525.36	-1316.87	-794.61	-1464.79	-1124.51	-1455.34	-1189.50	-1297.71	-833.71	-1599.17	-1511.10	-1263.97

Vu (kip)	399.68	206.29	429.37	175.91	276.70	268.31	189.06	420.33	292.16	149.69	313.14	128.23	211.50	232.90	137.52	306.75
Vuw (kip)	599.52	309.43	644.06	263.87	415.05	402.46	283.59	630.49	---	---	---	---	---	---	---	---
Mv (k*ft)	337.23	174.05	362.28	148.43	233.46	226.39	159.52	354.65	164.34	84.20	176.14	72.13	118.97	131.01	77.36	172.55
Huw (kip)	-2850.43	-2271.64	-2712.67	-2222.93	-2477.21	-2446.65	-2260.67	-2661.60	-1101.70	-790.92	-1065.84	-847.28	-967.45	-932.70	-912.33	-1040.65
Muw (k*ft)	76.42	462.29	168.27	494.76	325.24	345.61	469.60	202.31	0.85	104.74	52.12	167.54	82.71	27.05	191.36	61.78
Mu (k*ft)	413.65	636.34	530.55	643.19	558.71	572.00	629.12	556.96	165.19	188.94	228.26	239.68	201.68	158.06	268.72	234.33

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	43.85	34.95	41.73	34.20	38.11	37.64	34.78	40.95	16.95	12.17	16.40	13.04	14.88	14.35	14.04	16.01
PY1 (Vuw)	9.22	4.76	9.91	4.06	6.39	6.19	4.36	9.70	4.49	2.30	4.82	1.97	3.25	3.58	2.12	4.72
PX2 (Mu)	9.55	14.68	12.24	14.84	12.89	13.20	14.52	12.85	3.81	4.36	5.27	5.53	4.65	3.65	6.20	5.41
PY2 (Mu)	3.18	4.89	4.08	4.95	4.30	4.40	4.84	4.28	1.27	1.45	1.76	1.84	1.55	1.22	2.07	1.80
Pu (kip)	54.82	50.56	55.76	49.86	52.11	51.93	50.15	55.59	21.55	16.95	22.64	18.95	20.12	18.63	20.66	22.39

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.62	41.33	44.44	40.88	42.17	42.09	41.04	44.39
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.76	27.88	OK	22.64	11.32	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.76	1.47	114.56	OK
Web SPL	27.88	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7447	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7447

Node 7447

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7447 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
7447 R	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7447 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.07	-25.90	-14.79	-22.97	-25.97	-22.41	-13.99	-27.05	-28.44	-32.05	-27.34	-31.39	-14.60	-29.48	-25.48	-21.39
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.38	0.39	0.22	0.34	0.39	0.34	0.21	0.41	0.43	0.48	0.41	0.47	0.22	0.44	0.38	0.32
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.90		-22.97	-25.97			-27.05		-32.05		-31.39		-29.48	-25.48	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-25.07		-14.79			-22.41	-13.99		-28.44		-27.34		-14.60			-21.39
Rcf	1.56		1.56			1.56	1.56		1.56		1.56		1.56			1.56
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.13	-18.64	-10.97	-17.31	-19.00	-16.26	-10.33	-20.27	-14.98	-20.01	-17.56	-17.68	-10.73	-22.02	-18.86	-15.72
Fs (ksi)	-18.13	-18.64	-10.97	-17.31	-19.00	-16.26	-10.33	-20.27	-14.98	-20.01	-17.56	-17.68	-10.73	-22.02	-18.86	-15.72
Fs (kip)	-1450.38	-1491.52	-878.00	-1384.68	-1520.27	-1300.73	-826.02	-1621.73	-1198.19	-1601.00	-1405.12	-1414.33	-858.17	-1761.87	-1509.02	-1257.95

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1520.27	1761.87

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	383.53	189.46	417.17	161.71	257.71	262.45	175.02	409.45	280.77	137.56	304.54	117.95	187.77	254.93	127.36	299.09
Vuw (kip)	575.29	284.18	625.76	242.56	386.56	393.68	262.53	614.17	---	---	---	---	---	---	---	---
Mv (k*ft)	323.60	159.85	351.99	136.44	217.44	221.44	147.67	345.47	157.94	77.38	171.31	66.35	105.62	143.40	71.64	168.24
Huw (kip)	-2656.30	-2174.96	-2531.98	-2137.51	-2814.06	-2763.01	-2166.24	-2484.15	-1103.21	-848.51	-1057.87	-917.91	-1049.70	-1057.29	-982.51	-1037.61
Muw (k*ft)	205.84	526.74	288.72	551.71	100.68	134.71	532.55	320.61	10.29	126.67	54.89	198.93	100.70	2.30	225.92	62.77
Mu (k*ft)	529.45	686.59	640.71	688.15	318.11	356.15	680.23	666.08	168.22	204.05	226.19	265.28	206.32	145.70	297.56	231.00

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	40.87	33.46	38.95	32.88	43.29	42.51	33.33	38.22	16.97	13.05	16.27	14.12	16.15	16.27	15.12	15.96
PY1 (Vuw)	8.85	4.37	9.63	3.73	5.95	6.06	4.04	9.45	4.32	2.12	4.69	1.81	2.89	3.92	1.96	4.60
PX2 (Mu)	12.22	15.84	14.79	15.88	7.34	8.22	15.70	15.37	3.88	4.71	5.22	6.12	4.76	3.36	6.87	5.33
PY2 (Mu)	4.07	5.28	4.93	5.29	2.45	2.74	5.23	5.12	1.29	1.57	1.74	2.04	1.59	1.12	2.29	1.78
Pu (kip)	54.63	50.24	55.68	49.59	51.33	51.48	49.89	55.53	21.60	18.14	22.43	20.61	21.38	20.27	22.39	22.23

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.73	41.23	44.60	40.80	41.13	41.32	40.99	44.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	625.76
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 7447**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	767.49	10.66	OK
BF	2008.27	25.10	OK	883.98	11.05	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.68	27.84	OK	22.43	11.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.68	1.47	114.56	OK
Web SPL	27.84	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.58	4.35
Web	1.30	1.52	2.07
BF	1.44	1.52	5.41

Plate	Shear	Flexure
Web	2.62	1.13

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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.36	-25.15	-13.54	-21.26	-25.53	-22.17	-12.85	-25.18	-17.08	-20.49	-17.42	-21.23	-13.51	-27.55	-25.17	-21.30
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.37	0.38	0.20	0.32	0.38	0.33	0.19	0.38	0.26	0.31	0.26	0.32	0.20	0.41	0.38	0.32
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-25.15		-21.26	-25.53			-25.18		-20.49		-21.23		-27.55	-25.17	
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03		-50.03	-50.03	
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70		-4002.70	-4002.70	
fncf (ksi)	-24.36		-13.54			-22.17	-12.85		-17.08		-17.42		-13.51			-21.30
Rcf	1.82		1.82			1.82	1.82		1.82		1.82		1.82			1.82
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03		-50.03			-50.03
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70		-4002.70			-4002.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.84646	-18.30911	-9.895519	-15.59289	-18.66847	-16.19986	-9.414572	-18.3619	-12.66095	-17.19032	-16.13267	-16.23614	-9.874187	-20.03575	-18.41	-15.59
Fs (ksi)	-17.85	-18.31	-9.90	-15.59	-18.67	-16.20	-9.41	-18.36	-12.66	-17.19	-16.13	-16.24	-9.87	-20.04	-18.41	-15.59
Fs (kip)	-1427.72	-1464.73	-791.64	-1247.43	-1493.48	-1295.99	-753.17	-1468.95	-1012.88	-1375.23	-1290.61	-1298.89	-789.93	-1602.86	-1473.03	-1247.18

Vu (kip)	383.53	189.46	417.17	161.71	257.71	262.45	175.02	409.45	280.77	137.56	304.54	117.95	187.77	254.93	127.36	299.09
Vuw (kip)	575.29	284.18	625.76	242.56	386.56	393.68	262.53	614.17	---	---	---	---	---	---	---	---
Mv (k*ft)	323.60	159.85	351.99	136.44	217.44	221.44	147.67	345.47	157.94	77.38	171.31	66.35	105.62	143.40	71.64	168.24
Huw (kip)	-2810.00	-2220.01	-2690.31	-2182.92	-2412.94	-2431.48	-2218.36	-2643.26	-1084.67	-764.65	-1046.05	-833.29	-895.54	-971.06	-897.30	-1020.08
Muw (k*ft)	103.38	496.71	183.18	521.43	368.09	355.72	497.80	214.54	9.25	113.95	49.37	178.95	90.59	2.07	203.23	56.46
Mu (k*ft)	426.99	656.56	535.16	657.87	585.53	577.17	645.48	560.01	167.19	191.32	220.68	245.29	196.21	145.47	274.87	224.70

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7447	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	43.23	34.15	41.39	33.58	37.12	37.41	34.13	40.67	16.69	11.76	16.09	12.82	13.78	14.94	13.80	15.69
PY1 (Vuw)	8.85	4.37	9.63	3.73	5.95	6.06	4.04	9.45	4.32	2.12	4.69	1.81	2.89	3.92	1.96	4.60
PX2 (Mu)	9.85	15.15	12.35	15.18	13.51	13.32	14.90	12.92	3.86	4.42	5.09	5.66	4.53	3.36	6.34	5.19
PY2 (Mu)	3.28	5.05	4.12	5.06	4.50	4.44	4.97	4.31	1.29	1.47	1.70	1.89	1.51	1.12	2.11	1.73
Pu (kip)	54.45	50.20	55.47	49.55	51.70	51.80	49.84	55.33	21.30	16.57	22.13	18.85	18.83	18.98	20.56	21.82

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.41	41.13	44.27	40.71	41.97	42.01	40.88	44.23
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.47	27.73	OK	22.13	11.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.47	1.47	114.56	OK
Web SPL	27.73	1.47	91.65	OK

Field Splice - Node 1451

Node 1451

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1451 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
1451 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1451 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.40	-20.57	-25.90	-25.04	-27.30	-22.25	-12.34	-24.41	-26.14	-29.24	-28.31	-30.55	-26.27	-20.23	-13.44	-27.91
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.20	0.31	0.39	0.38	0.41	0.33	0.18	0.37	0.39	0.44	0.42	0.46	0.39	0.30	0.20	0.42
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-20.57	-25.90		-27.30			-24.41		-29.24		-30.55	-26.27			-27.91
Fcf (ksi)		-50.03	-50.03		-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70	-4002.70		-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-13.40			-25.04		-22.25	-12.34		-26.14		-28.31			-20.23	-13.44	
Rcf	1.64			1.64		1.64	1.64		1.64		1.64			1.64	1.64	
Fncf (ksi)	-50.03			-50.03		-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70			-4002.70		-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.48	-16.01	-19.50	-18.71	-20.56	-16.67	-9.65	-18.80	-14.36	-18.56	-18.68	-17.69	-19.85	-15.22	-10.38	-21.32
Fs (ksi)	-10.48	-16.01	-19.50	-18.71	-20.56	-16.67	-9.65	-18.80	-14.36	-18.56	-18.68	-17.69	-19.85	-15.22	-10.38	-21.32
Fs (kip)	-838.58	-1280.89	-1559.74	-1497.10	-1645.04	-1333.59	-771.84	-1504.38	-1148.81	-1484.60	-1494.58	-1415.33	-1587.77	-1217.76	-830.78	-1705.62

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1645.04	1705.62

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	174.71	397.09	427.74	147.15	245.74	270.56	411.36	169.22	128.97	290.98	312.63	109.50	182.77	257.11	301.06	125.09
Vuw (kip)	262.07	595.63	641.61	220.72	368.61	405.84	617.04	253.83	---	---	---	---	---	---	---	---
Mv (k*ft)	147.41	335.04	360.91	124.15	207.34	228.28	347.08	142.78	72.55	163.67	175.86	61.59	102.81	144.63	169.35	70.37
Huw (kip)	-2140.91	-2712.91	-2575.85	-2088.82	-2766.96	-2873.22	-2476.36	-2142.95	-794.80	-1146.32	-1116.99	-853.58	-987.53	-1091.21	-1052.07	-951.15
Muw (k*ft)	549.44	168.11	259.48	584.17	132.08	61.23	325.81	548.08	110.58	15.66	77.86	183.13	83.95	19.81	92.50	218.71
Mu (k*ft)	696.85	503.15	620.39	708.32	339.42	289.52	672.89	690.86	183.13	179.33	253.72	244.73	186.76	164.44	261.85	289.07

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.94	41.74	39.63	32.14	42.57	44.20	38.10	32.97	12.23	17.64	17.18	13.13	15.19	16.79	16.19	14.63
PY1 (Vuw)	4.03	9.16	9.87	3.40	5.67	6.24	9.49	3.91	1.98	4.48	4.81	1.68	2.81	3.96	4.63	1.92
PX2 (Mu)	16.08	11.61	14.32	16.35	7.83	6.68	15.53	15.94	4.23	4.14	5.86	5.65	4.31	3.79	6.04	6.67
PY2 (Mu)	5.36	3.87	4.77	5.45	2.61	2.23	5.18	5.31	1.41	1.38	1.95	1.88	1.44	1.26	2.01	2.22
Pu (kip)	49.91	54.92	55.90	49.28	51.08	51.58	55.60	49.77	16.80	22.55	24.01	19.12	19.96	21.23	23.20	21.70

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.03	43.86	44.70	40.64	41.01	41.24	44.61	40.93
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	641.61
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1451	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	830.48	11.53	OK
BF	2008.27	25.10	OK	855.76	10.70	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.90	27.95	OK	24.01	12.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.90	1.47	114.56	OK
Web SPL	27.95	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.46	4.35
Web	1.30	1.52	2.05
BF	1.44	1.57	5.41

Plate	Shear	Flexure
Web	2.56	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.29	-19.06	-24.25	-23.44	-25.25	-20.48	-11.67	-23.06	-15.46	-18.38	-17.43	-19.55	-24.53	-18.83	-12.72	-26.38
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.18	0.29	0.36	0.35	0.38	0.31	0.17	0.35	0.23	0.28	0.26	0.29	0.37	0.28	0.19	0.40
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-19.06	-24.25		-25.25			-23.06		-18.38		-19.55	-24.53			-26.38
Fcf (ksi)		-50.03	-50.03		-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70	-4002.70		-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-12.29			-23.44		-20.48	-11.67		-15.46		-17.43			-18.83	-12.72	
Rcf	1.90			1.90		1.90	1.90		1.90		1.90			1.90	1.90	
Fncf (ksi)	-50.03			-50.03		-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70			-4002.70		-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.061926	-14.03548	-17.78456	-17.08019	-18.49449	-14.99238	-8.628133	-16.86512	-11.7929	-15.56878	-15.84997	-14.95886	-17.98548	-13.82493	-9.37	-19.21
Fs (ksi)	-9.06	-14.04	-17.78	-17.08	-18.49	-14.99	-8.63	-16.87	-11.79	-15.57	-15.85	-14.96	-17.99	-13.82	-9.37	-19.21
Fs (kip)	-724.95	-1122.84	-1422.76	-1366.42	-1479.56	-1199.39	-690.25	-1349.21	-943.43	-1245.50	-1268.00	-1196.71	-1438.84	-1105.99	-749.56	-1536.53

Vu (kip)	174.71	397.09	427.74	147.15	245.74	270.56	411.36	169.22	128.97	290.98	312.63	109.50	182.77	257.11	301.06	125.09
Vuw (kip)	262.07	595.63	641.61	220.72	368.61	405.84	617.04	253.83	---	---	---	---	---	---	---	---
Mv (k*ft)	147.41	335.04	360.91	124.15	207.34	228.28	347.08	142.78	72.55	163.67	175.86	61.59	102.81	144.63	169.35	70.37
Huw (kip)	-2181.79	-2816.37	-2648.21	-2146.86	-2362.01	-2474.35	-2554.18	-2206.57	-692.92	-1045.94	-1004.61	-764.80	-820.85	-924.27	-954.31	-857.28
Muw (k*ft)	522.18	99.14	211.24	545.48	402.04	327.15	273.93	505.67	99.47	14.09	70.04	164.74	75.52	17.82	83.21	196.74
Mu (k*ft)	669.60	434.18	572.15	669.63	609.38	555.43	621.01	648.45	172.02	177.76	245.90	226.33	178.33	162.45	252.56	267.11

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.57	43.33	40.74	33.03	36.34	38.07	39.30	33.95	10.66	16.09	15.46	11.77	12.63	14.22	14.68	13.19
PY1 (Vuw)	4.03	9.16	9.87	3.40	5.67	6.24	9.49	3.91	1.98	4.48	4.81	1.68	2.81	3.96	4.63	1.92
PX2 (Mu)	15.45	10.02	13.20	15.45	14.06	12.82	14.33	14.96	3.97	4.10	5.67	5.22	4.12	3.75	5.83	6.16
PY2 (Mu)	5.15	3.34	4.40	5.15	4.69	4.27	4.78	4.99	1.32	1.37	1.89	1.74	1.37	1.25	1.94	2.05
Pu (kip)	49.87	54.79	55.80	49.23	51.45	51.96	55.49	49.71	15.00	21.02	22.17	17.33	17.26	18.71	21.54	19.76

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.95	43.64	44.55	40.52	41.86	42.07	44.45	40.80
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.80	27.90	OK	22.17	11.08	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.80	1.47	114.56	OK
Web SPL	27.90	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3451

Node 3451

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3451 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
3451 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3451 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.25	-21.94	-26.25	-25.38	-27.12	-22.95	-13.04	-25.50	-27.41	-31.11	-28.91	-31.77	-26.93	-22.00	-13.69	-28.05
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.21	0.33	0.39	0.38	0.41	0.34	0.20	0.38	0.41	0.47	0.43	0.48	0.40	0.33	0.21	0.42
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.94	-26.25		-27.12			-25.50		-31.11		-31.77	-26.93			-28.05
Fcf (ksi)		-50.03	-50.03		-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70	-4002.70		-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-14.25			-25.38		-22.95	-13.04		-27.41		-28.91			-22.00	-13.69	
Rcf	1.57			1.57		1.57	1.57		1.57		1.57			1.57	1.57	
Fncf (ksi)	-50.03			-50.03		-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70			-4002.70		-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.67	-16.60	-19.48	-18.72	-20.15	-16.95	-9.73	-19.20	-15.48	-18.87	-18.65	-19.25	-20.03	-16.26	-10.16	-21.03
Fs (ksi)	-10.67	-16.60	-19.48	-18.72	-20.15	-16.95	-9.73	-19.20	-15.48	-18.87	-18.65	-19.25	-20.03	-16.26	-10.16	-21.03
Fs (kip)	-853.57	-1328.29	-1558.70	-1497.74	-1612.17	-1355.91	-778.53	-1535.83	-1238.63	-1509.56	-1491.83	-1540.07	-1602.76	-1300.89	-812.84	-1682.73

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1612.17	1682.73

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	197.86	412.40	435.12	170.87	267.21	279.04	427.30	186.45	144.62	301.25	317.30	125.54	207.95	257.49	311.78	136.55
Vuw (kip)	296.80	618.61	652.68	256.30	400.81	418.56	640.95	279.67	---	---	---	---	---	---	---	---
Mv (k*ft)	166.95	347.97	367.13	144.17	225.46	235.44	360.54	157.31	81.35	169.45	178.48	70.62	116.97	144.84	175.37	76.81
Huw (kip)	-2155.82	-2681.67	-2566.94	-2098.63	-2777.60	-2848.23	-2521.85	-2129.52	-818.20	-1146.16	-1113.03	-867.89	-1030.57	-1136.96	-1088.87	-935.84
Muw (k*ft)	539.50	188.93	265.42	577.63	124.98	77.89	295.48	557.04	118.68	15.24	64.07	189.33	67.73	12.06	75.47	217.47
Mu (k*ft)	706.45	536.90	632.55	721.80	350.44	313.33	656.02	714.35	200.02	184.70	242.55	259.94	184.70	156.90	250.84	294.28

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.17	41.26	39.49	32.29	42.73	43.82	38.80	32.76	12.59	17.63	17.12	13.35	15.85	17.49	16.75	14.40
PY1 (Vuw)	4.57	9.52	10.04	3.94	6.17	6.44	9.86	4.30	2.22	4.63	4.88	1.93	3.20	3.96	4.80	2.10
PX2 (Mu)	16.30	12.39	14.60	16.66	8.09	7.23	15.14	16.48	4.62	4.26	5.60	6.00	4.26	3.62	5.79	6.79
PY2 (Mu)	5.43	4.13	4.87	5.55	2.70	2.41	5.05	5.49	1.54	1.42	1.87	2.00	1.42	1.21	1.93	2.26
Pu (kip)	50.47	55.36	56.11	49.86	51.59	51.81	55.96	50.21	17.61	22.72	23.70	19.75	20.64	21.74	23.52	21.63

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.42	44.20	44.85	41.05	41.38	41.44	44.80	41.27
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	652.68
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	813.88	11.30	OK
BF	2008.27	25.10	OK	844.28	10.55	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.11	28.05	OK	23.70	11.85	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.11	1.47	114.56	OK
Web SPL	28.05	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.49	4.35
Web	1.29	1.49	2.05
BF	1.44	1.59	5.41

Plate	Shear	Flexure
Web	2.51	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.80	-21.06	-25.29	-24.47	-25.94	-22.01	-13.03	-24.79	-17.06	-20.55	-18.08	-20.79	-25.71	-21.05	-13.77	-27.32
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.21	0.32	0.38	0.37	0.39	0.33	0.20	0.37	0.26	0.31	0.27	0.31	0.39	0.32	0.21	0.41
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.06	-25.29		-25.94			-24.79		-20.55		-20.79	-25.71			-27.32
Fcf (ksi)		-50.03	-50.03		-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70	-4002.70		-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-13.80			-24.47		-22.01	-13.03		-17.06		-18.08			-21.05	-13.77	
Rcf	1.83			1.83		1.83	1.83		1.83		1.83			1.83	1.83	
Fncf (ksi)	-50.03			-50.03		-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70			-4002.70		-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.10086	-15.43876	-18.50714	-17.82161	-18.96693	-16.08536	-9.557522	-18.073	-13.41439	-16.46078	-16.11986	-16.66225	-18.80204	-15.40768	-10.08	-19.86
Fs (ksi)	-10.10	-15.44	-18.51	-17.82	-18.97	-16.09	-9.56	-18.07	-13.41	-16.46	-16.12	-16.66	-18.80	-15.41	-10.08	-19.86
Fs (kip)	-808.07	-1235.10	-1480.57	-1425.73	-1517.35	-1286.83	-764.60	-1445.84	-1073.15	-1316.86	-1289.59	-1332.98	-1504.16	-1232.61	-806.63	-1589.15

Vu (kip)	197.86	412.40	435.12	170.87	267.21	279.04	427.30	186.45	144.62	301.25	317.30	125.54	207.95	257.49	311.78	136.55
Vuw (kip)	296.80	618.61	652.68	256.30	400.81	418.56	640.95	279.67	---	---	---	---	---	---	---	---
Mv (k*ft)	166.95	347.97	367.13	144.17	225.46	235.44	360.54	157.31	81.35	169.45	178.48	70.62	116.97	144.84	175.37	76.81
Huw (kip)	-2240.51	-2826.76	-2691.75	-2198.26	-2420.01	-2475.99	-2639.05	-2239.12	-766.19	-1089.86	-1051.57	-828.92	-896.26	-983.46	-1026.29	-898.42
Muw (k*ft)	483.04	92.21	182.21	511.21	363.37	326.05	217.34	483.97	106.76	13.71	57.63	170.31	60.93	10.85	67.89	195.63
Mu (k*ft)	649.99	440.17	549.35	655.38	588.83	561.50	577.88	641.28	188.10	183.16	236.11	240.93	177.90	155.69	243.26	272.44

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.47	43.49	41.41	33.82	37.23	38.09	40.60	34.45	11.79	16.77	16.18	12.75	13.79	15.13	15.79	13.82
PY1 (Vuw)	4.57	9.52	10.04	3.94	6.17	6.44	9.86	4.30	2.22	4.63	4.88	1.93	3.20	3.96	4.80	2.10
PX2 (Mu)	15.00	10.16	12.68	15.12	13.59	12.96	13.34	14.80	4.34	4.23	5.45	5.56	4.11	3.59	5.61	6.29
PY2 (Mu)	5.00	3.39	4.23	5.04	4.53	4.32	4.45	4.93	1.45	1.41	1.82	1.85	1.37	1.20	1.87	2.10
Pu (kip)	50.39	55.18	55.94	49.76	51.93	52.17	55.80	50.11	16.54	21.85	22.64	18.70	18.47	19.42	22.42	20.54

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.24	43.90	44.59	40.84	42.12	42.22	44.56	41.04
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.94	27.97	OK	22.64	11.32	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.94	1.47	114.56	OK
Web SPL	27.97	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5451

Node 5451

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5451 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
5451 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5451 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.90	-22.59	-25.30	-25.80	-26.48	-22.99	-13.98	-26.42	-27.49	-31.65	-28.71	-31.88	-26.06	-21.88	-14.33	-28.61
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.22	0.34	0.38	0.39	0.40	0.34	0.21	0.40	0.41	0.47	0.43	0.48	0.39	0.33	0.21	0.43
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-22.59		-25.80	-26.48			-26.42		-31.65		-31.88	-26.06			-28.61
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-14.90		-25.30			-22.99	-13.98		-27.49		-28.71			-21.88	-14.33	
Rcf	1.57		1.57			1.57	1.57		1.57		1.57			1.57	1.57	
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.70	-16.65	-18.53	-18.80	-19.38	-16.69	-9.96	-19.44	-16.86	-18.39	-16.27	-20.16	-19.15	-15.95	-10.18	-21.02
Fs (ksi)	-10.70	-16.65	-18.53	-18.80	-19.38	-16.69	-9.96	-19.44	-16.86	-18.39	-16.27	-20.16	-19.15	-15.95	-10.18	-21.02
Fs (kip)	-855.77	-1331.91	-1482.26	-1503.72	-1550.68	-1335.52	-796.98	-1554.84	-1349.01	-1470.98	-1301.20	-1613.14	-1531.62	-1275.91	-814.28	-1681.48

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1550.68	1681.48

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	210.40	407.94	438.20	180.55	275.41	283.27	429.71	195.60	153.17	298.02	319.40	132.08	247.12	226.46	313.40	142.72
Vuw (kip)	315.60	611.91	657.31	270.82	413.11	424.91	644.57	293.41	---	---	---	---	---	---	---	---
Mv (k*ft)	177.53	344.20	369.73	152.34	232.38	239.01	362.57	165.04	86.16	167.64	179.66	74.30	139.01	127.38	176.29	80.28
Huw (kip)	-2184.15	-2673.91	-2565.25	-2140.67	-2777.01	-2834.27	-2513.06	-2157.21	-820.38	-1119.74	-1082.33	-881.93	-1057.50	-1092.88	-1052.82	-935.91
Muw (k*ft)	520.62	194.10	266.54	549.60	125.37	87.20	301.34	538.57	119.04	5.37	53.79	189.46	30.49	77.99	63.93	216.80
Mu (k*ft)	698.14	538.30	636.28	701.94	357.75	326.21	663.91	703.61	205.20	173.00	233.45	263.76	169.50	205.37	240.21	297.08

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.60	41.14	39.47	32.93	42.72	43.60	38.66	33.19	12.62	17.23	16.65	13.57	16.27	16.81	16.20	14.40
PY1 (Vuw)	4.86	9.41	10.11	4.17	6.36	6.54	9.92	4.51	2.36	4.58	4.91	2.03	3.80	3.48	4.82	2.20
PX2 (Mu)	16.11	12.42	14.68	16.20	8.26	7.53	15.32	16.24	4.74	3.99	5.39	6.09	3.91	4.74	5.54	6.86
PY2 (Mu)	5.37	4.14	4.89	5.40	2.75	2.51	5.11	5.41	1.58	1.33	1.80	2.03	1.30	1.58	1.85	2.29
Pu (kip)	50.75	55.25	56.19	50.05	51.79	51.93	56.03	50.41	17.80	22.03	23.04	20.07	20.82	22.14	22.74	21.72

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.59	44.14	44.91	41.14	41.53	41.55	44.87	41.38
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	657.31
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5451	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	782.84	10.87	OK
BF	2008.27	25.10	OK	843.65	10.55	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.19	28.09	OK	23.04	11.52	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.19	1.47	114.56	OK
Web SPL	28.09	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.55	4.35
Web	1.29	1.48	2.05
BF	1.44	1.60	5.41

Plate	Shear	Flexure
Web	2.49	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.37	-21.63	-24.97	-25.44	-26.03	-22.74	-13.43	-25.17	-17.52	-21.44	-18.13	-21.12	-25.74	-21.80	-14.11	-27.59
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.22	0.32	0.37	0.38	0.39	0.34	0.20	0.38	0.26	0.32	0.27	0.32	0.39	0.33	0.21	0.41
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.63		-25.44	-26.03			-25.17		-21.44		-21.12	-25.74			-27.59
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-14.37		-24.97			-22.74	-13.43		-17.52		-18.13			-21.80	-14.11	
Rcf	1.81		1.81			1.81	1.81		1.81		1.81			1.81	1.81	
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.48577	-15.83971	-18.26744	-18.50877	-19.01898	-16.59952	-9.82127	-18.34297	-15.35228	-16.72369	-14.45636	-17.96395	-18.81571	-15.94046	-10.30	-20.05
Fs (ksi)	-10.49	-15.84	-18.27	-18.51	-19.02	-16.60	-9.82	-18.34	-15.35	-16.72	-14.46	-17.96	-18.82	-15.94	-10.30	-20.05
Fs (kip)	-838.86	-1267.18	-1461.39	-1480.70	-1521.52	-1327.96	-785.70	-1467.44	-1228.18	-1337.90	-1156.51	-1437.12	-1505.26	-1275.24	-824.13	-1604.22

Vu (kip)	210.40	407.94	438.20	180.55	275.41	283.27	429.71	195.60	153.17	298.02	319.40	132.08	247.12	226.46	313.40	142.72
Vuw (kip)	315.60	611.91	657.31	270.82	413.11	424.91	644.57	293.41	---	---	---	---	---	---	---	---
Mv (k*ft)	177.53	344.20	369.73	152.34	232.38	239.01	362.57	165.04	86.16	167.64	179.66	74.30	139.01	127.38	176.29	80.28
Huw (kip)	-2264.30	-2840.76	-2719.41	-2213.14	-2435.50	-2468.69	-2668.66	-2250.12	-789.76	-1103.29	-1068.56	-844.93	-962.28	-972.61	-1042.69	-910.63
Muw (k*ft)	467.18	82.87	163.78	501.29	353.05	330.92	197.61	476.63	107.08	4.83	48.39	170.43	27.43	70.15	57.51	195.02
Mu (k*ft)	644.71	427.07	533.51	653.62	585.42	569.93	560.18	641.67	193.24	172.46	228.05	244.73	166.43	197.53	233.79	275.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.84	43.70	41.84	34.05	37.47	37.98	41.06	34.62	12.15	16.97	16.44	13.00	14.80	14.96	16.04	14.01
PY1 (Vuw)	4.86	9.41	10.11	4.17	6.36	6.54	9.92	4.51	2.36	4.58	4.91	2.03	3.80	3.48	4.82	2.20
PX2 (Mu)	14.88	9.86	12.31	15.08	13.51	13.15	12.93	14.81	4.46	3.98	5.26	5.65	3.84	4.56	5.40	6.35
PY2 (Mu)	4.96	3.29	4.10	5.03	4.50	4.38	4.31	4.94	1.49	1.33	1.75	1.88	1.28	1.52	1.80	2.12
Pu (kip)	50.67	55.04	55.98	49.98	52.12	52.29	55.83	50.32	17.05	21.77	22.70	19.05	19.33	20.15	22.44	20.81

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.42	43.79	44.59	40.99	42.24	42.31	44.54	41.18
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.98	27.99	OK	22.70	11.35	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.98	1.47	114.56	OK
Web SPL	27.99	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7451	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type EE2

Field Splice - Node 7451

Node 7451

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	72
Web	65
BF	80

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7451 L	80.00	66.71	5336.93	80.00	66.71	5336.93	60.00	50.00	3000.00
7451 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7451 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	32.00	2.50	---	80.00	58.75	60.08	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	32.00	2.50	---	80.00	58.75	60.08	70	85
Splice Plates	TF Outside	32.00	1.000	56.50	32.00	23.50	---	70	85
	TF Inside	14.50	1.125	56.50	32.63	23.06	---	70	85
	BF Inside	14.50	1.250	62.50	36.25	25.63	---	70	85
	BF Outside	32.00	1.125	62.50	36.00	26.44	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.90566

N.A. (from I 26.5 in
Outer to Inr 0.90566038
Outer to Inr 0.90566038

Outer to Mi 0.95283019
Outer to Mi 0.95283019

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.38	-22.63	-24.52	-25.65	-25.74	-22.47	-13.29	-26.37	-27.48	-31.76	-27.83	-31.54	-25.71	-21.81	-14.10	-29.12
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.22	0.34	0.37	0.38	0.39	0.34	0.20	0.40	0.41	0.48	0.42	0.47	0.39	0.33	0.21	0.44
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-22.63		-25.65	-25.74			-26.37		-31.76		-31.54	-25.71			-29.12
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-14.38		-24.52			-22.47	-13.29		-27.48		-27.83			-21.81	-14.10	
Rcf	1.58		1.58			1.58	1.58		1.58		1.58			1.58	1.58	
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.68	-17.07	-18.17	-18.90	-19.03	-16.51	-9.82	-19.80	-17.98	-18.47	-15.19	-19.82	-19.10	-16.10	-10.36	-21.77
Fs (ksi)	-10.68	-17.07	-18.17	-18.90	-19.03	-16.51	-9.82	-19.80	-17.98	-18.47	-15.19	-19.82	-19.10	-16.10	-10.36	-21.77
Fs (kip)	-854.59	-1365.80	-1453.77	-1512.29	-1522.61	-1320.90	-785.74	-1583.82	-1438.14	-1477.25	-1215.01	-1585.46	-1527.62	-1288.32	-829.04	-1742.00

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	4002.70	4002.70	1527.62	1742.00

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	190.59	388.96	421.65	163.06	266.13	261.02	413.80	178.17	138.86	284.53	307.63	119.41	255.96	195.56	302.08	130.09
Vuw (kip)	285.88	583.45	632.47	244.59	399.20	391.53	620.71	267.26	---	---	---	---	---	---	---	---
Mv (k*ft)	160.81	328.19	355.77	137.58	224.55	220.24	349.15	150.33	78.11	160.05	173.04	67.17	143.98	110.00	169.92	73.18
Huw (kip)	-2162.41	-2641.65	-2544.75	-2110.46	-2781.51	-2797.93	-2513.38	-2148.92	-832.65	-1112.27	-1066.32	-888.59	-1093.27	-1050.18	-1055.98	-964.14
Muw (k*ft)	535.11	215.61	280.21	569.74	122.37	111.43	301.13	544.10	127.80	14.63	50.43	199.52	9.78	92.61	59.82	228.24
Mu (k*ft)	695.91	543.80	635.98	707.33	346.92	331.66	650.27	694.44	205.91	174.68	223.47	266.69	153.75	202.61	229.75	301.42

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.27	40.64	39.15	32.47	42.79	43.05	38.67	33.06	12.81	17.11	16.40	13.67	16.82	16.16	16.25	14.83
PY1 (Vuw)	4.40	8.98	9.73	3.76	6.14	6.02	9.55	4.11	2.14	4.38	4.73	1.84	3.94	3.01	4.65	2.00
PX2 (Mu)	16.06	12.55	14.68	16.32	8.01	7.65	15.01	16.03	4.75	4.03	5.16	6.15	3.55	4.68	5.30	6.96
PY2 (Mu)	5.35	4.18	4.89	5.44	2.67	2.55	5.00	5.34	1.58	1.34	1.72	2.05	1.18	1.56	1.77	2.32
Pu (kip)	50.28	54.79	55.78	49.65	51.56	51.42	55.61	49.99	17.95	21.90	22.51	20.20	21.00	21.33	22.48	22.21

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2128.00	1598.00	52.00	33.94	20.56	2736.75	1598.00	OK
TF Inside	0.00	2169.56	1568.25	117.00	76.36	16.45	4130.43	1568.25	OK
BF Inside	0.00	2410.63	1742.50	145.00	94.53	18.28	4971.44	1742.50	OK
BF Outside	0.00	2394.00	1797.75	65.25	42.54	23.13	3250.77	1797.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	1981.99	2016.00	OK
TF Inside	2020.70	2055.38	OK
BF Inside	2008.27	2283.75	OK
BF Outside	1994.42	2268.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.27	43.86	44.65	40.89	41.35	41.22	44.58	41.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	632.47
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7451**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2020.70	28.07	OK	771.20	10.71	OK
BF	2008.27	25.10	OK	874.01	10.93	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	1981.99	27.53	1.47	119.85	OK
TF	4002.70	55.59	1.47	299.63	OK
TF Inside	2020.70	28.07	1.47	134.83	OK
BF Inside	2008.27	25.10	1.47	149.81	OK
BF	4002.70	50.03	1.47	299.63	OK
BF Outside	1994.42	24.93	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.78	27.89	OK	22.51	11.25	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.78	1.47	114.56	OK
Web SPL	27.89	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.14
BF Outside	NA	1.14

Bolt	Shear	Slip	Bearing
TF	1.29	1.57	4.35
Web	1.30	1.52	2.06
BF	1.44	1.54	5.41

Plate	Shear	Flexure
Web	2.59	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.51	-21.29	-24.27	-25.33	-25.43	-22.35	-12.71	-25.05	-17.34	-21.37	-17.04	-20.53	-25.12	-21.44	-13.43	-27.61
ϕf Fnc (ksi)	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71	66.71
f / ϕf Fnc	0.20	0.32	0.36	0.38	0.38	0.34	0.19	0.38	0.26	0.32	0.26	0.31	0.38	0.32	0.20	0.41
α	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
fcf (ksi)		-21.29		-25.33	-25.43			-25.05		-21.37		-20.53	-25.12			-27.61
Fcf (ksi)		-50.03		-50.03	-50.03			-50.03		-50.03		-50.03	-50.03			-50.03
Fcf (kip)		-4002.70		-4002.70	-4002.70			-4002.70		-4002.70		-4002.70	-4002.70			-4002.70
fncf (ksi)	-13.51		-24.27			-22.35	-12.71		-17.34		-17.04			-21.44	-13.43	
Rcf	1.81		1.81			1.81	1.81		1.81		1.81			1.81	1.81	
Fncf (ksi)	-50.03		-50.03			-50.03	-50.03		-50.03		-50.03			-50.03	-50.03	
Fncf (kip)	-4002.70		-4002.70			-4002.70	-4002.70		-4002.70		-4002.70			-4002.70	-4002.70	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.872474	-15.62078	-17.77935	-18.43741	-18.60172	-16.33367	-9.303407	-18.27744	-16.034	-16.47371	-12.88179	-17.04729	-18.38175	-15.69097	-9.82	-20.08
Fs (ksi)	-9.87	-15.62	-17.78	-18.44	-18.60	-16.33	-9.30	-18.28	-16.03	-16.47	-12.88	-17.05	-18.38	-15.69	-9.82	-20.08
Fs (kip)	-789.80	-1249.66	-1422.35	-1474.99	-1488.14	-1306.69	-744.27	-1462.20	-1282.72	-1317.90	-1030.54	-1363.78	-1470.54	-1255.28	-785.23	-1606.49

Vu (kip)	190.59	388.96	421.65	163.06	266.13	261.02	413.80	178.17	138.86	284.53	307.63	119.41	255.96	195.56	302.08	130.09
Vuw (kip)	285.88	583.45	632.47	244.59	399.20	391.53	620.71	267.26	---	---	---	---	---	---	---	---
Mv (k*ft)	160.81	328.19	355.77	137.58	224.55	220.24	349.15	150.33	78.11	160.05	173.04	67.17	143.98	110.00	169.92	73.18
Huw (kip)	-2217.31	-2802.07	-2697.91	-2173.51	-2425.29	-2408.88	-2648.45	-2212.91	-764.80	-1086.50	-1048.06	-827.43	-975.23	-897.87	-1022.18	-896.90
Muw (k*ft)	498.51	108.67	178.11	527.71	359.85	370.80	211.08	501.44	114.97	13.16	45.36	179.48	8.79	83.31	53.82	205.31
Mu (k*ft)	659.32	436.86	533.87	665.29	584.40	591.03	560.23	651.77	193.07	173.21	218.40	246.65	152.77	193.31	223.74	278.49

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7451	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.11	43.11	41.51	33.44	37.31	37.06	40.75	34.04	11.77	16.72	16.12	12.73	15.00	13.81	15.73	13.80
PY1 (Vuw)	4.40	8.98	9.73	3.76	6.14	6.02	9.55	4.11	2.14	4.38	4.73	1.84	3.94	3.01	4.65	2.00
PX2 (Mu)	15.21	10.08	12.32	15.35	13.49	13.64	12.93	15.04	4.46	4.00	5.04	5.69	3.53	4.46	5.16	6.43
PY2 (Mu)	5.07	3.36	4.11	5.12	4.50	4.55	4.31	5.01	1.49	1.33	1.68	1.90	1.18	1.49	1.72	2.14
Pu (kip)	50.23	54.60	55.58	49.59	51.90	51.79	55.43	49.93	16.62	21.49	22.11	18.80	19.22	18.82	21.84	20.65

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.16	43.53	44.33	40.75	42.09	42.03	44.30	40.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.58	27.79	OK	22.11	11.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.58	1.47	114.56	OK
Web SPL	27.79	1.47	91.65	OK

Field Splice

Type FF

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 1462

Node 1462

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1462 L	99.00	50.00	4950.00	80.00	50.00	4000.00	66.00	50.00	3300.00
1462 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 1462 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.56	5.30	-26.29	-11.83	-32.15	-1.52	-22.87	-12.01	-28.68	-9.40	-28.61	-11.10	-33.56	6.19	-20.28	-15.75
ϕf Fnc (ksi)	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.51	0.11	0.53	0.24	0.64	0.03	0.46	0.24	0.57	0.19	0.57	0.23	0.67	0.12	0.41	0.32
α	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-25.56		-26.29		-32.15		-22.87		-28.68		-28.61		-33.56		-20.28	
Fcf (ksi)	-37.78		-38.15		-41.08		-37.50		-39.34		-39.30		-41.78		-37.50	
Fcf (kip)	-3740.39		-3776.50		-4066.67		-3712.50		-3894.57		-3891.03		-4136.05		-3712.50	
fncf (ksi)		5.30		-11.83		-1.52		-12.01		-9.40		-11.10		6.19		-15.75
Rcf		1.13		1.14		1.22		1.12		1.17		1.17		1.25		1.12
Fncf (ksi)		37.50		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.04	4.19	-19.58	-8.66	-24.07	-1.14	-16.90	-8.52	-21.23	-6.76	-21.08	-7.76	-24.95	5.06	-15.18	-11.65
Fs (ksi)	-19.04	4.19	-19.58	-8.66	-24.07	-1.14	-16.90	-8.52	-21.23	-6.76	-21.08	-7.76	-24.95	5.06	-15.18	-11.65
Fs (kip)	-1884.78	335.51	-1938.53	-693.14	-2383.17	-91.00	-1673.36	-681.20	-2101.46	-540.71	-2087.10	-620.50	-2469.84	405.01	-1502.51	-931.97

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2646.70	0.00	405.01
Comp	4370.91	3153.53	2469.84	931.97

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	344.49	480.13	558.09	304.66	469.59	373.91	529.89	349.25	247.70	353.68	408.76	219.57	346.24	268.49	378.69	261.21
Vuw (kip)	516.73	720.19	837.14	457.00	704.38	560.86	794.83	523.87	---	---	---	---	---	---	---	---
Mv (k*ft)	290.66	405.11	470.89	257.06	396.22	315.48	447.09	294.68	139.33	198.94	229.93	123.51	194.76	151.02	213.01	146.93
Huw (kip)	-1049.78	-1702.51	-1417.05	-1680.50	-1661.90	-1725.94	-1124.18	-1818.43	-489.86	-932.10	-831.93	-838.78	-923.53	-951.65	-656.21	-885.28
Muw (k*ft)	962.54	543.44	862.71	529.67	622.98	578.72	1088.79	437.71	511.11	240.17	504.57	184.53	318.30	293.16	660.23	77.60
Mu (k*ft)	1253.20	948.55	1333.60	786.73	1019.20	894.21	1535.88	732.39	650.44	439.11	734.50	308.03	513.05	444.19	873.24	224.53

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.46	21.83	18.17	21.54	21.31	22.13	14.41	23.31	6.28	11.95	10.67	10.75	11.84	12.20	8.41	11.35
PY1 (Vuw)	6.62	9.23	10.73	5.86	9.03	7.19	10.19	6.72	3.18	4.53	5.24	2.81	4.44	3.44	4.85	3.35
PX2 (Mu)	22.79	17.25	24.26	14.31	18.54	16.26	27.94	13.32	11.83	7.99	13.36	5.60	9.33	8.08	15.88	4.08
PY2 (Mu)	9.50	7.19	10.11	5.96	7.72	6.78	11.64	5.55	4.93	3.33	5.57	2.33	3.89	3.37	6.62	1.70
Pu (kip)	39.68	42.39	47.27	37.75	43.22	40.85	47.64	38.63	19.84	21.43	26.34	17.15	22.75	21.39	26.87	16.24

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1327.93	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1318.77	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2217.63	2520.00	OK
TF Inside	2153.28	2446.88	OK
BF Inside	1582.22	1631.25	OK
BF Outside	1571.31	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.64	41.08	45.84	37.34	42.09	40.20	46.60	37.86
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	837.14
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2217.63	19.80	OK	1253.10	11.19	OK
BF	1582.22	28.25	OK	467.60	8.35	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2217.63	19.80	1.47	160.39	OK
TF	4370.91	39.03	1.47	252.04	OK
TF Inside	2153.28	19.23	1.47	171.84	OK
BF Inside	1582.22	28.25	1.47	114.56	OK
BF	3153.53	56.31	1.47	229.13	OK
BF Outside	1571.31	28.06	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.64	23.82	OK	26.87	13.43	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.64	1.47	126.02	OK
Web SPL	23.82	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	1.00	1.03
BF Outside	1.04	1.03

Bolt	Shear	Slip	Bearing
TF	1.70	1.50	6.46
Web	2.25	1.33	3.92
BF	1.28	2.02	3.67

Plate	Shear	Flexure
Web	1.96	1.67

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.68	0.72	-26.04	-12.16	-31.47	-2.10	-17.83	-7.94	-25.92	-7.68	-21.50	-5.42	-30.99	3.53	-18.64	-14.47
ϕf Fnc (ksi)	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.41	0.01	0.52	0.25	0.63	0.04	0.36	0.16	0.52	0.16	0.43	0.11	0.62	0.07	0.37	0.29
α	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-20.68		-26.04		-31.47		-17.83		-25.92		-21.50		-30.99		-18.64	
Fcf (ksi)	-37.50		-38.02		-40.74		-37.50		-37.96		-37.50		-40.50		-37.50	
Fcf (kip)	-3712.50		-3763.87		-4032.97		-3712.50		-3757.82		-3712.50		-4009.15		-3712.50	
fncf (ksi)		0.72		-12.16		-2.10		-7.94		-7.68		-5.42		3.53		-14.47
Rcf		1.19		1.21		1.29		1.19		1.21		1.19		1.29		1.19
Fncf (ksi)		37.50		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.99826	0.421469	-19.07329	-9.120211	-22.91427	-2.013436	-12.98583	-5.697795	-18.98695	-5.955791	-15.574	-3.922538	-22.28318	2.4036158	-13.85	-10.75
Fs (ksi)	-15.00	0.42	-19.07	-9.12	-22.91	-2.01	-12.99	-5.70	-18.99	-5.96	-15.57	-3.92	-22.28	2.40	-13.85	-10.75
Fs (kip)	-1484.83	33.72	-1888.26	-729.62	-2268.51	-161.07	-1285.60	-455.82	-1879.71	-476.46	-1541.83	-313.80	-2206.03	192.29	-1371.05	-860.13

Vu (kip)	344.49	480.13	558.09	304.66	469.59	373.91	529.89	349.25	247.70	353.68	408.76	219.57	346.24	268.49	378.69	261.21
Vuw (kip)	516.73	720.19	837.14	457.00	704.38	560.86	794.83	523.87	---	---	---	---	---	---	---	---
Mv (k*ft)	290.66	405.11	470.89	257.06	396.22	315.48	447.09	294.68	139.33	198.94	229.93	123.51	194.76	151.02	213.01	146.93
Huw (kip)	-1209.04	-1739.30	-1434.03	-1549.58	-1558.26	-1450.78	-1186.53	-1806.35	-481.03	-930.39	-822.61	-616.56	-823.11	-643.39	-656.03	-811.82
Muw (k*ft)									339.23	218.97	459.82	160.34	286.69	256.33	543.11	68.14
Mu (k*ft)	290.66	405.11	470.89	257.06	396.22	315.48	447.09	294.68	478.57	417.91	689.75	283.84	481.44	407.36	756.12	215.07

Muw (k*ft)	843.97	513.29	836.41	616.95	631.30	682.81	980.82	445.76	formulas matching the Muw results
Pu (add)	200.05	121.67	198.26	146.24	149.64	161.85	234.86	105.66	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 3% 5% 4% 4% 4% 6% 3% percentage increase in flange force 5.87%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.50	22.30	18.38	19.87	19.98	18.60	15.21	23.16	6.17	11.93	10.55	7.90	10.55	8.25	8.41	10.41
PY1 (Vuw)	6.62	9.23	10.73	5.86	9.03	7.19	10.19	6.72	3.18	4.53	5.24	2.81	4.44	3.44	4.85	3.35
PX2 (Mu)	5.29	7.37	8.56	4.68	7.21	5.74	8.13	5.36	8.70	7.60	12.55	5.16	8.76	7.41	13.75	3.91
PY2 (Mu)	2.20	3.07	3.57	1.95	3.00	2.39	3.39	2.23	3.63	3.17	5.23	2.15	3.65	3.09	5.73	1.63
Pu (kip)	22.58	32.12	30.51	25.75	29.73	26.16	27.01	29.89	16.35	20.99	25.35	13.98	20.93	16.96	24.56	15.16

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	20.97	29.89	27.57	24.40	27.49	24.45	24.04	28.34
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.12	16.06	OK	25.35	12.68	OK

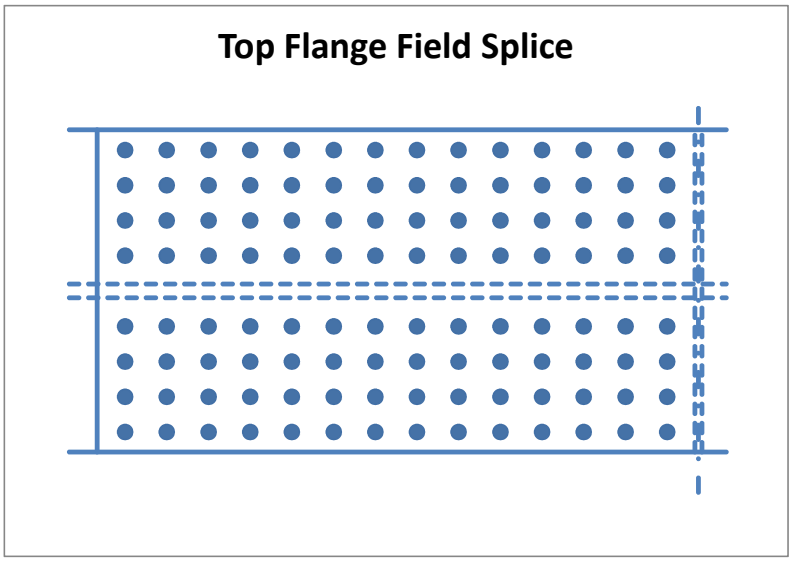
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.12	1.47	126.02	OK
Web SPL	16.06	1.47	91.65	OK

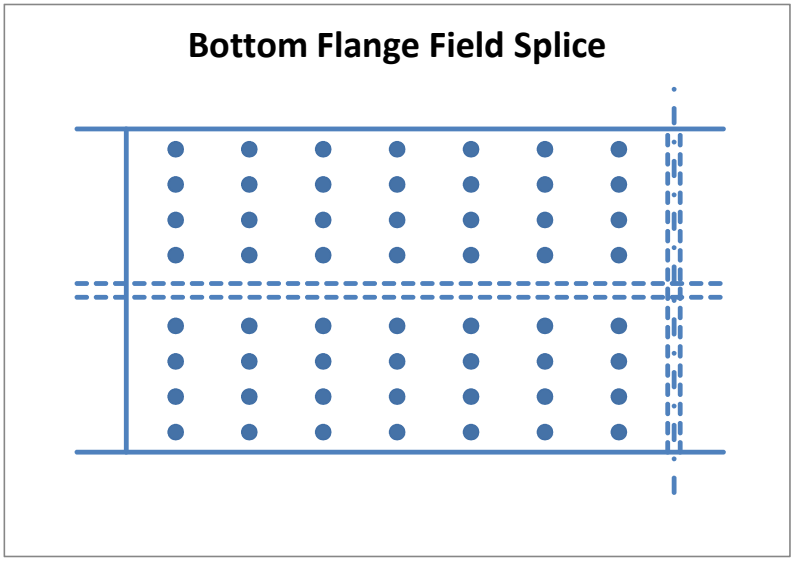
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1462	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1462

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.5	0	3.5
0	7	0	7
0	10.5	0	10.5
0	17.5	0	17.5
0	21	0	21
0	24.5	0	24.5
0	28	0	28
3	0	3	0
3	3.5	3	3.5
3	7	3	7
3	10.5	3	10.5
3	17.5	3	17.5
3	21	3	21
3	24.5	3	24.5
3	28	3	28
6	0	6	0
6	3.5	6	3.5
6	7	6	7
6	10.5	6	10.5
6	17.5	6	17.5
6	21	6	21
6	24.5	6	24.5
6	28	6	28
9	0	9	0
9	3.5	9	3.5
9	7	9	7
9	10.5	9	10.5
9	17.5	9	17.5
9	21	9	21
9	24.5	9	24.5
9	28	9	28
12	0	12	0
12	3.5	12	3.5
12	7	12	7
12	10.5	12	10.5
12	17.5	12	17.5
12	21	12	21
12	24.5	12	24.5
12	28	12	28
15	0	15	0
15	3.5	15	3.5
15	7	15	7
15	10.5	15	10.5
15	17.5	15	17.5
15	21	15	21
15	24.5	15	24.5
15	28	15	28
18	0	18	0
18	3.5	18	3.5
18	7	18	7
18	10.5	18	10.5
18	17.5	18	17.5
18	21	18	21
18	24.5	18	24.5
18	28	18	28
21	0		
21	3.5		
21	7		

	Top Flange		Bottom Flange	
No. Bolts =	112.0		56.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	13.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.000	OK	2.000	OK
No. Trans Space (per side of web) =	3.0		3.0	
Transverse Spacing (in) =	3.500	OK	3.500	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





21	10.5		
21	17.5		
21	21		
21	24.5		
21	28		
24	0		
24	3.5		
24	7		
24	10.5		
24	17.5		
24	21		
24	24.5		
24	28		
27	0		
27	3.5		
27	7		
27	10.5		
27	17.5		
27	21		
27	24.5		
27	28		
30	0		
30	3.5		
30	7		
30	10.5		
30	17.5		
30	21		
30	24.5		
30	28		
33	0		
33	3.5		
33	7		
33	10.5		
33	17.5		
33	21		
33	24.5		
33	28		
36	0		
36	3.5		
36	7		
36	10.5		
36	17.5		
36	21		
36	24.5		
36	28		
39	0		
39	3.5		
39	7		
39	10.5		
39	17.5		
39	21		
39	24.5		
39	28		

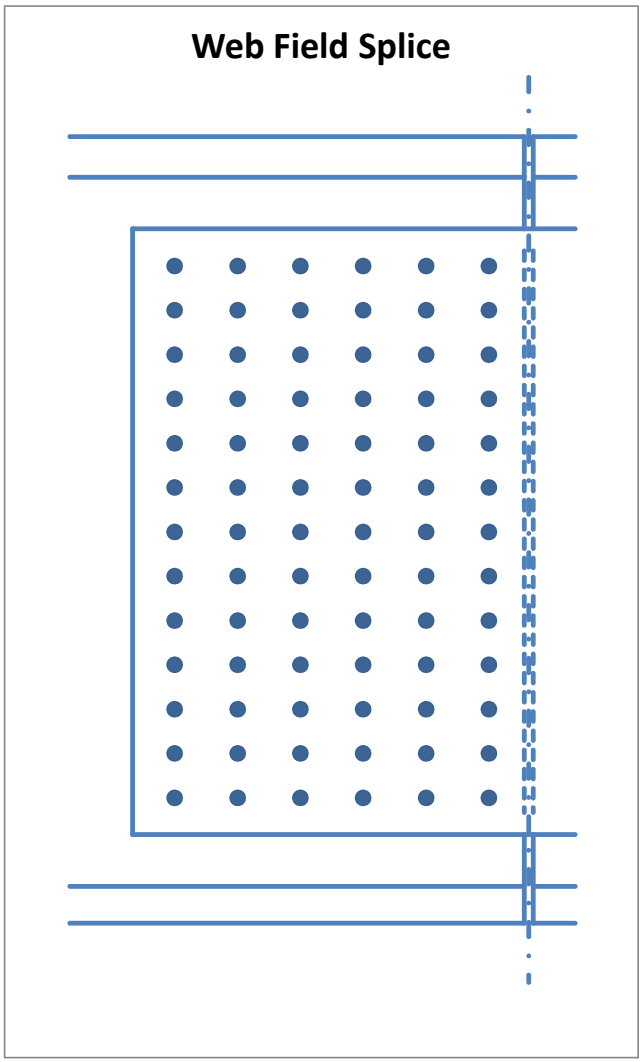
Flange Bolt Pattern Cont. - Node 1462

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1462	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1462

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	56.25	324
0	3	56.25	225
0	6	56.25	144
0	9	56.25	81
0	12	56.25	36
0	15	56.25	9
0	18	56.25	0
0	21	56.25	9
0	24	56.25	36
0	27	56.25	81
0	30	56.25	144
0	33	56.25	225
0	36	56.25	324
3	0	20.25	324
3	3	20.25	225
3	6	20.25	144
3	9	20.25	81
3	12	20.25	36
3	15	20.25	9
3	18	20.25	0
3	21	20.25	9
3	24	20.25	36
3	27	20.25	81
3	30	20.25	144
3	33	20.25	225
3	36	20.25	324
6	0	2.25	324
6	3	2.25	225
6	6	2.25	144
6	9	2.25	81
6	12	2.25	36
6	15	2.25	9
6	18	2.25	0
6	21	2.25	9
6	24	2.25	36
6	27	2.25	81
6	30	2.25	144
6	33	2.25	225
6	36	2.25	324
9	0	2.25	324
9	3	2.25	225
9	6	2.25	144
9	9	2.25	81
9	12	2.25	36
9	15	2.25	9
9	18	2.25	0
9	21	2.25	9
9	24	2.25	36
9	27	2.25	81
9	30	2.25	144
9	33	2.25	225
9	36	2.25	324
12	0	20.25	324
12	3	20.25	225
12	6	20.25	144
12	9	20.25	81
12	12	20.25	36
12	15	20.25	9
12	18	20.25	0

No. Bolts =	78.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	5.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	1.688	NG
Gap (in) =	0.438	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	7.5	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2047.5	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	9828	
Σd^2 (in^2) =	11875.5	



12	21	20.25	9
12	24	20.25	36
12	27	20.25	81
12	30	20.25	144
12	33	20.25	225
12	36	20.25	324
15	0	56.25	324
15	3	56.25	225
15	6	56.25	144
15	9	56.25	81
15	12	56.25	36
15	15	56.25	9
15	18	56.25	0
15	21	56.25	9
15	24	56.25	36
15	27	56.25	81
15	30	56.25	144
15	33	56.25	225
15	36	56.25	324

Web Bolt Pattern Cont. - Node 1462

Web Bolt Pattern Cont. - Node 1462

585	1404	2047.5	9828

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3462	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 3462

Node 3462

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3462 L	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00
3462 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 3462 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.30	-2.71	-28.59	-14.22	-33.86	-3.86	-23.05	-11.56	-31.18	-12.63	-28.24	-11.31	-33.66	2.91	-21.65	-16.21
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.51	0.05	0.57	0.29	0.68	0.08	0.46	0.23	0.62	0.26	0.56	0.23	0.67	0.06	0.43	0.33
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-25.30		-28.59		-33.86		-23.05		-31.18		-28.24		-33.66		-21.65	
Fcf (ksi)	-37.65		-39.30		-41.93		-37.50		-40.59		-39.12		-41.83		-37.50	
Fcf (kip)	-3727.32		-3890.43		-4151.31		-3712.50		-4018.27		-3872.94		-4141.29		-3712.50	
fncf (ksi)		-2.71		-14.22		-3.86		-11.56		-12.63		-11.31		2.91		-16.21
Rcf		1.11		1.16		1.24		1.11		1.20		1.16		1.24		1.11
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.92	-1.63	-20.98	-10.33	-25.01	-2.74	-17.12	-8.08	-22.88	-9.14	-20.89	-7.81	-25.07	2.72	-16.02	-11.99
Fs (ksi)	-18.92	-1.63	-20.98	-10.33	-25.01	-2.74	-17.12	-8.08	-22.88	-9.14	-20.89	-7.81	-25.07	2.72	-16.02	-11.99
Fs (kip)	-1873.52	-130.10	-2077.27	-826.66	-2475.57	-219.27	-1695.04	-646.13	-2265.30	-731.09	-2067.95	-624.69	-2482.32	217.49	-1585.55	-959.35

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2634.68	0.00	217.49
Comp	4364.13	3145.02	2482.32	959.35

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	381.36	491.99	561.17	348.57	482.71	394.23	538.50	382.44	275.40	359.67	408.54	252.23	353.12	284.49	386.42	282.27
Vuw (kip)	572.04	737.98	841.75	522.85	724.07	591.35	807.76	573.66	---	---	---	---	---	---	---	---
Mv (k*ft)	321.77	415.11	473.48	294.10	407.29	332.63	454.36	322.68	154.91	202.31	229.81	141.88	198.63	160.03	217.36	158.78
Huw (kip)	-1341.73	-1841.36	-1541.48	-1659.95	-1838.78	-1722.10	-1261.88	-1829.93	-678.17	-1033.42	-915.64	-831.54	-1056.67	-947.00	-737.73	-924.25
Muw (k*ft)	762.10	501.51	817.37	543.37	560.05	573.24	999.32	430.05	380.56	234.28	489.83	198.99	302.35	287.75	611.44	88.52
Mu (k*ft)	1083.88	916.62	1290.86	837.47	967.33	905.87	1453.69	752.73	535.47	436.60	719.63	340.87	500.98	447.78	828.80	247.30

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.20	23.61	19.76	21.28	23.57	22.08	16.18	23.46	8.69	13.25	11.74	10.66	13.55	12.14	9.46	11.85
PY1 (Vuw)	7.33	9.46	10.79	6.70	9.28	7.58	10.36	7.35	3.53	4.61	5.24	3.23	4.53	3.65	4.95	3.62
PX2 (Mu)	19.71	16.67	23.48	15.23	17.59	16.48	26.44	13.69	9.74	7.94	13.09	6.20	9.11	8.14	15.07	4.50
PY2 (Mu)	8.21	6.95	9.78	6.35	7.33	6.87	11.02	5.70	4.06	3.31	5.45	2.58	3.80	3.39	6.28	1.87
Pu (kip)	40.06	43.49	47.89	38.78	44.39	41.17	47.68	39.38	19.94	22.62	27.03	17.84	24.14	21.47	26.98	17.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1321.90	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1312.78	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2214.19	2520.00	OK
TF Inside	2149.94	2446.88	OK
BF Inside	1577.95	1631.25	OK
BF Outside	1567.07	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.57	42.09	46.44	38.18	43.14	40.40	46.52	38.44
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	841.75
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2214.19	19.77	OK	1259.44	11.24	OK
BF	1577.95	28.18	OK	481.33	8.60	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2214.19	19.77	1.47	160.39	OK
TF	4364.13	38.97	1.47	252.04	OK
TF Inside	2149.94	19.20	1.47	171.84	OK
BF Inside	1577.95	28.18	1.47	114.56	OK
BF	3145.02	56.16	1.47	229.13	OK
BF Outside	1567.07	27.98	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.89	23.94	OK	27.03	13.52	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.89	1.47	126.02	OK
Web SPL	23.94	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	1.01	1.03
BF Outside	1.05	1.03

Bolt	Shear	Slip	Bearing
TF	1.70	1.50	6.47
Web	2.16	1.30	3.76
BF	1.28	1.96	3.68

Plate	Shear	Flexure
Web	1.95	1.60

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.06	-1.58	-27.69	-13.96	-32.57	-3.86	-20.55	-9.77	-27.55	-10.11	-23.31	-7.56	-32.25	1.27	-21.28	-16.09
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.46	0.03	0.55	0.28	0.65	0.08	0.41	0.20	0.55	0.21	0.47	0.15	0.64	0.03	0.43	0.33
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-23.06		-27.69		-32.57		-20.55		-27.55		-23.31		-32.25		-21.28	
Fcf (ksi)	-37.50		-38.84		-41.29		-37.50		-38.78		-37.50		-41.12		-37.50	
Fcf (kip)	-3712.50		-3845.44		-4087.22		-3712.50		-3838.87		-3712.50		-4071.19		-3712.50	
fncf (ksi)		-1.58		-13.96		-3.86		-9.77		-10.11		-7.56		1.27		-16.09
Rcf		1.15		1.19		1.27		1.15		1.19		1.15		1.26		1.15
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.805	-1.167798	-20.12116	-10.44925	-23.57214	-3.313311	-15.03139	-6.95494	-20.02733	-7.72301	-16.98029	-5.391226	-23.29286	0.8514133	-15.59	-11.95
Fs (ksi)	-16.80	-1.17	-20.12	-10.45	-23.57	-3.31	-15.03	-6.95	-20.03	-7.72	-16.98	-5.39	-23.29	0.85	-15.59	-11.95
Fs (kip)	-1663.69	-93.42	-1991.99	-835.94	-2333.64	-265.06	-1488.11	-556.40	-1982.71	-617.84	-1681.05	-431.30	-2305.99	68.11	-1543.81	-955.94

Vu (kip)	381.36	491.99	561.17	348.57	482.71	394.23	538.50	382.44	275.40	359.67	408.54	252.23	353.12	284.49	386.42	282.27
Vuw (kip)	572.04	737.98	841.75	522.85	724.07	591.35	807.76	573.66	---	---	---	---	---	---	---	---
Mv (k*ft)	321.77	415.11	473.48	294.10	407.29	332.63	454.36	322.68	154.91	202.31	229.81	141.88	198.63	160.03	217.36	158.78
Huw (kip)	-1297.67	-1831.41	-1524.07	-1608.89	-1676.68	-1524.80	-1303.97	-1848.76	-593.10	-1008.82	-887.22	-725.55	-915.76	-738.26	-740.57	-908.93
Muw (k*ft)									344.02	212.78	445.69	177.68	270.70	254.96	531.17	80.18
Mu (k*ft)	321.77	415.11	473.48	294.10	407.29	332.63	454.36	322.68	498.93	415.10	675.50	319.56	469.32	414.99	748.54	238.96

Muw (k*ft)	784.89	488.15	800.50	577.41	588.38	633.47	940.70	417.48	formulas matching the Muw results
Pu (add)	186.05	115.71	189.75	136.87	139.47	150.16	222.84	98.96	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 3% 5% 3% 4% 4% 6% 3% percentage increase in flange force 5.66%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.64	23.48	19.54	20.63	21.50	19.55	16.72	23.70	7.60	12.93	11.37	9.30	11.74	9.46	9.49	11.65
PY1 (Vuw)	7.33	9.46	10.79	6.70	9.28	7.58	10.36	7.35	3.53	4.61	5.24	3.23	4.53	3.65	4.95	3.62
PX2 (Mu)	5.85	7.55	8.61	5.35	7.41	6.05	8.26	5.87	9.07	7.55	12.29	5.81	8.54	7.55	13.61	4.35
PY2 (Mu)	2.44	3.15	3.59	2.23	3.09	2.52	3.44	2.45	3.78	3.15	5.12	2.42	3.56	3.15	5.67	1.81
Pu (kip)	24.52	33.49	31.61	27.47	31.44	27.52	28.54	31.15	18.21	21.90	25.83	16.14	21.83	18.32	25.44	16.90

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.72	31.22	28.73	25.92	29.17	25.72	25.63	29.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.49	16.75	OK	25.83	12.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.49	1.47	126.02	OK
Web SPL	16.75	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 5462

Node 5462

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5462 L	99.00	50.00	4950.00	80.00	50.00	4000.00	66.00	50.00	3300.00
5462 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 5462 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.93	1.00	-30.85	-14.30	-36.39	-3.28	-23.17	-11.01	-27.61	-9.98	-31.46	-11.64	-36.24	5.49	-23.72	-16.47
ϕf Fnc (ksi)	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.52	0.02	0.62	0.29	0.73	0.07	0.46	0.22	0.55	0.20	0.63	0.24	0.72	0.11	0.47	0.33
α	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-25.93		-30.85		-36.39		-23.17		-27.61		-31.46		-36.24		-23.72	
Fcf (ksi)	-37.97		-40.43		-43.19		-37.50		-38.81		-40.73		-43.12		-37.50	
Fcf (kip)	-3758.56		-4002.14		-4276.15		-3712.50		-3841.82		-4032.28		-4268.64		-3712.50	
fncf (ksi)		1.00		-14.30		-3.28		-11.01		-9.98		-11.64		5.49		-16.47
Rcf		1.04		1.11		1.19		1.03		1.07		1.12		1.18		1.03
Fncf (ksi)		37.50		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.42	1.22	-22.72	-10.48	-26.94	-2.41	-17.24	-7.65	-20.28	-6.65	-23.20	-8.56	-26.95	4.62	-17.50	-12.18
Fs (ksi)	-19.42	1.22	-22.72	-10.48	-26.94	-2.41	-17.24	-7.65	-20.28	-6.65	-23.20	-8.56	-26.95	4.62	-17.50	-12.18
Fs (kip)	-1922.09	97.51	-2248.96	-838.55	-2667.55	-192.98	-1707.15	-611.80	-2007.94	-531.74	-2296.92	-684.47	-2668.13	369.87	-1732.30	-974.07

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2643.70	0.00	369.87
Comp	4500.50	3160.29	2668.13	974.07

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	415.76	525.70	598.96	377.76	465.68	451.53	578.47	409.14	300.25	383.00	434.75	273.40	335.51	330.59	415.20	300.64
Vuw (kip)	623.64	788.55	898.44	566.64	698.52	677.30	867.70	613.71	---	---	---	---	---	---	---	---
Mv (k*ft)	350.80	443.56	505.37	318.74	392.92	380.98	488.08	345.21	168.89	215.44	244.55	153.79	188.73	185.96	233.55	169.11
Huw (kip)	-1218.46	-1858.21	-1554.00	-1611.86	-1631.88	-1774.08	-1208.24	-1797.50	-600.47	-1095.56	-968.79	-821.42	-888.66	-1047.98	-736.81	-979.24
Muw (k*ft)	858.16	539.92	864.51	575.43	619.56	609.40	1091.67	451.67	453.95	269.17	539.72	211.12	299.98	322.20	694.63	117.09
Mu (k*ft)	1208.96	983.48	1369.88	894.16	1012.47	990.38	1579.76	796.88	622.84	484.60	784.27	364.91	488.71	508.16	928.18	286.20

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.62	23.82	19.92	20.66	20.92	22.74	15.49	23.04	7.70	14.05	12.42	10.53	11.39	13.44	9.45	12.55
PY1 (Vuw)	8.00	10.11	11.52	7.26	8.96	8.68	11.12	7.87	3.85	4.91	5.57	3.51	4.30	4.24	5.32	3.85
PX2 (Mu)	21.99	17.89	24.92	16.26	18.42	18.01	28.73	14.49	11.33	8.81	14.26	6.64	8.89	9.24	16.88	5.21
PY2 (Mu)	9.16	7.45	10.38	6.78	7.67	7.51	11.97	6.04	4.72	3.67	5.94	2.77	3.70	3.85	7.03	2.17
Pu (kip)	41.34	45.26	49.90	39.51	42.71	43.86	49.89	40.03	20.87	24.42	29.06	18.28	21.80	24.08	29.08	18.75

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1326.42	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1317.28	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2283.38	2520.00	OK
TF Inside	2217.12	2446.88	OK
BF Inside	1585.61	1631.25	OK
BF Outside	1574.68	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.75	43.72	48.29	38.81	41.58	42.85	48.57	38.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	898.44
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2283.38	20.39	OK	1353.71	12.09	OK
BF	1585.61	28.31	OK	488.72	8.73	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2283.38	20.39	1.47	160.39	OK
TF	4500.50	40.18	1.47	252.04	OK
TF Inside	2217.12	19.80	1.47	171.84	OK
BF Inside	1585.61	28.31	1.47	114.56	OK
BF	3160.29	56.43	1.47	229.13	OK
BF Outside	1574.68	28.12	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.90	24.95	OK	29.08	14.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.90	1.47	126.02	OK
Web SPL	24.95	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	1.00	1.03
BF Outside	1.04	1.03

Bolt	Shear	Slip	Bearing
TF	1.65	1.39	6.27
Web	2.15	1.26	3.74
BF	1.28	1.93	3.67

Plate	Shear	Flexure
Web	1.83	1.60

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5462**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.82	-1.13	-28.32	-12.68	-33.43	-1.92	-21.08	-9.61	-25.62	-8.88	-24.97	-6.61	-33.13	2.33	-21.81	-15.04
ϕf Fnc (ksi)	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.48	0.02	0.57	0.26	0.67	0.04	0.42	0.20	0.51	0.18	0.50	0.13	0.66	0.05	0.44	0.31
α	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-23.82		-28.32		-33.43		-21.08		-25.62		-24.97		-33.13		-21.81	
Fcf (ksi)	-37.50		-39.16		-41.72		-37.50		-37.81		-37.50		-41.56		-37.50	
Fcf (kip)	-3712.50		-3876.89		-4129.80		-3712.50		-3743.06		-3712.50		-4114.86		-3712.50	
fncf (ksi)		-1.13		-12.68		-1.92		-9.61		-8.88		-6.61		2.33		-15.04
Rcf		1.12		1.17		1.25		1.12		1.13		1.12		1.24		1.12
Fncf (ksi)		-37.50		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		-3000.00		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.34564	-0.815043	-20.48957	-9.503692	-24.09947	-1.906105	-15.41111	-6.803052	-18.61655	-6.289852	-18.1236	-5.218786	-23.92333	1.6316242	-15.89	-11.17
Fs (ksi)	-17.35	-0.82	-20.49	-9.50	-24.10	-1.91	-15.41	-6.80	-18.62	-6.29	-18.12	-5.22	-23.92	1.63	-15.89	-11.17
Fs (kip)	-1717.22	-65.20	-2028.47	-760.30	-2385.85	-152.49	-1525.70	-544.24	-1843.04	-503.19	-1794.24	-417.50	-2368.41	130.53	-1572.83	-893.90

Vu (kip)	415.76	525.70	598.96	377.76	465.68	451.53	578.47	409.14	300.25	383.00	434.75	273.40	335.51	330.59	415.20	300.64
Vuw (kip)	623.64	788.55	898.44	566.64	698.52	677.30	867.70	613.71	---	---	---	---	---	---	---	---
Mv (k*ft)	350.80	443.56	505.37	318.74	392.92	380.98	488.08	345.21	168.89	215.44	244.55	153.79	188.73	185.96	233.55	169.11
Huw (kip)	-1279.42	-1782.36	-1455.83	-1593.15	-1579.16	-1482.29	-1276.00	-1794.29	-599.30	-989.78	-858.18	-733.07	-821.91	-770.30	-735.63	-893.01
Muw (k*ft)									363.67	241.69	488.25	189.38	271.19	283.91	562.21	103.70
Mu (k*ft)	350.80	443.56	505.37	318.74	392.92	380.98	488.08	345.21	532.56	457.12	732.80	343.16	459.91	469.87	795.76	272.81
Muw (k*ft)	797.05	534.82	864.91	587.90	610.81	661.81	976.16	459.81		formulas matching the Muw results						
Pu (add)	188.93	126.77	205.02	139.35	144.78	156.87	231.86	107.57		additional flange force						

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 3% 5% 3% 4% 4% 6% 3% percentage increase in flange force 5.80%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.40	22.85	18.66	20.43	20.25	19.00	16.36	23.00	7.68	12.69	11.00	9.40	10.54	9.88	9.43	11.45
PY1 (Vuw)	8.00	10.11	11.52	7.26	8.96	8.68	11.12	7.87	3.85	4.91	5.57	3.51	4.30	4.24	5.32	3.85
PX2 (Mu)	6.38	8.07	9.19	5.80	7.15	6.93	8.88	6.28	9.69	8.31	13.33	6.24	8.37	8.55	14.47	4.96
PY2 (Mu)	2.66	3.36	3.83	2.42	2.98	2.89	3.70	2.62	4.04	3.46	5.55	2.60	3.49	3.56	6.03	2.07
Pu (kip)	25.15	33.73	31.81	27.95	29.88	28.40	29.27	31.10	19.08	22.61	26.75	16.79	20.44	20.00	26.46	17.45

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	23.12	31.24	28.58	26.25	27.67	26.24	26.01	29.27
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.73	16.86	OK	26.75	13.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.73	1.47	126.02	OK
Web SPL	16.86	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 7462

Node 7462

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7462 L	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00
7462 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 7462 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.88	-1.63	-30.71	-15.73	-36.01	-5.37	-20.66	-9.63	-25.82	-10.37	-33.46	-13.75	-34.20	3.43	-23.22	-17.28
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.48	0.03	0.61	0.32	0.72	0.11	0.41	0.20	0.52	0.21	0.67	0.28	0.68	0.07	0.46	0.35
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-23.88		-30.71		-36.01		-20.66		-25.82		-33.46		-34.20		-23.22	
Fcf (ksi)	-37.50		-40.36		-43.00		-37.50		-37.91		-41.73		-42.10		-37.50	
Fcf (kip)	-3712.50		-3995.39		-4257.41		-3712.50		-3752.96		-4131.16		-4168.08		-3712.50	
fncf (ksi)		-1.63		-15.73		-5.37		-9.63		-10.37		-13.75		3.43		-17.28
Rcf		1.04		1.12		1.19		1.04		1.05		1.16		1.17		1.04
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.84	-0.83	-22.69	-11.49	-26.73	-3.90	-15.35	-6.67	-19.01	-7.07	-24.72	-10.02	-25.38	3.02	-17.23	-12.74
Fs (ksi)	-17.84	-0.83	-22.69	-11.49	-26.73	-3.90	-15.35	-6.67	-19.01	-7.07	-24.72	-10.02	-25.38	3.02	-17.23	-12.74
Fs (kip)	-1765.89	-66.52	-2246.76	-919.23	-2646.70	-311.90	-1519.96	-533.94	-1882.12	-565.24	-2446.99	-801.43	-2512.27	241.76	-1705.34	-1019.35

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2634.20	0.00	241.76
Comp	4449.66	3147.52	2646.70	1019.35

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	383.66	493.73	563.72	350.01	399.99	483.90	540.70	384.14	276.63	362.01	411.46	252.85	288.17	355.07	387.58	284.59
Vuw (kip)	575.48	740.60	845.58	525.01	599.99	725.85	811.04	576.21	---	---	---	---	---	---	---	---
Mv (k*ft)	323.71	416.59	475.64	295.32	337.49	408.29	456.21	324.12	155.60	203.63	231.45	142.23	162.10	199.72	218.01	160.08
Huw (kip)	-1293.67	-1913.45	-1630.66	-1568.41	-1611.11	-1902.93	-1257.09	-1831.25	-616.07	-1128.10	-1010.89	-726.91	-860.53	-1146.25	-737.70	-988.93
Muw (k*ft)	787.56	500.10	805.07	604.39	593.91	567.45	1014.42	429.16	374.13	246.49	502.38	190.94	262.81	323.38	624.77	98.64
Mu (k*ft)	1111.27	916.68	1280.71	899.71	931.41	975.74	1470.63	753.28	529.73	450.12	733.83	333.17	424.90	523.11	842.78	258.72

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.59	24.53	20.91	20.11	20.66	24.40	16.12	23.48	7.90	14.46	12.96	9.32	11.03	14.70	9.46	12.68
PY1 (Vuw)	7.38	9.49	10.84	6.73	7.69	9.31	10.40	7.39	3.55	4.64	5.28	3.24	3.69	4.55	4.97	3.65
PX2 (Mu)	20.21	16.67	23.29	16.36	16.94	17.75	26.75	13.70	9.64	8.19	13.35	6.06	7.73	9.51	15.33	4.71
PY2 (Mu)	8.42	6.95	9.71	6.82	7.06	7.39	11.15	5.71	4.01	3.41	5.56	2.52	3.22	3.96	6.39	1.96
Pu (kip)	40.05	44.36	48.74	38.91	40.39	45.33	47.97	39.42	19.09	24.04	28.45	16.42	19.99	25.66	27.26	18.27

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1321.66	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1312.54	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2257.59	2520.00	OK
TF Inside	2192.08	2446.88	OK
BF Inside	1579.21	1631.25	OK
BF Outside	1568.32	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.58	42.97	47.31	38.40	39.59	44.10	46.83	38.46
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	845.58
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2257.59	20.16	OK	1342.84	11.99	OK
BF	1579.21	28.20	OK	511.44	9.13	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2257.59	20.16	1.47	160.39	OK
TF	4449.66	39.73	1.47	252.04	OK
TF Inside	2192.08	19.57	1.47	171.84	OK
BF Inside	1579.21	28.20	1.47	114.56	OK
BF	3147.52	56.21	1.47	229.13	OK
BF Outside	1568.32	28.01	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.74	24.37	OK	28.45	14.23	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.74	1.47	126.02	OK
Web SPL	24.37	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.01	1.03
BF Outside	1.05	1.03

Bolt	Shear	Slip	Bearing
TF	1.67	1.40	6.34
Web	2.17	1.30	3.78
BF	1.28	1.84	3.68

Plate	Shear	Flexure
Web	1.94	1.61

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.98	-1.70	-27.67	-13.59	-32.58	-3.49	-20.45	-9.86	-23.26	-8.68	-27.64	-9.32	-32.16	1.24	-21.25	-15.75
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.46	0.03	0.55	0.28	0.65	0.07	0.41	0.20	0.47	0.18	0.55	0.19	0.64	0.02	0.43	0.32
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-22.98		-27.67		-32.58		-20.45		-23.26		-27.64		-32.16		-21.25	
Fcf (ksi)	-37.50		-38.83		-41.29		-37.50		-37.50		-38.82		-41.08		-37.50	
Fcf (kip)	-3712.50		-3844.57		-4087.55		-3712.50		-3712.50		-3843.08		-4066.89		-3712.50	
fncf (ksi)		-1.70		-13.59		-3.49		-9.86		-8.68		-9.32		1.24		-15.75
Rcf		1.15		1.19		1.27		1.15		1.15		1.19		1.26		1.15
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.73078	-1.258423	-20.15137	-10.14226	-23.61945	-3.008757	-14.93913	-7.027479	-16.92435	-6.189	-20.13009	-7.125933	-23.21296	0.8162937	-15.62	-11.67
Fs (ksi)	-16.73	-1.26	-20.15	-10.14	-23.62	-3.01	-14.94	-7.03	-16.92	-6.19	-20.13	-7.13	-23.21	0.82	-15.62	-11.67
Fs (kip)	-1656.35	-100.67	-1994.99	-811.38	-2338.33	-240.70	-1478.97	-562.20	-1675.51	-495.12	-1992.88	-570.07	-2298.08	65.30	-1546.24	-933.85

Vu (kip)	383.66	493.73	563.72	350.01	399.99	483.90	540.70	384.14	276.63	362.01	411.46	252.85	288.17	355.07	387.58	284.59
Vuw (kip)	575.48	740.60	845.58	525.01	599.99	725.85	811.04	576.21	---	---	---	---	---	---	---	---
Mv (k*ft)	323.71	416.59	475.64	295.32	337.49	408.29	456.21	324.12	155.60	203.63	231.45	142.23	162.10	199.72	218.01	160.08
Huw (kip)	-1302.06	-1815.94	-1508.42	-1612.24	-1567.16	-1647.35	-1304.15	-1835.86	-593.64	-999.69	-878.73	-724.90	-762.74	-899.45	-739.09	-900.62
Muw (k*ft)									340.39	220.20	453.44	174.06	236.18	286.09	528.64	86.80
Mu (k*ft)	323.71	416.59	475.64	295.32	337.49	408.29	456.21	324.12	496.00	423.83	684.88	316.29	398.27	485.82	746.66	246.88

Muw (k*ft)	781.96	498.07	811.08	575.17	605.23	609.80	968.07	426.00	formulas matching the Muw results
Pu (add)	185.35	118.06	192.26	136.34	143.46	144.55	222.36	101.00	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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5% 3% 5% 3% 4% 4% 6% 3% percentage increase in flange force 5.64%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.69	23.28	19.34	20.67	20.09	21.12	16.72	23.54	7.61	12.82	11.27	9.29	9.78	11.53	9.48	11.55
PY1 (Vuw)	7.38	9.49	10.84	6.73	7.69	9.31	10.40	7.39	3.55	4.64	5.28	3.24	3.69	4.55	4.97	3.65
PX2 (Mu)	5.89	7.58	8.65	5.37	6.14	7.43	8.30	5.90	9.02	7.71	12.46	5.75	7.24	8.84	13.58	4.49
PY2 (Mu)	2.45	3.16	3.60	2.24	2.56	3.09	3.46	2.46	3.76	3.21	5.19	2.40	3.02	3.68	5.66	1.87
Pu (kip)	24.63	33.35	31.50	27.54	28.16	31.12	28.60	31.03	18.17	21.98	25.93	16.07	18.30	21.97	25.39	16.96

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	22.81	31.07	28.58	25.99	26.34	28.83	25.67	29.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.35	16.68	OK	25.93	12.96	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.35	1.47	126.02	OK
Web SPL	16.68	1.47	91.65	OK

Field Splice - Node 9462

Node 9462

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9462 L	99.00	50.00	4950.00	80.00	50.00	4000.00	66.00	50.00	3300.00
9462 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 9462 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.14	1.55	-29.83	-13.07	-34.11	-3.99	-18.36	-9.23	-24.36	-9.13	-31.06	-11.34	-32.18	5.27	-19.50	-15.76
ϕf Fnc (ksi)	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.42	0.03	0.60	0.27	0.68	0.08	0.37	0.19	0.49	0.19	0.62	0.23	0.64	0.11	0.39	0.32
α	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-21.14		-29.83		-34.11		-18.36		-24.36		-31.06		-32.18		-19.50	
Fcf (ksi)	-37.50		-39.92		-42.05		-37.50		-37.50		-40.53		-41.09		-37.50	
Fcf (kip)	-3712.50		-3951.70		-4163.40		-3712.50		-3712.50		-4012.56		-4067.90		-3712.50	
fncf (ksi)		1.55		-13.07		-3.99		-9.23		-9.13		-11.34		5.27		-15.76
Rcf		1.10		1.17		1.23		1.10		1.10		1.19		1.20		1.10
Fncf (ksi)		37.50		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.62	1.29	-22.10	-9.45	-25.38	-2.81	-13.43	-6.40	-18.17	-6.66	-22.74	-7.84	-23.82	4.29	-14.56	-11.58
Fs (ksi)	-15.62	1.29	-22.10	-9.45	-25.38	-2.81	-13.43	-6.40	-18.17	-6.66	-22.74	-7.84	-23.82	4.29	-14.56	-11.58
Fs (kip)	-1546.27	103.54	-2188.25	-756.34	-2512.80	-224.60	-1329.17	-512.18	-1798.63	-533.20	-2250.97	-627.46	-2358.67	343.03	-1441.13	-926.38

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2641.75	0.00	343.03
Comp	4359.54	3151.41	2512.80	926.38

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	325.23	475.44	538.26	286.04	362.94	443.10	509.90	331.50	233.03	350.73	395.11	205.34	271.24	316.31	363.51	249.03
Vuw (kip)	487.84	713.16	807.39	429.06	544.40	664.65	764.86	497.25	---	---	---	---	---	---	---	---
Mv (k*ft)	274.41	401.15	454.15	241.35	306.23	373.86	430.23	279.70	131.08	197.28	222.25	115.51	152.57	177.92	204.47	140.08
Huw (kip)	-1181.30	-1821.88	-1550.15	-1572.44	-1568.72	-1782.32	-1146.62	-1809.23	-472.71	-1041.41	-930.25	-654.33	-819.49	-1009.15	-644.72	-862.51
Muw (k*ft)	862.47	541.72	816.97	601.71	604.19	595.15	1043.54	443.85	372.09	278.28	496.63	154.52	253.07	327.66	618.48	65.50
Mu (k*ft)	1136.88	942.87	1271.12	843.06	910.41	969.01	1473.77	723.55	503.17	475.57	718.88	270.03	405.64	505.59	822.96	205.58

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.14	23.36	19.87	20.16	20.11	22.85	14.70	23.20	6.06	13.35	11.93	8.39	10.51	12.94	8.27	11.06
PY1 (Vuw)	6.25	9.14	10.35	5.50	6.98	8.52	9.81	6.37	2.99	4.50	5.07	2.63	3.48	4.06	4.66	3.19
PX2 (Mu)	20.68	17.15	23.12	15.33	16.56	17.63	26.81	13.16	9.15	8.65	13.08	4.91	7.38	9.20	14.97	3.74
PY2 (Mu)	8.62	7.15	9.63	6.39	6.90	7.34	11.17	5.48	3.81	3.60	5.45	2.05	3.07	3.83	6.24	1.56
Pu (kip)	38.79	43.66	47.41	37.43	39.21	43.47	46.51	38.24	16.66	23.45	27.12	14.10	19.05	23.50	25.66	15.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1325.44	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1316.30	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2211.86	2520.00	OK
TF Inside	2147.68	2446.88	OK
BF Inside	1581.16	1631.25	OK
BF Outside	1570.25	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	38.75	42.41	46.13	37.23	38.63	42.49	45.55	37.56
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	807.39
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9462**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2211.86	19.75	OK	1274.90	11.38	OK
BF	1581.16	28.23	OK	464.79	8.30	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2211.86	19.75	1.47	160.39	OK
TF	4359.54	38.92	1.47	252.04	OK
TF Inside	2147.68	19.18	1.47	171.84	OK
BF Inside	1581.16	28.23	1.47	114.56	OK
BF	3151.41	56.28	1.47	229.13	OK
BF Outside	1570.25	28.04	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.41	23.71	OK	27.12	13.56	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.41	1.47	126.02	OK
Web SPL	23.71	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	1.01	1.03
BF Outside	1.04	1.03

Bolt	Shear	Slip	Bearing
TF	1.71	1.48	6.48
Web	2.30	1.37	4.00
BF	1.28	2.03	3.68

Plate	Shear	Flexure
Web	2.03	1.71

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9462**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.78	0.12	-26.36	-10.61	-30.64	-2.06	-16.91	-8.29	-20.76	-6.50	-24.98	-6.68	-30.13	3.07	-17.77	-14.36
ϕf Fnc (ksi)	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00	50.00	49.25
f / ϕf Fnc	0.40	0.00	0.53	0.22	0.61	0.04	0.34	0.17	0.42	0.13	0.50	0.14	0.60	0.06	0.36	0.29
α	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00	1.00	0.99
fcf (ksi)	-19.78		-26.36		-30.64		-16.91		-20.76		-24.98		-30.13		-17.77	
Fcf (ksi)	-37.50		-38.18		-40.32		-37.50		-37.50		-37.50		-40.07		-37.50	
Fcf (kip)	-3712.50		-3779.71		-3991.62		-3712.50		-3712.50		-3712.50		-3966.55		-3712.50	
fncf (ksi)		0.12		-10.61		-2.06		-8.29		-6.50		-6.68		3.07		-14.36
Rcf		1.22		1.25		1.32		1.22		1.22		1.22		1.31		1.22
Fncf (ksi)		37.50		-36.94		-36.94		-36.94		-36.94		-36.94		37.50		-36.94
Fncf (kip)		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84		-2955.27

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.32142	-0.027145	-19.30659	-7.998928	-22.33117	-1.95348	-12.29117	-5.969738	-15.35149	-5.096268	-17.99652	-4.829726	-21.63329	2.0610042	-13.24	-10.65
Fs (ksi)	-14.32	-0.03	-19.31	-8.00	-22.33	-1.95	-12.29	-5.97	-15.35	-5.10	-18.00	-4.83	-21.63	2.06	-13.24	-10.65
Fs (kip)	-1417.82	-2.17	-1911.35	-639.91	-2210.79	-156.28	-1216.83	-477.58	-1519.80	-407.70	-1781.66	-386.38	-2141.70	164.88	-1310.85	-851.72

Vu (kip)	325.23	475.44	538.26	286.04	362.94	443.10	509.90	331.50	233.03	350.73	395.11	205.34	271.24	316.31	363.51	249.03
Vuw (kip)	487.84	713.16	807.39	429.06	544.40	664.65	764.86	497.25	---	---	---	---	---	---	---	---
Mv (k*ft)	274.41	401.15	454.15	241.35	306.23	373.86	430.23	279.70	131.08	197.28	222.25	115.51	152.57	177.92	204.47	140.08
Huw (kip)	-1232.70	-1696.33	-1419.85	-1572.42	-1500.23	-1507.25	-1189.51	-1817.52	-473.50	-901.08	-801.39	-602.61	-674.78	-753.27	-645.89	-788.28
Muw (k*ft)									314.47	248.77	448.31	139.07	225.61	289.67	521.27	57.08
Mu (k*ft)	274.41	401.15	454.15	241.35	306.23	373.86	430.23	279.70	445.55	446.05	670.56	254.58	378.19	467.59	725.75	197.16

Muw (k*ft)	828.20	548.98	827.49	601.72	649.85	645.17	969.90	458.32	formulas matching the Muw results
Pu (add)	196.31	130.13	196.15	142.63	154.04	152.93	229.90	103.90	additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9462	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5%	3%	5%	4%	4%	4%	6%	3%	percentage increase in flange force	5.75%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.80	21.75	18.20	20.16	19.23	19.32	15.25	23.30	6.07	11.55	10.27	7.73	8.65	9.66	8.28	10.11
PY1 (Vuw)	6.25	9.14	10.35	5.50	6.98	8.52	9.81	6.37	2.99	4.50	5.07	2.63	3.48	4.06	4.66	3.19
PX2 (Mu)	4.99	7.30	8.26	4.39	5.57	6.80	7.83	5.09	8.10	8.11	12.20	4.63	6.88	8.50	13.20	3.59
PY2 (Mu)	2.08	3.04	3.44	1.83	2.32	2.83	3.26	2.12	3.38	3.38	5.08	1.93	2.87	3.54	5.50	1.49
Pu (kip)	22.40	31.50	29.84	25.62	26.49	28.48	26.52	29.63	15.54	21.18	24.66	13.17	16.78	19.69	23.76	14.47

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	20.91	29.28	27.04	24.34	24.85	26.39	23.72	28.15
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.50	15.75	OK	24.66	12.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.50	1.47	126.02	OK
Web SPL	15.75	1.47	91.65	OK

Field Splice - Node 1476

Node 1476

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1476 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
1476 R	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 1476 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.97	-11.46	-21.39	1.80	-32.33	0.60	-18.86	-12.39	-23.60	-12.98	-30.17	-7.05	-17.92	-17.48	-31.45	4.99
ϕf Fnc (ksi)	50.00	49.25	50.00	50.00	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.54	0.23	0.43	0.04	0.65	0.01	0.38	0.25	0.47	0.26	0.60	0.14	0.36	0.35	0.63	0.10
α	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-26.97		-21.39		-32.33		-18.86		-23.60		-30.17		-17.92		-31.45	
Fcf (ksi)	-38.48		-37.50		-41.16		-37.50		-37.50		-40.08		-37.50		-40.73	
Fcf (kip)	-3810.01		-3712.50		-4075.28		-3712.50		-3712.50		-3968.19		-3712.50		-4031.79	
fncf (ksi)		-11.46		1.80		0.60		-12.39		-12.98		-7.05		-17.48		4.99
Rcf		1.19		1.16		1.27		1.16		1.16		1.24		1.16		1.26
Fncf (ksi)		-36.94		37.50		37.50		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		2411.84		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.80	-8.23	-16.08	1.54	-23.87	-1.34	-14.01	-8.80	-17.43	-9.14	-22.20	-4.99	-13.09	-12.72	-23.38	3.97
Fs (ksi)	-19.80	-8.23	-16.08	1.54	-23.87	-1.34	-14.01	-8.80	-17.43	-9.14	-22.20	-4.99	-13.09	-12.72	-23.38	3.97
Fs (kip)	-1960.09	-658.29	-1591.51	123.30	-2362.82	-107.42	-1386.68	-703.86	-1725.64	-731.50	-2197.47	-398.89	-1296.07	-1017.80	-2314.68	317.87

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2642.52	0.00	317.87
Comp	4274.57	3125.63	2362.82	1017.80

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	470.79	330.62	535.76	289.78	347.53	464.11	326.38	506.48	341.63	239.97	387.53	211.11	251.91	336.91	239.60	364.21
Vuw (kip)	706.19	495.94	803.64	434.67	521.30	696.17	489.57	759.72	---	---	---	---	---	---	---	---
Mv (k*ft)	397.23	278.96	452.05	244.50	293.23	391.59	275.39	427.34	192.17	134.98	217.99	118.75	141.70	189.51	134.78	204.87
Huw (kip)	-1720.13	-1168.74	-1333.26	-1711.83	-1734.29	-1611.15	-1906.56	-1136.69	-924.91	-479.64	-831.92	-752.57	-876.96	-897.03	-851.87	-640.44
Muw (k*ft)	546.58	870.84	922.39	508.78	493.81	689.54	378.96	1034.11	254.55	387.58	495.53	114.59	182.31	378.63	8.12	601.79
Mu (k*ft)	943.81	1149.81	1374.44	753.28	787.04	1081.14	654.34	1461.46	446.71	522.56	713.52	233.34	324.01	568.14	142.90	806.66

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.05	14.98	17.09	21.95	22.23	20.66	24.44	14.57	11.86	6.15	10.67	9.65	11.24	11.50	10.92	8.21
PY1 (Vuw)	9.05	6.36	10.30	5.57	6.68	8.93	6.28	9.74	4.38	3.08	4.97	2.71	3.23	4.32	3.07	4.67
PX2 (Mu)	17.17	20.91	25.00	13.70	14.32	19.66	11.90	26.58	8.13	9.50	12.98	4.24	5.89	10.33	2.60	14.67
PY2 (Mu)	7.15	8.71	10.42	5.71	5.96	8.19	4.96	11.08	3.39	3.96	5.41	1.77	2.46	4.31	1.08	6.11
Pu (kip)	42.44	38.93	46.92	37.39	38.68	43.80	38.04	46.12	21.44	17.16	25.82	14.60	18.05	23.48	14.14	25.30

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1325.83	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1316.69	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2168.75	2520.00	OK
TF Inside	2105.82	2446.88	OK
BF Inside	1568.22	1631.25	OK
BF Outside	1557.41	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.19	38.88	45.69	37.01	38.00	42.80	37.26	45.16
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	803.64
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2168.75	19.36	OK	1198.80	10.70	OK
BF	1568.22	28.00	OK	510.66	9.12	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2168.75	19.36	1.47	160.39	OK
TF	4274.57	38.17	1.47	252.04	OK
TF Inside	2105.82	18.80	1.47	171.84	OK
BF Inside	1568.22	28.00	1.47	114.56	OK
BF	3125.63	55.81	1.47	229.13	OK
BF Outside	1557.41	27.81	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.92	23.46	OK	25.82	12.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.92	1.47	126.02	OK
Web SPL	23.46	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	1.01	1.04
BF Outside	1.04	1.04

Bolt	Shear	Slip	Bearing
TF	1.74	1.57	6.60
Web	2.30	1.39	4.00
BF	1.29	1.85	3.71

Plate	Shear	Flexure
Web	2.04	1.71

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1476**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.79	-11.01	-19.83	0.19	-30.35	-1.48	-16.44	-10.48	-19.38	-9.62	-26.06	-4.28	-16.75	-16.45	-29.91	3.25
ϕf Fnc (ksi)	50.00	49.25	50.00	50.00	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.52	0.22	0.40	0.00	0.61	0.03	0.33	0.21	0.39	0.20	0.52	0.09	0.34	0.33	0.60	0.06
α	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-25.79		-19.83		-30.35		-16.44		-19.38		-26.06		-16.75		-29.91	
Fcf (ksi)	-37.90		-37.50		-40.18		-37.50		-37.50		-38.03		-37.50		-39.96	
Fcf (kip)	-3751.65		-3712.50		-3977.46		-3712.50		-3712.50		-3765.13		-3712.50		-3955.78	
fncf (ksi)		-11.01		0.19		-1.48		-10.48		-9.62		-4.28		-16.45		3.25
Rcf		1.25		1.24		1.32		1.24		1.24		1.25		1.24		1.32
Fncf (ksi)		-36.94		37.50		-37.50		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		2411.84		-3000.00		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.65556	-8.168317	-14.52337	-0.009422	-21.8786	-1.438634	-12.12815	-7.546002	-14.20591	-6.939632	-18.84798	-3.416293	-12.26965	-12.01506	-21.65	2.15
Fs (ksi)	-18.66	-8.17	-14.52	-0.01	-21.88	-1.44	-12.13	-7.55	-14.21	-6.94	-18.85	-3.42	-12.27	-12.02	-21.65	2.15
Fs (kip)	-1846.90	-653.47	-1437.81	-0.75	-2165.98	-115.09	-1200.69	-603.68	-1406.38	-555.17	-1865.95	-273.30	-1214.69	-961.20	-2143.30	172.37

Vu (kip)	470.79	330.62	535.76	289.78	347.53	464.11	326.38	506.48	341.63	239.97	387.53	211.11	251.91	336.91	239.60	364.21
Vuw (kip)	706.19	495.94	803.64	434.67	521.30	696.17	489.57	759.72	---	---	---	---	---	---	---	---
Mv (k*ft)	397.23	278.96	452.05	244.50	293.23	391.59	275.39	427.34	192.17	134.98	217.99	118.75	141.70	189.51	134.78	204.87
Huw (kip)	-1704.00	-1229.91	-1390.50	-1664.82	-1629.83	-1432.01	-1908.20	-1177.45	-885.19	-479.58	-769.47	-649.25	-697.80	-734.72	-801.40	-643.33
Muw (k*ft)									230.72	319.31	449.68	100.81	159.86	339.50	5.60	523.69
Mu (k*ft)	397.23	278.96	452.05	244.50	293.23	391.59	275.39	427.34	422.89	454.29	667.67	219.56	301.56	529.01	140.38	728.56
Muw (k*ft)	531.40	830.06	840.76	540.12	563.45	718.72	377.87	873.16		formulas matching the Muw results						
Pu (add)	125.96	196.75	199.29	128.03	133.56	170.36	89.57	230.67		additional flange force						

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1476**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3%	5%	5%	3%	3%	4%	2%	6%	percentage increase in flange force	5.85%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.85	15.77	17.83	21.34	20.90	18.36	24.46	15.10	11.35	6.15	9.86	8.32	8.95	9.42	10.27	8.25
PY1 (Vuw)	9.05	6.36	10.30	5.57	6.68	8.93	6.28	9.74	4.38	3.08	4.97	2.71	3.23	4.32	3.07	4.67
PX2 (Mu)	7.23	5.07	8.22	4.45	5.33	7.12	5.01	7.77	7.69	8.26	12.14	3.99	5.48	9.62	2.55	13.25
PY2 (Mu)	3.01	2.11	3.43	1.85	2.22	2.97	2.09	3.24	3.20	3.44	5.06	1.66	2.29	4.01	1.06	5.52
Pu (kip)	31.48	22.50	29.45	26.84	27.70	28.12	30.64	26.29	20.50	15.82	24.19	13.07	15.45	20.78	13.48	23.79

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.29	20.97	26.64	25.54	26.16	25.85	29.17	23.51
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.48	15.74	OK	24.19	12.09	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.48	1.47	126.02	OK
Web SPL	15.74	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3476	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 3476

Node 3476

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3476 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
3476 R	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 3476 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.10	-14.08	-23.97	-1.58	-34.95	-3.03	-21.65	-12.47	-26.64	-14.15	-33.46	-9.28	-21.90	-17.49	-33.65	3.46
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.60	0.29	0.48	0.03	0.70	0.06	0.43	0.25	0.53	0.29	0.67	0.19	0.44	0.36	0.67	0.07
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-30.10		-23.97		-34.95		-21.65		-26.64		-33.46		-21.90		-33.65	
Fcf (ksi)	-40.05		-37.50		-42.47		-37.50		-38.32		-41.73		-37.50		-41.83	
Fcf (kip)	-3964.89		-3712.50		-4204.97		-3712.50		-3793.61		-4131.16		-3712.50		-4140.88	
fncf (ksi)		-14.08		-1.58		-3.03		-12.47		-14.15		-9.28		-17.49		3.46
Rcf		1.15		1.07		1.22		1.07		1.10		1.19		1.07		1.20
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.20	-10.00	-17.77	-0.92	-25.93	-1.92	-15.88	-8.85	-19.46	-9.98	-24.72	-6.47	-15.96	-12.48	-25.10	2.74
Fs (ksi)	-22.20	-10.00	-17.77	-0.92	-25.93	-1.92	-15.88	-8.85	-19.46	-9.98	-24.72	-6.47	-15.96	-12.48	-25.10	2.74
Fs (kip)	-2197.31	-800.38	-1758.84	-73.95	-2566.83	-153.22	-1571.87	-707.67	-1926.31	-798.42	-2447.34	-517.61	-1579.98	-998.15	-2484.63	218.83

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2641.01	0.00	218.83
Comp	4403.98	3154.28	2566.83	998.15

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	511.09	382.35	578.54	352.88	402.09	513.57	384.74	548.88	373.16	273.06	420.82	252.23	287.00	374.92	274.74	399.86
Vuw (kip)	766.63	573.53	867.81	529.32	603.13	770.36	577.11	823.32	---	---	---	---	---	---	---	---
Mv (k*ft)	431.23	322.61	488.14	297.74	339.26	433.32	324.62	463.12	209.90	153.59	236.71	141.88	161.44	210.89	154.54	224.92
Huw (kip)	-1854.19	-1293.59	-1523.04	-1678.99	-1776.49	-1742.55	-1856.84	-1243.68	-1062.60	-616.78	-918.81	-815.87	-971.45	-1029.29	-938.40	-737.94
Muw (k*ft)	526.04	787.61	853.51	530.67	501.72	674.37	412.11	1011.27	268.19	370.52	528.27	154.69	208.51	401.51	76.61	612.32
Mu (k*ft)	957.27	1110.21	1341.66	828.41	840.98	1107.70	736.73	1474.39	478.09	524.11	764.98	296.58	369.94	612.40	231.16	837.24

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.77	16.58	19.53	21.53	22.78	22.34	23.81	15.94	13.62	7.91	11.78	10.46	12.45	13.20	12.03	9.46
PY1 (Vuw)	9.83	7.35	11.13	6.79	7.73	9.88	7.40	10.56	4.78	3.50	5.40	3.23	3.68	4.81	3.52	5.13
PX2 (Mu)	17.41	20.19	24.40	15.07	15.30	20.15	13.40	26.82	8.70	9.53	13.91	5.39	6.73	11.14	4.20	15.23
PY2 (Mu)	7.25	8.41	10.17	6.28	6.37	8.39	5.58	11.17	3.62	3.97	5.80	2.25	2.80	4.64	1.75	6.35
Pu (kip)	44.59	40.02	48.82	38.86	40.60	46.25	39.41	47.97	23.85	18.97	28.03	16.78	20.25	26.10	17.07	27.22

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1325.07	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1315.94	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2234.41	2520.00	OK
TF Inside	2169.57	2446.88	OK
BF Inside	1582.60	1631.25	OK
BF Outside	1571.68	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.11	39.55	47.31	38.22	39.67	44.97	38.42	46.74
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	867.81
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2234.41	19.95	OK	1302.31	11.63	OK
BF	1582.60	28.26	OK	500.80	8.94	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2234.41	19.95	1.47	160.39	OK
TF	4403.98	39.32	1.47	252.04	OK
TF Inside	2169.57	19.37	1.47	171.84	OK
BF Inside	1582.60	28.26	1.47	114.56	OK
BF	3154.28	56.33	1.47	229.13	OK
BF Outside	1571.68	28.07	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.82	24.41	OK	28.03	14.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.82	1.47	126.02	OK
Web SPL	24.41	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.13
TF Inside	NA	1.13
BF Inside	1.01	1.03
BF Outside	1.04	1.03

Bolt	Shear	Slip	Bearing
TF	1.69	1.45	6.41
Web	2.15	1.27	3.74
BF	1.28	1.88	3.67

Plate	Shear	Flexure
Web	1.89	1.60

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.43	-13.21	-23.02	-1.60	-33.30	-2.79	-20.27	-11.59	-22.88	-11.28	-29.59	-6.75	-21.05	-16.90	-32.60	2.13
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.57	0.27	0.46	0.03	0.67	0.06	0.41	0.24	0.46	0.23	0.59	0.14	0.42	0.34	0.65	0.04
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-28.43		-23.02		-33.30		-20.27		-22.88		-29.59		-21.05		-32.60	
Fcf (ksi)	-39.21		-37.50		-41.65		-37.50		-37.50		-39.79		-37.50		-41.30	
Fcf (kip)	-3882.22		-3712.50		-4123.12		-3712.50		-3712.50		-3939.47		-3712.50		-4088.68	
fncf (ksi)		-13.21		-1.60		-2.79		-11.59		-11.28		-6.75		-16.90		2.13
Rcf		1.18		1.13		1.25		1.13		1.13		1.20		1.13		1.24
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.70354	-9.683555	-16.63442	-1.315019	-24.14191	-2.317522	-14.69129	-8.367983	-16.53807	-8.149636	-21.52071	-5.120869	-15.24214	-12.12363	-23.65	1.16
Fs (ksi)	-20.70	-9.68	-16.63	-1.32	-24.14	-2.32	-14.69	-8.37	-16.54	-8.15	-21.52	-5.12	-15.24	-12.12	-23.65	1.16
Fs (kip)	-2049.65	-774.68	-1646.81	-105.20	-2390.05	-185.40	-1454.44	-669.44	-1637.27	-651.97	-2130.55	-409.67	-1508.97	-969.89	-2341.38	92.59

Vu (kip)	511.09	382.35	578.54	352.88	402.09	513.57	384.74	548.88	373.16	273.06	420.82	252.23	287.00	374.92	274.74	399.86
Vuw (kip)	766.63	573.53	867.81	529.32	603.13	770.36	577.11	823.32	---	---	---	---	---	---	---	---
Mv (k*ft)	431.23	322.61	488.14	297.74	339.26	433.32	324.62	463.12	209.90	153.59	236.71	141.88	161.44	210.89	154.54	224.92
Huw (kip)	-1807.55	-1297.07	-1489.35	-1668.10	-1656.61	-1579.51	-1865.67	-1275.59	-1002.77	-592.33	-873.16	-760.96	-814.69	-879.17	-903.07	-742.27
Muw (k*ft)									242.44	337.03	480.14	139.11	184.55	360.80	68.61	545.77
Mu (k*ft)	431.23	322.61	488.14	297.74	339.26	433.32	324.62	463.12	452.34	490.62	716.85	280.99	345.98	571.69	223.15	770.69
Muw (k*ft)	520.40	785.29	839.59	537.94	545.59	697.87	466.22	966.80	formulas matching the Muw results							
Pu (add)	123.35	186.14	199.02	127.51	129.33	165.42	96.29	229.17	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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3% 5% 5% 3% 3% 4% 2% 6% percentage increase in flange force 5.82%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.17	16.63	19.09	21.39	21.24	20.25	23.92	16.35	12.86	7.59	11.19	9.76	10.44	11.27	11.58	9.52
PY1 (Vuw)	9.83	7.35	11.13	6.79	7.73	9.88	7.40	10.56	4.78	3.50	5.40	3.23	3.68	4.81	3.52	5.13
PX2 (Mu)	7.84	5.87	8.88	5.42	6.17	7.88	5.90	8.42	8.23	8.92	13.04	5.11	6.29	10.40	4.06	14.02
PY2 (Mu)	3.27	2.44	3.70	2.26	2.57	3.28	2.46	3.51	3.43	3.72	5.43	2.13	2.62	4.33	1.69	5.84
Pu (kip)	33.67	24.54	31.66	28.29	29.28	31.06	31.41	28.49	22.63	18.03	26.54	15.80	17.88	23.52	16.48	25.96

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.28	22.73	28.62	26.72	27.47	28.54	29.70	25.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.67	16.83	OK	26.54	13.27	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.67	1.47	126.02	OK
Web SPL	16.83	1.47	91.65	OK

Field Splice - Node 5476

Node 5476

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5476 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
5476 R	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 5476 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.53	-13.96	-23.75	-2.07	-33.76	-2.91	-20.45	-11.67	-27.37	-13.27	-27.59	-10.33	-21.15	-16.83	-33.10	3.43
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.55	0.28	0.47	0.04	0.68	0.06	0.41	0.24	0.55	0.27	0.55	0.21	0.42	0.34	0.66	0.07
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-27.53		-23.75		-33.76		-20.45		-27.37		-27.59		-21.15		-33.10	
Fcf (ksi)	-38.76		-37.50		-41.88		-37.50		-38.69		-38.80		-37.50		-41.55	
Fcf (kip)	-3837.59		-3712.50		-4146.30		-3712.50		-3830.03		-3840.92		-3712.50		-4113.67	
fncf (ksi)		-13.96		-2.07		-2.91		-11.67		-13.27		-10.33		-16.83		3.43
Rcf		1.15		1.11		1.24		1.11		1.15		1.15		1.11		1.23
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.32	-9.95	-17.50	-1.30	-25.06	-1.84	-14.93	-8.31	-19.91	-9.35	-20.44	-7.33	-15.33	-12.03	-24.67	2.70
Fs (ksi)	-20.32	-9.95	-17.50	-1.30	-25.06	-1.84	-14.93	-8.31	-19.91	-9.35	-20.44	-7.33	-15.33	-12.03	-24.67	2.70
Fs (kip)	-2011.91	-796.17	-1732.82	-103.85	-2480.85	-147.35	-1477.82	-664.66	-1971.52	-748.03	-2024.01	-586.57	-1518.15	-962.24	-2442.28	215.97

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2635.90	0.00	215.97
Comp	4341.92	3150.89	2480.85	962.24

$\phi v Vn$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	506.09	388.61	575.95	359.04	424.69	454.00	390.48	544.20	370.11	275.94	419.47	255.05	301.44	333.31	277.26	397.03
Vuw (kip)	759.13	582.91	863.93	538.55	637.03	681.00	585.71	816.29	---	---	---	---	---	---	---	---
Mv (k*ft)	427.01	327.89	485.96	302.94	358.33	383.06	329.46	459.17	208.18	155.22	235.95	143.47	169.56	187.48	155.96	223.33
Huw (kip)	-1808.22	-1313.22	-1501.19	-1665.24	-1778.37	-1672.02	-1854.18	-1231.88	-999.06	-620.44	-887.73	-766.78	-965.73	-916.63	-902.97	-725.01
Muw (k*ft)	500.11	774.52	842.01	539.84	516.66	592.40	413.88	1007.04	228.14	356.51	510.78	145.62	232.41	288.47	72.75	602.12
Mu (k*ft)	927.13	1102.41	1327.97	842.77	874.99	975.46	743.34	1466.21	436.33	511.73	746.73	289.09	401.96	475.96	228.71	825.45

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.18	16.84	19.25	21.35	22.80	21.44	23.77	15.79	12.81	7.95	11.38	9.83	12.38	11.75	11.58	9.29
PY1 (Vuw)	9.73	7.47	11.08	6.90	8.17	8.73	7.51	10.47	4.74	3.54	5.38	3.27	3.86	4.27	3.55	5.09
PX2 (Mu)	16.86	20.05	24.15	15.33	15.91	17.74	13.52	26.67	7.94	9.31	13.58	5.26	7.31	8.66	4.16	15.01
PY2 (Mu)	7.03	8.35	10.06	6.39	6.63	7.39	5.63	11.11	3.31	3.88	5.66	2.19	3.05	3.61	1.73	6.26
Pu (kip)	43.41	40.14	48.27	39.01	41.45	42.37	39.54	47.63	22.25	18.79	27.29	16.05	20.87	21.88	16.60	26.83

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1322.51	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1313.39	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2202.92	2520.00	OK
TF Inside	2139.00	2446.88	OK
BF Inside	1580.90	1631.25	OK
BF Outside	1569.99	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.91	39.62	46.75	38.36	40.43	41.28	38.53	46.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	863.93
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2202.92	19.67	OK	1258.69	11.24	OK
BF	1580.90	28.23	OK	482.79	8.62	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2202.92	19.67	1.47	160.39	OK
TF	4341.92	38.77	1.47	252.04	OK
TF Inside	2139.00	19.10	1.47	171.84	OK
BF Inside	1580.90	28.23	1.47	114.56	OK
BF	3150.89	56.27	1.47	229.13	OK
BF Outside	1569.99	28.04	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.27	24.14	OK	27.29	13.65	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.27	1.47	126.02	OK
Web SPL	24.14	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	1.01	1.03
BF Outside	1.05	1.03

Bolt	Shear	Slip	Bearing
TF	1.71	1.50	6.50
Web	2.14	1.29	3.73
BF	1.28	1.95	3.68

Plate	Shear	Flexure
Web	1.90	1.59

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5476	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.10	-14.11	-22.61	-1.89	-32.43	-2.91	-19.85	-11.48	-23.46	-10.32	-24.95	-8.64	-20.66	-16.55	-31.60	1.72
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.54	0.29	0.45	0.04	0.65	0.06	0.40	0.23	0.47	0.21	0.50	0.18	0.41	0.34	0.63	0.03
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-27.10		-22.61		-32.43		-19.85		-23.46		-24.95		-20.66		-31.60	
Fcf (ksi)	-38.55		-37.50		-41.22		-37.50		-37.50		-37.50		-37.50		-40.80	
Fcf (kip)	-3816.41		-3712.50		-4080.41		-3712.50		-3712.50		-3712.50		-3712.50		-4039.23	
fncf (ksi)		-14.11		-1.89		-2.91		-11.48		-10.32		-8.64		-16.55		1.72
Rcf		1.19		1.16		1.27		1.16		1.16		1.16		1.16		1.26
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.75246	-10.30668	-16.22688	-1.505561	-23.52062	-2.399648	-14.275	-8.275248	-16.82769	-7.460629	-18.23488	-6.442857	-14.84461	-11.86399	-22.93	0.88
Fs (ksi)	-19.75	-10.31	-16.23	-1.51	-23.52	-2.40	-14.27	-8.28	-16.83	-7.46	-18.23	-6.44	-14.84	-11.86	-22.93	0.88
Fs (kip)	-1955.49	-824.53	-1606.46	-120.44	-2328.54	-191.97	-1413.22	-662.02	-1665.94	-596.85	-1805.25	-515.43	-1469.62	-949.12	-2270.35	70.07

Vu (kip)	506.09	388.61	575.95	359.04	424.69	454.00	390.48	544.20	370.11	275.94	419.47	255.05	301.44	333.31	277.26	397.03
Vuw (kip)	759.13	582.91	863.93	538.55	637.03	681.00	585.71	816.29	---	---	---	---	---	---	---	---
Mv (k*ft)	427.01	327.89	485.96	302.94	358.33	383.06	329.46	459.17	208.18	155.22	235.95	143.47	169.56	187.48	155.96	223.33
Huw (kip)	-1825.44	-1309.75	-1482.37	-1675.35	-1631.36	-1567.07	-1869.17	-1274.95	-991.95	-585.17	-855.37	-744.16	-801.51	-814.37	-881.38	-727.88
Muw (k*ft)									207.81	323.87	464.66	131.99	206.08	259.42	65.57	523.79
Mu (k*ft)	427.01	327.89	485.96	302.94	358.33	383.06	329.46	459.17	415.99	479.09	700.61	275.46	375.63	446.91	221.53	747.12
Muw (k*ft)	479.22	776.83	825.27	533.10	562.43	605.29	403.80	845.23	formulas matching the Muw results							
Pu (add)	113.59	184.14	195.62	126.36	133.32	143.48	95.74	224.06	additional flange force							

3% 5% 5% 3% 3% 4% 2% 6% percentage increase in flange force 5.69%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.40	16.79	19.00	21.48	20.91	20.09	23.96	16.35	12.72	7.50	10.97	9.54	10.28	10.44	11.30	9.33
PY1 (Vuw)	9.73	7.47	11.08	6.90	8.17	8.73	7.51	10.47	4.74	3.54	5.38	3.27	3.86	4.27	3.55	5.09
PX2 (Mu)	7.77	5.96	8.84	5.51	6.52	6.97	5.99	8.35	7.57	8.71	12.74	5.01	6.83	8.13	4.03	13.59
PY2 (Mu)	3.24	2.48	3.68	2.30	2.72	2.90	2.50	3.48	3.15	3.63	5.31	2.09	2.85	3.39	1.68	5.66
Pu (kip)	33.76	24.84	31.51	28.51	29.51	29.45	31.58	28.36	21.77	17.73	26.01	15.51	18.38	20.09	16.20	25.32

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.41	22.99	28.48	26.92	27.57	27.31	29.85	25.38
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.76	16.88	OK	26.01	13.00	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.76	1.47	126.02	OK
Web SPL	16.88	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 7476

Node 7476

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7476 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
7476 R	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 7476 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.79	-14.71	-23.69	-1.47	-35.40	-3.56	-20.37	-11.14	-33.72	-10.62	-26.06	-12.36	-21.36	-16.75	-34.34	4.13
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.62	0.30	0.47	0.03	0.71	0.07	0.41	0.23	0.67	0.22	0.52	0.25	0.43	0.34	0.69	0.08
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-30.79		-23.69		-35.40		-20.37		-33.72		-26.06		-21.36		-34.34	
Fcf (ksi)	-40.40		-37.50		-42.70		-37.50		-41.86		-38.03		-37.50		-42.17	
Fcf (kip)	-3999.34		-3712.50		-4227.22		-3712.50		-4144.28		-3765.01		-3712.50		-4174.76	
fncf (ksi)		-14.71		-1.47		-3.56		-11.14		-10.62		-12.36		-16.75		4.13
Rcf		1.14		1.06		1.21		1.06		1.18		1.07		1.06		1.19
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.67	-10.46	-17.62	-0.85	-26.22	-2.31	-15.03	-7.90	-24.72	-7.31	-19.32	-8.89	-15.64	-11.95	-25.56	3.16
Fs (ksi)	-22.67	-10.46	-17.62	-0.85	-26.22	-2.31	-15.03	-7.90	-24.72	-7.31	-19.32	-8.89	-15.64	-11.95	-25.56	3.16
Fs (kip)	-2244.13	-837.15	-1744.52	-68.09	-2596.16	-184.90	-1487.97	-632.36	-2447.36	-584.55	-1913.08	-710.81	-1548.22	-955.90	-2530.19	252.53

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2640.07	0.00	252.53
Comp	4425.91	3153.95	2596.16	955.90

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	507.41	379.50	574.40	350.98	500.38	410.46	381.98	545.47	370.61	270.88	417.94	250.73	356.28	302.11	272.63	397.50
Vuw (kip)	761.12	569.25	861.60	526.46	750.57	615.69	572.97	818.20	---	---	---	---	---	---	---	---
Mv (k*ft)	428.13	320.20	484.65	296.14	422.20	346.33	322.30	460.24	208.47	152.37	235.09	141.03	200.41	169.94	153.36	223.59
Huw (kip)	-1887.20	-1289.01	-1550.92	-1626.85	-1795.94	-1693.18	-1822.95	-1229.27	-1093.37	-609.59	-941.66	-756.84	-1056.91	-930.90	-910.38	-739.23
Muw (k*ft)	519.35	790.66	844.82	565.43	644.61	544.55	434.70	1035.93	268.48	368.95	526.08	156.76	383.11	229.66	81.18	631.71
Mu (k*ft)	947.48	1110.86	1329.47	861.57	1066.80	890.88	757.00	1496.17	476.95	521.32	761.17	297.79	583.52	399.59	234.53	855.30

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.19	16.53	19.88	20.86	23.02	21.71	23.37	15.76	14.02	7.82	12.07	9.70	13.55	11.93	11.67	9.48
PY1 (Vuw)	9.76	7.30	11.05	6.75	9.62	7.89	7.35	10.49	4.75	3.47	5.36	3.21	4.57	3.87	3.50	5.10
PX2 (Mu)	17.23	20.21	24.18	15.67	19.40	16.20	13.77	27.21	8.68	9.48	13.84	5.42	10.61	7.27	4.27	15.56
PY2 (Mu)	7.18	8.42	10.08	6.53	8.08	6.75	5.74	11.34	3.61	3.95	5.77	2.26	4.42	3.03	1.78	6.48
Pu (kip)	44.76	39.95	48.87	38.87	45.98	40.64	39.38	48.20	24.19	18.82	28.20	16.08	25.78	20.41	16.79	27.58

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1324.60	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1315.47	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2245.53	2520.00	OK
TF Inside	2180.37	2446.88	OK
BF Inside	1582.43	1631.25	OK
BF Outside	1571.52	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.31	39.51	47.39	38.29	44.75	39.73	38.44	47.03
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	861.60
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2245.53	20.05	OK	1317.19	11.76	OK
BF	1582.43	28.26	OK	479.61	8.56	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2245.53	20.05	1.47	160.39	OK
TF	4425.91	39.52	1.47	252.04	OK
TF Inside	2180.37	19.47	1.47	171.84	OK
BF Inside	1582.43	28.26	1.47	114.56	OK
BF	3153.95	56.32	1.47	229.13	OK
BF Outside	1571.52	28.06	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.87	24.43	OK	28.20	14.10	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.87	1.47	126.02	OK
Web SPL	24.43	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.01	1.03
BF Outside	1.05	1.03

Bolt	Shear	Slip	Bearing
TF	1.68	1.43	6.38
Web	2.16	1.28	3.76
BF	1.28	1.97	3.67

Plate	Shear	Flexure
Web	1.90	1.61

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7476	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.25	-13.06	-22.88	-1.61	-33.11	-2.75	-20.18	-11.32	-28.94	-7.24	-23.32	-10.44	-20.93	-16.55	-32.43	2.05
ϕf Fnc (ksi)	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.56	0.27	0.46	0.03	0.66	0.06	0.40	0.23	0.58	0.15	0.47	0.21	0.42	0.34	0.65	0.04
α	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-28.25		-22.88		-33.11		-20.18		-28.94		-23.32		-20.93		-32.43	
Fcf (ksi)	-39.12		-37.50		-41.56		-37.50		-39.47		-37.50		-37.50		-41.22	
Fcf (kip)	-3873.24		-3712.50		-4114.05		-3712.50		-3907.37		-3712.50		-3712.50		-4080.35	
fncf (ksi)		-13.06		-1.61		-2.75		-11.32		-7.24		-10.44		-16.55		2.05
Rcf		1.18		1.13		1.26		1.13		1.19		1.13		1.13		1.24
Fncf (ksi)		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.57703	-9.605957	-16.53158	-1.273333	-24.0142	-2.324396	-14.62191	-8.133347	-20.81041	-5.249455	-17.0977	-7.757602	-15.15517	-11.82287	-23.53	1.07
Fs (ksi)	-20.58	-9.61	-16.53	-1.27	-24.01	-2.32	-14.62	-8.13	-20.81	-5.25	-17.10	-7.76	-15.16	-11.82	-23.53	1.07
Fs (kip)	-2037.13	-768.48	-1636.63	-101.87	-2377.41	-185.95	-1447.57	-650.67	-2060.23	-419.96	-1692.67	-620.61	-1500.36	-945.83	-2329.79	85.44

Vu (kip)	507.41	379.50	574.40	350.98	500.38	410.46	381.98	545.47	370.61	270.88	417.94	250.73	356.28	302.11	272.63	397.50
Vuw (kip)	761.12	569.25	861.60	526.46	750.57	615.69	572.97	818.20	---	---	---	---	---	---	---	---
Mv (k*ft)	428.13	320.20	484.65	296.14	422.20	346.33	322.30	460.24	208.47	152.37	235.09	141.03	200.41	169.94	153.36	223.59
Huw (kip)	-1800.30	-1297.80	-1485.40	-1660.67	-1587.28	-1627.82	-1855.84	-1276.00	-996.04	-587.56	-869.17	-750.92	-859.98	-820.22	-890.28	-741.35
Muw (k*ft)									241.36	335.68	477.18	142.75	342.34	205.48	73.31	541.23
Mu (k*ft)	428.13	320.20	484.65	296.14	422.20	346.33	322.30	460.24	449.83	488.05	712.27	283.78	542.75	375.42	226.67	764.82
Muw (k*ft)	521.24	784.80	838.20	542.89	678.42	564.79	412.78	982.82	formulas matching the Muw results							
Pu (add)	123.55	186.03	198.69	128.68	160.81	133.88	97.84	228.22	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7476	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 5% 5% 3% 4% 3% 2% 6% percentage increase in flange force 5.79%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.08	16.64	19.04	21.29	20.35	20.87	23.79	16.36	12.77	7.53	11.14	9.63	11.03	10.52	11.41	9.50
PY1 (Vuw)	9.76	7.30	11.05	6.75	9.62	7.89	7.35	10.49	4.75	3.47	5.36	3.21	4.57	3.87	3.50	5.10
PX2 (Mu)	7.79	5.82	8.82	5.39	7.68	6.30	5.86	8.37	8.18	8.88	12.96	5.16	9.87	6.83	4.12	13.91
PY2 (Mu)	3.24	2.43	3.67	2.24	3.20	2.62	2.44	3.49	3.41	3.70	5.40	2.15	4.11	2.85	1.72	5.80
Pu (kip)	33.49	24.48	31.51	28.15	30.82	29.13	31.23	28.41	22.48	17.91	26.39	15.73	22.63	18.60	16.39	25.83

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.12	22.68	28.49	26.59	28.40	27.27	29.53	25.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7476	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.49	16.75	OK	26.39	13.19	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.49	1.47	126.02	OK
Web SPL	16.75	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9476	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 9476

Node 9476

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9476 L	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00
9476 R	99.00	50.00	4950.00	80.00	49.25	3940.36	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 9476 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.50	---	80.00	58.75	64.32	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.912307

N.A. (from I 28.5086735 in
Outer to Inr 0.88884994
Outer to Inr 0.91230739

Outer to Mi 0.94442497
Outer to Mi 0.95615369

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.78	-12.10	-19.82	0.72	-32.83	1.59	-17.17	-10.70	-30.67	-8.26	-22.20	-11.18	-16.77	-16.15	-32.18	5.97
ϕf Fnc (ksi)	50.00	49.25	50.00	50.00	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.56	0.25	0.40	0.01	0.66	0.03	0.34	0.22	0.61	0.17	0.44	0.23	0.34	0.33	0.64	0.12
α	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-27.78		-19.82		-32.83		-17.17		-30.67		-22.20		-16.77		-32.18	
Fcf (ksi)	-38.89		-37.50		-41.41		-37.50		-40.34		-37.50		-37.50		-41.09	
Fcf (kip)	-3850.18		-3712.50		-4100.03		-3712.50		-3993.38		-3712.50		-3712.50		-4067.80	
fncf (ksi)		-12.10		0.72		1.59		-10.70		-8.26		-11.18		-16.15		5.97
Rcf		1.18		1.14		1.26		1.14		1.23		1.14		1.14		1.25
Fncf (ksi)		-36.94		37.50		37.50		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		2411.84		2411.84		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.35	-8.73	-14.93	0.83	-24.19	-1.89	-12.72	-7.41	-22.70	-5.55	-16.31	-8.15	-12.29	-11.84	-24.00	4.85
Fs (ksi)	-20.35	-8.73	-14.93	0.83	-24.19	-1.89	-12.72	-7.41	-22.70	-5.55	-16.31	-8.15	-12.29	-11.84	-24.00	4.85
Fs (kip)	-2014.79	-698.17	-1477.92	66.76	-2395.05	-151.06	-1258.81	-593.12	-2247.62	-444.27	-1614.34	-651.73	-1216.68	-947.45	-2376.08	388.14

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2641.67	0.00	388.14
Comp	4299.11	3122.69	2395.05	947.45

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	463.13	322.72	526.10	284.11	449.03	346.61	320.64	498.34	336.12	234.20	380.61	206.93	323.44	253.79	235.45	358.29
Vuw (kip)	694.70	484.07	789.15	426.16	673.54	519.91	480.97	747.51	---	---	---	---	---	---	---	---
Mv (k*ft)	390.77	272.29	443.90	239.72	378.86	292.45	270.54	420.47	189.07	131.74	214.09	116.40	181.94	142.76	132.44	201.54
Huw (kip)	-1756.50	-1210.19	-1300.56	-1640.93	-1666.08	-1658.81	-1846.11	-1109.24	-959.59	-465.10	-860.66	-664.27	-932.47	-806.95	-796.38	-631.92
Muw (k*ft)	540.19	843.20	955.19	556.05	664.11	544.12	419.26	1068.41	255.73	346.78	490.69	116.63	377.30	179.52	9.82	634.76
Mu (k*ft)	930.96	1115.49	1399.09	795.76	1042.98	836.57	689.80	1488.89	444.80	478.52	704.78	233.02	559.23	322.28	142.26	836.29

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.52	15.52	16.67	21.04	21.36	21.27	23.67	14.22	12.30	5.96	11.03	8.52	11.95	10.35	10.21	8.10
PY1 (Vuw)	8.91	6.21	10.12	5.46	8.64	6.67	6.17	9.58	4.31	3.00	4.88	2.65	4.15	3.25	3.02	4.59
PX2 (Mu)	16.93	20.29	25.45	14.47	18.97	15.22	12.55	27.08	8.09	8.70	12.82	4.24	10.17	5.86	2.59	15.21
PY2 (Mu)	7.06	8.45	10.60	6.03	7.90	6.34	5.23	11.28	3.37	3.63	5.34	1.77	4.24	2.44	1.08	6.34
Pu (kip)	42.56	38.69	46.94	37.33	43.59	38.73	37.96	46.27	21.79	16.10	25.95	13.50	23.66	17.18	13.44	25.75

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1325.40	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1316.26	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2181.20	2520.00	OK
TF Inside	2117.91	2446.88	OK
BF Inside	1566.75	1631.25	OK
BF Outside	1555.94	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.36	38.65	45.82	37.05	42.65	38.15	37.29	45.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	789.15
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9476**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2181.20	19.48	OK	1215.16	10.85	OK
BF	1566.75	27.98	OK	475.37	8.49	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2181.20	19.48	1.47	160.39	OK
TF	4299.11	38.38	1.47	252.04	OK
TF Inside	2117.91	18.91	1.47	171.84	OK
BF Inside	1566.75	27.98	1.47	114.56	OK
BF	3122.69	55.76	1.47	229.13	OK
BF Outside	1555.94	27.78	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.94	23.47	OK	25.95	12.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.94	1.47	126.02	OK
Web SPL	23.47	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	1.01	1.04
BF Outside	1.04	1.04

Bolt	Shear	Slip	Bearing
TF	1.73	1.55	6.57
Web	2.33	1.41	4.05
BF	1.29	1.98	3.71

Plate	Shear	Flexure
Web	2.08	1.73

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9476**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.48	-10.65	-19.44	0.17	-29.91	-1.33	-16.18	-10.06	-25.44	-4.45	-19.28	-9.00	-16.51	-15.93	-29.52	3.24
ϕf Fnc (ksi)	50.00	49.25	50.00	50.00	50.00	50.00	50.00	49.25	50.00	49.25	50.00	49.25	50.00	49.25	50.00	50.00
f / ϕf Fnc	0.51	0.22	0.39	0.00	0.60	0.03	0.32	0.20	0.51	0.09	0.39	0.18	0.33	0.32	0.59	0.06
α	1.00	0.99	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	1.00	1.00
fcf (ksi)	-25.48		-19.44		-29.91		-16.18		-25.44		-19.28		-16.51		-29.52	
Fcf (ksi)	-37.74		-37.50		-39.95		-37.50		-37.72		-37.50		-37.50		-39.76	
Fcf (kip)	-3736.10		-3712.50		-3955.37		-3712.50		-3734.18		-3712.50		-3712.50		-3936.22	
fncf (ksi)		-10.65		0.17		-1.33		-10.06		-4.45		-9.00		-15.93		3.24
Rcf		1.26		1.25		1.34		1.25		1.26		1.25		1.25		1.33
Fncf (ksi)		-36.94		37.50		-37.50		-36.94		-36.94		-36.94		-36.94		37.50
Fncf (kip)		-2955.27		2411.84		-3000.00		-2955.27		-2955.27		-2955.27		-2955.27		2411.84

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.4221	-7.965466	-14.25271	0.065382	-21.55178	-1.37985	-11.94468	-7.164801	-18.48766	-3.199798	-14.04374	-6.795943	-12.0872	-11.69858	-21.37	2.24
Fs (ksi)	-18.42	-7.97	-14.25	0.07	-21.55	-1.38	-11.94	-7.16	-18.49	-3.20	-14.04	-6.80	-12.09	-11.70	-21.37	2.24
Fs (kip)	-1823.79	-637.24	-1411.02	5.23	-2133.63	-110.39	-1182.52	-573.18	-1830.28	-255.98	-1390.33	-543.68	-1196.63	-935.89	-2115.77	178.94

Vu (kip)	463.13	322.72	526.10	284.11	449.03	346.61	320.64	498.34	336.12	234.20	380.61	206.93	323.44	253.79	235.45	358.29
Vuw (kip)	694.70	484.07	789.15	426.16	673.54	519.91	480.97	747.51	---	---	---	---	---	---	---	---
Mv (k*ft)	390.77	272.29	443.90	239.72	378.86	292.45	270.54	420.47	189.07	131.74	214.09	116.40	181.94	142.76	132.44	201.54
Huw (kip)	-1688.87	-1230.46	-1377.06	-1653.92	-1430.00	-1609.71	-1896.84	-1169.78	-870.79	-468.18	-756.74	-630.61	-715.69	-687.71	-784.93	-631.44
Muw (k*ft)									230.05	315.00	443.78	105.16	336.33	159.45	8.55	519.38
Mu (k*ft)	390.77	272.29	443.90	239.72	378.86	292.45	270.54	420.47	419.11	446.74	657.87	221.55	518.27	302.21	140.99	720.91
Muw (k*ft)	534.58	829.69	839.91	547.39	706.30	576.86	380.44	989.38	formulas matching the Muw results							
Pu (add)	126.71	196.67	199.09	129.75	167.42	136.74	91.36	229.83	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 9476**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

3% 5% 5% 3% 4% 3% 2% 6% percentage increase in flange force 5.83%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.65	15.78	17.65	21.20	18.33	20.64	24.32	15.00	11.16	6.00	9.70	8.08	9.18	8.82	10.06	8.10
PY1 (Vuw)	8.91	6.21	10.12	5.46	8.64	6.67	6.17	9.58	4.31	3.00	4.88	2.65	4.15	3.25	3.02	4.59
PX2 (Mu)	7.11	4.95	8.07	4.36	6.89	5.32	4.92	7.65	7.62	8.13	11.97	4.03	9.43	5.50	2.56	13.11
PY2 (Mu)	2.96	2.06	3.36	1.82	2.87	2.22	2.05	3.19	3.18	3.39	4.99	1.68	3.93	2.29	1.07	5.46
Pu (kip)	31.11	22.32	29.05	26.58	27.72	27.43	30.37	26.00	20.22	15.51	23.81	12.87	20.28	15.35	13.27	23.47

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	28.96	20.84	26.30	25.30	25.55	25.89	28.93	23.27
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
31.11	15.56	OK	23.81	11.90	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	31.11	1.47	126.02	OK
Web SPL	15.56	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 1482

Node 1482

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1482 L	99.00	50.00	4950.00	72.00	50.00	3600.00	66.00	50.00	3300.00
1482 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 1482 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I	29.2167722 in
Outer to Inr	0.8843723
Outer to Inr	0.92298944
Outer to Mi	0.94218615
Outer to Mi	0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.03	6.07	-29.17	-7.53	-33.78	5.06	-20.32	-5.29	-31.67	3.92	-24.88	-6.95	-32.93	10.25	-19.29	-11.69
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.44	0.12	0.58	0.15	0.68	0.10	0.41	0.11	0.63	0.08	0.50	0.14	0.66	0.20	0.39	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-22.03		-29.17		-33.78		-20.32		-31.67		-24.88		-32.93		-19.29	
Fcf (ksi)	-37.50		-39.59		-41.89		-37.50		-40.84		-37.50		-41.46		-37.50	
Fcf (kip)	-3712.50		-3919.12		-4147.24		-3712.50		-4042.78		-3712.50		-4104.89		-3712.50	
fncf (ksi)		6.07		-7.53		5.06		-5.29		3.92		-6.95		10.25		-11.69
Rcf		1.11		1.17		1.24		1.11		1.21		1.11		1.23		1.11
Fncf (ksi)		37.50		-36.89		37.50		-36.89		37.50		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		2170.66		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.55	4.65	-21.47	-5.20	-24.99	3.85	-15.11	-3.46	-23.50	3.26	-18.43	-4.92	-24.63	7.93	-14.29	-8.42
Fs (ksi)	-16.55	4.65	-21.47	-5.20	-24.99	3.85	-15.11	-3.46	-23.50	3.26	-18.43	-4.92	-24.63	7.93	-14.29	-8.42
Fs (kip)	-1638.41	334.69	-2125.20	-374.37	-2473.83	277.04	-1496.15	-249.01	-2326.35	234.56	-1824.38	-354.06	-2438.74	570.79	-1414.85	-606.30

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2437.88	0.00	570.79
Comp	4377.99	2825.84	2473.83	606.30

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	327.49	473.85	530.90	302.93	456.34	360.78	502.56	345.55	236.97	343.81	384.12	219.61	328.00	263.92	360.65	253.16
Vuw (kip)	491.24	710.77	796.35	454.39	684.51	541.17	753.84	518.32	---	---	---	---	---	---	---	---
Mv (k*ft)	276.32	399.81	447.94	255.59	385.03	304.41	424.03	291.55	133.29	193.39	216.06	123.53	184.50	148.46	202.87	142.40
Huw (kip)	-1015.29	-1597.63	-1175.45	-1431.43	-1191.04	-1492.22	-953.30	-1665.73	-392.74	-879.99	-697.63	-612.84	-667.94	-770.40	-551.30	-749.50
Muw (k*ft)	973.14	676.75	1059.58	695.71	1002.77	655.19	1188.86	539.51	466.36	357.88	634.39	256.39	588.64	297.23	716.35	129.15
Mu (k*ft)	1249.46	1076.56	1507.53	951.31	1387.80	959.60	1612.90	831.07	599.65	551.27	850.46	379.92	773.14	445.69	919.22	271.56

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.02	20.48	15.07	18.35	15.27	19.13	12.22	21.36	5.04	11.28	8.94	7.86	8.56	9.88	7.07	9.61
PY1 (Vuw)	6.30	9.11	10.21	5.83	8.78	6.94	9.66	6.65	3.04	4.41	4.92	2.82	4.21	3.38	4.62	3.25
PX2 (Mu)	22.73	19.58	27.42	17.30	25.24	17.45	29.34	15.12	10.91	10.03	15.47	6.91	14.06	8.11	16.72	4.94
PY2 (Mu)	9.47	8.16	11.42	7.21	10.52	7.27	12.22	6.30	4.54	4.18	6.45	2.88	5.86	3.38	6.97	2.06
Pu (kip)	39.07	43.63	47.68	37.96	44.87	39.25	46.97	38.70	17.65	22.97	26.93	15.83	24.76	19.21	26.46	15.48

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1223.16	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1214.72	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2221.22	2520.00	OK
TF Inside	2156.77	2446.88	OK
BF Inside	1417.81	1631.25	OK
BF Outside	1408.03	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.14	42.54	46.62	37.83	44.25	38.75	46.17	38.11
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	796.35
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2221.22	19.83	OK	1255.13	11.21	OK
BF	1417.81	25.32	OK	304.20	5.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2221.22	19.83	1.47	160.39	OK
TF	4377.99	39.09	1.47	252.04	OK
TF Inside	2156.77	19.26	1.47	171.84	OK
BF Inside	1417.81	25.32	1.47	114.56	OK
BF	2825.84	50.46	1.47	206.21	OK
BF Outside	1408.03	25.14	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.68	23.84	OK	26.93	13.47	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.68	1.47	126.02	OK
Web SPL	23.84	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.13
TF Inside	NA	1.13
BF Inside	1.09	1.15
BF Outside	1.13	1.15

Bolt	Shear	Slip	Bearing
TF	1.70	1.50	6.45
Web	2.44	1.35	4.24
BF	1.30	3.10	4.09

Plate	Shear	Flexure
Web	2.06	1.82

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.91	4.69	-27.44	-6.64	-31.58	2.59	-18.56	-4.18	-27.26	-0.39	-21.25	-4.26	-31.23	8.16	-19.05	-11.71
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.42	0.09	0.55	0.14	0.63	0.05	0.37	0.09	0.55	0.01	0.43	0.09	0.62	0.16	0.38	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-20.91		-27.44		-31.58		-18.56		-27.26		-21.25		-31.23		-19.05	
Fcf (ksi)	-37.50		-38.72		-40.79		-37.50		-38.63		-37.50		-40.62		-37.50	
Fcf (kip)	-3712.50		-3833.30		-4038.07		-3712.50		-3824.37		-3712.50		-4021.11		-3712.50	
fncf (ksi)		4.69		-6.64		2.59		-4.18		-0.39		-4.26		8.16		-11.71
Rcf		1.19		1.23		1.29		1.19		1.22		1.19		1.29		1.19
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-37.50		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2700.00		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.28838	3.291216	-19.85715	-4.95062	-22.77982	1.575108	-13.62412	-2.979185	-19.77188	-0.302232	-15.48479	-3.269627	-22.57999	5.7420031	-13.93	-8.53
Fs (ksi)	-15.29	3.29	-19.86	-4.95	-22.78	1.58	-13.62	-2.98	-19.77	-0.30	-15.48	-3.27	-22.58	5.74	-13.93	-8.53
Fs (kip)	-1513.55	236.97	-1965.86	-356.44	-2255.20	113.41	-1348.79	-214.50	-1957.42	-21.76	-1532.99	-235.41	-2235.42	413.42	-1379.12	-614.04

Vu (kip)	327.49	473.85	530.90	302.93	456.34	360.78	502.56	345.55	236.97	343.81	384.12	219.61	328.00	263.92	360.65	253.16
Vuw (kip)	491.24	710.77	796.35	454.39	684.51	541.17	753.84	518.32	---	---	---	---	---	---	---	---
Mv (k*ft)	276.32	399.81	447.94	255.59	385.03	304.41	424.03	291.55	133.29	193.39	216.06	123.53	184.50	148.46	202.87	142.40
Huw (kip)	-1053.56	-1546.52	-1235.41	-1401.37	-1290.64	-1404.54	-993.90	-1696.23	-395.91	-818.66	-699.76	-547.91	-662.45	-618.90	-555.65	-741.14
Muw (k*ft)									408.75	327.94	535.81	234.19	428.33	268.73	623.08	118.85
Mu (k*ft)	276.32	399.81	447.94	255.59	385.03	304.41	424.03	291.55	542.04	521.34	751.87	357.72	612.83	417.19	825.95	261.25
Muw (k*ft)	947.63	672.68	971.09	715.75	839.29	713.64	1124.36	819.18		formulas matching the Muw results						
Pu (add)	225.18	159.84	230.75	170.08	199.44	169.58	267.22	123.37		additional flange force						

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

6% 4% 6% 5% 6% 5% 7% 3% percentage increase in flange force 7.42%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.51	19.83	15.84	17.97	16.55	18.01	12.74	21.75	5.08	10.50	8.97	7.02	8.49	7.93	7.12	9.50
PY1 (Vuw)	6.30	9.11	10.21	5.83	8.78	6.94	9.66	6.65	3.04	4.41	4.92	2.82	4.21	3.38	4.62	3.25
PX2 (Mu)	5.03	7.27	8.15	4.65	7.00	5.54	7.71	5.30	9.86	9.48	13.68	6.51	11.15	7.59	15.02	4.75
PY2 (Mu)	2.09	3.03	3.39	1.94	2.92	2.31	3.21	2.21	4.11	3.95	5.70	2.71	4.64	3.16	6.26	1.98
Pu (kip)	20.34	29.70	27.58	23.91	26.29	25.29	24.17	28.46	16.56	21.66	25.01	14.62	21.54	16.85	24.68	15.18

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	18.77	27.42	24.66	22.56	23.99	23.65	21.20	26.93
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
29.70	14.85	OK	25.01	12.51	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	29.70	1.47	126.02	OK
Web SPL	14.85	1.47	91.65	OK

Field Splice - Node 3482

Node 3482

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3482 L	99.00	50.00	4950.00	72.00	50.00	3600.00	66.00	50.00	3300.00
3482 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 3482 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.11	4.83	-34.02	-8.59	-38.45	3.50	-25.76	-4.59	-36.61	-4.83	-30.92	-7.85	-37.11	9.06	-25.97	-11.53
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.54	0.10	0.68	0.17	0.77	0.07	0.52	0.09	0.73	0.10	0.62	0.16	0.74	0.18	0.52	0.23
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-27.11		-34.02		-38.45		-25.76		-36.61		-30.92		-37.11		-25.97	
Fcf (ksi)	-38.56		-42.01		-44.22		-37.88		-43.31		-40.46		-43.55		-37.99	
Fcf (kip)	-3816.95		-4159.10		-4378.08		-3749.98		-4287.36		-4005.53		-4311.70		-3760.62	
fncf (ksi)		4.83		-8.59		3.50		-4.59		-4.83		-7.85		9.06		-11.53
Rcf		1.00		1.09		1.15		1.00		1.13		1.05		1.13		1.00
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.11	3.77	-25.21	-5.74	-28.61	2.89	-18.97	-2.93	-26.96	-3.04	-23.12	-5.40	-27.77	6.90	-18.99	-7.94
Fs (ksi)	-20.11	3.77	-25.21	-5.74	-28.61	2.89	-18.97	-2.93	-26.96	-3.04	-23.12	-5.40	-27.77	6.90	-18.99	-7.94
Fs (kip)	-1991.33	271.46	-2495.73	-413.49	-2832.86	208.19	-1877.90	-210.80	-2669.19	-219.11	-2289.23	-388.82	-2749.36	496.95	-1880.30	-571.42

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2442.44	0.00	496.95
Comp	4615.39	2858.20	2832.86	571.42

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	414.62	557.50	616.61	398.50	539.89	457.18	584.18	440.01	295.85	407.45	449.21	284.46	384.36	336.57	426.30	313.79
Vuw (kip)	621.93	836.24	924.91	597.75	809.84	685.78	876.26	660.01	---	---	---	---	---	---	---	---
Mv (k*ft)	349.83	470.39	520.26	336.23	455.53	385.75	492.90	371.26	166.42	229.19	252.68	160.01	216.20	189.32	239.79	176.51
Huw (kip)	-1112.54	-1696.20	-1326.44	-1401.40	-1608.52	-1607.88	-1098.63	-1634.01	-539.36	-1021.43	-848.86	-722.58	-990.16	-941.29	-688.68	-888.67
Muw (k*ft)	954.73	717.69	1061.52	732.39	833.15	708.32	1183.89	582.05	525.46	428.26	693.14	352.90	526.20	389.91	762.82	243.24
Mu (k*ft)	1304.57	1188.07	1581.78	1068.62	1288.68	1094.06	1676.79	953.30	691.88	657.45	945.82	512.91	742.40	579.23	1002.61	419.75

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.26	21.75	17.01	17.97	20.62	20.61	14.08	20.95	6.91	13.10	10.88	9.26	12.69	12.07	8.83	11.39
PY1 (Vuw)	7.97	10.72	11.86	7.66	10.38	8.79	11.23	8.46	3.79	5.22	5.76	3.65	4.93	4.32	5.47	4.02
PX2 (Mu)	23.73	21.61	28.77	19.44	23.44	19.90	30.50	17.34	12.58	11.96	17.20	9.33	13.50	10.54	18.24	7.63
PY2 (Mu)	9.89	9.00	11.99	8.10	9.77	8.29	12.71	7.22	5.24	4.98	7.17	3.89	5.63	4.39	7.60	3.18
Pu (kip)	41.98	47.63	51.61	40.59	48.45	43.97	50.61	41.38	21.49	27.05	30.92	20.06	28.24	24.22	30.05	20.35

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1225.44	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1216.99	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2341.67	2520.00	OK
TF Inside	2273.72	2446.88	OK
BF Inside	1434.04	1631.25	OK
BF Outside	1424.15	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.51	46.13	50.05	39.98	47.21	43.04	49.31	40.34
Check	OK	OK	NG	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	924.91
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2341.67	20.91	OK	1437.28	12.83	OK
BF	1434.04	25.61	OK	286.70	5.12	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2341.67	20.91	1.47	160.39	OK
TF	4615.39	41.21	1.47	252.04	OK
TF Inside	2273.72	20.30	1.47	171.84	OK
BF Inside	1434.04	25.61	1.47	114.56	OK
BF	2858.20	51.04	1.47	206.21	OK
BF Outside	1424.15	25.43	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.61	25.81	OK	30.92	15.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.61	1.47	126.02	OK
Web SPL	25.81	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.08
TF Inside	NA	1.08
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.61	1.31	6.12
Web	2.19	1.15	3.81
BF	1.28	3.29	4.04

Plate	Shear	Flexure
Web	1.77	1.65

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.29	3.66	-32.60	-8.09	-36.97	1.62	-24.54	-4.14	-32.80	-2.39	-27.29	-5.31	-36.21	7.62	-25.62	-11.65
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.53	0.07	0.65	0.16	0.74	0.03	0.49	0.08	0.66	0.05	0.55	0.11	0.72	0.15	0.51	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-26.29		-32.60		-36.97		-24.54		-32.80		-27.29		-36.21		-25.62	
Fcf (ksi)	-38.15		-41.30		-43.49		-37.50		-41.40		-38.64		-43.11		-37.81	
Fcf (kip)	-3776.48		-4088.67		-4305.08		-3712.50		-4098.76		-3825.70		-4267.44		-3743.13	
fncf (ksi)		3.66		-8.09		1.62		-4.14		-2.39		-5.31		7.62		-11.65
Rcf		1.03		1.12		1.18		1.01		1.12		1.05		1.17		1.02
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.99154	2.498918	-23.77417	-5.885349	-26.86294	0.980424	-17.75152	-3.014246	-23.59148	-1.777	-20.02069	-3.918687	-26.32573	5.2161713	-18.52	-8.32
Fs (ksi)	-18.99	2.50	-23.77	-5.89	-26.86	0.98	-17.75	-3.01	-23.59	-1.78	-20.02	-3.92	-26.33	5.22	-18.52	-8.32
Fs (kip)	-1880.16	179.92	-2353.64	-423.75	-2659.43	70.59	-1757.40	-217.03	-2335.56	-127.94	-1982.05	-282.15	-2606.25	375.56	-1833.03	-599.06

Vu (kip)	414.62	557.50	616.61	398.50	539.89	457.18	584.18	440.01	295.85	407.45	449.21	284.46	384.36	336.57	426.30	313.79
Vuw (kip)	621.93	836.24	924.91	597.75	809.84	685.78	876.26	660.01	---	---	---	---	---	---	---	---
Mv (k*ft)	349.83	470.39	520.26	336.23	455.53	385.75	492.90	371.26	166.42	229.19	252.68	160.01	216.20	189.32	239.79	176.51
Huw (kip)	-1134.18	-1661.28	-1372.02	-1376.15	-1454.61	-1458.42	-1129.36	-1640.95	-544.26	-978.76	-854.12	-685.27	-837.16	-790.00	-696.62	-885.58
Muw (k*ft)									472.79	393.55	612.55	324.22	479.92	354.24	693.92	224.29
Mu (k*ft)	349.83	470.39	520.26	336.23	455.53	385.75	492.90	371.26	639.21	622.74	865.23	484.23	696.12	543.57	933.71	400.80
Muw (k*ft)	922.32	709.67	998.69	732.57	851.93	728.03	1143.74	889.83								
Pu (add)	219.17	168.63	237.31	174.08	202.44	173.00	271.78	135.36								

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formulas matching the Muw results

additional flange force

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

6% 5% 7% 5% 6% 5% 8% 4% percentage increase in flange force 7.55%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.54	21.30	17.59	17.64	18.65	18.70	14.48	21.04	6.98	12.55	10.95	8.79	10.73	10.13	8.93	11.35
PY1 (Vuw)	7.97	10.72	11.86	7.66	10.38	8.79	11.23	8.46	3.79	5.22	5.76	3.65	4.93	4.32	5.47	4.02
PX2 (Mu)	6.36	8.56	9.46	6.12	8.29	7.02	8.97	6.75	11.63	11.33	15.74	8.81	12.66	9.89	16.98	7.29
PY2 (Mu)	2.65	3.56	3.94	2.55	3.45	2.92	3.74	2.81	4.84	4.72	6.56	3.67	5.28	4.12	7.08	3.04
Pu (kip)	23.45	33.10	31.33	25.86	30.28	28.26	27.82	29.99	20.51	25.86	29.39	19.05	25.52	21.72	28.79	19.94

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	21.32	30.33	27.87	23.98	27.49	26.05	24.33	27.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.10	16.55	OK	29.39	14.70	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.10	1.47	126.02	OK
Web SPL	16.55	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5482	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5482

Node 5482

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5482 L	99.00	50.00	4950.00	72.00	50.00	3600.00	66.00	50.00	3300.00
5482 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 5482 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I	29.2167722 in
Outer to Inr	0.8843723
Outer to Inr	0.92298944
Outer to Mi	0.94218615
Outer to Mi	0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.35	3.86	-32.16	-8.47	-36.79	2.24	-24.65	-4.16	-31.76	-9.00	-31.46	-4.35	-36.38	8.51	-25.86	-11.65
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.53	0.08	0.64	0.17	0.74	0.04	0.49	0.08	0.64	0.18	0.63	0.09	0.73	0.17	0.52	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-26.35		-32.16		-36.79		-24.65		-31.76		-31.46		-36.38		-25.86	
Fcf (ksi)	-38.17		-41.08		-43.39		-37.50		-40.88		-40.73		-43.19		-37.93	
Fcf (kip)	-3779.17		-4066.85		-4295.93		-3712.50		-4047.32		-4032.10		-4275.81		-3755.23	
fncf (ksi)		3.86		-8.47		2.24		-4.16		-9.00		-4.35		8.51		-11.65
Rcf		1.04		1.12		1.18		1.02		1.11		1.11		1.17		1.03
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.54	3.14	-23.88	-5.70	-27.52	2.11	-18.17	-2.75	-23.23	-6.14	-23.52	-2.80	-27.33	6.62	-18.90	-8.15
Fs (ksi)	-19.54	3.14	-23.88	-5.70	-27.52	2.11	-18.17	-2.75	-23.23	-6.14	-23.52	-2.80	-27.33	6.62	-18.90	-8.15
Fs (kip)	-1934.88	226.03	-2364.52	-410.36	-2724.05	151.65	-1798.37	-198.34	-2299.58	-442.16	-2328.60	-201.49	-2705.47	476.63	-1871.12	-586.49

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2437.36	0.00	476.63
Comp	4542.51	2847.20	2724.05	586.49

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	423.55	562.70	620.03	408.04	497.74	484.45	585.77	453.22	301.09	411.45	451.96	290.14	353.51	356.16	427.75	322.06
Vuw (kip)	635.33	844.05	930.05	612.06	746.61	726.67	878.65	679.83	---	---	---	---	---	---	---	---
Mv (k*ft)	357.37	474.78	523.15	344.28	419.97	408.75	494.24	382.41	169.37	231.44	254.23	163.20	198.85	200.34	240.61	181.16
Huw (kip)	-1127.64	-1667.91	-1344.82	-1377.40	-1679.01	-1502.84	-1095.47	-1648.13	-541.36	-976.25	-838.51	-690.37	-969.18	-868.55	-683.37	-892.52
Muw (k*ft)	927.87	695.55	1012.75	731.73	679.47	790.15	1170.05	570.24	499.04	400.06	651.68	339.03	375.91	455.90	746.85	236.60
Mu (k*ft)	1285.24	1170.32	1535.91	1076.02	1099.44	1198.91	1664.29	952.65	668.40	631.50	905.91	502.23	574.76	656.24	987.46	417.76

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.46	21.38	17.24	17.66	21.53	19.27	14.04	21.13	6.94	12.52	10.75	8.85	12.43	11.14	8.76	11.44
PY1 (Vuw)	8.15	10.82	11.92	7.85	9.57	9.32	11.26	8.72	3.86	5.27	5.79	3.72	4.53	4.57	5.48	4.13
PX2 (Mu)	23.38	21.29	27.94	19.57	20.00	21.81	30.27	17.33	12.16	11.49	16.48	9.13	10.45	11.94	17.96	7.60
PY2 (Mu)	9.74	8.87	11.64	8.15	8.33	9.09	12.61	7.22	5.07	4.79	6.87	3.81	4.36	4.97	7.48	3.17
Pu (kip)	41.85	46.99	50.95	40.52	45.22	45.01	50.34	41.63	21.08	26.03	30.03	19.50	24.55	24.97	29.70	20.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1222.90	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1214.46	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2304.69	2520.00	OK
TF Inside	2237.82	2446.88	OK
BF Inside	1428.52	1631.25	OK
BF Outside	1418.67	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.28	45.40	49.29	39.84	44.02	44.00	49.00	40.50
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	930.05
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2304.69	20.58	OK	1382.08	12.34	OK
BF	1428.52	25.51	OK	294.26	5.25	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2304.69	20.58	1.47	160.39	OK
TF	4542.51	40.56	1.47	252.04	OK
TF Inside	2237.82	19.98	1.47	171.84	OK
BF Inside	1428.52	25.51	1.47	114.56	OK
BF	2847.20	50.84	1.47	206.21	OK
BF Outside	1418.67	25.33	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.95	25.48	OK	30.03	15.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.95	1.47	126.02	OK
Web SPL	25.48	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.09
TF Inside	NA	1.09
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.64	1.36	6.21
Web	2.17	1.16	3.77
BF	1.29	3.20	4.06

Plate	Shear	Flexure
Web	1.76	1.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.91	3.04	-31.73	-8.81	-36.25	1.21	-24.21	-4.38	-28.58	-6.84	-28.28	-2.33	-35.43	7.04	-25.43	-11.69
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.52	0.06	0.63	0.18	0.73	0.02	0.48	0.09	0.57	0.14	0.57	0.05	0.71	0.14	0.51	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-25.91		-31.73		-36.25		-24.21		-28.58		-28.28		-35.43		-25.43	
Fcf (ksi)	-37.96		-40.86		-43.13		-37.50		-39.29		-39.14		-42.72		-37.71	
Fcf (kip)	-3757.60		-4045.61		-4269.45		-3712.50		-3889.52		-3874.83		-4228.88		-3733.76	
fncf (ksi)		3.04		-8.81		1.21		-4.38		-6.84		-2.33		7.04		-11.69
Rcf		1.05		1.13		1.19		1.03		1.08		1.08		1.18		1.04
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.60773	2.044252	-23.14058	-6.368138	-26.33553	0.71329	-17.40426	-3.203949	-20.49069	-4.940564	-20.70304	-1.792619	-25.7564	4.8339632	-18.27	-8.37
Fs (ksi)	-18.61	2.04	-23.14	-6.37	-26.34	0.71	-17.40	-3.20	-20.49	-4.94	-20.70	-1.79	-25.76	4.83	-18.27	-8.37
Fs (kip)	-1842.17	147.19	-2290.92	-458.51	-2607.22	51.36	-1723.02	-230.68	-2028.58	-355.72	-2049.60	-129.07	-2549.88	348.05	-1808.48	-602.50

Vu (kip)	423.55	562.70	620.03	408.04	497.74	484.45	585.77	453.22	301.09	411.45	451.96	290.14	353.51	356.16	427.75	322.06
Vuw (kip)	635.33	844.05	930.05	612.06	746.61	726.67	878.65	679.83	---	---	---	---	---	---	---	---
Mv (k*ft)	357.37	474.78	523.15	344.28	419.97	408.75	494.24	382.41	169.37	231.44	254.23	163.20	198.85	200.34	240.61	181.16
Huw (kip)	-1147.36	-1676.28	-1375.55	-1387.16	-1541.21	-1374.78	-1135.69	-1646.04	-546.59	-973.79	-845.53	-680.07	-839.23	-742.36	-690.44	-878.97
Muw (k*ft)									454.34	368.99	595.07	312.41	342.10	416.03	672.99	217.79
Mu (k*ft)	357.37	474.78	523.15	344.28	419.97	408.75	494.24	382.41	623.71	600.43	849.30	475.61	540.95	616.37	913.60	398.94
Muw (k*ft)	905.14	680.53	980.50	725.23	701.20	805.63	1122.38	882.09	formulas matching the Muw results							
Pu (add)	215.08	161.71	232.99	172.33	166.62	191.44	266.70	133.57	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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6% 4% 6% 5% 5% 5% 7% 4% percentage increase in flange force 7.41%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.71	21.49	17.64	17.78	19.76	17.63	14.56	21.10	7.01	12.48	10.84	8.72	10.76	9.52	8.85	11.27
PY1 (Vuw)	8.15	10.82	11.92	7.85	9.57	9.32	11.26	8.72	3.86	5.27	5.79	3.72	4.53	4.57	5.48	4.13
PX2 (Mu)	6.50	8.64	9.52	6.26	7.64	7.43	8.99	6.96	11.34	10.92	15.45	8.65	9.84	11.21	16.62	7.26
PY2 (Mu)	2.71	3.60	3.96	2.61	3.18	3.10	3.75	2.90	4.73	4.55	6.44	3.60	4.10	4.67	6.92	3.02
Pu (kip)	23.83	33.40	31.46	26.22	30.22	27.97	27.93	30.37	20.26	25.38	28.99	18.85	22.33	22.69	28.33	19.86

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	21.65	30.61	27.98	24.29	27.79	25.52	24.43	28.26
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.40	16.70	OK	28.99	14.50	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.40	1.47	126.02	OK
Web SPL	16.70	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 7482

Node 7482

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7482 L	99.00	50.00	4950.00	72.00	50.00	3600.00	66.00	50.00	3300.00
7482 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 7482 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.18	4.50	-33.85	-8.53	-37.95	2.80	-25.82	-4.48	-30.92	-8.14	-36.60	-4.41	-36.78	8.42	-26.35	-11.76
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.54	0.09	0.68	0.17	0.76	0.06	0.52	0.09	0.62	0.17	0.73	0.09	0.74	0.17	0.53	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-27.18		-33.85		-37.95		-25.82		-30.92		-36.60		-36.78		-26.35	
Fcf (ksi)	-38.59		-41.92		-43.98		-37.91		-40.46		-43.30		-43.39		-38.18	
Fcf (kip)	-3820.62		-4150.40		-4353.76		-3753.08		-4005.71		-4286.79		-4295.81		-3779.51	
fncf (ksi)		4.50		-8.53		2.80		-4.48		-8.14		-4.41		8.42		-11.76
Rcf		1.02		1.10		1.16		1.00		1.07		1.14		1.14		1.01
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.29	3.61	-25.13	-5.77	-28.30	2.44	-19.15	-2.94	-22.77	-5.50	-27.20	-2.76	-27.58	6.50	-19.40	-8.18
Fs (ksi)	-20.29	3.61	-25.13	-5.77	-28.30	2.44	-19.15	-2.94	-22.77	-5.50	-27.20	-2.76	-27.58	6.50	-19.40	-8.18
Fs (kip)	-2008.41	259.83	-2487.39	-415.59	-2801.69	175.83	-1895.48	-211.35	-2254.69	-396.07	-2692.74	-198.38	-2729.94	468.13	-1920.12	-589.04

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2439.53	0.00	468.13
Comp	4588.53	2859.76	2801.69	589.04

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	414.84	557.47	614.80	400.94	454.24	547.31	582.86	444.92	296.92	406.75	447.26	287.10	324.75	399.57	424.69	318.17
Vuw (kip)	622.26	836.20	922.20	601.41	681.36	820.96	874.30	667.38	---	---	---	---	---	---	---	---
Mv (k*ft)	350.02	470.36	518.74	338.29	383.27	461.79	491.79	375.40	167.01	228.80	251.58	161.49	182.67	224.76	238.89	178.97
Huw (kip)	-1122.61	-1694.38	-1344.33	-1398.94	-1621.58	-1594.87	-1114.12	-1650.13	-550.38	-1019.61	-853.31	-728.70	-933.09	-988.51	-695.42	-910.02
Muw (k*ft)	949.65	715.03	1038.79	735.41	699.26	841.99	1166.50	579.69	525.71	425.77	676.32	356.64	380.02	537.77	749.69	246.71
Mu (k*ft)	1299.67	1185.39	1557.53	1073.70	1082.53	1303.78	1658.29	955.09	692.72	654.56	927.91	518.13	562.70	762.53	988.58	425.68

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.39	21.72	17.23	17.94	20.79	20.45	14.28	21.16	7.06	13.07	10.94	9.34	11.96	12.67	8.92	11.67
PY1 (Vuw)	7.98	10.72	11.82	7.71	8.74	10.53	11.21	8.56	3.81	5.21	5.73	3.68	4.16	5.12	5.44	4.08
PX2 (Mu)	23.64	21.56	28.33	19.53	19.69	23.71	30.16	17.37	12.60	11.91	16.88	9.42	10.23	13.87	17.98	7.74
PY2 (Mu)	9.85	8.98	11.80	8.14	8.20	9.88	12.57	7.24	5.25	4.96	7.03	3.93	4.26	5.78	7.49	3.23
Pu (kip)	42.00	47.56	51.33	40.68	43.88	48.65	50.41	41.64	21.64	26.97	30.61	20.25	23.74	28.69	29.85	20.74

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1223.98	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1215.54	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2328.04	2520.00	OK
TF Inside	2260.49	2446.88	OK
BF Inside	1434.83	1631.25	OK
BF Outside	1424.93	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.52	46.05	49.75	40.05	42.96	47.37	49.10	40.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	922.20
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2328.04	20.79	OK	1421.47	12.69	OK
BF	1434.83	25.62	OK	295.54	5.28	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2328.04	20.79	1.47	160.39	OK
TF	4588.53	40.97	1.47	252.04	OK
TF Inside	2260.49	20.18	1.47	171.84	OK
BF Inside	1434.83	25.62	1.47	114.56	OK
BF	2859.76	51.07	1.47	206.21	OK
BF Outside	1424.93	25.45	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.33	25.66	OK	30.61	15.30	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.33	1.47	126.02	OK
Web SPL	25.66	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.08
TF Inside	NA	1.08
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.62	1.33	6.15
Web	2.18	1.15	3.80
BF	1.28	3.19	4.04

Plate	Shear	Flexure
Web	1.78	1.65

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.24	3.22	-32.58	-8.17	-36.85	1.26	-24.64	-4.07	-27.23	-5.54	-33.06	-2.23	-36.10	7.18	-25.84	-11.74
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.52	0.06	0.65	0.17	0.74	0.03	0.49	0.08	0.54	0.11	0.66	0.05	0.72	0.14	0.52	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-26.24		-32.58		-36.85		-24.64		-27.23		-33.06		-36.10		-25.84	
Fcf (ksi)	-38.12		-41.29		-43.43		-37.50		-38.62		-41.53		-43.05		-37.92	
Fcf (kip)	-3773.72		-4087.92		-4299.25		-3712.50		-3822.99		-4111.52		-4261.77		-3753.92	
fncf (ksi)		3.22		-8.17		1.26		-4.07		-5.54		-2.23		7.18		-11.74
Rcf		1.03		1.12		1.18		1.02		1.05		1.13		1.17		1.03
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.98832	2.185154	-23.73441	-5.946064	-26.7508	0.71589	-17.85844	-2.970894	-19.69166	-4.004102	-24.07129	-1.744721	-26.21581	4.8979456	-18.71	-8.39
Fs (ksi)	-18.99	2.19	-23.73	-5.95	-26.75	0.72	-17.86	-2.97	-19.69	-4.00	-24.07	-1.74	-26.22	4.90	-18.71	-8.39
Fs (kip)	-1879.84	157.33	-2349.71	-428.12	-2648.33	51.54	-1767.99	-213.90	-1949.47	-288.30	-2383.06	-125.62	-2595.37	352.65	-1851.87	-603.82

Vu (kip)	414.84	557.47	614.80	400.94	454.24	547.31	582.86	444.92	296.92	406.75	447.26	287.10	324.75	399.57	424.69	318.17
Vuw (kip)	622.26	836.20	922.20	601.41	681.36	820.96	874.30	667.38	---	---	---	---	---	---	---	---
Mv (k*ft)	350.02	470.36	518.74	338.29	383.27	461.79	491.79	375.40	167.01	228.80	251.58	161.49	182.67	224.76	238.89	178.97
Huw (kip)	-1147.90	-1664.79	-1384.19	-1374.33	-1465.80	-1453.26	-1143.96	-1649.91	-554.50	-979.46	-859.15	-687.37	-781.96	-851.93	-703.49	-894.04
Muw (k*ft)									465.82	391.34	604.27	327.53	345.13	491.18	684.50	227.03
Mu (k*ft)	350.02	470.36	518.74	338.29	383.27	461.79	491.79	375.40	632.83	620.14	855.85	489.02	527.80	715.94	923.39	405.99
Muw (k*ft)	911.94	706.99	987.98	733.78	721.91	858.50	1161.46	888.46	formulas matching the Muw results							
Pu (add)	216.70	168.00	234.77	174.36	171.54	204.00	268.87	135.08	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

6% 5% 7% 5% 5% 6% 7% 4% percentage increase in flange force 7.47%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.72	21.34	17.75	17.62	18.79	18.63	14.67	21.15	7.11	12.56	11.01	8.81	10.03	10.92	9.02	11.46
PY1 (Vuw)	7.98	10.72	11.82	7.71	8.74	10.53	11.21	8.56	3.81	5.21	5.73	3.68	4.16	5.12	5.44	4.08
PX2 (Mu)	6.37	8.56	9.44	6.15	6.97	8.40	8.95	6.83	11.51	11.28	15.57	8.89	9.60	13.02	16.80	7.38
PY2 (Mu)	2.65	3.56	3.93	2.56	2.90	3.50	3.73	2.85	4.80	4.70	6.49	3.71	4.00	5.43	7.00	3.08
Pu (kip)	23.61	33.14	31.42	25.90	28.27	30.45	27.94	30.21	20.51	25.82	29.26	19.19	21.26	26.16	28.66	20.16

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	21.49	30.38	27.99	24.00	26.08	27.61	24.48	28.16
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.14	16.57	OK	29.26	14.63	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.14	1.47	126.02	OK
Web SPL	16.57	1.47	91.65	OK

Field Splice - Node 9482

Node 9482

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9482 L	99.00	50.00	4950.00	72.00	50.00	3600.00	66.00	50.00	3300.00
9482 R	80.00	67.05	5363.81	80.00	67.05	5363.81	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 9482 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.86	5.17	-29.10	-7.83	-33.39	4.12	-20.36	-5.18	-24.96	-6.88	-31.21	-4.44	-32.61	9.25	-19.25	-11.62
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.44	0.10	0.58	0.16	0.67	0.08	0.41	0.11	0.50	0.14	0.62	0.09	0.65	0.18	0.39	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-21.86		-29.10		-33.39		-20.36		-24.96		-31.21		-32.61		-19.25	
Fcf (ksi)	-37.50		-39.55		-41.70		-37.50		-37.50		-40.61		-41.30		-37.50	
Fcf (kip)	-3712.50		-3915.53		-4128.00		-3712.50		-3712.50		-4019.92		-4089.09		-3712.50	
fncf (ksi)		5.17		-7.83		4.12		-5.18		-6.88		-4.44		9.25		-11.62
Rcf		1.12		1.18		1.25		1.12		1.12		1.22		1.24		1.12
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.52	4.06	-21.44	-5.50	-24.72	3.21	-15.27	-3.46	-18.57	-4.62	-23.03	-3.02	-24.35	7.12	-14.15	-8.32
Fs (ksi)	-16.52	4.06	-21.44	-5.50	-24.72	3.21	-15.27	-3.46	-18.57	-4.62	-23.03	-3.02	-24.35	7.12	-14.15	-8.32
Fs (kip)	-1635.83	291.97	-2122.78	-395.77	-2447.77	231.44	-1511.43	-249.14	-1838.09	-332.40	-2280.22	-217.32	-2410.30	512.81	-1400.95	-599.39

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2431.65	0.00	512.81
Comp	4352.38	2847.82	2447.77	599.39

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	327.61	475.67	529.71	307.23	363.64	456.92	503.26	348.26	238.38	344.15	382.33	223.98	263.83	330.90	362.48	254.13
Vuw (kip)	491.42	713.50	794.57	460.84	545.46	685.39	754.89	522.39	---	---	---	---	---	---	---	---
Mv (k*ft)	276.42	401.35	446.95	259.22	306.82	385.53	424.62	293.85	134.09	193.58	215.06	125.99	148.41	186.13	203.89	142.95
Huw (kip)	-1046.01	-1611.18	-1206.30	-1429.56	-1492.44	-1518.04	-985.51	-1668.26	-411.46	-888.99	-709.85	-618.00	-765.05	-859.68	-568.40	-741.70
Muw (k*ft)	952.66	666.12	1030.46	696.96	655.04	774.61	1160.37	537.82	452.73	350.80	614.67	259.75	306.90	440.31	692.31	128.18
Mu (k*ft)	1229.08	1067.46	1477.41	956.18	961.86	1160.14	1584.99	831.67	586.82	544.38	829.73	385.74	455.31	626.44	896.21	271.12

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.41	20.66	15.47	18.33	19.13	19.46	12.63	21.39	5.28	11.40	9.10	7.92	9.81	11.02	7.29	9.51
PY1 (Vuw)	6.30	9.15	10.19	5.91	6.99	8.79	9.68	6.70	3.06	4.41	4.90	2.87	3.38	4.24	4.65	3.26
PX2 (Mu)	22.36	19.42	26.87	17.39	17.49	21.10	28.83	15.13	10.67	9.90	15.09	7.02	8.28	11.39	16.30	4.93
PY2 (Mu)	9.31	8.09	11.20	7.25	7.29	8.79	12.01	6.30	4.45	4.13	6.29	2.92	3.45	4.75	6.79	2.05
Pu (kip)	39.03	43.62	47.43	38.06	39.31	44.21	46.79	38.76	17.63	22.95	26.65	16.02	19.34	24.15	26.22	15.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1220.03	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1211.62	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2208.23	2520.00	OK
TF Inside	2144.15	2446.88	OK
BF Inside	1428.84	1631.25	OK
BF Outside	1418.98	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.08	42.51	46.35	37.91	38.80	43.36	45.96	38.16
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	794.57
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9482**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2208.23	19.72	OK	1241.91	11.09	OK
BF	1428.84	25.51	OK	300.73	5.37	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2208.23	19.72	1.47	160.39	OK
TF	4352.38	38.86	1.47	252.04	OK
TF Inside	2144.15	19.14	1.47	171.84	OK
BF Inside	1428.84	25.51	1.47	114.56	OK
BF	2847.82	50.85	1.47	206.21	OK
BF Outside	1418.98	25.34	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.43	23.72	OK	26.65	13.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.43	1.47	126.02	OK
Web SPL	23.72	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.71	1.52	6.49
Web	2.42	1.36	4.22
BF	1.29	3.13	4.05

Plate	Shear	Flexure
Web	2.06	1.81

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9482	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.70	3.77	-27.33	-6.90	-31.28	1.76	-18.64	-4.11	-21.39	-4.24	-26.88	-1.38	-31.02	7.27	-19.03	-11.66
ϕf Fnc (ksi)	50.00	50.00	50.00	49.18	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18
f / ϕf Fnc	0.41	0.08	0.55	0.14	0.63	0.04	0.37	0.08	0.43	0.09	0.54	0.03	0.62	0.15	0.38	0.24
α	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98
fcf (ksi)	-20.70		-27.33		-31.28		-18.64		-21.39		-26.88		-31.02		-19.03	
Fcf (ksi)	-37.50		-38.67		-40.64		-37.50		-37.50		-38.44		-40.51		-37.50	
Fcf (kip)	-3712.50		-3827.93		-4023.48		-3712.50		-3712.50		-3805.43		-4010.34		-3712.50	
fncf (ksi)		3.77		-6.90		1.76		-4.11		-4.24		-1.38		7.27		-11.66
Rcf		1.20		1.24		1.30		1.20		1.20		1.23		1.29		1.20
Fncf (ksi)		37.50		-36.89		37.50		-36.89		-36.89		-36.89		37.50		-36.89
Fncf (kip)		2170.66		-2655.76		2170.66		-2655.76		-2655.76		-2655.76		2170.66		-2655.76

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.17395	2.629123	-19.74319	-5.143932	-22.53433	0.968447	-13.72157	-2.941157	-15.66101	-3.034853	-19.4221	-1.24969	-22.466	5.1003492	-13.88	-8.51
Fs (ksi)	-15.17	2.63	-19.74	-5.14	-22.53	0.97	-13.72	-2.94	-15.66	-3.03	-19.42	-1.25	-22.47	5.10	-13.88	-8.51
Fs (kip)	-1502.22	189.30	-1954.58	-370.36	-2230.90	69.73	-1358.44	-211.76	-1550.44	-218.51	-1922.79	-89.98	-2224.13	367.23	-1373.93	-612.58

Vu (kip)	327.61	475.67	529.71	307.23	363.64	456.92	503.26	348.26	238.38	344.15	382.33	223.98	263.83	330.90	362.48	254.13
Vuw (kip)	491.42	713.50	794.57	460.84	545.46	685.39	754.89	522.39	---	---	---	---	---	---	---	---
Mv (k*ft)	276.42	401.35	446.95	259.22	306.82	385.53	424.62	293.85	134.09	193.58	215.06	125.99	148.41	186.13	203.89	142.95
Huw (kip)	-1088.19	-1557.24	-1265.89	-1400.07	-1405.32	-1324.59	-1026.02	-1698.64	-413.98	-821.27	-711.67	-549.87	-616.96	-682.17	-573.07	-738.74
Muw (k*ft)									391.67	321.18	517.06	237.17	277.78	399.79	606.46	118.14
Mu (k*ft)	276.42	401.35	446.95	259.22	306.82	385.53	424.62	293.85	525.76	514.77	732.12	363.16	426.18	585.92	810.35	261.09
Muw (k*ft)	924.54	663.14	944.29	716.62	713.12	808.25	1088.36	817.97		formulas matching the Muw results						
Pu (add)	219.69	157.58	224.39	170.29	169.45	192.06	261.00	122.99		additional flange force						

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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6% 4% 6% 5% 5% 5% 7% 3% percentage increase in flange force 7.25%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.95	19.96	16.23	17.95	18.02	16.98	13.15	21.78	5.31	10.53	9.12	7.05	7.91	8.75	7.35	9.47
PY1 (Vuw)	6.30	9.15	10.19	5.91	6.99	8.79	9.68	6.70	3.06	4.41	4.90	2.87	3.38	4.24	4.65	3.26
PX2 (Mu)	5.03	7.30	8.13	4.71	5.58	7.01	7.72	5.34	9.56	9.36	13.32	6.61	7.75	10.66	14.74	4.75
PY2 (Mu)	2.09	3.04	3.39	1.96	2.33	2.92	3.22	2.23	3.98	3.90	5.55	2.75	3.23	4.44	6.14	1.98
Pu (kip)	20.75	29.87	27.89	23.99	25.37	26.70	24.54	28.55	16.45	21.56	24.75	14.77	17.00	21.26	24.58	15.15

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	19.19	27.59	25.01	22.63	23.71	24.41	21.61	27.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 9482**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
29.87	14.93	OK	24.75	12.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	29.87	1.47	126.02	OK
Web SPL	14.93	1.47	91.65	OK

Field Splice - Node 1496

Node 1496

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1496 L	80.00	67.15	5371.71	80.00	69.29	5543.60	48.00	50.00	2400.00
1496 R	99.00	50.00	4950.00	72.00	49.18	3541.01	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 1496 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.01	-6.78	-22.69	6.03	-34.49	5.56	-19.90	-5.87	-25.78	-5.83	-31.37	3.30	-19.36	-10.63	-32.90	9.69
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.60	0.14	0.45	0.12	0.69	0.11	0.40	0.12	0.52	0.12	0.63	0.07	0.39	0.22	0.66	0.19
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	-30.01		-22.69		-34.49		-19.90		-25.78		-31.37		-19.36		-32.90	
Fcf (ksi)	-40.01		-37.50		-42.24		-37.50		-37.89		-40.69		-37.50		-41.45	
Fcf (kip)	-3960.60		-3712.50		-4182.02		-3712.50		-3750.87		-4027.83		-3712.50		-4103.62	
fncf (ksi)		-6.78		6.03		5.56		-5.87		-5.83		3.30		-10.63		9.69
Rcf		1.16		1.09		1.22		1.09		1.10		1.18		1.09		1.20
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		37.50		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		2170.66		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.22	-4.90	-16.86	4.75	-25.65	3.88	-14.65	-3.71	-19.35	-4.44	-23.17	2.97	-14.42	-7.84	-24.53	7.71
Fs (ksi)	-22.22	-4.90	-16.86	4.75	-25.65	3.88	-14.65	-3.71	-19.35	-4.44	-23.17	2.97	-14.42	-7.84	-24.53	7.71
Fs (kip)	-2199.91	-352.68	-1669.10	341.70	-2539.04	279.07	-1450.75	-267.30	-1915.31	-319.97	-2294.11	213.90	-1427.57	-564.71	-2428.25	555.34

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2437.95	0.00	555.34
Comp	4418.94	2833.10	2539.04	564.71

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	480.20	333.48	543.59	294.85	370.90	451.95	335.81	515.63	353.18	239.23	397.97	211.94	275.96	322.94	251.17	367.93
Vuw (kip)	720.30	500.22	815.39	442.27	556.35	677.93	503.71	773.45	---	---	---	---	---	---	---	---
Mv (k*ft)	405.17	281.37	458.66	248.78	312.95	381.34	283.34	435.07	198.67	134.57	223.86	119.22	155.23	181.65	141.28	206.96
Huw (kip)	-1579.91	-1021.06	-1169.18	-1448.21	-1461.64	-1214.32	-1619.06	-983.48	-894.95	-399.76	-718.44	-606.10	-785.09	-666.67	-734.68	-554.88
Muw (k*ft)	706.99	969.30	1079.22	684.53	692.63	980.60	570.62	1168.17	381.11	475.32	649.50	240.71	327.86	575.16	144.69	709.30
Mu (k*ft)	1112.16	1250.67	1537.88	933.31	1005.58	1361.94	853.96	1603.24	579.77	609.89	873.36	359.93	483.09	756.81	285.97	916.26

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.26	13.09	14.99	18.57	18.74	15.57	20.76	12.61	11.47	5.13	9.21	7.77	10.07	8.55	9.42	7.11
PY1 (Vuw)	9.23	6.41	10.45	5.67	7.13	8.69	6.46	9.92	4.53	3.07	5.10	2.72	3.54	4.14	3.22	4.72
PX2 (Mu)	20.23	22.75	27.97	16.98	18.29	24.77	15.53	29.16	10.55	11.09	15.89	6.55	8.79	13.77	5.20	16.67
PY2 (Mu)	8.43	9.48	11.66	7.07	7.62	10.32	6.47	12.15	4.39	4.62	6.62	2.73	3.66	5.74	2.17	6.94
Pu (kip)	44.17	39.20	48.32	37.76	39.86	44.60	38.52	47.24	23.76	17.95	27.70	15.32	20.18	24.40	15.58	26.48

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1223.19	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1214.76	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2242.00	2520.00	OK
TF Inside	2176.94	2446.88	OK
BF Inside	1421.45	1631.25	OK
BF Outside	1411.65	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.09	39.24	47.19	37.65	39.36	43.98	38.03	46.33
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	815.39
Rr (kip)	1639.95
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2242.00	20.02	OK	1288.21	11.50	OK
BF	1421.45	25.38	OK	283.33	5.06	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2242.00	20.02	1.47	160.39	OK
TF	4418.94	39.45	1.47	252.04	OK
TF Inside	2176.94	19.44	1.47	171.84	OK
BF Inside	1421.45	25.38	1.47	114.56	OK
BF	2833.10	50.59	1.47	206.21	OK
BF Outside	1411.65	25.21	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.32	24.16	OK	27.70	13.85	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.32	1.47	126.02	OK
Web SPL	24.16	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.09	1.15
BF Outside	1.13	1.15

Bolt	Shear	Slip	Bearing
TF	1.68	1.46	6.39
Web	2.45	1.30	4.27
BF	1.30	3.33	4.08

Plate	Shear	Flexure
Web	2.01	1.84

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.10	-5.79	-21.12	4.26	-32.45	3.23	-18.25	-4.82	-22.03	-3.10	-27.07	-0.91	-19.13	-10.70	-31.79	8.12
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	50.00	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.56	0.12	0.42	0.09	0.65	0.06	0.37	0.10	0.44	0.06	0.54	0.02	0.38	0.22	0.64	0.16
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00	1.00	0.98	1.00	1.00
fcf (ksi)	-28.10		-21.12		-32.45		-18.25		-22.03		-27.07		-19.13		-31.79	
Fcf (ksi)	-39.05		-37.50		-41.22		-37.50		-37.50		-38.53		-37.50		-40.90	
Fcf (kip)	-3866.14		-3712.50		-4081.11		-3712.50		-3712.50		-3814.81		-3712.50		-4048.77	
fncf (ksi)		-5.79		4.26		3.23		-4.82		-3.10		-0.91		-10.70		8.12
Rcf		1.20		1.16		1.27		1.16		1.16		1.19		1.16		1.26
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-37.50		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2700.00		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.51875	-4.643443	-15.30743	3.131663	-23.5871	1.72332	-13.2835	-3.286783	-16.22922	-2.742222	-19.51182	-0.524784	-14.18118	-8.112111	-22.85	5.86
Fs (ksi)	-20.52	-4.64	-15.31	3.13	-23.59	1.72	-13.28	-3.29	-16.23	-2.74	-19.51	-0.52	-14.18	-8.11	-22.85	5.86
Fs (kip)	-2031.36	-334.33	-1515.44	225.48	-2335.12	124.08	-1315.07	-236.65	-1606.69	-197.44	-1931.67	-37.78	-1403.94	-584.07	-2262.26	421.75

Vu (kip)	480.20	333.48	543.59	294.85	370.90	451.95	335.81	515.63	353.18	239.23	397.97	211.94	275.96	322.94	251.17	367.93
Vuw (kip)	720.30	500.22	815.39	442.27	556.35	677.93	503.71	773.45	---	---	---	---	---	---	---	---
Mv (k*ft)	405.17	281.37	458.66	248.78	312.95	381.34	283.34	435.07	198.67	134.57	223.86	119.22	155.23	181.65	141.28	206.96
Huw (kip)	-1518.52	-1075.00	-1225.14	-1421.48	-1355.55	-1307.45	-1645.42	-1011.89	-830.35	-401.80	-721.50	-546.82	-626.06	-661.21	-735.68	-560.78
Muw (k*ft)									349.26	405.66	556.83	219.93	296.71	417.71	133.52	631.59
Mu (k*ft)	405.17	281.37	458.66	248.78	312.95	381.34	283.34	435.07	547.92	540.23	780.69	339.14	451.94	599.37	274.80	838.55
Muw (k*ft)	705.93	933.33	997.06	702.34	746.30	823.84	563.06	1124.86	formulas matching the Muw results							
Pu (add)	167.75	221.78	236.93	166.89	177.34	195.76	131.42	267.29	additional flange force							

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5% 6% 7% 5% 5% 6% 4% 8% percentage increase in flange force 7.55%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.47	13.78	15.71	18.22	17.38	16.76	21.10	12.97	10.65	5.15	9.25	7.01	8.03	8.48	9.43	7.19
PY1 (Vuw)	9.23	6.41	10.45	5.67	7.13	8.69	6.46	9.92	4.53	3.07	5.10	2.72	3.54	4.14	3.22	4.72
PX2 (Mu)	7.37	5.12	8.34	4.52	5.69	6.94	5.15	7.91	9.97	9.83	14.20	6.17	8.22	10.90	5.00	15.25
PY2 (Mu)	3.07	2.13	3.48	1.89	2.37	2.89	2.15	3.30	4.15	4.09	5.92	2.57	3.43	4.54	2.08	6.36
Pu (kip)	29.52	20.74	27.79	23.97	24.95	26.38	27.62	24.71	22.36	16.60	25.91	14.20	17.68	21.23	15.37	25.02

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	27.20	19.14	24.76	22.66	23.23	24.11	26.13	21.66
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 1496**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
29.52	14.76	OK	25.91	12.95	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	29.52	1.47	126.02	OK
Web SPL	14.76	1.47	91.65	OK

Field Splice - Node 3496

Node 3496

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3496 L	80.00	67.08	5366.55	80.00	69.29	5543.60	48.00	50.00	2400.00
3496 R	99.00	50.00	4950.00	72.00	49.18	3541.01	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 3496 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-34.49	-7.76	-28.01	4.63	-38.99	4.66	-25.49	-6.46	-31.15	-7.57	-36.52	-4.97	-25.19	-10.84	-37.50	8.66
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.69	0.16	0.56	0.09	0.78	0.09	0.51	0.13	0.62	0.15	0.73	0.10	0.50	0.22	0.75	0.17
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-34.49		-28.01		-38.99		-25.49		-31.15		-36.52		-25.19		-37.50	
Fcf (ksi)	-42.24		-39.00		-44.49		-37.75		-40.58		-43.26		-37.60		-43.75	
Fcf (kip)	-4182.17		-3861.39		-4404.98		-3736.97		-4017.07		-4282.67		-3722.14		-4331.36	
fncf (ksi)		-7.76		4.63		4.66		-6.46		-7.57		-4.97		-10.84		8.66
Rcf		1.08		1.00		1.14		1.00		1.04		1.11		1.00		1.12
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.44	-5.52	-20.93	3.90	-28.91	3.30	-18.92	-4.03	-23.23	-5.63	-27.06	-2.88	-18.85	-8.08	-27.95	7.00
Fs (ksi)	-25.44	-5.52	-20.93	3.90	-28.91	3.30	-18.92	-4.03	-23.23	-5.63	-27.06	-2.88	-18.85	-8.08	-27.95	7.00
Fs (kip)	-2518.24	-397.22	-2072.07	280.64	-2862.12	237.68	-1873.56	-290.39	-2299.92	-405.34	-2678.56	-207.28	-1866.29	-581.59	-2766.63	503.75

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2443.88	0.00	503.75
Comp	4651.58	2857.10	2862.12	581.59

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	556.66	430.42	626.15	392.89	458.49	540.31	419.27	601.19	406.97	310.44	456.07	283.92	337.61	388.08	309.90	431.09
Vuw (kip)	834.98	645.63	939.23	589.34	687.73	810.46	628.90	901.79	---	---	---	---	---	---	---	---
Mv (k*ft)	469.68	363.17	528.32	331.50	386.85	455.88	353.76	507.26	228.92	174.62	256.54	159.71	189.91	218.29	174.32	242.49
Huw (kip)	-1671.40	-1134.25	-1292.95	-1458.93	-1598.94	-1609.48	-1598.28	-1123.14	-1021.47	-562.06	-845.10	-757.62	-952.42	-987.86	-888.66	-691.32
Muw (k*ft)	744.47	960.01	1095.80	688.26	719.41	830.42	588.76	1176.29	438.23	546.21	708.65	327.62	387.24	531.90	237.02	768.73
Mu (k*ft)	1214.15	1323.18	1624.12	1019.76	1106.25	1286.31	942.52	1683.55	667.15	720.83	965.19	487.32	577.15	750.19	411.34	1011.22

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.43	14.54	16.58	18.70	20.50	20.63	20.49	14.40	13.10	7.21	10.83	9.71	12.21	12.66	11.39	8.86
PY1 (Vuw)	10.70	8.28	12.04	7.56	8.82	10.39	8.06	11.56	5.22	3.98	5.85	3.64	4.33	4.98	3.97	5.53
PX2 (Mu)	22.08	24.07	29.54	18.55	20.12	23.40	17.14	30.62	12.13	13.11	17.56	8.86	10.50	13.65	7.48	18.39
PY2 (Mu)	9.20	10.03	12.31	7.73	8.38	9.75	7.14	12.76	5.06	5.46	7.31	3.69	4.37	5.69	3.12	7.66
Pu (kip)	47.85	42.73	52.15	40.27	44.11	48.42	40.59	51.17	27.24	22.40	31.29	19.97	24.32	28.39	20.16	30.28

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1226.17	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1217.71	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2360.03	2520.00	OK
TF Inside	2291.55	2446.88	OK
BF Inside	1433.49	1631.25	OK
BF Outside	1423.61	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.38	42.17	50.55	39.63	43.19	47.18	39.68	49.75
Check	OK	OK	NG	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	939.23
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2360.03	21.07	OK	1452.13	12.97	OK
BF	1433.49	25.60	OK	291.80	5.21	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2360.03	21.07	1.47	160.39	OK
TF	4651.58	41.53	1.47	252.04	OK
TF Inside	2291.55	20.46	1.47	171.84	OK
BF Inside	1433.49	25.60	1.47	114.56	OK
BF	2857.10	51.02	1.47	206.21	OK
BF Outside	1423.61	25.42	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.15	26.08	OK	31.29	15.65	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.15	1.47	126.02	OK
Web SPL	26.08	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.07
TF Inside	NA	1.07
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.60	1.30	6.07
Web	2.21	1.13	3.85
BF	1.29	3.23	4.04

Plate	Shear	Flexure
Web	1.75	1.67

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3496	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.98	-7.22	-26.76	3.09	-37.65	2.87	-24.10	-5.79	-27.42	-4.95	-32.84	-2.64	-24.73	-10.86	-37.02	7.58
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.66	0.15	0.54	0.06	0.75	0.06	0.48	0.12	0.55	0.10	0.66	0.05	0.49	0.22	0.74	0.15
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-32.98		-26.76		-37.65		-24.10		-27.42		-32.84		-24.73		-37.02	
Fcf (ksi)	-41.49		-38.38		-43.83		-37.50		-38.71		-41.42		-37.50		-43.51	
Fcf (kip)	-4107.27		-3799.76		-4338.85		-3712.50		-3832.13		-4100.39		-3712.50		-4307.55	
fncf (ksi)		-7.22		3.09		2.87		-5.79		-4.95		-2.64		-10.86		7.58
Rcf		1.10		1.02		1.16		1.00		1.03		1.10		1.00		1.16
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.96057	-5.655953	-19.48349	2.33462	-27.26585	1.474008	-17.60033	-3.938909	-20.03342	-4.053698	-23.77444	-1.710956	-18.13821	-8.229236	-26.73	5.51
Fs (ksi)	-23.96	-5.66	-19.48	2.33	-27.27	1.47	-17.60	-3.94	-20.03	-4.05	-23.77	-1.71	-18.14	-8.23	-26.73	5.51
Fs (kip)	-2372.10	-407.23	-1928.87	168.09	-2699.32	106.13	-1742.43	-283.60	-1983.31	-291.87	-2353.67	-123.19	-1795.68	-592.50	-2646.39	396.51

Vu (kip)	556.66	430.42	626.15	392.89	458.49	540.31	419.27	601.19	406.97	310.44	456.07	283.92	337.61	388.08	309.90	431.09
Vuw (kip)	834.98	645.63	939.23	589.34	687.73	810.46	628.90	901.79	---	---	---	---	---	---	---	---
Mv (k*ft)	469.68	363.17	528.32	331.50	386.85	455.88	353.76	507.26	228.92	174.62	256.54	159.71	189.91	218.29	174.32	242.49
Huw (kip)	-1631.54	-1162.80	-1335.91	-1428.70	-1445.31	-1462.65	-1595.89	-1146.96	-977.35	-565.91	-851.13	-710.79	-794.87	-841.02	-870.13	-700.40
Muw (k*ft)									402.70	480.00	632.28	300.55	351.55	485.40	218.00	709.24
Mu (k*ft)	469.68	363.17	528.32	331.50	386.85	455.88	353.76	507.26	631.62	654.62	888.82	460.26	541.46	703.69	392.32	951.73
Muw (k*ft)	737.76	913.59	1037.77	697.53	739.63	847.30	580.07	1149.83	formulas matching the Muw results							
Pu (add)	175.31	217.09	246.60	165.75	175.75	201.34	139.27	273.23	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3496	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 6% 7% 5% 5% 6% 4% 8% percentage increase in flange force 7.72%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.92	14.91	17.13	18.32	18.53	18.75	20.46	14.70	12.53	7.26	10.91	9.11	10.19	10.78	11.16	8.98
PY1 (Vuw)	10.70	8.28	12.04	7.56	8.82	10.39	8.06	11.56	5.22	3.98	5.85	3.64	4.33	4.98	3.97	5.53
PX2 (Mu)	8.54	6.61	9.61	6.03	7.04	8.29	6.43	9.23	11.49	11.91	16.17	8.37	9.85	12.80	7.14	17.31
PY2 (Mu)	3.56	2.75	4.00	2.51	2.93	3.45	2.68	3.84	4.79	4.96	6.74	3.49	4.10	5.33	2.97	7.21
Pu (kip)	32.73	24.18	31.18	26.35	28.14	30.38	28.96	28.46	26.02	21.15	29.86	18.88	21.74	25.74	19.57	29.21

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.96	21.96	27.61	24.52	25.91	27.60	27.04	24.85
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.73	16.37	OK	29.86	14.93	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.73	1.47	126.02	OK
Web SPL	16.37	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5496	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 5496

Node 5496

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5496 L	80.00	67.05	5364.24	80.00	69.29	5543.60	48.00	50.00	2400.00
5496 R	99.00	50.00	4950.00	72.00	49.18	3541.01	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 5496 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I	29.2167722 in
Outer to Inr	0.8843723
Outer to Inr	0.92298944
Outer to Mi	0.94218615
Outer to Mi	0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.10	-7.75	-27.50	3.49	-37.72	3.70	-24.40	-6.01	-31.61	-5.78	-31.91	-6.31	-25.11	-11.16	-37.44	8.45
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.64	0.16	0.55	0.07	0.75	0.07	0.49	0.12	0.63	0.12	0.64	0.13	0.50	0.23	0.75	0.17
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-32.10		-27.50		-37.72		-24.40		-31.61		-31.91		-25.11		-37.44	
Fcf (ksi)	-41.05		-38.75		-43.86		-37.50		-40.81		-40.96		-37.56		-43.72	
Fcf (kip)	-4063.95		-3836.08		-4342.14		-3712.50		-4039.88		-4054.75		-3717.95		-4328.47	
fncf (ksi)		-7.75		3.49		3.70		-6.01		-5.78		-6.31		-11.16		8.45
Rcf		1.09		1.03		1.16		1.00		1.08		1.09		1.00		1.16
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.78	-5.75	-20.53	3.04	-28.07	2.81	-18.12	-3.71	-23.46	-4.34	-23.72	-3.95	-18.64	-8.32	-27.84	6.78
Fs (ksi)	-23.78	-5.75	-20.53	3.04	-28.07	2.81	-18.12	-3.71	-23.46	-4.34	-23.72	-3.95	-18.64	-8.32	-27.84	6.78
Fs (kip)	-2354.40	-413.65	-2032.53	218.77	-2778.50	202.18	-1793.82	-267.08	-2322.52	-312.25	-2348.73	-284.52	-1845.67	-599.09	-2756.34	488.04

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2438.45	0.00	488.04
Comp	4596.26	2841.11	2778.50	599.09

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	557.36	442.52	628.07	404.41	481.05	498.09	436.20	604.05	405.82	319.71	455.78	292.79	351.90	358.98	320.22	433.84
Vuw (kip)	836.04	663.77	942.10	606.62	721.57	747.13	654.30	906.08	---	---	---	---	---	---	---	---
Mv (k*ft)	470.27	373.37	529.93	341.22	405.89	420.26	368.04	509.67	228.27	179.84	256.37	164.69	197.94	201.92	180.12	244.04
Huw (kip)	-1632.91	-1160.54	-1305.30	-1435.87	-1552.96	-1577.52	-1607.65	-1119.58	-974.39	-577.24	-833.50	-720.35	-917.29	-913.31	-889.81	-695.09
Muw (k*ft)	717.60	931.23	1059.64	692.75	760.20	750.43	580.66	1177.38	396.81	518.52	679.22	317.02	420.70	435.00	227.09	761.64
Mu (k*ft)	1187.87	1304.60	1589.57	1033.97	1166.08	1170.69	948.70	1687.05	625.08	698.36	935.60	481.71	618.65	636.93	407.21	1005.68

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.93	14.88	16.73	18.41	19.91	20.22	20.61	14.35	12.49	7.40	10.69	9.24	11.76	11.71	11.41	8.91
PY1 (Vuw)	10.72	8.51	12.08	7.78	9.25	9.58	8.39	11.62	5.20	4.10	5.84	3.75	4.51	4.60	4.11	5.56
PX2 (Mu)	21.61	23.73	28.91	18.81	21.21	21.29	17.26	30.69	11.37	12.70	17.02	8.76	11.25	11.58	7.41	18.29
PY2 (Mu)	9.00	9.89	12.05	7.84	8.84	8.87	7.19	12.79	4.74	5.29	7.09	3.65	4.69	4.83	3.09	7.62
Pu (kip)	46.89	42.77	51.63	40.36	44.92	45.43	40.95	51.22	25.85	22.19	30.57	19.46	24.78	25.13	20.14	30.23

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1223.44	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1215.00	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2331.96	2520.00	OK
TF Inside	2264.30	2446.88	OK
BF Inside	1425.47	1631.25	OK
BF Outside	1415.64	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.35	42.09	49.96	39.65	43.91	44.31	39.92	49.78
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	942.10
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2331.96	20.82	OK	1409.71	12.59	OK
BF	1425.47	25.45	OK	300.58	5.37	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2331.96	20.82	1.47	160.39	OK
TF	4596.26	41.04	1.47	252.04	OK
TF Inside	2264.30	20.22	1.47	171.84	OK
BF Inside	1425.47	25.45	1.47	114.56	OK
BF	2841.11	50.73	1.47	206.21	OK
BF Outside	1415.64	25.28	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.63	25.82	OK	30.57	15.29	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.63	1.47	126.02	OK
Web SPL	25.82	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.08
TF Inside	NA	1.08
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.62	1.34	6.14
Web	2.19	1.15	3.82
BF	1.29	3.14	4.06

Plate	Shear	Flexure
Web	1.74	1.65

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5496**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-31.86	-8.27	-26.67	2.32	-36.93	2.42	-23.98	-6.19	-28.04	-3.38	-29.01	-4.49	-24.90	-11.39	-36.38	6.87
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.64	0.17	0.53	0.05	0.74	0.05	0.48	0.13	0.56	0.07	0.58	0.09	0.50	0.23	0.73	0.14
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-31.86		-26.67		-36.93		-23.98		-28.04		-29.01		-24.90		-36.38	
Fcf (ksi)	-40.93		-38.33		-43.47		-37.50		-39.02		-39.51		-37.50		-43.19	
Fcf (kip)	-4052.10		-3795.14		-4303.14		-3712.50		-3863.01		-3911.08		-3712.50		-4275.86	
fncf (ksi)		-8.27		2.32		2.42		-6.19		-3.38		-4.49		-11.39		6.87
Rcf		1.11		1.04		1.18		1.02		1.06		1.07		1.02		1.17
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.02911	-6.394798	-19.42427	1.785373	-26.61224	1.162992	-17.52118	-4.231325	-20.33016	-2.934036	-21.0791	-3.030931	-18.10792	-8.598876	-26.29	5.00
Fs (ksi)	-23.03	-6.39	-19.42	1.79	-26.61	1.16	-17.52	-4.23	-20.33	-2.93	-21.08	-3.03	-18.11	-8.60	-26.29	5.00
Fs (kip)	-2279.88	-460.43	-1923.00	128.55	-2634.61	83.74	-1734.60	-304.66	-2012.69	-211.25	-2086.83	-218.23	-1792.68	-619.12	-2602.27	359.81

Vu (kip)	557.36	442.52	628.07	404.41	481.05	498.09	436.20	604.05	405.82	319.71	455.78	292.79	351.90	358.98	320.22	433.84
Vuw (kip)	836.04	663.77	942.10	606.62	721.57	747.13	654.30	906.08	---	---	---	---	---	---	---	---
Mv (k*ft)	470.27	373.37	529.93	341.22	405.89	420.26	368.04	509.67	228.27	179.84	256.37	164.69	197.94	201.92	180.12	244.04
Huw (kip)	-1653.28	-1185.45	-1340.24	-1444.98	-1405.34	-1462.30	-1619.25	-1160.16	-970.99	-582.08	-839.83	-717.83	-767.72	-795.63	-881.32	-702.51
Muw (k*ft)									365.95	466.61	611.06	292.38	382.71	397.06	209.20	688.22
Mu (k*ft)	470.27	373.37	529.93	341.22	405.89	420.26	368.04	509.67	594.23	646.45	867.43	457.07	580.66	598.98	389.32	932.26
Muw (k*ft)	698.75	896.43	1019.01	686.68	780.00	763.39	570.30	1126.94	formulas matching the Muw results							
Pu (add)	166.04	213.01	242.14	163.17	185.35	181.40	135.56	267.79	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 5496**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 6% 7% 5% 5% 5% 4% 8% percentage increase in flange force 7.56%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.20	15.20	17.18	18.53	18.02	18.75	20.76	14.87	12.45	7.46	10.77	9.20	9.84	10.20	11.30	9.01
PY1 (Vuw)	10.72	8.51	12.08	7.78	9.25	9.58	8.39	11.62	5.20	4.10	5.84	3.75	4.51	4.60	4.11	5.56
PX2 (Mu)	8.55	6.79	9.64	6.21	7.38	7.64	6.69	9.27	10.81	11.76	15.78	8.31	10.56	10.89	7.08	16.96
PY2 (Mu)	3.56	2.83	4.02	2.59	3.08	3.19	2.79	3.86	4.50	4.90	6.57	3.46	4.40	4.54	2.95	7.07
Pu (kip)	33.00	24.74	31.28	26.82	28.23	29.32	29.64	28.68	25.20	21.22	29.31	18.95	22.27	22.99	19.69	28.87

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	30.23	22.45	27.69	24.93	25.83	26.83	27.63	25.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
33.00	16.50	OK	29.31	14.65	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	33.00	1.47	126.02	OK
Web SPL	16.50	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type FF

Field Splice - Node 7496

Node 7496

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7496 L	80.00	67.05	5364.36	80.00	69.29	5543.60	48.00	50.00	2400.00
7496 R	99.00	50.00	4950.00	72.00	49.18	3541.01	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 7496 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-34.81	-7.84	-27.49	3.52	-39.26	5.08	-25.08	-6.65	-36.74	-5.49	-30.91	-6.74	-24.97	-10.63	-37.64	8.34
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.70	0.16	0.55	0.07	0.79	0.10	0.50	0.14	0.73	0.11	0.62	0.14	0.50	0.22	0.75	0.17
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-34.81		-27.49		-39.26		-25.08		-36.74		-30.91		-24.97		-37.64	
Fcf (ksi)	-42.41		-38.75		-44.63		-37.54		-43.37		-40.45		-37.50		-43.82	
Fcf (kip)	-4198.16		-3835.78		-4418.22		-3716.33		-4293.87		-4004.80		-3712.50		-4338.26	
fncf (ksi)		-7.84		3.52		5.08		-6.65		-5.49		-6.74		-10.63		8.34
Rcf		1.08		1.00		1.14		1.00		1.10		1.03		1.00		1.12
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.89	-5.71	-20.71	3.18	-29.32	3.87	-18.78	-4.37	-27.33	-3.99	-23.01	-4.35	-18.70	-7.88	-27.97	6.65
Fs (ksi)	-25.89	-5.71	-20.71	3.18	-29.32	3.87	-18.78	-4.37	-27.33	-3.99	-23.01	-4.35	-18.70	-7.88	-27.97	6.65
Fs (kip)	-2563.00	-411.23	-2050.78	229.19	-2902.88	278.45	-1859.48	-314.97	-2705.97	-286.97	-2277.55	-313.23	-1851.15	-567.34	-2769.22	478.74

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2441.26	0.00	478.74
Comp	4665.74	2855.37	2902.88	567.34

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	556.18	431.68	624.94	393.89	542.24	457.71	418.52	601.71	406.32	311.55	454.90	284.84	396.47	329.94	309.07	431.67
Vuw (kip)	834.27	647.52	937.41	590.83	813.36	686.56	627.79	902.56	---	---	---	---	---	---	---	---
Mv (k*ft)	469.27	364.23	527.30	332.34	457.51	386.19	353.13	507.69	228.55	175.24	255.88	160.22	223.02	185.59	173.85	242.82
Huw (kip)	-1678.95	-1162.56	-1282.32	-1458.26	-1631.45	-1564.09	-1588.40	-1138.70	-1042.82	-578.55	-840.00	-764.19	-1033.52	-902.75	-877.08	-703.65
Muw (k*ft)	746.55	929.75	1108.77	679.53	820.75	737.18	591.06	1168.99	443.90	525.76	730.16	316.98	513.64	410.41	238.01	761.66
Mu (k*ft)	1215.83	1293.98	1636.07	1011.87	1278.27	1123.37	944.19	1676.68	672.46	701.00	986.05	477.20	736.66	596.00	411.86	1004.48

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.52	14.90	16.44	18.70	20.92	20.05	20.36	14.60	13.37	7.42	10.77	9.80	13.25	11.57	11.24	9.02
PY1 (Vuw)	10.70	8.30	12.02	7.57	10.43	8.80	8.05	11.57	5.21	3.99	5.83	3.65	5.08	4.23	3.96	5.53
PX2 (Mu)	22.11	23.54	29.76	18.40	23.25	20.43	17.17	30.50	12.23	12.75	17.93	8.68	13.40	10.84	7.49	18.27
PY2 (Mu)	9.21	9.81	12.40	7.67	9.69	8.51	7.16	12.71	5.10	5.31	7.47	3.62	5.58	4.52	3.12	7.61
Pu (kip)	47.97	42.49	52.25	40.11	48.53	44.03	40.50	51.22	27.60	22.21	31.64	19.86	28.70	24.06	20.03	30.29

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1224.85	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1216.41	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2367.22	2520.00	OK
TF Inside	2298.52	2446.88	OK
BF Inside	1432.63	1631.25	OK
BF Outside	1422.75	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.51	41.89	50.68	39.45	47.27	43.13	39.59	49.79
Check	OK	OK	NG	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	937.41
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2367.22	21.14	OK	1472.81	13.15	OK
BF	1432.63	25.58	OK	284.65	5.08	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2367.22	21.14	1.47	160.39	OK
TF	4665.74	41.66	1.47	252.04	OK
TF Inside	2298.52	20.52	1.47	171.84	OK
BF Inside	1432.63	25.58	1.47	114.56	OK
BF	2855.37	50.99	1.47	206.21	OK
BF Outside	1422.75	25.41	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.25	26.13	OK	31.64	15.82	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.25	1.47	126.02	OK
Web SPL	26.13	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.06
TF Inside	NA	1.06
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.59	1.28	6.05
Web	2.22	1.13	3.86
BF	1.29	3.31	4.04

Plate	Shear	Flexure
Web	1.75	1.67

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7496	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.99	-7.03	-26.77	2.44	-37.63	3.03	-24.10	-6.34	-32.81	-2.93	-27.59	-4.52	-24.71	-10.84	-37.02	7.14
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.66	0.14	0.54	0.05	0.75	0.06	0.48	0.13	0.66	0.06	0.55	0.09	0.49	0.22	0.74	0.14
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-32.99		-26.77		-37.63		-24.10		-32.81		-27.59		-24.71		-37.02	
Fcf (ksi)	-41.49		-38.38		-43.82		-37.50		-41.41		-38.80		-37.50		-43.51	
Fcf (kip)	-4107.78		-3799.90		-4337.79		-3712.50		-4099.13		-3840.75		-3712.50		-4307.31	
fncf (ksi)		-7.03		2.44		3.03		-6.34		-2.93		-4.52		-10.84		7.14
Rcf		1.10		1.02		1.16		1.00		1.10		1.03		1.00		1.16
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.95777	-5.461306	-19.49132	1.824563	-27.24078	1.650047	-17.60686	-4.378166	-23.83433	-2.562137	-20.07446	-3.091283	-18.11423	-8.150254	-26.73	5.14
Fs (ksi)	-23.96	-5.46	-19.49	1.82	-27.24	1.65	-17.61	-4.38	-23.83	-2.56	-20.07	-3.09	-18.11	-8.15	-26.73	5.14
Fs (kip)	-2371.82	-393.21	-1929.64	131.37	-2696.84	118.80	-1743.08	-315.23	-2359.60	-184.47	-1987.37	-222.57	-1793.31	-586.82	-2646.64	370.32

Vu (kip)	556.18	431.68	624.94	393.89	542.24	457.71	418.52	601.71	406.32	311.55	454.90	284.84	396.47	329.94	309.07	431.67
Vuw (kip)	834.27	647.52	937.41	590.83	813.36	686.56	627.79	902.56	---	---	---	---	---	---	---	---
Mv (k*ft)	469.27	364.23	527.30	332.34	457.51	386.19	353.13	507.69	228.55	175.24	255.88	160.22	223.02	185.59	173.85	242.82
Huw (kip)	-1625.11	-1184.42	-1329.37	-1446.61	-1472.70	-1433.86	-1595.14	-1163.37	-970.83	-583.00	-844.49	-725.51	-871.08	-764.47	-866.73	-712.49
Muw (k*ft)									406.92	468.95	635.60	291.03	467.99	373.63	219.21	701.29
Mu (k*ft)	469.27	364.23	527.30	332.34	457.51	386.19	353.13	507.69	635.48	644.19	891.48	451.26	691.00	559.22	393.06	944.11
Muw (k*ft)	742.27	899.23	1041.66	685.59	840.04	751.09	580.37	1138.78	formulas matching the Muw results							
Pu (add)	176.38	213.68	247.52	162.91	199.61	178.48	139.38	270.60	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	**Cleveland InnerBelt : Field Splice - Node 7496**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 6% 7% 5% 6% 5% 4% 8% percentage increase in flange force 7.64%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.83	15.18	17.04	18.55	18.88	18.38	20.45	14.91	12.45	7.47	10.83	9.30	11.17	9.80	11.11	9.13
PY1 (Vuw)	10.70	8.30	12.02	7.57	10.43	8.80	8.05	11.57	5.21	3.99	5.83	3.65	5.08	4.23	3.96	5.53
PX2 (Mu)	8.54	6.62	9.59	6.04	8.32	7.02	6.42	9.23	11.56	11.72	16.21	8.21	12.57	10.17	7.15	17.17
PY2 (Mu)	3.56	2.76	4.00	2.52	3.47	2.93	2.68	3.85	4.82	4.88	6.76	3.42	5.24	4.24	2.98	7.16
Pu (kip)	32.65	24.45	31.08	26.58	30.55	27.98	28.93	28.65	26.01	21.14	29.83	18.88	25.88	21.69	19.54	29.21

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	29.87	22.24	27.50	24.76	27.76	25.76	27.02	25.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
32.65	16.32	OK	29.83	14.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	32.65	1.47	126.02	OK
Web SPL	16.32	1.47	91.65	OK

Field Splice - Node 9496

Node 9496

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	112
Web	78
BF	56

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9496 L	80.00	67.11	5369.18	80.00	69.29	5543.60	48.00	50.00	2400.00
9496 R	99.00	50.00	4950.00	72.00	49.18	3541.01	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 9496 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	75.63	82.79	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	32.00	2.25	---	72.00	52.88	57.88	50	65
Splice Plates	TF Outside	32.00	1.750	86.50	56.00	41.13	---	50	65
	TF Inside	14.50	1.875	86.50	54.38	38.44	---	50	65
	BF Inside	14.50	1.250	44.50	36.25	25.63	---	50	65
	BF Outside	32.00	1.125	44.50	36.00	26.44	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.922989

N.A. (from I 29.2167722 in
Outer to Inr 0.8843723
Outer to Inr 0.92298944

Outer to Mi 0.94218615
Outer to Mi 0.96149472

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.41	-6.97	-22.21	4.74	-34.72	5.96	-19.55	-6.34	-31.81	-4.75	-25.16	-5.38	-19.85	-11.03	-33.03	9.13
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.61	0.14	0.44	0.09	0.69	0.12	0.39	0.13	0.64	0.10	0.50	0.11	0.40	0.22	0.66	0.18
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-30.41		-22.21		-34.72		-19.55		-31.81		-25.16		-19.85		-33.03	
Fcf (ksi)	-40.21		-37.50		-42.36		-37.50		-40.91		-37.58		-37.50		-41.52	
Fcf (kip)	-3980.40		-3712.50		-4193.56		-3712.50		-4049.83		-3720.55		-3712.50		-4110.15	
fncf (ksi)		-6.97		4.74		5.96		-6.34		-4.75		-5.38		-11.03		9.13
Rcf		1.16		1.08		1.22		1.08		1.18		1.08		1.08		1.20
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.74	-5.10	-16.63	3.84	-26.05	4.47	-14.52	-4.30	-23.80	-3.48	-18.61	-3.52	-15.00	-8.19	-24.44	7.06
Fs (ksi)	-22.74	-5.10	-16.63	3.84	-26.05	4.47	-14.52	-4.30	-23.80	-3.48	-18.61	-3.52	-15.00	-8.19	-24.44	7.06
Fs (kip)	-2251.39	-366.91	-1646.31	276.13	-2578.68	322.01	-1437.60	-309.33	-2355.93	-250.21	-1842.08	-253.45	-1484.74	-589.81	-2419.52	508.56

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2432.45	0.00	508.56
Comp	4431.26	2848.23	2578.68	589.81

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	475.91	330.39	538.50	292.01	457.79	361.48	332.46	512.01	350.03	237.03	394.26	209.91	337.23	258.99	248.69	365.34
Vuw (kip)	713.86	495.59	807.76	438.01	686.68	542.21	498.69	768.01	---	---	---	---	---	---	---	---
Mv (k*ft)	401.55	278.77	454.36	246.38	386.26	305.00	280.51	432.01	196.89	133.33	221.77	118.07	189.69	145.68	139.89	205.51
Huw (kip)	-1593.14	-1068.53	-1157.93	-1463.47	-1534.66	-1432.46	-1630.62	-1009.65	-918.63	-422.21	-711.98	-620.98	-899.99	-730.19	-765.24	-573.42
Muw (k*ft)	706.97	937.65	1091.85	674.36	776.82	698.60	562.92	1153.63	388.20	450.22	671.43	224.95	447.09	331.91	149.72	693.06
Mu (k*ft)	1108.52	1216.41	1546.21	920.74	1163.08	1003.60	843.43	1585.64	585.09	583.55	893.20	343.02	636.78	477.59	289.61	898.57

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.42	13.70	14.85	18.76	19.68	18.36	20.91	12.94	11.78	5.41	9.13	7.96	11.54	9.36	9.81	7.35
PY1 (Vuw)	9.15	6.35	10.36	5.62	8.80	6.95	6.39	9.85	4.49	3.04	5.05	2.69	4.32	3.32	3.19	4.68
PX2 (Mu)	20.16	22.13	28.12	16.75	21.15	18.25	15.34	28.84	10.64	10.61	16.25	6.24	11.58	8.69	5.27	16.34
PY2 (Mu)	8.40	9.22	11.72	6.98	8.81	7.61	6.39	12.02	4.43	4.42	6.77	2.60	4.83	3.62	2.19	6.81
Pu (kip)	44.22	39.06	48.31	37.68	44.47	39.41	38.44	47.16	24.13	17.68	27.99	15.15	24.87	19.34	16.01	26.34

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2660.00	2138.50	143.50	93.30	35.98	4685.02	2138.50	OK
TF Inside	0.00	2582.81	1998.75	307.50	199.92	27.42	7455.58	1998.75	OK
BF Inside	1220.43	1721.88	1332.50	100.00	65.47	18.28	2925.16	1332.50	OK
BF Outside	1212.02	1710.00	1374.75	45.00	29.46	23.13	2091.45	1374.75	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2248.25	2520.00	OK
TF Inside	2183.01	2446.88	OK
BF Inside	1429.04	1631.25	OK
BF Outside	1419.19	1620.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.17	39.08	47.23	37.57	43.62	38.96	37.95	46.27
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	807.76
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9496**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.67
Web	0.19	1.00	1.0	36.19
BF	0.25	0.91	1.0	32.90

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2248.25	20.07	OK	1308.32	11.68	OK
BF	1429.04	25.52	OK	295.92	5.28	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2248.25	20.07	1.47	160.39	OK
TF	4431.26	39.56	1.47	252.04	OK
TF Inside	2183.01	19.49	1.47	171.84	OK
BF Inside	1429.04	25.52	1.47	114.56	OK
BF	2848.23	50.86	1.47	206.21	OK
BF Outside	1419.19	25.34	1.47	103.11	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.31	24.15	OK	27.99	14.00	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.31	1.47	126.02	OK
Web SPL	24.15	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.09	1.14
BF Outside	1.13	1.14

Bolt	Shear	Slip	Bearing
TF	1.68	1.44	6.37
Web	2.47	1.30	4.29
BF	1.29	3.18	4.05

Plate	Shear	Flexure
Web	2.03	1.85

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9496	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.11	-5.62	-20.98	3.29	-32.39	3.36	-18.15	-5.49	-27.29	-1.53	-21.86	-3.03	-19.13	-10.66	-31.66	7.34
ϕf Fnc (ksi)	50.00	49.18	50.00	50.00	50.00	50.00	50.00	49.18	50.00	49.18	50.00	49.18	50.00	49.18	50.00	50.00
f / ϕf Fnc	0.56	0.11	0.42	0.07	0.65	0.07	0.36	0.11	0.55	0.03	0.44	0.06	0.38	0.22	0.63	0.15
α	1.00	0.98	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	0.98	1.00	0.98	1.00	1.00
fcf (ksi)	-28.11		-20.98		-32.39		-18.15		-27.29		-21.86		-19.13		-31.66	
Fcf (ksi)	-39.05		-37.50		-41.19		-37.50		-38.64		-37.50		-37.50		-40.83	
Fcf (kip)	-3866.31		-3712.50		-4078.18		-3712.50		-3825.63		-3712.50		-3712.50		-4042.03	
fncf (ksi)		-5.62		3.29		3.36		-5.49		-1.53		-3.03		-10.66		7.34
Rcf		1.21		1.16		1.27		1.16		1.19		1.16		1.16		1.26
Fncf (ksi)		-36.89		37.50		37.50		-36.89		-36.89		-36.89		-36.89		37.50
Fncf (kip)		-2655.76		2170.66		2170.66		-2655.76		-2655.76		-2655.76		-2655.76		2170.66

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.5346	-4.412513	-15.19967	2.341292	-23.55868	1.936054	-13.20291	-3.864748	-19.95398	-1.520197	-15.8183	-2.126804	-14.19096	-7.968295	-22.74	5.20
Fs (ksi)	-20.53	-4.41	-15.20	2.34	-23.56	1.94	-13.20	-3.86	-19.95	-1.52	-15.82	-2.13	-14.19	-7.97	-22.74	5.20
Fs (kip)	-2032.93	-317.70	-1504.77	168.57	-2332.31	139.40	-1307.09	-278.26	-1975.44	-109.45	-1566.01	-153.13	-1404.90	-573.72	-2251.52	374.37

Vu (kip)	475.91	330.39	538.50	292.01	457.79	361.48	332.46	512.01	350.03	237.03	394.26	209.91	337.23	258.99	248.69	365.34
Vuw (kip)	713.86	495.59	807.76	438.01	686.68	542.21	498.69	768.01	---	---	---	---	---	---	---	---
Mv (k*ft)	401.55	278.77	454.36	246.38	386.26	305.00	280.51	432.01	196.89	133.33	221.77	118.07	189.69	145.68	139.89	205.51
Huw (kip)	-1512.57	-1111.76	-1218.31	-1447.39	-1335.47	-1353.40	-1644.70	-1042.14	-823.25	-424.33	-713.55	-563.23	-708.65	-592.19	-731.26	-578.92
Muw (k*ft)									354.69	385.90	560.88	205.44	405.54	301.21	136.90	614.73
Mu (k*ft)	401.55	278.77	454.36	246.38	386.26	305.00	280.51	432.01	551.58	519.23	782.66	323.51	595.24	446.89	276.78	820.24
Muw (k*ft)	709.98	908.83	1000.32	685.08	809.96	747.74	563.36	1191.70	formulas matching the Muw results							
Pu (add)	168.71	215.96	237.70	162.79	192.47	177.68	131.53	261.79	additional flange force							

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9496	Backchk'd	WME	Date	8/5/2011	Sheet No.	

5% 6% 7% 5% 5% 5% 4% 7% percentage increase in flange force 7.39%

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.39	14.25	15.62	18.56	17.12	17.35	21.09	13.36	10.55	5.44	9.15	7.22	9.09	7.59	9.38	7.42
PY1 (Vuw)	9.15	6.35	10.36	5.62	8.80	6.95	6.39	9.85	4.49	3.04	5.05	2.69	4.32	3.32	3.19	4.68
PX2 (Mu)	7.30	5.07	8.26	4.48	7.03	5.55	5.10	7.86	10.03	9.44	14.24	5.88	10.83	8.13	5.03	14.92
PY2 (Mu)	3.04	2.11	3.44	1.87	2.93	2.31	2.13	3.27	4.18	3.94	5.93	2.45	4.51	3.39	2.10	6.22
Pu (kip)	29.35	21.10	27.58	24.22	26.85	24.70	27.54	24.95	22.34	16.44	25.84	14.08	21.78	17.09	15.35	24.86

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	27.05	19.53	24.59	22.93	24.56	23.04	26.06	21.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
29.35	14.67	OK	25.84	12.92	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	29.35	1.47	126.02	OK
Web SPL	14.67	1.47	91.65	OK

Field Splice

Type GG

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type GG

Field Splice - Node 1502

Node 1502

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1502 L	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00
1502 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 1502 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I 27.518939 in
Outer to Inr 0.8941537
Outer to Inr 0.9000688

Outer to Mi 0.9470768
Outer to Mi 0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.61	2.10	-27.71	-13.63	-33.82	2.79	-18.49	-10.50	-33.04	-9.63	-26.08	-13.40	-33.16	6.38	-18.50	-16.00
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.45	0.04	0.55	0.27	0.68	0.06	0.37	0.21	0.66	0.19	0.52	0.27	0.66	0.13	0.37	0.32
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-22.61		-27.71		-33.82		-18.49		-33.04		-26.08		-33.16		-18.50	
Fcf (ksi)	-37.50		-38.85		-41.91		-37.50		-41.52		-38.04		-41.58		-37.50	
Fcf (kip)	-4021.88		-4166.95		-4495.05		-4021.88		-4453.16		-4079.62		-4459.68		-4021.88	
fncf (ksi)		2.10		-13.63		2.79		-10.50		-9.63		-13.40		6.38		-16.00
Rcf		1.11		1.15		1.24		1.11		1.23		1.12		1.23		1.11
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2864.70		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.08	2.00	-20.34	-9.78	-25.02	2.18	-13.64	-7.19	-24.45	-6.51	-19.16	-9.64	-24.79	5.29	-13.61	-11.67
Fs (ksi)	-17.08	2.00	-20.34	-9.78	-25.02	2.18	-13.64	-7.19	-24.45	-6.51	-19.16	-9.64	-24.79	5.29	-13.61	-11.67
Fs (kip)	-1831.49	197.94	-2181.01	-967.88	-2683.31	215.84	-1463.17	-711.47	-2621.83	-644.31	-2054.52	-954.70	-2659.26	523.25	-1460.14	-1155.23

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	523.25
Comp	4495.05	3712.50	2683.31	1155.23

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	385.83	504.01	584.10	355.94	490.10	430.32	562.46	383.69	281.61	365.44	422.03	260.49	355.28	313.38	406.40	280.43
Vuw (kip)	578.75	756.02	876.16	533.91	735.16	645.48	843.68	575.54	---	---	---	---	---	---	---	---
Mv (k*ft)	325.55	425.26	492.84	300.32	413.52	363.08	474.57	323.74	158.41	205.56	237.39	146.53	199.85	176.27	228.60	157.74
Huw (kip)	-1160.74	-1798.74	-1269.16	-1621.72	-1760.14	-1752.41	-1113.36	-1822.98	-497.56	-993.71	-753.69	-687.36	-1021.49	-950.39	-643.82	-834.35
Muw (k*ft)	876.18	510.36	998.02	568.86	653.51	505.42	1087.37	434.68	419.68	232.30	598.39	142.03	394.63	209.28	661.77	42.80
Mu (k*ft)	1201.72	935.62	1490.86	869.18	1067.03	868.50	1561.94	758.42	578.08	437.86	835.78	288.56	594.48	385.56	890.37	200.54

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.88	23.06	16.27	20.79	22.57	22.47	14.27	23.37	6.38	12.74	9.66	8.81	13.10	12.18	8.25	10.70
PY1 (Vuw)	7.42	9.69	11.23	6.84	9.43	8.28	10.82	7.38	3.61	4.69	5.41	3.34	4.55	4.02	5.21	3.60
PX2 (Mu)	21.86	17.02	27.12	15.81	19.41	15.80	28.41	13.79	10.51	7.96	15.20	5.25	10.81	7.01	16.19	3.65
PY2 (Mu)	9.11	7.09	11.30	6.59	8.09	6.58	11.84	5.75	4.38	3.32	6.33	2.19	4.51	2.92	6.75	1.52
Pu (kip)	40.29	43.45	48.89	38.99	45.48	41.05	48.32	39.42	18.69	22.20	27.50	15.11	25.57	20.41	27.22	15.23

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2345.25	2835.00	OK
TF Inside	2149.81	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.89	41.97	47.41	38.39	44.32	39.97	47.03	38.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	876.16
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0
Ks	0.33 (Class A)
Ns	1.0
Pt	51.0
Rr	16.83

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2345.25	19.54	OK	1399.99	11.67	OK
BF	1936.96	27.67	OK	602.73	8.61	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2345.25	19.54	1.47	160.39	OK
TF	4495.05	37.46	1.47	252.04	OK
TF Inside	2149.81	17.92	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.89	24.44	OK	27.50	13.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.89	1.47	126.02	OK
Web SPL	24.44	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.21
TF Inside	NA	1.21
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.85	1.44	6.73
Web	1.53	1.34	2.66
BF	1.31	1.95	4.14

Plate	Shear	Flexure
Web	1.87	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.85	0.67	-25.04	-12.04	-30.68	0.20	-17.66	-10.22	-25.89	-4.50	-20.95	-9.43	-30.39	4.04	-18.08	-15.74
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.42	0.01	0.50	0.24	0.61	0.00	0.35	0.20	0.52	0.09	0.42	0.19	0.61	0.08	0.36	0.31
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-20.85		-25.04		-30.68		-17.66		-25.89		-20.95		-30.39		-18.08	
Fcf (ksi)	-37.50		-37.52		-40.34		-37.50		-37.95		-37.50		-40.20		-37.50	
Fcf (kip)	-4021.88		-4024.15		-4326.53		-4021.88		-4069.79		-4021.88		-4310.97		-4021.88	
fncf (ksi)		0.67		-12.04		0.20		-10.22		-4.50		-9.43		4.04		-15.74
Rcf		1.22		1.22		1.31		1.22		1.24		1.22		1.31		1.22
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2864.70		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.24266	0.418357	-18.18006	-8.914885	-22.16405	-0.269699	-12.99118	-7.276328	-18.80921	-3.233364	-15.28685	-7.073908	-21.98684	2.7981549	-13.26	-11.53
Fs (ksi)	-15.24	0.42	-18.18	-8.91	-22.16	-0.27	-12.99	-7.28	-18.81	-3.23	-15.29	-7.07	-21.99	2.80	-13.26	-11.53
Fs (kip)	-1634.78	41.42	-1949.81	-882.57	-2377.09	-26.70	-1393.30	-720.36	-2017.29	-320.10	-1639.51	-700.32	-2358.09	277.02	-1422.59	-1141.50

Vu (kip)	385.83	504.01	584.10	355.94	490.10	430.32	562.46	383.69	281.61	365.44	422.03	260.49	355.28	313.38	406.40	280.43
Vuw (kip)	578.75	756.02	876.16	533.91	735.16	645.48	843.68	575.54	---	---	---	---	---	---	---	---
Mv (k*ft)	325.55	425.26	492.84	300.32	413.52	363.08	474.57	323.74	158.41	205.56	237.39	146.53	199.85	176.27	228.60	157.74
Huw (kip)	-1210.54	-1724.12	-1322.75	-1649.82	-1435.92	-1618.05	-1151.93	-1872.46	-489.20	-894.13	-740.31	-668.83	-727.40	-737.90	-633.23	-818.22
Muw (k*ft)	842.97	501.52	893.15	550.12	712.38	571.30	1000.65	401.70	344.54	203.83	481.68	125.73	342.67	180.68	545.27	38.15
Mu (k*ft)	1168.52	926.78	1385.99	850.44	1125.90	934.38	1475.22	725.44	502.95	409.39	719.07	272.25	542.51	356.96	773.87	195.89

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.52	22.10	16.96	21.15	18.41	20.74	14.77	24.01	6.27	11.46	9.49	8.57	9.33	9.46	8.12	10.49
PY1 (Vuw)	7.42	9.69	11.23	6.84	9.43	8.28	10.82	7.38	3.61	4.69	5.41	3.34	4.55	4.02	5.21	3.60
PX2 (Mu)	21.25	16.86	25.21	15.47	20.48	17.00	26.83	13.19	9.15	7.45	13.08	4.95	9.87	6.49	14.08	3.56
PY2 (Mu)	8.86	7.02	10.50	6.45	8.53	7.08	11.18	5.50	3.81	3.10	5.45	2.06	4.11	2.71	5.86	1.48
Pu (kip)	40.21	42.40	47.44	38.96	42.83	40.74	47.06	39.37	17.11	20.45	25.05	14.57	21.06	17.31	24.80	14.94

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.79	40.87	45.81	38.33	41.62	39.74	45.64	38.37
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.44	23.72	OK	25.05	12.52	OK

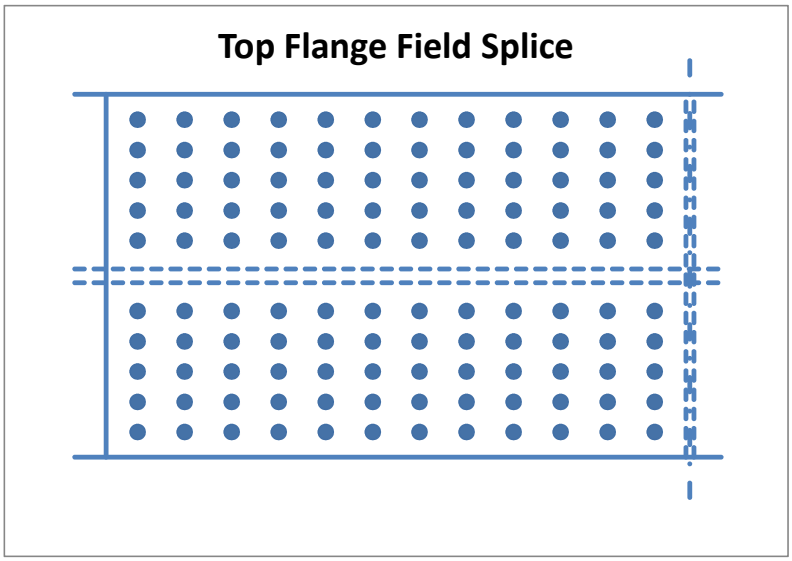
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.44	1.47	126.02	OK
Web SPL	23.72	1.47	91.65	OK

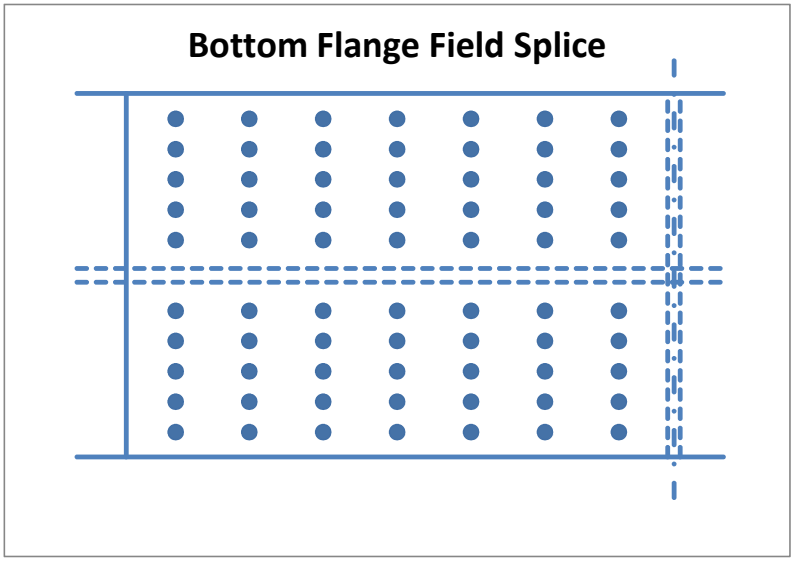
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	**Cleveland InnerBelt : Field Splice - Node 1502**	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1502

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	19	0	19
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	19	3	19
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	19	6	19
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	19	9	19
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	19	12	19
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	19	15	19
15	22	15	22
15	25	15	25
15	28	15	28

	Top Flange		Bottom Flange	
No. Bolts =	120.0		70.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	11.0		6.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





15	31	15	31
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	19	18	19
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
21	0		
21	3		
21	6		
21	9		
21	12		
21	19		
21	22		
21	25		
21	28		
21	31		
24	0		
24	3		
24	6		
24	9		
24	12		
24	19		
24	22		
24	25		
24	28		
24	31		
27	0		
27	3		
27	6		
27	9		
27	12		
27	19		
27	22		
27	25		
27	28		
27	31		
30	0		
30	3		
30	6		
30	9		
30	12		
30	19		
30	22		
30	25		
30	28		
30	31		
33	0		
33	3		
33	6		
33	9		
33	12		
33	19		
33	22		
33	25		
33	28		
33	31		

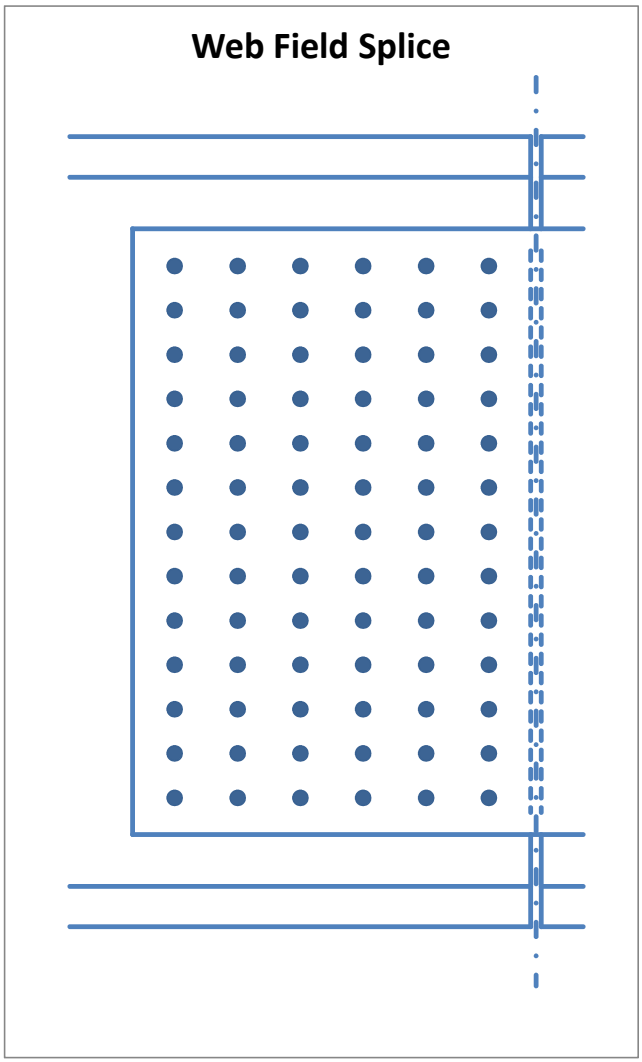
Flange Bolt Pattern Cont. - Node 1502

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1502	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1502

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	56.25	324
0	3	56.25	225
0	6	56.25	144
0	9	56.25	81
0	12	56.25	36
0	15	56.25	9
0	18	56.25	0
0	21	56.25	9
0	24	56.25	36
0	27	56.25	81
0	30	56.25	144
0	33	56.25	225
0	36	56.25	324
3	0	20.25	324
3	3	20.25	225
3	6	20.25	144
3	9	20.25	81
3	12	20.25	36
3	15	20.25	9
3	18	20.25	0
3	21	20.25	9
3	24	20.25	36
3	27	20.25	81
3	30	20.25	144
3	33	20.25	225
3	36	20.25	324
6	0	2.25	324
6	3	2.25	225
6	6	2.25	144
6	9	2.25	81
6	12	2.25	36
6	15	2.25	9
6	18	2.25	0
6	21	2.25	9
6	24	2.25	36
6	27	2.25	81
6	30	2.25	144
6	33	2.25	225
6	36	2.25	324
9	0	2.25	324
9	3	2.25	225
9	6	2.25	144
9	9	2.25	81
9	12	2.25	36
9	15	2.25	9
9	18	2.25	0
9	21	2.25	9
9	24	2.25	36
9	27	2.25	81
9	30	2.25	144
9	33	2.25	225
9	36	2.25	324
12	0	20.25	324
12	3	20.25	225
12	6	20.25	144
12	9	20.25	81
12	12	20.25	36
12	15	20.25	9
12	18	20.25	0

No. Bolts =	78.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	5.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	7.5	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2047.5	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	9828	
Σd^2 (in^2) =	11875.5	



12	21	20.25	9
12	24	20.25	36
12	27	20.25	81
12	30	20.25	144
12	33	20.25	225
12	36	20.25	324
15	0	56.25	324
15	3	56.25	225
15	6	56.25	144
15	9	56.25	81
15	12	56.25	36
15	15	56.25	9
15	18	56.25	0
15	21	56.25	9
15	24	56.25	36
15	27	56.25	81
15	30	56.25	144
15	33	56.25	225
15	36	56.25	324

Web Bolt Pattern Cont. - Node 1502

Web Bolt Pattern Cont. - Node 1502

585	1404	2047.5	9828

Field Splice - Node 3502

Node 3502

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3502 L	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00
3502 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 3502 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I 27.518939 in
Outer to Inr 0.8941537
Outer to Inr 0.9000688

Outer to Mi 0.9470768
Outer to Mi 0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.41	-1.65	-31.62	-14.09	-37.11	0.96	-22.68	-10.95	-34.88	-13.10	-29.31	-13.74	-36.76	4.45	-23.13	-16.57
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.51	0.03	0.63	0.28	0.74	0.02	0.45	0.22	0.70	0.26	0.59	0.27	0.74	0.09	0.46	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-25.41		-31.62		-37.11		-22.68		-34.88		-29.31		-36.76		-23.13	
Fcf (ksi)	-37.70		-40.81		-43.56		-37.50		-42.44		-39.66		-43.38		-37.50	
Fcf (kip)	-4043.62		-4376.86		-4671.51		-4021.88		-4551.50		-4253.17		-4652.48		-4021.88	
fncf (ksi)		-1.65		-14.09		0.96		-10.95		-13.10		-13.74		4.45		-16.57
Rcf		1.02		1.10		1.17		1.01		1.14		1.07		1.17		1.01
Fncf (ksi)		-37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3712.50		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.06	-0.87	-23.15	-10.01	-27.37	0.92	-16.68	-7.45	-25.71	-9.00	-21.53	-9.84	-27.37	3.95	-16.95	-11.97
Fs (ksi)	-19.06	-0.87	-23.15	-10.01	-27.37	0.92	-16.68	-7.45	-25.71	-9.00	-21.53	-9.84	-27.37	3.95	-16.95	-11.97
Fs (kip)	-2044.17	-86.08	-2482.60	-990.58	-2935.31	90.79	-1788.41	-737.38	-2757.09	-891.42	-2308.65	-974.62	-2935.13	390.58	-1817.52	-1184.67

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	390.58
Comp	4671.51	3712.50	2935.31	1184.67

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	450.62	571.75	652.31	431.35	541.71	495.22	637.17	456.17	327.22	413.00	469.91	313.61	391.58	358.92	459.02	331.34
Vuw (kip)	675.93	857.63	978.47	647.02	812.56	742.83	955.75	684.26	---	---	---	---	---	---	---	---
Mv (k*ft)	380.21	482.42	550.39	363.95	457.06	417.84	537.61	384.89	184.06	232.31	264.33	176.40	220.26	201.89	258.20	186.38
Huw (kip)	-1299.58	-1857.84	-1400.32	-1602.65	-1894.91	-1793.08	-1259.83	-1790.05	-657.67	-1094.07	-872.91	-796.07	-1145.48	-1035.23	-772.92	-954.12
Muw (k*ft)	792.53	557.07	982.97	581.56	604.01	549.50	1068.82	456.63	400.19	289.12	622.29	202.99	367.46	256.99	688.87	109.56
Mu (k*ft)	1172.74	1039.49	1533.36	945.52	1061.07	967.34	1606.43	841.53	584.25	521.43	886.62	379.40	587.73	458.88	947.07	295.94

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.66	23.82	17.95	20.55	24.29	22.99	16.15	22.95	8.43	14.03	11.19	10.21	14.69	13.27	9.91	12.23
PY1 (Vuw)	8.67	11.00	12.54	8.30	10.42	9.52	12.25	8.77	4.20	5.29	6.02	4.02	5.02	4.60	5.88	4.25
PX2 (Mu)	21.33	18.91	27.89	17.20	19.30	17.59	29.22	15.31	10.63	9.48	16.13	6.90	10.69	8.35	17.23	5.38
PY2 (Mu)	8.89	7.88	11.62	7.17	8.04	7.33	12.17	6.38	4.43	3.95	6.72	2.88	4.45	3.48	7.18	2.24
Pu (kip)	41.85	46.71	51.82	40.79	47.34	43.94	51.53	41.15	20.92	25.26	30.14	18.44	27.09	23.08	30.12	18.77

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2437.31	2835.00	OK
TF Inside	2234.20	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.96	44.92	49.92	39.79	45.83	42.58	49.77	39.85
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	978.47
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2437.31	20.31	OK	1531.47	12.76	OK
BF	1936.96	27.67	OK	618.09	8.83	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2437.31	20.31	1.47	160.39	OK
TF	4671.51	38.93	1.47	252.04	OK
TF Inside	2234.20	18.62	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.82	25.91	OK	30.14	15.07	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.82	1.47	126.02	OK
Web SPL	25.91	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.16
TF Inside	NA	1.16
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.78	1.32	6.47
Web	1.43	1.21	2.49
BF	1.31	1.91	4.14

Plate	Shear	Flexure
Web	1.68	1.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.85	-1.74	-29.04	-12.80	-34.30	-1.26	-21.66	-10.74	-28.42	-8.50	-24.63	-10.37	-34.03	2.22	-22.39	-16.27
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.48	0.03	0.58	0.26	0.69	0.03	0.43	0.21	0.57	0.17	0.49	0.21	0.68	0.04	0.45	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.85		-29.04		-34.30		-21.66		-28.42		-24.63		-34.03		-22.39	
Fcf (ksi)	-37.50		-39.52		-42.15		-37.50		-39.21		-37.50		-42.01		-37.50	
Fcf (kip)	-4021.88		-4238.41		-4520.75		-4021.88		-4205.17		-4021.88		-4505.88		-4021.88	
fncf (ksi)		-1.74		-12.80		-1.26		-10.74		-8.50		-10.37		2.22		-16.27
Rcf		1.09		1.15		1.23		1.09		1.14		1.09		1.22		1.09
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.3621	-1.296898	-21.00674	-9.442229	-24.72668	-1.289184	-15.81816	-7.652061	-20.59164	-6.071677	-17.89041	-7.731418	-24.55357	1.5070763	-16.31	-11.89
Fs (ksi)	-17.36	-1.30	-21.01	-9.44	-24.73	-1.29	-15.82	-7.65	-20.59	-6.07	-17.89	-7.73	-24.55	1.51	-16.31	-11.89
Fs (kip)	-1862.08	-128.39	-2252.97	-934.78	-2651.94	-127.63	-1696.50	-757.55	-2208.45	-601.10	-1918.75	-765.41	-2633.37	149.20	-1749.17	-1177.60

Vu (kip)	450.62	571.75	652.31	431.35	541.71	495.22	637.17	456.17	327.22	413.00	469.91	313.61	391.58	358.92	459.02	331.34
Vuw (kip)	675.93	857.63	978.47	647.02	812.56	742.83	955.75	684.26	---	---	---	---	---	---	---	---
Mv (k*ft)	380.21	482.42	550.39	363.95	457.06	417.84	537.61	384.89	184.06	232.31	264.33	176.40	220.26	201.89	258.20	186.38
Huw (kip)	-1300.43	-1790.61	-1441.95	-1624.93	-1614.61	-1611.77	-1296.52	-1824.36	-615.75	-1004.82	-858.52	-774.52	-879.89	-845.52	-760.53	-930.74
Muw (k*ft)	783.05	545.10	893.37	566.72	648.79	575.49	984.22	433.76	353.43	254.42	515.62	179.65	319.44	223.50	573.33	97.12
Mu (k*ft)	1163.26	1027.51	1443.76	930.67	1105.86	993.33	1521.83	818.65	537.50	486.73	779.95	356.06	539.70	425.39	831.53	283.49

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.67	22.96	18.49	20.83	20.70	20.66	16.62	23.39	7.89	12.88	11.01	9.93	11.28	10.84	9.75	11.93
PY1 (Vuw)	8.67	11.00	12.54	8.30	10.42	9.52	12.25	8.77	4.20	5.29	6.02	4.02	5.02	4.60	5.88	4.25
PX2 (Mu)	21.16	18.69	26.26	16.93	20.11	18.07	27.68	14.89	9.78	8.85	14.19	6.48	9.82	7.74	15.12	5.16
PY2 (Mu)	8.82	7.79	10.94	7.05	8.38	7.53	11.53	6.20	4.07	3.69	5.91	2.70	4.09	3.22	6.30	2.15
Pu (kip)	41.67	45.69	50.54	40.76	44.94	42.32	50.28	41.11	19.51	23.52	27.88	17.73	22.98	20.16	27.70	18.25

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.77	43.84	48.50	39.75	43.37	40.93	48.40	39.78
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.54	25.27	OK	27.88	13.94	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.54	1.47	126.02	OK
Web SPL	25.27	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5502

Node 5502

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5502 L	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00
5502 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 5502 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I	27.518939 in
Outer to Inr	0.8941537
Outer to Inr	0.9000688
Outer to Mi	0.9470768
Outer to Mi	0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.65	-1.92	-31.28	-13.93	-37.81	0.32	-23.49	-10.02	-32.81	-14.08	-30.46	-13.03	-37.40	4.08	-24.13	-16.48
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.04	0.63	0.28	0.76	0.01	0.47	0.20	0.66	0.28	0.61	0.26	0.75	0.08	0.48	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.65		-31.28		-37.81		-23.49		-32.81		-30.46		-37.40		-24.13	
Fcf (ksi)	-38.32		-40.64		-43.90		-37.50		-41.40		-40.23		-43.70		-37.50	
Fcf (kip)	-4110.22		-4358.44		-4708.72		-4021.88		-4440.68		-4314.77		-4686.87		-4021.88	
fncf (ksi)		-1.92		-13.93		0.32		-10.02		-14.08		-13.03		4.08		-16.48
Rcf		1.01		1.07		1.16		1.00		1.10		1.06		1.16		1.00
Fncf (ksi)		-37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3712.50		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.95	-1.03	-22.88	-9.87	-28.07	0.99	-17.38	-7.25	-24.19	-9.74	-22.38	-9.31	-27.85	3.71	-17.64	-11.85
Fs (ksi)	-19.95	-1.03	-22.88	-9.87	-28.07	0.99	-17.38	-7.25	-24.19	-9.74	-22.38	-9.31	-27.85	3.71	-17.64	-11.85
Fs (kip)	-2140.14	-101.51	-2453.64	-976.64	-3010.22	97.75	-1864.10	-717.79	-2594.49	-963.93	-2400.07	-921.33	-2986.62	367.21	-1892.39	-1173.01

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	367.21
Comp	4708.72	3712.50	3010.22	1173.01

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	465.03	587.84	674.47	447.01	537.58	516.27	656.82	475.01	337.63	424.11	485.60	324.61	388.89	373.54	473.13	344.40
Vuw (kip)	697.54	881.76	1011.70	670.51	806.37	774.40	985.23	712.52	---	---	---	---	---	---	---	---
Mv (k*ft)	392.37	495.99	569.08	377.16	453.58	435.60	554.19	400.79	189.92	238.56	273.15	182.59	218.75	210.12	266.14	193.72
Huw (kip)	-1328.84	-1835.03	-1436.49	-1568.18	-1875.26	-1785.13	-1286.55	-1781.23	-692.34	-1080.51	-893.64	-812.83	-1119.62	-1045.60	-796.56	-973.28
Muw (k*ft)	800.35	564.73	974.12	604.55	571.64	580.08	1065.12	462.51	416.45	286.28	639.20	222.87	318.00	287.58	694.24	127.51
Mu (k*ft)	1192.72	1060.72	1543.20	981.71	1025.23	1015.67	1619.31	863.30	606.36	524.84	912.35	405.47	536.74	497.70	960.38	321.24

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.04	23.53	18.42	20.10	24.04	22.89	16.49	22.84	8.88	13.85	11.46	10.42	14.35	13.41	10.21	12.48
PY1 (Vuw)	8.94	11.30	12.97	8.60	10.34	9.93	12.63	9.13	4.33	5.44	6.23	4.16	4.99	4.79	6.07	4.42
PX2 (Mu)	21.69	19.29	28.07	17.86	18.65	18.47	29.45	15.70	11.03	9.55	16.59	7.37	9.76	9.05	17.47	5.84
PY2 (Mu)	9.04	8.04	11.70	7.44	7.77	7.70	12.27	6.54	4.60	3.98	6.91	3.07	4.07	3.77	7.28	2.43
Pu (kip)	42.70	46.99	52.62	41.21	46.37	44.96	52.26	41.61	21.81	25.22	30.98	19.21	25.76	24.03	30.73	19.56

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2456.72	2835.00	OK
TF Inside	2252.00	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.75	45.09	50.57	40.15	44.83	43.52	50.37	40.21
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1011.70
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5502	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2456.72	20.47	OK	1570.55	13.09	OK
BF	1936.96	27.67	OK	612.00	8.74	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2456.72	20.47	1.47	160.39	OK
TF	4708.72	39.24	1.47	252.04	OK
TF Inside	2252.00	18.77	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.62	26.31	OK	30.98	15.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.62	1.47	126.02	OK
Web SPL	26.31	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.15
TF Inside	NA	1.15
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.77	1.29	6.42
Web	1.40	1.16	2.44
BF	1.31	1.92	4.14

Plate	Shear	Flexure
Web	1.62	1.01

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.75	-1.76	-29.77	-13.62	-35.58	-1.33	-22.71	-10.15	-27.55	-10.39	-26.10	-10.09	-35.23	2.38	-23.47	-16.32
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.49	0.04	0.60	0.27	0.71	0.03	0.45	0.20	0.55	0.21	0.52	0.20	0.70	0.05	0.47	0.33
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.75		-29.77		-35.58		-22.71		-27.55		-26.10		-35.23		-23.47	
Fcf (ksi)	-37.50		-39.89		-42.79		-37.50		-38.78		-38.05		-42.62		-37.50	
Fcf (kip)	-4021.88		-4277.68		-4589.42		-4021.88		-4158.84		-4080.85		-4570.55		-4021.88	
fncf (ksi)		-1.76		-13.62		-1.33		-10.15		-10.39		-10.09		2.38		-16.32
Rcf		1.05		1.12		1.20		1.05		1.09		1.07		1.20		1.05
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.00369	-1.298522	-21.5139	-10.00974	-25.66049	-1.001491	-16.52901	-7.559144	-19.98758	-7.401824	-18.92062	-7.513103	-25.41194	1.6240696	-17.06	-11.92
Fs (ksi)	-18.00	-1.30	-21.51	-10.01	-25.66	-1.00	-16.53	-7.56	-19.99	-7.40	-18.92	-7.51	-25.41	1.62	-17.06	-11.92
Fs (kip)	-1930.90	-128.55	-2307.37	-990.96	-2752.09	-99.15	-1772.74	-748.36	-2143.67	-732.78	-2029.24	-743.80	-2725.43	160.78	-1830.09	-1180.07

Vu (kip)	465.03	587.84	674.47	447.01	537.58	516.27	656.82	475.01	337.63	424.11	485.60	324.61	388.89	373.54	473.13	344.40
Vuw (kip)	697.54	881.76	1011.70	670.51	806.37	774.40	985.23	712.52	---	---	---	---	---	---	---	---
Mv (k*ft)	392.37	495.99	569.08	377.16	453.58	435.60	554.19	400.79	189.92	238.56	273.15	182.59	218.75	210.12	266.14	193.72
Huw (kip)	-1298.55	-1820.04	-1465.11	-1590.57	-1653.43	-1611.60	-1312.21	-1805.22	-636.97	-1040.28	-879.85	-794.91	-903.85	-872.31	-785.00	-956.46
Muw (k*ft)	784.30	541.59	906.10	589.62	603.91	599.80	1000.29	446.52	367.51	253.09	542.50	197.34	276.89	250.97	594.79	113.17
Mu (k*ft)	1176.67	1037.58	1475.18	966.78	1057.49	1035.40	1554.48	847.31	557.43	491.65	815.65	379.93	495.64	461.08	860.93	306.89

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.65	23.33	18.78	20.39	21.20	20.66	16.82	23.14	8.17	13.34	11.28	10.19	11.59	11.18	10.06	12.26
PY1 (Vuw)	8.94	11.30	12.97	8.60	10.34	9.93	12.63	9.13	4.33	5.44	6.23	4.16	4.99	4.79	6.07	4.42
PX2 (Mu)	21.40	18.87	26.83	17.58	19.23	18.83	28.27	15.41	10.14	8.94	14.84	6.91	9.01	8.39	15.66	5.58
PY2 (Mu)	8.92	7.86	11.18	7.33	8.01	7.85	11.78	6.42	4.22	3.73	6.18	2.88	3.76	3.49	6.52	2.33
Pu (kip)	42.03	46.35	51.61	41.18	44.40	43.31	51.28	41.58	20.20	24.09	28.91	18.49	22.38	21.25	28.64	19.08

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.04	44.42	49.46	40.10	42.81	41.83	49.29	40.16
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.61	25.81	OK	28.91	14.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.61	1.47	126.02	OK
Web SPL	25.81	1.47	91.65	OK

Field Splice - Node 7502

Node 7502

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7502 L	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00
7502 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 7502 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I 27.518939 in
Outer to Inr 0.8941537
Outer to Inr 0.9000688

Outer to Mi 0.9470768
Outer to Mi 0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.46	0.57	-32.43	-13.15	-36.45	0.57	-23.44	-9.48	-30.97	-10.62	-34.17	-12.31	-36.44	4.25	-24.40	-15.80
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.01	0.65	0.26	0.73	0.01	0.47	0.19	0.62	0.21	0.68	0.25	0.73	0.09	0.49	0.32
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.46		-32.43		-36.45		-23.44		-30.97		-34.17		-36.44		-24.40	
Fcf (ksi)	-38.23		-41.21		-43.22		-37.50		-40.49		-42.08		-43.22		-37.50	
Fcf (kip)	-4100.31		-4420.27		-4635.66		-4021.88		-4342.28		-4513.55		-4635.21		-4021.88	
fncf (ksi)		0.57		-13.15		0.57		-9.48		-10.62		-12.31		4.25		-15.80
Rcf		1.05		1.13		1.19		1.03		1.11		1.15		1.19		1.03
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2864.70		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.84	0.93	-23.83	-9.35	-26.94	0.98	-17.27	-6.75	-22.94	-7.24	-25.11	-8.71	-27.18	3.82	-17.96	-11.42
Fs (ksi)	-19.84	0.93	-23.83	-9.35	-26.94	0.98	-17.27	-6.75	-22.94	-7.24	-25.11	-8.71	-27.18	3.82	-17.96	-11.42
Fs (kip)	-2128.28	92.26	-2556.03	-925.77	-2889.23	97.44	-1852.69	-668.38	-2460.57	-716.27	-2692.63	-862.39	-2914.65	377.74	-1926.03	-1130.88

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	377.74
Comp	4635.66	3712.50	2914.65	1130.88

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	457.79	582.78	661.14	441.99	506.19	550.25	645.77	467.03	333.13	420.63	476.81	321.16	367.33	397.65	465.95	338.86
Vuw (kip)	686.68	874.17	991.71	662.99	759.28	825.38	968.66	700.55	---	---	---	---	---	---	---	---
Mv (k*ft)	386.26	491.72	557.84	372.93	427.10	464.28	544.87	394.06	187.39	236.61	268.20	180.65	206.62	223.68	262.10	190.61
Huw (kip)	-1241.81	-1850.80	-1404.14	-1559.24	-1725.50	-1857.74	-1259.87	-1773.98	-624.10	-1095.06	-856.51	-792.85	-995.85	-1115.96	-770.90	-969.58
Muw (k*ft)	854.30	579.58	965.72	610.50	631.11	613.22	1061.71	467.35	457.07	318.59	614.32	231.51	345.56	360.69	681.82	143.78
Mu (k*ft)	1240.56	1071.30	1523.56	983.43	1058.21	1077.50	1606.58	861.41	644.46	555.19	882.52	412.16	552.19	584.37	943.91	334.38

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.92	23.73	18.00	19.99	22.12	23.82	16.15	22.74	8.00	14.04	10.98	10.16	12.77	14.31	9.88	12.43
PY1 (Vuw)	8.80	11.21	12.71	8.50	9.73	10.58	12.42	8.98	4.27	5.39	6.11	4.12	4.71	5.10	5.97	4.34
PX2 (Mu)	22.56	19.49	27.71	17.89	19.25	19.60	29.22	15.67	11.72	10.10	16.05	7.50	10.04	10.63	17.17	6.08
PY2 (Mu)	9.40	8.12	11.55	7.45	8.02	8.17	12.18	6.53	4.88	4.21	6.69	3.12	4.18	4.43	7.15	2.53
Pu (kip)	42.57	47.34	51.75	41.10	45.02	47.29	51.61	41.42	21.74	25.98	29.91	19.09	24.48	26.69	30.07	19.75

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2418.61	2835.00	OK
TF Inside	2217.05	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.71	45.51	49.75	40.08	43.71	45.73	49.77	40.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	991.71
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2418.61	20.16	OK	1520.69	12.67	OK
BF	1936.96	27.67	OK	590.02	8.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2418.61	20.16	1.47	160.39	OK
TF	4635.66	38.63	1.47	252.04	OK
TF Inside	2217.05	18.48	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.75	25.88	OK	30.07	15.03	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.75	1.47	126.02	OK
Web SPL	25.88	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.17
TF Inside	NA	1.17
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.80	1.33	6.52
Web	1.42	1.19	2.47
BF	1.31	2.00	4.14

Plate	Shear	Flexure
Web	1.65	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.28	-1.16	-29.75	-11.88	-34.78	-0.59	-22.40	-9.39	-25.74	-7.07	-28.80	-8.72	-34.49	2.74	-23.07	-15.08
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.49	0.02	0.59	0.24	0.70	0.01	0.45	0.19	0.51	0.14	0.58	0.17	0.69	0.05	0.46	0.30
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.28		-29.75		-34.78		-22.40		-25.74		-28.80		-34.49		-23.07	
Fcf (ksi)	-37.50		-39.87		-42.39		-37.50		-37.87		-39.40		-42.25		-37.50	
Fcf (kip)	-4021.88		-4276.52		-4546.59		-4021.88		-4061.44		-4225.77		-4530.89		-4021.88	
fncf (ksi)		-1.16		-11.88		-0.59		-9.39		-7.07		-8.72		2.74		-15.08
Rcf		1.08		1.15		1.22		1.08		1.09		1.13		1.21		1.08
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.70901	-0.873618	-21.508	-8.766475	-25.12979	-0.471235	-16.31538	-7.004996	-18.73784	-5.043405	-20.83932	-6.533916	-24.92294	1.887648	-16.79	-11.03
Fs (ksi)	-17.71	-0.87	-21.51	-8.77	-25.13	-0.47	-16.32	-7.00	-18.74	-5.04	-20.84	-6.53	-24.92	1.89	-16.79	-11.03
Fs (kip)	-1899.29	-86.49	-2306.73	-867.88	-2695.17	-46.65	-1749.82	-693.49	-2009.63	-499.30	-2235.02	-646.86	-2672.99	186.88	-1800.33	-1091.72

Vu (kip)	457.79	582.78	661.14	441.99	506.19	550.25	645.77	467.03	333.13	420.63	476.81	321.16	367.33	397.65	465.95	338.86
Vuw (kip)	686.68	874.17	991.71	662.99	759.28	825.38	968.66	700.55	---	---	---	---	---	---	---	---
Mv (k*ft)	386.26	491.72	557.84	372.93	427.10	464.28	544.87	394.06	187.39	236.61	268.20	180.65	206.62	223.68	262.10	190.61
Huw (kip)	-1278.92	-1765.41	-1422.86	-1571.59	-1503.53	-1626.34	-1284.14	-1774.13	-613.23	-999.06	-844.83	-769.57	-784.78	-903.32	-760.16	-917.86
Muw (k*ft)	797.39	577.53	916.69	602.28	663.88	649.42	1002.73	467.24	370.38	280.31	542.49	204.83	301.28	314.72	589.83	126.69
Mu (k*ft)	1183.65	1069.25	1474.53	975.20	1090.98	1113.70	1547.60	861.30	557.77	516.92	810.69	385.48	507.90	538.40	851.93	317.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.40	22.63	18.24	20.15	19.28	20.85	16.46	22.75	7.86	12.81	10.83	9.87	10.06	11.58	9.75	11.77
PY1 (Vuw)	8.80	11.21	12.71	8.50	9.73	10.58	12.42	8.98	4.27	5.39	6.11	4.12	4.71	5.10	5.97	4.34
PX2 (Mu)	21.53	19.45	26.82	17.74	19.84	20.26	28.15	15.67	10.15	9.40	14.75	7.01	9.24	9.79	15.50	5.77
PY2 (Mu)	8.97	8.10	11.17	7.39	8.27	8.44	11.73	6.53	4.23	3.92	6.14	2.92	3.85	4.08	6.46	2.40
Pu (kip)	41.88	46.30	51.00	41.08	43.06	45.30	50.73	41.42	19.91	24.08	28.36	18.29	21.11	23.26	28.14	18.79

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.95	44.43	48.93	40.05	41.70	43.68	48.80	40.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.00	25.50	OK	28.36	14.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.00	1.47	126.02	OK
Web SPL	25.50	1.47	91.65	OK

Field Splice - Node 9502

Node 9502

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9502 L	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00
9502 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 1.00

Controlling Section = 9502 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I	27.518939 in
Outer to Inr	0.8941537
Outer to Inr	0.9000688
Outer to Mi	0.9470768
Outer to Mi	0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.27	2.60	-29.94	-11.14	-32.92	1.83	-20.33	-6.55	-28.62	-9.48	-32.75	-9.18	-32.73	5.88	-21.36	-14.31
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.47	0.05	0.60	0.22	0.66	0.04	0.41	0.13	0.57	0.19	0.65	0.18	0.65	0.12	0.43	0.29
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-23.27		-29.94		-32.92		-20.33		-28.62		-32.75		-32.73		-21.36	
Fcf (ksi)	-37.50		-39.97		-41.46		-37.50		-39.31		-41.37		-41.36		-37.50	
Fcf (kip)	-4021.88		-4286.91		-4446.34		-4021.88		-4216.16		-4437.43		-4436.38		-4021.88	
fncf (ksi)		2.60		-11.14		1.83		-6.55		-9.48		-9.18		5.88		-14.31
Rcf		1.14		1.21		1.26		1.14		1.19		1.26		1.26		1.14
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2864.70		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.58	2.35	-22.09	-7.92	-24.59	2.01	-15.11	-5.18	-21.26	-6.40	-24.16	-6.46	-24.48	4.90	-15.80	-10.38
Fs (ksi)	-17.58	2.35	-22.09	-7.92	-24.59	2.01	-15.11	-5.18	-21.26	-6.40	-24.16	-6.46	-24.48	4.90	-15.80	-10.38
Fs (kip)	-1885.12	232.60	-2369.00	-784.15	-2637.11	198.83	-1620.47	-512.73	-2279.86	-633.83	-2590.83	-639.19	-2625.89	485.41	-1694.78	-1027.70

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	485.41
Comp	4446.34	3712.50	2637.11	1027.70

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	399.48	530.04	599.66	379.54	460.35	509.15	581.27	409.49	292.76	383.77	434.19	278.57	335.76	369.01	421.19	298.60
Vuw (kip)	599.23	795.06	899.49	569.31	690.52	763.72	871.90	614.24	---	---	---	---	---	---	---	---
Mv (k*ft)	337.06	447.22	505.96	320.24	388.42	429.59	490.44	345.51	164.68	215.87	244.23	156.70	188.86	207.57	236.92	167.96
Huw (kip)	-1139.91	-1765.35	-1292.06	-1483.83	-1670.91	-1746.36	-1121.03	-1775.44	-502.50	-990.31	-745.14	-669.52	-912.77	-1010.24	-646.16	-864.04
Muw (k*ft)	890.06	581.83	962.76	660.78	615.77	656.24	1072.70	466.37	438.38	311.69	585.13	218.46	326.81	389.41	646.51	119.27
Mu (k*ft)	1227.12	1029.05	1468.72	981.02	1004.18	1085.84	1563.14	811.88	603.06	527.57	829.36	375.16	515.68	596.98	883.44	287.24

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.61	22.63	16.56	19.02	21.42	22.39	14.37	22.76	6.44	12.70	9.55	8.58	11.70	12.95	8.28	11.08
PY1 (Vuw)	7.68	10.19	11.53	7.30	8.85	9.79	11.18	7.87	3.75	4.92	5.57	3.57	4.30	4.73	5.40	3.83
PX2 (Mu)	22.32	18.72	26.71	17.84	18.26	19.75	28.43	14.77	10.97	9.60	15.08	6.82	9.38	10.86	16.07	5.22
PY2 (Mu)	9.30	7.80	11.13	7.43	7.61	8.23	11.85	6.15	4.57	4.00	6.29	2.84	3.91	4.52	6.70	2.18
Pu (kip)	40.65	45.09	48.85	39.70	42.97	45.83	48.60	40.07	19.30	24.01	27.34	16.69	22.62	25.55	27.19	17.37

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2319.83	2835.00	OK
TF Inside	2126.51	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.18	43.57	47.21	39.10	41.88	44.55	47.15	39.04
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	899.49
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9502**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2319.83	19.33	OK	1375.88	11.47	OK
BF	1936.96	27.67	OK	536.19	7.66	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2319.83	19.33	1.47	160.39	OK
TF	4446.34	37.05	1.47	252.04	OK
TF Inside	2126.51	17.72	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.85	24.43	OK	27.34	13.67	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.85	1.47	126.02	OK
Web SPL	24.43	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.22
TF Inside	NA	1.22
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.87	1.47	6.80
Web	1.50	1.30	2.61
BF	1.31	2.20	4.14

Plate	Shear	Flexure
Web	1.82	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.35	1.02	-26.82	-9.44	-31.48	0.81	-19.33	-6.50	-22.92	-5.42	-26.57	-4.96	-31.22	4.70	-19.77	-13.26
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.43	0.02	0.54	0.19	0.63	0.02	0.39	0.13	0.46	0.11	0.53	0.10	0.62	0.09	0.40	0.27
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-21.35		-26.82		-31.48		-19.33		-22.92		-26.57		-31.22		-19.77	
Fcf (ksi)	-37.50		-38.41		-40.74		-37.50		-37.50		-38.28		-40.61		-37.50	
Fcf (kip)	-4021.88		-4119.47		-4369.43		-4021.88		-4021.88		-4105.87		-4355.67		-4021.88	
fncf (ksi)		1.02		-9.44		0.81		-6.50		-5.42		-4.96		4.70		-13.26
Rcf		1.19		1.22		1.29		1.19		1.19		1.22		1.29		1.19
Fncf (ksi)		37.50		-37.50		37.50		-37.50		-37.50		-37.50		37.50		-37.50
Fncf (kip)		2864.70		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		2864.70		-3712.50

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.66118	0.689591	-19.45011	-7.012964	-22.81781	0.543817	-14.10201	-5.32634	-16.772	-3.857624	-19.27097	-3.853409	-22.6366	3.2952865	-14.47	-9.72
Fs (ksi)	-15.66	0.69	-19.45	-7.01	-22.82	0.54	-14.10	-5.33	-16.77	-3.86	-19.27	-3.85	-22.64	3.30	-14.47	-9.72
Fs (kip)	-1679.66	68.27	-2086.02	-694.28	-2447.21	53.84	-1512.44	-527.31	-1798.80	-381.90	-2066.81	-381.49	-2427.78	326.23	-1552.10	-962.05

Vu (kip)	399.48	530.04	599.66	379.54	460.35	509.15	581.27	409.49	292.76	383.77	434.19	278.57	335.76	369.01	421.19	298.60
Vuw (kip)	599.23	795.06	899.49	569.31	690.52	763.72	871.90	614.24	---	---	---	---	---	---	---	---
Mv (k*ft)	337.06	447.22	505.96	320.24	388.42	429.59	490.44	345.51	164.68	215.87	244.23	156.70	188.86	207.57	236.92	167.96
Huw (kip)	-1197.58	-1647.47	-1309.88	-1493.04	-1450.57	-1462.57	-1139.96	-1758.92	-494.06	-873.28	-735.04	-641.14	-680.78	-763.10	-638.26	-798.25
Muw (k*ft)	851.62	591.72	919.33	654.64	682.95	709.41	1026.97	477.38	359.72	273.62	513.96	193.06	284.12	339.19	570.50	104.59
Mu (k*ft)	1188.68	1038.94	1425.30	974.88	1071.37	1139.00	1517.41	822.90	524.39	489.49	758.19	349.76	472.98	546.75	807.42	272.55

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9502	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.35	21.12	16.79	19.14	18.60	18.75	14.61	22.55	6.33	11.20	9.42	8.22	8.73	9.78	8.18	10.23
PY1 (Vuw)	7.68	10.19	11.53	7.30	8.85	9.79	11.18	7.87	3.75	4.92	5.57	3.57	4.30	4.73	5.40	3.83
PX2 (Mu)	21.62	18.90	25.92	17.73	19.49	20.72	27.60	14.97	9.54	8.90	13.79	6.36	8.60	9.94	14.69	4.96
PY2 (Mu)	9.01	7.87	10.80	7.39	8.12	8.63	11.50	6.24	3.97	3.71	5.75	2.65	3.58	4.14	6.12	2.07
Pu (kip)	40.57	43.91	48.20	39.69	41.69	43.56	47.92	40.08	17.65	21.87	25.82	15.85	19.04	21.63	25.61	16.29

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.06	42.34	46.50	39.09	40.63	42.23	46.40	39.07
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.20	24.10	OK	25.82	12.91	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.20	1.47	126.02	OK
Web SPL	24.10	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1516

Node 1516

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1516 L	99.00	68.37	6768.87	99.00	69.42	6872.60	48.00	50.00	2400.00
1516 R	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 1516 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I	27.518939 in
Outer to Inr	0.8941537
Outer to Inr	0.9000688
Outer to Mi	0.9470768
Outer to Mi	0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.89	-15.52	-21.71	0.88	-34.63	2.74	-18.65	-11.71	-24.97	-11.36	-33.92	-11.71	-20.05	-18.36	-33.93	6.46
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.58	0.31	0.43	0.02	0.69	0.05	0.37	0.23	0.50	0.23	0.68	0.23	0.40	0.37	0.68	0.13
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-28.89		-21.71		-34.63		-18.65		-24.97		-33.92		-20.05		-33.93	
Fcf (ksi)	-39.44		-37.50		-42.32		-37.50		-37.50		-41.96		-37.50		-41.96	
Fcf (kip)	-4230.24		-4021.88		-4538.29		-4021.88		-4021.88		-4500.38		-4021.88		-4500.74	
fncf (ksi)		-15.52		0.88		2.74		-11.71		-11.36		-11.71		-18.36		6.46
Rcf		1.14		1.08		1.22		1.08		1.08		1.21		1.08		1.21
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		2864.70		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.29	-11.27	-16.37	0.99	-25.69	2.49	-13.94	-8.69	-18.50	-7.84	-25.01	-8.42	-14.83	-13.49	-25.27	5.19
Fs (ksi)	-21.29	-11.27	-16.37	0.99	-25.69	2.49	-13.94	-8.69	-18.50	-7.84	-25.01	-8.42	-14.83	-13.49	-25.27	5.19
Fs (kip)	-2282.97	-1115.94	-1755.51	97.54	-2755.19	246.61	-1495.06	-860.80	-1984.06	-776.42	-2681.96	-833.33	-1590.05	-1335.71	-2710.16	514.14

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	514.14
Comp	4538.29	3712.50	2755.19	1335.71

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	500.70	386.42	587.94	355.27	431.32	495.33	378.96	570.02	362.52	282.85	425.23	259.77	314.58	358.73	276.51	412.57
Vuw (kip)	751.06	579.63	881.91	532.91	646.98	743.00	568.44	855.03	---	---	---	---	---	---	---	---
Mv (k*ft)	422.47	326.04	496.07	299.76	363.93	417.94	319.75	480.96	203.92	159.10	239.19	146.12	176.95	201.78	155.54	232.07
Huw (kip)	-1885.00	-1205.90	-1285.90	-1655.87	-1643.54	-1852.92	-1893.43	-1126.55	-1074.43	-507.65	-765.55	-746.95	-869.28	-1102.99	-934.48	-662.52
Muw (k*ft)	478.82	846.07	1004.60	546.09	554.30	611.03	387.71	1095.43	220.32	381.78	619.97	115.39	234.45	364.96	29.34	670.18
Mu (k*ft)	901.29	1172.11	1500.67	845.85	918.23	1028.97	707.46	1576.38	424.23	540.88	859.16	261.51	411.40	566.75	184.88	902.25

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.17	15.46	16.49	21.23	21.07	23.76	24.27	14.44	13.77	6.51	9.81	9.58	11.14	14.14	11.98	8.49
PY1 (Vuw)	9.63	7.43	11.31	6.83	8.29	9.53	7.29	10.96	4.65	3.63	5.45	3.33	4.03	4.60	3.54	5.29
PX2 (Mu)	16.39	21.32	27.30	15.38	16.70	18.72	12.87	28.67	7.72	9.84	15.63	4.76	7.48	10.31	3.36	16.41
PY2 (Mu)	6.83	8.88	11.37	6.41	6.96	7.80	5.36	11.95	3.22	4.10	6.51	1.98	3.12	4.30	1.40	6.84
Pu (kip)	43.77	40.24	49.31	38.94	40.74	45.87	39.24	48.82	22.88	18.08	28.11	15.29	19.95	26.02	16.12	27.70

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2367.80	2835.00	OK
TF Inside	2170.49	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.29	39.81	47.82	38.31	39.71	44.63	38.24	47.50
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	881.91
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2367.80	19.73	OK	1437.49	11.98	OK
BF	1936.96	27.67	OK	696.89	9.96	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2367.80	19.73	1.47	160.39	OK
TF	4538.29	37.82	1.47	252.04	OK
TF Inside	2170.49	18.09	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.31	24.65	OK	28.11	14.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.31	1.47	126.02	OK
Web SPL	24.65	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.20
TF Inside	NA	1.20
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.83	1.40	6.66
Web	1.52	1.33	2.64
BF	1.31	1.69	4.14

Plate	Shear	Flexure
Web	1.86	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.83	-12.59	-20.71	0.17	-31.03	-0.26	-17.35	-10.92	-21.01	-8.55	-26.04	-5.82	-17.78	-16.31	-30.74	3.74
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.50	0.25	0.41	0.00	0.62	0.01	0.35	0.22	0.42	0.17	0.52	0.12	0.36	0.33	0.61	0.07
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-24.83		-20.71		-31.03		-17.35		-21.01		-26.04		-17.78		-30.74	
Fcf (ksi)	-37.50		-37.50		-40.52		-37.50		-37.50		-38.02		-37.50		-40.37	
Fcf (kip)	-4021.88		-4021.88		-4345.37		-4021.88		-4021.88		-4077.63		-4021.88		-4329.83	
fncf (ksi)		-12.59		0.17		-0.26		-10.92		-8.55		-5.82		-16.31		3.74
Rcf		1.21		1.21		1.31		1.21		1.21		1.23		1.21		1.30
Fncf (ksi)		-37.50		37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.98869	-9.285303	-15.20287	0.031087	-22.49363	-0.270603	-12.7038	-8.103949	-15.41563	-6.133828	-18.84654	-4.502905	-13.00741	-11.91697	-22.29	2.56
Fs (ksi)	-17.99	-9.29	-15.20	0.03	-22.49	-0.27	-12.70	-8.10	-15.42	-6.13	-18.85	-4.50	-13.01	-11.92	-22.29	2.56
Fs (kip)	-1929.29	-919.24	-1630.51	3.08	-2412.44	-26.79	-1362.48	-802.29	-1653.33	-607.25	-2021.29	-445.79	-1395.05	-1179.78	-2390.48	253.00

Vu (kip)	500.70	386.42	587.94	355.27	431.32	495.33	378.96	570.02	362.52	282.85	425.23	259.77	314.58	358.73	276.51	412.57
Vuw (kip)	751.06	579.63	881.91	532.91	646.98	743.00	568.44	855.03	---	---	---	---	---	---	---	---
Mv (k*ft)	422.47	326.04	496.07	299.76	363.93	417.94	319.75	480.96	203.92	159.10	239.19	146.12	176.95	201.78	155.54	232.07
Huw (kip)	-1739.53	-1230.69	-1348.07	-1672.85	-1578.65	-1489.97	-1888.07	-1171.53	-900.04	-500.67	-751.22	-686.66	-711.13	-770.53	-822.50	-651.20
Muw (k*ft)	490.31	829.54	884.00	534.77	597.57	679.56	391.29	995.32	191.47	335.15	488.91	101.20	204.20	315.56	23.99	546.58
Mu (k*ft)	912.78	1155.58	1380.07	834.53	961.49	1097.50	711.04	1476.28	395.39	494.25	728.10	247.32	381.15	517.34	179.52	778.65

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.30	15.78	17.28	21.45	20.24	19.10	24.21	15.02	11.54	6.42	9.63	8.80	9.12	9.88	10.54	8.35
PY1 (Vuw)	9.63	7.43	11.31	6.83	8.29	9.53	7.29	10.96	4.65	3.63	5.45	3.33	4.03	4.60	3.54	5.29
PX2 (Mu)	16.60	21.02	25.10	15.18	17.49	19.96	12.93	26.85	7.19	8.99	13.24	4.50	6.93	9.41	3.27	14.16
PY2 (Mu)	6.92	8.76	10.46	6.32	7.29	8.32	5.39	11.19	3.00	3.75	5.52	1.87	2.89	3.92	1.36	5.90
Pu (kip)	42.28	40.20	47.65	38.92	40.82	42.95	39.24	47.37	20.23	17.08	25.37	14.28	17.48	21.09	14.66	25.14

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.76	39.76	46.00	38.27	39.84	41.67	38.25	45.90
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 1516**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.65	23.82	OK	25.37	12.68	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.65	1.47	126.02	OK
Web SPL	23.82	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3516

Node 3516

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3516 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
3516 R	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 3516 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I	27.518939 in
Outer to Inr	0.8941537
Outer to Inr	0.9000688
Outer to Mi	0.9470768
Outer to Mi	0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-31.87	-15.97	-25.09	-1.35	-37.78	1.37	-22.40	-12.42	-28.51	-11.88	-35.01	-14.07	-24.13	-18.62	-36.64	4.53
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.64	0.32	0.50	0.03	0.76	0.03	0.45	0.25	0.57	0.24	0.70	0.28	0.48	0.37	0.73	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-31.87		-25.09		-37.78		-22.40		-28.51		-35.01		-24.13		-36.64	
Fcf (ksi)	-40.93		-37.54		-43.89		-37.50		-39.25		-42.51		-37.50		-43.32	
Fcf (kip)	-4390.04		-4026.64		-4707.35		-4021.88		-4209.95		-4558.69		-4021.88		-4645.88	
fncf (ksi)		-15.97		-1.35		1.37		-12.42		-11.88		-14.07		-18.62		4.53
Rcf		1.08		1.00		1.16		1.00		1.04		1.12		1.00		1.15
Fncf (ksi)		-37.50		-37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.41	-11.55	-18.82	-0.58	-27.94	1.57	-16.61	-9.15	-21.10	-8.15	-25.73	-10.12	-17.76	-13.61	-27.19	3.87
Fs (ksi)	-23.41	-11.55	-18.82	-0.58	-27.94	1.57	-16.61	-9.15	-21.10	-8.15	-25.73	-10.12	-17.76	-13.61	-27.19	3.87
Fs (kip)	-2511.11	-1143.46	-2018.24	-57.09	-2996.19	155.70	-1781.88	-905.79	-2262.53	-806.83	-2759.09	-1001.58	-1904.35	-1347.82	-2916.37	383.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	383.27
Comp	4707.35	3712.50	2996.19	1347.82

ϕvVn (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	564.42	449.53	655.08	423.98	492.72	538.38	450.51	637.75	407.18	327.17	472.40	307.96	357.68	388.78	326.70	460.15
Vuw (kip)	846.63	674.29	982.62	635.98	739.08	807.56	675.76	956.63	---	---	---	---	---	---	---	---
Mv (k*ft)	476.23	379.29	552.73	357.74	415.73	454.25	380.12	538.10	229.04	184.03	265.72	173.23	201.20	218.69	183.77	258.83
Huw (kip)	-1921.68	-1283.60	-1396.00	-1647.27	-1702.57	-1924.94	-1851.84	-1258.19	-1153.80	-640.03	-870.00	-850.20	-965.11	-1182.81	-1035.23	-769.59
Muw (k*ft)	519.92	796.22	1000.55	551.82	592.11	586.94	415.44	1067.21	261.00	401.31	649.20	164.23	284.81	343.39	91.12	683.40
Mu (k*ft)	996.15	1175.51	1553.28	909.56	1007.85	1041.19	795.56	1605.31	490.04	585.34	914.93	337.45	486.01	562.08	274.89	942.24

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.64	16.46	17.90	21.12	21.83	24.68	23.74	16.13	14.79	8.21	11.15	10.90	12.37	15.16	13.27	9.87
PY1 (Vuw)	10.85	8.64	12.60	8.15	9.48	10.35	8.66	12.26	5.22	4.19	6.06	3.95	4.59	4.98	4.19	5.90
PX2 (Mu)	18.12	21.38	28.25	16.54	18.33	18.94	14.47	29.20	8.91	10.65	16.64	6.14	8.84	10.22	5.00	17.14
PY2 (Mu)	7.55	8.91	11.77	6.89	7.64	7.89	6.03	12.17	3.71	4.44	6.93	2.56	3.68	4.26	2.08	7.14
Pu (kip)	46.55	41.71	52.19	40.56	43.65	47.28	40.94	51.49	25.33	20.73	30.68	18.24	22.77	27.02	19.32	29.99

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2456.01	2835.00	OK
TF Inside	2251.34	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.77	40.83	50.29	39.57	42.35	45.77	39.62	49.72
Check	OK	OK	NG	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	982.62
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2456.01	20.47	OK	1563.23	13.03	OK
BF	1936.96	27.67	OK	703.21	10.05	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2456.01	20.47	1.47	160.39	OK
TF	4707.35	39.23	1.47	252.04	OK
TF Inside	2251.34	18.76	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.19	26.09	OK	30.68	15.34	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.19	1.47	126.02	OK
Web SPL	26.09	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.15
TF Inside	NA	1.15
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.77	1.29	6.42
Web	1.43	1.19	2.48
BF	1.31	1.68	4.14

Plate	Shear	Flexure
Web	1.67	1.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.20	-13.56	-23.82	-1.71	-34.59	-1.19	-21.00	-11.74	-24.63	-9.34	-28.12	-9.01	-21.87	-16.83	-34.14	2.51
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.56	0.27	0.48	0.03	0.69	0.02	0.42	0.23	0.49	0.19	0.56	0.18	0.44	0.34	0.68	0.05
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-28.20		-23.82		-34.59		-21.00		-24.63		-28.12		-21.87		-34.14	
Fcf (ksi)	-39.10		-37.50		-42.30		-37.50		-37.50		-39.06		-37.50		-42.07	
Fcf (kip)	-4193.48		-4021.88		-4536.31		-4021.88		-4021.88		-4188.95		-4021.88		-4511.94	
fncf (ksi)		-13.56		-1.71		-1.19		-11.74		-9.34		-9.01		-16.83		2.51
Rcf		1.13		1.08		1.22		1.08		1.08		1.13		1.08		1.22
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.36244	-9.995837	-17.39705	-1.26751	-25.01065	-0.90302	-15.27475	-8.706289	-17.97212	-6.655754	-20.30273	-6.775132	-15.89067	-12.30497	-24.69	1.72
Fs (ksi)	-20.36	-10.00	-17.40	-1.27	-25.01	-0.90	-15.27	-8.71	-17.97	-6.66	-20.30	-6.78	-15.89	-12.30	-24.69	1.72
Fs (kip)	-2183.87	-989.59	-1865.83	-125.48	-2682.39	-89.40	-1638.22	-861.92	-1927.51	-658.92	-2177.47	-670.74	-1704.27	-1218.19	-2647.95	169.87

Vu (kip)	564.42	449.53	655.08	423.98	492.72	538.38	450.51	637.75	407.18	327.17	472.40	307.96	357.68	388.78	326.70	460.15
Vuw (kip)	846.63	674.29	982.62	635.98	739.08	807.56	675.76	956.63	---	---	---	---	---	---	---	---
Mv (k*ft)	476.23	379.29	552.73	357.74	415.73	454.25	380.12	538.10	229.04	184.03	265.72	173.23	201.20	218.69	183.77	258.83
Huw (kip)	-1796.26	-1298.66	-1443.96	-1657.46	-1571.48	-1624.47	-1839.67	-1287.44	-1001.82	-615.93	-855.15	-791.37	-812.72	-893.57	-930.46	-758.13
Muw (k*ft)	522.90	784.23	898.42	545.03	602.35	635.56	423.55	992.76	228.07	354.85	530.37	144.51	248.96	297.61	78.89	580.92
Mu (k*ft)	999.13	1163.52	1451.14	902.76	1018.08	1089.82	803.67	1530.86	457.10	538.88	796.09	317.73	450.16	516.29	262.65	839.75

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.03	16.65	18.51	21.25	20.15	20.83	23.59	16.51	12.84	7.90	10.96	10.15	10.42	11.46	11.93	9.72
PY1 (Vuw)	10.85	8.64	12.60	8.15	9.48	10.35	8.66	12.26	5.22	4.19	6.06	3.95	4.59	4.98	4.19	5.90
PX2 (Mu)	18.17	21.16	26.39	16.42	18.52	19.82	14.62	27.84	8.31	9.80	14.48	5.78	8.19	9.39	4.78	15.27
PY2 (Mu)	7.57	8.82	11.00	6.84	7.72	8.26	6.09	11.60	3.46	4.08	6.03	2.41	3.41	3.91	1.99	6.36
Pu (kip)	45.13	41.65	50.73	40.54	42.31	44.71	40.95	50.36	22.87	19.54	28.17	17.15	20.25	22.67	17.81	27.84

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.30	40.75	48.69	39.55	40.97	43.15	39.65	48.49
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.73	25.36	OK	28.17	14.08	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.73	1.47	126.02	OK
Web SPL	25.36	1.47	91.65	OK

Field Splice - Node 5516

Node 5516

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5516 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
5516 R	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 5516 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I 27.518939 in
Outer to Inr 0.8941537
Outer to Inr 0.9000688

Outer to Mi 0.9470768
Outer to Mi 0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-31.01	-14.21	-25.84	-1.22	-37.81	0.53	-23.76	-12.08	-29.80	-11.34	-32.30	-13.29	-24.22	-17.39	-37.45	4.53
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.62	0.28	0.52	0.02	0.76	0.01	0.48	0.24	0.60	0.23	0.65	0.27	0.48	0.35	0.75	0.09
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-31.01		-25.84		-37.81		-23.76		-29.80		-32.30		-24.22		-37.45	
Fcf (ksi)	-40.51		-37.92		-43.90		-37.50		-39.90		-41.15		-37.50		-43.72	
Fcf (kip)	-4344.27		-4067.17		-4708.64		-4021.88		-4279.07		-4413.53		-4021.88		-4689.41	
fncf (ksi)		-14.21		-1.22		0.53		-12.08		-11.34		-13.29		-17.39		4.53
Rcf		1.07		1.00		1.16		1.00		1.06		1.09		1.00		1.16
Fncf (ksi)		-37.50		-37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		-3712.50		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.81	-10.28	-19.27	-0.31	-27.96	1.04	-17.58	-8.87	-22.07	-7.71	-23.75	-9.59	-17.82	-12.71	-27.78	3.93
Fs (ksi)	-22.81	-10.28	-19.27	-0.31	-27.96	1.04	-17.58	-8.87	-22.07	-7.71	-23.75	-9.59	-17.82	-12.71	-27.78	3.93
Fs (kip)	-2445.86	-1017.33	-2066.29	-31.11	-2999.16	102.88	-1885.77	-878.13	-2367.35	-763.30	-2547.65	-949.31	-1911.49	-1258.47	-2979.04	389.13

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	389.13
Comp	4708.64	3712.50	2999.16	1258.47

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	583.25	461.94	677.87	439.34	509.41	527.92	468.60	658.53	420.52	335.95	488.52	318.84	369.50	381.42	339.51	474.85
Vuw (kip)	874.88	692.91	1016.81	659.01	764.12	791.89	702.91	987.79	---	---	---	---	---	---	---	---
Mv (k*ft)	492.12	389.76	571.96	370.69	429.82	445.44	395.39	555.63	236.54	188.97	274.79	179.35	207.84	214.55	190.98	267.10
Huw (kip)	-1838.98	-1291.66	-1428.59	-1636.11	-1711.46	-1835.22	-1811.33	-1270.11	-1091.68	-646.15	-888.53	-872.95	-982.85	-1100.33	-1007.64	-786.92
Muw (k*ft)	556.28	807.47	979.36	559.26	614.54	587.20	442.45	1077.12	275.64	416.94	638.07	191.68	315.99	311.64	112.44	697.56
Mu (k*ft)	1048.40	1197.23	1551.31	929.95	1044.36	1032.64	837.83	1632.75	512.18	605.91	912.86	371.03	523.83	526.19	303.42	964.66

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.58	16.56	18.32	20.98	21.94	23.53	23.22	16.28	14.00	8.28	11.39	11.19	12.60	14.11	12.92	10.09
PY1 (Vuw)	11.22	8.88	13.04	8.45	9.80	10.15	9.01	12.66	5.39	4.31	6.26	4.09	4.74	4.89	4.35	6.09
PX2 (Mu)	19.07	21.78	28.22	16.91	19.00	18.78	15.24	29.70	9.32	11.02	16.60	6.75	9.53	9.57	5.52	17.55
PY2 (Mu)	7.95	9.07	11.76	7.05	7.91	7.83	6.35	12.37	3.88	4.59	6.92	2.81	3.97	3.99	2.30	7.31
Pu (kip)	46.75	42.33	52.72	40.94	44.60	45.97	41.42	52.36	25.09	21.26	30.94	19.22	23.78	25.29	19.60	30.71

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2456.68	2835.00	OK
TF Inside	2251.96	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.88	41.39	50.64	39.87	43.24	44.50	40.03	50.46
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1016.81
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2456.68	20.47	OK	1564.78	13.04	OK
BF	1936.96	27.67	OK	656.59	9.38	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2456.68	20.47	1.47	160.39	OK
TF	4708.64	39.24	1.47	252.04	OK
TF Inside	2251.96	18.77	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.72	26.36	OK	30.94	15.47	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.72	1.47	126.02	OK
Web SPL	26.36	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.15
TF Inside	NA	1.15
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.77	1.29	6.42
Web	1.39	1.15	2.43
BF	1.31	1.79	4.14

Plate	Shear	Flexure
Web	1.61	1.01

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.21	-13.59	-24.58	-1.63	-35.96	-0.79	-22.03	-11.20	-25.88	-8.88	-27.02	-9.59	-22.92	-16.58	-35.45	2.97
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.58	0.27	0.49	0.03	0.72	0.02	0.44	0.22	0.52	0.18	0.54	0.19	0.46	0.33	0.71	0.06
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-29.21		-24.58		-35.96		-22.03		-25.88		-27.02		-22.92		-35.45	
Fcf (ksi)	-39.61		-37.50		-42.98		-37.50		-37.94		-38.51		-37.50		-42.72	
Fcf (kip)	-4247.69		-4021.88		-4609.43		-4021.88		-4069.31		-4130.21		-4021.88		-4582.17	
fncf (ksi)		-13.59		-1.63		-0.79		-11.20		-8.88		-9.59		-16.58		2.97
Rcf		1.10		1.04		1.20		1.04		1.06		1.07		1.04		1.19
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.08004	-10.03065	-17.93409	-1.166889	-25.9749	-0.572895	-16.00314	-8.341957	-18.85877	-6.289221	-19.53216	-7.205194	-16.63225	-12.13883	-25.62	2.09
Fs (ksi)	-21.08	-10.03	-17.93	-1.17	-25.97	-0.57	-16.00	-8.34	-18.86	-6.29	-19.53	-7.21	-16.63	-12.14	-25.62	2.09
Fs (kip)	-2260.83	-993.03	-1923.43	-115.52	-2785.81	-56.72	-1716.34	-825.85	-2022.60	-622.63	-2094.82	-713.31	-1783.81	-1201.74	-2747.30	206.76

Vu (kip)	583.25	461.94	677.87	439.34	509.41	527.92	468.60	658.53	420.52	335.95	488.52	318.84	369.50	381.42	339.51	474.85
Vuw (kip)	874.88	692.91	1016.81	659.01	764.12	791.89	702.91	987.79	---	---	---	---	---	---	---	---
Mv (k*ft)	492.12	389.76	571.96	370.69	429.82	445.44	395.39	555.63	236.54	188.97	274.79	179.35	207.84	214.55	190.98	267.10
Huw (kip)	-1801.03	-1293.71	-1449.54	-1623.03	-1561.43	-1609.88	-1807.98	-1293.27	-1026.65	-630.33	-876.08	-803.39	-829.88	-882.33	-949.45	-776.40
Muw (k*ft)	541.95	787.53	924.69	567.98	628.51	621.19	444.68	1017.69	243.09	368.88	558.84	168.55	276.53	271.19	98.86	609.50
Mu (k*ft)	1034.07	1177.29	1496.64	938.68	1058.33	1066.63	840.06	1573.32	479.63	557.85	833.63	347.89	484.37	485.74	289.83	876.60

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.09	16.59	18.58	20.81	20.02	20.64	23.18	16.58	13.16	8.08	11.23	10.30	10.64	11.31	12.17	9.95
PY1 (Vuw)	11.22	8.88	13.04	8.45	9.80	10.15	9.01	12.66	5.39	4.31	6.26	4.09	4.74	4.89	4.35	6.09
PX2 (Mu)	18.81	21.41	27.22	17.07	19.25	19.40	15.28	28.62	8.72	10.15	15.16	6.33	8.81	8.84	5.27	15.94
PY2 (Mu)	7.84	8.92	11.34	7.11	8.02	8.08	6.37	11.92	3.63	4.23	6.32	2.64	3.67	3.68	2.20	6.64
Pu (kip)	46.03	41.96	51.89	40.95	43.12	44.00	41.42	51.45	23.67	20.13	29.24	17.94	21.19	21.89	18.63	28.86

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.11	40.99	49.73	39.90	41.71	42.48	40.04	49.47
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.89	25.94	OK	29.24	14.62	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.89	1.47	126.02	OK
Web SPL	25.94	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7516	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type GG

Field Splice - Node 7516

Node 7516

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7516 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
7516 R	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 7516 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I	27.518939 in
Outer to Inr	0.8941537
Outer to Inr	0.9000688
Outer to Mi	0.9470768
Outer to Mi	0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.33	-13.20	-26.19	0.67	-36.72	0.78	-23.11	-11.08	-34.05	-10.12	-30.10	-11.67	-22.97	-15.64	-36.76	5.09
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.61	0.26	0.52	0.01	0.73	0.02	0.46	0.22	0.68	0.20	0.60	0.23	0.46	0.31	0.74	0.10
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-30.33		-26.19		-36.72		-23.11		-34.05		-30.10		-22.97		-36.76	
Fcf (ksi)	-40.16		-38.10		-43.36		-37.50		-42.03		-40.05		-37.50		-43.38	
Fcf (kip)	-4307.54		-4085.77		-4650.38		-4021.88		-4507.28		-4295.26		-4021.88		-4652.59	
fncf (ksi)		-13.20		0.67		0.78		-11.08		-10.12		-11.67		-15.64		5.09
Rcf		1.09		1.04		1.18		1.02		1.14		1.09		1.02		1.18
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		2864.70		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.11	-9.35	-19.52	0.95	-27.35	1.40	-17.13	-8.14	-25.20	-6.69	-22.18	-8.44	-16.94	-11.45	-27.29	4.37
Fs (ksi)	-22.11	-9.35	-19.52	0.95	-27.35	1.40	-17.13	-8.14	-25.20	-6.69	-22.18	-8.44	-16.94	-11.45	-27.29	4.37
Fs (kip)	-2371.32	-925.71	-2093.52	94.08	-2932.77	138.94	-1836.69	-805.95	-2703.23	-662.75	-2378.95	-835.77	-1817.26	-1134.01	-2926.47	432.78

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	432.78
Comp	4652.59	3712.50	2932.77	1134.01

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	570.67	452.98	662.95	431.81	557.98	489.99	456.12	643.43	411.82	329.76	478.11	313.71	403.95	354.82	330.89	464.32
Vuw (kip)	856.01	679.48	994.42	647.72	836.98	734.99	684.18	965.15	---	---	---	---	---	---	---	---
Mv (k*ft)	481.51	382.21	559.36	364.34	470.80	413.43	384.85	542.90	231.65	185.49	268.94	176.46	227.22	199.59	186.13	261.18
Huw (kip)	-1801.42	-1234.20	-1400.42	-1610.36	-1768.48	-1741.02	-1764.08	-1233.30	-1038.21	-612.80	-856.08	-833.78	-1052.68	-1010.58	-937.16	-756.19
Muw (k*ft)	566.25	853.41	974.23	576.43	670.15	601.48	473.95	1086.55	280.71	450.34	632.47	197.66	407.23	302.26	120.77	696.47
Mu (k*ft)	1047.76	1235.61	1533.59	940.77	1140.95	1014.91	858.80	1629.45	512.36	635.84	901.40	374.12	634.45	501.85	306.89	957.65

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.10	15.82	17.95	20.65	22.67	22.32	22.62	15.81	13.31	7.86	10.98	10.69	13.50	12.96	12.01	9.69
PY1 (Vuw)	10.97	8.71	12.75	8.30	10.73	9.42	8.77	12.37	5.28	4.23	6.13	4.02	5.18	4.55	4.24	5.95
PX2 (Mu)	19.06	22.47	27.89	17.11	20.75	18.46	15.62	29.64	9.32	11.57	16.40	6.80	11.54	9.13	5.58	17.42
PY2 (Mu)	7.94	9.36	11.62	7.13	8.65	7.69	6.51	12.35	3.88	4.82	6.83	2.84	4.81	3.80	2.33	7.26
Pu (kip)	46.20	42.35	51.92	40.79	47.55	44.23	41.18	51.74	24.41	21.43	30.28	18.79	26.95	23.61	18.78	30.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2427.44	2835.00	OK
TF Inside	2225.15	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.41	41.51	49.92	39.79	46.00	42.97	39.91	49.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	994.42
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2427.44	20.23	OK	1530.14	12.75	OK
BF	1936.96	27.67	OK	591.65	8.45	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2427.44	20.23	1.47	160.39	OK
TF	4652.59	38.77	1.47	252.04	OK
TF Inside	2225.15	18.54	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.92	25.96	OK	30.28	15.14	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.92	1.47	126.02	OK
Web SPL	25.96	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.17
TF Inside	NA	1.17
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.79	1.32	6.50
Web	1.41	1.18	2.46
BF	1.31	1.99	4.14

Plate	Shear	Flexure
Web	1.65	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.67	-12.74	-24.15	-0.94	-35.07	-0.38	-21.67	-10.50	-29.23	-7.17	-24.93	-8.05	-22.25	-15.40	-34.62	3.39
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.57	0.25	0.48	0.02	0.70	0.01	0.43	0.21	0.58	0.14	0.50	0.16	0.44	0.31	0.69	0.07
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-28.67		-24.15		-35.07		-21.67		-29.23		-24.93		-22.25		-34.62	
Fcf (ksi)	-39.33		-37.50		-42.53		-37.50		-39.61		-37.50		-37.50		-42.31	
Fcf (kip)	-4218.46		-4021.88		-4561.67		-4021.88		-4248.44		-4021.88		-4021.88		-4537.53	
fncf (ksi)		-12.74		-0.94		-0.38		-10.50		-7.17		-8.05		-15.40		3.39
Rcf		1.12		1.07		1.21		1.07		1.13		1.07		1.07		1.21
Fncf (ksi)		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.71292	-9.437533	-17.64362	-0.623408	-25.35532	-0.223187	-15.76963	-7.852883	-21.22846	-5.025372	-18.07337	-6.120258	-16.17641	-11.31936	-25.04	2.43
Fs (ksi)	-20.71	-9.44	-17.64	-0.62	-25.36	-0.22	-15.77	-7.85	-21.23	-5.03	-18.07	-6.12	-16.18	-11.32	-25.04	2.43
Fs (kip)	-2221.46	-934.32	-1892.28	-61.72	-2719.36	-22.10	-1691.29	-777.44	-2276.75	-497.51	-1938.37	-605.91	-1734.92	-1120.62	-2685.24	240.99

Vu (kip)	570.67	452.98	662.95	431.81	557.98	489.99	456.12	643.43	411.82	329.76	478.11	313.71	403.95	354.82	330.89	464.32
Vuw (kip)	856.01	679.48	994.42	647.72	836.98	734.99	684.18	965.15	---	---	---	---	---	---	---	---
Mv (k*ft)	481.51	382.21	559.36	364.34	470.80	413.43	384.85	542.90	231.65	185.49	268.94	176.46	227.22	199.59	186.13	261.18
Huw (kip)	-1769.61	-1270.75	-1418.63	-1607.99	-1574.60	-1521.45	-1781.14	-1261.36	-994.96	-602.81	-844.09	-779.54	-866.38	-798.39	-907.36	-745.90
Muw (k*ft)	550.91	802.83	925.70	578.00	693.22	635.70	462.57	1020.64	248.06	374.44	552.91	174.17	356.47	262.97	106.86	604.37
Mu (k*ft)	1032.42	1185.04	1485.07	942.35	1164.02	1049.13	847.42	1563.54	479.71	559.94	821.84	350.63	583.69	462.56	292.98	865.55

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.69	16.29	18.19	20.62	20.19	19.51	22.84	16.17	12.76	7.73	10.82	9.99	11.11	10.24	11.63	9.56
PY1 (Vuw)	10.97	8.71	12.75	8.30	10.73	9.42	8.77	12.37	5.28	4.23	6.13	4.02	5.18	4.55	4.24	5.95
PX2 (Mu)	18.78	21.55	27.01	17.14	21.17	19.08	15.41	28.44	8.73	10.18	14.95	6.38	10.62	8.41	5.33	15.74
PY2 (Mu)	7.82	8.98	11.25	7.14	8.82	7.95	6.42	11.85	3.64	4.24	6.23	2.66	4.42	3.51	2.22	6.56
Pu (kip)	45.53	41.78	51.18	40.79	45.75	42.32	41.16	50.76	23.26	19.81	28.58	17.68	23.75	20.31	18.15	28.23

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.69	40.88	49.10	39.79	44.13	41.02	39.87	48.87
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.18	25.59	OK	28.58	14.29	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.18	1.47	126.02	OK
Web SPL	25.59	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type GG

Field Splice - Node 9516

Node 9516

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	78
BF	70

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9516 L	99.00	68.44	6775.37	99.00	69.42	6872.60	48.00	50.00	2400.00
9516 R	107.25	50.00	5362.50	99.00	50.00	4950.00	66.00	50.00	3300.00

Rh = 1.00

Controlling Section = 9516 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	39.00	2.75	---	107.25	78.03	85.42	50	65
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	36.00	2.75	---	99.00	69.78	76.39	50	65
Splice Plates	TF Outside	36.00	1.750	74.50	63.00	44.41	---	50	65
	TF Inside	16.50	1.750	74.50	57.75	39.16	---	50	65
	BF Inside	16.50	1.250	44.50	41.25	27.97	---	50	65
	BF Outside	36.00	1.250	44.50	45.00	31.72	---	50	65
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.900069

N.A. (from I	27.518939 in
Outer to Inr	0.8941537
Outer to Inr	0.9000688
Outer to Mi	0.9470768
Outer to Mi	0.9500344

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.89	-11.09	-24.99	4.74	-34.13	2.24	-22.79	-8.68	-32.87	-5.84	-28.82	-12.00	-21.34	-15.16	-33.99	7.65
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.56	0.22	0.50	0.09	0.68	0.04	0.46	0.17	0.66	0.12	0.58	0.24	0.43	0.30	0.68	0.15
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-27.89		-24.99		-34.13		-22.79		-32.87		-28.82		-21.34		-33.99	
Fcf (ksi)	-38.94		-37.50		-42.06		-37.50		-41.44		-39.41		-37.50		-41.99	
Fcf (kip)	-4176.85		-4021.88		-4511.33		-4021.88		-4444.14		-4226.69		-4021.88		-4503.94	
fncf (ksi)		-11.09		4.74		2.24		-8.68		-5.84		-12.00		-15.16		7.65
Rcf		1.14		1.10		1.23		1.10		1.21		1.15		1.10		1.23
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		2864.70		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.42	-7.85	-18.75	3.92	-25.52	2.46	-16.97	-6.39	-24.48	-3.53	-21.28	-8.69	-15.80	-11.12	-25.39	6.25
Fs (ksi)	-20.42	-7.85	-18.75	3.92	-25.52	2.46	-16.97	-6.39	-24.48	-3.53	-21.28	-8.69	-15.80	-11.12	-25.39	6.25
Fs (kip)	-2189.84	-776.90	-2010.71	387.64	-2737.22	243.93	-1819.92	-632.94	-2625.14	-349.59	-2282.13	-859.93	-1694.36	-1100.40	-2722.72	619.20

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	2864.70	0.00	619.20
Comp	4511.33	3712.50	2737.22	1100.40

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	530.17	400.64	610.38	380.40	529.79	452.57	412.14	584.16	383.98	293.84	442.03	278.16	385.09	329.15	300.59	423.51
Vuw (kip)	795.25	600.96	915.56	570.60	794.68	678.86	618.21	876.24	---	---	---	---	---	---	---	---
Mv (k*ft)	447.33	338.04	515.00	320.96	447.01	381.86	347.74	492.89	215.99	165.29	248.64	156.47	216.61	185.15	169.08	238.22
Huw (kip)	-1702.90	-1065.79	-1296.80	-1552.36	-1601.54	-1757.62	-1787.18	-1075.22	-932.77	-489.46	-760.91	-770.95	-924.26	-988.84	-888.14	-631.36
Muw (k*ft)	578.31	939.47	986.27	615.09	755.54	562.28	458.55	1130.96	276.55	498.60	615.69	232.66	460.80	277.03	103.03	696.11
Mu (k*ft)	1025.64	1277.51	1501.27	936.06	1202.55	944.14	806.29	1623.85	492.54	663.88	864.33	389.13	677.42	462.18	272.11	934.33

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.83	13.66	16.63	19.90	20.53	22.53	22.91	13.78	11.96	6.28	9.76	9.88	11.85	12.68	11.39	8.09
PY1 (Vuw)	10.20	7.70	11.74	7.32	10.19	8.70	7.93	11.23	4.92	3.77	5.67	3.57	4.94	4.22	3.85	5.43
PX2 (Mu)	18.66	23.24	27.31	17.03	21.87	17.17	14.67	29.54	8.96	12.08	15.72	7.08	12.32	8.41	4.95	16.99
PY2 (Mu)	7.77	9.68	11.38	7.09	9.11	7.16	6.11	12.31	3.73	5.03	6.55	2.95	5.13	3.50	2.06	7.08
Pu (kip)	44.30	40.79	49.64	39.64	46.59	42.76	40.11	49.30	22.64	20.35	28.25	18.17	26.19	22.45	17.37	28.03

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2992.50	2309.13	122.50	79.73	37.52	4355.60	2309.13	OK
TF Inside	0.00	2743.13	2036.13	245.00	159.47	27.13	6220.08	2036.13	OK
BF Inside	1370.08	1959.38	1454.38	100.00	65.47	19.38	2982.04	1454.38	OK
BF Outside	1494.63	2137.50	1649.38	50.00	32.73	26.80	2380.71	1649.38	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2353.74	2835.00	OK
TF Inside	2157.59	2598.75	OK
BF Inside	1775.54	1856.25	OK
BF Outside	1936.96	2025.00	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.73	40.36	47.97	38.98	45.28	41.65	39.06	47.89
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	915.56
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9516**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.19	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2353.74	19.61	OK	1428.12	11.90	OK
BF	1936.96	27.67	OK	574.12	8.20	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2353.74	19.61	1.47	160.39	OK
TF	4511.33	37.59	1.47	252.04	OK
TF Inside	2157.59	17.98	1.47	160.39	OK
BF Inside	1775.54	25.36	1.47	114.56	OK
BF	3712.50	53.04	1.47	252.04	OK
BF Outside	1936.96	27.67	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.64	24.82	OK	28.25	14.13	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.64	1.47	126.02	OK
Web SPL	24.82	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.20
TF Inside	NA	1.20
BF Inside	1.06	1.05
BF Outside	1.10	1.05

Bolt	Shear	Slip	Bearing
TF	1.85	1.41	6.70
Web	1.49	1.28	2.59
BF	1.31	2.05	4.14

Plate	Shear	Flexure
Web	1.79	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.35	-10.73	-21.71	1.88	-32.13	0.72	-19.44	-6.47	-27.93	-3.00	-22.52	-7.22	-19.76	-14.06	-31.73	5.75
ϕf Fnc (ksi)	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
f / ϕf Fnc	0.53	0.21	0.43	0.04	0.64	0.01	0.39	0.13	0.56	0.06	0.45	0.14	0.40	0.28	0.63	0.12
α	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
fcf (ksi)	-26.35		-21.71		-32.13		-19.44		-27.93		-22.52		-19.76		-31.73	
Fcf (ksi)	-38.18		-37.50		-41.07		-37.50		-38.96		-37.50		-37.50		-40.86	
Fcf (kip)	-4094.33		-4021.88		-4404.36		-4021.88		-4178.74		-4021.88		-4021.88		-4382.76	
fncf (ksi)		-10.73		1.88		0.72		-6.47		-3.00		-7.22		-14.06		5.75
Rcf		1.19		1.17		1.28		1.17		1.21		1.17		1.17		1.27
Fncf (ksi)		-37.50		37.50		37.50		-37.50		-37.50		-37.50		-37.50		37.50
Fncf (kip)		-3712.50		2864.70		2864.70		-3712.50		-3712.50		-3712.50		-3712.50		2864.70

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.10869	-7.998897	-15.96627	1.439473	-23.33294	0.615521	-14.2241	-4.994026	-20.36028	-2.008273	-16.39866	-5.519713	-14.45061	-10.35282	-23.05	4.17
Fs (ksi)	-19.11	-8.00	-15.97	1.44	-23.33	0.62	-14.22	-4.99	-20.36	-2.01	-16.40	-5.52	-14.45	-10.35	-23.05	4.17
Fs (kip)	-2049.41	-791.89	-1712.38	142.51	-2502.46	60.94	-1525.53	-494.41	-2183.64	-198.82	-1758.76	-546.45	-1549.83	-1024.93	-2471.92	413.21

Vu (kip)	530.17	400.64	610.38	380.40	529.79	452.57	412.14	584.16	383.98	293.84	442.03	278.16	385.09	329.15	300.59	423.51
Vuw (kip)	795.25	600.96	915.56	570.60	794.68	678.86	618.21	876.24	---	---	---	---	---	---	---	---
Mv (k*ft)	447.33	338.04	515.00	320.96	447.01	381.86	347.74	492.89	215.99	165.29	248.64	156.47	216.61	185.15	169.08	238.22
Huw (kip)	-1680.39	-1165.01	-1324.99	-1486.86	-1405.71	-1515.52	-1778.97	-1107.12	-894.55	-479.38	-749.67	-634.20	-738.16	-723.31	-818.51	-622.85
Muw (k*ft)	559.46	873.33	923.59	658.76	777.21	639.66	464.02	1059.97	244.42	382.93	526.87	203.06	403.74	239.34	90.15	598.89
Mu (k*ft)	1006.79	1211.36	1438.60	979.72	1224.22	1021.51	811.76	1552.86	460.40	548.21	775.51	359.53	620.36	424.49	259.23	837.11

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9516	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.54	14.94	16.99	19.06	18.02	19.43	22.81	14.19	11.47	6.15	9.61	8.13	9.46	9.27	10.49	7.99
PY1 (Vuw)	10.20	7.70	11.74	7.32	10.19	8.70	7.93	11.23	4.92	3.77	5.67	3.57	4.94	4.22	3.85	5.43
PX2 (Mu)	18.31	22.03	26.17	17.82	22.27	18.58	14.76	28.24	8.37	9.97	14.11	6.54	11.28	7.72	4.72	15.23
PY2 (Mu)	7.63	9.18	10.90	7.42	9.28	7.74	6.15	11.77	3.49	4.15	5.88	2.72	4.70	3.22	1.96	6.34
Pu (kip)	43.66	40.64	48.73	39.72	44.75	41.41	40.12	48.27	21.55	17.96	26.38	15.96	22.88	18.55	16.28	26.03

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.05	40.15	46.97	39.11	43.36	40.36	39.08	46.76
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 9516**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.73	24.37	OK	26.38	13.19	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.73	1.47	126.02	OK
Web SPL	24.37	1.47	91.65	OK

Field Splice

Type HH

Field Splice - Node 1507

Node 1507

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1507 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
1507 R	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1507 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.83	-25.72	-6.99	-20.37	-20.13	-21.82	-5.70	-24.92	-18.79	-27.72	-17.53	-26.14	-5.95	-27.82	-20.17	-20.58
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.26	0.38	0.10	0.30	0.30	0.32	0.08	0.37	0.28	0.41	0.26	0.38	0.09	0.41	0.30	0.30
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.72		-20.37		-21.82		-24.92		-27.72		-26.14		-27.82		-20.58
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-17.83		-6.99		-20.13		-5.70		-18.79		-17.53		-5.95		-20.17	
Rcf	1.84		1.84		1.84		1.84		1.84		1.84		1.84		1.84	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.52	-19.51	-5.83	-16.14	-15.27	-16.64	-4.81	-19.47	-14.26	-17.57	-7.54	-18.62	-4.93	-21.56	-15.32	-15.73
Fs (ksi)	-13.52	-19.51	-5.83	-16.14	-15.27	-16.64	-4.81	-19.47	-14.26	-17.57	-7.54	-18.62	-4.93	-21.56	-15.32	-15.73
Fs (kip)	-1338.67	-1931.08	-577.21	-1597.55	-1511.42	-1647.00	-476.08	-1927.12	-1412.10	-1739.12	-746.06	-1843.41	-488.33	-2134.48	-1516.72	-1557.65

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1516.72	2134.48

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	277.12	43.47	344.68	0.95	161.02	144.38	24.10	325.86	202.96	32.02	250.69	1.98	200.54	55.81	18.33	237.40
Vuw (kip)	415.68	65.20	517.02	1.43	241.53	216.57	36.15	488.78	---	---	---	---	---	---	---	---
Mv (k*ft)	233.82	36.68	290.82	0.80	135.86	121.82	20.33	274.94	114.17	18.01	141.01	1.11	112.80	31.39	10.31	133.54
Huw (kip)	-2498.66	-1901.87	-2625.63	-1830.78	-2551.53	-2482.38	-1844.31	-2627.92	-990.83	-659.02	-957.10	-728.24	-954.92	-784.69	-794.79	-931.63
Muw (k*ft)	356.54	754.40	271.90	801.79	321.29	367.39	792.77	270.37	119.68	206.13	27.39	293.14	66.07	221.69	332.55	8.27
Mu (k*ft)	590.36	791.08	562.72	802.60	457.15	489.21	813.10	545.31	233.84	224.14	168.40	294.25	178.87	253.08	342.87	141.80

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.44	29.26	40.39	28.17	39.25	38.19	28.37	40.43	15.24	10.14	14.72	11.20	14.69	12.07	12.23	14.33
PY1 (Vuw)	6.40	1.00	7.95	0.02	3.72	3.33	0.56	7.52	3.12	0.49	3.86	0.03	3.09	0.86	0.28	3.65
PX2 (Mu)	13.62	18.26	12.99	18.52	10.55	11.29	18.76	12.58	5.40	5.17	3.89	6.79	4.13	5.84	7.91	3.27
PY2 (Mu)	4.54	6.09	4.33	6.17	3.52	3.76	6.25	4.19	1.80	1.72	1.30	2.26	1.38	1.95	2.64	1.09
Pu (kip)	53.20	48.04	54.77	47.10	50.33	49.99	47.63	54.29	21.22	15.47	19.31	18.14	19.34	18.13	20.35	18.23

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.11	40.14	44.07	39.51	40.91	40.75	39.90	43.73
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	517.02
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	765.32	8.50	OK
BF	2551.51	28.35	OK	1077.03	11.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.77	27.39	OK	21.22	10.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.77	1.47	114.56	OK
Web SPL	27.39	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	1.98	4.84
Web	1.32	1.76	2.09
BF	1.28	1.41	4.84

Plate	Shear	Flexure
Web	3.17	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.23	-23.56	-5.48	-17.89	-18.01	-19.58	-4.58	-22.41	-10.45	-18.73	-9.42	-17.40	-5.20	-25.50	-17.77	-18.15
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.24	0.35	0.08	0.26	0.26	0.29	0.07	0.33	0.15	0.28	0.14	0.26	0.08	0.37	0.26	0.27
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-23.56		-17.89		-19.58		-22.41		-18.73		-17.40		-25.50		-18.15
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-16.23		-5.48		-18.01		-4.58		-10.45		-9.42		-5.20		-17.77	
Rcf	2.00		2.00		2.00		2.00		2.00		2.00		2.00		2.00	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.88754	-17.15968	-4.049269	-13.12986	-13.13989	-14.3465	-3.415262	-16.32894	-11.3124	-14.22277	-5.084409	-14.85038	-3.857882	-18.50791	-12.97	-13.34
Fs (ksi)	-11.89	-17.16	-4.05	-13.13	-13.14	-14.35	-3.42	-16.33	-11.31	-14.22	-5.08	-14.85	-3.86	-18.51	-12.97	-13.34
Fs (kip)	-1176.87	-1698.81	-400.88	-1299.86	-1300.85	-1420.30	-338.11	-1616.57	-1119.93	-1408.05	-503.36	-1470.19	-381.93	-1832.28	-1284.15	-1320.21

Vu (kip)	277.12	43.47	344.68	0.95	161.02	144.38	24.10	325.86	202.96	32.02	250.69	1.98	200.54	55.81	18.33	237.40
Vuw (kip)	415.68	65.20	517.02	1.43	241.53	216.57	36.15	488.78	---	---	---	---	---	---	---	---
Mv (k*ft)	233.82	36.68	290.82	0.80	135.86	121.82	20.33	274.94	114.17	18.01	141.01	1.11	112.80	31.39	10.31	133.54
Huw (kip)	-2492.38	-1845.80	-2598.90	-1791.87	-2144.59	-2082.62	-1829.52	-2584.55	-871.42	-515.37	-824.59	-592.33	-766.06	-598.04	-670.97	-789.20
Muw (k*ft)	360.73	791.78	289.71	827.73	592.59	633.90	802.63	299.28	105.44	181.61	24.13	258.27	58.21	195.32	293.00	7.28
Mu (k*ft)	594.55	828.46	580.53	828.54	728.45	755.72	822.97	574.22	219.61	199.62	165.15	259.39	171.01	226.71	303.31	140.82

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.34	28.40	39.98	27.57	32.99	32.04	28.15	39.76	13.41	7.93	12.69	9.11	11.79	9.20	10.32	12.14
PY1 (Vuw)	6.40	1.00	7.95	0.02	3.72	3.33	0.56	7.52	3.12	0.49	3.86	0.03	3.09	0.86	0.28	3.65
PX2 (Mu)	13.72	19.12	13.40	19.12	16.81	17.44	18.99	13.25	5.07	4.61	3.81	5.99	3.95	5.23	7.00	3.25
PY2 (Mu)	4.57	6.37	4.47	6.37	5.60	5.81	6.33	4.42	1.69	1.54	1.27	2.00	1.32	1.74	2.33	1.08
Pu (kip)	53.21	48.08	54.81	47.12	50.67	50.32	47.64	54.34	19.09	12.70	17.28	15.23	16.34	14.67	17.52	16.10

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.13	40.25	44.13	39.60	41.75	41.58	39.94	43.82
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.81	27.40	OK	19.09	9.55	OK

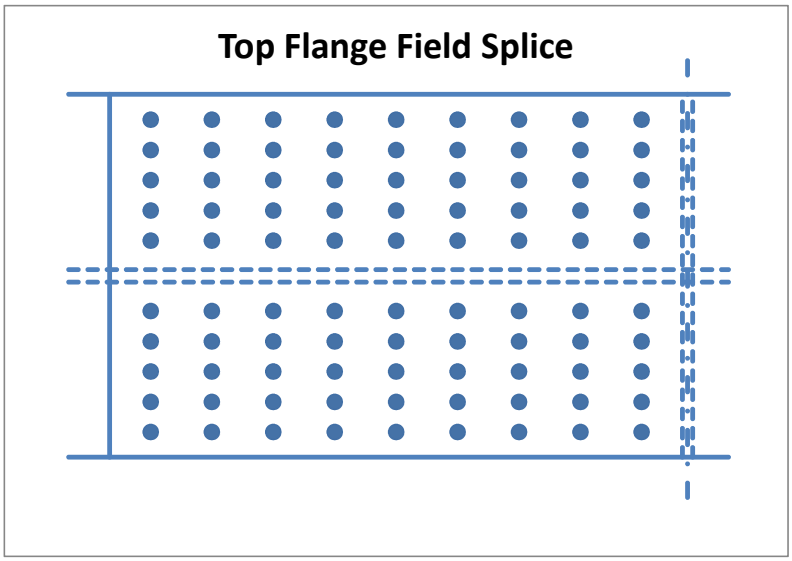
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.81	1.47	114.56	OK
Web SPL	27.40	1.47	91.65	OK

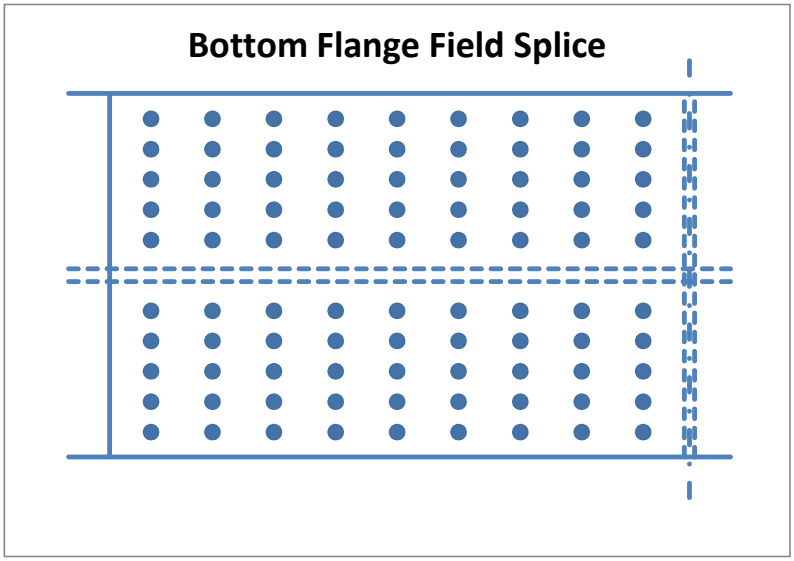
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1507	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1507

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3
0	6	0	6
0	9	0	9
0	12	0	12
0	19	0	19
0	22	0	22
0	25	0	25
0	28	0	28
0	31	0	31
3	0	3	0
3	3	3	3
3	6	3	6
3	9	3	9
3	12	3	12
3	19	3	19
3	22	3	22
3	25	3	25
3	28	3	28
3	31	3	31
6	0	6	0
6	3	6	3
6	6	6	6
6	9	6	9
6	12	6	12
6	19	6	19
6	22	6	22
6	25	6	25
6	28	6	28
6	31	6	31
9	0	9	0
9	3	9	3
9	6	9	6
9	9	9	9
9	12	9	12
9	19	9	19
9	22	9	22
9	25	9	25
9	28	9	28
9	31	9	31
12	0	12	0
12	3	12	3
12	6	12	6
12	9	12	9
12	12	12	12
12	19	12	19
12	22	12	22
12	25	12	25
12	28	12	28
12	31	12	31
15	0	15	0
15	3	15	3
15	6	15	6
15	9	15	9
15	12	15	12
15	19	15	19
15	22	15	22
15	25	15	25
15	28	15	28

	Top Flange		Bottom Flange	
No. Bolts =	90.0		90.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	8.0		8.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.500	OK
No. Trans Space (per side of web) =	4.0		4.0	
Transverse Spacing (in) =	3.000	OK	3.000	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





15	31	15	31
18	0	18	0
18	3	18	3
18	6	18	6
18	9	18	9
18	12	18	12
18	19	18	19
18	22	18	22
18	25	18	25
18	28	18	28
18	31	18	31
21	0	21	0
21	3	21	3
21	6	21	6
21	9	21	9
21	12	21	12
21	19	21	19
21	22	21	22
21	25	21	25
21	28	21	28
21	31	21	31
24	0	24	0
24	3	24	3
24	6	24	6
24	9	24	9
24	12	24	12
24	19	24	19
24	22	24	22
24	25	24	25
24	28	24	28
24	31	24	31

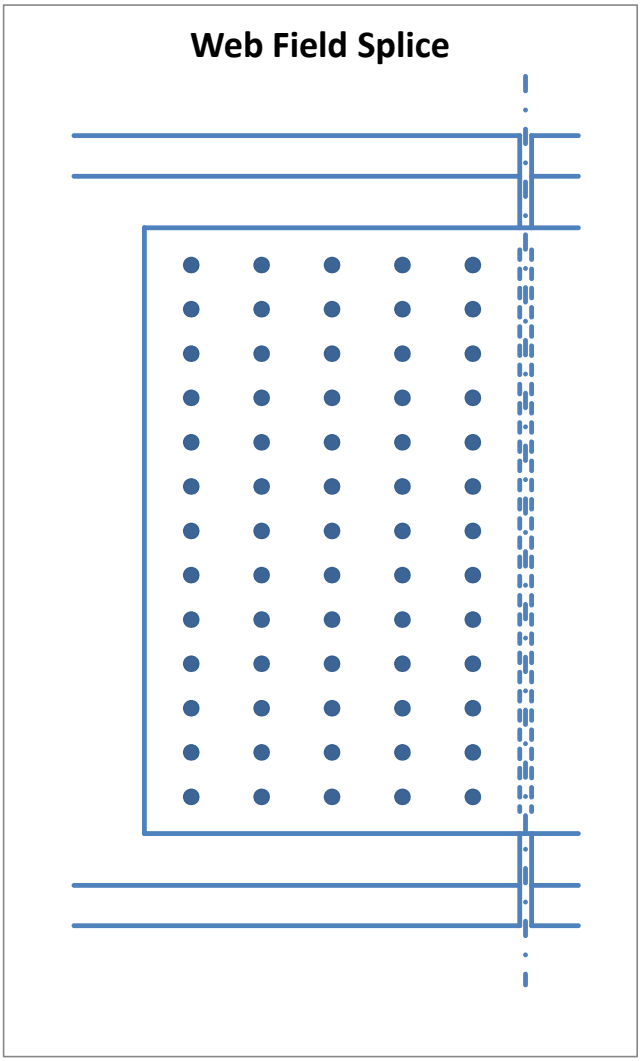
Flange Bolt Pattern Cont. - Node 1507

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1507	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1507

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1507

Web Bolt Pattern Cont. - Node 1507

390	1170	1170	8190

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3507	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type HH

Field Splice - Node 3507

Node 3507

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3507 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
3507 R	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3507 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.24	-27.33	-7.82	-22.53	-20.98	-24.12	-6.25	-26.99	-19.53	-29.90	-18.87	-28.96	-6.69	-29.87	-21.07	-23.38
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.28	0.40	0.11	0.33	0.31	0.35	0.09	0.40	0.29	0.44	0.28	0.43	0.10	0.44	0.31	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-27.33		-22.53		-24.12		-26.99		-29.90		-28.96		-29.87		-23.38
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-19.24		-7.82		-20.98		-6.25		-19.53		-18.87		-6.69		-21.07	
Rcf	1.71		1.71		1.71		1.71		1.71		1.71		1.71		1.71	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.20	-20.34	-5.88	-17.23	-15.53	-17.98	-4.66	-20.50	-14.14	-19.56	-9.00	-19.83	-4.92	-22.57	-15.61	-17.44
Fs (ksi)	-14.20	-20.34	-5.88	-17.23	-15.53	-17.98	-4.66	-20.50	-14.14	-19.56	-9.00	-19.83	-4.92	-22.57	-15.61	-17.44
Fs (kip)	-1406.29	-2013.34	-582.18	-1706.03	-1537.54	-1779.92	-461.39	-2029.17	-1399.84	-1936.61	-891.24	-1962.97	-487.37	-2234.71	-1545.57	-1726.64

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1545.57	2234.71

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	312.50	74.74	360.67	28.82	172.67	167.89	44.93	350.60	227.62	53.41	261.65	20.97	199.59	97.86	32.35	254.54
Vuw (kip)	468.75	112.11	541.00	43.23	259.00	251.84	67.39	525.90	---	---	---	---	---	---	---	---
Mv (k*ft)	263.67	63.06	304.31	24.32	145.69	141.66	37.91	295.82	128.04	30.04	147.18	11.79	112.27	55.05	18.19	143.18
Huw (kip)	-2502.46	-1917.47	-2591.87	-1837.18	-2517.26	-2483.60	-1859.53	-2596.62	-1036.25	-693.40	-1005.29	-754.71	-1011.05	-864.91	-824.87	-991.58
Muw (k*ft)	354.01	744.00	294.40	797.53	344.14	366.58	782.62	291.23	122.64	227.04	48.97	316.72	108.44	216.51	353.00	36.58
Mu (k*ft)	617.68	807.07	598.71	821.84	489.83	508.24	820.53	587.05	250.67	257.08	196.15	328.52	220.71	271.56	371.19	179.76

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.50	29.50	39.87	28.26	38.73	38.21	28.61	39.95	15.94	10.67	15.47	11.61	15.55	13.31	12.69	15.26
PY1 (Vuw)	7.21	1.72	8.32	0.67	3.98	3.87	1.04	8.09	3.50	0.82	4.03	0.32	3.07	1.51	0.50	3.92
PX2 (Mu)	14.25	18.62	13.82	18.97	11.30	11.73	18.94	13.55	5.78	5.93	4.53	7.58	5.09	6.27	8.57	4.15
PY2 (Mu)	4.75	6.21	4.61	6.32	3.77	3.91	6.31	4.52	1.93	1.98	1.51	2.53	1.70	2.09	2.86	1.38
Pu (kip)	54.09	48.77	55.23	47.74	50.63	50.54	48.11	54.96	22.40	16.83	20.74	19.40	21.19	19.90	21.52	20.11

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.75	40.67	44.43	40.01	41.19	41.17	40.25	44.24
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	541.00
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	779.87	8.67	OK
BF	2551.51	28.35	OK	1127.61	12.53	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.23	27.61	OK	22.40	11.20	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.23	1.47	114.56	OK
Web SPL	27.61	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	1.94	4.84
Web	1.31	1.61	2.07
BF	1.28	1.34	4.84

Plate	Shear	Flexure
Web	3.03	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.21	-25.72	-7.14	-20.79	-19.60	-22.51	-5.95	-25.19	-11.33	-20.96	-11.02	-20.39	-6.55	-28.06	-19.33	-21.48
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.27	0.38	0.10	0.31	0.29	0.33	0.09	0.37	0.17	0.31	0.16	0.30	0.10	0.41	0.28	0.32
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.72		-20.79		-22.51		-25.19		-20.96		-20.39		-28.06		-21.48
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-18.21		-7.14		-19.60		-5.95		-11.33		-11.02		-6.55		-19.33	
Rcf	1.82		1.82		1.82		1.82		1.82		1.82		1.82		1.82	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.29348	-18.69599	-5.193353	-15.19519	-14.26955	-16.42666	-4.353461	-18.30614	-11.72457	-16.50161	-7.154172	-16.69208	-4.778811	-20.32946	-14.08	-15.70
Fs (ksi)	-13.29	-18.70	-5.19	-15.20	-14.27	-16.43	-4.35	-18.31	-11.72	-16.50	-7.15	-16.69	-4.78	-20.33	-14.08	-15.70
Fs (kip)	-1316.05	-1850.90	-514.14	-1504.32	-1412.69	-1626.24	-430.99	-1812.31	-1160.73	-1633.66	-708.26	-1652.52	-473.10	-2012.62	-1394.31	-1553.85

Vu (kip)	312.50	74.74	360.67	28.82	172.67	167.89	44.93	350.60	227.62	53.41	261.65	20.97	199.59	97.86	32.35	254.54
Vuw (kip)	468.75	112.11	541.00	43.23	259.00	251.84	67.39	525.90	---	---	---	---	---	---	---	---
Mv (k*ft)	263.67	63.06	304.31	24.32	145.69	141.66	37.91	295.82	128.04	30.04	147.18	11.79	112.27	55.05	18.19	143.18
Huw (kip)	-2511.47	-1906.66	-2586.92	-1841.74	-2135.26	-2118.81	-1874.62	-2572.57	-959.68	-611.66	-920.89	-679.79	-846.79	-715.39	-753.25	-893.38
Muw (k*ft)	348.00	751.21	297.70	794.49	598.81	609.77	772.57	307.27	108.05	200.04	43.14	279.05	95.54	190.76	311.01	32.23
Mu (k*ft)	611.67	814.27	602.02	818.81	744.49	751.43	810.48	603.08	236.09	230.08	190.32	290.85	207.81	245.81	329.21	175.41

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.64	29.33	39.80	28.33	32.85	32.60	28.84	39.58	14.76	9.41	14.17	10.46	13.03	11.01	11.59	13.74
PY1 (Vuw)	7.21	1.72	8.32	0.67	3.98	3.87	1.04	8.09	3.50	0.82	4.03	0.32	3.07	1.51	0.50	3.92
PX2 (Mu)	14.12	18.79	13.89	18.90	17.18	17.34	18.70	13.92	5.45	5.31	4.39	6.71	4.80	5.67	7.60	4.05
PY2 (Mu)	4.71	6.26	4.63	6.30	5.73	5.78	6.23	4.64	1.82	1.77	1.46	2.24	1.60	1.89	2.53	1.35
Pu (kip)	54.08	48.78	55.23	47.74	50.96	50.86	48.10	54.99	20.90	14.95	19.35	17.36	18.42	17.02	19.42	18.55

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.73	40.69	44.44	40.00	41.98	41.93	40.22	44.29
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.23	27.62	OK	20.90	10.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.23	1.47	114.56	OK
Web SPL	27.62	1.47	91.65	OK

Field Splice - Node 5507

Node 5507

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5507 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
5507 R	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5507 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.33	-27.78	-7.21	-22.59	-20.47	-24.46	-5.64	-27.56	-19.17	-30.04	-18.64	-29.86	-5.87	-30.33	-20.40	-23.42
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.28	0.41	0.11	0.33	0.30	0.36	0.08	0.40	0.28	0.44	0.27	0.44	0.09	0.45	0.30	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-27.78		-22.59		-24.46		-27.56		-30.04		-29.86		-30.33		-23.42
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-19.33		-7.21		-20.47		-5.64		-19.17		-18.64		-5.87		-20.40	
Rcf	1.68		1.68		1.68		1.68		1.68		1.68		1.68		1.68	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.95	-20.33	-4.93	-16.83	-14.84	-17.90	-3.69	-20.47	-11.60	-19.66	-9.71	-19.69	-3.81	-22.47	-14.81	-17.14
Fs (ksi)	-13.95	-20.33	-4.93	-16.83	-14.84	-17.90	-3.69	-20.47	-11.60	-19.66	-9.71	-19.69	-3.81	-22.47	-14.81	-17.14
Fs (kip)	-1380.78	-2012.57	-487.86	-1666.52	-1469.05	-1771.66	-365.68	-2026.11	-1148.72	-1946.54	-960.92	-1949.56	-377.13	-2224.59	-1465.71	-1697.20

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1469.05	2224.59

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	324.23	80.96	365.76	27.38	172.51	167.20	39.05	355.47	235.97	57.28	265.30	19.43	160.94	126.22	27.67	258.04
Vuw (kip)	486.35	121.44	548.64	41.07	258.77	250.80	58.58	533.21	---	---	---	---	---	---	---	---
Mv (k*ft)	273.57	68.31	308.61	23.10	145.56	141.08	32.95	299.93	132.73	32.22	149.23	10.93	90.53	71.00	15.56	145.15
Huw (kip)	-2493.25	-1881.29	-2551.01	-1801.81	-2485.57	-2458.68	-1813.49	-2547.30	-1028.29	-652.84	-982.03	-724.79	-937.96	-881.96	-788.40	-958.46
Muw (k*ft)	360.15	768.12	321.64	821.11	365.26	383.19	813.32	324.11	127.64	238.11	61.13	335.44	161.18	199.72	373.22	46.77
Mu (k*ft)	633.72	836.43	630.25	844.21	510.82	524.27	846.27	624.04	260.37	270.33	210.37	346.37	251.71	270.72	388.79	191.91

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.36	28.94	39.25	27.72	38.24	37.83	27.90	39.19	15.82	10.04	15.11	11.15	14.43	13.57	12.13	14.75
PY1 (Vuw)	7.48	1.87	8.44	0.63	3.98	3.86	0.90	8.20	3.63	0.88	4.08	0.30	2.48	1.94	0.43	3.97
PX2 (Mu)	14.62	19.30	14.54	19.48	11.79	12.10	19.53	14.40	6.01	6.24	4.85	7.99	5.81	6.25	8.97	4.43
PY2 (Mu)	4.87	6.43	4.85	6.49	3.93	4.03	6.51	4.80	2.00	2.08	1.62	2.66	1.94	2.08	2.99	1.48
Pu (kip)	54.40	48.95	55.41	47.74	50.65	50.54	48.00	55.15	22.54	16.55	20.76	19.37	20.71	20.22	21.38	19.93

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.98	40.86	44.61	40.05	41.25	41.21	40.24	44.43
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	548.64
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	741.26	8.24	OK
BF	2551.51	28.35	OK	1122.50	12.47	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.41	27.70	OK	22.54	11.27	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.41	1.47	114.56	OK
Web SPL	27.70	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	2.04	4.84
Web	1.31	1.56	2.07
BF	1.28	1.35	4.84

Plate	Shear	Flexure
Web	2.99	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.72	-26.57	-7.38	-21.65	-19.87	-23.57	-5.97	-26.31	-11.38	-21.46	-11.10	-21.51	-6.41	-29.10	-19.62	-22.42
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.27	0.39	0.11	0.32	0.29	0.35	0.09	0.39	0.17	0.32	0.16	0.32	0.09	0.43	0.29	0.33
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.57		-21.65		-23.57		-26.31		-21.46		-21.51		-29.10		-22.42
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-18.72		-7.38		-19.87		-5.97		-11.38		-11.10		-6.41		-19.62	
Rcf	1.76		1.76		1.76		1.76		1.76		1.76		1.76		1.76	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.65658	-19.2793	-5.329894	-15.81949	-14.46754	-17.16062	-4.335867	-19.11304	-10.04036	-17.14069	-8.505066	-17.30352	-4.644091	-21.08576	-14.29	-16.35
Fs (ksi)	-13.66	-19.28	-5.33	-15.82	-14.47	-17.16	-4.34	-19.11	-10.04	-17.14	-8.51	-17.30	-4.64	-21.09	-14.29	-16.35
Fs (kip)	-1352.00	-1908.65	-527.66	-1566.13	-1432.29	-1698.90	-429.25	-1892.19	-994.00	-1696.93	-842.00	-1713.05	-459.76	-2087.49	-1414.87	-1618.83

Vu (kip)	324.23	80.96	365.76	27.38	172.51	167.20	39.05	355.47	235.97	57.28	265.30	19.43	160.94	126.22	27.67	258.04
Vuw (kip)	486.35	121.44	548.64	41.07	258.77	250.80	58.58	533.21	---	---	---	---	---	---	---	---
Mv (k*ft)	273.57	68.31	308.61	23.10	145.56	141.08	32.95	299.93	132.73	32.22	149.23	10.93	90.53	71.00	15.56	145.15
Huw (kip)	-2502.43	-1905.40	-2562.87	-1831.32	-2115.78	-2101.10	-1854.29	-2549.76	-988.08	-634.48	-948.84	-703.47	-815.43	-774.26	-771.90	-919.30
Muw (k*ft)	354.03	752.05	313.73	801.44	611.79	621.58	786.12	322.47	112.45	209.79	53.86	295.54	142.01	175.97	328.83	41.20
Mu (k*ft)	627.60	820.35	622.34	824.54	757.35	762.66	819.07	622.40	245.18	242.01	203.10	306.47	232.53	246.97	344.40	186.35

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.50	29.31	39.43	28.17	32.55	32.32	28.53	39.23	15.20	9.76	14.60	10.82	12.55	11.91	11.88	14.14
PY1 (Vuw)	7.48	1.87	8.44	0.63	3.98	3.86	0.90	8.20	3.63	0.88	4.08	0.30	2.48	1.94	0.43	3.97
PX2 (Mu)	14.48	18.93	14.36	19.03	17.48	17.60	18.90	14.36	5.66	5.58	4.69	7.07	5.37	5.70	7.95	4.30
PY2 (Mu)	4.83	6.31	4.79	6.34	5.83	5.87	6.30	4.79	1.89	1.86	1.56	2.36	1.79	1.90	2.65	1.43
Pu (kip)	54.39	48.93	55.39	47.71	50.98	50.86	47.97	55.14	21.58	15.59	20.09	18.09	18.41	18.02	20.06	19.22

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.96	40.81	44.58	39.99	42.02	41.96	40.15	44.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.39	27.70	OK	21.58	10.79	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.39	1.47	114.56	OK
Web SPL	27.70	1.47	91.65	OK

Field Splice - Node 7507

Node 7507

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7507 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
7507 R	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7507 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.94	-27.22	-6.96	-22.67	-19.17	-23.53	-5.38	-27.20	-18.51	-29.56	-18.54	-29.86	-6.07	-30.20	-19.36	-22.89
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.26	0.40	0.10	0.33	0.28	0.35	0.08	0.40	0.27	0.43	0.27	0.44	0.09	0.44	0.28	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-27.22		-22.67		-23.53		-27.20		-29.56		-29.86		-30.20		-22.89
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-17.94		-6.96		-19.17		-5.38		-18.51		-18.54		-6.07		-19.36	
Rcf	1.69		1.69		1.69		1.69		1.69		1.69		1.69		1.69	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.23	-20.23	-5.13	-17.34	-14.07	-17.40	-3.90	-20.66	-9.40	-20.41	-12.76	-19.48	-4.35	-22.82	-14.35	-17.06
Fs (ksi)	-13.23	-20.23	-5.13	-17.34	-14.07	-17.40	-3.90	-20.66	-9.40	-20.41	-12.76	-19.48	-4.35	-22.82	-14.35	-17.06
Fs (kip)	-1310.22	-2002.72	-508.18	-1716.71	-1392.92	-1723.00	-386.40	-2044.86	-930.36	-2020.10	-1263.10	-1928.78	-430.36	-2258.74	-1420.31	-1688.86

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1420.31	2258.74

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	294.61	66.81	342.44	20.22	154.18	161.06	34.87	331.85	214.95	46.85	248.75	13.93	104.57	178.67	24.28	241.27
Vuw (kip)	441.91	100.21	513.65	30.33	231.27	241.60	52.30	497.77	---	---	---	---	---	---	---	---
Mv (k*ft)	248.58	56.37	288.93	17.06	130.09	135.90	29.42	280.00	120.91	26.35	139.92	7.83	58.82	100.50	13.66	135.71
Huw (kip)	-2427.04	-1869.99	-2489.39	-1789.87	-2455.79	-2457.49	-1824.88	-2499.15	-1003.92	-674.21	-944.22	-736.74	-894.08	-967.24	-814.88	-942.17
Muw (k*ft)	404.29	775.65	362.72	829.07	385.12	383.99	805.73	356.22	139.90	244.15	66.68	335.04	220.15	134.48	369.37	54.25
Mu (k*ft)	652.86	832.02	651.65	846.13	515.21	519.88	835.15	636.21	260.81	270.50	206.60	342.88	278.97	234.98	383.03	189.97

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.34	28.77	38.30	27.54	37.78	37.81	28.08	38.45	15.44	10.37	14.53	11.33	13.76	14.88	12.54	14.49
PY1 (Vuw)	6.80	1.54	7.90	0.47	3.56	3.72	0.80	7.66	3.31	0.72	3.83	0.21	1.61	2.75	0.37	3.71
PX2 (Mu)	15.07	19.20	15.04	19.53	11.89	12.00	19.27	14.68	6.02	6.24	4.77	7.91	6.44	5.42	8.84	4.38
PY2 (Mu)	5.02	6.40	5.01	6.51	3.96	4.00	6.42	4.89	2.01	2.08	1.59	2.64	2.15	1.81	2.95	1.46
Pu (kip)	53.72	48.62	54.88	47.58	50.24	50.40	47.90	54.59	22.11	16.85	20.04	19.46	20.54	20.81	21.63	19.57

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.58	40.62	44.31	39.95	40.98	41.10	40.14	44.10
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	513.65
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	716.67	7.96	OK
BF	2551.51	28.35	OK	1139.73	12.66	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.88	27.44	OK	22.11	11.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.88	1.47	114.56	OK
Web SPL	27.44	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	2.11	4.84
Web	1.32	1.60	2.09
BF	1.28	1.33	4.84

Plate	Shear	Flexure
Web	3.19	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.54	-26.16	-6.60	-21.17	-18.85	-22.90	-5.37	-25.62	-10.44	-20.69	-10.77	-21.27	-6.02	-28.41	-18.59	-21.86
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.26	0.38	0.10	0.31	0.28	0.34	0.08	0.38	0.15	0.30	0.16	0.31	0.09	0.42	0.27	0.32
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.16		-21.17		-22.90		-25.62		-20.69		-21.27		-28.41		-21.86
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-17.54		-6.60		-18.85		-5.37		-10.44		-10.77		-6.02		-18.59	
Rcf	1.80		1.80		1.80		1.80		1.80		1.80		1.80		1.80	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.82901	-18.99198	-4.751282	-15.50666	-13.75486	-16.69242	-3.887736	-18.64744	-7.333649	-17.03185	-10.85721	-16.78153	-4.347237	-20.61912	-13.57	-15.96
Fs (ksi)	-12.83	-18.99	-4.75	-15.51	-13.75	-16.69	-3.89	-18.65	-7.33	-17.03	-10.86	-16.78	-4.35	-20.62	-13.57	-15.96
Fs (kip)	-1270.07	-1880.21	-470.38	-1535.16	-1361.73	-1652.55	-384.89	-1846.10	-726.03	-1686.15	-1074.86	-1661.37	-430.38	-2041.29	-1343.01	-1579.62

Vu (kip)	294.61	66.81	342.44	20.22	154.18	161.06	34.87	331.85	214.95	46.85	248.75	13.93	104.57	178.67	24.28	241.27
Vuw (kip)	441.91	100.21	513.65	30.33	231.27	241.60	52.30	497.77	---	---	---	---	---	---	---	---
Mv (k*ft)	248.58	56.37	288.93	17.06	130.09	135.90	29.42	280.00	120.91	26.35	139.92	7.83	58.82	100.50	13.66	135.71
Huw (kip)	-2463.00	-1872.51	-2533.68	-1806.59	-2079.88	-2097.44	-1841.67	-2519.24	-954.63	-607.74	-913.42	-676.06	-730.96	-829.16	-748.99	-885.64
Muw (k*ft)	380.31	773.97	333.19	817.92	635.73	624.02	794.54	342.82	123.26	215.11	58.75	295.19	193.96	118.49	325.44	47.80
Mu (k*ft)	628.89	830.34	622.12	834.98	765.82	759.92	823.95	622.81	244.17	241.46	198.67	303.03	252.78	218.99	339.09	183.51

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.89	28.81	38.98	27.79	32.00	32.27	28.33	38.76	14.69	9.35	14.05	10.40	11.25	12.76	11.52	13.63
PY1 (Vuw)	6.80	1.54	7.90	0.47	3.56	3.72	0.80	7.66	3.31	0.72	3.83	0.21	1.61	2.75	0.37	3.71
PX2 (Mu)	14.51	19.16	14.36	19.27	17.67	17.54	19.01	14.37	5.63	5.57	4.58	6.99	5.83	5.05	7.83	4.23
PY2 (Mu)	4.84	6.39	4.79	6.42	5.89	5.85	6.34	4.79	1.88	1.86	1.53	2.33	1.94	1.68	2.61	1.41
Pu (kip)	53.68	48.62	54.82	47.56	50.56	50.71	47.88	54.57	20.97	15.14	19.39	17.58	17.44	18.35	19.58	18.58

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.50	40.62	44.22	39.91	41.76	41.85	40.10	44.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.82	27.41	OK	20.97	10.49	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.82	1.47	114.56	OK
Web SPL	27.41	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9507	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9507

Node 9507

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9507 L	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00
9507 R	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9507 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.74	-25.30	-5.85	-21.35	-17.24	-21.41	-4.63	-27.02	-16.94	-27.40	-16.93	-27.89	-5.25	-28.93	-17.71	-20.81
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.23	0.37	0.09	0.31	0.25	0.31	0.07	0.40	0.25	0.40	0.25	0.41	0.08	0.42	0.26	0.31
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.30		-21.35		-21.41		-27.02		-27.40		-27.89		-28.93		-20.81
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-15.74		-5.85		-17.24		-4.63		-16.94		-16.93		-5.25		-17.71	
Rcf	1.77		1.77		1.77		1.77		1.77		1.77		1.77		1.77	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.96	-19.16	-4.80	-16.89	-13.12	-16.31	-3.81	-21.03	-7.18	-19.74	-12.38	-17.50	-4.22	-22.40	-13.47	-15.86
Fs (ksi)	-11.96	-19.16	-4.80	-16.89	-13.12	-16.31	-3.81	-21.03	-7.18	-19.74	-12.38	-17.50	-4.22	-22.40	-13.47	-15.86
Fs (kip)	-1183.78	-1896.98	-475.35	-1672.47	-1298.81	-1614.86	-377.06	-2081.80	-711.00	-1954.75	-1225.83	-1732.48	-417.98	-2217.92	-1333.99	-1570.30

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1333.99	2217.92

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	247.51	28.09	303.49	13.46	119.62	135.84	3.50	292.66	181.64	19.62	221.19	9.74	50.90	167.50	2.25	213.54
Vuw (kip)	371.26	42.13	455.23	20.20	179.43	203.77	5.25	438.99	---	---	---	---	---	---	---	---
Mv (k*ft)	208.83	23.70	256.07	11.36	100.93	114.62	2.96	246.93	102.17	11.04	124.42	5.48	28.63	94.22	1.27	120.12
Huw (kip)	-2350.40	-1826.81	-2429.93	-1762.07	-2414.22	-2413.30	-1794.89	-2455.05	-933.56	-650.85	-882.93	-745.11	-807.80	-896.46	-798.76	-880.09
Muw (k*ft)	455.38	804.44	402.36	847.60	412.83	413.45	825.72	385.61	144.08	241.84	63.85	344.39	251.26	102.35	363.62	47.74
Mu (k*ft)	664.21	828.14	658.43	858.96	513.76	528.07	828.68	632.54	246.26	252.88	188.27	349.87	279.89	196.57	364.89	167.86

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	36.16	28.10	37.38	27.11	37.14	37.13	27.61	37.77	14.36	10.01	13.58	11.46	12.43	13.79	12.29	13.54
PY1 (Vuw)	5.71	0.65	7.00	0.31	2.76	3.13	0.08	6.75	2.79	0.30	3.40	0.15	0.78	2.58	0.03	3.29
PX2 (Mu)	15.33	19.11	15.19	19.82	11.86	12.19	19.12	14.60	5.68	5.84	4.34	8.07	6.46	4.54	8.42	3.87
PY2 (Mu)	5.11	6.37	5.06	6.61	3.95	4.06	6.37	4.87	1.89	1.95	1.45	2.69	2.15	1.51	2.81	1.29
Pu (kip)	52.61	47.73	53.95	47.44	49.46	49.84	47.18	53.64	20.59	16.01	18.57	19.74	19.11	18.78	20.90	18.00

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.89	40.01	43.73	39.88	40.44	40.74	39.64	43.49
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	455.23
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9507**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	673.11	7.48	OK
BF	2551.51	28.35	OK	1119.13	12.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.95	26.97	OK	20.90	10.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.95	1.47	114.56	OK
Web SPL	26.97	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	2.25	4.84
Web	1.34	1.76	2.13
BF	1.28	1.35	4.84

Plate	Shear	Flexure
Web	3.60	1.15

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.33	-24.21	-4.50	-18.88	-16.64	-20.52	-3.79	-24.56	-8.41	-18.12	-9.36	-19.53	-4.19	-26.16	-16.53	-19.40
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.23	0.36	0.07	0.28	0.24	0.30	0.06	0.36	0.12	0.27	0.14	0.29	0.06	0.38	0.24	0.28
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-24.21		-18.88		-20.52		-24.56		-18.12		-19.53		-26.16		-19.40
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-15.33		-4.50		-16.64		-3.79		-8.41		-9.36		-4.19		-16.53	
Rcf	1.95		1.95		1.95		1.95		1.95		1.95		1.95		1.95	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.25567	-17.60294	-3.262363	-13.9162	-12.18354	-14.99629	-2.755511	-17.92702	-4.541929	-15.61083	-10.24146	-14.75049	-3.038828	-19.05753	-12.11	-14.21
Fs (ksi)	-11.26	-17.60	-3.26	-13.92	-12.18	-15.00	-2.76	-17.93	-4.54	-15.61	-10.24	-14.75	-3.04	-19.06	-12.11	-14.21
Fs (kip)	-1114.31	-1742.69	-322.97	-1377.70	-1206.17	-1484.63	-272.80	-1774.78	-449.65	-1545.47	-1013.90	-1460.30	-300.84	-1886.70	-1198.48	-1406.68

Vu (kip)	247.51	28.09	303.49	13.46	119.62	135.84	3.50	292.66	181.64	19.62	221.19	9.74	50.90	167.50	2.25	213.54
Vuw (kip)	371.26	42.13	455.23	20.20	179.43	203.77	5.25	438.99	---	---	---	---	---	---	---	---
Mv (k*ft)	208.83	23.70	256.07	11.36	100.93	114.62	2.96	246.93	102.17	11.04	124.42	5.48	28.63	94.22	1.27	120.12
Huw (kip)	-2414.91	-1780.53	-2491.85	-1738.50	-2009.61	-2064.80	-1762.00	-2485.41	-865.76	-515.36	-815.39	-620.48	-604.58	-749.76	-662.89	-789.44
Muw (k*ft)	412.37	835.29	361.08	863.31	682.57	645.78	847.65	365.37	126.95	213.08	56.26	303.43	221.38	90.18	320.37	42.06
Mu (k*ft)	621.21	858.99	617.15	874.67	783.50	760.40	850.60	612.30	229.12	224.11	180.68	308.91	250.01	184.40	321.64	162.18

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9507	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.15	27.39	38.34	26.75	30.92	31.77	27.11	38.24	13.32	7.93	12.54	9.55	9.30	11.53	10.20	12.15
PY1 (Vuw)	5.71	0.65	7.00	0.31	2.76	3.13	0.08	6.75	2.79	0.30	3.40	0.15	0.78	2.58	0.03	3.29
PX2 (Mu)	14.34	19.82	14.24	20.18	18.08	17.55	19.63	14.13	5.29	5.17	4.17	7.13	5.77	4.26	7.42	3.74
PY2 (Mu)	4.78	6.61	4.75	6.73	6.03	5.85	6.54	4.71	1.76	1.72	1.39	2.38	1.92	1.42	2.47	1.25
Pu (kip)	52.55	47.77	53.88	47.46	49.78	50.13	47.20	53.61	19.16	13.26	17.39	16.86	15.31	16.29	17.80	16.52

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.75	40.11	43.61	39.93	41.29	41.47	39.70	43.42
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.88	26.94	OK	19.16	9.58	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.88	1.47	114.56	OK
Web SPL	26.94	1.47	91.65	OK

Field Splice - Node 1511

Node 1511

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1511 L	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00
1511 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1511 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.75	-20.65	-18.02	-25.96	-19.84	-21.44	-5.37	-25.03	-17.59	-26.33	-18.91	-27.87	-20.31	-20.96	-6.06	-27.97
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.10	0.30	0.26	0.38	0.29	0.31	0.08	0.37	0.26	0.39	0.28	0.41	0.30	0.31	0.09	0.41
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.65		-25.96		-21.44		-25.03		-26.33		-27.87		-20.96		-27.97
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-6.75		-18.02		-19.84		-5.37		-17.59		-18.91		-20.31		-6.06	
Rcf	1.83		1.83		1.83		1.83		1.83		1.83		1.83		1.83	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.71	-16.42	-13.70	-19.70	-15.10	-16.39	-4.62	-19.62	-8.45	-19.27	-14.67	-17.73	-15.45	-16.03	-5.07	-21.74
Fs (ksi)	-5.71	-16.42	-13.70	-19.70	-15.10	-16.39	-4.62	-19.62	-8.45	-19.27	-14.67	-17.73	-15.45	-16.03	-5.07	-21.74
Fs (kip)	-564.87	-1625.66	-1356.15	-1950.49	-1495.01	-1622.64	-457.28	-1942.53	-836.58	-1907.30	-1452.72	-1755.73	-1529.69	-1587.33	-501.90	-2152.35

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1529.69	2152.35

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	47.33	275.34	348.26	2.46	143.86	162.95	330.12	23.42	34.73	201.74	253.26	3.03	74.94	202.59	240.44	17.84
Vuw (kip)	70.99	413.02	522.40	3.68	215.79	244.43	495.18	35.13	---	---	---	---	---	---	---	---
Mv (k*ft)	39.93	232.32	293.85	2.07	121.38	137.49	278.54	19.76	19.54	113.48	142.46	1.70	42.15	113.96	135.25	10.04
Huw (kip)	-1886.61	-2504.34	-2603.88	-1810.72	-2480.73	-2552.61	-2629.67	-1848.94	-663.80	-1002.01	-944.74	-727.22	-831.48	-972.26	-944.55	-804.32
Muw (k*ft)	764.58	352.75	286.39	815.17	368.49	320.57	269.20	789.69	214.30	120.07	25.79	300.05	216.31	61.21	11.64	333.42
Mu (k*ft)	804.51	585.08	580.24	817.24	489.88	458.06	547.74	809.45	233.84	233.54	168.24	301.76	258.46	175.17	146.89	343.46

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.02	38.53	40.06	27.86	38.17	39.27	40.46	28.45	10.21	15.42	14.53	11.19	12.79	14.96	14.53	12.37
PY1 (Vuw)	1.09	6.35	8.04	0.06	3.32	3.76	7.62	0.54	0.53	3.10	3.90	0.05	1.15	3.12	3.70	0.27
PX2 (Mu)	18.57	13.50	13.39	18.86	11.30	10.57	12.64	18.68	5.40	5.39	3.88	6.96	5.96	4.04	3.39	7.93
PY2 (Mu)	6.19	4.50	4.46	6.29	3.77	3.52	4.21	6.23	1.80	1.80	1.29	2.32	1.99	1.35	1.13	2.64
Pu (kip)	48.14	53.15	54.89	47.15	49.98	50.37	54.40	47.61	15.78	21.37	19.13	18.31	19.02	19.52	18.56	20.51

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.24	43.07	44.18	39.58	40.74	40.94	43.80	39.88
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	522.40
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	771.86	8.58	OK
BF	2551.51	28.35	OK	1086.05	12.07	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.89	27.45	OK	21.37	10.69	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.89	1.47	114.56	OK
Web SPL	27.45	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	1.96	4.84
Web	1.32	1.76	2.09
BF	1.28	1.39	4.84

Plate	Shear	Flexure
Web	3.14	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.29	-18.19	-16.23	-23.59	-18.02	-19.51	-4.49	-22.73	-9.38	-17.49	-10.47	-18.79	-17.73	-18.34	-5.22	-25.55
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.08	0.27	0.24	0.35	0.26	0.29	0.07	0.33	0.14	0.26	0.15	0.28	0.26	0.27	0.08	0.38
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-18.19		-23.59		-19.51		-22.73		-17.49		-18.79		-18.34		-25.55
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-5.29		-16.23		-18.02		-4.49		-9.38		-10.47		-17.73		-5.22	
Rcf	2.00		2.00		2.00		2.00		2.00		2.00		2.00		2.00	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.921289	-13.36184	-11.88287	-17.17224	-13.14975	-14.28567	-3.354807	-16.57292	-5.763829	-15.29274	-11.52999	-14.22658	-12.94408	-13.45705	-3.87	-18.56
Fs (ksi)	-3.92	-13.36	-11.88	-17.17	-13.15	-14.29	-3.35	-16.57	-5.76	-15.29	-11.53	-14.23	-12.94	-13.46	-3.87	-18.56
Fs (kip)	-388.21	-1322.82	-1176.40	-1700.05	-1301.83	-1414.28	-332.13	-1640.72	-570.62	-1513.98	-1141.47	-1408.43	-1281.46	-1332.25	-383.38	-1837.53

Vu (kip)	47.33	275.34	348.26	2.46	143.86	162.95	330.12	23.42	34.73	201.74	253.26	3.03	74.94	202.59	240.44	17.84
Vuw (kip)	70.99	413.02	522.40	3.68	215.79	244.43	495.18	35.13	---	---	---	---	---	---	---	---
Mv (k*ft)	39.93	232.32	293.85	2.07	121.38	137.49	278.54	19.76	19.54	113.48	142.46	1.70	42.15	113.96	135.25	10.04
Huw (kip)	-1834.10	-2490.35	-2597.90	-1786.01	-2079.33	-2144.89	-2580.44	-1829.97	-518.49	-871.65	-823.06	-597.83	-631.70	-772.70	-792.03	-673.00
Muw (k*ft)	799.58	362.08	290.38	831.64	636.10	592.38	302.02	802.34	188.81	105.79	22.72	264.36	190.58	53.93	10.26	293.77
Mu (k*ft)	839.51	594.40	584.23	833.71	757.48	729.87	580.56	822.09	208.35	219.26	165.17	266.07	232.73	167.89	145.50	303.80

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.22	38.31	39.97	27.48	31.99	33.00	39.70	28.15	7.98	13.41	12.66	9.20	9.72	11.89	12.19	10.35
PY1 (Vuw)	1.09	6.35	8.04	0.06	3.32	3.76	7.62	0.54	0.53	3.10	3.90	0.05	1.15	3.12	3.70	0.27
PX2 (Mu)	19.37	13.72	13.48	19.24	17.48	16.84	13.40	18.97	4.81	5.06	3.81	6.14	5.37	3.87	3.36	7.01
PY2 (Mu)	6.46	4.57	4.49	6.41	5.83	5.61	4.47	6.32	1.60	1.69	1.27	2.05	1.79	1.29	1.12	2.34
Pu (kip)	48.19	53.16	54.90	47.16	50.31	50.72	54.45	47.62	12.96	19.08	17.27	15.48	15.37	16.37	16.27	17.56

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.35	43.10	44.19	39.64	41.58	41.79	43.90	39.92
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.90	27.45	OK	19.08	9.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.90	1.47	114.56	OK
Web SPL	27.45	1.47	91.65	OK

Field Splice - Node 3511

Node 3511

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3511 L	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00
3511 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3511 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.95	-22.75	-19.08	-27.42	-20.65	-23.98	-6.28	-27.10	-19.13	-29.26	-19.49	-29.87	-20.40	-22.88	-6.97	-30.08
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.12	0.33	0.28	0.40	0.30	0.35	0.09	0.40	0.28	0.43	0.29	0.44	0.30	0.34	0.10	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.75		-27.42		-23.98		-27.10		-29.26		-29.87		-22.88		-30.08
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-7.95		-19.08		-20.65		-6.28		-19.13		-19.49		-20.40		-6.97	
Rcf	1.70		1.70		1.70		1.70		1.70		1.70		1.70		1.70	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.06	-17.48	-14.13	-20.45	-15.34	-17.93	-4.77	-20.67	-10.33	-20.27	-14.19	-19.72	-15.18	-17.14	-5.21	-22.82
Fs (ksi)	-6.06	-17.48	-14.13	-20.45	-15.34	-17.93	-4.77	-20.67	-10.33	-20.27	-14.19	-19.72	-15.18	-17.14	-5.21	-22.82
Fs (kip)	-599.79	-1730.70	-1399.30	-2024.96	-1518.47	-1775.53	-472.35	-2046.19	-1022.73	-2007.00	-1405.16	-1951.95	-1503.03	-1696.93	-516.15	-2258.84

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1518.47	2258.84

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	77.28	318.15	365.68	28.36	166.99	174.67	355.67	43.98	54.98	231.86	265.44	20.42	118.52	198.63	258.36	31.45
Vuw (kip)	115.92	477.22	548.52	42.53	250.48	262.01	533.50	65.96	---	---	---	---	---	---	---	---
Mv (k*ft)	65.20	268.44	308.54	23.92	140.90	147.38	300.09	37.10	30.93	130.42	149.31	11.49	66.67	111.73	145.33	17.69
Huw (kip)	-1921.46	-2488.52	-2568.53	-1836.79	-2491.45	-2509.29	-2556.12	-1871.79	-706.21	-1037.66	-998.18	-763.19	-918.10	-1017.31	-969.69	-840.90
Muw (k*ft)	741.34	363.30	309.96	797.78	361.35	349.45	318.23	774.45	228.47	126.40	51.93	317.95	198.84	110.46	39.17	352.06
Mu (k*ft)	806.54	631.74	618.50	821.71	502.25	496.83	618.33	811.56	259.40	256.81	201.24	329.43	265.51	222.19	184.50	369.75

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.56	38.28	39.52	28.26	38.33	38.60	39.32	28.80	10.86	15.96	15.36	11.74	14.12	15.65	14.92	12.94
PY1 (Vuw)	1.78	7.34	8.44	0.65	3.85	4.03	8.21	1.01	0.85	3.57	4.08	0.31	1.82	3.06	3.97	0.48
PX2 (Mu)	18.61	14.58	14.27	18.96	11.59	11.47	14.27	18.73	5.99	5.93	4.64	7.60	6.13	5.13	4.26	8.53
PY2 (Mu)	6.20	4.86	4.76	6.32	3.86	3.82	4.76	6.24	2.00	1.98	1.55	2.53	2.04	1.71	1.42	2.84
Pu (kip)	48.83	54.25	55.38	47.73	50.51	50.68	55.14	48.08	17.09	22.58	20.78	19.55	20.62	21.32	19.92	21.73

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.71	43.88	44.57	40.00	41.14	41.24	44.41	40.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	548.52
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	766.20	8.51	OK
BF	2551.51	28.35	OK	1139.78	12.66	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.38	27.69	OK	22.58	11.29	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.38	1.47	114.56	OK
Web SPL	27.69	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	1.98	4.84
Web	1.31	1.60	2.07
BF	1.28	1.33	4.84

Plate	Shear	Flexure
Web	2.99	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.08	-20.82	-18.07	-25.81	-19.52	-22.61	-5.92	-25.24	-11.00	-20.39	-11.32	-20.96	-19.21	-21.51	-6.62	-28.07
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.10	0.31	0.27	0.38	0.29	0.33	0.09	0.37	0.16	0.30	0.17	0.31	0.28	0.32	0.10	0.41
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.82		-25.81		-22.61		-25.24		-20.39		-20.96		-21.51		-28.07
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-7.08		-18.07		-19.52		-5.92		-11.00		-11.32		-19.21		-6.62	
Rcf	1.82		1.82		1.82		1.82		1.82		1.82		1.82		1.82	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.159646	-15.22433	-13.18783	-18.75595	-14.20543	-16.49314	-4.338327	-18.34483	-7.942314	-16.70192	-11.64718	-16.51338	-13.99235	-15.71796	-4.83	-20.34
Fs (ksi)	-5.16	-15.22	-13.19	-18.76	-14.21	-16.49	-4.34	-18.34	-7.94	-16.70	-11.65	-16.51	-13.99	-15.72	-4.83	-20.34
Fs (kip)	-510.81	-1507.21	-1305.60	-1856.84	-1406.34	-1632.82	-429.49	-1816.14	-786.29	-1653.49	-1153.07	-1634.82	-1385.24	-1556.08	-478.41	-2013.83

Vu (kip)	77.28	318.15	365.68	28.36	166.99	174.67	355.67	43.98	54.98	231.86	265.44	20.42	118.52	198.63	258.36	31.45
Vuw (kip)	115.92	477.22	548.52	42.53	250.48	262.01	533.50	65.96	---	---	---	---	---	---	---	---
Mv (k*ft)	65.20	268.44	308.54	23.92	140.90	147.38	300.09	37.10	30.93	130.42	149.31	11.49	66.67	111.73	145.33	17.69
Huw (kip)	-1903.51	-2503.57	-2582.21	-1840.05	-2117.06	-2134.81	-2565.74	-1878.23	-611.52	-958.31	-920.96	-680.49	-739.33	-844.82	-891.31	-755.22
Muw (k*ft)	753.30	353.26	300.84	795.62	610.94	599.11	311.82	770.16	201.29	111.36	45.75	280.13	175.19	97.32	34.51	310.18
Mu (k*ft)	818.51	621.70	609.38	819.54	751.84	746.49	611.91	807.26	232.22	241.78	195.06	291.62	241.86	209.05	179.84	327.88

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.28	38.52	39.73	28.31	32.57	32.84	39.47	28.90	9.41	14.74	14.17	10.47	11.37	13.00	13.71	11.62
PY1 (Vuw)	1.78	7.34	8.44	0.65	3.85	4.03	8.21	1.01	0.85	3.57	4.08	0.31	1.82	3.06	3.97	0.48
PX2 (Mu)	18.89	14.35	14.06	18.91	17.35	17.23	14.12	18.63	5.36	5.58	4.50	6.73	5.58	4.82	4.15	7.57
PY2 (Mu)	6.30	4.78	4.69	6.30	5.78	5.74	4.71	6.21	1.79	1.86	1.50	2.24	1.86	1.61	1.38	2.52
Pu (kip)	48.85	54.24	55.37	47.73	50.84	51.01	55.13	48.07	15.00	21.03	19.49	17.39	17.35	18.42	18.65	19.42

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.74	43.85	44.54	39.99	41.92	42.02	44.39	40.19
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.37	27.68	OK	21.03	10.52	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.37	1.47	114.56	OK
Web SPL	27.68	1.47	91.65	OK

Field Splice - Node 5511

Node 5511

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5511 L	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00
5511 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5511 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.28	-22.47	-19.54	-27.78	-20.43	-24.33	-5.73	-27.55	-18.56	-29.72	-19.62	-30.45	-20.09	-23.19	-6.22	-30.49
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.11	0.33	0.29	0.41	0.30	0.36	0.08	0.40	0.27	0.44	0.29	0.45	0.29	0.34	0.09	0.45
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.47		-27.78		-24.33		-27.55		-29.72		-30.45		-23.19		-30.49
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-7.28		-19.54		-20.43		-5.73		-18.56		-19.62		-20.09		-6.22	
Rcf	1.68		1.68		1.68		1.68		1.68		1.68		1.68		1.68	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.07	-16.84	-14.17	-20.40	-14.88	-17.88	-3.62	-20.31	-10.40	-19.20	-12.40	-20.83	-14.65	-17.06	-3.92	-22.44
Fs (ksi)	-5.07	-16.84	-14.17	-20.40	-14.88	-17.88	-3.62	-20.31	-10.40	-19.20	-12.40	-20.83	-14.65	-17.06	-3.92	-22.44
Fs (kip)	-502.39	-1666.91	-1402.88	-2019.49	-1473.51	-1770.03	-358.38	-2010.46	-1029.69	-1901.16	-1227.37	-2062.51	-1450.64	-1689.05	-387.82	-2221.14

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1473.51	2221.14

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	80.44	328.78	368.25	22.63	164.20	172.56	356.88	35.90	56.48	239.54	267.43	15.63	135.40	165.69	259.40	25.01
Vuw (kip)	120.67	493.18	552.37	33.94	246.31	258.85	535.32	53.84	---	---	---	---	---	---	---	---
Mv (k*ft)	67.87	277.41	310.71	19.09	138.55	145.60	301.12	30.29	31.77	134.74	150.43	8.79	76.16	93.20	145.91	14.07
Huw (kip)	-1882.38	-2498.68	-2543.62	-1804.66	-2449.57	-2502.66	-2526.13	-1829.09	-657.36	-1037.08	-982.89	-717.83	-888.14	-996.94	-951.42	-790.59
Muw (k*ft)	767.40	356.53	326.57	819.21	389.27	353.87	338.23	802.92	235.26	124.57	59.90	333.75	176.05	168.72	48.16	370.37
Mu (k*ft)	835.27	633.94	637.28	838.30	527.81	499.47	639.35	833.20	267.03	259.31	210.33	342.55	252.22	261.92	194.07	384.43

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.96	38.44	39.13	27.76	37.69	38.50	38.86	28.14	10.11	15.96	15.12	11.04	13.66	15.34	14.64	12.16
PY1 (Vuw)	1.86	7.59	8.50	0.52	3.79	3.98	8.24	0.83	0.87	3.69	4.11	0.24	2.08	2.55	3.99	0.38
PX2 (Mu)	19.28	14.63	14.71	19.35	12.18	11.53	14.75	19.23	6.16	5.98	4.85	7.90	5.82	6.04	4.48	8.87
PY2 (Mu)	6.43	4.88	4.90	6.45	4.06	3.84	4.92	6.41	2.05	1.99	1.62	2.63	1.94	2.01	1.49	2.96
Pu (kip)	48.94	54.51	55.48	47.62	50.48	50.64	55.21	47.92	16.54	22.66	20.78	19.17	19.90	21.86	19.89	21.30

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.84	44.05	44.67	39.96	41.18	41.22	44.50	40.15
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	552.37
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	743.52	8.26	OK
BF	2551.51	28.35	OK	1120.76	12.45	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.48	27.74	OK	22.66	11.33	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.48	1.47	114.56	OK
Web SPL	27.74	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	2.04	4.84
Web	1.31	1.56	2.07
BF	1.28	1.35	4.84

Plate	Shear	Flexure
Web	2.97	1.12

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.42	-21.52	-18.75	-26.39	-19.87	-23.48	-6.01	-26.26	-11.09	-21.44	-11.38	-21.42	-19.48	-22.36	-6.53	-29.06
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.11	0.32	0.28	0.39	0.29	0.34	0.09	0.39	0.16	0.31	0.17	0.31	0.29	0.33	0.10	0.43
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-21.52		-26.39		-23.48		-26.26		-21.44		-21.42		-22.36		-29.06
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-7.42		-18.75		-19.87		-6.01		-11.09		-11.38		-19.48		-6.53	
Rcf	1.76		1.76		1.76		1.76		1.76		1.76		1.76		1.76	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.364717	-15.72854	-13.67239	-19.15993	-14.46621	-17.10506	-4.370349	-19.07317	-8.92756	-16.68328	-10.38796	-17.82037	-14.1895	-16.31124	-4.74	-21.05
Fs (ksi)	-5.36	-15.73	-13.67	-19.16	-14.47	-17.11	-4.37	-19.07	-8.93	-16.68	-10.39	-17.82	-14.19	-16.31	-4.74	-21.05
Fs (kip)	-531.11	-1557.13	-1353.57	-1896.83	-1432.16	-1693.40	-432.66	-1888.24	-883.83	-1651.64	-1028.41	-1764.22	-1404.76	-1614.81	-468.91	-2084.17

Vu (kip)	80.44	328.78	368.25	22.63	164.20	172.56	356.88	35.90	56.48	239.54	267.43	15.63	135.40	165.69	259.40	25.01
Vuw (kip)	120.67	493.18	552.37	33.94	246.31	258.85	535.32	53.84	---	---	---	---	---	---	---	---
Mv (k*ft)	67.87	277.41	310.71	19.09	138.55	145.60	301.12	30.29	31.77	134.74	150.43	8.79	76.16	93.20	145.91	14.07
Huw (kip)	-1908.07	-2505.47	-2564.72	-1833.85	-2101.50	-2116.68	-2544.06	-1861.18	-632.80	-984.97	-947.14	-703.31	-768.33	-846.25	-915.02	-773.66
Muw (k*ft)	750.27	352.00	312.50	799.75	621.32	611.19	326.27	781.53	207.28	109.75	52.78	294.06	155.11	148.65	42.43	326.32
Mu (k*ft)	818.14	629.41	623.21	818.84	759.86	756.79	627.39	811.82	239.05	244.49	203.20	302.85	231.28	241.85	188.35	340.38

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.35	38.55	39.46	28.21	32.33	32.56	39.14	28.63	9.74	15.15	14.57	10.82	11.82	13.02	14.08	11.90
PY1 (Vuw)	1.86	7.59	8.50	0.52	3.79	3.98	8.24	0.83	0.87	3.69	4.11	0.24	2.08	2.55	3.99	0.38
PX2 (Mu)	18.88	14.52	14.38	18.90	17.54	17.46	14.48	18.73	5.52	5.64	4.69	6.99	5.34	5.58	4.35	7.85
PY2 (Mu)	6.29	4.84	4.79	6.30	5.85	5.82	4.83	6.24	1.84	1.88	1.56	2.33	1.78	1.86	1.45	2.62
Pu (kip)	48.92	54.51	55.46	47.60	50.79	50.98	55.19	47.89	15.49	21.53	20.08	17.99	17.59	19.12	19.21	19.98

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.79	44.03	44.62	39.90	41.90	42.02	44.46	40.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.46	27.73	OK	21.53	10.76	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.46	1.47	114.56	OK
Web SPL	27.73	1.47	91.65	OK

Field Splice - Node 7511

Node 7511

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7511 L	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00
7511 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7511 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.99	-22.34	-17.82	-26.98	-19.43	-23.95	-5.66	-27.20	-18.32	-29.56	-18.88	-29.88	-18.73	-22.41	-6.36	-30.30
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.10	0.33	0.26	0.40	0.29	0.35	0.08	0.40	0.27	0.43	0.28	0.44	0.27	0.33	0.09	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.34		-26.98		-23.95		-27.20		-29.56		-29.88		-22.41		-30.30
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-6.99		-17.82		-19.43		-5.66		-18.32		-18.88		-18.73		-6.36	
Rcf	1.69		1.69		1.69		1.69		1.69		1.69		1.69		1.69	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.08	-17.00	-12.82	-19.74	-13.84	-17.30	-4.03	-20.55	-12.01	-19.31	-11.05	-21.04	-13.83	-16.67	-4.48	-22.79
Fs (ksi)	-5.08	-17.00	-12.82	-19.74	-13.84	-17.30	-4.03	-20.55	-12.01	-19.31	-11.05	-21.04	-13.83	-16.67	-4.48	-22.79
Fs (kip)	-503.38	-1683.23	-1269.58	-1954.21	-1370.40	-1713.10	-399.03	-2034.72	-1188.89	-1911.95	-1093.50	-2083.12	-1368.97	-1650.33	-443.33	-2256.48

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1370.40	2256.48

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	66.63	305.17	347.40	13.75	158.71	152.76	332.47	30.60	46.02	222.86	252.70	8.66	164.96	130.32	242.15	20.57
Vuw (kip)	99.94	457.76	521.10	20.62	238.06	229.14	498.70	45.90	---	---	---	---	---	---	---	---
Mv (k*ft)	56.22	257.49	293.12	11.60	133.91	128.89	280.52	25.82	25.89	125.36	142.14	4.87	92.79	73.31	136.21	11.57
Huw (kip)	-1870.12	-2417.99	-2499.11	-1803.00	-2442.98	-2471.42	-2463.63	-1838.27	-662.61	-976.91	-934.39	-737.50	-939.65	-962.61	-914.94	-818.12
Muw (k*ft)	775.57	410.32	356.24	820.31	393.66	374.70	379.89	796.80	238.35	138.31	69.23	330.44	146.07	199.92	56.84	366.29
Mu (k*ft)	831.78	667.81	649.36	831.91	527.57	503.59	660.41	822.62	264.24	263.67	211.38	335.31	238.87	273.23	193.05	377.86

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.77	37.20	38.45	27.74	37.58	38.02	37.90	28.28	10.19	15.03	14.38	11.35	14.46	14.81	14.08	12.59
PY1 (Vuw)	1.54	7.04	8.02	0.32	3.66	3.53	7.67	0.71	0.71	3.43	3.89	0.13	2.54	2.00	3.73	0.32
PX2 (Mu)	19.19	15.41	14.99	19.20	12.17	11.62	15.24	18.98	6.10	6.08	4.88	7.74	5.51	6.31	4.45	8.72
PY2 (Mu)	6.40	5.14	5.00	6.40	4.06	3.87	5.08	6.33	2.03	2.03	1.63	2.58	1.84	2.10	1.48	2.91
Pu (kip)	48.62	54.00	54.99	47.41	50.35	50.19	54.65	47.79	16.52	21.81	20.03	19.28	20.44	21.51	19.25	21.55

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.62	43.79	44.38	39.80	41.09	40.92	44.19	40.04
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	521.10
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	691.49	7.68	OK
BF	2551.51	28.35	OK	1138.59	12.65	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.99	27.50	OK	21.81	10.90	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.99	1.47	114.56	OK
Web SPL	27.50	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	2.19	4.84
Web	1.32	1.60	2.08
BF	1.28	1.33	4.84

Plate	Shear	Flexure
Web	3.15	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.74	-20.98	-17.57	-26.07	-18.81	-23.00	-5.46	-25.45	-10.77	-21.20	-10.44	-20.65	-18.27	-21.69	-6.14	-28.36
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.10	0.31	0.26	0.38	0.28	0.34	0.08	0.37	0.16	0.31	0.15	0.30	0.27	0.32	0.09	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.98		-26.07		-23.00		-25.45		-21.20		-20.65		-21.69		-28.36
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-6.74		-17.57		-18.81		-5.46		-10.77		-10.44		-18.27		-6.14	
Rcf	1.80		1.80		1.80		1.80		1.80		1.80		1.80		1.80	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.854684	-15.3549	-12.84316	-18.93607	-13.72221	-16.77207	-3.953518	-18.51058	-10.25699	-16.69198	-8.723586	-17.53082	-13.33768	-15.84167	-4.43	-20.57
Fs (ksi)	-4.85	-15.35	-12.84	-18.94	-13.72	-16.77	-3.95	-18.51	-10.26	-16.69	-8.72	-17.53	-13.34	-15.84	-4.43	-20.57
Fs (kip)	-480.61	-1520.13	-1271.47	-1874.67	-1358.50	-1660.43	-391.40	-1832.55	-1015.44	-1652.51	-863.64	-1735.55	-1320.43	-1568.32	-438.72	-2036.21

Vu (kip)	66.63	305.17	347.40	13.75	158.71	152.76	332.47	30.60	46.02	222.86	252.70	8.66	164.96	130.32	242.15	20.57
Vuw (kip)	99.94	457.76	521.10	20.62	238.06	229.14	498.70	45.90	---	---	---	---	---	---	---	---
Mv (k*ft)	56.22	257.49	293.12	11.60	133.91	128.89	280.52	25.82	25.89	125.36	142.14	4.87	92.79	73.31	136.21	11.57
Huw (kip)	-1880.81	-2466.04	-2533.27	-1811.89	-2098.50	-2080.72	-2503.86	-1848.44	-606.29	-953.38	-914.83	-673.92	-808.47	-787.63	-875.38	-749.98
Muw (k*ft)	768.44	378.29	333.47	814.39	623.31	635.17	353.07	790.02	210.00	121.86	61.00	291.14	128.70	176.14	50.08	322.73
Mu (k*ft)	824.66	635.77	626.59	825.99	757.22	764.06	633.59	815.84	235.89	247.22	203.14	296.01	221.49	249.45	186.29	334.29

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.94	37.94	38.97	27.88	32.28	32.01	38.52	28.44	9.33	14.67	14.07	10.37	12.44	12.12	13.47	11.54
PY1 (Vuw)	1.54	7.04	8.02	0.32	3.66	3.53	7.67	0.71	0.71	3.43	3.89	0.13	2.54	2.00	3.73	0.32
PX2 (Mu)	19.03	14.67	14.46	19.06	17.47	17.63	14.62	18.83	5.44	5.71	4.69	6.83	5.11	5.76	4.30	7.71
PY2 (Mu)	6.34	4.89	4.82	6.35	5.82	5.88	4.87	6.28	1.81	1.90	1.56	2.28	1.70	1.92	1.43	2.57
Pu (kip)	48.61	53.95	54.95	47.41	50.66	50.53	54.60	47.78	14.98	21.06	19.54	17.37	18.05	18.30	18.50	19.47

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.60	43.69	44.31	39.79	41.81	41.74	44.10	40.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.95	27.48	OK	21.06	10.53	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.95	1.47	114.56	OK
Web SPL	27.48	1.47	91.65	OK

Field Splice - Node 9511

Node 9511

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	90
Web	65
BF	90

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9511 L	99.00	68.10	6742.16	99.00	68.10	6742.16	60.00	50.00	3000.00
9511 R	99.00	68.37	6768.87	99.00	68.37	6768.87	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9511 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	36.00	2.75	---	99.00	69.78	71.36	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	36.00	2.75	---	99.00	69.78	71.36	70	85
Splice Plates	TF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	TF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Inside	16.50	1.250	56.50	41.25	27.97	---	70	85
	BF Outside	36.00	1.125	56.50	40.50	28.55	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.89719626
Outer to Inr 0.89719626

Outer to Mi 0.94859813
Outer to Mi 0.94859813

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.91	-20.78	-15.39	-25.12	-17.45	-21.94	-4.92	-25.73	-16.93	-27.74	-17.26	-27.68	-17.52	-20.83	-5.52	-28.87
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.09	0.31	0.23	0.37	0.26	0.32	0.07	0.38	0.25	0.41	0.25	0.41	0.26	0.31	0.08	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.78		-25.12		-21.94		-25.73		-27.74		-27.68		-20.83		-28.87
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-5.91		-15.39		-17.45		-4.92		-16.93		-17.26		-17.52		-5.52	
Rcf	1.77		1.77		1.77		1.77		1.77		1.77		1.77		1.77	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.81	-16.40	-11.67	-19.01	-13.22	-16.67	-4.00	-20.01	-12.30	-17.63	-8.52	-20.27	-13.29	-15.85	-4.37	-22.28
Fs (ksi)	-4.81	-16.40	-11.67	-19.01	-13.22	-16.67	-4.00	-20.01	-12.30	-17.63	-8.52	-20.27	-13.29	-15.85	-4.37	-22.28
Fs (kip)	-476.39	-1623.98	-1154.97	-1881.90	-1308.88	-1649.96	-395.97	-1981.22	-1217.29	-1745.11	-843.11	-2006.27	-1316.06	-1569.54	-432.75	-2205.97

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	5056.62	5056.62	1316.06	2205.97

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	22.41	269.33	314.38	23.87	133.65	117.30	293.99	1.45	14.44	197.68	229.51	18.26	172.80	65.28	215.10	2.42
Vuw (kip)	33.62	403.99	471.57	35.80	200.48	175.95	440.98	2.18	---	---	---	---	---	---	---	---
Mv (k*ft)	18.91	227.24	265.26	20.14	112.77	98.97	248.05	1.23	8.12	111.19	129.10	10.27	97.20	36.72	120.99	1.36
Huw (kip)	-1830.57	-2333.37	-2442.75	-1777.94	-2415.20	-2432.66	-2446.52	-1809.44	-636.48	-920.26	-896.62	-720.36	-897.70	-863.45	-874.42	-799.61
Muw (k*ft)	801.93	466.74	393.81	837.02	412.18	400.54	391.30	816.02	231.84	146.85	68.90	320.25	106.63	234.98	51.21	358.23
Mu (k*ft)	820.84	693.98	659.07	857.16	524.95	499.51	639.35	817.25	239.96	258.05	198.00	330.52	203.83	271.70	172.20	359.59

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.16	35.90	37.58	27.35	37.16	37.43	37.64	27.84	9.79	14.16	13.79	11.08	13.81	13.28	13.45	12.30
PY1 (Vuw)	0.52	6.22	7.25	0.55	3.08	2.71	6.78	0.03	0.22	3.04	3.53	0.28	2.66	1.00	3.31	0.04
PX2 (Mu)	18.94	16.01	15.21	19.78	12.11	11.53	14.75	18.86	5.54	5.95	4.57	7.63	4.70	6.27	3.97	8.30
PY2 (Mu)	6.31	5.34	5.07	6.59	4.04	3.84	4.92	6.29	1.85	1.98	1.52	2.54	1.57	2.09	1.32	2.77
Pu (kip)	47.60	53.18	54.21	47.67	49.78	49.39	53.68	47.12	15.47	20.73	19.05	18.92	18.99	19.80	18.03	20.79

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK
TF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Inside	0.00	2743.13	1901.88	130.00	84.84	19.38	4663.74	1901.88	OK
BF Outside	0.00	2693.25	1941.19	58.50	38.18	24.12	3145.78	1941.19	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	2505.11	2551.50	OK
TF Inside	2551.51	2598.75	OK
BF Inside	2551.51	2598.75	OK
BF Outside	2505.11	2551.50	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.90	43.32	43.90	40.04	40.70	40.36	43.53	39.57
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	471.57
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9511**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	2551.51	28.35	OK	664.07	7.38	OK
BF	2551.51	28.35	OK	1113.10	12.37	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	2505.11	27.83	1.47	134.83	OK
TF	5056.62	56.18	1.47	329.59	OK
TF Inside	2551.51	28.35	1.47	149.81	OK
BF Inside	2551.51	28.35	1.47	149.81	OK
BF	5056.62	56.18	1.47	329.59	OK
BF Outside	2505.11	27.83	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.21	27.10	OK	20.79	10.39	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.21	1.47	114.56	OK
Web SPL	27.10	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.02
TF Inside	NA	1.02
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.28	2.28	4.84
Web	1.34	1.72	2.12
BF	1.28	1.36	4.84

Plate	Shear	Flexure
Web	3.48	1.14

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.71	-18.51	-15.35	-24.38	-16.69	-20.86	-3.74	-23.05	-9.45	-19.48	-8.50	-18.17	-16.22	-19.29	-4.50	-26.18
ϕf Fnc (ksi)	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10	68.10
f / ϕf Fnc	0.07	0.27	0.23	0.36	0.25	0.31	0.05	0.34	0.14	0.29	0.12	0.27	0.24	0.28	0.07	0.38
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-18.51		-24.38		-20.86		-23.05		-19.48		-18.17		-19.29		-26.18
Fcf (ksi)		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08
Fcf (kip)		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62
fncf (ksi)	-4.71		-15.35		-16.69		-3.74		-9.45		-8.50		-16.22		-4.50	
Rcf	1.95		1.95		1.95		1.95		1.95		1.95		1.95		1.95	
Fncf (ksi)	-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08		-51.08	
Fncf (kip)	-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62		-5056.62	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-3.417511	-13.63063	-11.27266	-17.74203	-12.21693	-15.2524	-2.731004	-16.83914	-10.17343	-14.87084	-5.692947	-16.04458	-11.88739	-14.14328	-3.27	-19.05
Fs (ksi)	-3.42	-13.63	-11.27	-17.74	-12.22	-15.25	-2.73	-16.84	-10.17	-14.87	-5.69	-16.04	-11.89	-14.14	-3.27	-19.05
Fs (kip)	-338.33	-1349.43	-1115.99	-1756.46	-1209.48	-1509.99	-270.37	-1667.08	-1007.17	-1472.21	-563.60	-1588.41	-1176.85	-1400.19	-323.61	-1885.92

Vu (kip)	22.41	269.33	314.38	23.87	133.65	117.30	293.99	1.45	14.44	197.68	229.51	18.26	172.80	65.28	215.10	2.42
Vuw (kip)	33.62	403.99	471.57	35.80	200.48	175.95	440.98	2.18	---	---	---	---	---	---	---	---
Mv (k*ft)	18.91	227.24	265.26	20.14	112.77	98.97	248.05	1.23	8.12	111.19	129.10	10.27	97.20	36.72	120.99	1.36
Huw (kip)	-1792.68	-2415.50	-2493.73	-1735.80	-2069.80	-2014.40	-2466.43	-1780.36	-511.44	-870.44	-824.08	-587.10	-751.33	-652.13	-780.92	-669.55
Muw (k*ft)	827.19	411.98	359.83	865.11	642.44	679.38	378.03	835.41	204.26	129.39	60.71	282.16	93.95	207.03	45.12	315.62
Mu (k*ft)	846.10	639.22	625.08	885.25	755.21	778.36	626.08	836.64	212.38	240.58	189.81	292.43	191.15	243.75	166.11	316.98

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9511	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.58	37.16	38.37	26.70	31.84	30.99	37.95	27.39	7.87	13.39	12.68	9.03	11.56	10.03	12.01	10.30
PY1 (Vuw)	0.52	6.22	7.25	0.55	3.08	2.71	6.78	0.03	0.22	3.04	3.53	0.28	2.66	1.00	3.31	0.04
PX2 (Mu)	19.53	14.75	14.42	20.43	17.43	17.96	14.45	19.31	4.90	5.55	4.38	6.75	4.41	5.63	3.83	7.31
PY2 (Mu)	6.51	4.92	4.81	6.81	5.81	5.99	4.82	6.44	1.63	1.85	1.46	2.25	1.47	1.88	1.28	2.44
Pu (kip)	47.63	53.09	54.15	47.70	50.07	49.72	53.66	47.14	12.90	19.56	17.77	15.98	16.50	15.92	16.50	17.79

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.98	43.15	43.80	40.13	41.41	41.23	43.49	39.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.15	27.08	OK	19.56	9.78	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.15	1.47	114.56	OK
Web SPL	27.08	1.47	91.65	OK

Field Splice

Type II

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1522	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type II

Field Splice - Node 1522

Node 1522

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1522 L	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00
1522 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1522 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.41	8.30	-27.85	-8.97	-34.43	7.82	-22.86	-7.66	-29.83	-7.16	-22.82	-1.63	-34.13	11.41	-22.28	-10.79
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.37	0.17	0.40	0.18	0.50	0.16	0.33	0.15	0.43	0.14	0.33	0.03	0.49	0.23	0.32	0.22
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-25.41		-27.85		-34.43		-22.86		-29.83		-22.82		-34.13		-22.28	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.30		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		8.30		-8.97		7.82		-7.66		-7.16		-1.63		11.41		-10.79
Rcf		1.51		1.51		1.51		1.51		1.51		1.51		1.51		1.51
Fncf (ksi)		37.20		-37.20		37.20		-37.20		-37.20		-37.20		37.20		-37.20
Fncf (kip)		3939.59		-5021.39		3939.59		-5021.39		-5021.39		-5021.39		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.31	6.57	-20.92	-6.25	-25.86	6.40	-17.32	-5.40	-22.40	-4.89	-17.34	-0.78	-25.69	8.98	-16.83	-7.69
Fs (ksi)	-19.31	6.57	-20.92	-6.25	-25.86	6.40	-17.32	-5.40	-22.40	-4.89	-17.34	-0.78	-25.69	8.98	-16.83	-7.69
Fs (kip)	-2433.39	886.28	-2636.13	-844.08	-3258.84	864.48	-2182.85	-729.11	-2822.36	-660.45	-2185.25	-105.08	-3236.94	1211.91	-2120.71	-1038.44

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	1211.91
Comp	6561.30	5021.39	3258.84	1038.44

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	452.63	544.87	655.78	415.62	498.47	479.99	621.67	438.80	333.06	397.62	476.59	306.30	364.83	352.38	452.49	322.67
Vuw (kip)	678.95	817.31	983.67	623.44	747.70	719.98	932.51	658.20	---	---	---	---	---	---	---	---
Mv (k*ft)	381.91	459.74	553.32	350.68	420.58	404.99	524.54	370.24	187.34	223.66	268.08	172.29	205.22	198.22	254.52	181.50
Huw (kip)	-1290.04	-2152.10	-1314.03	-2086.69	-2061.78	-1785.86	-1135.10	-2243.08	-420.67	-896.75	-642.19	-749.93	-900.63	-598.01	-551.52	-809.26
Muw (k*ft)	1412.61	837.90	1396.62	881.51	898.11	1082.06	1515.90	777.25	569.31	322.72	709.88	262.31	385.16	364.43	762.68	201.06
Mu (k*ft)	1794.52	1297.64	1949.94	1232.19	1318.70	1487.05	2040.43	1147.49	756.65	546.38	977.96	434.61	590.38	562.64	1017.20	382.56

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.18	23.65	14.44	22.93	22.66	19.62	12.47	24.65	4.62	9.85	7.06	8.24	9.90	6.57	6.06	8.89
PY1 (Vuw)	7.46	8.98	10.81	6.85	8.22	7.91	10.25	7.23	3.66	4.37	5.24	3.37	4.01	3.87	4.97	3.55
PX2 (Mu)	26.29	19.01	28.57	18.05	19.32	21.79	29.90	16.81	11.09	8.01	14.33	6.37	8.65	8.24	14.90	5.61
PY2 (Mu)	13.15	9.51	14.29	9.03	9.66	10.89	14.95	8.41	5.54	4.00	7.16	3.18	4.33	4.12	7.45	2.80
Pu (kip)	45.41	46.50	49.80	43.95	45.63	45.48	49.30	44.31	18.21	19.72	24.72	16.01	20.33	16.83	24.37	15.83

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3270.92	3969.00	OK
TF Inside	3290.39	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.33	43.23	46.23	41.47	42.71	42.90	46.03	41.54
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	983.67
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3290.39	21.09	OK	1634.26	10.48	OK
BF	2543.73	23.55	OK	613.93	5.68	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3270.92	20.97	1.47	179.78	OK
TF	6561.30	42.06	1.47	359.55	OK
TF Inside	3290.39	21.09	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.80	24.90	OK	24.72	12.36	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.80	1.47	126.02	OK
Web SPL	24.90	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.21
TF Inside	NA	1.21
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.59	1.61	8.55
Web	1.46	1.54	2.54
BF	1.41	2.96	4.99

Plate	Shear	Flexure
Web	2.08	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.41	4.46	-23.86	-6.12	-30.12	3.84	-18.58	-4.23	-22.96	-1.53	-21.29	-1.57	-29.14	6.66	-18.87	-8.03
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.31	0.09	0.34	0.12	0.43	0.08	0.27	0.09	0.33	0.03	0.31	0.03	0.42	0.13	0.27	0.16
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-21.41		-23.86		-30.12		-18.58		-22.96		-21.29		-29.14		-18.87	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		4.46		-6.12		3.84		-4.23		-1.53		-1.57		6.66		-8.03
Rcf		1.73		1.73		1.73		1.73		1.73		1.73		1.73		1.73
Fncf (ksi)		37.20		-37.20		37.20		-37.20		-37.20		-37.20		37.20		-37.20
Fncf (kip)		3939.59		-5021.39		3939.59		-5021.39		-5021.39		-5021.39		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.77736	3.143936	-17.44539	-4.421195	-21.92975	2.709533	-13.71947	-3.083578	-16.81436	-1.172756	-15.68957	-1.116663	-21.23969	4.6993402	-13.92	-5.77
Fs (ksi)	-15.78	3.14	-17.45	-4.42	-21.93	2.71	-13.72	-3.08	-16.81	-1.17	-15.69	-1.12	-21.24	4.70	-13.92	-5.77
Fs (kip)	-1987.95	424.43	-2198.12	-596.86	-2763.15	365.79	-1728.65	-416.28	-2118.61	-158.32	-1976.89	-150.75	-2676.20	634.41	-1754.09	-778.49

Vu (kip)	452.63	544.87	655.78	415.62	498.47	479.99	621.67	438.80	333.06	397.62	476.59	306.30	364.83	352.38	452.49	322.67
Vuw (kip)	678.95	817.31	983.67	623.44	747.70	719.98	932.51	658.20	---	---	---	---	---	---	---	---
Mv (k*ft)	381.91	459.74	553.32	350.68	420.58	404.99	524.54	370.24	187.34	223.66	268.08	172.29	205.22	198.22	254.52	181.50
Huw (kip)	-1450.24	-2053.80	-1485.32	-1945.79	-1791.49	-1794.29	-1324.64	-2162.44	-416.90	-721.60	-634.27	-554.50	-593.57	-554.61	-545.83	-649.70
Muw (k*ft)	1305.81	903.43	1282.42	975.44	1078.31	1076.44	1389.54	831.01	416.27	286.53	542.06	233.99	344.12	320.60	570.66	179.41
Mu (k*ft)	1687.71	1363.17	1835.74	1326.12	1498.89	1481.43	1914.08	1201.24	603.61	510.19	810.14	406.28	549.33	518.82	825.18	360.91

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	15.94	22.57	16.32	21.38	19.69	19.72	14.56	23.76	4.58	7.93	6.97	6.09	6.52	6.09	6.00	7.14
PY1 (Vuw)	7.46	8.98	10.81	6.85	8.22	7.91	10.25	7.23	3.66	4.37	5.24	3.37	4.01	3.87	4.97	3.55
PX2 (Mu)	24.73	19.97	26.90	19.43	21.96	21.71	28.05	17.60	8.84	7.48	11.87	5.95	8.05	7.60	12.09	5.29
PY2 (Mu)	12.36	9.99	13.45	9.72	10.98	10.85	14.02	8.80	4.42	3.74	5.94	2.98	4.02	3.80	6.05	2.64
Pu (kip)	45.24	46.58	49.56	44.05	45.86	45.48	49.03	44.36	15.67	17.41	21.90	13.61	16.64	15.70	21.18	13.88

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.06	43.39	45.94	41.70	43.16	42.89	45.72	41.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.56	24.78	OK	21.90	10.95	OK

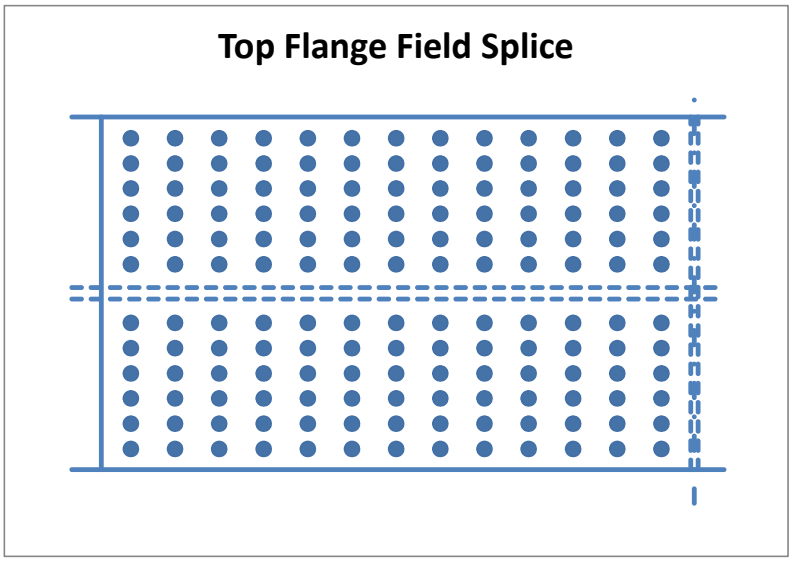
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.56	1.47	126.02	OK
Web SPL	24.78	1.47	114.56	OK

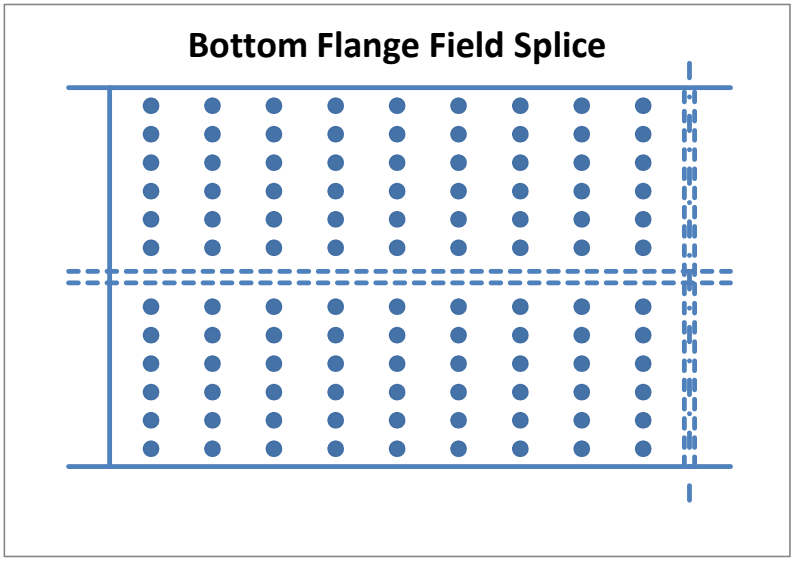
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1522	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1522

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3.375
0	6	0	6.75
0	9	0	10.125
0	12	0	13.5
0	15	0	16.875
0	22	0	23.875
0	25	0	27.25
0	28	0	30.625
0	31	0	34
0	34	0	37.375
0	37	0	40.75
3	0	3	0
3	3	3	3.375
3	6	3	6.75
3	9	3	10.125
3	12	3	13.5
3	15	3	16.875
3	22	3	23.875
3	25	3	27.25
3	28	3	30.625
3	31	3	34
3	34	3	37.375
3	37	3	40.75
6	0	6	0
6	3	6	3.375
6	6	6	6.75
6	9	6	10.125
6	12	6	13.5
6	15	6	16.875
6	22	6	23.875
6	25	6	27.25
6	28	6	30.625
6	31	6	34
6	34	6	37.375
6	37	6	40.75
9	0	9	0
9	3	9	3.375
9	6	9	6.75
9	9	9	10.125
9	12	9	13.5
9	15	9	16.875
9	22	9	23.875
9	25	9	27.25
9	28	9	30.625
9	31	9	34
9	34	9	37.375
9	37	9	40.75
12	0	12	0
12	3	12	3.375
12	6	12	6.75
12	9	12	10.125
12	12	12	13.5
12	15	12	16.875
12	22	12	23.875
12	25	12	27.25
12	28	12	30.625
12	31	12	34
12	34	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	156.0		108.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	12.0		8.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.000	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	37	12	40.75
15	0	15	0
15	3	15	3.375
15	6	15	6.75
15	9	15	10.125
15	12	15	13.5
15	15	15	16.875
15	22	15	23.875
15	25	15	27.25
15	28	15	30.625
15	31	15	34
15	34	15	37.375
15	37	15	40.75
18	0	18	0
18	3	18	3.375
18	6	18	6.75
18	9	18	10.125
18	12	18	13.5
18	15	18	16.875
18	22	18	23.875
18	25	18	27.25
18	28	18	30.625
18	31	18	34
18	34	18	37.375
18	37	18	40.75
21	0	21	0
21	3	21	3.375
21	6	21	6.75
21	9	21	10.125
21	12	21	13.5
21	15	21	16.875
21	22	21	23.875
21	25	21	27.25
21	28	21	30.625
21	31	21	34
21	34	21	37.375
21	37	21	40.75
24	0	24	0
24	3	24	3.375
24	6	24	6.75
24	9	24	10.125
24	12	24	13.5
24	15	24	16.875
24	22	24	23.875
24	25	24	27.25
24	28	24	30.625
24	31	24	34
24	34	24	37.375
24	37	24	40.75
27	0		
27	3		
27	6		
27	9		
27	12		
27	15		
27	22		
27	25		
27	28		
27	31		
27	34		
27	37		
30	0		
30	3		
30	6		
30	9		
30	12		

Flange Bolt Pattern Cont. - Node 1522

30	15		
30	22		
30	25		
30	28		
30	31		
30	34		
30	37		
33	0		
33	3		
33	6		
33	9		
33	12		
33	15		
33	22		
33	25		
33	28		
33	31		
33	34		
33	37		
36	0		
36	3		
36	6		
36	9		
36	12		
36	15		
36	22		
36	25		
36	28		
36	31		
36	34		
36	37		

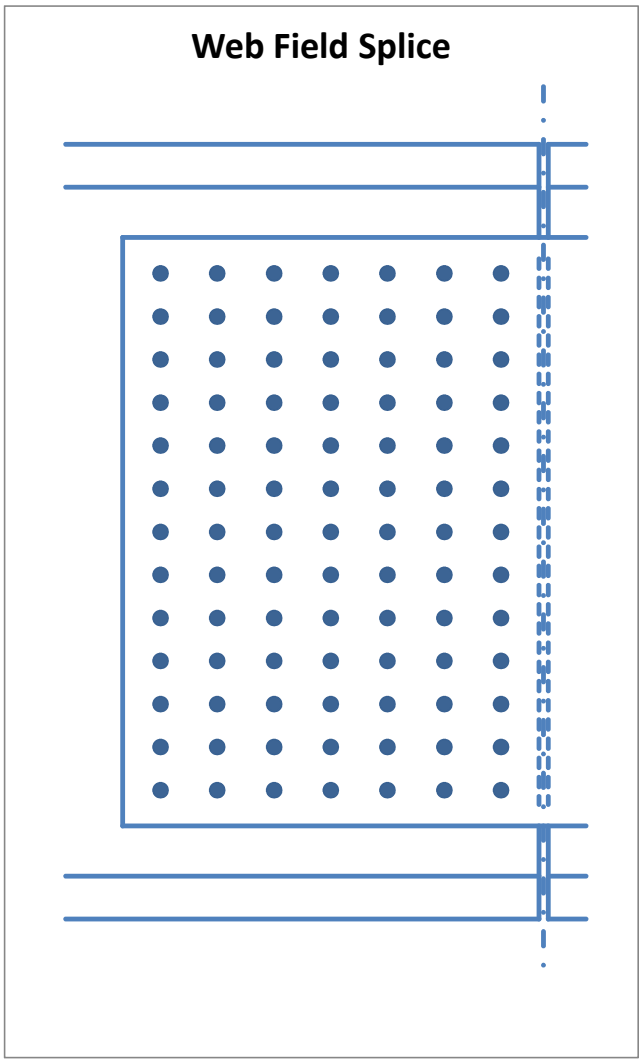
Flange Bolt Pattern Cont. - Node 1522

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1522	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1522

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	81	324
0	3	81	225
0	6	81	144
0	9	81	81
0	12	81	36
0	15	81	9
0	18	81	0
0	21	81	9
0	24	81	36
0	27	81	81
0	30	81	144
0	33	81	225
0	36	81	324
3	0	36	324
3	3	36	225
3	6	36	144
3	9	36	81
3	12	36	36
3	15	36	9
3	18	36	0
3	21	36	9
3	24	36	36
3	27	36	81
3	30	36	144
3	33	36	225
3	36	36	324
6	0	9	324
6	3	9	225
6	6	9	144
6	9	9	81
6	12	9	36
6	15	9	9
6	18	9	0
6	21	9	9
6	24	9	36
6	27	9	81
6	30	9	144
6	33	9	225
6	36	9	324
9	0	0	324
9	3	0	225
9	6	0	144
9	9	0	81
9	12	0	36
9	15	0	9
9	18	0	0
9	21	0	9
9	24	0	36
9	27	0	81
9	30	0	144
9	33	0	225
9	36	0	324
12	0	9	324
12	3	9	225
12	6	9	144
12	9	9	81
12	12	9	36
12	15	9	9
12	18	9	0

No. Bolts =	91.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	6.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	9	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	3276	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	11466	
Σd^2 (in^2) =	14742	



12	21	9	9
12	24	9	36
12	27	9	81
12	30	9	144
12	33	9	225
12	36	9	324
15	0	36	324
15	3	36	225
15	6	36	144
15	9	36	81
15	12	36	36
15	15	36	9
15	18	36	0
15	21	36	9
15	24	36	36
15	27	36	81
15	30	36	144
15	33	36	225
15	36	36	324
18	0	81	324
18	3	81	225
18	6	81	144
18	9	81	81
18	12	81	36
18	15	81	9
18	18	81	0
18	21	81	9
18	24	81	36
18	27	81	81
18	30	81	144
18	33	81	225
18	36	81	324

Web Bolt Pattern Cont. - Node 1522

Web Bolt Pattern Cont. - Node 1522

819	1638	3276	11466

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3522	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type II

Field Splice - Node 3522

Node 3522

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3522 L	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00
3522 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3522 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-31.42	8.91	-37.99	-8.97	-43.03	11.21	-28.21	-5.42	-39.94	8.00	-28.99	0.12	-41.98	12.84	-30.30	-11.30
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.45	0.18	0.55	0.18	0.62	0.23	0.41	0.11	0.58	0.16	0.42	0.00	0.60	0.26	0.44	0.23
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-31.42		-37.99		-43.03		-28.21		-39.94		-28.99		-41.98		-30.30	
Fcf (ksi)	-52.07		-53.86		-56.41		-52.07		-54.85		-52.07		-55.88		-52.07	
Fcf (kip)	-6561.28		-6786.84		-7107.23		-6561.28		-6911.32		-6561.28		-7040.51		-6561.28	
fncf (ksi)		8.91		-8.97		11.21		-5.42		8.00		0.12		12.84		-11.30
Rcf		1.21		1.25		1.31		1.21		1.27		1.21		1.30		1.21
Fncf (ksi)		37.20		-37.20		37.20		-37.20		37.20		37.20		37.20		-37.20
Fncf (kip)		3939.59		-5021.39		3939.59		-5021.39		3939.59		3939.59		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.67	7.15	-28.40	-6.08	-32.25	9.09	-21.19	-3.40	-29.84	6.59	-21.84	0.83	-31.39	10.19	-22.77	-7.93
Fs (ksi)	-23.67	7.15	-28.40	-6.08	-32.25	9.09	-21.19	-3.40	-29.84	6.59	-21.84	0.83	-31.39	10.19	-22.77	-7.93
Fs (kip)	-2982.79	965.65	-3578.38	-820.31	-4063.79	1227.70	-2669.93	-459.61	-3759.83	889.46	-2751.74	111.79	-3955.09	1375.54	-2868.62	-1070.80

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	1375.54
Comp	7107.23	5021.39	4063.79	1070.80

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	585.26	718.26	805.66	559.18	690.46	616.91	790.90	585.84	426.37	520.61	582.35	407.94	500.96	448.73	571.65	427.05
Vuw (kip)	877.90	1077.40	1208.49	838.77	1035.69	925.36	1186.34	878.76	---	---	---	---	---	---	---	---
Mv (k*ft)	493.82	606.04	679.78	471.81	582.57	520.52	667.32	494.30	239.83	292.84	327.57	229.47	281.79	252.41	321.55	240.21
Huw (kip)	-1348.63	-2133.42	-1361.20	-1920.97	-1458.98	-1699.59	-1278.73	-2155.74	-545.16	-1137.71	-764.22	-811.62	-767.29	-693.37	-699.62	-1013.06
Muw (k*ft)	1373.55	928.48	1554.27	991.99	1421.23	1139.57	1586.14	835.48	678.17	491.12	909.62	391.28	801.43	498.68	914.73	326.37
Mu (k*ft)	1867.36	1534.52	2234.04	1463.79	2003.80	1660.09	2253.46	1329.78	918.00	783.96	1237.19	620.74	1083.22	751.09	1236.29	566.58

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.82	23.44	14.96	21.11	16.03	18.68	14.05	23.69	5.99	12.50	8.40	8.92	8.43	7.62	7.69	11.13
PY1 (Vuw)	9.65	11.84	13.28	9.22	11.38	10.17	13.04	9.66	4.69	5.72	6.40	4.48	5.51	4.93	6.28	4.69
PX2 (Mu)	27.36	22.48	32.73	21.45	29.36	24.32	33.02	19.48	13.45	11.49	18.13	9.10	15.87	11.00	18.11	8.30
PY2 (Mu)	13.68	11.24	16.37	10.72	14.68	12.16	16.51	9.74	6.73	5.74	9.06	4.55	7.94	5.50	9.06	4.15
Pu (kip)	48.20	51.40	56.16	47.00	52.34	48.45	55.57	47.33	22.54	26.59	30.70	20.15	27.77	21.35	30.02	21.35

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3543.07	3969.00	OK
TF Inside	3564.16	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.15	47.10	51.56	43.82	48.56	45.02	51.08	43.81
Check	OK	OK	NG	OK	OK	OK	NG	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1208.49
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3564.16	22.85	OK	2037.92	13.06	OK
BF	2543.73	23.55	OK	696.82	6.45	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3543.07	22.71	1.47	179.78	OK
TF	7107.23	45.56	1.47	359.55	OK
TF Inside	3564.16	22.85	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.16	28.08	OK	30.70	15.35	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.16	1.47	126.02	OK
Web SPL	28.08	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	1.29	7.89
Web	1.36	1.28	2.36
BF	1.41	2.61	4.99

Plate	Shear	Flexure
Web	1.70	1.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.62	4.32	-31.44	-4.15	-35.98	4.43	-24.55	-3.22	-30.85	-1.04	-27.03	-1.36	-35.79	6.95	-25.13	-7.20
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.38	0.09	0.45	0.08	0.52	0.09	0.35	0.06	0.44	0.02	0.39	0.03	0.52	0.14	0.36	0.15
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-26.62		-31.44		-35.98		-24.55		-30.85		-27.03		-35.79		-25.13	
Fcf (ksi)	-52.07		-52.07		-52.85		-52.07		-52.07		-52.07		-52.76		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6659.55		-6561.28		-6561.28		-6561.28		-6647.61		-6561.28	
fncf (ksi)		4.32		-4.15		4.43		-3.22		-1.04		-1.36		6.95		-7.20
Rcf		1.45		1.45		1.47		1.45		1.45		1.45		1.47		1.45
Fncf (ksi)		37.20		-37.20		37.20		-37.20		-37.20		-37.20		37.20		-37.20
Fncf (kip)		3939.59		-5021.39		3939.59		-5021.39		-5021.39		-5021.39		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.44504	3.080501	-22.83973	-2.995701	-26.04622	3.06461	-17.98044	-2.246323	-22.42417	-0.799584	-19.73441	-0.935003	-25.9237	4.9368401	-18.38	-5.15
Fs (ksi)	-19.45	3.08	-22.84	-3.00	-26.05	3.06	-17.98	-2.25	-22.42	-0.80	-19.73	-0.94	-25.92	4.94	-18.38	-5.15
Fs (kip)	-2450.08	415.87	-2877.81	-404.42	-3281.82	413.72	-2265.53	-303.25	-2825.45	-107.94	-2486.54	-126.23	-3266.39	666.47	-2315.55	-695.62

Vu (kip)	585.26	718.26	805.66	559.18	690.46	616.91	790.90	585.84	426.37	520.61	582.35	407.94	500.96	448.73	571.65	427.05
Vuw (kip)	877.90	1077.40	1208.49	838.77	1035.69	925.36	1186.34	878.76	---	---	---	---	---	---	---	---
Mv (k*ft)	493.82	606.04	679.78	471.81	582.57	520.52	667.32	494.30	239.83	292.84	327.57	229.47	281.79	252.41	321.55	240.21
Huw (kip)	-1498.01	-1902.70	-1515.40	-1858.10	-1754.25	-1769.45	-1390.59	-2048.52	-540.03	-852.57	-758.39	-667.48	-766.38	-682.09	-692.57	-776.49
Muw (k*ft)	1273.96	1004.17	1296.40	1033.90	1103.13	1093.00	1375.48	906.96	495.56	436.57	640.44	346.15	475.74	413.59	678.93	290.94
Mu (k*ft)	1767.77	1610.20	1976.18	1505.71	1685.71	1613.52	2042.80	1401.26	735.39	729.41	968.01	575.62	757.53	666.00	1000.49	531.16

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.46	20.91	16.65	20.42	19.28	19.44	15.28	22.51	5.93	9.37	8.33	7.33	8.42	7.50	7.61	8.53
PY1 (Vuw)	9.65	11.84	13.28	9.22	11.38	10.17	13.04	9.66	4.69	5.72	6.40	4.48	5.51	4.93	6.28	4.69
PX2 (Mu)	25.90	23.59	28.96	22.06	24.70	23.64	29.93	20.53	10.77	10.69	14.18	8.43	11.10	9.76	14.66	7.78
PY2 (Mu)	12.95	11.80	14.48	11.03	12.35	11.82	14.97	10.27	5.39	5.34	7.09	4.22	5.55	4.88	7.33	3.89
Pu (kip)	48.01	50.39	53.39	47.06	49.97	48.37	53.18	47.43	19.51	22.91	26.25	18.01	22.43	19.85	26.10	18.44

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.90	46.15	48.64	43.92	46.00	44.91	48.57	43.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.39	26.70	OK	26.25	13.12	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.39	1.47	126.02	OK
Web SPL	26.70	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5522	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type II

Field Splice - Node 5522

Node 5522

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5522 L	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00
5522 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5522 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.77	4.63	-32.88	-10.50	-38.19	5.54	-24.43	-4.09	-34.53	-6.95	-25.44	-2.75	-37.06	8.31	-26.11	-11.25
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.39	0.09	0.47	0.21	0.55	0.11	0.35	0.08	0.50	0.14	0.37	0.06	0.53	0.17	0.38	0.23
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-26.77		-32.88		-38.19		-24.43		-34.53		-25.44		-37.06		-26.11	
Fcf (ksi)	-52.07		-52.07		-53.97		-52.07		-52.12		-52.07		-53.40		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6799.69		-6561.28		-6567.17		-6561.28		-6728.28		-6561.28	
fncf (ksi)		4.63		-10.50		5.54		-4.09		-6.95		-2.75		8.31		-11.25
Rcf		1.36		1.36		1.41		1.36		1.36		1.36		1.40		1.36
Fncf (ksi)		37.20		-37.20		37.20		-37.20		-37.20		-37.20		37.20		-37.20
Fncf (kip)		3939.59		-5021.39		3939.59		-5021.39		-5021.39		-5021.39		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.08	3.87	-24.54	-7.28	-28.56	4.83	-18.27	-2.47	-25.81	-4.66	-19.00	-1.45	-27.58	6.71	-19.60	-7.96
Fs (ksi)	-20.08	3.87	-24.54	-7.28	-28.56	4.83	-18.27	-2.47	-25.81	-4.66	-19.00	-1.45	-27.58	6.71	-19.60	-7.96
Fs (kip)	-2530.21	523.06	-3091.73	-982.88	-3598.53	652.38	-2301.85	-332.85	-3252.22	-629.20	-2394.14	-195.38	-3475.70	906.29	-2469.47	-1075.03

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	906.29
Comp	6799.69	5021.39	3598.53	1075.03

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	518.49	651.12	730.06	503.34	637.11	548.00	710.09	535.89	376.84	471.79	527.57	366.13	461.90	397.69	512.21	390.38
Vuw (kip)	777.73	976.68	1095.09	755.01	955.67	822.00	1065.14	803.84	---	---	---	---	---	---	---	---
Mv (k*ft)	437.47	549.38	615.99	424.69	537.56	462.38	599.14	452.16	211.97	265.38	296.76	205.95	259.82	223.70	288.12	219.59
Huw (kip)	-1496.21	-2176.98	-1507.84	-1888.38	-2018.84	-1828.24	-1364.19	-2210.56	-534.81	-1050.00	-783.00	-684.23	-1005.57	-674.80	-688.76	-909.55
Muw (k*ft)	1275.16	821.31	1349.99	1013.72	928.78	1053.81	1421.02	798.93	527.02	379.65	734.63	347.67	465.31	386.18	754.56	255.99
Mu (k*ft)	1712.64	1370.70	1965.98	1438.41	1466.34	1516.18	2020.16	1251.08	738.99	645.04	1031.38	553.62	725.13	609.88	1042.68	475.58

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.44	23.92	16.57	20.75	22.19	20.09	14.99	24.29	5.88	11.54	8.60	7.52	11.05	7.42	7.57	10.00
PY1 (Vuw)	8.55	10.73	12.03	8.30	10.50	9.03	11.70	8.83	4.14	5.18	5.80	4.02	5.08	4.37	5.63	4.29
PX2 (Mu)	25.09	20.08	28.81	21.08	21.48	22.22	29.60	18.33	10.83	9.45	15.11	8.11	10.62	8.94	15.28	6.97
PY2 (Mu)	12.55	10.04	14.40	10.54	10.74	11.11	14.80	9.17	5.41	4.73	7.56	4.06	5.31	4.47	7.64	3.48
Pu (kip)	46.58	48.66	52.51	45.87	48.56	46.86	51.87	46.27	19.24	23.21	27.22	17.60	24.04	18.59	26.42	18.66

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3389.75	3969.00	OK
TF Inside	3409.93	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.94	44.72	48.39	43.07	44.82	43.81	47.92	43.00
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1095.09
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3409.93	21.86	OK	1804.61	11.57	OK
BF	2543.73	23.55	OK	544.59	5.04	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3389.75	21.73	1.47	179.78	OK
TF	6799.69	43.59	1.47	359.55	OK
TF Inside	3409.93	21.86	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.51	26.26	OK	27.22	13.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.51	1.47	126.02	OK
Web SPL	26.26	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.17
TF Inside	NA	1.17
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.54	1.45	8.25
Web	1.42	1.42	2.47
BF	1.41	3.34	4.99

Plate	Shear	Flexure
Web	1.87	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.92	2.09	-28.41	-7.41	-32.80	0.50	-22.50	-3.55	-28.47	-2.53	-24.36	-3.29	-32.52	4.14	-23.09	-9.15
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.34	0.04	0.41	0.15	0.47	0.01	0.32	0.07	0.41	0.05	0.35	0.07	0.47	0.08	0.33	0.18
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-23.92		-28.41		-32.80		-22.50		-28.47		-24.36		-32.52		-23.09	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		2.09		-7.41		0.50		-3.55		-2.53		-3.29		4.14		-9.15
Rcf		1.59		1.59		1.59		1.59		1.59		1.59		1.59		1.59
Fncf (ksi)		37.20		-37.20		37.20		-37.20		-37.20		-37.20		37.20		-37.20
Fncf (kip)		3939.59		-5021.39		3939.59		-5021.39		-5021.39		-5021.39		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.43887	1.46277	-20.64339	-5.334052	-23.74374	0.254922	-16.43393	-2.517917	-20.68269	-1.888211	-17.74648	-2.336826	-23.5148	2.9110784	-16.89	-6.56
Fs (ksi)	-17.44	1.46	-20.64	-5.33	-23.74	0.25	-16.43	-2.52	-20.68	-1.89	-17.75	-2.34	-23.51	2.91	-16.89	-6.56
Fs (kip)	-2197.30	197.47	-2601.07	-720.10	-2991.71	34.41	-2070.68	-339.92	-2606.02	-254.91	-2236.06	-315.47	-2962.86	393.00	-2127.73	-886.19

Vu (kip)	518.49	651.12	730.06	503.34	637.11	548.00	710.09	535.89	376.84	471.79	527.57	366.13	461.90	397.69	512.21	390.38
Vuw (kip)	777.73	976.68	1095.09	755.01	955.67	822.00	1065.14	803.84	---	---	---	---	---	---	---	---
Mv (k*ft)	437.47	549.38	615.99	424.69	537.56	462.38	599.14	452.16	211.97	265.38	296.76	205.95	259.82	223.70	288.12	219.59
Huw (kip)	-1595.04	-2092.78	-1678.31	-1890.24	-1837.24	-1876.81	-1487.64	-2184.02	-527.21	-857.26	-775.13	-625.41	-744.84	-662.75	-679.92	-773.89
Muw (k*ft)	1209.27	877.45	1153.76	1012.47	1047.81	1021.42	1280.88	816.62	415.84	336.81	527.97	306.15	413.48	339.01	581.37	227.09
Mu (k*ft)	1646.75	1426.83	1769.75	1437.16	1585.37	1483.80	1880.02	1268.78	627.81	602.19	824.73	512.10	673.30	562.71	869.49	446.68

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.53	23.00	18.44	20.77	20.19	20.62	16.35	24.00	5.79	9.42	8.52	6.87	8.19	7.28	7.47	8.50
PY1 (Vuw)	8.55	10.73	12.03	8.30	10.50	9.03	11.70	8.83	4.14	5.18	5.80	4.02	5.08	4.37	5.63	4.29
PX2 (Mu)	24.13	20.91	25.93	21.06	23.23	21.74	27.55	18.59	9.20	8.82	12.08	7.50	9.87	8.24	12.74	6.54
PY2 (Mu)	12.06	10.45	12.97	10.53	11.61	10.87	13.77	9.30	4.60	4.41	6.04	3.75	4.93	4.12	6.37	3.27
Pu (kip)	46.48	48.75	50.93	45.87	48.73	46.81	50.75	46.29	17.35	20.61	23.76	16.34	20.64	17.70	23.50	16.84

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.77	44.86	46.69	43.06	45.09	43.73	46.72	43.05
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.93	25.47	OK	23.76	11.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.93	1.47	126.02	OK
Web SPL	25.47	1.47	114.56	OK

Field Splice - Node 9522

Node 9522

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9522 L	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00
9522 R	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9522 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.97	17.15	-31.14	5.00	-35.17	11.33	-28.72	14.25	-32.59	14.54	-30.13	8.31	-33.97	15.70	-28.46	-7.21
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.42	0.35	0.45	0.10	0.51	0.23	0.41	0.29	0.47	0.29	0.43	0.17	0.49	0.32	0.41	0.15
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-28.97		-31.14		-35.17		-28.72		-32.59		-30.13		-33.97		-28.46	
Fcf (ksi)	-52.07		-52.07		-52.45		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6608.14		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		17.15		5.00		11.33		14.25		14.54		8.31		15.70		-7.21
Rcf		1.48		1.48		1.49		1.48		1.48		1.48		1.48		1.48
Fncf (ksi)		37.20		37.20		37.20		37.20		37.20		37.20		37.20		-37.20
Fncf (kip)		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.96	13.12	-23.70	4.66	-26.79	9.37	-22.20	11.85	-24.68	11.35	-22.72	6.81	-25.72	12.33	-21.65	5.15
Fs (ksi)	-21.96	13.12	-23.70	4.66	-26.79	9.37	-22.20	11.85	-24.68	11.35	-22.72	6.81	-25.72	12.33	-21.65	5.15
Fs (kip)	-2766.42	1771.22	-2985.71	628.50	-3375.74	1264.70	-2796.86	1599.66	-3109.75	1531.99	-2862.90	919.73	-3241.32	1664.77	-2728.15	695.55

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	1771.22
Comp	6608.14	5021.39	3375.74	0.00

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	436.60	583.87	659.93	429.74	473.29	583.96	616.78	473.49	321.70	425.87	479.61	317.48	347.75	425.81	449.00	347.89
Vuw (kip)	654.90	875.81	989.90	644.62	709.94	875.94	925.17	710.24	---	---	---	---	---	---	---	---
Mv (k*ft)	368.38	492.64	556.82	362.60	399.34	492.71	520.41	399.51	180.96	239.55	269.78	178.58	195.61	239.52	252.56	195.69
Huw (kip)	-866.77	-1459.96	-1159.25	-1008.46	-994.23	-1298.59	-937.24	-2056.75	-291.57	-628.34	-574.97	-341.48	-439.97	-524.98	-441.97	-544.49
Muw (k*ft)	1694.79	1299.33	1516.03	1600.33	1609.82	1406.91	1647.81	901.47	771.67	623.74	795.51	749.02	792.63	649.75	837.24	589.69
Mu (k*ft)	2063.17	1791.97	2072.85	1962.93	2009.16	1899.62	2168.22	1300.98	952.63	863.29	1065.30	927.61	988.24	889.27	1089.81	785.38

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9522	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	9.52	16.04	12.74	11.08	10.93	14.27	10.30	22.60	3.20	6.90	6.32	3.75	4.83	5.77	4.86	5.98
PY1 (Vuw)	7.20	9.62	10.88	7.08	7.80	9.63	10.17	7.80	3.54	4.68	5.27	3.49	3.82	4.68	4.93	3.82
PX2 (Mu)	30.23	26.26	30.37	28.76	29.44	27.83	31.77	19.06	13.96	12.65	15.61	13.59	14.48	13.03	15.97	11.51
PY2 (Mu)	15.11	13.13	15.19	14.38	14.72	13.92	15.88	9.53	6.98	6.32	7.80	6.80	7.24	6.51	7.98	5.75
Pu (kip)	45.59	48.03	50.38	45.26	46.22	48.24	49.48	45.13	20.13	22.44	25.53	20.16	22.26	21.88	24.51	19.94

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3294.26	3969.00	OK
TF Inside	3313.87	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.80	44.94	46.82	43.47	44.12	45.21	46.29	42.36
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	989.90
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3313.87	21.24	OK	1692.88	10.85	OK
BF	2543.73	23.55	OK	897.27	8.31	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3294.26	21.12	1.47	179.78	OK
TF	6608.14	42.36	1.47	359.55	OK
TF Inside	3313.87	21.24	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.38	25.19	OK	25.53	12.76	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.38	1.47	126.02	OK
Web SPL	25.19	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.20
TF Inside	NA	1.20
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.58	1.55	8.49
Web	1.45	1.50	2.52
BF	1.41	2.03	4.99

Plate	Shear	Flexure
Web	2.07	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.54	9.59	-26.54	0.67	-30.94	7.42	-20.81	6.18	-21.83	3.46	-27.85	6.43	-29.81	11.80	-21.35	-1.20
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.31	0.19	0.38	0.01	0.45	0.15	0.30	0.12	0.31	0.07	0.40	0.13	0.43	0.24	0.31	0.02
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-21.54		-26.54		-30.94		-20.81		-21.83		-27.85		-29.81		-21.35	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		9.59		0.67		7.42		6.18		3.46		6.43		11.80		-1.20
Rcf		1.68		1.68		1.68		1.68		1.68		1.68		1.68		1.68
Fncf (ksi)		37.20		37.20		37.20		37.20		37.20		37.20		37.20		-37.20
Fncf (kip)		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.8987	6.973874	-19.42277	0.551197	-22.52801	5.317864	-15.39595	4.9073597	-16.09234	2.525098	-20.35291	4.7434007	-21.73639	8.5346771	-15.75	-0.77
Fs (ksi)	-15.90	6.97	-19.42	0.55	-22.53	5.32	-15.40	4.91	-16.09	2.53	-20.35	4.74	-21.74	8.53	-15.75	-0.77
Fs (kip)	-2003.24	941.47	-2447.27	74.41	-2838.53	717.91	-1939.89	662.49	-2027.63	340.89	-2564.47	640.36	-2738.79	1152.18	-1985.02	-104.48

Vu (kip)	436.60	583.87	659.93	429.74	473.29	583.96	616.78	473.49	321.70	425.87	479.61	317.48	347.75	425.81	449.00	347.89
Vuw (kip)	654.90	875.81	989.90	644.62	709.94	875.94	925.17	710.24	---	---	---	---	---	---	---	---
Mv (k*ft)	368.38	492.64	556.82	362.60	399.34	492.71	520.41	399.51	180.96	239.55	269.78	178.58	195.61	239.52	252.56	195.69
Huw (kip)	-1171.92	-1667.23	-1292.50	-1361.20	-1512.05	-1347.27	-1049.22	-1771.40	-294.52	-622.76	-567.93	-346.12	-447.72	-515.11	-435.66	-545.43
Muw (k*ft)	1491.36	1161.15	1410.97	1365.17	1264.60	1374.46	1573.16	1091.70	503.20	439.43	612.61	446.67	409.58	552.12	665.96	329.56
Mu (k*ft)	1859.73	1653.79	1967.79	1727.77	1663.94	1867.17	2093.56	1491.21	684.15	678.98	882.39	625.26	605.19	791.64	918.53	525.25

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	12.88	18.32	14.20	14.96	16.62	14.81	11.53	19.47	3.24	6.84	6.24	3.80	4.92	5.66	4.79	5.99
PY1 (Vuw)	7.20	9.62	10.88	7.08	7.80	9.63	10.17	7.80	3.54	4.68	5.27	3.49	3.82	4.68	4.93	3.82
PX2 (Mu)	27.25	24.23	28.83	25.32	24.38	27.36	30.67	21.85	10.02	9.95	12.93	9.16	8.87	11.60	13.46	7.70
PY2 (Mu)	13.62	12.12	14.42	12.66	12.19	13.68	15.34	10.92	5.01	4.97	6.46	4.58	4.43	5.80	6.73	3.85
Pu (kip)	45.21	47.78	49.92	44.85	45.61	48.17	49.31	45.36	15.78	19.37	22.48	15.27	16.07	20.19	21.65	15.69

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.30	44.60	46.32	42.88	43.26	45.13	46.10	42.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.92	24.96	OK	22.48	11.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.92	1.47	126.02	OK
Web SPL	24.96	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 1536

Node 1536

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1536 L	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00
1536 R	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00

Rh = 0.99

Controlling Section = 1536 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.92	-8.74	-22.39	5.48	-32.03	4.49	-19.49	-5.63	-24.61	-9.97	-30.49	6.71	-21.05	-11.61	-31.66	8.76
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.37	0.18	0.32	0.11	0.46	0.09	0.28	0.11	0.35	0.20	0.44	0.14	0.30	0.23	0.46	0.18
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-25.92		-22.39		-32.03		-19.49		-24.61		-30.49		-21.05		-31.66	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		-8.74		5.48		4.49		-5.63		-9.97		6.71		-11.61		8.76
Rcf		1.63		1.63		1.63		1.63		1.63		1.63		1.63		1.63
Fncf (ksi)		-37.20		37.20		37.20		-37.20		-37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		-5021.39		-5021.39		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.51	-6.29	-17.30	4.75	-24.27	4.22	-14.90	-4.15	-18.54	-7.20	-23.08	5.68	-15.91	-8.47	-24.08	7.30
Fs (ksi)	-19.51	-6.29	-17.30	4.75	-24.27	4.22	-14.90	-4.15	-18.54	-7.20	-23.08	5.68	-15.91	-8.47	-24.08	7.30
Fs (kip)	-2458.36	-849.04	-2179.75	641.68	-3058.19	569.11	-1877.76	-560.85	-2335.85	-972.42	-2907.69	766.96	-2005.24	-1143.57	-3034.18	985.97

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	985.97
Comp	6561.28	5021.39	3058.19	1143.57

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	549.77	446.96	659.79	406.30	462.78	553.98	432.28	626.48	400.03	329.25	479.62	298.66	338.57	404.86	317.02	456.08
Vuw (kip)	824.65	670.44	989.69	609.45	694.18	830.97	648.42	939.72	---	---	---	---	---	---	---	---
Mv (k*ft)	463.87	377.12	556.70	342.82	390.47	467.42	364.74	528.59	225.01	185.20	269.79	168.00	190.45	227.73	178.32	256.55
Huw (kip)	-2173.63	-1410.50	-1463.72	-2006.32	-2239.42	-1344.27	-2327.43	-1234.47	-851.40	-414.03	-661.84	-628.89	-849.47	-574.06	-804.72	-553.65
Muw (k*ft)	823.55	1332.30	1296.82	935.09	779.68	1376.45	721.01	1449.65	290.88	485.16	626.71	236.47	249.38	632.68	163.76	690.45
Mu (k*ft)	1287.41	1709.42	1853.52	1277.91	1170.16	1843.87	1085.75	1978.24	515.89	670.37	896.50	404.46	439.82	860.41	342.08	947.00

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.89	15.50	16.08	22.05	24.61	14.77	25.58	13.57	9.36	4.55	7.27	6.91	9.33	6.31	8.84	6.08
PY1 (Vuw)	9.06	7.37	10.88	6.70	7.63	9.13	7.13	10.33	4.40	3.62	5.27	3.28	3.72	4.45	3.48	5.01
PX2 (Mu)	18.86	25.05	27.16	18.72	17.15	27.02	15.91	28.99	7.56	9.82	13.14	5.93	6.44	12.61	5.01	13.88
PY2 (Mu)	9.43	12.52	13.58	9.36	8.57	13.51	7.95	14.49	3.78	4.91	6.57	2.96	3.22	6.30	2.51	6.94
Pu (kip)	46.58	45.16	49.68	43.82	44.79	47.53	44.14	49.26	18.79	16.71	23.59	14.28	17.24	21.76	15.09	23.26

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3270.91	3969.00	OK
TF Inside	3290.38	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.26	43.05	46.04	41.47	41.90	44.71	41.31	45.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	989.69
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3290.38	21.09	OK	1533.63	9.83	OK
BF	2543.73	23.55	OK	579.31	5.36	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3270.91	20.97	1.47	179.78	OK
TF	6561.28	42.06	1.47	359.55	OK
TF Inside	3290.38	21.09	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.68	24.84	OK	23.59	11.80	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.68	1.47	126.02	OK
Web SPL	24.84	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.21
TF Inside	NA	1.21
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.59	1.71	8.55
Web	1.46	1.55	2.54
BF	1.41	3.14	4.99

Plate	Shear	Flexure
Web	2.07	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.30	-7.24	-20.88	4.29	-29.81	2.76	-17.59	-4.63	-19.31	-5.41	-25.63	2.07	-17.78	-8.83	-29.11	6.62
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.34	0.15	0.30	0.09	0.43	0.06	0.25	0.09	0.28	0.11	0.37	0.04	0.26	0.18	0.42	0.13
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-23.30		-20.88		-29.81		-17.59		-19.31		-25.63		-17.78		-29.11	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		-7.24		4.29		2.76		-4.63		-5.41		2.07		-8.83		6.62
Rcf		1.75		1.75		1.75		1.75		1.75		1.75		1.75		1.75
Fncf (ksi)		-37.20		37.20		37.20		-37.20		-37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		-5021.39		-5021.39		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.00893	-5.311882	-15.38298	3.05725	-21.69737	1.978145	-12.97181	-3.467544	-14.18673	-4.019655	-18.74471	1.490592	-13.10503	-6.438745	-21.20	4.70
Fs (ksi)	-17.01	-5.31	-15.38	3.06	-21.70	1.98	-12.97	-3.47	-14.19	-4.02	-18.74	1.49	-13.11	-6.44	-21.20	4.70
Fs (kip)	-2143.12	-717.10	-1938.26	412.73	-2733.87	267.05	-1634.45	-468.12	-1787.53	-542.65	-2361.83	201.23	-1651.23	-869.23	-2670.94	635.04

Vu (kip)	549.77	446.96	659.79	406.30	462.78	553.98	432.28	626.48	400.03	329.25	479.62	298.66	338.57	404.86	317.02	456.08
Vuw (kip)	824.65	670.44	989.69	609.45	694.18	830.97	648.42	939.72	---	---	---	---	---	---	---	---
Mv (k*ft)	463.87	377.12	556.70	342.82	390.47	467.42	364.74	528.59	225.01	185.20	269.79	168.00	190.45	227.73	178.32	256.55
Huw (kip)	-2121.78	-1457.43	-1545.47	-1971.32	-2016.36	-1585.24	-2213.72	-1323.08	-736.59	-406.75	-650.73	-542.50	-600.81	-569.39	-644.94	-544.30
Muw (k*ft)	858.11	1301.01	1242.32	958.42	928.40	1215.81	796.82	1390.58	257.34	405.69	520.86	209.09	223.68	445.18	146.66	569.84
Mu (k*ft)	1321.98	1678.14	1799.02	1301.24	1318.87	1683.22	1161.56	1919.17	482.35	590.89	790.65	377.09	414.12	672.91	324.98	826.39

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.32	16.02	16.98	21.66	22.16	17.42	24.33	14.54	8.09	4.47	7.15	5.96	6.60	6.26	7.09	5.98
PY1 (Vuw)	9.06	7.37	10.88	6.70	7.63	9.13	7.13	10.33	4.40	3.62	5.27	3.28	3.72	4.45	3.48	5.01
PX2 (Mu)	19.37	24.59	26.36	19.07	19.32	24.66	17.02	28.12	7.07	8.66	11.58	5.53	6.07	9.86	4.76	12.11
PY2 (Mu)	9.68	12.29	13.18	9.53	9.66	12.33	8.51	14.06	3.53	4.33	5.79	2.76	3.03	4.93	2.38	6.05
Pu (kip)	46.62	45.11	49.57	43.84	44.94	47.24	44.20	49.14	17.11	15.35	21.76	12.98	14.36	18.65	13.22	21.21

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.35	42.97	45.90	41.53	42.27	44.30	41.50	45.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.57	24.79	OK	21.76	10.88	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.57	1.47	126.02	OK
Web SPL	24.79	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5536

Node 5536

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5536 L	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00
5536 R	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00

Rh = 0.99

Controlling Section = 5536 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-36.84	-6.30	-30.42	8.49	-42.55	9.45	-28.44	-3.97	-34.22	5.04	-32.61	2.67	-29.96	-10.16	-41.41	12.07
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.53	0.13	0.44	0.17	0.61	0.19	0.41	0.08	0.49	0.10	0.47	0.05	0.43	0.20	0.60	0.24
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-36.84		-30.42		-42.55		-28.44		-34.22		-32.61		-29.96		-41.41	
Fcf (ksi)	-53.29		-52.07		-56.17		-52.07		-52.07		-52.07		-52.07		-55.59	
Fcf (kip)	-6714.07		-6561.28		-7077.00		-6561.28		-6561.28		-6561.28		-6561.28		-7004.35	
fncf (ksi)		-6.30		8.49		9.45		-3.97		5.04		2.67		-10.16		12.07
Rcf		1.25		1.22		1.32		1.22		1.22		1.22		1.22		1.31
Fncf (ksi)		-37.20		37.20		37.20		-37.20		37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		-5021.39		3939.59		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.64	-4.24	-22.74	6.66	-31.98	7.93	-21.14	-2.11	-25.74	4.47	-25.41	2.91	-22.56	-7.20	-30.80	9.48
Fs (ksi)	-27.64	-4.24	-22.74	6.66	-31.98	7.93	-21.14	-2.11	-25.74	4.47	-25.41	2.91	-22.56	-7.20	-30.80	9.48
Fs (kip)	-3482.69	-573.00	-2865.56	899.42	-4029.36	1071.18	-2663.80	-284.90	-3242.92	602.79	-3201.60	392.52	-2843.03	-971.36	-3881.03	1280.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	1280.47
Comp	7077.00	5021.39	4029.36	971.36

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	741.29	581.82	828.72	560.80	633.18	682.20	594.81	808.22	536.44	423.18	598.21	408.33	460.06	513.82	432.95	583.14
Vuw (kip)	1111.94	872.72	1243.08	841.20	949.78	1023.30	892.21	1212.33	---	---	---	---	---	---	---	---
Mv (k*ft)	625.47	490.91	699.23	473.18	534.25	575.61	501.87	681.94	301.75	238.04	336.49	229.69	258.78	289.02	243.53	328.02
Huw (kip)	-2004.39	-1361.59	-1426.68	-1864.94	-1500.87	-1596.74	-2114.92	-1299.35	-1052.20	-530.65	-793.46	-767.30	-701.99	-742.57	-982.04	-703.46
Muw (k*ft)	989.30	1364.91	1500.15	1029.34	1272.05	1208.14	862.69	1559.87	514.71	646.91	878.10	418.68	664.46	622.98	338.11	886.31
Mu (k*ft)	1614.76	1855.82	2199.38	1502.52	1806.30	1783.75	1364.56	2241.80	816.46	884.95	1214.60	648.37	923.24	912.00	581.64	1214.33

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	22.03	14.96	15.68	20.49	16.49	17.55	23.24	14.28	11.56	5.83	8.72	8.43	7.71	8.16	10.79	7.73
PY1 (Vuw)	12.22	9.59	13.66	9.24	10.44	11.25	9.80	13.32	5.89	4.65	6.57	4.49	5.06	5.65	4.76	6.41
PX2 (Mu)	23.66	27.19	32.23	22.01	26.47	26.14	19.99	32.85	11.96	12.97	17.80	9.50	13.53	13.36	8.52	17.79
PY2 (Mu)	11.83	13.60	16.11	11.01	13.23	13.07	10.00	16.42	5.98	6.48	8.90	4.75	6.76	6.68	4.26	8.90
Pu (kip)	51.63	48.11	56.40	47.09	49.05	49.99	47.55	55.73	26.35	21.85	30.70	20.17	24.31	24.80	21.32	29.76

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3528.00	3969.00	OK
TF Inside	3549.00	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.22	45.08	51.60	43.94	45.59	46.14	44.01	51.08
Check	OK	OK	NG	OK	OK	OK	OK	NG

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1243.08
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3549.00	22.75	OK	2020.66	12.95	OK
BF	2543.73	23.55	OK	648.66	6.01	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3528.00	22.62	1.47	179.78	OK
TF	7077.00	45.37	1.47	359.55	OK
TF Inside	3549.00	22.75	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.40	28.20	OK	30.70	15.35	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.40	1.47	126.02	OK
Web SPL	28.20	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.48	1.30	7.93
Web	1.33	1.24	2.32
BF	1.41	2.80	4.99

Plate	Shear	Flexure
Web	1.65	1.01

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.48	-3.93	-26.81	5.17	-37.46	4.79	-24.81	-1.92	-27.63	-1.39	-30.97	1.59	-25.52	-6.91	-37.15	8.26
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.47	0.08	0.39	0.10	0.54	0.10	0.36	0.04	0.40	0.03	0.45	0.03	0.37	0.14	0.54	0.17
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-32.48		-26.81		-37.46		-24.81		-27.63		-30.97		-25.52		-37.15	
Fcf (ksi)	-52.07		-52.07		-53.60		-52.07		-52.07		-52.07		-52.07		-53.44	
Fcf (kip)	-6561.28		-6561.28		-6753.68		-6561.28		-6561.28		-6561.28		-6561.28		-6733.81	
fncf (ksi)		-3.93		5.17		4.79		-1.92		-1.39		1.59		-6.91		8.26
Rcf		1.39		1.39		1.43		1.39		1.39		1.39		1.39		1.43
Fncf (ksi)		-37.20		37.20		37.20		-37.20		-37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		-5021.39		-5021.39		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.54317	-2.8532	-19.54432	3.691322	-27.06097	3.308501	-18.131	-1.319404	-20.11234	-1.059567	-23.45314	1.3790332	-18.621	-4.957799	-26.85	5.87
Fs (ksi)	-23.54	-2.85	-19.54	3.69	-27.06	3.31	-18.13	-1.32	-20.11	-1.06	-23.45	1.38	-18.62	-4.96	-26.85	5.87
Fs (kip)	-2966.44	-385.18	-2462.58	498.33	-3409.68	446.65	-2284.51	-178.12	-2534.16	-143.04	-2955.10	186.17	-2346.25	-669.30	-3383.36	792.92

Vu (kip)	741.29	581.82	828.72	560.80	633.18	682.20	594.81	808.22	536.44	423.18	598.21	408.33	460.06	513.82	432.95	583.14
Vuw (kip)	1111.94	872.72	1243.08	841.20	949.78	1023.30	892.21	1212.33	---	---	---	---	---	---	---	---
Mv (k*ft)	625.47	490.91	699.23	473.18	534.25	575.61	501.87	681.94	301.75	238.04	336.49	229.69	258.78	289.02	243.53	328.02
Huw (kip)	-1884.59	-1467.25	-1528.08	-1792.56	-1768.14	-1631.61	-2021.23	-1360.43	-871.08	-523.15	-783.83	-641.86	-698.67	-728.45	-778.10	-692.29
Muw (k*ft)	1016.24	1294.47	1320.55	1077.59	1093.87	1184.90	925.15	1425.44	455.18	511.18	668.13	369.86	419.16	546.31	300.59	719.96
Mu (k*ft)	1641.70	1785.38	2019.78	1550.77	1628.12	1760.50	1427.02	2107.38	756.93	749.22	1004.62	599.54	677.94	835.33	544.12	1047.98

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	20.71	16.12	16.79	19.70	19.43	17.93	22.21	14.95	9.57	5.75	8.61	7.05	7.68	8.00	8.55	7.61
PY1 (Vuw)	12.22	9.59	13.66	9.24	10.44	11.25	9.80	13.32	5.89	4.65	6.57	4.49	5.06	5.65	4.76	6.41
PX2 (Mu)	24.05	26.16	29.59	22.72	23.86	25.79	20.91	30.88	11.09	10.98	14.72	8.78	9.93	12.24	7.97	15.36
PY2 (Mu)	12.03	13.08	14.80	11.36	11.93	12.90	10.45	15.44	5.55	5.49	7.36	4.39	4.97	6.12	3.99	7.68
Pu (kip)	50.91	47.98	54.42	47.16	48.72	49.95	47.64	54.10	23.62	19.56	27.18	18.16	20.26	23.42	18.69	26.94

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.51	44.90	49.51	44.06	45.14	46.08	44.17	49.38
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
54.42	27.21	OK	27.18	13.59	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	54.42	1.47	126.02	OK
Web SPL	27.21	1.47	114.56	OK

Field Splice - Node 7536

Node 7536

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7536 L	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00
7536 R	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00

Rh = 0.99

Controlling Section = 7536 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-36.59	-5.21	-29.56	9.81	-40.91	10.63	-27.76	3.55	-34.40	-6.69	-29.23	6.10	-29.66	-8.50	-39.40	12.99
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.53	0.11	0.43	0.20	0.59	0.21	0.40	0.07	0.50	0.13	0.42	0.12	0.43	0.17	0.57	0.26
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-36.59		-29.56		-40.91		-27.76		-34.40		-29.23		-29.66		-39.40	
Fcf (ksi)	-53.16		-52.07		-55.34		-52.07		-52.07		-52.07		-52.07		-54.57	
Fcf (kip)	-6698.30		-6561.28		-6972.31		-6561.28		-6561.28		-6561.28		-6561.28		-6876.44	
fncf (ksi)		-5.21		9.81		10.63		3.55		-6.69		6.10		-8.50		12.99
Rcf		1.30		1.27		1.35		1.27		1.27		1.27		1.27		1.33
Fncf (ksi)		-37.20		37.20		37.20		37.20		-37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		3939.59		-5021.39		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-27.46	-3.33	-22.23	7.70	-30.76	8.79	-20.78	3.10	-25.84	-4.45	-22.53	5.73	-22.36	-5.87	-29.43	10.20
Fs (ksi)	-27.46	-3.33	-22.23	7.70	-30.76	8.79	-20.78	3.10	-25.84	-4.45	-22.53	5.73	-22.36	-5.87	-29.43	10.20
Fs (kip)	-3459.99	-450.05	-2800.50	1039.39	-3876.33	1186.71	-2618.24	418.91	-3255.93	-600.54	-2838.24	772.89	-2817.06	-791.91	-3708.46	1376.99

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	1376.99
Comp	6972.31	5021.39	3876.33	791.91

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	715.78	559.52	787.81	544.05	648.38	587.46	579.55	763.23	518.68	407.46	569.57	396.54	471.06	433.92	422.43	551.39
Vuw (kip)	1073.67	839.28	1181.71	816.08	972.57	881.19	869.32	1144.84	---	---	---	---	---	---	---	---
Mv (k*ft)	603.94	472.09	664.71	459.04	547.07	495.67	488.99	643.97	291.76	229.20	320.38	223.05	264.97	244.08	237.61	310.16
Huw (kip)	-1963.68	-1292.19	-1336.64	-1555.44	-1985.45	-1448.25	-2061.67	-1214.64	-1016.20	-479.39	-725.15	-583.33	-999.54	-554.42	-931.38	-634.67
Muw (k*ft)	1010.97	1411.17	1523.91	1235.67	949.00	1307.14	898.19	1572.03	530.78	658.36	870.21	525.42	470.63	621.52	362.82	871.91
Mu (k*ft)	1614.91	1883.27	2188.62	1694.71	1496.07	1802.80	1387.18	2216.01	822.54	887.56	1190.59	748.47	735.60	865.60	600.43	1182.06

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	21.58	14.20	14.69	17.09	21.82	15.91	22.66	13.35	11.17	5.27	7.97	6.41	10.98	6.09	10.23	6.97
PY1 (Vuw)	11.80	9.22	12.99	8.97	10.69	9.68	9.55	12.58	5.70	4.48	6.26	4.36	5.18	4.77	4.64	6.06
PX2 (Mu)	23.66	27.59	32.07	24.83	21.92	26.41	20.33	32.47	12.05	13.00	17.44	10.97	10.78	12.68	8.80	17.32
PY2 (Mu)	11.83	13.80	16.03	12.42	10.96	13.21	10.16	16.23	6.03	6.50	8.72	5.48	5.39	6.34	4.40	8.66
Pu (kip)	51.04	47.71	55.03	47.06	48.80	48.12	47.29	54.12	26.01	21.32	29.50	19.97	24.19	21.82	21.07	28.41

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3475.81	3969.00	OK
TF Inside	3496.50	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.83	44.87	50.54	44.21	45.00	45.02	43.88	49.82
Check	OK	OK	NG	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1181.71
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3496.50	22.41	OK	1943.92	12.46	OK
BF	2543.73	23.55	OK	697.55	6.46	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3475.81	22.28	1.47	179.78	OK
TF	6972.31	44.69	1.47	359.55	OK
TF Inside	3496.50	22.41	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.03	27.51	OK	29.50	14.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.03	1.47	126.02	OK
Web SPL	27.51	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.14
TF Inside	NA	1.14
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.50	1.35	8.04
Web	1.37	1.30	2.38
BF	1.41	2.61	4.99

Plate	Shear	Flexure
Web	1.73	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-31.44	-2.05	-25.95	6.46	-35.47	5.56	-24.33	0.42	-28.24	-2.18	-26.97	4.25	-24.97	-5.07	-35.13	9.12
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.45	0.04	0.37	0.13	0.51	0.11	0.35	0.01	0.41	0.04	0.39	0.09	0.36	0.10	0.51	0.18
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-31.44		-25.95		-35.47		-24.33		-28.24		-26.97		-24.97		-35.13	
Fcf (ksi)	-52.07		-52.07		-52.60		-52.07		-52.07		-52.07		-52.07		-52.42	
Fcf (kip)	-6561.28		-6561.28		-6627.41		-6561.28		-6561.28		-6561.28		-6561.28		-6605.35	
fncf (ksi)		-2.05		6.46		5.56		0.42		-2.18		4.25		-5.07		9.12
Rcf		1.47		1.47		1.48		1.47		1.47		1.47		1.47		1.48
Fncf (ksi)		-37.20		37.20		37.20		37.20		-37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		3939.59		-5021.39		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.80998	-1.444517	-18.9583	4.632604	-25.66348	3.929553	-17.81378	0.3611487	-20.55024	-1.533795	-20.0837	3.5782874	-18.23821	-3.580145	-25.44	6.51
Fs (ksi)	-22.81	-1.44	-18.96	4.63	-25.66	3.93	-17.81	0.36	-20.55	-1.53	-20.08	3.58	-18.24	-3.58	-25.44	6.51
Fs (kip)	-2874.06	-195.01	-2388.75	625.40	-3233.60	530.49	-2244.54	48.76	-2589.33	-207.06	-2530.55	483.07	-2298.01	-483.32	-3205.69	878.32

Vu (kip)	715.78	559.52	787.81	544.05	648.38	587.46	579.55	763.23	518.68	407.46	569.57	396.54	471.06	433.92	422.43	551.39
Vuw (kip)	1073.67	839.28	1181.71	816.08	972.57	881.19	869.32	1144.84	---	---	---	---	---	---	---	---
Mv (k*ft)	603.94	472.09	664.71	459.04	547.07	495.67	488.99	643.97	291.76	229.20	320.38	223.05	264.97	244.08	237.61	310.16
Huw (kip)	-1803.75	-1391.36	-1449.75	-1684.22	-1809.87	-1498.62	-1950.17	-1271.40	-800.40	-472.75	-717.22	-575.94	-728.77	-544.68	-720.01	-624.88
Muw (k*ft)	1070.14	1345.06	1329.04	1149.82	1066.06	1273.55	972.52	1440.30	470.04	519.00	651.05	399.85	418.36	520.56	322.48	702.86
Mu (k*ft)	1674.08	1817.15	1993.75	1608.86	1613.13	1769.22	1461.51	2084.27	761.80	748.20	971.43	622.90	683.33	764.64	560.09	1013.01

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.82	15.29	15.93	18.51	19.89	16.47	21.43	13.97	8.80	5.20	7.88	6.33	8.01	5.99	7.91	6.87
PY1 (Vuw)	11.80	9.22	12.99	8.97	10.69	9.68	9.55	12.58	5.70	4.48	6.26	4.36	5.18	4.77	4.64	6.06
PX2 (Mu)	24.53	26.62	29.21	23.57	23.64	25.92	21.41	30.54	11.16	10.96	14.23	9.13	10.01	11.20	8.21	14.84
PY2 (Mu)	12.26	13.31	14.61	11.79	11.82	12.96	10.71	15.27	5.58	5.48	7.12	4.56	5.01	5.60	4.10	7.42
Pu (kip)	50.46	47.59	52.91	46.92	49.00	48.06	47.39	52.51	22.92	18.98	25.85	17.85	20.70	20.07	18.34	25.55

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.28	44.71	48.30	44.00	45.29	44.93	44.07	48.11
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.91	26.45	OK	25.85	12.92	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.91	1.47	126.02	OK
Web SPL	26.45	1.47	114.56	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9536	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9536

Node 9536

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9536 L	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00
9536 R	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00

Rh = 0.99

Controlling Section = 9536 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	44.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.86	3.64	-24.76	12.68	-34.23	10.19	-24.24	9.81	-28.42	7.41	-23.83	7.22	-24.60	-5.74	-33.00	14.63
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.43	0.07	0.36	0.26	0.49	0.21	0.35	0.20	0.41	0.15	0.34	0.15	0.35	0.12	0.48	0.30
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.86		-24.76		-34.23		-24.24		-28.42		-23.83		-24.60		-33.00	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		3.64		12.68		10.19		9.81		7.41		7.22		-5.74		14.63
Rcf		1.52		1.52		1.52		1.52		1.52		1.52		1.52		1.52
Fncf (ksi)		37.20		37.20		37.20		37.20		37.20		37.20		-37.20		37.20
Fncf (kip)		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-22.59	3.54	-18.84	9.78	-25.92	8.41	-18.37	7.66	-21.58	6.21	-18.47	6.29	-18.71	-3.81	-24.88	11.39
Fs (ksi)	-22.59	3.54	-18.84	9.78	-25.92	8.41	-18.37	7.66	-21.58	6.21	-18.47	6.29	-18.71	-3.81	-24.88	11.39
Fs (kip)	-2846.16	477.99	-2373.75	1320.82	-3265.88	1135.25	-2314.77	1034.36	-2718.78	837.78	-2327.27	849.41	-2357.88	-514.07	-3135.05	1537.11

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	1537.11
Comp	6561.28	5021.39	3265.88	514.07

$\phi_v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	585.09	443.51	661.97	434.59	521.42	464.47	471.55	620.94	427.29	325.91	481.60	319.61	382.30	345.36	347.07	451.27
Vuw (kip)	877.64	665.26	992.95	651.88	782.13	696.71	707.32	931.41	---	---	---	---	---	---	---	---
Mv (k*ft)	493.67	374.21	558.53	366.68	439.95	391.90	397.87	523.92	240.35	183.32	270.90	179.78	215.04	194.26	195.22	253.84
Huw (kip)	-1521.65	-1067.90	-1192.98	-1211.73	-1332.29	-1342.21	-1992.46	-969.80	-628.58	-298.83	-577.84	-353.41	-507.27	-401.89	-743.20	-445.35
Muw (k*ft)	1258.20	1560.70	1477.31	1464.81	1384.44	1377.83	944.32	1626.10	574.84	629.71	755.24	572.73	611.24	544.77	327.92	797.88
Mu (k*ft)	1751.87	1934.91	2035.85	1831.50	1824.39	1769.73	1342.19	2150.02	815.19	813.03	1026.14	752.51	826.28	739.03	523.14	1051.72

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.72	11.74	13.11	13.32	14.64	14.75	21.90	10.66	6.91	3.28	6.35	3.88	5.57	4.42	8.17	4.89
PY1 (Vuw)	9.64	7.31	10.91	7.16	8.59	7.66	7.77	10.24	4.70	3.58	5.29	3.51	4.20	3.80	3.81	4.96
PX2 (Mu)	25.67	28.35	29.83	26.84	26.73	25.93	19.67	31.50	11.94	11.91	15.03	11.03	12.11	10.83	7.67	15.41
PY2 (Mu)	12.83	14.18	14.91	13.42	13.37	12.97	9.83	15.75	5.97	5.96	7.52	5.51	6.05	5.41	3.83	7.70
Pu (kip)	47.98	45.48	50.11	45.12	46.84	45.61	45.14	49.52	21.66	17.94	24.93	17.43	20.44	17.81	17.58	23.93

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3270.91	3969.00	OK
TF Inside	3290.38	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.86	43.57	46.52	43.20	44.25	43.41	42.43	46.30
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	992.95
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3290.38	21.09	OK	1637.78	10.50	OK
BF	2543.73	23.55	OK	778.67	7.21	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3270.91	20.97	1.47	179.78	OK
TF	6561.28	42.06	1.47	359.55	OK
TF Inside	3290.38	21.09	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.11	25.05	OK	24.93	12.46	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.11	1.47	126.02	OK
Web SPL	25.05	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.21
TF Inside	NA	1.21
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.59	1.60	8.55
Web	1.45	1.53	2.53
BF	1.41	2.33	4.99

Plate	Shear	Flexure
Web	2.06	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.45	-0.50	-21.03	9.07	-29.88	6.15	-19.99	5.66	-22.94	2.03	-21.41	5.06	-20.14	-2.39	-29.13	11.04
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.37	0.01	0.30	0.18	0.43	0.12	0.29	0.11	0.33	0.04	0.31	0.10	0.29	0.05	0.42	0.22
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-25.45		-21.03		-29.88		-19.99		-22.94		-21.41		-20.14		-29.13	
Fcf (ksi)	-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07		-52.07	
Fcf (kip)	-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28		-6561.28	
fncf (ksi)		-0.50		9.07		6.15		5.66		2.03		5.06		-2.39		11.04
Rcf		1.74		1.74		1.74		1.74		1.74		1.74		1.74		1.74
Fncf (ksi)		-37.20		37.20		37.20		37.20		37.20		37.20		-37.20		37.20
Fncf (kip)		-5021.39		3939.59		3939.59		3939.59		3939.59		3939.59		-5021.39		3939.59

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.61085	-0.261454	-15.49372	6.535738	-21.73896	4.43449	-14.76036	4.1280404	-16.83571	1.5289335	-15.99771	4.0087915	-14.85756	-1.59793	-21.22	7.93
Fs (ksi)	-18.61	-0.26	-15.49	6.54	-21.74	4.43	-14.76	4.13	-16.84	1.53	-16.00	4.01	-14.86	-1.60	-21.22	7.93
Fs (kip)	-2344.97	-35.30	-1952.21	882.32	-2739.11	598.66	-1859.80	557.29	-2121.30	206.41	-2015.71	541.19	-1872.05	-215.72	-2673.55	1070.47

Vu (kip)	585.09	443.51	661.97	434.59	521.42	464.47	471.55	620.94	427.29	325.91	481.60	319.61	382.30	345.36	347.07	451.27
Vuw (kip)	877.64	665.26	992.95	651.88	782.13	696.71	707.32	931.41	---	---	---	---	---	---	---	---
Mv (k*ft)	493.67	374.21	558.53	366.68	439.95	391.90	397.87	523.92	240.35	183.32	270.90	179.78	215.04	194.26	195.22	253.84
Huw (kip)	-1733.23	-1183.05	-1351.01	-1379.02	-1587.51	-1413.58	-1842.01	-1069.61	-622.79	-295.61	-571.05	-350.87	-505.12	-395.63	-543.03	-438.55
Muw (k*ft)	1117.15	1483.94	1371.96	1353.29	1214.30	1330.25	1044.63	1559.56	403.69	484.65	575.82	415.54	404.02	440.14	291.71	641.26
Mu (k*ft)	1610.82	1858.14	1930.49	1719.97	1654.24	1722.14	1442.49	2083.48	644.04	667.97	846.72	595.32	619.07	634.41	486.94	895.10

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9536	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.05	13.00	14.85	15.15	17.45	15.53	20.24	11.75	6.84	3.25	6.28	3.86	5.55	4.35	5.97	4.82
PY1 (Vuw)	9.64	7.31	10.91	7.16	8.59	7.66	7.77	10.24	4.70	3.58	5.29	3.51	4.20	3.80	3.81	4.96
PX2 (Mu)	23.60	27.23	28.29	25.20	24.24	25.23	21.14	30.53	9.44	9.79	12.41	8.72	9.07	9.30	7.13	13.11
PY2 (Mu)	11.80	13.61	14.14	12.60	12.12	12.62	10.57	15.26	4.72	4.89	6.20	4.36	4.54	4.65	3.57	6.56
Pu (kip)	47.74	45.34	49.88	44.93	46.55	45.53	45.26	49.37	18.81	15.55	21.93	14.84	17.03	16.04	15.04	21.31

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.51	43.38	46.26	42.92	43.83	43.30	42.68	46.13
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
49.88	24.94	OK	21.93	10.97	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	49.88	1.47	126.02	OK
Web SPL	24.94	1.47	114.56	OK

Field Splice

Type II2

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3536	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3536

Node 3536

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	78
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3536 L	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00
3536 R	138.00	69.41	9578.67	135.00	49.58	6693.17	66.00	50.00	3300.00

Rh = 0.99

Controlling Section = 3536 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	46.00	3.00	---	138.00	99.75	102.00	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	45.00	1.375	80.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	80.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.250	38.50	102.50	67.97	---	50	65

Max Outer to Inner stress ratio
0.88981

N.A. (from I 27.2256637 in
Outer to Inr 0.8879524
Outer to Inr 0.88980985

Outer to Mi 0.9439762
Outer to Mi 0.94490492

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.45	-7.28	-24.19	3.62	-33.20	3.50	-21.70	-5.00	-27.03	-6.37	-31.04	-5.60	-22.28	-9.37	-33.09	6.83
ϕf Fnc (ksi)	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58
f / ϕf Fnc	0.41	0.15	0.35	0.07	0.48	0.07	0.31	0.10	0.39	0.13	0.45	0.11	0.32	0.19	0.48	0.14
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-28.45		-24.19		-33.20		-21.70		-27.03		-31.04		-22.28		-33.09	
Fcf (ksi)	-52.06		-52.06		-52.06		-52.06		-52.06		-52.06		-52.06		-52.06	
Fcf (kip)	-7184.00		-7184.00		-7184.00		-7184.00		-7184.00		-7184.00		-7184.00		-7184.00	
fncf (ksi)		-7.28		3.62		3.50		-5.00		-6.37		-5.60		-9.37		6.83
Rcf		1.57		1.57		1.57		1.57		1.57		1.57		1.57		1.57
Fncf (ksi)		-37.18		37.18		37.18		-37.18		-37.18		-37.18		-37.18		37.18
Fncf (kip)		-5019.88		3938.40		3938.40		-5019.88		-5019.88		-5019.88		-5019.88		3938.40

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.95	-4.74	-18.47	3.38	-25.01	3.46	-16.21	-3.34	-20.21	-4.38	-23.28	-3.65	-16.69	-6.66	-24.98	5.87
Fs (ksi)	-20.95	-4.74	-18.47	3.38	-25.01	3.46	-16.21	-3.34	-20.21	-4.38	-23.28	-3.65	-16.69	-6.66	-24.98	5.87
Fs (kip)	-2890.55	-639.97	-2549.33	456.20	-3450.73	467.32	-2237.01	-450.54	-2788.74	-591.79	-3212.19	-492.30	-2303.86	-899.10	-3447.80	793.04

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3938.40	0.00	793.04
Comp	7184.00	5019.88	3450.73	899.10

$\phi v V_n$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	663.60	536.50	743.58	513.70	585.25	629.55	543.05	724.17	480.42	390.85	537.15	374.51	425.06	456.59	395.25	523.44
Vuw (kip)	995.40	804.75	1115.37	770.55	877.87	944.33	814.58	1086.26	---	---	---	---	---	---	---	---
Mv (k*ft)	559.91	452.67	627.40	433.44	493.80	531.18	458.20	611.02	270.23	219.85	302.15	210.66	239.09	256.83	222.33	294.44
Huw (kip)	-2080.37	-1516.32	-1522.49	-1962.01	-2033.26	-1993.35	-2188.45	-1350.12	-847.65	-498.11	-710.94	-645.07	-811.53	-888.47	-770.70	-630.62
Muw (k*ft)	884.35	1260.39	1256.27	963.26	915.76	942.36	812.30	1371.19	356.52	480.76	626.27	283.20	348.14	431.86	220.76	678.89
Mu (k*ft)	1444.26	1713.06	1883.67	1396.70	1409.56	1473.55	1270.50	1982.21	626.76	700.61	928.42	493.86	587.24	688.69	443.09	973.32

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3536**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.67	19.44	19.52	25.15	26.07	25.56	28.06	17.31	10.87	6.39	9.11	8.27	10.40	11.39	9.88	8.08
PY1 (Vuw)	12.76	10.32	14.30	9.88	11.25	12.11	10.44	13.93	6.16	5.01	6.89	4.80	5.45	5.85	5.07	6.71
PX2 (Mu)	26.27	31.16	34.26	25.40	25.64	26.80	23.11	36.05	11.40	12.74	16.89	8.98	10.68	12.53	8.06	17.70
PY2 (Mu)	10.95	12.98	14.28	10.59	10.68	11.17	9.63	15.02	4.75	5.31	7.04	3.74	4.45	5.22	3.36	7.38
Pu (kip)	58.01	55.71	60.90	54.54	56.17	57.30	54.96	60.71	24.80	21.74	29.49	19.25	23.29	26.36	19.82	29.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	104.50	67.98	39.96	5398.34	3015.38	OK
TF Inside	0.00	4189.50	2983.50	228.00	148.31	34.69	8208.20	2983.50	OK
BF Inside	1995.11	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.29	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3559.64	3898.13	OK
TF Inside	3624.36	3969.00	OK
BF Inside	2542.96	2598.75	OK
BF Outside	2476.91	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.04	44.14	47.13	43.07	43.99	44.69	43.12	47.13
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 700.4

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1115.37
Rr (kip)	2049.94
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.92	1.0	33.43
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3624.36	23.23	OK	1740.91	11.16	OK
BF	2542.96	23.55	OK	455.47	4.22	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3559.64	22.82	1.47	164.79	OK
TF	7184.00	46.05	1.47	359.55	OK
TF Inside	3624.36	23.23	1.47	179.78	OK
BF Inside	2542.96	23.55	1.47	126.02	OK
BF	5019.88	46.48	1.47	274.95	OK
BF Outside	2476.91	22.93	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.90	30.45	OK	29.49	14.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.90	1.47	126.02	OK
Web SPL	30.45	1.47	114.56	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.10
TF Inside	NA	1.10
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.44	1.51	7.22
Web	1.19	1.23	2.07
BF	1.41	3.99	5.00

Plate	Shear	Flexure
Web	1.84	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.78	-7.15	-22.80	2.50	-31.08	1.78	-20.81	-5.31	-23.52	-4.41	-26.38	-2.84	-21.51	-9.54	-30.73	4.82
ϕf Fnc (ksi)	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58	69.41	49.58
f / ϕf Fnc	0.39	0.14	0.33	0.05	0.45	0.04	0.30	0.11	0.34	0.09	0.38	0.06	0.31	0.19	0.44	0.10
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-26.78		-22.80		-31.08		-20.81		-23.52		-26.38		-21.51		-30.73	
Fcf (ksi)	-52.06		-52.06		-52.06		-52.06		-52.06		-52.06		-52.06		-52.06	
Fcf (kip)	-7184.00		-7184.00		-7184.00		-7184.00		-7184.00		-7184.00		-7184.00		-7184.00	
fncf (ksi)		-7.15		2.50		1.78		-5.31		-4.41		-2.84		-9.54		4.82
Rcf		1.67		1.67		1.67		1.67		1.67		1.67		1.67		1.67
Fncf (ksi)		-37.18		37.18		37.18		-37.18		-37.18		-37.18		-37.18		37.18
Fncf (kip)		-5019.88		3938.40		3938.40		-5019.88		-5019.88		-5019.88		-5019.88		3938.40

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.44302	-5.232211	-16.65305	1.761485	-22.50078	1.251163	-15.22637	-3.934133	-17.14193	-3.296657	-19.17636	-2.008433	-15.72107	-6.920355	-22.25	3.40
Fs (ksi)	-19.44	-5.23	-16.65	1.76	-22.50	1.25	-15.23	-3.93	-17.14	-3.30	-19.18	-2.01	-15.72	-6.92	-22.25	3.40
Fs (kip)	-2683.14	-706.35	-2298.12	237.80	-3105.11	168.91	-2101.24	-531.11	-2365.59	-445.05	-2646.34	-271.14	-2169.51	-934.25	-3070.57	459.03

Vu (kip)	663.60	536.50	743.58	513.70	585.25	629.55	543.05	724.17	480.42	390.85	537.15	374.51	425.06	456.59	395.25	523.44
Vuw (kip)	995.40	804.75	1115.37	770.55	877.87	944.33	814.58	1086.26	---	---	---	---	---	---	---	---
Mv (k*ft)	559.91	452.67	627.40	433.44	493.80	531.18	458.20	611.02	270.23	219.85	302.15	210.66	239.09	256.83	222.33	294.44
Huw (kip)	-2098.43	-1565.28	-1605.20	-1996.87	-1947.00	-1860.21	-2230.49	-1437.08	-814.28	-491.42	-701.24	-632.30	-674.47	-699.10	-747.17	-622.06
Muw (k*ft)	872.32	1227.75	1201.13	940.02	973.26	1031.13	784.27	1313.21	312.64	405.12	522.54	248.43	304.60	377.69	193.62	564.32
Mu (k*ft)	1432.23	1680.42	1828.52	1373.45	1467.06	1562.31	1242.47	1924.23	582.87	624.97	824.69	459.09	543.69	634.53	415.94	858.75

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.90	20.07	20.58	25.60	24.96	23.85	28.60	18.42	10.44	6.30	8.99	8.11	8.65	8.96	9.58	7.98
PY1 (Vuw)	12.76	10.32	14.30	9.88	11.25	12.11	10.44	13.93	6.16	5.01	6.89	4.80	5.45	5.85	5.07	6.71
PX2 (Mu)	26.05	30.56	33.26	24.98	26.68	28.42	22.60	35.00	10.60	11.37	15.00	8.35	9.89	11.54	7.57	15.62
PY2 (Mu)	10.85	12.74	13.86	10.41	11.12	11.84	9.42	14.58	4.42	4.74	6.25	3.48	4.12	4.81	3.15	6.51
Pu (kip)	57.98	55.63	60.76	54.50	56.28	57.49	54.91	60.55	23.55	20.18	27.35	18.42	20.86	23.11	19.01	27.05

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.01	44.06	46.99	43.01	44.13	44.91	43.05	46.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
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Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.76	30.38	OK	27.35	13.68	OK

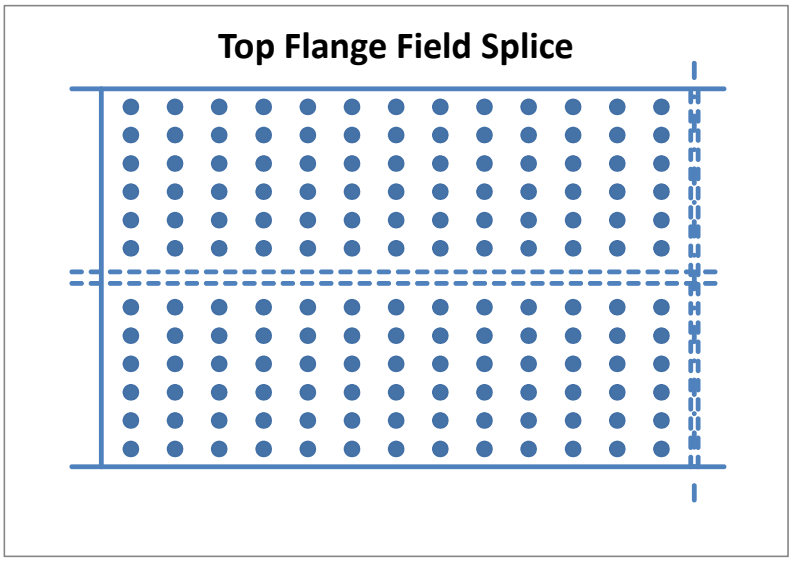
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.76	1.47	126.02	OK
Web SPL	30.38	1.47	114.56	OK

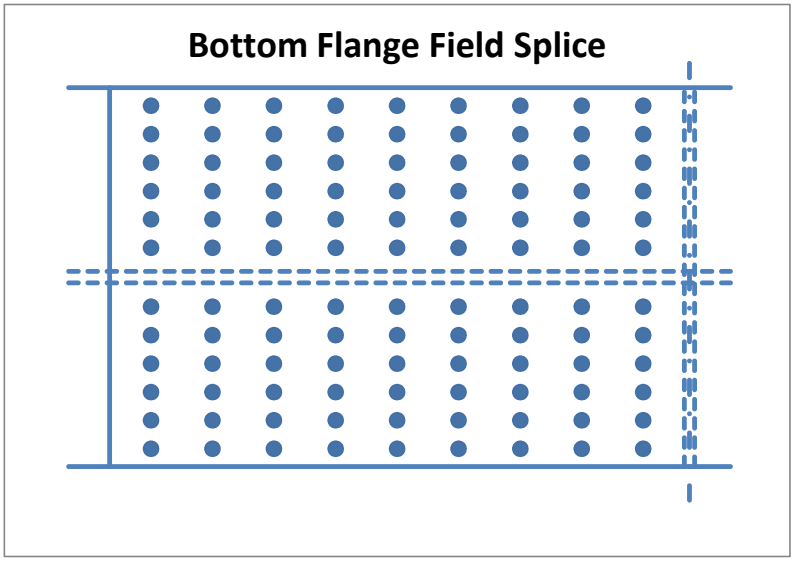
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
		Checked	WME	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3536	Backchk'd	SAE	Date	8/5/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 3536

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3.375
0	6.75	0	6.75
0	10.125	0	10.125
0	13.5	0	13.5
0	16.875	0	16.875
0	23.875	0	23.875
0	27.25	0	27.25
0	30.625	0	30.625
0	34	0	34
0	37.375	0	37.375
0	40.75	0	40.75
3	0	3	0
3	3.375	3	3.375
3	6.75	3	6.75
3	10.125	3	10.125
3	13.5	3	13.5
3	16.875	3	16.875
3	23.875	3	23.875
3	27.25	3	27.25
3	30.625	3	30.625
3	34	3	34
3	37.375	3	37.375
3	40.75	3	40.75
6	0	6	0
6	3.375	6	3.375
6	6.75	6	6.75
6	10.125	6	10.125
6	13.5	6	13.5
6	16.875	6	16.875
6	23.875	6	23.875
6	27.25	6	27.25
6	30.625	6	30.625
6	34	6	34
6	37.375	6	37.375
6	40.75	6	40.75
9	0	9	0
9	3.375	9	3.375
9	6.75	9	6.75
9	10.125	9	10.125
9	13.5	9	13.5
9	16.875	9	16.875
9	23.875	9	23.875
9	27.25	9	27.25
9	30.625	9	30.625
9	34	9	34
9	37.375	9	37.375
9	40.75	9	40.75
12	0	12	0
12	3.375	12	3.375
12	6.75	12	6.75
12	10.125	12	10.125
12	13.5	12	13.5
12	16.875	12	16.875
12	23.875	12	23.875
12	27.25	12	27.25
12	30.625	12	30.625
12	34	12	34
12	37.375	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	156.0		108.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	12.0		8.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	40.75	12	40.75
15	0	15	0
15	3.375	15	3.375
15	6.75	15	6.75
15	10.125	15	10.125
15	13.5	15	13.5
15	16.875	15	16.875
15	23.875	15	23.875
15	27.25	15	27.25
15	30.625	15	30.625
15	34	15	34
15	37.375	15	37.375
15	40.75	15	40.75
18	0	18	0
18	3.375	18	3.375
18	6.75	18	6.75
18	10.125	18	10.125
18	13.5	18	13.5
18	16.875	18	16.875
18	23.875	18	23.875
18	27.25	18	27.25
18	30.625	18	30.625
18	34	18	34
18	37.375	18	37.375
18	40.75	18	40.75
21	0	21	0
21	3.375	21	3.375
21	6.75	21	6.75
21	10.125	21	10.125
21	13.5	21	13.5
21	16.875	21	16.875
21	23.875	21	23.875
21	27.25	21	27.25
21	30.625	21	30.625
21	34	21	34
21	37.375	21	37.375
21	40.75	21	40.75
24	0	24	0
24	3.375	24	3.375
24	6.75	24	6.75
24	10.125	24	10.125
24	13.5	24	13.5
24	16.875	24	16.875
24	23.875	24	23.875
24	27.25	24	27.25
24	30.625	24	30.625
24	34	24	34
24	37.375	24	37.375
24	40.75	24	40.75
27	0		
27	3.375		
27	6.75		
27	10.125		
27	13.5		
27	16.875		
27	23.875		
27	27.25		
27	30.625		
27	34		
27	37.375		
27	40.75		
30	0		
30	3.375		
30	6.75		
30	10.125		
30	13.5		

Flange Bolt Pattern Cont. - Node 3536

30	16.875		
30	23.875		
30	27.25		
30	30.625		
30	34		
30	37.375		
30	40.75		
33	0		
33	3.375		
33	6.75		
33	10.125		
33	13.5		
33	16.875		
33	23.875		
33	27.25		
33	30.625		
33	34		
33	37.375		
33	40.75		
36	0		
36	3.375		
36	6.75		
36	10.125		
36	13.5		
36	16.875		
36	23.875		
36	27.25		
36	30.625		
36	34		
36	37.375		
36	40.75		

Flange Bolt Pattern Cont. - Node 3536

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	8/5/2011	Job Number	49633
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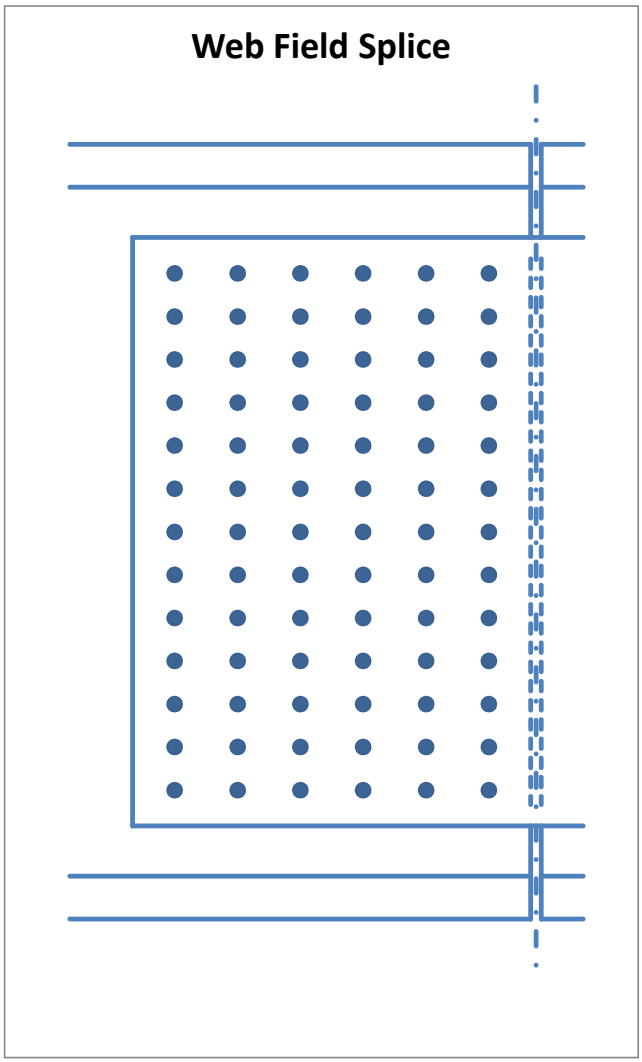
Web Bolt Pattern - Node 3536

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	56.25	324
0	3	56.25	225
0	6	56.25	144
0	9	56.25	81
0	12	56.25	36
0	15	56.25	9
0	18	56.25	0
0	21	56.25	9
0	24	56.25	36
0	27	56.25	81
0	30	56.25	144
0	33	56.25	225
0	36	56.25	324
3	0	20.25	324
3	3	20.25	225
3	6	20.25	144
3	9	20.25	81
3	12	20.25	36
3	15	20.25	9
3	18	20.25	0
3	21	20.25	9
3	24	20.25	36
3	27	20.25	81
3	30	20.25	144
3	33	20.25	225
3	36	20.25	324
6	0	2.25	324
6	3	2.25	225
6	6	2.25	144
6	9	2.25	81
6	12	2.25	36
6	15	2.25	9
6	18	2.25	0
6	21	2.25	9
6	24	2.25	36
6	27	2.25	81
6	30	2.25	144
6	33	2.25	225
6	36	2.25	324
9	0	2.25	324
9	3	2.25	225
9	6	2.25	144
9	9	2.25	81
9	12	2.25	36
9	15	2.25	9
9	18	2.25	0
9	21	2.25	9
9	24	2.25	36
9	27	2.25	81
9	30	2.25	144
9	33	2.25	225
9	36	2.25	324
12	0	20.25	324
12	3	20.25	225
12	6	20.25	144
12	9	20.25	81
12	12	20.25	36
12	15	20.25	9
12	18	20.25	0

No. Bolts =	78.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	5.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	7.5	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2047.5	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	9828	
Σd^2 (in^2) =	11875.5	



12	21	20.25	9
12	24	20.25	36
12	27	20.25	81
12	30	20.25	144
12	33	20.25	225
12	36	20.25	324
15	0	56.25	324
15	3	56.25	225
15	6	56.25	144
15	9	56.25	81
15	12	56.25	36
15	15	56.25	9
15	18	56.25	0
15	21	56.25	9
15	24	56.25	36
15	27	56.25	81
15	30	56.25	144
15	33	56.25	225
15	36	56.25	324

Web Bolt Pattern Cont. - Node 3536

Web Bolt Pattern Cont. - Node 3536

585	1404	2047.5	9828

Field Splice

Type II3

Field Splice - Node 7522

Node 7522

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	156
Web	91
BF	108

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7522 L	126.00	69.43	8748.37	135.00	49.59	6695.18	66.00	50.00	3300.00
7522 R	123.75	67.97	8411.27	123.75	69.53	8604.23	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7522 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	42.00	3.00	---	126.00	87.75	89.73	70	85
	Web	48.00	1.38	---	66.00	47.01	---	50	65
	BF	45.00	3.00	---	135.00	96.75	105.92	50	65
Splice Plates	TF Outside	42.00	1.500	80.50	63.00	43.88	---	70	85
	TF Inside	19.50	1.625	80.50	63.38	42.66	---	70	85
	BF Inside	21.00	1.375	56.50	57.75	40.22	---	50	65
	BF Outside	45.00	1.250	56.50	56.25	40.31	---	50	65
	Web	41.00	1.375	44.50	112.75	74.77	---	50	65

Max Outer to Inner stress ratio
0.891704

N.A. (from I 26.2981651 in
Outer to Inr 0.89170392
Outer to Inr 0.8859236

Outer to Mi 0.94585196
Outer to Mi 0.9429618

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-35.32	14.54	-42.07	7.21	-48.51	17.44	-32.52	7.19	-44.57	15.49	-35.73	6.91	-46.94	19.16	-34.04	-5.95
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.51	0.29	0.61	0.15	0.70	0.35	0.47	0.14	0.64	0.31	0.51	0.14	0.68	0.39	0.49	0.12
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-35.32		-42.07		-48.51		-32.52		-44.57		-35.73		-46.94		-34.04	
Fcf (ksi)	-52.52		-55.92		-59.17		-52.07		-57.18		-52.73		-58.38		-52.07	
Fcf (kip)	-6617.34		-7046.44		-7455.46		-6561.28		-7205.31		-6643.36		-7355.59		-6561.28	
fncf (ksi)		14.54		7.21		17.44		7.19		15.49		6.91		19.16		-5.95
Rcf		1.08		1.15		1.22		1.07		1.18		1.09		1.20		1.07
Fncf (ksi)		37.20		37.20		37.20		37.20		37.20		37.20		37.20		-37.20
Fncf (kip)		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.68	11.45	-31.70	6.41	-36.54	13.92	-24.11	5.40	-33.51	12.29	-26.99	6.08	-35.18	15.01	-25.82	-3.93
Fs (ksi)	-26.68	11.45	-31.70	6.41	-36.54	13.92	-24.11	5.40	-33.51	12.29	-26.99	6.08	-35.18	15.01	-25.82	-3.93
Fs (kip)	-3361.61	1546.37	-3994.64	865.13	-4603.61	1879.02	-3037.62	728.70	-4221.90	1659.71	-3400.33	820.84	-4433.11	2026.66	-3252.76	-530.80

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	3939.59	0.00	2026.66
Comp	7455.46	5021.39	4603.61	530.80

$\phi v Vn$ (kip) = 1914.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	631.36	788.31	873.04	612.83	739.71	731.44	854.23	642.85	460.44	571.92	631.78	447.85	537.58	531.15	617.90	469.15
Vuw (kip)	947.04	1182.46	1309.56	919.25	1109.56	1097.16	1281.34	964.27	---	---	---	---	---	---	---	---
Mv (k*ft)	532.71	665.14	736.63	517.08	624.13	617.15	720.76	542.40	259.00	321.70	355.38	251.91	302.39	298.77	347.57	263.89
Huw (kip)	-1199.61	-1556.18	-1234.79	-1449.93	-1269.21	-1478.05	-1149.88	-1915.30	-502.42	-834.74	-746.39	-617.44	-700.03	-689.91	-665.65	-981.66
Muw (k*ft)	1492.32	1403.23	1759.16	1306.01	1649.56	1315.70	1781.17	995.77	838.95	838.46	1110.01	649.13	1007.63	727.47	1104.31	481.44
Mu (k*ft)	2025.03	2068.36	2495.79	1823.09	2273.69	1932.85	2501.92	1538.17	1097.94	1160.16	1465.39	901.04	1310.02	1026.24	1451.87	745.34

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	13.18	17.10	13.57	15.93	13.95	16.24	12.64	21.05	5.52	9.17	8.20	6.79	7.69	7.58	7.31	10.79
PY1 (Vuw)	10.41	12.99	14.39	10.10	12.19	12.06	14.08	10.60	5.06	6.28	6.94	4.92	5.91	5.84	6.79	5.16
PX2 (Mu)	29.67	30.31	36.57	26.71	33.31	28.32	36.66	22.54	16.09	17.00	21.47	13.20	19.19	15.04	21.27	10.92
PY2 (Mu)	14.84	15.15	18.28	13.36	16.66	14.16	18.33	11.27	8.04	8.50	10.74	6.60	9.60	7.52	10.64	5.46
Pu (kip)	49.74	55.13	59.84	48.67	55.37	51.70	58.99	48.76	25.27	30.06	34.54	23.07	31.04	26.27	33.48	24.16

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4189.50	2983.50	114.00	74.16	37.97	5506.60	2983.50	OK
TF Inside	0.00	4214.44	2900.63	247.00	160.67	31.48	8477.84	2900.63	OK
BF Inside	1995.71	2743.13	2091.38	143.00	93.33	31.80	4468.21	2091.38	OK
BF Outside	1943.88	2671.88	2096.25	65.00	42.42	36.33	3168.51	2096.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3716.67	3969.00	OK
TF Inside	3738.79	3992.63	OK
BF Inside	2543.73	2598.75	OK
BF Outside	2477.66	2531.25	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.18	46.02	49.82	41.25	46.67	43.21	49.17	40.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 770.5

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1309.56
Rr (kip)	2254.93
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7522**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.25	0.93	1.0	33.61
Web	0.19	1.00	1.0	36.19
BF	0.25	0.92	1.0	33.21

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3738.79	23.97	OK	2308.63	14.80	OK
BF	2543.73	23.55	OK	1026.67	9.51	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3716.67	23.82	1.47	179.78	OK
TF	7455.46	47.79	1.47	359.55	OK
TF Inside	3738.79	23.97	1.47	194.76	OK
BF Inside	2543.73	23.55	1.47	126.02	OK
BF	5021.39	46.49	1.47	274.95	OK
BF Outside	2477.66	22.94	1.47	114.56	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.84	29.92	OK	34.54	17.27	NG

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.84	1.47	126.02	OK
Web SPL	29.92	1.47	126.02	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.07
TF Inside	NA	1.07
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.40	1.14	7.52
Web	1.28	1.16	2.23
BF	1.41	1.77	4.99

Plate	Shear	Flexure
Web	1.72	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.46	8.85	-35.27	0.70	-39.86	8.98	-27.88	2.81	-33.40	4.23	-33.69	5.43	-39.55	12.02	-28.45	-2.08
ϕf Fnc (ksi)	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59	69.43	49.59
f / ϕf Fnc	0.42	0.18	0.51	0.01	0.57	0.18	0.40	0.06	0.48	0.09	0.49	0.11	0.57	0.24	0.41	0.04
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.46		-35.27		-39.86		-27.88		-33.40		-33.69		-39.55		-28.45	
Fcf (ksi)	-52.07		-52.49		-54.81		-52.07		-52.07		-52.07		-54.65		-52.07	
Fcf (kip)	-6561.28		-6614.22		-6905.88		-6561.28		-6561.28		-6561.28		-6886.48		-6561.28	
fncf (ksi)		8.85		0.70		8.98		2.81		4.23		5.43		12.02		-2.08
Rcf		1.31		1.32		1.38		1.31		1.31		1.31		1.37		1.31
Fncf (ksi)		37.20		37.20		37.20		37.20		37.20		37.20		37.20		-37.20
Fncf (kip)		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		3939.59		-5021.39

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.53177	6.424996	-25.6552	0.555564	-28.89941	6.403161	-20.33426	1.8420941	-24.33578	3.045607	-24.5185	4.0115621	-28.66173	8.6706187	-20.84	-1.41
Fs (ksi)	-21.53	6.42	-25.66	0.56	-28.90	6.40	-20.33	1.84	-24.34	3.05	-24.52	4.01	-28.66	8.67	-20.84	-1.41
Fs (kip)	-2713.00	867.37	-3232.55	75.00	-3641.33	864.43	-2562.12	248.68	-3066.31	411.16	-3089.33	541.56	-3611.38	1170.53	-2625.44	-190.39

Vu (kip)	631.36	788.31	873.04	612.83	739.71	731.44	854.23	642.85	460.44	571.92	631.78	447.85	537.58	531.15	617.90	469.15
Vuw (kip)	947.04	1182.46	1309.56	919.25	1109.56	1097.16	1281.34	964.27	---	---	---	---	---	---	---	---
Mv (k*ft)	532.71	665.14	736.63	517.08	624.13	617.15	720.76	542.40	259.00	321.70	355.38	251.91	302.39	298.77	347.57	263.89
Huw (kip)	-1323.09	-1687.66	-1386.51	-1583.27	-1522.21	-1470.36	-1244.85	-1794.11	-498.52	-828.29	-742.38	-610.24	-702.58	-676.73	-659.71	-734.16
Muw (k*ft)	1390.57	1165.86	1467.65	1217.12	1257.83	1292.39	1555.38	1076.56	615.05	576.64	776.66	487.88	602.39	627.66	821.31	427.38
Mu (k*ft)	1923.28	1831.00	2204.28	1734.20	1881.95	1909.55	2276.13	1618.96	874.04	898.34	1132.03	739.79	904.78	926.43	1168.88	691.28

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7522	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	14.54	18.55	15.24	17.40	16.73	16.16	13.68	19.72	5.48	9.10	8.16	6.71	7.72	7.44	7.25	8.07
PY1 (Vuw)	10.41	12.99	14.39	10.10	12.19	12.06	14.08	10.60	5.06	6.28	6.94	4.92	5.91	5.84	6.79	5.16
PX2 (Mu)	28.18	26.83	32.30	25.41	27.57	27.98	33.35	23.72	12.81	13.16	16.59	10.84	13.26	13.57	17.13	10.13
PY2 (Mu)	14.09	13.41	16.15	12.70	13.79	13.99	16.67	11.86	6.40	6.58	8.29	5.42	6.63	6.79	8.56	5.06
Pu (kip)	49.24	52.50	56.50	48.50	51.36	51.25	56.19	48.90	21.58	25.71	29.06	20.37	24.44	24.51	28.81	20.87

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.69	43.49	46.63	41.05	42.81	42.78	46.49	41.13
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.50	28.25	OK	29.06	14.53	OK

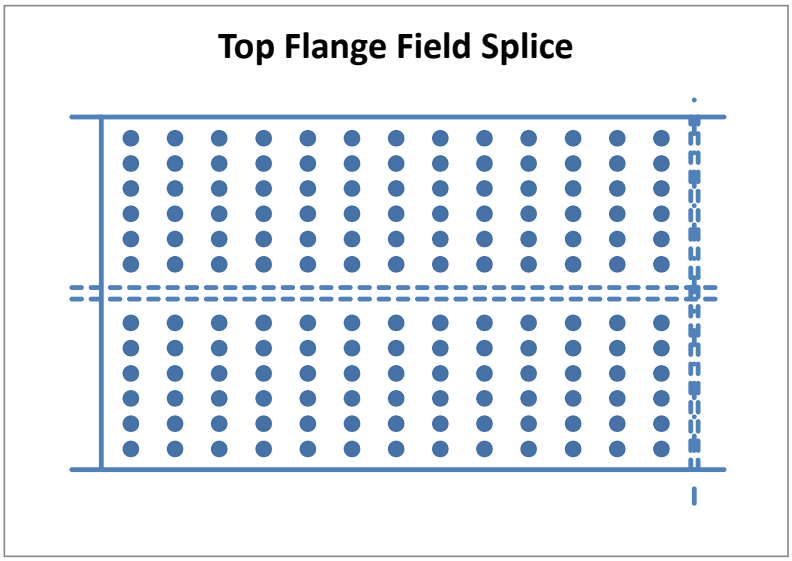
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.50	1.47	126.02	OK
Web SPL	28.25	1.47	126.02	OK

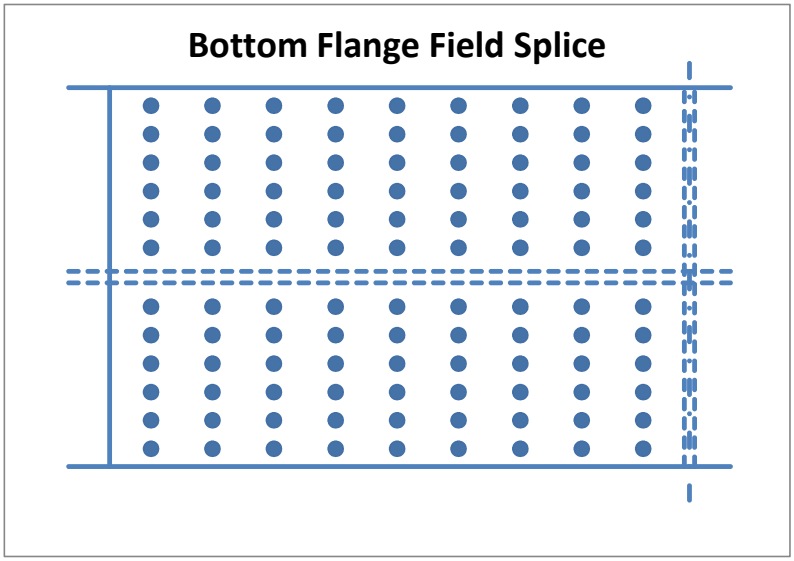
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 7522	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 7522

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3	0	3.375
0	6	0	6.75
0	9	0	10.125
0	12	0	13.5
0	15	0	16.875
0	22	0	23.875
0	25	0	27.25
0	28	0	30.625
0	31	0	34
0	34	0	37.375
0	37	0	40.75
3	0	3	0
3	3	3	3.375
3	6	3	6.75
3	9	3	10.125
3	12	3	13.5
3	15	3	16.875
3	22	3	23.875
3	25	3	27.25
3	28	3	30.625
3	31	3	34
3	34	3	37.375
3	37	3	40.75
6	0	6	0
6	3	6	3.375
6	6	6	6.75
6	9	6	10.125
6	12	6	13.5
6	15	6	16.875
6	22	6	23.875
6	25	6	27.25
6	28	6	30.625
6	31	6	34
6	34	6	37.375
6	37	6	40.75
9	0	9	0
9	3	9	3.375
9	6	9	6.75
9	9	9	10.125
9	12	9	13.5
9	15	9	16.875
9	22	9	23.875
9	25	9	27.25
9	28	9	30.625
9	31	9	34
9	34	9	37.375
9	37	9	40.75
12	0	12	0
12	3	12	3.375
12	6	12	6.75
12	9	12	10.125
12	12	12	13.5
12	15	12	16.875
12	22	12	23.875
12	25	12	27.25
12	28	12	30.625
12	31	12	34
12	34	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	156.0		108.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	12.0		8.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.500	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.000	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





Flange Bolt Pattern Cont. - Node 7522

12	37	12	40.75
15	0	15	0
15	3	15	3.375
15	6	15	6.75
15	9	15	10.125
15	12	15	13.5
15	15	15	16.875
15	22	15	23.875
15	25	15	27.25
15	28	15	30.625
15	31	15	34
15	34	15	37.375
15	37	15	40.75
18	0	18	0
18	3	18	3.375
18	6	18	6.75
18	9	18	10.125
18	12	18	13.5
18	15	18	16.875
18	22	18	23.875
18	25	18	27.25
18	28	18	30.625
18	31	18	34
18	34	18	37.375
18	37	18	40.75
21	0	21	0
21	3	21	3.375
21	6	21	6.75
21	9	21	10.125
21	12	21	13.5
21	15	21	16.875
21	22	21	23.875
21	25	21	27.25
21	28	21	30.625
21	31	21	34
21	34	21	37.375
21	37	21	40.75
24	0	24	0
24	3	24	3.375
24	6	24	6.75
24	9	24	10.125
24	12	24	13.5
24	15	24	16.875
24	22	24	23.875
24	25	24	27.25
24	28	24	30.625
24	31	24	34
24	34	24	37.375
24	37	24	40.75
27	0		
27	3		
27	6		
27	9		
27	12		
27	15		
27	22		
27	25		
27	28		
27	31		
27	34		
27	37		
30	0		
30	3		
30	6		
30	9		
30	12		

30	15		
30	22		
30	25		
30	28		
30	31		
30	34		
30	37		
33	0		
33	3		
33	6		
33	9		
33	12		
33	15		
33	22		
33	25		
33	28		
33	31		
33	34		
33	37		
36	0		
36	3		
36	6		
36	9		
36	12		
36	15		
36	22		
36	25		
36	28		
36	31		
36	34		
36	37		

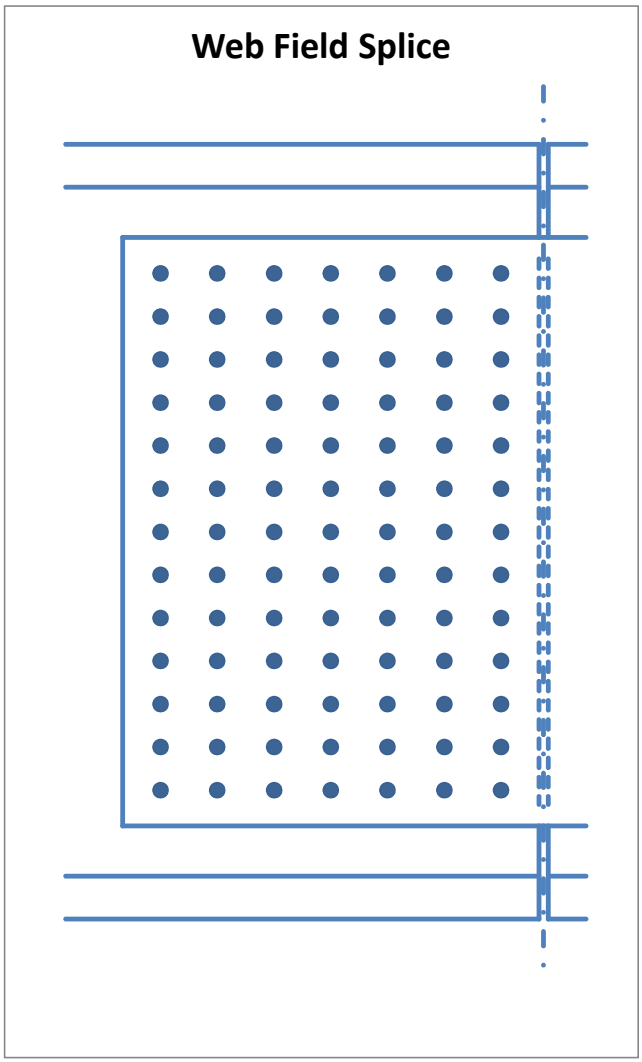
Flange Bolt Pattern Cont. - Node 7522

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 7522	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 7522

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	81	324
0	3	81	225
0	6	81	144
0	9	81	81
0	12	81	36
0	15	81	9
0	18	81	0
0	21	81	9
0	24	81	36
0	27	81	81
0	30	81	144
0	33	81	225
0	36	81	324
3	0	36	324
3	3	36	225
3	6	36	144
3	9	36	81
3	12	36	36
3	15	36	9
3	18	36	0
3	21	36	9
3	24	36	36
3	27	36	81
3	30	36	144
3	33	36	225
3	36	36	324
6	0	9	324
6	3	9	225
6	6	9	144
6	9	9	81
6	12	9	36
6	15	9	9
6	18	9	0
6	21	9	9
6	24	9	36
6	27	9	81
6	30	9	144
6	33	9	225
6	36	9	324
9	0	0	324
9	3	0	225
9	6	0	144
9	9	0	81
9	12	0	36
9	15	0	9
9	18	0	0
9	21	0	9
9	24	0	36
9	27	0	81
9	30	0	144
9	33	0	225
9	36	0	324
12	0	9	324
12	3	9	225
12	6	9	144
12	9	9	81
12	12	9	36
12	15	9	9
12	18	9	0

No. Bolts =	91.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	6.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	9	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	3276	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	11466	
Σd^2 (in^2) =	14742	



12	21	9	9
12	24	9	36
12	27	9	81
12	30	9	144
12	33	9	225
12	36	9	324
15	0	36	324
15	3	36	225
15	6	36	144
15	9	36	81
15	12	36	36
15	15	36	9
15	18	36	0
15	21	36	9
15	24	36	36
15	27	36	81
15	30	36	144
15	33	36	225
15	36	36	324
18	0	81	324
18	3	81	225
18	6	81	144
18	9	81	81
18	12	81	36
18	15	81	9
18	18	81	0
18	21	81	9
18	24	81	36
18	27	81	81
18	30	81	144
18	33	81	225
18	36	81	324

Web Bolt Pattern Cont. - Node 7522

Web Bolt Pattern Cont. - Node 7522

819	1638	3276	11466

Field Splice

Type JJ

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1527	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type JJ

Field Splice - Node 1527

Node 1527

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1527 L	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00
1527 R	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1527 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.72	-22.02	-1.37	-18.75	-11.79	-18.66	0.41	-21.96	-11.56	-24.46	-11.63	-24.93	-0.08	-24.04	-11.66	-17.76
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.16	0.32	0.02	0.28	0.17	0.27	0.01	0.32	0.17	0.36	0.17	0.37	0.00	0.35	0.17	0.26
α	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-22.02		-18.75		-18.66		-21.96		-24.46		-24.93		-24.04		-17.76
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-10.72		-1.37		-11.79		0.41		-11.56		-11.63		-0.08		-11.66	
Rcf	2.04		2.04		2.04		2.04		2.04		2.04		2.04		2.04	
Fncf (ksi)	-50.90		-50.90		-50.90		52.07		-50.90		-50.90		-52.07		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		4721.68		-6299.11		-6299.11		-6443.06		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.69	-17.40	-0.31	-13.77	-9.53	-14.95	1.26	-17.14	-8.96	-18.04	-7.79	-19.30	0.93	-18.63	-9.45	-14.30
Fs (ksi)	-8.69	-17.40	-0.31	-13.77	-9.53	-14.95	1.26	-17.14	-8.96	-18.04	-7.79	-19.30	0.93	-18.63	-9.45	-14.30
Fs (kip)	-1075.52	-2153.65	-38.40	-1703.57	-1179.36	-1849.98	155.33	-2120.96	-1108.62	-2232.53	-964.38	-2388.24	115.26	-2305.75	-1169.38	-1769.73

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4721.68	0.00	155.33	0.00
Comp	6443.06	6299.11	1179.36	2388.24

$\phi v Vn$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	170.75	78.20	219.73	120.69	33.81	35.46	103.47	200.15	124.52	56.99	159.12	87.01	79.59	23.13	74.85	145.28
Vuw (kip)	256.13	117.29	329.59	181.03	50.72	53.20	155.20	300.22	---	---	---	---	---	---	---	---
Mv (k*ft)	144.07	65.98	185.40	101.83	28.53	29.92	87.30	168.87	70.04	32.06	89.51	48.95	44.77	13.01	42.10	81.72
Huw (kip)	-2171.19	-1598.29	-2236.71	-1489.59	-2222.54	-2226.63	-1519.20	-2228.47	-782.83	-422.30	-734.39	-476.52	-809.98	-812.76	-531.03	-712.51
Muw (k*ft)	571.75	953.68	528.07	1026.15	537.52	534.79	1006.41	533.56	174.24	269.12	108.38	367.89	181.64	230.12	391.28	97.03
Mu (k*ft)	715.82	1019.66	713.47	1127.98	566.04	564.71	1093.71	702.44	244.28	301.18	197.89	416.83	226.41	243.13	433.38	178.75

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.40	24.59	34.41	22.92	34.19	34.26	23.37	34.28	12.04	6.50	11.30	7.33	12.46	12.50	8.17	10.96
PY1 (Vuw)	3.94	1.80	5.07	2.79	0.78	0.82	2.39	4.62	1.92	0.88	2.45	1.34	1.22	0.36	1.15	2.24
PX2 (Mu)	16.52	23.53	16.46	26.03	13.06	13.03	25.24	16.21	5.64	6.95	4.57	9.62	5.22	5.61	10.00	4.12
PY2 (Mu)	5.51	7.84	5.49	8.68	4.35	4.34	8.41	5.40	1.88	2.32	1.52	3.21	1.74	1.87	3.33	1.37
Pu (kip)	50.81	49.08	51.96	50.27	47.53	47.57	49.80	51.48	18.08	13.82	16.35	17.55	17.93	18.25	18.72	15.51

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2317.92	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2403.77	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3162.96	3189.38	OK
TF Inside	3280.10	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.81	41.33	42.56	42.32	39.23	39.25	41.95	42.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	329.59
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3280.10	27.33	OK	600.40	5.00	OK
BF	3206.82	26.72	OK	1215.83	10.13	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3162.96	26.36	1.47	134.83	OK
TF	6443.06	53.69	1.47	329.59	OK
TF Inside	3280.10	27.33	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.96	25.98	OK	18.72	9.36	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.96	1.47	114.56	OK
Web SPL	25.98	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.01
TF Inside	1.03	1.01
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.32	3.36	5.12
Web	1.39	1.99	2.21
BF	1.35	1.66	5.23

Plate	Shear	Flexure
Web	4.98	1.18

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.52	-21.04	-1.05	-17.24	-11.63	-18.03	-0.26	-20.98	-5.36	-17.38	-4.63	-17.02	-0.79	-22.98	-11.29	-16.98
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.16	0.31	0.02	0.25	0.17	0.27	0.00	0.31	0.08	0.26	0.07	0.25	0.01	0.34	0.17	0.25
α	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-21.04		-17.24		-18.03		-20.98		-17.38		-17.02		-22.98		-16.98
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-10.52		-1.05		-11.63		-0.26		-5.36		-4.63		-0.79		-11.29	
Rcf	2.21		2.21		2.21		2.21		2.21		2.21		2.21		2.21	
Fncf (ksi)	-50.90		-50.90		-50.90		-52.07		-50.90		-50.90		-52.07		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6443.06		-6299.11		-6299.11		-6443.06		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.696662	-15.40033	-0.836113	-12.7344	-8.477483	-13.26935	-0.278176	-15.3763	-5.69641	-13.72719	-4.12711	-14.30112	-0.651162	-16.79418	-8.24	-12.53
Fs (ksi)	-7.70	-15.40	-0.84	-12.73	-8.48	-13.27	-0.28	-15.38	-5.70	-13.73	-4.13	-14.30	-0.65	-16.79	-8.24	-12.53
Fs (kip)	-952.46	-1905.79	-103.47	-1575.88	-1049.09	-1642.08	-34.42	-1902.82	-704.93	-1698.74	-510.73	-1769.76	-80.58	-2078.28	-1019.68	-1550.53

Vu (kip)	170.75	78.20	219.73	120.69	33.81	35.46	103.47	200.15	124.52	56.99	159.12	87.01	79.59	23.13	74.85	145.28
Vuw (kip)	256.13	117.29	329.59	181.03	50.72	53.20	155.20	300.22	---	---	---	---	---	---	---	---
Mv (k*ft)	144.07	65.98	185.40	101.83	28.53	29.92	87.30	168.87	70.04	32.06	89.51	48.95	44.77	13.01	42.10	81.72
Huw (kip)	-2213.64	-1584.37	-2287.07	-1531.90	-1870.77	-1822.05	-1566.98	-2264.72	-692.91	-407.12	-652.40	-469.63	-582.71	-552.85	-523.36	-623.08
Muw (k*ft)	543.45	962.96	494.50	997.94	772.03	804.51	974.56	509.40	154.07	237.97	95.84	301.96	160.62	203.48	322.86	85.79
Mu (k*ft)	687.52	1028.94	679.90	1099.77	800.55	834.44	1061.86	678.27	224.11	270.02	185.34	350.91	205.38	216.49	364.96	167.52

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	34.06	24.37	35.19	23.57	28.78	28.03	24.11	34.84	10.66	6.26	10.04	7.23	8.96	8.51	8.05	9.59
PY1 (Vuw)	3.94	1.80	5.07	2.79	0.78	0.82	2.39	4.62	1.92	0.88	2.45	1.34	1.22	0.36	1.15	2.24
PX2 (Mu)	15.87	23.74	15.69	25.38	18.47	19.26	24.50	15.65	5.17	6.23	4.28	8.10	4.74	5.00	8.42	3.87
PY2 (Mu)	5.29	7.91	5.23	8.46	6.16	6.42	8.17	5.22	1.72	2.08	1.43	2.70	1.58	1.67	2.81	1.29
Pu (kip)	50.77	49.09	51.91	50.22	47.76	47.84	49.74	51.44	16.24	12.84	14.83	15.85	13.99	13.65	16.94	13.91

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.72	41.36	42.45	42.23	39.96	40.09	41.85	42.14
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.91	25.95	OK	16.94	8.47	OK

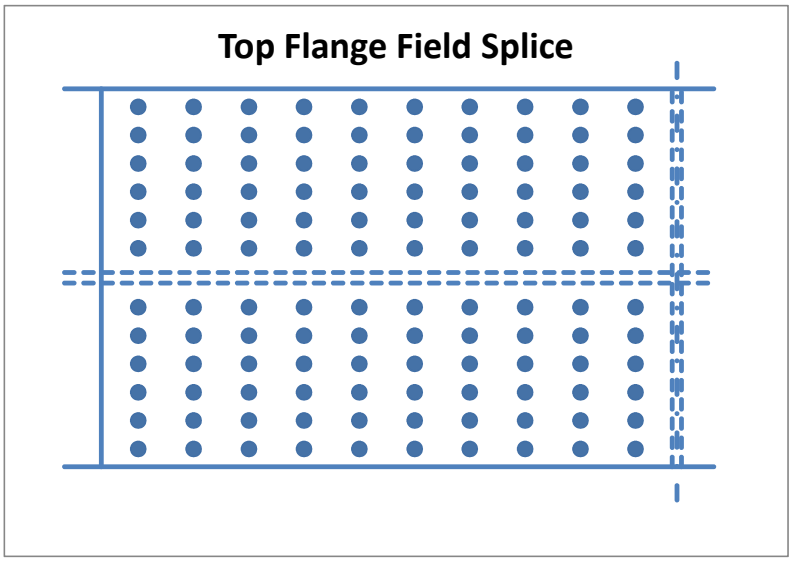
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.91	1.47	114.56	OK
Web SPL	25.95	1.47	91.65	OK

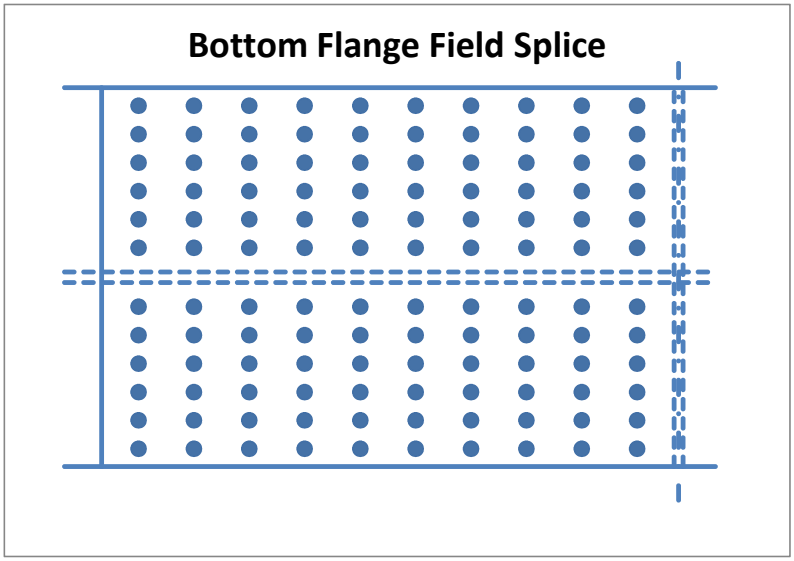
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1527	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1527

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3.375
0	6.75	0	6.75
0	10.125	0	10.125
0	13.5	0	13.5
0	16.875	0	16.875
0	23.875	0	23.875
0	27.25	0	27.25
0	30.625	0	30.625
0	34	0	34
0	37.375	0	37.375
0	40.75	0	40.75
3	0	3	0
3	3.375	3	3.375
3	6.75	3	6.75
3	10.125	3	10.125
3	13.5	3	13.5
3	16.875	3	16.875
3	23.875	3	23.875
3	27.25	3	27.25
3	30.625	3	30.625
3	34	3	34
3	37.375	3	37.375
3	40.75	3	40.75
6	0	6	0
6	3.375	6	3.375
6	6.75	6	6.75
6	10.125	6	10.125
6	13.5	6	13.5
6	16.875	6	16.875
6	23.875	6	23.875
6	27.25	6	27.25
6	30.625	6	30.625
6	34	6	34
6	37.375	6	37.375
6	40.75	6	40.75
9	0	9	0
9	3.375	9	3.375
9	6.75	9	6.75
9	10.125	9	10.125
9	13.5	9	13.5
9	16.875	9	16.875
9	23.875	9	23.875
9	27.25	9	27.25
9	30.625	9	30.625
9	34	9	34
9	37.375	9	37.375
9	40.75	9	40.75
12	0	12	0
12	3.375	12	3.375
12	6.75	12	6.75
12	10.125	12	10.125
12	13.5	12	13.5
12	16.875	12	16.875
12	23.875	12	23.875
12	27.25	12	27.25
12	30.625	12	30.625
12	34	12	34
12	37.375	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	120.0		120.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	9.0		9.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





Flange Bolt Pattern Cont. - Node 1527

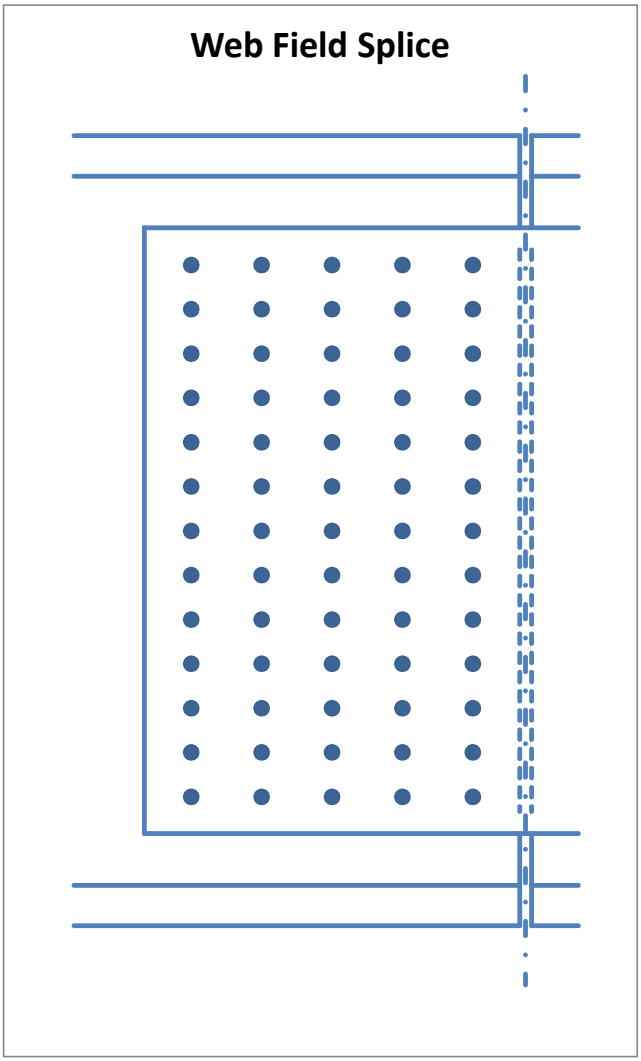
12	40.75	12	40.75
15	0	15	0
15	3.375	15	3.375
15	6.75	15	6.75
15	10.125	15	10.125
15	13.5	15	13.5
15	16.875	15	16.875
15	23.875	15	23.875
15	27.25	15	27.25
15	30.625	15	30.625
15	34	15	34
15	37.375	15	37.375
15	40.75	15	40.75
18	0	18	0
18	3.375	18	3.375
18	6.75	18	6.75
18	10.125	18	10.125
18	13.5	18	13.5
18	16.875	18	16.875
18	23.875	18	23.875
18	27.25	18	27.25
18	30.625	18	30.625
18	34	18	34
18	37.375	18	37.375
18	40.75	18	40.75
21	0	21	0
21	3.375	21	3.375
21	6.75	21	6.75
21	10.125	21	10.125
21	13.5	21	13.5
21	16.875	21	16.875
21	23.875	21	23.875
21	27.25	21	27.25
21	30.625	21	30.625
21	34	21	34
21	37.375	21	37.375
21	40.75	21	40.75
24	0	24	0
24	3.375	24	3.375
24	6.75	24	6.75
24	10.125	24	10.125
24	13.5	24	13.5
24	16.875	24	16.875
24	23.875	24	23.875
24	27.25	24	27.25
24	30.625	24	30.625
24	34	24	34
24	37.375	24	37.375
24	40.75	24	40.75
27	0	27	0
27	3.375	27	3.375
27	6.75	27	6.75
27	10.125	27	10.125
27	13.5	27	13.5
27	16.875	27	16.875
27	23.875	27	23.875
27	27.25	27	27.25
27	30.625	27	30.625
27	34	27	34
27	37.375	27	37.375
27	40.75	27	40.75

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1527	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1527

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1527

Web Bolt Pattern Cont. - Node 1527

390	1170	1170	8190

Field Splice - Node 3527

Node 3527

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3527 L	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00
3527 R	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3527 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.87	-26.31	-1.93	-21.93	-12.79	-23.12	-1.04	-26.02	-12.33	-28.27	-12.87	-28.56	-1.73	-28.44	-12.54	-22.12
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87
f / ϕf Fnc	0.17	0.39	0.03	0.32	0.19	0.34	0.02	0.38	0.18	0.42	0.19	0.42	0.03	0.42	0.18	0.33
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-26.31		-21.93		-23.12		-26.02		-28.27		-28.56		-28.44		-22.12
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-11.87		-1.93		-12.79		-1.04		-12.33		-12.87		-1.73		-12.54	
Rcf	1.78		1.78		1.78		1.78		1.78		1.78		1.78		1.78	
Fncf (ksi)	-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.88	-19.98	-1.19	-16.60	-9.55	-17.59	-0.44	-19.56	-8.67	-19.55	-6.36	-20.79	-0.86	-21.27	-9.38	-16.87
Fs (ksi)	-8.88	-19.98	-1.19	-16.60	-9.55	-17.59	-0.44	-19.56	-8.67	-19.55	-6.36	-20.79	-0.86	-21.27	-9.38	-16.87
Fs (kip)	-1099.39	-2472.67	-146.77	-2054.48	-1181.67	-2176.45	-54.92	-2420.41	-1072.67	-2419.71	-786.67	-2572.51	-106.64	-2632.07	-1160.82	-2087.39

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	6299.11	6299.11	1181.67	2632.07

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	181.38	53.16	233.99	94.68	41.43	57.66	77.55	221.99	130.46	39.55	167.63	68.88	94.74	23.36	56.78	159.15
Vuw (kip)	272.07	79.74	350.98	142.03	62.14	86.49	116.32	332.98	---	---	---	---	---	---	---	---
Mv (k*ft)	153.04	44.85	197.43	79.89	34.95	48.65	65.43	187.30	73.38	22.24	94.29	38.75	53.29	13.14	31.94	89.52
Huw (kip)	-2149.17	-1617.36	-2198.36	-1570.24	-2173.76	-2202.33	-1606.84	-2184.87	-865.95	-533.64	-814.09	-600.08	-846.64	-814.35	-663.93	-787.44
Muw (k*ft)	586.43	940.97	553.63	972.38	570.04	550.99	947.98	562.63	221.94	308.32	160.77	382.30	217.70	288.62	408.15	149.75
Mu (k*ft)	739.47	985.82	751.06	1052.27	604.99	599.64	1013.41	749.93	295.33	330.56	255.06	421.05	270.99	301.76	440.09	239.27

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.06	24.88	33.82	24.16	33.44	33.88	24.72	33.61	13.32	8.21	12.52	9.23	13.03	12.53	10.21	12.11
PY1 (Vuw)	4.19	1.23	5.40	2.19	0.96	1.33	1.79	5.12	2.01	0.61	2.58	1.06	1.46	0.36	0.87	2.45
PX2 (Mu)	17.06	22.75	17.33	24.28	13.96	13.84	23.39	17.31	6.82	7.63	5.89	9.72	6.25	6.96	10.16	5.52
PY2 (Mu)	5.69	7.58	5.78	8.09	4.65	4.61	7.80	5.77	2.27	2.54	1.96	3.24	2.08	2.32	3.39	1.84
Pu (kip)	51.09	48.44	52.36	49.52	47.73	48.09	49.05	52.07	20.59	16.15	18.96	19.43	19.60	19.68	20.81	18.15

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3092.29	3189.38	OK
TF Inside	3206.82	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.05	40.84	42.89	41.68	39.47	39.70	41.30	42.71
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	350.98
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3206.82	26.72	OK	601.58	5.01	OK
BF	3206.82	26.72	OK	1339.96	11.17	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3092.29	25.77	1.47	134.83	OK
TF	6299.11	52.49	1.47	329.59	OK
TF Inside	3206.82	26.72	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.36	26.18	OK	20.81	10.41	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.36	1.47	114.56	OK
Web SPL	26.18	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.03
TF Inside	NA	1.03
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.35	3.36	5.23
Web	1.38	1.74	2.19
BF	1.35	1.51	5.23

Plate	Shear	Flexure
Web	4.67	1.17

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.77	-25.22	-2.29	-20.92	-12.84	-22.46	-1.54	-24.80	-6.04	-20.89	-6.04	-20.66	-2.24	-27.12	-12.57	-21.50
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87
f / ϕf Fnc	0.17	0.37	0.03	0.31	0.19	0.33	0.02	0.37	0.09	0.31	0.09	0.30	0.03	0.40	0.19	0.32
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-25.22		-20.92		-22.46		-24.80		-20.89		-20.66		-27.12		-21.50
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-11.77		-2.29		-12.84		-1.54		-6.04		-6.04		-2.24		-12.57	
Rcf	1.88		1.88		1.88		1.88		1.88		1.88		1.88		1.88	
Fncf (ksi)	-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.545708	-18.35828	-1.70047	-15.33178	-9.303302	-16.41139	-1.16913	-18.07151	-6.665673	-16.2908	-4.32352	-17.08401	-1.66275	-19.7079	-9.11	-15.73
Fs (ksi)	-8.55	-18.36	-1.70	-15.33	-9.30	-16.41	-1.17	-18.07	-6.67	-16.29	-4.32	-17.08	-1.66	-19.71	-9.11	-15.73
Fs (kip)	-1057.53	-2271.84	-210.43	-1897.31	-1151.28	-2030.91	-144.68	-2236.35	-824.88	-2015.99	-535.04	-2114.15	-205.77	-2438.85	-1127.53	-1946.84

Vu (kip)	181.38	53.16	233.99	94.68	41.43	57.66	77.55	221.99	130.46	39.55	167.63	68.88	94.74	23.36	56.78	159.15
Vuw (kip)	272.07	79.74	350.98	142.03	62.14	86.49	116.32	332.98	---	---	---	---	---	---	---	---
Mv (k*ft)	153.04	44.85	197.43	79.89	34.95	48.65	65.43	187.30	73.38	22.24	94.29	38.75	53.29	13.14	31.94	89.52
Huw (kip)	-2177.19	-1643.53	-2237.58	-1601.18	-1854.46	-1854.48	-1640.52	-2222.28	-807.12	-510.97	-771.44	-577.22	-688.69	-642.23	-641.12	-745.30
Muw (k*ft)	567.75	923.52	527.49	951.76	782.91	782.89	925.53	537.69	196.25	272.63	142.16	338.05	192.50	255.21	360.90	132.41
Mu (k*ft)	720.79	968.38	724.92	1031.65	817.86	831.54	990.96	724.99	269.64	294.87	236.45	376.79	245.79	268.35	392.84	221.93

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.50	25.29	34.42	24.63	28.53	28.53	25.24	34.19	12.42	7.86	11.87	8.88	10.60	9.88	9.86	11.47
PY1 (Vuw)	4.19	1.23	5.40	2.19	0.96	1.33	1.79	5.12	2.01	0.61	2.58	1.06	1.46	0.36	0.87	2.45
PX2 (Mu)	16.63	22.35	16.73	23.81	18.87	19.19	22.87	16.73	6.22	6.80	5.46	8.70	5.67	6.19	9.07	5.12
PY2 (Mu)	5.54	7.45	5.58	7.94	6.29	6.40	7.62	5.58	2.07	2.27	1.82	2.90	1.89	2.06	3.02	1.71
Pu (kip)	51.06	48.42	52.32	49.49	47.95	48.34	49.02	52.03	19.08	14.95	17.87	18.02	16.61	16.25	19.33	17.10

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.99	40.78	42.81	41.62	40.13	40.42	41.23	42.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.32	26.16	OK	19.33	9.66	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.32	1.47	114.56	OK
Web SPL	26.16	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5527	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 5527

Node 5527

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5527 L	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00
5527 R	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5527 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.13	-27.22	-1.23	-22.75	-12.08	-24.33	0.52	-27.37	-11.21	-28.45	-11.41	-29.21	0.00	-30.03	-11.78	-23.25
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.16	0.40	0.02	0.34	0.18	0.36	0.01	0.40	0.17	0.42	0.17	0.43	0.00	0.44	0.17	0.34
α	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-27.22		-22.75		-24.33		-27.37		-28.45		-29.21		-30.03		-23.25
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-11.13		-1.23		-12.08		0.52		-11.21		-11.41		0.00		-11.78	
Rcf	1.70		1.70		1.70		1.70		1.70		1.70		1.70		1.70	
Fncf (ksi)	-50.90		-50.90		-50.90		52.07		-50.90		-50.90		-52.07		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		4721.68		-6299.11		-6299.11		-6443.06		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.71	-20.12	-0.52	-17.06	-8.45	-18.00	0.85	-20.42	-5.78	-19.57	-5.87	-20.41	0.52	-22.34	-8.25	-17.22
Fs (ksi)	-7.71	-20.12	-0.52	-17.06	-8.45	-18.00	0.85	-20.42	-5.78	-19.57	-5.87	-20.41	0.52	-22.34	-8.25	-17.22
Fs (kip)	-954.21	-2489.84	-64.18	-2110.66	-1045.42	-2227.05	104.64	-2527.58	-715.67	-2421.51	-726.89	-2526.10	64.17	-2764.82	-1021.26	-2130.86

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4721.68	0.00	104.64	0.00
Comp	6443.06	6299.11	1045.42	2764.82

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	182.08	66.21	221.14	112.05	29.60	35.99	97.14	208.35	129.27	48.66	156.88	81.05	52.30	47.08	70.51	147.84
Vuw (kip)	273.12	99.32	331.71	168.08	44.39	53.99	145.72	312.53	---	---	---	---	---	---	---	---
Mv (k*ft)	153.63	55.87	186.59	94.55	24.97	30.37	81.97	175.80	72.72	27.37	88.24	45.59	29.42	26.48	39.66	83.16
Huw (kip)	-2080.25	-1576.93	-2128.71	-1488.11	-2084.23	-2094.56	-1514.54	-2113.60	-834.92	-527.23	-793.33	-587.38	-760.53	-788.60	-654.70	-764.15
Muw (k*ft)	632.38	967.93	600.07	1027.14	629.72	622.84	1009.52	610.14	248.18	330.74	190.97	425.41	275.69	290.78	457.21	179.33
Mu (k*ft)	786.01	1023.79	786.66	1121.68	654.69	653.21	1091.48	785.94	320.90	358.11	279.21	471.00	305.11	317.26	496.87	262.49

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.00	24.26	32.75	22.89	32.07	32.22	23.30	32.52	12.84	8.11	12.21	9.04	11.70	12.13	10.07	11.76
PY1 (Vuw)	4.20	1.53	5.10	2.59	0.68	0.83	2.24	4.81	1.99	0.75	2.41	1.25	0.80	0.72	1.08	2.27
PX2 (Mu)	18.14	23.63	18.15	25.88	15.11	15.07	25.19	18.14	7.41	8.26	6.44	10.87	7.04	7.32	11.47	6.06
PY2 (Mu)	6.05	7.88	6.05	8.63	5.04	5.02	8.40	6.05	2.47	2.75	2.15	3.62	2.35	2.44	3.82	2.02
Pu (kip)	51.18	48.80	52.11	50.05	47.52	47.66	49.64	51.80	20.74	16.75	19.20	20.49	19.00	19.71	22.09	18.32

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2317.92	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2403.77	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3162.96	3189.38	OK
TF Inside	3280.10	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.20	41.16	42.81	42.17	39.44	39.53	41.84	42.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	331.71
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3280.10	27.33	OK	532.21	4.44	OK
BF	3206.82	26.72	OK	1407.54	11.73	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3162.96	26.36	1.47	134.83	OK
TF	6443.06	53.69	1.47	329.59	OK
TF Inside	3280.10	27.33	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.11	26.06	OK	22.09	11.05	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.11	1.47	114.56	OK
Web SPL	26.06	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.01
TF Inside	1.03	1.01
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.32	3.79	5.12
Web	1.39	1.65	2.20
BF	1.35	1.43	5.23

Plate	Shear	Flexure
Web	4.94	1.17

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.20	-26.19	-1.52	-21.57	-12.11	-23.52	-0.61	-25.86	-5.32	-21.38	-5.01	-21.59	-1.18	-28.42	-11.75	-22.43
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.17	0.39	0.02	0.32	0.18	0.35	0.01	0.38	0.08	0.32	0.07	0.32	0.02	0.42	0.17	0.33
α	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-26.19		-21.57		-23.52		-25.86		-21.38		-21.59		-28.42		-22.43
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-11.20		-1.52		-12.11		-0.61		-5.32		-5.01		-1.18		-11.75	
Rcf	1.79		1.79		1.79		1.79		1.79		1.79		1.79		1.79	
Fncf (ksi)	-50.90		-50.90		-50.90		-52.07		-50.90		-50.90		-52.07		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6443.06		-6299.11		-6299.11		-6443.06		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.083546	-19.05617	-1.144751	-15.76763	-8.724288	-17.16752	-0.499394	-18.79722	-4.921781	-17.11069	-4.983163	-17.83916	-0.903132	-20.60512	-8.47	-16.40
Fs (ksi)	-8.08	-19.06	-1.14	-15.77	-8.72	-17.17	-0.50	-18.80	-4.92	-17.11	-4.98	-17.84	-0.90	-20.61	-8.47	-16.40
Fs (kip)	-1000.34	-2358.20	-141.66	-1951.24	-1079.63	-2124.48	-61.80	-2326.16	-609.07	-2117.45	-616.67	-2207.60	-111.76	-2549.88	-1047.83	-2028.99

Vu (kip)	182.08	66.21	221.14	112.05	29.60	35.99	97.14	208.35	129.27	48.66	156.88	81.05	52.30	47.08	70.51	147.84
Vuw (kip)	273.12	99.32	331.71	168.08	44.39	53.99	145.72	312.53	---	---	---	---	---	---	---	---
Mv (k*ft)	153.63	55.87	186.59	94.55	24.97	30.37	81.97	175.80	72.72	27.37	88.24	45.59	29.42	26.48	39.66	83.16
Huw (kip)	-2116.44	-1596.23	-2165.18	-1547.15	-1800.28	-1783.70	-1577.86	-2145.64	-814.19	-507.37	-776.75	-578.90	-660.97	-684.67	-645.25	-745.90
Muw (k*ft)	608.25	955.05	575.76	987.78	819.02	830.08	967.31	588.79	219.45	292.46	168.86	365.96	243.78	257.12	394.04	158.57
Mu (k*ft)	761.87	1010.92	762.35	1082.32	843.99	860.44	1049.27	764.59	292.17	319.83	257.11	411.54	273.20	283.60	433.70	241.73

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.56	24.56	33.31	23.80	27.70	27.44	24.27	33.01	12.53	7.81	11.95	8.91	10.17	10.53	9.93	11.48
PY1 (Vuw)	4.20	1.53	5.10	2.59	0.68	0.83	2.24	4.81	1.99	0.75	2.41	1.25	0.80	0.72	1.08	2.27
PX2 (Mu)	17.58	23.33	17.59	24.98	19.48	19.86	24.21	17.64	6.74	7.38	5.93	9.50	6.30	6.54	10.01	5.58
PY2 (Mu)	5.86	7.78	5.86	8.33	6.49	6.62	8.07	5.88	2.25	2.46	1.98	3.17	2.10	2.18	3.34	1.86
Pu (kip)	51.14	48.78	52.07	49.98	47.72	47.88	49.57	51.77	19.73	15.52	18.41	18.92	16.73	17.32	20.42	17.55

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.13	41.12	42.73	42.05	40.03	40.18	41.71	42.54
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.07	26.04	OK	20.42	10.21	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.07	1.47	114.56	OK
Web SPL	26.04	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7527	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7527

Node 7527

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7527 L	123.75	69.53	8604.23	123.75	67.97	8411.27	48.00	50.00	2400.00
7527 R	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7527 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.60	-27.31	1.35	-22.86	-10.08	-24.53	2.48	-27.33	-9.83	-28.59	-10.32	-29.96	1.97	-30.00	-9.70	-23.45
ϕf Fnc (ksi)	67.87	67.87	69.42	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.13	0.40	0.02	0.34	0.15	0.36	0.04	0.40	0.14	0.42	0.15	0.44	0.03	0.44	0.14	0.35
α	0.97	0.97	0.99	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-27.31		-22.86		-24.53		-27.33		-28.59		-29.96		-30.00		-23.45
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-8.60		1.35		-10.08		2.48		-9.83		-10.32		1.97		-9.70	
Rcf	1.70		1.70		1.70		1.70		1.70		1.70		1.70		1.70	
Fncf (ksi)	-50.90		52.07		-50.90		52.07		-50.90		-50.90		52.07		-50.90	
Fncf (kip)	-6299.11		4721.68		-6299.11		4721.68		-6299.11		-6299.11		4721.68		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.33	-20.79	1.76	-17.57	-7.46	-18.74	2.65	-20.82	-4.98	-20.80	-6.43	-21.11	2.33	-22.74	-7.20	-17.97
Fs (ksi)	-6.33	-20.79	1.76	-17.57	-7.46	-18.74	2.65	-20.82	-4.98	-20.80	-6.43	-21.11	2.33	-22.74	-7.20	-17.97
Fs (kip)	-783.74	-2572.36	217.57	-2173.81	-923.58	-2319.65	328.31	-2576.36	-616.25	-2573.93	-795.60	-2612.39	288.07	-2814.36	-891.26	-2223.27

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4721.68	0.00	328.31	0.00
Comp	6299.11	6299.11	923.58	2814.36

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	85.18	143.06	133.75	188.94	44.59	34.54	173.48	121.56	57.89	104.44	92.20	136.85	13.46	7.95	125.93	83.59
Vuw (kip)	127.77	214.59	200.63	283.41	66.88	51.81	260.22	182.34	---	---	---	---	---	---	---	---
Mv (k*ft)	71.87	120.71	112.86	159.42	37.62	29.14	146.38	102.57	32.56	58.75	51.86	76.98	7.57	4.47	70.84	47.02
Huw (kip)	-1952.05	-1445.69	-2027.67	-1388.05	-2014.60	-2039.69	-1414.07	-2007.91	-813.60	-474.24	-786.24	-544.98	-773.38	-826.18	-612.43	-755.04
Muw (k*ft)	717.84	1055.42	667.43	1093.84	676.15	659.42	1076.50	680.60	289.07	386.49	225.63	469.44	316.39	293.62	501.40	215.27
Mu (k*ft)	789.71	1176.13	780.28	1253.26	713.77	688.56	1222.87	783.17	321.63	445.23	277.49	546.42	323.96	298.09	572.24	262.29

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7527	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.03	22.24	31.19	21.35	30.99	31.38	21.75	30.89	12.52	7.30	12.10	8.38	11.90	12.71	9.42	11.62
PY1 (Vuw)	1.97	3.30	3.09	4.36	1.03	0.80	4.00	2.81	0.89	1.61	1.42	2.11	0.21	0.12	1.94	1.29
PX2 (Mu)	18.22	27.14	18.01	28.92	16.47	15.89	28.22	18.07	7.42	10.27	6.40	12.61	7.48	6.88	13.21	6.05
PY2 (Mu)	6.07	9.05	6.00	9.64	5.49	5.30	9.41	6.02	2.47	3.42	2.13	4.20	2.49	2.29	4.40	2.02
Pu (kip)	48.92	50.90	50.03	52.19	47.91	47.66	51.74	49.75	20.22	18.28	18.84	21.92	19.56	19.74	23.50	17.98

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2317.92	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2403.77	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3092.29	3189.38	OK
TF Inside	3206.82	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.72	42.82	41.44	43.77	39.85	39.62	43.43	41.26
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	283.41
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3206.82	26.72	OK	470.19	3.92	OK
BF	3206.82	26.72	OK	1432.76	11.94	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3092.29	25.77	1.47	134.83	OK
TF	6299.11	52.49	1.47	329.59	OK
TF Inside	3206.82	26.72	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.19	26.09	OK	23.50	11.75	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.19	1.47	114.56	OK
Web SPL	26.09	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.03
TF Inside	1.03	1.03
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.35	4.30	5.23
Web	1.39	1.60	2.20
BF	1.35	1.41	5.23

Plate	Shear	Flexure
Web	5.79	1.15

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.96	-26.38	0.22	-21.42	-10.00	-23.45	0.92	-25.41	-3.62	-21.10	-3.57	-21.86	0.24	-27.87	-9.68	-22.48
ϕf Fnc (ksi)	67.87	67.87	69.42	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.13	0.39	0.00	0.32	0.15	0.35	0.01	0.37	0.05	0.31	0.05	0.32	0.00	0.41	0.14	0.33
α	0.97	0.97	0.99	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-26.38		-21.42		-23.45		-25.41		-21.10		-21.86		-27.87		-22.48
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-8.96		0.22		-10.00		0.92		-3.62		-3.57		0.24		-9.68	
Rcf	1.83		1.83		1.83		1.83		1.83		1.83		1.83		1.83	
Fncf (ksi)	-50.90		52.07		-50.90		52.07		-50.90		-50.90		52.07		-50.90	
Fncf (kip)	-6299.11		4721.68		-6299.11		4721.68		-6299.11		-6299.11		4721.68		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.43181	-19.21222	0.115735	-15.69553	-7.166906	-17.14233	0.608353	-18.51208	-3.270495	-17.25884	-4.510931	-17.49261	0.1289683	-20.24862	-6.94	-16.46
Fs (ksi)	-6.43	-19.21	0.12	-15.70	-7.17	-17.14	0.61	-18.51	-3.27	-17.26	-4.51	-17.49	0.13	-20.25	-6.94	-16.46
Fs (kip)	-795.94	-2377.51	14.32	-1942.32	-886.90	-2121.36	75.28	-2290.87	-404.72	-2135.78	-558.23	-2164.71	15.96	-2505.77	-858.90	-2036.72

Vu (kip)	85.18	143.06	133.75	188.94	44.59	34.54	173.48	121.56	57.89	104.44	92.20	136.85	13.46	7.95	125.93	83.59
Vuw (kip)	127.77	214.59	200.63	283.41	66.88	51.81	260.22	182.34	---	---	---	---	---	---	---	---
Mv (k*ft)	71.87	120.71	112.86	159.42	37.62	29.14	146.38	102.57	32.56	58.75	51.86	76.98	7.57	4.47	70.84	47.02
Huw (kip)	-2005.18	-1502.29	-2062.19	-1464.09	-1712.97	-1709.95	-1501.27	-2044.64	-769.32	-467.39	-729.28	-537.11	-615.88	-660.11	-603.59	-701.97
Muw (k*ft)	682.42	1017.68	644.42	1043.15	877.23	879.24	1018.37	656.11	255.61	316.23	199.51	382.41	279.77	259.63	407.55	190.35
Mu (k*ft)	754.30	1138.39	757.27	1202.57	914.85	908.39	1164.74	758.68	288.17	374.97	251.37	459.39	287.34	264.10	478.39	237.37

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.85	23.11	31.73	22.52	26.35	26.31	23.10	31.46	11.84	7.19	11.22	8.26	9.48	10.16	9.29	10.80
PY1 (Vuw)	1.97	3.30	3.09	4.36	1.03	0.80	4.00	2.81	0.89	1.61	1.42	2.11	0.21	0.12	1.94	1.29
PX2 (Mu)	17.41	26.27	17.48	27.75	21.11	20.96	26.88	17.51	6.65	8.65	5.80	10.60	6.63	6.09	11.04	5.48
PY2 (Mu)	5.80	8.76	5.83	9.25	7.04	6.99	8.96	5.84	2.22	2.88	1.93	3.53	2.21	2.03	3.68	1.83
Pu (kip)	48.88	50.83	50.00	52.09	48.15	47.91	51.63	49.72	18.75	16.47	17.35	19.69	16.29	16.39	21.09	16.57

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.61	42.70	41.37	43.61	40.48	40.31	43.25	41.18
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.09	26.04	OK	21.09	10.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.09	1.47	114.56	OK
Web SPL	26.04	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9527	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9527

Node 9527

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9527 L	123.75	69.53	8604.23	123.75	67.97	8411.27	48.00	50.00	2400.00
9527 R	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9527 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.96	-22.58	3.95	-17.70	-6.83	-20.19	4.78	-21.84	6.46	-24.06	-8.02	-25.81	4.52	-24.55	-6.52	-18.86
ϕf Fnc (ksi)	67.87	67.87	69.42	67.87	67.87	67.87	69.42	67.87	69.42	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.09	0.33	0.06	0.26	0.10	0.30	0.07	0.32	0.09	0.35	0.12	0.38	0.07	0.36	0.10	0.28
α	0.97	0.97	0.99	0.97	0.97	0.97	0.99	0.97	0.99	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-22.58		-17.70		-20.19		-21.84		-24.06		-25.81		-24.55		-18.86
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-5.96		3.95		-6.83		4.78		6.46		-8.02		4.52		-6.52	
Rcf	1.97		1.97		1.97		1.97		1.97		1.97		1.97		1.97	
Fncf (ksi)	-50.90		52.07		-50.90		52.07		52.07		-50.90		52.07		-50.90	
Fncf (kip)	-6299.11		4721.68		-6299.11		4721.68		4721.68		-6299.11		4721.68		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.47	-17.41	3.34	-13.60	-5.63	-16.15	4.59	-17.20	3.82	-18.33	-5.42	-18.47	4.44	-19.14	-5.43	-15.19
Fs (ksi)	-4.47	-17.41	3.34	-13.60	-5.63	-16.15	4.59	-17.20	3.82	-18.33	-5.42	-18.47	4.44	-19.14	-5.43	-15.19
Fs (kip)	-553.74	-2154.77	413.65	-1683.23	-696.85	-1998.19	568.40	-2128.24	473.10	-2268.61	-670.40	-2285.42	549.94	-2368.87	-672.34	-1879.53

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4721.68	0.00	568.40	0.00
Comp	6299.11	6299.11	696.85	2368.87

$\phi v Vn$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	25.88	198.57	64.68	237.92	95.85	82.76	219.21	51.28	14.77	144.40	42.19	172.20	64.76	37.84	158.98	32.72
Vuw (kip)	38.83	297.85	97.03	356.88	143.78	124.14	328.81	76.92	---	---	---	---	---	---	---	---
Mv (k*ft)	21.84	167.54	54.58	200.74	80.88	69.83	184.96	43.27	8.31	81.22	23.73	96.86	36.43	21.28	89.43	18.40
Huw (kip)	-1867.28	-1280.58	-1918.39	-1231.62	-1132.32	-1989.14	-1246.95	-1900.18	-656.61	-307.78	-653.35	-378.14	-435.27	-716.56	-440.95	-618.64
Muw (k*ft)	774.36	1165.49	740.29	1198.13	1264.33	693.11	1187.91	752.42	258.75	338.89	210.32	435.82	443.11	261.01	471.73	195.10
Mu (k*ft)	796.20	1333.03	794.86	1398.87	1345.21	762.94	1372.86	795.69	267.06	420.11	234.05	532.68	479.53	282.30	561.15	213.50

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.73	19.70	29.51	18.95	17.42	30.60	19.18	29.23	10.10	4.74	10.05	5.82	6.70	11.02	6.78	9.52
PY1 (Vuw)	0.60	4.58	1.49	5.49	2.21	1.91	5.06	1.18	0.23	2.22	0.65	2.65	1.00	0.58	2.45	0.50
PX2 (Mu)	18.37	30.76	18.34	32.28	31.04	17.61	31.68	18.36	6.16	9.69	5.40	12.29	11.07	6.51	12.95	4.93
PY2 (Mu)	6.12	10.25	6.11	10.76	10.35	5.87	10.56	6.12	2.05	3.23	1.80	4.10	3.69	2.17	4.32	1.64
Pu (kip)	47.58	52.60	48.46	53.75	50.06	48.83	53.21	48.15	16.42	15.43	15.65	19.33	18.37	17.75	20.86	14.60

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2317.92	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2403.77	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3092.29	3189.38	OK
TF Inside	3206.82	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.82	44.16	40.42	44.98	42.62	40.60	44.61	40.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	356.88
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9527**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3206.82	26.72	OK	354.76	2.96	OK
BF	3206.82	26.72	OK	1205.97	10.05	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3092.29	25.77	1.47	134.83	OK
TF	6299.11	52.49	1.47	329.59	OK
TF Inside	3206.82	26.72	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.75	26.87	OK	20.86	10.43	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.75	1.47	114.56	OK
Web SPL	26.87	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.03
TF Inside	1.03	1.03
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.35	5.69	5.23
Web	1.35	1.84	2.13
BF	1.35	1.67	5.23

Plate	Shear	Flexure
Web	4.60	1.11

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.99	-21.46	2.93	-16.47	-6.71	-19.16	3.46	-20.28	-0.87	-16.48	-1.40	-17.96	2.84	-22.58	-6.50	-17.99
ϕf Fnc (ksi)	67.87	67.87	69.42	67.87	67.87	67.87	69.42	67.87	69.42	67.87	67.87	67.87	69.42	67.87	67.87	67.87
f / ϕf Fnc	0.09	0.32	0.04	0.24	0.10	0.28	0.05	0.30	0.01	0.24	0.02	0.26	0.04	0.33	0.10	0.27
α	0.97	0.97	0.99	0.97	0.97	0.97	0.99	0.97	0.99	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-21.46		-16.47		-19.16		-20.28		-16.48		-17.96		-22.58		-17.99
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-5.99		2.93		-6.71		3.46		-0.87		-1.40		2.84		-6.50	
Rcf	2.25		2.25		2.25		2.25		2.25		2.25		2.25		2.25	
Fncf (ksi)	-50.90		52.07		-50.90		52.07		-52.07		-50.90		52.07		-50.90	
Fncf (kip)	-6299.11		4721.68		-6299.11		4721.68		-6443.06		-6299.11		4721.68		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.278807	-15.71877	2.06262	-12.17372	-4.790291	-14.08886	2.439746	-14.86252	-0.553687	-13.74595	-2.564232	-14.10418	1.9986801	-16.48487	-4.64	-13.26
Fs (ksi)	-4.28	-15.72	2.06	-12.17	-4.79	-14.09	2.44	-14.86	-0.55	-13.75	-2.56	-14.10	2.00	-16.48	-4.64	-13.26
Fs (kip)	-529.50	-1945.20	255.25	-1506.50	-592.80	-1743.50	301.92	-1839.24	-68.52	-1701.06	-317.32	-1745.39	247.34	-2040.00	-574.03	-1641.48

Vu (kip)	25.88	198.57	64.68	237.92	95.85	82.76	219.21	51.28	14.77	144.40	42.19	172.20	64.76	37.84	158.98	32.72
Vuw (kip)	38.83	297.85	97.03	356.88	143.78	124.14	328.81	76.92	---	---	---	---	---	---	---	---
Mv (k*ft)	21.84	167.54	54.58	200.74	80.88	69.83	184.96	43.27	8.31	81.22	23.73	96.86	36.43	21.28	89.43	18.40
Huw (kip)	-1919.48	-1316.39	-1968.45	-1280.29	-1572.98	-1608.98	-1322.51	-1953.93	-599.93	-303.33	-566.37	-372.68	-428.99	-500.05	-434.59	-537.09
Muw (k*ft)	739.55	1141.62	706.91	1165.69	970.56	946.56	1137.53	716.59	228.80	284.73	185.97	346.05	263.85	230.80	369.67	172.52
Mu (k*ft)	761.39	1309.16	761.49	1366.43	1051.43	1016.38	1322.49	759.85	237.11	365.95	209.70	442.91	300.27	252.08	459.10	190.92

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9527	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.53	20.25	30.28	19.70	24.20	24.75	20.35	30.06	9.23	4.67	8.71	5.73	6.60	7.69	6.69	8.26
PY1 (Vuw)	0.60	4.58	1.49	5.49	2.21	1.91	5.06	1.18	0.23	2.22	0.65	2.65	1.00	0.58	2.45	0.50
PX2 (Mu)	17.57	30.21	17.57	31.53	24.26	23.46	30.52	17.54	5.47	8.45	4.84	10.22	6.93	5.82	10.59	4.41
PY2 (Mu)	5.86	10.07	5.86	10.51	8.09	7.82	10.17	5.85	1.82	2.82	1.61	3.41	2.31	1.94	3.53	1.47
Pu (kip)	47.54	52.55	48.42	53.67	49.55	49.18	53.10	48.11	14.84	14.05	13.74	17.07	13.93	13.74	18.29	12.82

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.71	44.09	40.31	44.88	41.70	41.39	44.45	40.10
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.67	26.84	OK	18.29	9.14	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.67	1.47	114.56	OK
Web SPL	26.84	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1531	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type JJ

Field Splice - Node 1531

Node 1531

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1531 L	123.75	69.42	8590.75	123.75	67.87	8398.81	60.00	50.00	3000.00
1531 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1531 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.92	-23.08	-1.09	-18.85	0.53	-24.22	-12.39	-19.89	-12.15	-25.73	-11.18	-24.67	-0.09	-24.96	-11.82	-18.58
ϕf Fnc (ksi)	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97
f / ϕf Fnc	0.16	0.34	0.02	0.28	0.01	0.36	0.18	0.29	0.18	0.38	0.16	0.36	0.00	0.37	0.17	0.27
α	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-23.08		-18.85		-24.22		-19.89		-25.73		-24.67		-24.96		-18.58
Fcf (ksi)		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98
Fcf (kip)		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45
fncf (ksi)	-10.92		-1.09		0.53		-12.39		-12.15		-11.18		-0.09		-11.82	
Rcf	1.98		1.98		1.98		1.98		1.98		1.98		1.98		1.98	
Fncf (ksi)	-50.98		-50.98		52.15		-50.98		-50.98		-50.98		-52.15		-50.98	
Fncf (kip)	-6308.45		-6308.45		4729.09		-6308.45		-6308.45		-6308.45		-6453.17		-6308.45	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.34	-17.72	-0.60	-14.35	1.48	-18.94	-9.95	-15.87	-9.21	-18.49	-6.00	-18.29	1.06	-19.47	-9.18	-14.53
Fs (ksi)	-8.34	-17.72	-0.60	-14.35	1.48	-18.94	-9.95	-15.87	-9.21	-18.49	-6.00	-18.29	1.06	-19.47	-9.18	-14.53
Fs (kip)	-1032.36	-2193.02	-73.95	-1775.85	183.11	-2343.24	-1231.65	-1963.39	-1139.79	-2288.14	-742.62	-2263.96	130.64	-2409.39	-1135.54	-1797.99

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4729.09	0.00	183.11	0.00
Comp	6453.17	6308.45	1231.65	2409.39

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	71.96	131.09	186.70	142.78	15.15	41.00	173.39	127.03	50.79	95.00	134.29	100.83	15.75	33.34	124.89	89.70
Vuw (kip)	107.95	196.64	280.06	214.17	22.73	61.51	260.09	190.55	---	---	---	---	---	---	---	---
Mv (k*ft)	60.72	110.61	157.53	120.47	12.79	34.60	146.30	107.18	28.57	53.44	75.54	56.71	8.86	18.75	70.25	50.46
Huw (kip)	-1734.55	-1267.12	-1190.21	-1804.33	-1792.88	-1747.03	-1219.66	-1777.58	-625.53	-358.75	-418.93	-619.65	-664.81	-583.09	-441.94	-568.93
Muw (k*ft)	463.93	775.55	826.83	417.42	425.05	455.62	807.20	435.25	150.07	220.04	326.64	94.61	148.47	196.70	328.41	85.65
Mu (k*ft)	524.65	886.16	984.36	537.89	437.83	490.21	953.50	542.43	178.64	273.48	402.18	151.32	157.33	215.45	398.66	136.11

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	26.69	19.49	18.31	27.76	27.58	26.88	18.76	27.35	9.62	5.52	6.45	9.53	10.23	8.97	6.80	8.75
PY1 (Vuw)	1.66	3.03	4.31	3.29	0.35	0.95	4.00	2.93	0.78	1.46	2.07	1.55	0.24	0.51	1.92	1.38
PX2 (Mu)	12.11	20.45	22.72	12.41	10.10	11.31	22.00	12.52	4.12	6.31	9.28	3.49	3.63	4.97	9.20	3.14
PY2 (Mu)	4.04	6.82	7.57	4.14	3.37	3.77	7.33	4.17	1.37	2.10	3.09	1.16	1.21	1.66	3.07	1.05
Pu (kip)	39.21	41.14	42.71	40.85	37.87	38.48	42.31	40.49	13.91	12.36	16.55	13.31	13.93	14.11	16.76	12.14

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2321.55	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2407.54	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3167.92	3189.38	OK
TF Inside	3285.25	3307.50	OK
BF Inside	3211.57	3307.50	OK
BF Outside	3096.88	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.39	34.43	35.60	33.52	31.24	31.80	35.29	33.29
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	280.06
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3285.25	27.38	OK	627.02	5.23	OK
BF	3211.57	26.76	OK	1226.60	10.22	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3167.92	26.40	1.47	134.83	OK
TF	6453.17	53.78	1.47	329.59	OK
TF Inside	3285.25	27.38	1.47	149.81	OK
BF Inside	3211.57	26.76	1.47	149.81	OK
BF	6308.45	52.57	1.47	329.59	OK
BF Outside	3096.88	25.81	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.71	21.36	OK	16.76	8.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.71	1.47	91.65	OK
Web SPL	21.36	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.01
TF Inside	1.03	1.01
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.32	3.22	5.11
Web	1.70	2.23	2.15
BF	1.35	1.65	5.22

Plate	Shear	Flexure
Web	5.86	1.41

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.75	-22.08	-1.08	-17.62	-0.70	-22.65	-11.79	-18.78	-5.73	-18.38	-4.63	-17.19	-1.03	-23.65	-11.56	-17.85
ϕf Fnc (ksi)	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97
f / ϕf Fnc	0.16	0.32	0.02	0.26	0.01	0.33	0.17	0.28	0.08	0.27	0.07	0.25	0.01	0.35	0.17	0.26
α	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-22.08		-17.62		-22.65		-18.78		-18.38		-17.19		-23.65		-17.85
Fcf (ksi)		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98
Fcf (kip)		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45
fncf (ksi)	-10.75		-1.08		-0.70		-11.79		-5.73		-4.63		-1.03		-11.56	
Rcf	2.16		2.16		2.16		2.16		2.16		2.16		2.16		2.16	
Fncf (ksi)	-50.98		-50.98		-52.15		-50.98		-50.98		-50.98		-52.15		-50.98	
Fncf (kip)	-6308.45		-6308.45		-6453.17		-6308.45		-6308.45		-6308.45		-6453.17		-6308.45	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.833868	-16.12724	-0.879126	-13.03987	-0.607424	-16.59608	-8.568097	-13.79665	-6.241136	-14.44648	-3.130726	-14.00126	-0.845669	-17.30262	-8.41	-13.14
Fs (ksi)	-7.83	-16.13	-0.88	-13.04	-0.61	-16.60	-8.57	-13.80	-6.24	-14.45	-3.13	-14.00	-0.85	-17.30	-8.41	-13.14
Fs (kip)	-969.44	-1995.75	-108.79	-1613.68	-75.17	-2053.77	-1060.30	-1707.34	-772.34	-1787.75	-387.43	-1732.66	-104.65	-2141.20	-1040.25	-1626.01

Vu (kip)	71.96	131.09	186.70	142.78	15.15	41.00	173.39	127.03	50.79	95.00	134.29	100.83	15.75	33.34	124.89	89.70
Vuw (kip)	107.95	196.64	280.06	214.17	22.73	61.51	260.09	190.55	---	---	---	---	---	---	---	---
Mv (k*ft)	60.72	110.61	157.53	120.47	12.79	34.60	146.30	107.18	28.57	53.44	75.54	56.71	8.86	18.75	70.25	50.46
Huw (kip)	-1771.38	-1271.15	-1251.26	-1825.13	-1511.79	-1454.53	-1268.70	-1813.26	-575.07	-334.06	-412.88	-536.75	-496.50	-411.17	-435.56	-517.09
Muw (k*ft)	439.38	772.87	786.13	403.55	612.44	650.62	774.50	411.46	132.69	194.57	255.82	83.66	131.29	173.93	263.31	75.74
Mu (k*ft)	500.10	883.48	943.66	524.02	625.23	685.22	920.80	518.64	161.26	248.01	331.36	140.37	140.15	192.68	333.56	126.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	27.25	19.56	19.25	28.08	23.26	22.38	19.52	27.90	8.85	5.14	6.35	8.26	7.64	6.33	6.70	7.96
PY1 (Vuw)	1.66	3.03	4.31	3.29	0.35	0.95	4.00	2.93	0.78	1.46	2.07	1.55	0.24	0.51	1.92	1.38
PX2 (Mu)	11.54	20.39	21.78	12.09	14.43	15.81	21.25	11.97	3.72	5.72	7.65	3.24	3.23	4.45	7.70	2.91
PY2 (Mu)	3.85	6.80	7.26	4.03	4.81	5.27	7.08	3.99	1.24	1.91	2.55	1.08	1.08	1.48	2.57	0.97
Pu (kip)	39.18	41.13	42.63	40.83	38.04	38.69	42.25	40.46	12.73	11.37	14.74	11.79	10.95	10.96	15.08	11.12

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.31	34.42	35.47	33.48	31.83	32.41	35.19	33.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
42.63	21.31	OK	15.08	7.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	42.63	1.47	91.65	OK
Web SPL	21.31	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3531	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type JJ

Field Splice - Node 3531

Node 3531

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3531 L	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00
3531 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3531 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.81	-22.04	-11.99	-26.65	-12.82	-23.93	-1.20	-26.36	-11.87	-27.77	-12.62	-29.23	-12.72	-22.97	-1.90	-28.98
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87
f / ϕf Fnc	0.03	0.32	0.18	0.39	0.19	0.35	0.02	0.39	0.17	0.41	0.19	0.43	0.19	0.34	0.03	0.43
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-22.04		-26.65		-23.93		-26.36		-27.77		-29.23		-22.97		-28.98
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-1.81		-11.99		-12.82		-1.20		-11.87		-12.62		-12.72		-1.90	
Rcf	1.74		1.74		1.74		1.74		1.74		1.74		1.74		1.74	
Fncf (ksi)	-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.38	-16.98	-8.23	-19.52	-9.10	-17.74	-0.86	-20.13	-5.67	-19.71	-9.03	-20.70	-8.77	-16.77	-1.32	-22.01
Fs (ksi)	-1.38	-16.98	-8.23	-19.52	-9.10	-17.74	-0.86	-20.13	-5.67	-19.71	-9.03	-20.70	-8.77	-16.77	-1.32	-22.01
Fs (kip)	-171.14	-2101.43	-1018.56	-2415.45	-1125.52	-2195.18	-106.39	-2491.24	-702.23	-2439.60	-1117.79	-2561.35	-1085.40	-2075.85	-163.70	-2724.24

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	6299.11	6299.11	1125.52	2724.24

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	47.31	217.51	253.77	88.85	50.94	70.48	239.99	68.00	34.29	155.45	181.07	63.64	39.32	104.42	171.34	48.91
Vuw (kip)	70.96	326.26	380.65	133.27	76.41	105.71	359.98	102.01	---	---	---	---	---	---	---	---
Mv (k*ft)	39.91	183.52	214.12	74.96	42.98	59.46	202.49	57.38	19.29	87.44	101.85	35.79	22.12	58.73	96.38	27.51
Huw (kip)	-1608.80	-2140.93	-2184.32	-1576.99	-2134.80	-2173.70	-2179.13	-1613.90	-550.92	-832.49	-805.02	-629.73	-761.66	-891.91	-766.36	-700.11
Muw (k*ft)	946.68	591.92	563.00	967.89	596.01	570.08	566.45	943.28	311.97	225.76	172.87	385.43	280.79	233.30	160.07	413.82
Mu (k*ft)	986.59	775.44	777.11	1042.85	638.99	629.54	768.95	1000.66	331.25	313.20	274.73	421.23	302.90	292.04	256.45	441.33

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.75	32.94	33.60	24.26	32.84	33.44	33.53	24.83	8.48	12.81	12.38	9.69	11.72	13.72	11.79	10.77
PY1 (Vuw)	1.09	5.02	5.86	2.05	1.18	1.63	5.54	1.57	0.53	2.39	2.79	0.98	0.60	1.61	2.64	0.75
PX2 (Mu)	22.77	17.89	17.93	24.07	14.75	14.53	17.74	23.09	7.64	7.23	6.34	9.72	6.99	6.74	5.92	10.18
PY2 (Mu)	7.59	5.96	5.98	8.02	4.92	4.84	5.91	7.70	2.55	2.41	2.11	3.24	2.33	2.25	1.97	3.39
Pu (kip)	48.30	52.01	52.88	49.37	47.98	48.40	52.53	48.81	16.41	20.60	19.35	19.86	18.94	20.82	18.30	21.36

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3092.29	3189.38	OK
TF Inside	3206.82	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.75	42.72	43.28	41.57	39.72	39.99	43.04	41.11
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	380.65
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3206.82	26.72	OK	572.99	4.77	OK
BF	3206.82	26.72	OK	1386.88	11.56	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3092.29	25.77	1.47	134.83	OK
TF	6299.11	52.49	1.47	329.59	OK
TF Inside	3206.82	26.72	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.88	26.44	OK	21.36	10.68	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.88	1.47	114.56	OK
Web SPL	26.44	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.03
TF Inside	NA	1.03
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.35	3.52	5.23
Web	1.37	1.72	2.17
BF	1.35	1.46	5.23

Plate	Shear	Flexure
Web	4.31	1.16

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-2.14	-20.98	-11.67	-25.33	-12.54	-22.89	-1.35	-24.79	-5.69	-20.50	-5.92	-21.39	-12.23	-21.78	-2.04	-27.26
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87	67.87
f / ϕf Fnc	0.03	0.31	0.17	0.37	0.18	0.34	0.02	0.37	0.08	0.30	0.09	0.32	0.18	0.32	0.03	0.40
α	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
fcf (ksi)		-20.98		-25.33		-22.89		-24.79		-20.50		-21.39		-21.78		-27.26
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-2.14		-11.67		-12.54		-1.35		-5.69		-5.92		-12.23		-2.04	
Rcf	1.87		1.87		1.87		1.87		1.87		1.87		1.87		1.87	
Fncf (ksi)	-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.593764	-15.38643	-8.453486	-18.43476	-9.067576	-16.7107	-1.036382	-18.07706	-3.985275	-16.39943	-6.799785	-17.11462	-8.848813	-15.92593	-1.52	-19.82
Fs (ksi)	-1.59	-15.39	-8.45	-18.43	-9.07	-16.71	-1.04	-18.08	-3.99	-16.40	-6.80	-17.11	-8.85	-15.93	-1.52	-19.82
Fs (kip)	-197.23	-1904.07	-1046.12	-2281.30	-1122.11	-2067.95	-128.25	-2237.04	-493.18	-2029.43	-841.47	-2117.93	-1095.04	-1970.83	-188.67	-2452.80

Vu (kip)	47.31	217.51	253.77	88.85	50.94	70.48	239.99	68.00	34.29	155.45	181.07	63.64	39.32	104.42	171.34	48.91
Vuw (kip)	70.96	326.26	380.65	133.27	76.41	105.71	359.98	102.01	---	---	---	---	---	---	---	---
Mv (k*ft)	39.91	183.52	214.12	74.96	42.98	59.46	202.49	57.38	19.29	87.44	101.85	35.79	22.12	58.73	96.38	27.51
Huw (kip)	-1634.16	-2168.36	-2217.05	-1589.96	-1833.37	-1846.06	-2199.71	-1628.68	-509.41	-806.65	-773.35	-573.40	-611.54	-717.43	-743.24	-640.36
Muw (k*ft)	929.77	573.64	541.18	959.24	796.96	788.51	552.74	933.43	275.85	199.63	152.86	340.81	248.28	206.30	141.54	365.92
Mu (k*ft)	969.69	757.16	755.29	1034.20	839.95	847.97	755.23	990.80	295.14	287.07	254.71	376.61	270.40	265.03	237.92	393.43

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.14	33.36	34.11	24.46	28.21	28.40	33.84	25.06	7.84	12.41	11.90	8.82	9.41	11.04	11.43	9.85
PY1 (Vuw)	1.09	5.02	5.86	2.05	1.18	1.63	5.54	1.57	0.53	2.39	2.79	0.98	0.60	1.61	2.64	0.75
PX2 (Mu)	22.38	17.47	17.43	23.87	19.38	19.57	17.43	22.86	6.81	6.62	5.88	8.69	6.24	6.12	5.49	9.08
PY2 (Mu)	7.46	5.82	5.81	7.96	6.46	6.52	5.81	7.62	2.27	2.21	1.96	2.90	2.08	2.04	1.83	3.03
Pu (kip)	48.28	51.98	52.84	49.35	48.20	48.66	52.51	48.79	14.91	19.58	18.40	17.94	15.88	17.54	17.50	19.30

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.70	42.66	43.21	41.54	40.35	40.67	43.00	41.08
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.84	26.42	OK	19.58	9.79	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.84	1.47	114.56	OK
Web SPL	26.42	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 5531	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type JJ

Field Splice - Node 5531

Node 5531

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5531 L	123.75	67.87	8398.81	123.75	67.87	8398.81	60.00	50.00	3000.00
5531 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5531 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.42	-22.50	-11.75	-28.13	-12.54	-24.76	0.18	-27.15	-11.01	-28.36	-11.78	-29.18	-12.06	-23.54	-0.37	-29.81
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87
f / ϕf Fnc	0.02	0.33	0.17	0.41	0.18	0.36	0.00	0.40	0.16	0.42	0.17	0.43	0.18	0.35	0.01	0.44
α	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97
fcf (ksi)		-22.50		-28.13		-24.76		-27.15		-28.36		-29.18		-23.54		-29.81
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-1.42		-11.75		-12.54		0.18		-11.01		-11.78		-12.06		-0.37	
Rcf	1.71		1.71		1.71		1.71		1.71		1.71		1.71		1.71	
Fncf (ksi)	-50.90		-50.90		-50.90		52.07		-50.90		-50.90		-50.90		-52.07	
Fncf (kip)	-6299.11		-6299.11		-6299.11		4721.68		-6299.11		-6299.11		-6299.11		-6443.06	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-0.59	-16.80	-8.04	-20.68	-8.68	-18.23	0.64	-20.31	-5.40	-19.39	-7.67	-21.10	-8.35	-17.35	0.30	-22.23
Fs (ksi)	-0.59	-16.80	-8.04	-20.68	-8.68	-18.23	0.64	-20.31	-5.40	-19.39	-7.67	-21.10	-8.35	-17.35	0.30	-22.23
Fs (kip)	-72.75	-2078.61	-995.48	-2559.36	-1074.19	-2255.57	79.68	-2513.76	-668.72	-2399.62	-949.43	-2611.18	-1033.91	-2146.75	36.77	-2751.01

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4721.68	0.00	79.68	0.00
Comp	6443.06	6299.11	1074.19	2751.01

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	75.76	172.00	220.77	126.36	16.90	38.95	206.73	110.55	55.29	122.31	156.77	91.04	33.74	73.61	146.84	79.87
Vuw (kip)	113.64	258.01	331.16	189.54	25.36	58.43	310.09	165.82	---	---	---	---	---	---	---	---
Mv (k*ft)	63.92	145.13	186.28	106.62	14.26	32.87	174.42	93.28	31.10	68.80	88.18	51.21	18.98	41.41	82.60	44.93
Huw (kip)	-1586.95	-2116.39	-2156.83	-1505.33	-2078.27	-2117.88	-2132.21	-1533.31	-521.54	-861.78	-807.22	-590.08	-743.84	-863.18	-771.07	-658.00
Muw (k*ft)	961.24	608.29	581.33	1015.65	633.70	607.29	597.74	997.00	324.18	252.75	190.93	419.14	279.74	268.57	179.85	450.55
Mu (k*ft)	1025.17	753.41	767.60	1122.27	647.96	640.16	772.16	1090.28	355.28	321.55	279.11	470.35	298.72	309.97	262.45	495.47

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.41	32.56	33.18	23.16	31.97	32.58	32.80	23.59	8.02	13.26	12.42	9.08	11.44	13.28	11.86	10.12
PY1 (Vuw)	1.75	3.97	5.09	2.92	0.39	0.90	4.77	2.55	0.85	1.88	2.41	1.40	0.52	1.13	2.26	1.23
PX2 (Mu)	23.66	17.39	17.71	25.90	14.95	14.77	17.82	25.16	8.20	7.42	6.44	10.85	6.89	7.15	6.06	11.43
PY2 (Mu)	7.89	5.80	5.90	8.63	4.98	4.92	5.94	8.39	2.73	2.47	2.15	3.62	2.30	2.38	2.02	3.81
Pu (kip)	49.03	50.89	52.07	50.40	47.23	47.71	51.74	49.96	16.61	21.13	19.40	20.55	18.55	20.73	18.42	22.14

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2317.92	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2403.77	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3162.96	3189.38	OK
TF Inside	3280.10	3307.50	OK
BF Inside	3206.82	3307.50	OK
BF Outside	3092.29	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.31	41.94	42.74	42.39	39.22	39.54	42.54	42.05
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	331.16
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3280.10	27.33	OK	546.86	4.56	OK
BF	3206.82	26.72	OK	1400.51	11.67	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3162.96	26.36	1.47	134.83	OK
TF	6443.06	53.69	1.47	329.59	OK
TF Inside	3280.10	27.33	1.47	149.81	OK
BF Inside	3206.82	26.72	1.47	149.81	OK
BF	6299.11	52.49	1.47	329.59	OK
BF Outside	3092.29	25.77	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.07	26.04	OK	22.14	11.07	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.07	1.47	114.56	OK
Web SPL	26.04	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.01
TF Inside	1.03	1.01
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.32	3.69	5.12
Web	1.39	1.64	2.20
BF	1.35	1.44	5.23

Plate	Shear	Flexure
Web	4.95	1.17

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.69	-21.33	-11.15	-26.41	-12.19	-23.58	-0.85	-25.73	-5.09	-21.25	-5.44	-21.65	-11.75	-22.44	-1.46	-28.28
ϕf Fnc (ksi)	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87	67.87	67.87	67.87	67.87	67.87	67.87	69.42	67.87
f / ϕf Fnc	0.02	0.31	0.16	0.39	0.18	0.35	0.01	0.38	0.08	0.31	0.08	0.32	0.17	0.33	0.02	0.42
α	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97
fcf (ksi)		-21.33		-26.41		-23.58		-25.73		-21.25		-21.65		-22.44		-28.28
Fcf (ksi)		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90		-50.90
Fcf (kip)		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11		-6299.11
fncf (ksi)	-1.69		-11.15		-12.19		-0.85		-5.09		-5.44		-11.75		-1.46	
Rcf	1.80		1.80		1.80		1.80		1.80		1.80		1.80		1.80	
Fncf (ksi)	-50.90		-50.90		-50.90		-52.07		-50.90		-50.90		-50.90		-52.07	
Fncf (kip)	-6299.11		-6299.11		-6299.11		-6443.06		-6299.11		-6299.11		-6299.11		-6443.06	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-1.266369	-15.59902	-8.038914	-19.21348	-8.772457	-17.21388	-0.674619	-18.71072	-4.419443	-16.78742	-6.219842	-18.09367	-8.461868	-16.41352	-1.11	-20.51
Fs (ksi)	-1.27	-15.60	-8.04	-19.21	-8.77	-17.21	-0.67	-18.71	-4.42	-16.79	-6.22	-18.09	-8.46	-16.41	-1.11	-20.51
Fs (kip)	-156.71	-1930.38	-994.82	-2377.67	-1085.59	-2130.22	-83.48	-2315.45	-546.91	-2077.44	-769.71	-2239.09	-1047.16	-2031.17	-136.95	-2538.10

Vu (kip)	75.76	172.00	220.77	126.36	16.90	38.95	206.73	110.55	55.29	122.31	156.77	91.04	33.74	73.61	146.84	79.87
Vuw (kip)	113.64	258.01	331.16	189.54	25.36	58.43	310.09	165.82	---	---	---	---	---	---	---	---
Mv (k*ft)	63.92	145.13	186.28	106.62	14.26	32.87	174.42	93.28	31.10	68.80	88.18	51.21	18.98	41.41	82.60	44.93
Huw (kip)	-1605.61	-2116.57	-2172.63	-1560.39	-1789.39	-1808.32	-2148.89	-1593.41	-505.96	-817.57	-779.59	-581.56	-636.21	-729.41	-746.26	-648.50
Muw (k*ft)	948.80	608.16	570.79	978.95	826.28	813.67	586.62	956.94	286.65	223.49	168.83	360.72	247.36	237.48	159.03	388.06
Mu (k*ft)	1012.72	753.29	757.07	1085.57	840.55	846.53	761.04	1050.21	317.75	292.29	257.01	411.93	266.34	278.88	241.63	432.99

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.70	32.56	33.43	24.01	27.53	27.82	33.06	24.51	7.78	12.58	11.99	8.95	9.79	11.22	11.48	9.98
PY1 (Vuw)	1.75	3.97	5.09	2.92	0.39	0.90	4.77	2.55	0.85	1.88	2.41	1.40	0.52	1.13	2.26	1.23
PX2 (Mu)	23.37	17.38	17.47	25.05	19.40	19.54	17.56	24.24	7.33	6.75	5.93	9.51	6.15	6.44	5.58	9.99
PY2 (Mu)	7.79	5.79	5.82	8.35	6.47	6.51	5.85	8.08	2.44	2.25	1.98	3.17	2.05	2.15	1.86	3.33
Pu (kip)	49.01	50.89	52.05	50.33	47.42	47.93	51.73	49.90	15.47	19.76	18.45	19.01	16.14	17.96	17.55	20.48

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.27	41.94	42.71	42.28	39.82	40.18	42.50	41.92
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
52.05	26.03	OK	20.48	10.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	52.05	1.47	114.56	OK
Web SPL	26.03	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7531	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type JJ

Field Splice - Node 7531

Node 7531

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7531 L	123.75	69.42	8590.75	123.75	67.87	8398.81	60.00	50.00	3000.00
7531 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7531 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.21	-29.13	1.34	-23.31	1.83	-29.25	-10.58	-25.88	-10.32	-30.13	-9.61	-29.75	1.18	-29.97	-9.89	-24.46
ϕf Fnc (ksi)	67.97	67.97	69.53	67.97	69.53	67.97	67.97	67.97	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97
f / ϕf Fnc	0.15	0.43	0.02	0.34	0.03	0.43	0.16	0.38	0.15	0.44	0.14	0.44	0.02	0.44	0.15	0.36
α	0.97	0.97	0.99	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-29.13		-23.31		-29.25		-25.88		-30.13		-29.75		-29.97		-24.46
Fcf (ksi)		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98
Fcf (kip)		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45
fncf (ksi)	-10.21		1.34		1.83		-10.58		-10.32		-9.61		1.18		-9.89	
Rcf	1.69		1.69		1.69		1.69		1.69		1.69		1.69		1.69	
Fncf (ksi)	-50.98		52.15		52.15		-50.98		-50.98		-50.98		52.15		-50.98	
Fncf (kip)	-6308.45		4729.09		4729.09		-6308.45		-6308.45		-6308.45		4729.09		-6308.45	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.40	-22.06	1.71	-17.84	2.18	-22.16	-7.73	-19.69	-6.65	-23.15	-5.25	-21.04	1.73	-22.69	-7.25	-18.68
Fs (ksi)	-7.40	-22.06	1.71	-17.84	2.18	-22.16	-7.73	-19.69	-6.65	-23.15	-5.25	-21.04	1.73	-22.69	-7.25	-18.68
Fs (kip)	-915.66	-2730.29	211.64	-2207.41	269.65	-2742.53	-956.00	-2436.98	-823.22	-2865.33	-649.87	-2603.85	214.61	-2807.27	-897.50	-2311.26

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4729.09	0.00	269.65	0.00
Comp	6308.45	6308.45	956.00	2865.33

$\phi v Vn$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	5.77	200.18	258.39	46.27	95.06	116.14	247.52	36.28	1.10	146.82	187.95	29.71	50.40	69.19	180.27	22.66
Vuw (kip)	8.65	300.27	387.59	69.40	142.59	174.21	371.28	54.42	---	---	---	---	---	---	---	---
Mv (k*ft)	4.87	168.90	218.02	39.04	80.21	97.99	208.84	30.61	0.62	82.59	105.72	16.71	28.35	38.92	101.40	12.74
Huw (kip)	-1629.92	-1160.61	-1141.01	-1644.74	-1634.52	-1605.65	-1167.14	-1616.78	-707.09	-387.06	-479.59	-658.03	-715.36	-631.02	-502.82	-622.30
Muw (k*ft)	533.69	846.56	859.63	523.81	530.62	549.87	842.21	542.45	234.62	312.77	389.45	191.48	264.03	252.64	390.71	182.79
Mu (k*ft)	538.55	1015.46	1077.65	562.85	610.83	647.86	1051.05	573.06	235.24	395.35	495.18	208.19	292.38	291.56	492.11	195.53

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	25.08	17.86	17.55	25.30	25.15	24.70	17.96	24.87	10.88	5.95	7.38	10.12	11.01	9.71	7.74	9.57
PY1 (Vuw)	0.13	4.62	5.96	1.07	2.19	2.68	5.71	0.84	0.02	2.26	2.89	0.46	0.78	1.06	2.77	0.35
PX2 (Mu)	12.43	23.43	24.87	12.99	14.10	14.95	24.26	13.22	5.43	9.12	11.43	4.80	6.75	6.73	11.36	4.51
PY2 (Mu)	4.14	7.81	8.29	4.33	4.70	4.98	8.09	4.41	1.81	3.04	3.81	1.60	2.25	2.24	3.79	1.50
Pu (kip)	37.75	43.12	44.75	38.67	39.84	40.39	44.41	38.46	16.41	15.98	19.96	15.07	18.01	16.77	20.19	14.21

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2321.55	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2407.54	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3096.88	3189.38	OK
TF Inside	3211.57	3307.50	OK
BF Inside	3211.57	3307.50	OK
BF Outside	3096.88	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.41	35.90	36.99	32.11	33.01	33.46	36.74	31.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	387.59
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3211.57	26.76	OK	486.69	4.06	OK
BF	3211.57	26.76	OK	1458.71	12.16	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3096.88	25.81	1.47	134.83	OK
TF	6308.45	52.57	1.47	329.59	OK
TF Inside	3211.57	26.76	1.47	149.81	OK
BF Inside	3211.57	26.76	1.47	149.81	OK
BF	6308.45	52.57	1.47	329.59	OK
BF Outside	3096.88	25.81	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.75	22.38	OK	20.19	10.09	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.75	1.47	91.65	OK
Web SPL	22.38	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.03
TF Inside	1.03	1.03
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.35	4.15	5.22
Web	1.62	1.80	2.05
BF	1.35	1.38	5.22

Plate	Shear	Flexure
Web	4.23	1.35

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.37	-27.00	0.25	-21.90	0.72	-27.74	-10.10	-24.35	-3.69	-22.14	-3.41	-22.17	0.29	-28.66	-9.74	-23.31
ϕf Fnc (ksi)	67.97	67.97	69.53	67.97	69.53	67.97	67.97	67.97	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97
f / ϕf Fnc	0.14	0.40	0.00	0.32	0.01	0.41	0.15	0.36	0.05	0.33	0.05	0.33	0.00	0.42	0.14	0.34
α	0.97	0.97	0.99	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-27.00		-21.90		-27.74		-24.35		-22.14		-22.17		-28.66		-23.31
Fcf (ksi)		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98
Fcf (kip)		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45
fncf (ksi)	-9.37		0.25		0.72		-10.10		-3.69		-3.41		0.29		-9.74	
Rcf	1.78		1.78		1.78		1.78		1.78		1.78		1.78		1.78	
Fncf (ksi)	-50.98		52.15		52.15		-50.98		-50.98		-50.98		52.15		-50.98	
Fncf (kip)	-6308.45		4729.09		4729.09		-6308.45		-6308.45		-6308.45		4729.09		-6308.45	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.720501	-19.68677	0.141689	-16.0363	0.470204	-20.16455	-7.232314	-17.81447	-4.458409	-19.05001	-3.533837	-17.49579	0.1666557	-20.81495	-6.98	-17.08
Fs (ksi)	-6.72	-19.69	0.14	-16.04	0.47	-20.16	-7.23	-17.81	-4.46	-19.05	-3.53	-17.50	0.17	-20.81	-6.98	-17.08
Fs (kip)	-831.66	-2436.24	17.53	-1984.49	58.19	-2495.36	-895.00	-2204.54	-551.73	-2357.44	-437.31	-2165.10	20.62	-2575.85	-863.58	-2113.68

Vu (kip)	5.77	200.18	258.39	46.27	95.06	116.14	247.52	36.28	1.10	146.82	187.95	29.71	50.40	69.19	180.27	22.66
Vuw (kip)	8.65	300.27	387.59	69.40	142.59	174.21	371.28	54.42	---	---	---	---	---	---	---	---
Mv (k*ft)	4.87	168.90	218.02	39.04	80.21	97.99	208.84	30.61	0.62	82.59	105.72	16.71	28.35	38.92	101.40	12.74
Huw (kip)	-1615.28	-1204.52	-1184.68	-1646.20	-1372.87	-1360.96	-1203.02	-1630.86	-633.77	-381.47	-472.66	-601.12	-564.20	-504.71	-495.56	-577.41
Muw (k*ft)	543.45	817.29	830.52	522.83	705.05	713.00	818.29	533.06	207.46	258.85	330.16	169.31	233.47	223.39	335.71	161.63
Mu (k*ft)	548.32	986.19	1048.54	561.87	785.26	810.99	1027.14	563.67	208.08	341.44	435.88	186.03	261.82	262.31	437.11	174.37

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	24.85	18.53	18.23	25.33	21.12	20.94	18.51	25.09	9.75	5.87	7.27	9.25	8.68	7.76	7.62	8.88
PY1 (Vuw)	0.13	4.62	5.96	1.07	2.19	2.68	5.71	0.84	0.02	2.26	2.89	0.46	0.78	1.06	2.77	0.35
PX2 (Mu)	12.65	22.76	24.20	12.97	18.12	18.72	23.70	13.01	4.80	7.88	10.06	4.29	6.04	6.05	10.09	4.02
PY2 (Mu)	4.22	7.59	8.07	4.32	6.04	6.24	7.90	4.34	1.60	2.63	3.35	1.43	2.01	2.02	3.36	1.34
Pu (kip)	37.76	43.06	44.68	38.67	40.10	40.64	44.35	38.45	14.64	14.59	18.42	13.67	14.98	14.16	18.74	13.02

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.44	35.81	36.90	32.11	33.56	33.97	36.67	31.96
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
44.68	22.34	OK	18.74	9.37	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	44.68	1.47	91.65	OK
Web SPL	22.34	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9531	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9531

Node 9531

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	120
Web	65
BF	120

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9531 L	123.75	69.42	8590.75	123.75	67.87	8398.81	60.00	50.00	3000.00
9531 R	123.75	67.97	8411.27	123.75	67.97	8411.27	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9531 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	2.75	---	123.75	88.69	90.69	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	2.75	---	123.75	88.69	90.69	70	85
Splice Plates	TF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	TF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Inside	21.00	1.250	62.50	52.50	36.56	---	70	85
	BF Outside	45.00	1.125	62.50	50.63	36.28	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.897196

N.A. (from I 26.75 in
Outer to Inr 0.897196262
Outer to Inr 0.897196262

Outer to Mi 0.948598131
Outer to Mi 0.948598131

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.63	-24.26	3.72	-18.06	4.72	-23.86	-7.36	-21.44	-7.66	-25.52	-7.55	-25.92	4.39	-25.35	-7.05	-20.30
ϕf Fnc (ksi)	67.97	67.97	69.53	67.97	69.53	67.97	67.97	67.97	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97
f / ϕf Fnc	0.10	0.36	0.05	0.27	0.07	0.35	0.11	0.32	0.11	0.38	0.11	0.38	0.06	0.37	0.10	0.30
α	0.97	0.97	0.99	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-24.26		-18.06		-23.86		-21.44		-25.52		-25.92		-25.35		-20.30
Fcf (ksi)		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98
Fcf (kip)		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45
fncf (ksi)	-6.63		3.72		4.72		-7.36		-7.66		-7.55		4.39		-7.05	
Rcf	1.97		1.97		1.97		1.97		1.97		1.97		1.97		1.97	
Fncf (ksi)	-50.98		52.15		52.15		-50.98		-50.98		-50.98		52.15		-50.98	
Fncf (kip)	-6308.45		4729.09		4729.09		-6308.45		-6308.45		-6308.45		4729.09		-6308.45	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-5.39	-19.15	3.75	-14.41	4.57	-18.62	-5.97	-17.09	-5.31	-20.65	-5.31	-19.26	4.62	-20.11	-5.37	-15.84
Fs (ksi)	-5.39	-19.15	3.75	-14.41	4.57	-18.62	-5.97	-17.09	-5.31	-20.65	-5.31	-19.26	4.62	-20.11	-5.37	-15.84
Fs (kip)	-666.87	-2369.77	464.41	-1783.82	565.01	-2304.09	-739.37	-2114.71	-657.52	-2555.90	-657.20	-2383.62	571.11	-2488.96	-664.54	-1959.74

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	4729.09	0.00	571.11	0.00
Comp	6308.45	6308.45	739.37	2555.90

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	26.43	232.49	281.57	10.04	121.99	136.37	264.67	6.89	22.02	170.45	205.13	3.75	92.38	69.38	190.34	11.07
Vuw (kip)	39.64	348.73	422.36	15.05	182.98	204.55	397.01	10.34	---	---	---	---	---	---	---	---
Mv (k*ft)	22.30	196.16	237.58	8.47	102.93	115.06	223.32	5.82	12.38	95.88	115.39	2.11	51.96	39.03	107.07	6.22
Huw (kip)	-1528.09	-1039.44	-992.29	-1562.75	-1576.93	-1571.77	-1008.01	-1547.95	-588.93	-255.88	-337.28	-553.52	-623.21	-589.74	-371.95	-508.95
Muw (k*ft)	601.58	927.34	958.77	578.47	569.02	572.46	948.30	588.34	220.17	290.68	370.95	177.82	245.45	223.21	395.65	167.46
Mu (k*ft)	623.87	1123.50	1196.35	586.93	671.95	687.52	1171.62	594.15	232.56	386.56	486.34	179.93	297.41	262.24	502.71	173.69

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9531**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.51	15.99	15.27	24.04	24.26	24.18	15.51	23.81	9.06	3.94	5.19	8.52	9.59	9.07	5.72	7.83
PY1 (Vuw)	0.61	5.37	6.50	0.23	2.82	3.15	6.11	0.16	0.34	2.62	3.16	0.06	1.42	1.07	2.93	0.17
PX2 (Mu)	14.40	25.93	27.61	13.54	15.51	15.87	27.04	13.71	5.37	8.92	11.22	4.15	6.86	6.05	11.60	4.01
PY2 (Mu)	4.80	8.64	9.20	4.51	5.17	5.29	9.01	4.57	1.79	2.97	3.74	1.38	2.29	2.02	3.87	1.34
Pu (kip)	38.29	44.20	45.66	37.89	40.56	40.93	45.15	37.82	14.58	14.02	17.80	12.75	16.86	15.44	18.61	11.93

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	2321.55	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK
TF Inside	2407.54	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Inside	0.00	3491.25	2486.25	145.00	94.53	28.91	5693.94	2486.25	OK
BF Outside	0.00	3366.56	2467.13	65.25	42.54	32.70	3901.02	2467.13	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3096.88	3189.38	OK
TF Inside	3211.57	3307.50	OK
BF Inside	3211.57	3307.50	OK
BF Outside	3096.88	3189.38	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	32.00	36.74	37.72	31.63	33.62	33.89	37.38	31.60
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	422.36
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3211.57	26.76	OK	376.41	3.14	OK
BF	3211.57	26.76	OK	1301.19	10.84	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3096.88	25.81	1.47	134.83	OK
TF	6308.45	52.57	1.47	329.59	OK
TF Inside	3211.57	26.76	1.47	149.81	OK
BF Inside	3211.57	26.76	1.47	149.81	OK
BF	6308.45	52.57	1.47	329.59	OK
BF Outside	3096.88	25.81	1.47	134.83	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.66	22.83	OK	18.61	9.30	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.66	1.47	91.65	OK
Web SPL	22.83	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	1.06	1.03
TF Inside	1.03	1.03
BF Inside	NA	1.03
BF Outside	NA	1.03

Bolt	Shear	Slip	Bearing
TF	1.35	5.37	5.22
Web	1.59	2.06	2.01
BF	1.35	1.55	5.22

Plate	Shear	Flexure
Web	3.88	1.33

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9531	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.17	-22.60	3.04	-17.17	3.32	-22.18	-6.79	-19.90	-0.96	-17.59	-1.29	-18.40	2.78	-23.43	-6.51	-18.85
ϕf Fnc (ksi)	67.97	67.97	69.53	67.97	69.53	67.97	67.97	67.97	67.97	67.97	67.97	67.97	69.53	67.97	67.97	67.97
f / ϕf Fnc	0.09	0.33	0.04	0.25	0.05	0.33	0.10	0.29	0.01	0.26	0.02	0.27	0.04	0.34	0.10	0.28
α	0.97	0.97	0.99	0.97	0.99	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.99	0.97	0.97	0.97
fcf (ksi)		-22.60		-17.17		-22.18		-19.90		-17.59		-18.40		-23.43		-18.85
Fcf (ksi)		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98		-50.98
Fcf (kip)		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45		-6308.45
fncf (ksi)	-6.17		3.04		3.32		-6.79		-0.96		-1.29		2.78		-6.51	
Rcf	2.18		2.18		2.18		2.18		2.18		2.18		2.18		2.18	
Fncf (ksi)	-50.98		52.15		52.15		-50.98		-50.98		-50.98		52.15		-50.98	
Fncf (kip)	-6308.45		4729.09		4729.09		-6308.45		-6308.45		-6308.45		4729.09		-6308.45	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-4.42119	-16.58907	2.150539	-12.65846	2.350702	-16.20096	-4.856757	-14.68405	-1.754973	-15.31967	-2.210831	-14.54679	1.9048967	-17.17891	-4.59	-13.85
Fs (ksi)	-4.42	-16.59	2.15	-12.66	2.35	-16.20	-4.86	-14.68	-1.75	-15.32	-2.21	-14.55	1.90	-17.18	-4.59	-13.85
Fs (kip)	-547.12	-2052.90	266.13	-1566.48	290.90	-2004.87	-601.02	-1817.15	-217.18	-1895.81	-273.59	-1800.16	235.73	-2125.89	-568.24	-1713.51

Vu (kip)	26.43	232.49	281.57	10.04	121.99	136.37	264.67	6.89	22.02	170.45	205.13	3.75	92.38	69.38	190.34	11.07
Vuw (kip)	39.64	348.73	422.36	15.05	182.98	204.55	397.01	10.34	---	---	---	---	---	---	---	---
Mv (k*ft)	22.30	196.16	237.58	8.47	102.93	115.06	223.32	5.82	12.38	95.88	115.39	2.11	51.96	39.03	107.07	6.22
Huw (kip)	-1537.52	-1056.71	-1041.92	-1569.71	-1265.40	-1282.70	-1070.06	-1554.94	-504.25	-252.19	-332.41	-468.98	-409.79	-402.18	-366.58	-442.52
Muw (k*ft)	595.29	915.83	925.69	573.83	776.70	765.17	906.93	583.68	194.69	236.94	296.83	157.24	217.04	197.38	305.34	148.08
Mu (k*ft)	617.58	1111.99	1163.27	582.30	879.63	880.23	1130.25	589.49	207.07	332.82	412.21	159.34	269.00	236.40	412.41	154.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	23.65	16.26	16.03	24.15	19.47	19.73	16.46	23.92	7.76	3.88	5.11	7.22	6.30	6.19	5.64	6.81
PY1 (Vuw)	0.61	5.37	6.50	0.23	2.82	3.15	6.11	0.16	0.34	2.62	3.16	0.06	1.42	1.07	2.93	0.17
PX2 (Mu)	14.25	25.66	26.84	13.44	20.30	20.31	26.08	13.60	4.78	7.68	9.51	3.68	6.21	5.46	9.52	3.56
PY2 (Mu)	4.75	8.55	8.95	4.48	6.77	6.77	8.69	4.53	1.59	2.56	3.17	1.23	2.07	1.82	3.17	1.19
Pu (kip)	38.28	44.17	45.57	37.88	40.90	41.26	45.05	37.82	12.68	12.67	15.94	10.97	12.99	12.00	16.34	10.46

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	31.98	36.70	37.62	31.61	34.27	34.49	37.25	31.59
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
45.57	22.79	OK	16.34	8.17	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	45.57	1.47	91.65	OK
Web SPL	22.79	1.47	91.65	OK

Field Splice

Type KK

Field Splice - Node 1542

Node 1542

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1542 L	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00
1542 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1542 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I	27 in
Outer to Inr	0.8888889
Outer to Inr	0.8888889
Outer to Mi	0.9444444
Outer to Mi	0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.34	-25.47	-25.05	-14.98	-22.36	-26.43	-34.44	-14.95	-30.21	-23.41	-23.86	-19.90	-22.90	-28.17	-33.38	-12.87
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.42	0.37	0.36	0.22	0.32	0.38	0.50	0.21	0.43	0.34	0.34	0.29	0.33	0.40	0.48	0.19
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.34		-25.05			-26.43	-34.44		-30.21		-23.86			-28.17	-33.38	
Fcf (ksi)	-52.17		-52.17			-52.17	-52.17		-52.17		-52.17			-52.17	-52.17	
Fcf (kip)	-7043.57		-7043.57			-7043.57	-7043.57		-7043.57		-7043.57			-7043.57	-7043.57	
fncf (ksi)		-25.47		-14.98	-22.36			-14.95		-23.41		-19.90	-22.90			-12.87
Rcf		1.51		1.51	1.51			1.51		1.51		1.51	1.51			1.51
Fncf (ksi)		-52.17		-52.17	-52.17			-52.17		-52.17		-52.17	-52.17			-52.17
Fncf (kip)		-7043.57		-7043.57	-7043.57			-7043.57		-7043.57		-7043.57	-7043.57			-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.65	-18.86	-18.73	-11.04	-16.55	-19.70	-25.56	-10.83	-22.32	-17.34	-17.77	-14.64	-16.91	-20.95	-24.83	-9.34
Fs (ksi)	-21.65	-18.86	-18.73	-11.04	-16.55	-19.70	-25.56	-10.83	-22.32	-17.34	-17.77	-14.64	-16.91	-20.95	-24.83	-9.34
Fs (kip)	-2923.22	-2545.60	-2529.09	-1490.39	-2234.84	-2659.41	-3450.52	-1461.50	-3013.63	-2341.24	-2398.90	-1976.41	-2283.30	-2828.63	-3352.20	-1261.07

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7043.57	7043.57	3450.52	2828.63

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	371.75	326.84	240.71	492.21	355.62	337.93	250.07	473.30	269.27	239.12	176.69	355.96	257.87	246.95	183.30	342.59
Vuw (kip)	557.62	490.26	361.06	738.32	533.43	506.90	375.10	709.94	---	---	---	---	---	---	---	---
Mv (k*ft)	313.66	275.77	203.10	415.30	300.06	285.13	210.99	399.34	151.46	134.51	99.39	200.23	145.05	138.91	103.11	192.71
Huw (kip)	-2170.52	-1788.98	-2057.29	-1787.88	-2095.70	-1967.82	-2077.03	-1712.54	-972.23	-714.58	-870.09	-873.25	-951.98	-777.83	-908.79	-820.14
Muw (k*ft)	212.23	466.59	287.71	467.32	262.11	347.36	274.55	517.54	44.76	123.11	50.32	235.74	79.69	50.07	64.63	247.84
Mu (k*ft)	525.89	742.36	490.81	882.62	562.16	632.49	485.55	916.89	196.22	257.61	149.70	435.96	224.74	188.98	167.74	440.55

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.39	27.52	31.65	27.51	32.24	30.27	31.95	26.35	14.96	10.99	13.39	13.43	14.65	11.97	13.98	12.62
PY1 (Vuw)	8.58	7.54	5.55	11.36	8.21	7.80	5.77	10.92	4.14	3.68	2.72	5.48	3.97	3.80	2.82	5.27
PX2 (Mu)	12.14	17.13	11.33	20.37	12.97	14.60	11.20	21.16	4.53	5.94	3.45	10.06	5.19	4.36	3.87	10.17
PY2 (Mu)	4.05	5.71	3.78	6.79	4.32	4.87	3.73	7.05	1.51	1.98	1.15	3.35	1.73	1.45	1.29	3.39
Pu (kip)	47.25	46.58	43.98	51.20	46.92	46.62	44.19	50.79	20.29	17.86	17.28	25.10	20.63	17.15	18.32	24.37

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0
Rp	1.0
Ubs	1.0

assumed drilled holes

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3490.06	3898.13	OK
TF Inside	3553.51	3969.00	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.73	37.72	35.60	40.71	37.60	37.54	35.73	40.52
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	738.32
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3553.51	24.68	OK	1740.80	12.09	OK
BF	3568.13	27.03	OK	1432.93	10.86	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3490.06	24.24	1.47	164.79	OK
TF	7043.57	48.91	1.47	359.55	OK
TF Inside	3553.51	24.68	1.47	179.78	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.20	25.60	OK	25.10	12.55	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.20	1.47	91.65	OK
Web SPL	25.60	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	1.39	6.80
Web	1.20	1.63	1.78
BF	1.34	1.55	5.69

Plate	Shear	Flexure
Web	2.22	1.22

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.57	-17.98	-18.03	-8.69	-15.00	-18.78	-26.50	-8.44	-21.07	-14.77	-18.48	-14.80	-15.45	-20.33	-25.66	-6.66
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.31	0.26	0.26	0.12	0.22	0.27	0.38	0.12	0.30	0.21	0.27	0.21	0.22	0.29	0.37	0.10
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-21.57		-18.03			-18.78	-26.50		-21.07		-18.48			-20.33	-25.66	
Fcf (ksi)	-52.17		-52.17			-52.17	-52.17		-52.17		-52.17			-52.17	-52.17	
Fcf (kip)	-7043.57		-7043.57			-7043.57	-7043.57		-7043.57		-7043.57			-7043.57	-7043.57	
fncf (ksi)		-17.98		-8.69	-15.00			-8.44		-14.77		-14.80	-15.45			-6.66
Rcf		1.97		1.97	1.97			1.97		1.97		1.97	1.97			1.97
Fncf (ksi)		-52.17		-52.17	-52.17			-52.17		-52.17		-52.17	-52.17			-52.17
Fncf (kip)		-7043.57		-7043.57	-7043.57			-7043.57		-7043.57		-7043.57	-7043.57			-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.70828	-13.25775	-13.23154	-6.491094	-11.07001	-13.82516	-19.22052	-6.313193	-15.35737	-10.99409	-13.55172	-10.81009	-11.38454	-14.92339	-18.63	-5.06
Fs (ksi)	-15.71	-13.26	-13.23	-6.49	-11.07	-13.83	-19.22	-6.31	-15.36	-10.99	-13.55	-10.81	-11.38	-14.92	-18.63	-5.06
Fs (kip)	-2120.62	-1789.80	-1786.26	-876.30	-1494.45	-1866.40	-2594.77	-852.28	-2073.25	-1484.20	-1829.48	-1459.36	-1536.91	-2014.66	-2514.67	-682.73

Vu (kip)	371.75	326.84	240.71	492.21	355.62	337.93	250.07	473.30	269.27	239.12	176.69	355.96	257.87	246.95	183.30	342.59
Vuw (kip)	557.62	490.26	361.06	738.32	533.43	506.90	375.10	709.94	---	---	---	---	---	---	---	---
Mv (k*ft)	313.66	275.77	203.10	415.30	300.06	285.13	210.99	399.34	151.46	134.51	99.39	200.23	145.05	138.91	103.11	192.71
Huw (kip)	-2093.70	-1655.01	-1953.13	-1643.11	-1942.33	-1943.82	-1974.16	-1559.13	-695.18	-473.34	-597.48	-612.81	-632.44	-584.68	-631.39	-568.43
Muw (k*ft)	263.44	555.90	357.16	563.83	364.35	363.36	343.13	619.82	39.21	107.85	44.08	206.52	69.81	43.87	56.62	217.12
Mu (k*ft)	577.10	831.67	560.25	979.13	664.41	648.49	554.13	1019.16	190.67	242.35	143.47	406.74	214.87	182.78	159.73	409.83

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.21	25.46	30.05	25.28	29.88	29.90	30.37	23.99	10.70	7.28	9.19	9.43	9.73	9.00	9.71	8.75
PY1 (Vuw)	8.58	7.54	5.55	11.36	8.21	7.80	5.77	10.92	4.14	3.68	2.72	5.48	3.97	3.80	2.82	5.27
PX2 (Mu)	13.32	19.19	12.93	22.60	15.33	14.97	12.79	23.52	4.40	5.59	3.31	9.39	4.96	4.22	3.69	9.46
PY2 (Mu)	4.44	6.40	4.31	7.53	5.11	4.99	4.26	7.84	1.47	1.86	1.10	3.13	1.65	1.41	1.23	3.15
Pu (kip)	47.35	46.78	44.09	51.47	47.13	46.66	44.31	51.08	16.10	14.02	13.07	20.69	15.73	14.20	14.00	20.06

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	37.89	37.99	35.82	41.01	37.92	37.59	35.94	40.84
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.47	25.73	OK	20.69	10.34	OK

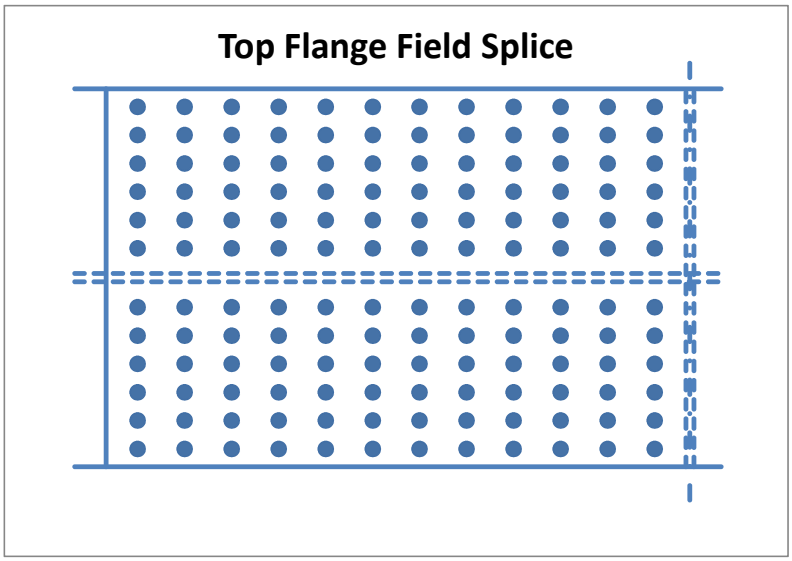
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.47	1.47	91.65	OK
Web SPL	25.73	1.47	91.65	OK

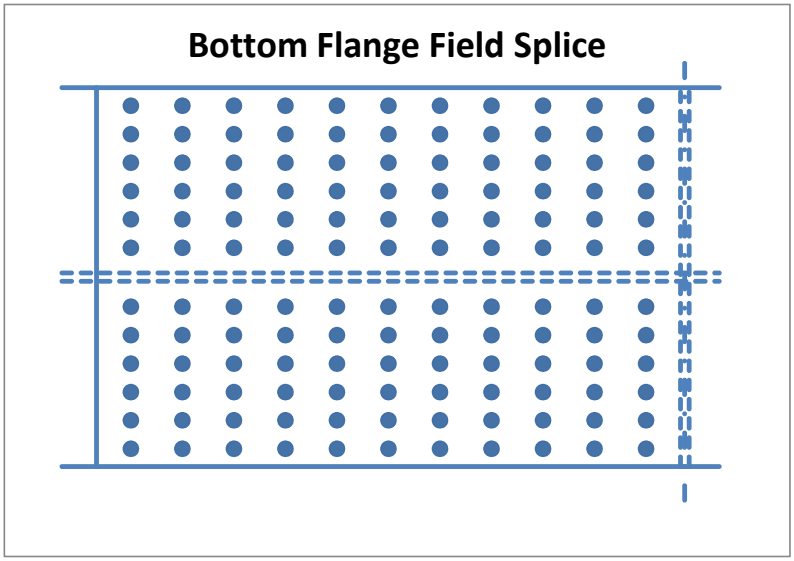
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1542	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1542

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3.375
0	6.75	0	6.75
0	10.125	0	10.125
0	13.5	0	13.5
0	16.875	0	16.875
0	23.875	0	23.875
0	27.25	0	27.25
0	30.625	0	30.625
0	34	0	34
0	37.375	0	37.375
0	40.75	0	40.75
3	0	3	0
3	3.375	3	3.375
3	6.75	3	6.75
3	10.125	3	10.125
3	13.5	3	13.5
3	16.875	3	16.875
3	23.875	3	23.875
3	27.25	3	27.25
3	30.625	3	30.625
3	34	3	34
3	37.375	3	37.375
3	40.75	3	40.75
6	0	6	0
6	3.375	6	3.375
6	6.75	6	6.75
6	10.125	6	10.125
6	13.5	6	13.5
6	16.875	6	16.875
6	23.875	6	23.875
6	27.25	6	27.25
6	30.625	6	30.625
6	34	6	34
6	37.375	6	37.375
6	40.75	6	40.75
9	0	9	0
9	3.375	9	3.375
9	6.75	9	6.75
9	10.125	9	10.125
9	13.5	9	13.5
9	16.875	9	16.875
9	23.875	9	23.875
9	27.25	9	27.25
9	30.625	9	30.625
9	34	9	34
9	37.375	9	37.375
9	40.75	9	40.75
12	0	12	0
12	3.375	12	3.375
12	6.75	12	6.75
12	10.125	12	10.125
12	13.5	12	13.5
12	16.875	12	16.875
12	23.875	12	23.875
12	27.25	12	27.25
12	30.625	12	30.625
12	34	12	34
12	37.375	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	144.0		132.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	11.0		10.0	
Longitudinal Spacing (in) =	3.000	OK	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





12	40.75	12	40.75
15	0	15	0
15	3.375	15	3.375
15	6.75	15	6.75
15	10.125	15	10.125
15	13.5	15	13.5
15	16.875	15	16.875
15	23.875	15	23.875
15	27.25	15	27.25
15	30.625	15	30.625
15	34	15	34
15	37.375	15	37.375
15	40.75	15	40.75
18	0	18	0
18	3.375	18	3.375
18	6.75	18	6.75
18	10.125	18	10.125
18	13.5	18	13.5
18	16.875	18	16.875
18	23.875	18	23.875
18	27.25	18	27.25
18	30.625	18	30.625
18	34	18	34
18	37.375	18	37.375
18	40.75	18	40.75
21	0	21	0
21	3.375	21	3.375
21	6.75	21	6.75
21	10.125	21	10.125
21	13.5	21	13.5
21	16.875	21	16.875
21	23.875	21	23.875
21	27.25	21	27.25
21	30.625	21	30.625
21	34	21	34
21	37.375	21	37.375
21	40.75	21	40.75
24	0	24	0
24	3.375	24	3.375
24	6.75	24	6.75
24	10.125	24	10.125
24	13.5	24	13.5
24	16.875	24	16.875
24	23.875	24	23.875
24	27.25	24	27.25
24	30.625	24	30.625
24	34	24	34
24	37.375	24	37.375
24	40.75	24	40.75
27	0	27	0
27	3.375	27	3.375
27	6.75	27	6.75
27	10.125	27	10.125
27	13.5	27	13.5
27	16.875	27	16.875
27	23.875	27	23.875
27	27.25	27	27.25
27	30.625	27	30.625
27	34	27	34
27	37.375	27	37.375
27	40.75	27	40.75
30	0	30	0
30	3.375	30	3.375
30	6.75	30	6.75
30	10.125	30	10.125
30	13.5	30	13.5

Flange Bolt Pattern Cont. - Node 1542

30	16.875	30	16.875
30	23.875	30	23.875
30	27.25	30	27.25
30	30.625	30	30.625
30	34	30	34
30	37.375	30	37.375
30	40.75	30	40.75
33	0		
33	3.375		
33	6.75		
33	10.125		
33	13.5		
33	16.875		
33	23.875		
33	27.25		
33	30.625		
33	34		
33	37.375		
33	40.75		

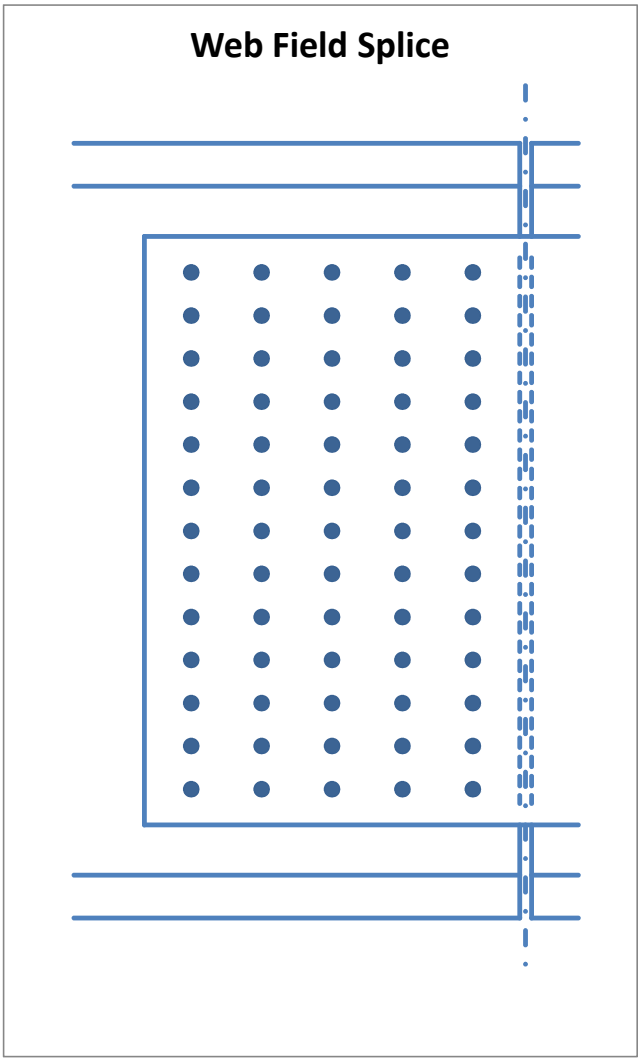
Flange Bolt Pattern Cont. - Node 1542

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1542	Backchk'd	SAE	Date	6/10/2011	Sheet No.	

Web Bolt Pattern - Node 1542

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	36	324
0	3	36	225
0	6	36	144
0	9	36	81
0	12	36	36
0	15	36	9
0	18	36	0
0	21	36	9
0	24	36	36
0	27	36	81
0	30	36	144
0	33	36	225
0	36	36	324
3	0	9	324
3	3	9	225
3	6	9	144
3	9	9	81
3	12	9	36
3	15	9	9
3	18	9	0
3	21	9	9
3	24	9	36
3	27	9	81
3	30	9	144
3	33	9	225
3	36	9	324
6	0	0	324
6	3	0	225
6	6	0	144
6	9	0	81
6	12	0	36
6	15	0	9
6	18	0	0
6	21	0	9
6	24	0	36
6	27	0	81
6	30	0	144
6	33	0	225
6	36	0	324
9	0	9	324
9	3	9	225
9	6	9	144
9	9	9	81
9	12	9	36
9	15	9	9
9	18	9	0
9	21	9	9
9	24	9	36
9	27	9	81
9	30	9	144
9	33	9	225
9	36	9	324
12	0	36	324
12	3	36	225
12	6	36	144
12	9	36	81
12	12	36	36
12	15	36	9
12	18	36	0

No. Bolts =	65.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	4.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	6	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	1170	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	8190	
Σd^2 (in^2) =	9360	



12	21	36	9
12	24	36	36
12	27	36	81
12	30	36	144
12	33	36	225
12	36	36	324

Web Bolt Pattern Cont. - Node 1542

Web Bolt Pattern Cont. - Node 1542

390	1170	1170	8190

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3542	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type KK

Field Splice - Node 3542

Node 3542

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3542 L	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00
3542 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3542 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-31.86	-20.21	-25.39	-11.88	-24.13	-21.51	-35.38	-10.92	-30.54	-10.98	-29.01	-21.50	-24.77	-23.51	-34.89	-9.21
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.46	0.29	0.36	0.17	0.35	0.31	0.51	0.16	0.44	0.16	0.42	0.31	0.36	0.34	0.50	0.13
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-31.86		-25.39		-24.13		-35.38		-30.54		-29.01		-24.77		-34.89	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.58		-52.17		-52.17		-52.17		-52.34	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7098.49		-7043.57		-7043.57		-7043.57		-7065.27	
fncf (ksi)		-20.21		-11.88		-21.51		-10.92		-10.98		-21.50		-23.51		-9.21
Rcf		1.47		1.47		1.47		1.49		1.47		1.47		1.47		1.48
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.19	-14.57	-18.93	-8.62	-17.54	-15.67	-26.21	-7.71	-22.50	-7.96	-21.36	-15.53	-17.97	-17.11	-25.89	-6.48
Fs (ksi)	-23.19	-14.57	-18.93	-8.62	-17.54	-15.67	-26.21	-7.71	-22.50	-7.96	-21.36	-15.53	-17.97	-17.11	-25.89	-6.48
Fs (kip)	-3131.27	-1966.61	-2555.05	-1163.06	-2368.38	-2115.56	-3538.16	-1041.32	-3037.16	-1075.21	-2884.10	-2096.64	-2426.00	-2310.25	-3494.89	-874.47

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7098.49	7043.57	3538.16	2310.25

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	545.95	444.59	397.50	634.49	549.44	462.80	409.66	623.23	393.04	324.17	288.15	458.34	395.50	337.04	296.74	450.39
Vuw (kip)	818.93	666.89	596.26	951.73	824.16	694.20	614.49	934.85	---	---	---	---	---	---	---	---
Mv (k*ft)	460.65	375.13	335.39	535.35	463.59	390.49	345.65	525.85	221.08	182.35	162.09	257.82	222.47	189.58	166.92	253.34
Huw (kip)	-1959.78	-1665.04	-2005.80	-1643.80	-1633.18	-2005.36	-2076.65	-1575.26	-906.29	-661.00	-797.15	-814.13	-731.09	-885.47	-842.00	-776.78
Muw (k*ft)	352.72	549.22	322.04	576.31	570.45	322.34	274.80	614.18	138.03	164.98	29.96	295.92	232.53	93.33	13.72	310.57
Mu (k*ft)	813.37	924.34	657.44	1111.66	1034.04	712.82	620.46	1140.03	359.12	347.32	192.05	553.74	455.00	282.91	180.64	563.91

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.15	25.62	30.86	25.29	25.13	30.85	31.95	24.23	13.94	10.17	12.26	12.53	11.25	13.62	12.95	11.95
PY1 (Vuw)	12.60	10.26	9.17	14.64	12.68	10.68	9.45	14.38	6.05	4.99	4.43	7.05	6.08	5.19	4.57	6.93
PX2 (Mu)	18.77	21.33	15.17	25.65	23.86	16.45	14.32	26.31	8.29	8.02	4.43	12.78	10.50	6.53	4.17	13.01
PY2 (Mu)	6.26	7.11	5.06	8.55	7.95	5.48	4.77	8.77	2.76	2.67	1.48	4.26	3.50	2.18	1.39	4.34
Pu (kip)	52.43	50.06	48.18	55.97	53.16	49.99	48.40	55.59	23.91	19.73	17.71	27.72	23.77	21.45	18.13	27.39

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3517.27	3898.13	OK
TF Inside	3581.22	3969.00	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.32	40.10	38.54	43.85	42.06	39.72	38.61	43.63
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	951.73
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3581.22	24.87	OK	1785.02	12.40	OK
BF	3568.13	27.03	OK	1170.32	8.87	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3517.27	24.43	1.47	164.79	OK
TF	7098.49	49.30	1.47	359.55	OK
TF Inside	3581.22	24.87	1.47	179.78	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.97	27.99	OK	27.72	13.86	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.97	1.47	91.65	OK
Web SPL	27.99	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.11
TF Inside	NA	1.11
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.46	1.36	6.75
Web	1.11	1.29	1.65
BF	1.34	1.90	5.69

Plate	Shear	Flexure
Web	1.72	1.15

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.71	-18.91	-23.67	-11.15	-22.39	-19.97	-32.97	-10.31	-29.20	-11.08	-25.52	-18.55	-22.96	-21.80	-32.58	-8.78
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.43	0.27	0.34	0.16	0.32	0.29	0.47	0.15	0.42	0.16	0.37	0.27	0.33	0.31	0.47	0.13
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.71		-23.67		-22.39		-32.97		-29.20		-25.52		-22.96		-32.58	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-18.91		-11.15		-19.97		-10.31		-11.08		-18.55		-21.80		-8.78
Rcf		1.58		1.58		1.58		1.58		1.58		1.58		1.58		1.58
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.47174	-13.91389	-17.27092	-8.23785	-16.30034	-14.65969	-23.84705	-7.644353	-21.11382	-8.382141	-18.57787	-13.46781	-16.70596	-15.95478	-23.57	-6.57
Fs (ksi)	-21.47	-13.91	-17.27	-8.24	-16.30	-14.66	-23.85	-7.64	-21.11	-8.38	-18.58	-13.47	-16.71	-15.95	-23.57	-6.57
Fs (kip)	-2898.69	-1878.38	-2331.57	-1112.11	-2200.55	-1979.06	-3219.35	-1031.99	-2850.37	-1131.59	-2508.01	-1818.15	-2255.30	-2153.90	-3181.96	-886.33

Vu (kip)	545.95	444.59	397.50	634.49	549.44	462.80	409.66	623.23	393.04	324.17	288.15	458.34	395.50	337.04	296.74	450.39
Vuw (kip)	818.93	666.89	596.26	951.73	824.16	694.20	614.49	934.85	---	---	---	---	---	---	---	---
Mv (k*ft)	460.65	375.13	335.39	535.35	463.59	390.49	345.65	525.85	221.08	182.35	162.09	257.82	222.47	189.58	166.92	253.34
Huw (kip)	-1962.54	-1667.91	-2002.62	-1636.01	-1665.21	-1949.02	-2072.23	-1578.02	-849.26	-612.21	-743.04	-755.79	-707.90	-769.10	-783.86	-723.25
Muw (k*ft)	350.88	547.30	324.16	568.56	549.10	359.89	277.75	607.22	120.93	144.53	26.25	259.24	203.71	81.76	12.02	272.07
Mu (k*ft)	811.53	922.42	659.55	1103.91	1012.69	750.38	623.40	1133.08	342.01	326.88	188.34	517.06	426.18	271.34	178.94	525.42

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.19	25.66	30.81	25.17	25.62	29.98	31.88	24.28	13.07	9.42	11.43	11.63	10.89	11.83	12.06	11.13
PY1 (Vuw)	12.60	10.26	9.17	14.64	12.68	10.68	9.45	14.38	6.05	4.99	4.43	7.05	6.08	5.19	4.57	6.93
PX2 (Mu)	18.73	21.29	15.22	25.47	23.37	17.32	14.39	26.15	7.89	7.54	4.35	11.93	9.83	6.26	4.13	12.12
PY2 (Mu)	6.24	7.10	5.07	8.49	7.79	5.77	4.80	8.72	2.63	2.51	1.45	3.98	3.28	2.09	1.38	4.04
Pu (kip)	52.42	50.05	48.18	55.68	53.09	50.08	48.41	55.46	22.68	18.55	16.84	26.01	22.74	19.50	17.24	25.71

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.31	40.09	38.55	43.59	42.00	39.84	38.62	43.51
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
55.68	27.84	OK	26.01	13.01	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	55.68	1.47	91.65	OK
Web SPL	27.84	1.47	91.65	OK

Field Splice - Node 5542

Node 5542

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5542 L	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00
5542 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5542 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-34.43	-18.94	-26.52	-10.68	-24.65	-19.72	-38.76	-9.59	-33.38	-11.60	-30.37	-20.77	-25.57	-22.04	-38.11	-7.75
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.49	0.27	0.38	0.15	0.35	0.28	0.56	0.14	0.48	0.17	0.44	0.30	0.37	0.32	0.55	0.11
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-34.43		-26.52		-24.65		-38.76		-33.38		-30.37		-25.57		-38.11	
Fcf (ksi)	-52.17		-52.17		-52.17		-54.29		-52.17		-52.17		-52.17		-53.95	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7328.53		-7043.57		-7043.57		-7043.57		-7283.86	
fncf (ksi)		-18.94		-10.68		-19.72		-9.59		-11.60		-20.77		-22.04		-7.75
Rcf		1.35		1.35		1.35		1.40		1.35		1.35		1.35		1.39
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.97	-13.46	-19.85	-7.79	-18.14	-14.52	-28.78	-6.75	-24.65	-8.44	-22.45	-15.05	-18.46	-15.89	-28.34	-5.42
Fs (ksi)	-24.97	-13.46	-19.85	-7.79	-18.14	-14.52	-28.78	-6.75	-24.65	-8.44	-22.45	-15.05	-18.46	-15.89	-28.34	-5.42
Fs (kip)	-3371.35	-1817.19	-2679.84	-1051.61	-2449.30	-1960.04	-3884.85	-911.73	-3328.20	-1139.32	-3030.73	-2031.37	-2492.49	-2145.66	-3825.41	-731.99

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7328.53	7043.57	3884.85	2145.66

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	588.81	471.41	423.42	684.41	578.74	486.24	436.09	675.21	423.09	342.84	306.25	493.33	415.98	353.32	315.19	486.83
Vuw (kip)	883.21	707.12	635.14	1026.61	868.10	729.36	654.13	1012.82	---	---	---	---	---	---	---	---
Mv (k*ft)	496.81	397.75	357.26	577.47	488.31	410.26	367.95	569.71	237.99	192.85	172.26	277.50	233.99	198.74	177.29	273.84
Huw (kip)	-1856.42	-1589.29	-1881.32	-1617.27	-1619.11	-1915.29	-1956.47	-1545.61	-922.41	-663.37	-783.88	-852.73	-794.23	-899.93	-824.56	-810.20
Muw (k*ft)	421.63	599.71	405.03	648.19	579.83	382.38	354.92	685.43	184.20	192.97	57.99	352.37	259.42	118.44	41.11	366.63
Mu (k*ft)	918.43	997.47	762.29	1225.66	1068.14	792.65	722.87	1255.14	422.19	385.82	230.25	629.87	493.41	317.18	218.40	640.47

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.56	24.45	28.94	24.88	24.91	29.47	30.10	23.78	14.19	10.21	12.06	13.12	12.22	13.85	12.69	12.46
PY1 (Vuw)	13.59	10.88	9.77	15.79	13.36	11.22	10.06	15.58	6.51	5.27	4.71	7.59	6.40	5.44	4.85	7.49
PX2 (Mu)	21.19	23.02	17.59	28.28	24.65	18.29	16.68	28.96	9.74	8.90	5.31	14.54	11.39	7.32	5.04	14.78
PY2 (Mu)	7.06	7.67	5.86	9.43	8.22	6.10	5.56	9.65	3.25	2.97	1.77	4.85	3.80	2.44	1.68	4.93
Pu (kip)	53.87	50.97	49.09	58.84	54.05	50.80	49.32	58.47	25.85	20.81	18.54	30.32	25.71	22.58	18.89	29.94

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3631.25	3898.13	OK
TF Inside	3697.28	3969.00	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.31	40.74	39.27	45.97	42.62	40.33	39.34	45.73
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1026.61
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3697.28	25.68	OK	1959.92	13.61	OK
BF	3568.13	27.03	OK	1086.95	8.23	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3631.25	25.22	1.47	164.79	OK
TF	7328.53	50.89	1.47	359.55	OK
TF Inside	3697.28	25.68	1.47	179.78	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
58.84	29.42	OK	30.32	15.16	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	58.84	1.47	91.65	OK
Web SPL	29.42	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.07
TF Inside	NA	1.07
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.41	1.24	6.54
Web	1.06	1.18	1.58
BF	1.34	2.04	5.69

Plate	Shear	Flexure
Web	1.60	1.11

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.58	-18.22	-25.47	-10.79	-24.02	-19.45	-36.27	-9.23	-30.93	-10.74	-27.20	-18.29	-24.71	-21.44	-35.87	-7.73
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.47	0.26	0.37	0.16	0.35	0.28	0.52	0.13	0.44	0.15	0.39	0.26	0.36	0.31	0.52	0.11
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-32.58		-25.47		-24.02		-36.27		-30.93		-27.20		-24.71		-35.87	
Fcf (ksi)	-52.17		-52.17		-52.17		-53.03		-52.17		-52.17		-52.17		-52.83	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7159.03		-7043.57		-7043.57		-7043.57		-7131.88	
fncf (ksi)		-18.22		-10.79		-19.45		-9.23		-10.74		-18.29		-21.44		-7.73
Rcf		1.44		1.44		1.44		1.46		1.44		1.44		1.44		1.46
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.49064	-13.40521	-18.55813	-7.992135	-17.44678	-14.27189	-26.18983	-6.896394	-22.32466	-8.120436	-19.78115	-13.29601	-17.93068	-15.68	-25.91	-5.83
Fs (ksi)	-23.49	-13.41	-18.56	-7.99	-17.45	-14.27	-26.19	-6.90	-22.32	-8.12	-19.78	-13.30	-17.93	-15.68	-25.91	-5.83
Fs (kip)	-3171.24	-1809.70	-2505.35	-1078.94	-2355.32	-1926.70	-3535.63	-931.01	-3013.83	-1096.26	-2670.46	-1794.96	-2420.64	-2116.80	-3497.50	-787.51

Vu (kip)	588.81	471.41	423.42	684.41	578.74	486.24	436.09	675.21	423.09	342.84	306.25	493.33	415.98	353.32	315.19	486.83
Vuw (kip)	883.21	707.12	635.14	1026.61	868.10	729.36	654.13	1012.82	---	---	---	---	---	---	---	---
Mv (k*ft)	496.81	397.75	357.26	577.47	488.31	410.26	367.95	569.71	237.99	192.85	172.26	277.50	233.99	198.74	177.29	273.84
Huw (kip)	-1873.62	-1616.81	-1915.97	-1588.89	-1615.36	-1876.01	-1984.78	-1530.27	-885.50	-637.21	-761.25	-794.07	-730.68	-793.85	-806.66	-761.78
Muw (k*ft)	410.16	581.36	381.93	627.18	582.34	408.57	336.05	659.86	161.37	169.06	50.80	308.69	227.27	103.76	36.01	321.18
Mu (k*ft)	906.97	979.12	739.19	1204.65	1070.64	818.83	704.00	1229.57	399.36	361.90	223.06	586.19	461.25	302.50	213.31	595.03

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.82	24.87	29.48	24.44	24.85	28.86	30.54	23.54	13.62	9.80	11.71	12.22	11.24	12.21	12.41	11.72
PY1 (Vuw)	13.59	10.88	9.77	15.79	13.36	11.22	10.06	15.58	6.51	5.27	4.71	7.59	6.40	5.44	4.85	7.49
PX2 (Mu)	20.93	22.60	17.06	27.80	24.71	18.90	16.25	28.37	9.22	8.35	5.15	13.53	10.64	6.98	4.92	13.73
PY2 (Mu)	6.98	7.53	5.69	9.27	8.24	6.30	5.42	9.46	3.07	2.78	1.72	4.51	3.55	2.33	1.64	4.58
Pu (kip)	53.84	50.91	49.03	57.94	54.06	50.87	49.28	57.64	24.77	19.86	18.04	28.45	24.04	20.70	18.51	28.17

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.27	40.69	39.20	45.18	42.63	40.41	39.28	44.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
57.94	28.97	OK	28.45	14.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	57.94	1.47	91.65	OK
Web SPL	28.97	1.47	91.65	OK

Field Splice - Node 7542

Node 7542

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7542 L	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00
7542 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7542 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I	27 in
Outer to Inr	0.8888889
Outer to Inr	0.8888889
Outer to Mi	0.9444444
Outer to Mi	0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-35.70	-22.46	-29.69	-13.86	-26.46	-20.88	-40.71	-13.42	-27.55	-16.25	-37.63	-19.28	-28.13	-23.96	-39.71	-11.21
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.51	0.32	0.43	0.20	0.38	0.30	0.59	0.19	0.40	0.23	0.54	0.28	0.40	0.34	0.57	0.16
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-35.70		-29.69		-26.46		-40.71		-27.55		-37.63		-28.13		-39.71	
Fcf (ksi)	-52.74		-52.17		-52.17		-55.27		-52.17		-53.72		-52.17		-54.76	
Fcf (kip)	-7120.30		-7043.57		-7043.57		-7460.90		-7043.57		-7251.62		-7043.57		-7392.66	
fncf (ksi)		-22.46		-13.86		-20.88		-13.42		-16.25		-19.28		-23.96		-11.21
Rcf		1.30		1.28		1.28		1.36		1.28		1.32		1.28		1.35
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-26.57	-16.42	-21.78	-9.94	-19.29	-15.11	-30.40	-9.73	-20.18	-11.72	-28.04	-14.06	-20.45	-17.32	-29.72	-8.15
Fs (ksi)	-26.57	-16.42	-21.78	-9.94	-19.29	-15.11	-30.40	-9.73	-20.18	-11.72	-28.04	-14.06	-20.45	-17.32	-29.72	-8.15
Fs (kip)	-3587.19	-2216.04	-2940.27	-1342.16	-2604.60	-2039.94	-4104.33	-1314.21	-2724.32	-1582.69	-3785.74	-1897.82	-2760.21	-2337.93	-4011.84	-1099.93

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7460.90	7043.57	4104.33	2337.93

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	541.93	455.33	408.91	640.38	453.65	547.96	425.09	630.04	393.36	329.16	296.36	462.92	327.97	397.62	307.79	455.61
Vuw (kip)	812.90	682.99	613.36	960.57	680.48	821.94	637.63	945.06	---	---	---	---	---	---	---	---
Mv (k*ft)	457.26	384.18	345.02	540.32	382.77	462.34	358.67	531.60	221.26	185.15	166.70	260.39	184.49	223.66	173.13	256.28
Huw (kip)	-1956.47	-1670.78	-1886.67	-1755.28	-1744.32	-1891.60	-1981.51	-1667.83	-1031.69	-761.32	-825.70	-963.30	-765.69	-1010.41	-906.33	-908.76
Muw (k*ft)	373.00	545.38	401.46	587.36	496.36	447.18	338.23	629.58	162.51	189.41	66.92	330.68	135.30	223.75	50.05	345.11
Mu (k*ft)	830.26	929.57	746.47	1127.68	879.13	909.52	696.90	1161.18	383.77	374.56	233.62	591.07	319.79	447.41	223.18	601.40

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	30.10	25.70	29.03	27.00	26.84	29.10	30.48	25.66	15.87	11.71	12.70	14.82	11.78	15.54	13.94	13.98
PY1 (Vuw)	12.51	10.51	9.44	14.78	10.47	12.65	9.81	14.54	6.05	5.06	4.56	7.12	5.05	6.12	4.74	7.01
PX2 (Mu)	19.16	21.45	17.23	26.02	20.29	20.99	16.08	26.80	8.86	8.64	5.39	13.64	7.38	10.32	5.15	13.88
PY2 (Mu)	6.39	7.15	5.74	8.67	6.76	7.00	5.36	8.93	2.95	2.88	1.80	4.55	2.46	3.44	1.72	4.63
Pu (kip)	52.76	50.35	48.68	57.98	50.17	53.80	48.98	57.47	26.32	21.85	19.18	30.76	20.58	27.58	20.15	30.19

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3696.84	3898.13	OK
TF Inside	3764.06	3969.00	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.64	40.28	38.99	45.56	40.10	42.55	39.09	45.21
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	960.57
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3764.06	26.14	OK	2070.65	14.38	OK
BF	3568.13	27.03	OK	1184.34	8.97	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3696.84	25.67	1.47	164.79	OK
TF	7460.90	51.81	1.47	359.55	OK
TF Inside	3764.06	26.14	1.47	179.78	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
57.98	28.99	OK	30.76	15.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	57.98	1.47	91.65	OK
Web SPL	28.99	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.05
TF Inside	NA	1.05
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.38	1.17	6.42
Web	1.10	1.27	1.64
BF	1.34	1.88	5.69

Plate	Shear	Flexure
Web	1.71	1.14

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.44	-17.17	-24.02	-9.35	-22.73	-17.56	-33.42	-8.12	-24.71	-14.24	-29.36	-12.35	-23.50	-19.63	-33.04	-6.63
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.42	0.25	0.35	0.13	0.33	0.25	0.48	0.12	0.36	0.20	0.42	0.18	0.34	0.28	0.48	0.10
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.44		-24.02		-22.73		-33.42		-24.71		-29.36		-23.50		-33.04	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-17.17		-9.35		-17.56		-8.12		-14.24		-12.35		-19.63		-6.63
Rcf		1.56		1.56		1.56		1.56		1.56		1.56		1.56		1.56
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.39274	-12.49492	-17.43547	-7.064915	-16.5239	-12.85969	-24.2041	-6.098193	-17.92389	-10.51554	-21.33916	-9.087874	-17.06611	-14.32581	-23.94	-5.04
Fs (ksi)	-21.39	-12.49	-17.44	-7.06	-16.52	-12.86	-24.20	-6.10	-17.92	-10.52	-21.34	-9.09	-17.07	-14.33	-23.94	-5.04
Fs (kip)	-2888.02	-1686.81	-2353.79	-953.76	-2230.73	-1736.06	-3267.55	-823.26	-2419.72	-1419.60	-2880.79	-1226.86	-2303.92	-1933.98	-3232.02	-681.03

Vu (kip)	541.93	455.33	408.91	640.38	453.65	547.96	425.09	630.04	393.36	329.16	296.36	462.92	327.97	397.62	307.79	455.61
Vuw (kip)	812.90	682.99	613.36	960.57	680.48	821.94	637.63	945.06	---	---	---	---	---	---	---	---
Mv (k*ft)	457.26	384.18	345.02	540.32	382.77	462.34	358.67	531.60	221.26	185.15	166.70	260.39	184.49	223.66	173.13	256.28
Huw (kip)	-1887.98	-1594.94	-1902.27	-1548.72	-1777.94	-1707.28	-1980.03	-1492.85	-813.30	-588.01	-705.21	-727.25	-682.55	-730.25	-753.41	-695.65
Muw (k*ft)	400.59	595.95	391.06	626.76	473.94	521.05	339.22	664.01	142.37	165.93	58.63	289.69	118.53	196.02	43.84	302.34
Mu (k*ft)	857.84	980.13	736.08	1167.08	856.71	983.39	697.89	1195.60	363.63	351.08	225.33	550.09	303.02	419.68	216.98	558.62

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.05	24.54	29.27	23.83	27.35	26.27	30.46	22.97	12.51	9.05	10.85	11.19	10.50	11.23	11.59	10.70
PY1 (Vuw)	12.51	10.51	9.44	14.78	10.47	12.65	9.81	14.54	6.05	5.06	4.56	7.12	5.05	6.12	4.74	7.01
PX2 (Mu)	19.80	22.62	16.99	26.93	19.77	22.69	16.11	27.59	8.39	8.10	5.20	12.69	6.99	9.68	5.01	12.89
PY2 (Mu)	6.60	7.54	5.66	8.98	6.59	7.56	5.37	9.20	2.80	2.70	1.73	4.23	2.33	3.23	1.67	4.30
Pu (kip)	52.45	50.49	48.65	56.04	50.12	52.97	48.98	55.85	22.70	18.82	17.24	26.44	18.99	22.91	17.79	26.16

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.40	40.44	38.96	43.88	40.03	41.88	39.09	43.81
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
56.04	28.02	OK	26.44	13.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	56.04	1.47	91.65	OK
Web SPL	28.02	1.47	91.65	OK

Field Splice - Node 9542

Node 9542

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9542 L	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00
9542 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9542 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I	27 in
Outer to Inr	0.8888889
Outer to Inr	0.8888889
Outer to Mi	0.9444444
Outer to Mi	0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.38	-17.94	-27.08	-14.93	-26.46	-20.79	-33.86	-10.55	-27.27	-11.48	-31.48	-21.22	-25.96	-23.79	-34.07	-9.03
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.42	0.26	0.39	0.21	0.38	0.30	0.49	0.15	0.39	0.17	0.45	0.30	0.37	0.34	0.49	0.13
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.38		-27.08		-26.46		-33.86		-27.27		-31.48		-25.96		-34.07	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-17.94		-14.93		-20.79		-10.55		-11.48		-21.22		-23.79		-9.03
Rcf		1.53		1.53		1.53		1.53		1.53		1.53		1.53		1.53
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.61	-12.87	-20.48	-11.19	-20.15	-16.40	-25.02	-7.40	-20.21	-8.22	-23.55	-15.66	-19.01	-17.19	-25.68	-6.75
Fs (ksi)	-21.61	-12.87	-20.48	-11.19	-20.15	-16.40	-25.02	-7.40	-20.21	-8.22	-23.55	-15.66	-19.01	-17.19	-25.68	-6.75
Fs (kip)	-2917.83	-1736.94	-2765.06	-1510.08	-2720.88	-2214.33	-3378.22	-999.29	-2728.30	-1109.40	-3179.06	-2114.50	-2566.17	-2320.61	-3467.35	-910.95

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7043.57	7043.57	3467.35	2320.61

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	463.71	347.52	326.57	545.05	464.49	386.15	344.97	528.44	337.39	254.18	239.77	394.85	337.93	281.47	253.50	382.00
Vuw (kip)	695.57	521.28	489.85	817.57	696.73	579.23	517.46	792.66	---	---	---	---	---	---	---	---
Mv (k*ft)	391.26	293.22	275.54	459.88	391.91	325.82	291.07	445.87	189.78	142.98	134.87	222.10	190.09	158.33	142.59	214.88
Huw (kip)	-1903.56	-1793.25	-2008.52	-1631.99	-1666.39	-2024.12	-2118.57	-1576.15	-827.51	-760.03	-877.37	-778.22	-682.26	-941.08	-868.76	-778.36
Muw (k*ft)	390.20	463.74	320.23	571.25	548.31	309.83	246.86	608.47	139.96	148.74	60.04	281.95	191.87	126.17	29.10	302.98
Mu (k*ft)	781.46	756.96	595.77	1031.13	940.22	635.64	537.93	1054.35	329.74	291.71	194.91	504.05	381.96	284.50	171.69	517.86

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	29.29	27.59	30.90	25.11	25.64	31.14	32.59	24.25	12.73	11.69	13.50	11.97	10.50	14.48	13.37	11.97
PY1 (Vuw)	10.70	8.02	7.54	12.58	10.72	8.91	7.96	12.19	5.19	3.91	3.69	6.07	5.20	4.33	3.90	5.88
PX2 (Mu)	18.03	17.47	13.75	23.80	21.70	14.67	12.41	24.33	7.61	6.73	4.50	11.63	8.81	6.57	3.96	11.95
PY2 (Mu)	6.01	5.82	4.58	7.93	7.23	4.89	4.14	8.11	2.54	2.24	1.50	3.88	2.94	2.19	1.32	3.98
Pu (kip)	50.18	47.14	46.26	53.03	50.62	47.84	46.61	52.65	21.76	19.43	18.73	25.62	20.96	22.03	18.10	25.88

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3490.06	3898.13	OK
TF Inside	3553.51	3969.00	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	39.95	38.08	37.25	41.98	40.46	38.30	37.36	41.80
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	817.57
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9542**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges
0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3553.51	24.68	OK	1749.29	12.15	OK
BF	3568.13	27.03	OK	1175.57	8.91	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3490.06	24.24	1.47	164.79	OK
TF	7043.57	48.91	1.47	359.55	OK
TF Inside	3553.51	24.68	1.47	179.78	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.03	26.51	OK	25.88	12.94	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.03	1.47	91.65	OK
Web SPL	26.51	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	1.39	6.80
Web	1.16	1.49	1.72
BF	1.34	1.89	5.69

Plate	Shear	Flexure
Web	2.01	1.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.62	-14.01	-18.18	-6.92	-17.64	-12.38	-28.51	-6.90	-24.90	-10.27	-20.17	-10.65	-18.39	-16.38	-27.42	-4.20
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.35	0.20	0.26	0.10	0.25	0.18	0.41	0.10	0.36	0.15	0.29	0.15	0.26	0.24	0.39	0.06
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-24.62		-18.18		-17.64		-28.51		-24.90		-20.17		-18.39		-27.42	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-14.01		-6.92		-12.38		-6.90		-10.27		-10.65		-16.38		-4.20
Rcf		1.83		1.83		1.83		1.83		1.83		1.83		1.83		1.83
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.94606	-10.28293	-13.35875	-5.214782	-12.88927	-9.602129	-20.69698	-5.259415	-18.14193	-7.636396	-14.76169	-7.853447	-13.54577	-11.95228	-19.88	-3.30
Fs (ksi)	-17.95	-10.28	-13.36	-5.21	-12.89	-9.60	-20.70	-5.26	-18.14	-7.64	-14.76	-7.85	-13.55	-11.95	-19.88	-3.30
Fs (kip)	-2422.72	-1388.20	-1803.43	-704.00	-1740.05	-1296.29	-2794.09	-710.02	-2449.16	-1030.91	-1992.83	-1060.22	-1828.68	-1613.56	-2684.47	-444.93

Vu (kip)	463.71	347.52	326.57	545.05	464.49	386.15	344.97	528.44	337.39	254.18	239.77	394.85	337.93	281.47	253.50	382.00
Vuw (kip)	695.57	521.28	489.85	817.57	696.73	579.23	517.46	792.66	---	---	---	---	---	---	---	---
Mv (k*ft)	391.26	293.22	275.54	459.88	391.91	325.82	291.07	445.87	189.78	142.98	134.87	222.10	190.09	158.33	142.59	214.88
Huw (kip)	-1859.88	-1548.29	-1788.32	-1547.61	-1695.37	-1712.31	-1963.65	-1429.00	-677.50	-445.76	-539.79	-622.95	-618.68	-542.76	-611.95	-556.34
Muw (k*ft)	419.32	627.05	467.02	627.50	529.00	517.70	350.14	706.57	122.61	130.30	52.59	247.00	168.09	110.53	25.50	265.43
Mu (k*ft)	810.57	920.27	742.56	1087.38	920.90	843.51	641.21	1152.45	312.39	273.28	187.47	469.11	358.18	268.86	168.09	480.30

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9542	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	28.61	23.82	27.51	23.81	26.08	26.34	30.21	21.98	10.42	6.86	8.30	9.58	9.52	8.35	9.41	8.56
PY1 (Vuw)	10.70	8.02	7.54	12.58	10.72	8.91	7.96	12.19	5.19	3.91	3.69	6.07	5.20	4.33	3.90	5.88
PX2 (Mu)	18.71	21.24	17.14	25.09	21.25	19.47	14.80	26.59	7.21	6.31	4.33	10.83	8.27	6.20	3.88	11.08
PY2 (Mu)	6.24	7.08	5.71	8.36	7.08	6.49	4.93	8.86	2.40	2.10	1.44	3.61	2.76	2.07	1.29	3.69
Pu (kip)	50.26	47.52	46.57	53.20	50.57	48.33	46.82	52.95	19.20	14.47	13.63	22.59	19.48	15.90	14.27	21.85

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.04	38.59	37.71	42.16	40.40	38.95	37.68	42.11
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
53.20	26.60	OK	22.59	11.29	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	53.20	1.47	91.65	OK
Web SPL	26.60	1.47	91.65	OK

Field Splice - Node 1547

Node 1547

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1547 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
1547 R	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 1547 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.84	-22.50	-8.13	-18.34	-19.26	-18.29	-7.79	-21.95	-19.38	-26.55	-20.71	-24.11	-8.47	-24.05	-19.09	-17.44
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.26	0.32	0.12	0.26	0.28	0.26	0.11	0.32	0.28	0.38	0.30	0.35	0.12	0.35	0.27	0.25
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-22.50		-18.34	-19.26			-21.95		-26.55		-24.11		-24.05	-19.09	
Fcf (ksi)		-52.10		-52.10	-52.10			-52.10		-52.10		-52.10		-52.10	-52.10	
Fcf (kip)		-7033.35		-7033.35	-7033.35			-7033.35		-7033.35		-7033.35		-7033.35	-7033.35	
fncf (ksi)	-17.84		-8.13			-18.29	-7.79		-19.38		-20.71		-8.47			-17.44
Rcf	1.96		1.96			1.96	1.96		1.96		1.96		1.96			1.96
Fncf (ksi)	-52.10		-52.10			-52.10	-52.10		-52.10		-52.10		-52.10			-52.10
Fncf (kip)	-7033.35		-7033.35			-7033.35	-7033.35		-7033.35		-7033.35		-7033.35			-7033.35

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.58	-17.23	-6.86	-14.73	-13.40	-12.83	-6.08	-16.89	-14.30	-20.13	-16.03	-18.18	-6.31	-18.18	-13.23	-12.16
Fs (ksi)	-13.58	-17.23	-6.86	-14.73	-13.40	-12.83	-6.08	-16.89	-14.30	-20.13	-16.03	-18.18	-6.31	-18.18	-13.23	-12.16
Fs (kip)	-1833.40	-2325.62	-926.39	-1988.19	-1809.22	-1732.26	-820.83	-2280.14	-1930.66	-2718.05	-2163.73	-2454.44	-851.77	-2454.48	-1785.91	-1641.31

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2163.73	2718.05

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	407.40	175.80	461.67	136.72	294.00	360.96	157.17	450.94	296.26	132.60	334.61	104.98	222.56	279.21	119.43	327.02
Vuw (kip)	611.11	263.71	692.51	205.08	440.99	541.45	235.75	676.41	---	---	---	---	---	---	---	---
Mv (k*ft)	343.75	148.34	389.53	115.36	248.06	304.56	132.61	380.48	166.65	74.59	188.22	59.05	125.19	157.05	67.18	183.95
Huw (kip)	-2601.08	-2029.46	-2627.63	-2009.79	-2692.23	-2770.40	-2049.92	-2577.60	-924.23	-647.68	-786.99	-689.10	-1033.05	-1026.26	-734.72	-761.60
Muw (k*ft)	333.98	715.06	316.28	728.17	273.21	221.10	701.42	349.64	72.92	157.30	11.40	216.19	116.65	43.07	237.44	21.42
Mu (k*ft)	677.73	863.39	705.81	843.53	521.27	525.66	834.03	730.11	239.57	231.89	199.62	275.25	241.84	200.12	304.62	205.37

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	40.02	31.22	40.43	30.92	41.42	42.62	31.54	39.66	14.22	9.96	12.11	10.60	15.89	15.79	11.30	11.72
PY1 (Vuw)	9.40	4.06	10.65	3.16	6.78	8.33	3.63	10.41	4.56	2.04	5.15	1.62	3.42	4.30	1.84	5.03
PX2 (Mu)	15.64	19.92	16.29	19.47	12.03	12.13	19.25	16.85	5.53	5.35	4.61	6.35	5.58	4.62	7.03	4.74
PY2 (Mu)	5.21	6.64	5.43	6.49	4.01	4.04	6.42	5.62	1.84	1.78	1.54	2.12	1.86	1.54	2.34	1.58
Pu (kip)	57.54	52.25	58.95	51.30	54.53	56.13	51.77	58.73	20.76	15.79	18.00	17.36	22.11	21.22	18.80	17.73

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.23	43.24	47.16	42.57	44.00	45.04	42.86	47.07
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	692.51
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1091.61	7.58	OK
BF	3562.95	26.99	OK	1376.91	10.43	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
58.95	29.47	OK	22.11	11.06	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	58.95	1.47	114.56	OK
Web SPL	29.47	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.22	6.81
Web	1.23	1.76	1.95
BF	1.34	1.61	5.70

Plate	Shear	Flexure
Web	2.37	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-16.61	-20.93	-8.19	-17.66	-18.05	-17.14	-7.77	-20.89	-12.66	-19.30	-14.58	-17.73	-8.33	-22.77	-17.80	-16.27
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.24	0.30	0.12	0.25	0.26	0.25	0.11	0.30	0.18	0.28	0.21	0.26	0.12	0.33	0.26	0.23
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-20.93		-17.66	-18.05			-20.89		-19.30		-17.73		-22.77	-17.80	
Fcf (ksi)		-52.10		-52.10	-52.10			-52.10		-52.10		-52.10		-52.10	-52.10	
Fcf (kip)		-7033.35		-7033.35	-7033.35			-7033.35		-7033.35		-7033.35		-7033.35	-7033.35	
fncf (ksi)	-16.61		-8.19			-17.14	-7.77		-12.66		-14.58		-8.33			-16.27
Rcf	2.29		2.29			2.29	2.29		2.29		2.29		2.29			2.29
Fncf (ksi)	-52.10		-52.10			-52.10	-52.10		-52.10		-52.10		-52.10			-52.10
Fncf (kip)	-7033.35		-7033.35			-7033.35	-7033.35		-7033.35		-7033.35		-7033.35			-7033.35

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.12906	-15.3232	-6.12034	-13.01064	-13.14754	-12.64814	-5.82592	-15.29579	-9.488308	-14.5979	-11.33444	-13.2209	-6.220031	-16.62053	-12.97	-12.03
Fs (ksi)	-12.13	-15.32	-6.12	-13.01	-13.15	-12.65	-5.83	-15.30	-9.49	-14.60	-11.33	-13.22	-6.22	-16.62	-12.97	-12.03
Fs (kip)	-1637.42	-2068.63	-826.25	-1756.44	-1774.92	-1707.50	-786.50	-2064.93	-1280.92	-1970.72	-1530.15	-1784.82	-839.70	-2243.77	-1751.22	-1624.54

Vu (kip)	407.40	175.80	461.67	136.72	294.00	360.96	157.17	450.94	296.26	132.60	334.61	104.98	222.56	279.21	119.43	327.02
Vuw (kip)	611.11	263.71	692.51	205.08	440.99	541.45	235.75	676.41	---	---	---	---	---	---	---	---
Mv (k*ft)	343.75	148.34	389.53	115.36	248.06	304.56	132.61	380.48	166.65	74.59	188.22	59.05	125.19	157.05	67.18	183.95
Huw (kip)	-2691.10	-2113.15	-2727.87	-2084.54	-2420.10	-2551.79	-2122.84	-2668.16	-823.57	-573.93	-773.87	-633.65	-722.59	-736.66	-685.22	-750.17
Muw (k*ft)	273.97	659.27	249.45	678.34	454.63	366.84	652.81	289.26	63.88	137.81	9.99	189.40	102.19	37.73	208.01	18.77
Mu (k*ft)	617.71	807.60	638.99	793.70	702.69	671.40	785.42	669.74	230.53	212.39	198.20	248.45	227.38	194.78	275.19	202.72

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	41.40	32.51	41.97	32.07	37.23	39.26	32.66	41.05	12.67	8.83	11.91	9.75	11.12	11.33	10.54	11.54
PY1 (Vuw)	9.40	4.06	10.65	3.16	6.78	8.33	3.63	10.41	4.56	2.04	5.15	1.62	3.42	4.30	1.84	5.03
PX2 (Mu)	14.25	18.64	14.75	18.32	16.22	15.49	18.13	15.46	5.32	4.90	4.57	5.73	5.25	4.50	6.35	4.68
PY2 (Mu)	4.75	6.21	4.92	6.11	5.41	5.16	6.04	5.15	1.77	1.63	1.52	1.91	1.75	1.50	2.12	1.56
Pu (kip)	57.43	52.17	58.81	51.23	54.82	56.39	51.70	58.61	19.07	14.21	17.78	15.88	17.16	16.86	17.35	17.51

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.05	43.07	46.95	42.42	44.56	45.50	42.71	46.88
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
58.81	29.41	OK	19.07	9.54	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	58.81	1.47	114.56	OK
Web SPL	29.41	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 3547

Node 3547

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3547 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
3547 R	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 3547 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I	27 in
Outer to Inr	0.8888889
Outer to Inr	0.8888889
Outer to Mi	0.9444444
Outer to Mi	0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.24	-27.38	-12.19	-23.87	-22.07	-25.38	-11.05	-27.17	-20.69	-28.81	-19.91	-28.50	-11.40	-29.18	-21.41	-23.53
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.29	0.39	0.18	0.34	0.32	0.37	0.16	0.39	0.30	0.41	0.29	0.41	0.16	0.42	0.31	0.34
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-27.38		-23.87		-25.38		-27.17		-28.81		-28.50		-29.18		-23.53
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-20.24		-12.19		-22.07		-11.05		-20.69		-19.91		-11.40		-21.41	
Rcf	1.79		1.79		1.79		1.79		1.79		1.79		1.79		1.79	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.91	-20.42	-8.22	-17.26	-16.28	-18.92	-7.64	-20.01	-15.03	-21.50	-14.98	-21.84	-8.39	-21.98	-15.84	-17.59
Fs (ksi)	-14.91	-20.42	-8.22	-17.26	-16.28	-18.92	-7.64	-20.01	-15.03	-21.50	-14.98	-21.84	-8.39	-21.98	-15.84	-17.59
Fs (kip)	-2012.90	-2756.09	-1110.24	-2330.67	-2197.90	-2554.47	-1031.67	-2701.20	-2028.50	-2902.10	-2021.69	-2948.29	-1132.13	-2967.39	-2137.73	-2375.00

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2197.90	2967.39

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	487.91	252.19	525.26	212.73	323.33	350.81	235.64	510.44	353.95	185.88	380.33	158.00	290.10	295.09	174.18	369.87
Vuw (kip)	731.87	378.28	787.88	319.09	485.00	526.21	353.46	765.67	---	---	---	---	---	---	---	---
Mv (k*ft)	411.68	212.78	443.18	179.49	272.81	295.99	198.82	430.69	199.10	104.56	213.94	88.87	163.18	165.99	97.98	208.05
Huw (kip)	-2635.51	-2204.09	-2733.47	-2142.74	-2659.54	-2617.66	-2161.91	-2697.84	-1059.78	-764.65	-1056.08	-829.53	-1095.69	-1104.44	-911.00	-1002.83
Muw (k*ft)	311.03	598.64	245.72	639.54	295.01	322.93	626.76	269.47	110.10	180.80	52.82	247.34	129.42	137.27	271.89	35.15
Mu (k*ft)	722.70	811.42	688.90	819.03	567.82	618.92	825.58	700.16	309.20	285.36	266.76	336.21	292.60	303.26	369.87	243.20

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	40.55	33.91	42.05	32.97	40.92	40.27	33.26	41.51	16.30	11.76	16.25	12.76	16.86	16.99	14.02	15.43
PY1 (Vuw)	11.26	5.82	12.12	4.91	7.46	8.10	5.44	11.78	5.45	2.86	5.85	2.43	4.46	4.54	2.68	5.69
PX2 (Mu)	16.68	18.73	15.90	18.90	13.10	14.28	19.05	16.16	7.14	6.59	6.16	7.76	6.75	7.00	8.54	5.61
PY2 (Mu)	5.56	6.24	5.30	6.30	4.37	4.76	6.35	5.39	2.38	2.20	2.05	2.59	2.25	2.33	2.85	1.87
Pu (kip)	59.64	54.00	60.51	53.06	55.30	56.05	53.62	60.16	24.71	19.03	23.76	21.13	24.55	24.95	23.22	22.36

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.62	44.26	48.09	43.67	44.59	45.18	44.05	47.89
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	787.88
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1108.85	7.70	OK
BF	3562.95	26.99	OK	1503.22	11.39	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.51	30.26	OK	24.95	12.48	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.51	1.47	114.56	OK
Web SPL	30.26	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.19	6.81
Web	1.20	1.42	1.89
BF	1.34	1.48	5.70

Plate	Shear	Flexure
Web	2.08	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.91	-26.53	-11.49	-22.31	-20.85	-23.92	-10.92	-25.87	-14.35	-21.87	-14.43	-22.39	-11.68	-28.16	-20.61	-22.58
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.29	0.38	0.17	0.32	0.30	0.34	0.16	0.37	0.21	0.31	0.21	0.32	0.17	0.41	0.30	0.33
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-26.53		-22.31		-23.92		-25.87		-21.87		-22.39		-28.16		-22.58
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-19.91		-11.49		-20.85		-10.92		-14.35		-14.43		-11.68		-20.61	
Rcf	1.85		1.85		1.85		1.85		1.85		1.85		1.85		1.85	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.48177	-19.30452	-8.455877	-16.37557	-15.1451	-17.45896	-8.051961	-18.88603	-12.00383	-17.67286	-12.87398	-18.88694	-8.593944	-20.50349	-14.97	-16.51
Fs (ksi)	-14.48	-19.30	-8.46	-16.38	-15.15	-17.46	-8.05	-18.89	-12.00	-17.67	-12.87	-18.89	-8.59	-20.50	-14.97	-16.51
Fs (kip)	-1955.04	-2606.11	-1141.54	-2210.70	-2044.59	-2356.96	-1087.01	-2549.61	-1620.52	-2385.84	-1737.99	-2549.74	-1160.18	-2767.97	-2021.38	-2229.24

Vu (kip)	487.91	252.19	525.26	212.73	323.33	350.81	235.64	510.44	353.95	185.88	380.33	158.00	290.10	295.09	174.18	369.87
Vuw (kip)	731.87	378.28	787.88	319.09	485.00	526.21	353.46	765.67	---	---	---	---	---	---	---	---
Mv (k*ft)	411.68	212.78	443.18	179.49	272.81	295.99	198.82	430.69	199.10	104.56	213.94	88.87	163.18	165.99	97.98	208.05
Huw (kip)	-2656.52	-2188.81	-2708.64	-2157.08	-2347.50	-2352.25	-2199.66	-2695.13	-1013.59	-744.94	-978.12	-808.14	-890.30	-952.83	-872.92	-944.58
Muw (k*ft)	297.02	608.82	262.28	629.98	503.03	499.86	601.59	271.28	96.45	158.39	46.28	216.68	113.38	120.26	238.19	30.80
Mu (k*ft)	708.70	821.61	705.46	809.47	775.84	795.86	800.41	701.97	295.55	262.95	260.21	305.55	276.56	286.25	336.17	238.84

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	40.87	33.67	41.67	33.19	36.12	36.19	33.84	41.46	15.59	11.46	15.05	12.43	13.70	14.66	13.43	14.53
PY1 (Vuw)	11.26	5.82	12.12	4.91	7.46	8.10	5.44	11.78	5.45	2.86	5.85	2.43	4.46	4.54	2.68	5.69
PX2 (Mu)	16.35	18.96	16.28	18.68	17.90	18.37	18.47	16.20	6.82	6.07	6.00	7.05	6.38	6.61	7.76	5.51
PY2 (Mu)	5.45	6.32	5.43	6.23	5.97	6.12	6.16	5.40	2.27	2.02	2.00	2.35	2.13	2.20	2.59	1.84
Pu (kip)	59.61	54.02	60.55	53.05	55.66	56.38	53.58	60.17	23.71	18.20	22.47	20.06	21.13	22.31	21.83	21.41

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.57	44.29	48.14	43.64	45.24	45.73	43.97	47.90
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.55	30.27	OK	23.71	11.85	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.55	1.47	114.56	OK
Web SPL	30.27	1.47	91.65	OK

Field Splice - Node 5547

Node 5547

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5547 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
5547 R	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 5547 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.77	-28.86	-12.97	-24.79	-22.21	-25.94	-11.66	-29.02	-20.66	-29.58	-19.90	-28.97	-12.09	-31.43	-21.90	-24.64
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.30	0.42	0.19	0.36	0.32	0.37	0.17	0.42	0.30	0.43	0.29	0.42	0.17	0.45	0.32	0.35
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-28.86		-24.79		-25.94		-29.02		-29.58		-28.97		-31.43		-24.64
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-20.77		-12.97		-22.21		-11.66		-20.66		-19.90		-12.09		-21.90	
Rcf	1.66		1.66		1.66		1.66		1.66		1.66		1.66		1.66	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.92	-21.12	-9.26	-18.43	-16.02	-18.97	-8.22	-21.53	-13.84	-21.34	-13.89	-20.70	-8.49	-23.27	-15.83	-18.03
Fs (ksi)	-14.92	-21.12	-9.26	-18.43	-16.02	-18.97	-8.22	-21.53	-13.84	-21.34	-13.89	-20.70	-8.49	-23.27	-15.83	-18.03
Fs (kip)	-2013.89	-2851.10	-1250.39	-2488.30	-2163.29	-2560.66	-1109.90	-2906.76	-1867.94	-2881.43	-1875.49	-2794.27	-1145.68	-3142.02	-2136.72	-2433.98

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2163.29	3142.02

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	476.17	254.06	524.08	198.54	312.02	344.95	214.87	511.68	346.04	185.78	379.89	146.55	281.15	292.69	158.09	371.13
Vuw (kip)	714.26	381.08	786.12	297.81	468.03	517.42	322.31	767.52	---	---	---	---	---	---	---	---
Mv (k*ft)	401.77	214.36	442.19	167.52	263.27	291.05	181.30	431.73	194.65	104.50	213.69	82.44	158.14	164.64	88.93	208.76
Huw (kip)	-2583.97	-2195.99	-2655.60	-2130.71	-2578.55	-2540.99	-2152.21	-2640.31	-1081.11	-830.82	-1049.77	-892.59	-1055.41	-1037.73	-952.82	-1015.71
Muw (k*ft)	345.38	604.04	297.63	647.56	349.00	374.04	633.22	307.82	124.03	183.40	58.87	266.20	150.15	136.12	295.75	44.04
Mu (k*ft)	747.15	818.40	739.82	815.08	612.27	665.09	814.52	739.55	318.68	287.89	272.55	348.64	308.29	300.75	384.68	252.80

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	39.75	33.78	40.86	32.78	39.67	39.09	33.11	40.62	16.63	12.78	16.15	13.73	16.24	15.97	14.66	15.63
PY1 (Vuw)	10.99	5.86	12.09	4.58	7.20	7.96	4.96	11.81	5.32	2.86	5.84	2.25	4.33	4.50	2.43	5.71
PX2 (Mu)	17.24	18.89	17.07	18.81	14.13	15.35	18.80	17.07	7.35	6.64	6.29	8.05	7.11	6.94	8.88	5.83
PY2 (Mu)	5.75	6.30	5.69	6.27	4.71	5.12	6.27	5.69	2.45	2.21	2.10	2.68	2.37	2.31	2.96	1.94
Pu (kip)	59.40	54.06	60.60	52.72	55.10	55.99	53.11	60.28	25.22	20.08	23.80	22.33	24.29	23.90	24.15	22.78

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.51	44.31	48.23	43.44	44.56	45.23	43.69	48.04
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	786.12
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1091.39	7.58	OK
BF	3562.95	26.99	OK	1591.68	12.06	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.60	30.30	OK	25.22	12.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.60	1.47	114.56	OK
Web SPL	30.30	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.22	6.81
Web	1.20	1.38	1.89
BF	1.34	1.40	5.70

Plate	Shear	Flexure
Web	2.09	1.04

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.41	-27.91	-12.11	-23.06	-21.43	-24.88	-11.24	-27.33	-14.55	-22.81	-14.80	-23.20	-11.90	-29.82	-21.06	-23.59
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.29	0.40	0.17	0.33	0.31	0.36	0.16	0.39	0.21	0.33	0.21	0.33	0.17	0.43	0.30	0.34
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-27.91		-23.06		-24.88		-27.33		-22.81		-23.20		-29.82		-23.59
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-20.41		-12.11		-21.43		-11.24		-14.55		-14.80		-11.90		-21.06	
Rcf	1.75		1.75		1.75		1.75		1.75		1.75		1.75		1.75	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-14.83548	-20.26841	-8.870226	-16.90343	-15.55315	-18.13179	-8.260038	-19.92037	-12.15597	-18.73278	-13.18972	-19.15194	-8.724727	-21.67957	-15.29	-17.22
Fs (ksi)	-14.84	-20.27	-8.87	-16.90	-15.55	-18.13	-8.26	-19.92	-12.16	-18.73	-13.19	-19.15	-8.72	-21.68	-15.29	-17.22
Fs (kip)	-2002.79	-2736.23	-1197.48	-2281.96	-2099.68	-2447.79	-1115.11	-2689.25	-1641.06	-2528.93	-1780.61	-2585.51	-1177.84	-2926.74	-2064.34	-2324.76

Vu (kip)	476.17	254.06	524.08	198.54	312.02	344.95	214.87	511.68	346.04	185.78	379.89	146.55	281.15	292.69	158.09	371.13
Vuw (kip)	714.26	381.08	786.12	297.81	468.03	517.42	322.31	767.52	---	---	---	---	---	---	---	---
Mv (k*ft)	401.77	214.36	442.19	167.52	263.27	291.05	181.30	431.73	194.65	104.50	213.69	82.44	158.14	164.64	88.93	208.76
Huw (kip)	-2620.71	-2185.53	-2673.94	-2140.27	-2313.29	-2326.82	-2174.74	-2654.53	-1053.12	-773.21	-1010.55	-845.41	-926.66	-970.25	-912.13	-975.36
Muw (k*ft)	320.90	611.01	285.41	641.19	525.84	516.82	618.21	298.35	108.66	160.66	51.57	233.21	131.54	119.24	259.10	38.58
Mu (k*ft)	722.66	825.37	727.60	808.70	789.11	807.87	799.51	730.08	303.30	265.16	265.26	315.64	289.68	283.88	348.02	247.34

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	40.32	33.62	41.14	32.93	35.59	35.80	33.46	40.84	16.20	11.90	15.55	13.01	14.26	14.93	14.03	15.01
PY1 (Vuw)	10.99	5.86	12.09	4.58	7.20	7.96	4.96	11.81	5.32	2.86	5.84	2.25	4.33	4.50	2.43	5.71
PX2 (Mu)	16.68	19.05	16.79	18.66	18.21	18.64	18.45	16.85	7.00	6.12	6.12	7.28	6.68	6.55	8.03	5.71
PY2 (Mu)	5.56	6.35	5.60	6.22	6.07	6.21	6.15	5.62	2.33	2.04	2.04	2.43	2.23	2.18	2.68	1.90
Pu (kip)	59.35	54.07	60.57	52.71	55.41	56.26	53.08	60.26	24.43	18.67	23.06	20.82	21.94	22.49	22.65	22.07

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	47.44	44.33	48.19	43.42	45.11	45.68	43.64	48.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.57	30.28	OK	24.43	12.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.57	1.47	114.56	OK
Web SPL	30.28	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 7547

Node 7547

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7547 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
7547 R	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 7547 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I	27 in
Outer to Inr	0.8888889
Outer to Inr	0.8888889
Outer to Mi	0.9444444
Outer to Mi	0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.66	-27.33	-11.58	-24.77	-19.04	-24.49	-10.42	-28.10	-19.31	-29.12	-17.86	-28.10	-10.84	-30.31	-19.05	-23.58
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.27	0.39	0.17	0.36	0.27	0.35	0.15	0.40	0.28	0.42	0.26	0.40	0.16	0.44	0.27	0.34
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-27.33		-24.77		-24.49		-28.10		-29.12		-28.10		-30.31		-23.58
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-18.66		-11.58		-19.04		-10.42		-19.31		-17.86		-10.84		-19.05	
Rcf	1.72		1.72		1.72		1.72		1.72		1.72		1.72		1.72	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.05	-19.73	-8.69	-18.96	-13.87	-18.14	-7.78	-21.40	-13.51	-22.41	-13.70	-20.43	-8.04	-23.00	-13.53	-17.11
Fs (ksi)	-13.05	-19.73	-8.69	-18.96	-13.87	-18.14	-7.78	-21.40	-13.51	-22.41	-13.70	-20.43	-8.04	-23.00	-13.53	-17.11
Fs (kip)	-1762.21	-2663.43	-1173.41	-2559.25	-1872.97	-2449.32	-1050.45	-2889.50	-1823.23	-3025.98	-1849.70	-2758.19	-1085.39	-3105.33	-1826.02	-2309.58

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	1872.97	3105.33

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	430.68	207.17	465.51	159.51	270.39	297.58	177.65	450.10	313.32	150.67	337.93	117.00	232.25	269.50	129.82	327.04
Vuw (kip)	646.02	310.75	698.27	239.26	405.59	446.37	266.47	675.14	---	---	---	---	---	---	---	---
Mv (k*ft)	363.38	174.80	392.78	134.58	228.14	251.08	149.89	379.77	176.24	84.75	190.08	65.81	130.64	151.59	73.02	183.96
Huw (kip)	-2513.05	-2148.04	-2532.74	-2088.27	-2546.63	-2471.83	-2109.84	-2533.55	-983.47	-829.48	-960.51	-875.54	-1077.60	-1023.98	-931.27	-919.02
Muw (k*ft)	392.67	636.01	379.54	675.85	370.28	420.15	661.47	379.00	133.51	205.31	85.38	272.45	178.18	134.59	299.25	71.64
Mu (k*ft)	756.05	810.80	772.31	810.43	598.42	671.23	811.36	758.77	309.75	290.06	275.47	338.26	308.82	286.18	372.27	255.59

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	38.66	33.05	38.97	32.13	39.18	38.03	32.46	38.98	15.13	12.76	14.78	13.47	16.58	15.75	14.33	14.14
PY1 (Vuw)	9.94	4.78	10.74	3.68	6.24	6.87	4.10	10.39	4.82	2.32	5.20	1.80	3.57	4.15	2.00	5.03
PX2 (Mu)	17.45	18.71	17.82	18.70	13.81	15.49	18.72	17.51	7.15	6.69	6.36	7.81	7.13	6.60	8.59	5.90
PY2 (Mu)	5.82	6.24	5.94	6.23	4.60	5.16	6.24	5.84	2.38	2.23	2.12	2.60	2.38	2.20	2.86	1.97
Pu (kip)	58.28	52.92	59.19	51.79	54.09	54.85	52.22	58.77	23.41	19.98	22.37	21.73	24.44	23.24	23.43	21.22

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.84	43.56	47.43	42.82	43.87	44.52	43.11	47.15
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	698.27
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	944.92	6.56	OK
BF	3562.95	26.99	OK	1573.10	11.92	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.19	29.59	OK	24.44	12.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.19	1.47	114.56	OK
Web SPL	29.59	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.56	6.81
Web	1.22	1.48	1.94
BF	1.34	1.41	5.70

Plate	Shear	Flexure
Web	2.35	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-18.15	-26.18	-10.07	-22.29	-18.81	-23.86	-9.39	-25.78	-12.69	-21.78	-12.81	-22.30	-10.03	-28.08	-18.53	-22.73
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.26	0.38	0.14	0.32	0.27	0.34	0.14	0.37	0.18	0.31	0.18	0.32	0.14	0.40	0.27	0.33
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-26.18		-22.29		-23.86		-25.78		-21.78		-22.30		-28.08		-22.73
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-18.15		-10.07		-18.81		-9.39		-12.69		-12.81		-10.03		-18.53	
Rcf	1.86		1.86		1.86		1.86		1.86		1.86		1.86		1.86	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-13.20203	-19.05033	-7.37593	-16.36902	-13.6684	-17.40849	-6.895414	-18.82954	-10.31386	-18.11883	-11.82186	-17.71726	-7.347247	-20.45523	-13.47	-16.61
Fs (ksi)	-13.20	-19.05	-7.38	-16.37	-13.67	-17.41	-6.90	-18.83	-10.31	-18.12	-11.82	-17.72	-7.35	-20.46	-13.47	-16.61
Fs (kip)	-1782.27	-2571.79	-995.75	-2209.82	-1845.23	-2350.15	-930.88	-2541.99	-1392.37	-2446.04	-1595.95	-2391.83	-991.88	-2761.46	-1819.00	-2242.62

Vu (kip)	430.68	207.17	465.51	159.51	270.39	297.58	177.65	450.10	313.32	150.67	337.93	117.00	232.25	269.50	129.82	327.04
Vuw (kip)	646.02	310.75	698.27	239.26	405.59	446.37	266.47	675.14	---	---	---	---	---	---	---	---
Mv (k*ft)	363.38	174.80	392.78	134.58	228.14	251.08	149.89	379.77	176.24	84.75	190.08	65.81	130.64	151.59	73.02	183.96
Huw (kip)	-2561.18	-2111.53	-2597.93	-2073.67	-2257.16	-2264.28	-2109.27	-2582.62	-967.57	-712.35	-932.31	-771.75	-852.98	-886.17	-834.07	-902.58
Muw (k*ft)	360.58	660.35	336.08	685.59	563.26	558.51	661.85	346.29	116.97	179.86	74.80	238.68	156.10	117.91	262.16	62.76
Mu (k*ft)	723.96	835.14	728.86	820.17	791.40	809.60	811.74	726.05	293.21	264.61	264.89	304.49	286.74	269.50	335.18	246.72

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	39.40	32.49	39.97	31.90	34.73	34.84	32.45	39.73	14.89	10.96	14.34	11.87	13.12	13.63	12.83	13.89
PY1 (Vuw)	9.94	4.78	10.74	3.68	6.24	6.87	4.10	10.39	4.82	2.32	5.20	1.80	3.57	4.15	2.00	5.03
PX2 (Mu)	16.71	19.27	16.82	18.93	18.26	18.68	18.73	16.76	6.77	6.11	6.11	7.03	6.62	6.22	7.73	5.69
PY2 (Mu)	5.57	6.42	5.61	6.31	6.09	6.23	6.24	5.59	2.26	2.04	2.04	2.34	2.21	2.07	2.58	1.90
Pu (kip)	58.21	52.96	59.09	51.80	54.40	55.10	52.22	58.70	22.78	17.61	21.70	19.35	20.57	20.80	21.07	20.77

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	46.74	43.64	47.29	42.85	44.47	44.95	43.11	47.04
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 7547**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.09	29.55	OK	22.78	11.39	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.09	1.47	114.56	OK
Web SPL	29.55	1.47	91.65	OK

Field Splice - Node 9547

Node 9547

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9547 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
9547 R	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00

Rh = 0.99

Controlling Section = 9547 R

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.61	-23.37	-12.09	-22.35	-17.14	-21.05	-8.56	-23.93	-18.73	-26.74	-18.60	-26.45	-8.60	-25.67	-16.73	-19.71
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.22	0.34	0.17	0.32	0.25	0.30	0.12	0.34	0.27	0.38	0.27	0.38	0.12	0.37	0.24	0.28
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-23.37		-22.35		-21.05		-23.93		-26.74		-26.45		-25.67		-19.71
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-15.61		-12.09		-17.14		-8.56		-18.73		-18.60		-8.60		-16.73	
Rcf	1.95		1.95		1.95		1.95		1.95		1.95		1.95		1.95	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.90	-17.91	-9.60	-17.62	-11.76	-14.90	-7.01	-18.83	-14.05	-20.54	-13.84	-19.62	-7.00	-20.10	-11.76	-14.20
Fs (ksi)	-11.90	-17.91	-9.60	-17.62	-11.76	-14.90	-7.01	-18.83	-14.05	-20.54	-13.84	-19.62	-7.00	-20.10	-11.76	-14.20
Fs (kip)	-1606.39	-2418.32	-1296.34	-2378.21	-1587.90	-2011.33	-946.07	-2542.66	-1897.04	-2772.24	-1868.08	-2648.48	-944.70	-2713.28	-1587.62	-1917.56

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	1897.04	2772.24

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	350.55	154.69	395.32	109.91	268.94	293.18	127.33	377.42	256.66	112.77	288.29	81.13	207.04	223.33	93.44	275.64
Vuw (kip)	525.83	232.03	592.98	164.86	403.41	439.76	191.00	566.13	---	---	---	---	---	---	---	---
Mv (k*ft)	295.78	130.52	333.55	92.73	226.92	247.37	107.44	318.45	144.37	63.43	162.16	45.63	116.46	125.62	52.56	155.05
Huw (kip)	-2463.73	-2257.65	-2553.20	-2051.61	-2645.95	-2638.32	-2053.66	-2529.17	-894.38	-816.57	-799.83	-775.27	-1037.62	-1003.68	-812.88	-778.93
Muw (k*ft)	425.54	562.93	365.90	700.29	304.07	309.15	698.93	381.92	120.29	160.28	62.73	236.53	129.66	115.61	262.01	48.88
Mu (k*ft)	721.32	693.45	699.45	793.02	530.99	556.52	806.36	700.36	264.65	223.71	224.89	282.17	246.12	241.24	314.57	203.93

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	37.90	34.73	39.28	31.56	40.71	40.59	31.59	38.91	13.76	12.56	12.31	11.93	15.96	15.44	12.51	11.98
PY1 (Vuw)	8.09	3.57	9.12	2.54	6.21	6.77	2.94	8.71	3.95	1.73	4.44	1.25	3.19	3.44	1.44	4.24
PX2 (Mu)	16.65	16.00	16.14	18.30	12.25	12.84	18.61	16.16	6.11	5.16	5.19	6.51	5.68	5.57	7.26	4.71
PY2 (Mu)	5.55	5.33	5.38	6.10	4.08	4.28	6.20	5.39	2.04	1.72	1.73	2.17	1.89	1.86	2.42	1.57
Pu (kip)	56.23	51.51	57.29	50.61	53.95	54.56	51.03	56.85	20.75	18.06	18.55	18.75	22.23	21.66	20.14	17.67

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.49	42.38	46.12	42.00	43.64	44.09	42.31	45.84
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	592.98
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9547**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	957.07	6.65	OK
BF	3562.95	26.99	OK	1404.36	10.64	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
57.29	28.64	OK	22.23	11.12	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	57.29	1.47	114.56	OK
Web SPL	28.64	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.53	6.81
Web	1.27	1.73	2.00
BF	1.34	1.58	5.70

Plate	Shear	Flexure
Web	2.77	1.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9547	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-15.34	-22.52	-7.97	-17.49	-16.08	-19.70	-7.27	-21.51	-11.66	-19.08	-13.51	-20.78	-7.86	-23.68	-15.86	-18.62
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.22	0.32	0.11	0.25	0.23	0.28	0.10	0.31	0.17	0.27	0.19	0.30	0.11	0.34	0.23	0.27
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-22.52		-17.49		-19.70		-21.51		-19.08		-20.78		-23.68		-18.62
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-15.34		-7.97		-16.08		-7.27		-11.66		-13.51		-7.86		-15.86	
Rcf	2.20		2.20		2.20		2.20		2.20		2.20		2.20		2.20	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.22004	-16.4889	-5.877788	-12.89836	-11.74474	-14.49254	-5.382041	-15.74282	-8.830987	-14.51039	-10.37076	-15.43498	-5.797293	-17.27411	-11.59	-13.73
Fs (ksi)	-11.22	-16.49	-5.88	-12.90	-11.74	-14.49	-5.38	-15.74	-8.83	-14.51	-10.37	-15.43	-5.80	-17.27	-11.59	-13.73
Fs (kip)	-1514.71	-2226.00	-793.50	-1741.28	-1585.54	-1956.49	-726.58	-2125.28	-1192.18	-1958.90	-1400.05	-2083.72	-782.63	-2332.00	-1564.84	-1853.88

Vu (kip)	350.55	154.69	395.32	109.91	268.94	293.18	127.33	377.42	256.66	112.77	288.29	81.13	207.04	223.33	93.44	275.64
Vuw (kip)	525.83	232.03	592.98	164.86	403.41	439.76	191.00	566.13	---	---	---	---	---	---	---	---
Mv (k*ft)	295.78	130.52	333.55	92.73	226.92	247.37	107.44	318.45	144.37	63.43	162.16	45.63	116.46	125.62	52.56	155.05
Huw (kip)	-2563.29	-2077.34	-2612.31	-2031.02	-2320.86	-2442.64	-2069.82	-2597.98	-831.27	-563.28	-787.12	-633.75	-700.24	-774.17	-692.14	-759.72
Muw (k*ft)	359.17	683.14	326.49	714.02	520.79	439.61	688.15	336.04	105.38	140.41	54.96	207.22	113.59	101.28	229.54	42.82
Mu (k*ft)	654.95	813.66	660.04	806.75	747.72	686.98	795.59	654.49	249.75	203.84	217.12	252.85	230.05	226.91	282.09	197.87

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	39.44	31.96	40.19	31.25	35.71	37.58	31.84	39.97	12.79	8.67	12.11	9.75	10.77	11.91	10.65	11.69
PY1 (Vuw)	8.09	3.57	9.12	2.54	6.21	6.77	2.94	8.71	3.95	1.73	4.44	1.25	3.19	3.44	1.44	4.24
PX2 (Mu)	15.11	18.78	15.23	18.62	17.25	15.85	18.36	15.10	5.76	4.70	5.01	5.83	5.31	5.24	6.51	4.57
PY2 (Mu)	5.04	6.26	5.08	6.21	5.75	5.28	6.12	5.03	1.92	1.57	1.67	1.94	1.77	1.75	2.17	1.52
Pu (kip)	56.11	51.68	57.21	50.62	54.29	54.77	51.01	56.76	19.46	13.77	18.18	15.91	16.83	17.91	17.53	17.25

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	45.29	42.76	45.99	42.05	44.32	44.50	42.28	45.70
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
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Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
57.21	28.61	OK	19.46	9.73	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	57.21	1.47	114.56	OK
Web SPL	28.61	1.47	91.65	OK

Field Splice - Node 1551

Node 1551

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1551 L	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00
1551 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 1551 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.64	-18.34	-18.78	-24.44	-18.22	-18.49	-7.95	-21.60	-17.40	-22.94	-18.09	-24.36	-20.42	-19.61	-11.06	-26.22
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.12	0.26	0.27	0.35	0.26	0.27	0.11	0.31	0.25	0.33	0.26	0.35	0.29	0.28	0.16	0.38
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-18.34		-24.44		-18.49		-21.60		-22.94		-24.36	-20.42			-26.22
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	-52.10			-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	-7033.35			-7033.35
fncf (ksi)	-8.64		-18.78		-18.22		-7.95		-17.40		-18.09			-19.61	-11.06	
Rcf	1.99		1.99		1.99		1.99		1.99		1.99			1.99	1.99	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10			-52.10	-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35			-7033.35	-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.26	-14.68	-14.28	-18.70	-13.92	-14.31	-6.47	-16.85	-15.54	-17.06	-13.69	-20.39	-15.79	-15.36	-8.63	-20.14
Fs (ksi)	-7.26	-14.68	-14.28	-18.70	-13.92	-14.31	-6.47	-16.85	-15.54	-17.06	-13.69	-20.39	-15.79	-15.36	-8.63	-20.14
Fs (kip)	-979.45	-1981.84	-1927.52	-2523.92	-1879.73	-1931.51	-872.80	-2274.71	-2098.28	-2303.16	-1848.13	-2752.28	-2131.73	-2073.26	-1165.11	-2719.49

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2131.73	2752.28

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	156.30	414.53	501.57	122.15	257.69	298.10	471.98	160.05	114.66	304.02	365.52	90.53	305.74	215.01	337.69	124.23
Vuw (kip)	234.45	621.79	752.36	183.23	386.53	447.15	707.96	240.08	---	---	---	---	---	---	---	---
Mv (k*ft)	131.88	349.76	423.20	103.06	217.42	251.52	398.23	135.04	64.50	171.01	205.61	50.92	171.98	120.94	189.95	69.88
Huw (kip)	-2066.38	-2670.52	-2637.53	-2024.77	-2588.44	-2629.74	-2719.88	-2210.38	-658.06	-989.21	-846.94	-699.45	-978.10	-1022.31	-934.44	-863.25
Muw (k*ft)	690.45	287.69	309.68	718.18	342.41	314.87	254.78	594.45	148.50	88.36	7.67	207.69	30.35	133.95	8.66	230.28
Mu (k*ft)	822.33	637.44	732.88	821.25	559.83	566.39	653.01	729.49	213.00	259.37	213.28	258.62	202.33	254.89	198.62	300.16

Note: Mu = Muw + Mv

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For	**Cleveland InnerBelt : Field Splice - Node 1551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	31.79	41.08	40.58	31.15	39.82	40.46	41.84	34.01	10.12	15.22	13.03	10.76	15.05	15.73	14.38	13.28
PY1 (Vuw)	3.61	9.57	11.57	2.82	5.95	6.88	10.89	3.69	1.76	4.68	5.62	1.39	4.70	3.31	5.20	1.91
PX2 (Mu)	18.98	14.71	16.91	18.95	12.92	13.07	15.07	16.83	4.92	5.99	4.92	5.97	4.67	5.88	4.58	6.93
PY2 (Mu)	6.33	4.90	5.64	6.32	4.31	4.36	5.02	5.61	1.64	2.00	1.64	1.99	1.56	1.96	1.53	2.31
Pu (kip)	51.73	57.64	60.01	50.93	53.73	54.69	59.10	51.68	15.42	22.23	19.37	17.07	20.69	22.24	20.12	20.64

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.81	46.22	47.86	42.28	43.56	44.20	47.15	42.58
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	752.36
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1075.47	7.47	OK
BF	3562.95	26.99	OK	1394.25	10.56	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
60.01	30.01	OK	22.24	11.12	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	60.01	1.47	114.56	OK
Web SPL	30.01	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.25	6.81
Web	1.21	1.70	1.91
BF	1.34	1.59	5.70

Plate	Shear	Flexure
Web	2.18	1.05

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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.61	-17.60	-16.56	-21.80	-17.92	-18.16	-8.08	-20.74	-11.45	-16.58	-12.18	-17.99	-17.28	-16.52	-8.99	-23.04
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.12	0.25	0.24	0.31	0.26	0.26	0.12	0.30	0.16	0.24	0.18	0.26	0.25	0.24	0.13	0.33
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-17.60		-21.80		-18.16		-20.74		-16.58		-17.99	-17.28			-23.04
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	-52.10			-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	-7033.35			-7033.35
fncf (ksi)	-8.61		-16.56		-17.92		-8.08		-11.45		-12.18			-16.52	-8.99	
Rcf	2.26		2.26		2.26		2.26		2.26		2.26			2.26	2.26	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10			-52.10	-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35			-7033.35	-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.391778	-12.89653	-12.13016	-16.00038	-13.09293	-13.42893	-6.017755	-15.11519	-11.34687	-12.67643	-9.762722	-15.62999	-12.51433	-12.13487	-6.78	-16.87
Fs (ksi)	-6.39	-12.90	-12.13	-16.00	-13.09	-13.43	-6.02	-15.12	-11.35	-12.68	-9.76	-15.63	-12.51	-12.13	-6.78	-16.87
Fs (kip)	-862.89	-1741.03	-1637.57	-2160.05	-1767.55	-1812.91	-812.40	-2040.55	-1531.83	-1711.32	-1317.97	-2110.05	-1689.44	-1638.21	-915.95	-2277.67

Vu (kip)	156.30	414.53	501.57	122.15	257.69	298.10	471.98	160.05	114.66	304.02	365.52	90.53	305.74	215.01	337.69	124.23
Vuw (kip)	234.45	621.79	752.36	183.23	386.53	447.15	707.96	240.08	---	---	---	---	---	---	---	---
Mv (k*ft)	131.88	349.76	423.20	103.06	217.42	251.52	398.23	135.04	64.50	171.01	205.61	50.92	171.98	120.94	189.95	69.88
Huw (kip)	-2135.30	-2674.23	-2766.69	-2099.38	-2327.82	-2377.46	-2672.00	-2160.94	-578.65	-843.92	-795.66	-633.99	-720.70	-761.78	-739.48	-709.69
Muw (k*ft)	644.50	285.21	223.58	668.45	516.15	483.06	286.70	627.41	130.10	77.40	6.72	181.95	26.59	117.35	7.59	201.74
Mu (k*ft)	776.38	634.97	646.78	771.51	733.58	734.58	684.93	762.45	194.59	248.42	212.33	232.87	198.57	238.29	197.54	271.62

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.85	41.14	42.56	32.30	35.81	36.58	41.11	33.25	8.90	12.98	12.24	9.75	11.09	11.72	11.38	10.92
PY1 (Vuw)	3.61	9.57	11.57	2.82	5.95	6.88	10.89	3.69	1.76	4.68	5.62	1.39	4.70	3.31	5.20	1.91
PX2 (Mu)	17.92	14.65	14.93	17.80	16.93	16.95	15.81	17.60	4.49	5.73	4.90	5.37	4.58	5.50	4.56	6.27
PY2 (Mu)	5.97	4.88	4.98	5.93	5.64	5.65	5.27	5.87	1.50	1.91	1.63	1.79	1.53	1.83	1.52	2.09
Pu (kip)	51.66	57.64	59.82	50.86	54.00	54.98	59.16	51.73	13.78	19.84	18.61	15.46	16.86	17.97	17.29	17.65

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.67	46.21	47.59	42.12	44.10	44.73	47.25	42.68
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.82	29.91	OK	19.84	9.92	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.82	1.47	114.56	OK
Web SPL	29.91	1.47	91.65	OK

Field Splice - Node 3551

Node 3551

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3551 L	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00
3551 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 3551 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.84	-23.64	-21.17	-29.14	-21.58	-25.87	-11.26	-27.34	-19.40	-27.91	-20.77	-29.80	-20.37	-23.63	-12.05	-30.09
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.17	0.34	0.30	0.42	0.31	0.37	0.16	0.39	0.28	0.40	0.30	0.43	0.29	0.34	0.17	0.43
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-23.64		-29.14		-25.87		-27.34		-27.91		-29.80		-23.63		-30.09
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-11.84		-21.17		-21.58		-11.26		-19.40		-20.77		-20.37		-12.05	
Rcf	1.73		1.73		1.73		1.73		1.73		1.73		1.73		1.73	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.29	-17.39	-15.61	-21.74	-15.97	-19.35	-7.43	-19.73	-14.06	-19.81	-14.09	-22.33	-15.13	-17.75	-7.92	-21.69
Fs (ksi)	-8.29	-17.39	-15.61	-21.74	-15.97	-19.35	-7.43	-19.73	-14.06	-19.81	-14.09	-22.33	-15.13	-17.75	-7.92	-21.69
Fs (kip)	-1118.82	-2347.49	-2106.78	-2934.32	-2155.30	-2611.90	-1002.91	-2663.79	-1898.25	-2674.63	-1901.53	-3014.45	-2042.72	-2395.98	-1069.83	-2927.55

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2155.30	3014.45

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	253.72	520.83	567.44	216.88	335.16	369.37	547.07	246.86	184.38	378.50	411.43	158.35	333.08	282.53	397.04	179.53
Vuw (kip)	380.57	781.25	851.16	325.31	502.73	554.06	820.60	370.28	---	---	---	---	---	---	---	---
Mv (k*ft)	214.07	439.45	478.78	182.99	282.79	311.66	461.59	208.28	103.71	212.91	231.43	89.07	187.36	158.92	223.33	100.99
Huw (kip)	-2166.22	-2651.01	-2671.90	-2136.11	-2558.83	-2629.93	-2609.04	-2177.24	-770.29	-1120.24	-1059.38	-814.82	-1016.20	-1092.44	-986.38	-888.31
Muw (k*ft)	623.89	300.69	286.77	643.96	362.15	314.74	328.67	616.54	182.03	122.60	67.65	246.06	115.02	164.88	52.34	275.22
Mu (k*ft)	837.96	740.15	765.54	826.95	644.93	626.40	790.26	824.82	285.74	335.50	299.07	335.13	302.38	323.80	275.67	376.20

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.33	40.78	41.11	32.86	39.37	40.46	40.14	33.50	11.85	17.23	16.30	12.54	15.63	16.81	15.18	13.67
PY1 (Vuw)	5.85	12.02	13.09	5.00	7.73	8.52	12.62	5.70	2.84	5.82	6.33	2.44	5.12	4.35	6.11	2.76
PX2 (Mu)	19.34	17.08	17.67	19.08	14.88	14.46	18.24	19.03	6.59	7.74	6.90	7.73	6.98	7.47	6.36	8.68
PY2 (Mu)	6.45	5.69	5.89	6.36	4.96	4.82	6.08	6.34	2.20	2.58	2.30	2.58	2.33	2.49	2.12	2.89
Pu (kip)	54.08	60.52	61.76	53.18	55.72	56.51	61.30	53.89	19.12	26.35	24.75	20.88	23.81	25.22	23.06	23.05

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.36	48.18	48.98	43.76	45.02	45.49	48.74	44.22
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	851.16
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1087.36	7.55	OK
BF	3562.95	26.99	OK	1527.06	11.57	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
61.76	30.88	OK	26.35	13.18	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	61.76	1.47	114.56	OK
Web SPL	30.88	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.23	6.81
Web	1.17	1.37	1.86
BF	1.34	1.45	5.70

Plate	Shear	Flexure
Web	1.93	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.52	-22.45	-19.59	-26.97	-20.43	-24.41	-10.82	-25.73	-14.09	-21.99	-14.36	-22.73	-19.87	-22.89	-11.64	-28.36
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.17	0.32	0.28	0.39	0.29	0.35	0.16	0.37	0.20	0.32	0.21	0.33	0.29	0.33	0.17	0.41
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-22.45		-26.97		-24.41		-25.73		-21.99		-22.73		-22.89		-28.36
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-11.52		-19.59		-20.43		-10.82		-14.09		-14.36		-19.87		-11.64	
Rcf	1.84		1.84		1.84		1.84		1.84		1.84		1.84		1.84	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.467001	-16.4402	-14.26796	-19.63808	-14.86186	-17.8249	-7.974222	-18.75211	-12.58213	-17.62031	-11.79004	-19.0121	-14.46345	-16.75588	-8.55	-20.61
Fs (ksi)	-8.47	-16.44	-14.27	-19.64	-14.86	-17.82	-7.97	-18.75	-12.58	-17.62	-11.79	-19.01	-14.46	-16.76	-8.55	-20.61
Fs (kip)	-1143.05	-2219.43	-1926.18	-2651.14	-2006.35	-2406.36	-1076.52	-2531.54	-1698.59	-2378.74	-1591.66	-2566.63	-1952.57	-2262.04	-1154.84	-2782.29

Vu (kip)	253.72	520.83	567.44	216.88	335.16	369.37	547.07	246.86	184.38	378.50	411.43	158.35	333.08	282.53	397.04	179.53
Vuw (kip)	380.57	781.25	851.16	325.31	502.73	554.06	820.60	370.28	---	---	---	---	---	---	---	---
Mv (k*ft)	214.07	439.45	478.78	182.99	282.79	311.66	461.59	208.28	103.71	212.91	231.43	89.07	187.36	158.92	223.33	100.99
Huw (kip)	-2186.04	-2630.80	-2677.13	-2147.60	-2327.88	-2342.55	-2646.05	-2192.86	-747.22	-1017.18	-980.60	-801.79	-906.07	-924.06	-936.58	-874.92
Muw (k*ft)	610.67	314.17	283.28	636.30	516.12	506.34	304.00	606.13	159.46	107.40	59.26	215.56	100.76	144.44	45.85	241.10
Mu (k*ft)	824.74	753.62	762.05	819.29	798.90	818.00	765.59	814.41	263.18	320.31	290.69	304.63	288.12	303.36	269.18	342.09

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.63	40.47	41.19	33.04	35.81	36.04	40.71	33.74	11.50	15.65	15.09	12.34	13.94	14.22	14.41	13.46
PY1 (Vuw)	5.85	12.02	13.09	5.00	7.73	8.52	12.62	5.70	2.84	5.82	6.33	2.44	5.12	4.35	6.11	2.76
PX2 (Mu)	19.03	17.39	17.59	18.91	18.44	18.88	17.67	18.79	6.07	7.39	6.71	7.03	6.65	7.00	6.21	7.89
PY2 (Mu)	6.34	5.80	5.86	6.30	6.15	6.29	5.89	6.26	2.02	2.46	2.24	2.34	2.22	2.33	2.07	2.63
Pu (kip)	54.06	60.55	61.75	53.16	56.00	56.88	61.24	53.88	18.23	24.49	23.42	19.95	21.86	22.24	22.18	22.03

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.32	48.22	48.97	43.74	45.50	46.09	48.66	44.18
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
61.75	30.88	OK	24.49	12.24	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	61.75	1.47	114.56	OK
Web SPL	30.88	1.47	91.65	OK

Field Splice - Node 5551

Node 5551

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5551 L	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00
5551 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 5551 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.84	-24.84	-21.70	-30.54	-21.99	-26.81	-12.20	-29.62	-19.27	-28.30	-20.97	-30.57	-20.53	-24.14	-13.09	-32.68
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.18	0.36	0.31	0.44	0.32	0.39	0.18	0.43	0.28	0.41	0.30	0.44	0.30	0.35	0.19	0.47
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-24.84		-30.54		-26.81		-29.62		-28.30		-30.57		-24.14		-32.68
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-12.84		-21.70		-21.99		-12.20		-19.27		-20.97		-20.53		-13.09	
Rcf	1.59		1.59		1.59		1.59		1.59		1.59		1.59		1.59	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-9.07	-18.36	-15.63	-22.38	-15.92	-19.66	-8.51	-21.86	-13.22	-19.39	-14.39	-23.38	-14.84	-17.68	-9.10	-24.06
Fs (ksi)	-9.07	-18.36	-15.63	-22.38	-15.92	-19.66	-8.51	-21.86	-13.22	-19.39	-14.39	-23.38	-14.84	-17.68	-9.10	-24.06
Fs (kip)	-1224.74	-2478.74	-2109.87	-3020.78	-2148.65	-2653.79	-1149.11	-2950.56	-1784.51	-2617.75	-1942.96	-3156.89	-2003.04	-2386.40	-1228.15	-3248.00

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2148.65	3248.00

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	259.57	518.49	563.43	208.84	329.30	362.38	538.58	235.24	188.98	375.76	407.51	153.14	309.04	296.84	389.95	171.79
Vuw (kip)	389.35	777.73	845.14	313.26	493.96	543.58	807.87	352.86	---	---	---	---	---	---	---	---
Mv (k*ft)	219.01	437.47	475.39	176.21	277.85	305.76	454.43	198.48	106.30	211.36	229.22	86.14	173.84	166.97	219.35	96.63
Huw (kip)	-2164.90	-2588.90	-2602.77	-2134.49	-2472.80	-2553.69	-2532.70	-2177.12	-823.00	-1140.14	-1067.21	-911.04	-978.28	-1133.30	-975.43	-994.70
Muw (k*ft)	624.77	342.10	332.85	645.04	419.50	365.58	379.56	616.62	185.78	134.95	74.83	266.88	123.44	179.84	56.80	299.24
Mu (k*ft)	843.77	779.58	808.24	821.25	697.35	671.34	833.99	815.10	292.08	346.31	304.06	353.02	297.28	346.81	276.14	395.87

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.31	39.83	40.04	32.84	38.04	39.29	38.96	33.49	12.66	17.54	16.42	14.02	15.05	17.44	15.01	15.30
PY1 (Vuw)	5.99	11.97	13.00	4.82	7.60	8.36	12.43	5.43	2.91	5.78	6.27	2.36	4.75	4.57	6.00	2.64
PX2 (Mu)	19.47	17.99	18.65	18.95	16.09	15.49	19.25	18.81	6.74	7.99	7.02	8.15	6.86	8.00	6.37	9.14
PY2 (Mu)	6.49	6.00	6.22	6.32	5.36	5.16	6.42	6.27	2.25	2.66	2.34	2.72	2.29	2.67	2.12	3.05
Pu (kip)	54.23	60.55	61.76	52.97	55.67	56.43	61.18	53.60	20.07	26.89	24.97	22.74	23.01	26.45	22.87	25.09

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.47	48.27	49.05	43.62	45.09	45.52	48.75	44.01
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	845.14
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1084.01	7.53	OK
BF	3562.95	26.99	OK	1645.37	12.46	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
61.76	30.88	OK	26.89	13.45	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	61.76	1.47	114.56	OK
Web SPL	30.88	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.24	6.81
Web	1.17	1.33	1.86
BF	1.34	1.35	5.70

Plate	Shear	Flexure
Web	1.94	1.02

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-12.12	-23.24	-20.05	-28.25	-20.93	-25.40	-11.25	-27.40	-14.41	-22.77	-14.66	-23.56	-20.29	-23.64	-11.90	-30.06
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.17	0.33	0.29	0.41	0.30	0.37	0.16	0.39	0.21	0.33	0.21	0.34	0.29	0.34	0.17	0.43
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-23.24		-28.25		-25.40		-27.40		-22.77		-23.56		-23.64		-30.06
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-12.12		-20.05		-20.93		-11.25		-14.41		-14.66		-20.29		-11.90	
Rcf	1.73		1.73		1.73		1.73		1.73		1.73		1.73		1.73	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.880761	-17.01835	-14.59156	-20.50275	-15.20976	-18.48772	-8.27143	-19.96156	-12.37185	-17.77896	-12.40746	-20.28496	-14.75679	-17.24457	-8.73	-21.84
Fs (ksi)	-8.88	-17.02	-14.59	-20.50	-15.21	-18.49	-8.27	-19.96	-12.37	-17.78	-12.41	-20.28	-14.76	-17.24	-8.73	-21.84
Fs (kip)	-1198.90	-2297.48	-1969.86	-2767.87	-2053.32	-2495.84	-1116.64	-2694.81	-1670.20	-2400.16	-1675.01	-2738.47	-1992.17	-2328.02	-1178.71	-2948.21

Vu (kip)	259.57	518.49	563.43	208.84	329.30	362.38	538.58	235.24	188.98	375.76	407.51	153.14	309.04	296.84	389.95	171.79
Vuw (kip)	389.35	777.73	845.14	313.26	493.96	543.58	807.87	352.86	---	---	---	---	---	---	---	---
Mv (k*ft)	219.01	437.47	475.39	176.21	277.85	305.76	454.43	198.48	106.30	211.36	229.22	86.14	173.84	166.97	219.35	96.63
Huw (kip)	-2181.01	-2593.77	-2639.27	-2136.16	-2300.10	-2313.04	-2605.93	-2170.00	-776.97	-1052.83	-1010.92	-846.99	-904.52	-980.77	-960.04	-917.09
Muw (k*ft)	614.03	338.85	308.52	643.92	534.63	526.00	330.75	621.37	162.75	118.22	65.56	233.80	108.14	157.55	49.76	262.15
Mu (k*ft)	833.04	776.33	783.92	820.13	812.48	831.76	785.17	819.85	269.05	329.59	294.78	319.95	281.98	324.52	269.10	358.78

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	33.55	39.90	40.60	32.86	35.39	35.59	40.09	33.38	11.95	16.20	15.55	13.03	13.92	15.09	14.77	14.11
PY1 (Vuw)	5.99	11.97	13.00	4.82	7.60	8.36	12.43	5.43	2.91	5.78	6.27	2.36	4.75	4.57	6.00	2.64
PX2 (Mu)	19.22	17.92	18.09	18.93	18.75	19.19	18.12	18.92	6.21	7.61	6.80	7.38	6.51	7.49	6.21	8.28
PY2 (Mu)	6.41	5.97	6.03	6.31	6.25	6.40	6.04	6.31	2.07	2.54	2.27	2.46	2.17	2.50	2.07	2.76
Pu (kip)	54.21	60.54	61.70	52.97	55.88	56.73	61.07	53.60	18.83	25.21	23.93	20.97	21.56	23.66	22.48	23.03

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	44.44	48.26	48.97	43.61	45.45	46.02	48.59	44.02
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
61.70	30.85	OK	25.21	12.61	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	61.70	1.47	114.56	OK
Web SPL	30.85	1.47	91.65	OK

Field Splice - Node 7551

Node 7551

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7551 L	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00
7551 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 7551 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I	27 in
Outer to Inr	0.8888889
Outer to Inr	0.8888889
Outer to Mi	0.9444444
Outer to Mi	0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-11.48	-23.92	-20.74	-29.84	-20.33	-26.05	-11.19	-28.44	-17.44	-27.00	-20.02	-30.16	-19.03	-23.79	-12.10	-31.23
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.17	0.34	0.30	0.43	0.29	0.37	0.16	0.41	0.25	0.39	0.29	0.43	0.27	0.34	0.17	0.45
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-23.92		-29.84		-26.05		-28.44		-27.00		-30.16		-23.79		-31.23
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-11.48		-20.74		-20.33		-11.19		-17.44		-20.02		-19.03		-12.10	
Rcf	1.67		1.67		1.67		1.67		1.67		1.67		1.67		1.67	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.97	-17.42	-15.22	-22.43	-14.36	-18.78	-8.30	-21.60	-13.86	-19.50	-14.20	-24.75	-14.01	-17.72	-8.91	-23.61
Fs (ksi)	-7.97	-17.42	-15.22	-22.43	-14.36	-18.78	-8.30	-21.60	-13.86	-19.50	-14.20	-24.75	-14.01	-17.72	-8.91	-23.61
Fs (kip)	-1075.61	-2351.25	-2054.33	-3027.43	-1938.18	-2535.49	-1120.88	-2916.45	-1871.59	-2633.12	-1917.23	-3341.65	-1891.58	-2391.97	-1202.54	-3187.36

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2054.33	3341.65

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	197.41	444.55	481.28	152.48	268.68	300.97	453.87	176.73	146.78	319.25	347.34	112.90	281.45	229.67	327.97	130.03
Vuw (kip)	296.11	666.83	721.92	228.72	403.01	451.46	680.81	265.09	---	---	---	---	---	---	---	---
Mv (k*ft)	166.56	375.09	406.08	128.65	226.69	253.94	382.95	149.11	82.56	179.58	195.38	63.50	158.31	129.19	184.49	73.14
Huw (kip)	-2125.82	-2588.99	-2568.71	-2110.97	-2424.13	-2552.82	-2503.65	-2156.54	-761.52	-1129.28	-994.15	-897.19	-1001.05	-1168.64	-951.90	-975.53
Muw (k*ft)	650.82	342.04	355.56	660.72	451.95	366.15	398.93	630.34	188.98	144.16	88.49	266.01	112.82	211.03	74.13	294.05
Mu (k*ft)	817.38	717.13	761.64	789.37	678.64	620.10	781.88	779.45	271.54	323.74	283.87	329.51	271.13	340.21	258.62	367.19

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.70	39.83	39.52	32.48	37.29	39.27	38.52	33.18	11.72	17.37	15.29	13.80	15.40	17.98	14.64	15.01
PY1 (Vuw)	4.56	10.26	11.11	3.52	6.20	6.95	10.47	4.08	2.26	4.91	5.34	1.74	4.33	3.53	5.05	2.00
PX2 (Mu)	18.86	16.55	17.58	18.22	15.66	14.31	18.04	17.99	6.27	7.47	6.55	7.60	6.26	7.85	5.97	8.47
PY2 (Mu)	6.29	5.52	5.86	6.07	5.22	4.77	6.01	6.00	2.09	2.49	2.18	2.53	2.09	2.62	1.99	2.82
Pu (kip)	52.70	58.55	59.56	51.59	54.17	54.85	58.92	52.15	18.50	25.92	23.11	21.83	22.59	26.55	21.78	23.97

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.43	46.93	47.64	42.65	44.10	44.41	47.28	42.99
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	721.92
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1036.42	7.20	OK
BF	3562.95	26.99	OK	1692.81	12.82	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.56	29.78	OK	26.55	13.28	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.56	1.47	114.56	OK
Web SPL	29.78	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.34	6.81
Web	1.22	1.46	1.92
BF	1.34	1.31	5.70

Plate	Shear	Flexure
Web	2.27	1.05

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.54	-22.07	-17.97	-26.41	-18.70	-23.99	-9.72	-25.71	-12.78	-21.63	-12.94	-22.34	-18.06	-22.47	-10.32	-28.05
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.15	0.32	0.26	0.38	0.27	0.35	0.14	0.37	0.18	0.31	0.19	0.32	0.26	0.32	0.15	0.40
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-22.07		-26.41		-23.99		-25.71		-21.63		-22.34		-22.47		-28.05
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-10.54		-17.97		-18.70		-9.72		-12.78		-12.94		-18.06		-10.32	
Rcf	1.86		1.86		1.86		1.86		1.86		1.86		1.86		1.86	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-7.835551	-16.1135	-12.98189	-19.29658	-13.59878	-17.4749	-7.149916	-18.80187	-11.89069	-16.83247	-10.33772	-19.58118	-13.14982	-16.39699	-7.57	-20.45
Fs (ksi)	-7.84	-16.11	-12.98	-19.30	-13.60	-17.47	-7.15	-18.80	-11.89	-16.83	-10.34	-19.58	-13.15	-16.40	-7.57	-20.45
Fs (kip)	-1057.80	-2175.32	-1752.56	-2605.04	-1835.84	-2359.11	-965.24	-2538.25	-1605.24	-2272.38	-1395.59	-2643.46	-1775.23	-2213.59	-1022.20	-2761.01

Vu (kip)	197.41	444.55	481.28	152.48	268.68	300.97	453.87	176.73	146.78	319.25	347.34	112.90	281.45	229.67	327.97	130.03
Vuw (kip)	296.11	666.83	721.92	228.72	403.01	451.46	680.81	265.09	---	---	---	---	---	---	---	---
Mv (k*ft)	166.56	375.09	406.08	128.65	226.69	253.94	382.95	149.11	82.56	179.58	195.38	63.50	158.31	129.19	184.49	73.14
Huw (kip)	-2138.49	-2552.70	-2593.08	-2092.68	-2263.07	-2272.19	-2557.67	-2125.96	-718.47	-968.35	-932.21	-778.55	-861.69	-897.57	-886.40	-840.71
Muw (k*ft)	642.38	366.23	339.31	672.91	559.32	553.24	362.92	650.72	165.56	126.29	77.52	233.04	98.84	184.87	64.94	257.60
Mu (k*ft)	808.94	741.32	745.39	801.56	786.01	807.18	745.88	799.84	248.12	305.87	272.90	296.54	257.15	314.06	249.43	330.74

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.90	39.27	39.89	32.20	34.82	34.96	39.35	32.71	11.05	14.90	14.34	11.98	13.26	13.81	13.64	12.93
PY1 (Vuw)	4.56	10.26	11.11	3.52	6.20	6.95	10.47	4.08	2.26	4.91	5.34	1.74	4.33	3.53	5.05	2.00
PX2 (Mu)	18.67	17.11	17.20	18.50	18.14	18.63	17.21	18.46	5.73	7.06	6.30	6.84	5.93	7.25	5.76	7.63
PY2 (Mu)	6.22	5.70	5.73	6.17	6.05	6.21	5.74	6.15	1.91	2.35	2.10	2.28	1.98	2.42	1.92	2.54
Pu (kip)	52.68	58.60	59.53	51.61	54.35	55.18	58.84	52.18	17.29	23.13	21.94	19.25	20.20	21.88	20.61	21.06

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.40	47.01	47.59	42.69	44.43	45.00	47.16	43.06
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
	Checked	MTB	Date	8/5/2011		
For **Cleveland InnerBelt : Field Splice - Node 7551**	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
59.53	29.76	OK	23.13	11.56	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	59.53	1.47	114.56	OK
Web SPL	29.76	1.47	91.65	OK

Field Splice - Node 9551

Node 9551

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	144
Web	65
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9551 L	135.00	69.47	9377.80	135.00	69.47	9377.80	60.00	50.00	3000.00
9551 R	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00

Rh = 0.99

Controlling Section = 9551 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.25	---	60.00	42.73	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.375	74.50	61.88	44.34	---	70	85
	TF Inside	21.00	1.500	74.50	63.00	43.88	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	32.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-10.37	-20.57	-16.97	-25.25	-19.54	-23.89	-8.19	-22.50	-17.70	-25.87	-20.85	-28.90	-17.96	-21.44	-9.25	-26.01
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.15	0.30	0.24	0.36	0.28	0.34	0.12	0.32	0.25	0.37	0.30	0.42	0.26	0.31	0.13	0.37
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-20.57		-25.25		-23.89		-22.50		-25.87		-28.90		-21.44		-26.01
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-10.37		-16.97		-19.54		-8.19		-17.70		-20.85		-17.96		-9.25	
Rcf	1.80		1.80		1.80		1.80		1.80		1.80		1.80		1.80	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.88	-14.67	-13.12	-19.71	-15.02	-18.66	-5.25	-16.12	-13.11	-19.33	-15.82	-22.22	-12.38	-15.15	-7.50	-20.42
Fs (ksi)	-6.88	-14.67	-13.12	-19.71	-15.02	-18.66	-5.25	-16.12	-13.11	-19.33	-15.82	-22.22	-12.38	-15.15	-7.50	-20.42
Fs (kip)	-928.71	-1980.68	-1771.66	-2660.19	-2028.00	-2519.56	-709.16	-2175.90	-1769.47	-2609.94	-2136.36	-2999.82	-1671.18	-2045.04	-1012.62	-2756.52

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7033.35	7033.35	2136.36	2999.82

$\phi_v V_n$ (kip) = 1740.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	151.83	373.79	427.51	107.60	294.98	297.20	402.73	132.59	113.94	271.15	309.10	82.69	228.45	225.89	291.21	100.73
Vuw (kip)	227.75	560.69	641.26	161.40	442.46	445.80	604.10	198.88	---	---	---	---	---	---	---	---
Mv (k*ft)	128.11	315.39	360.71	90.79	248.89	250.76	339.80	111.87	64.09	152.52	173.87	46.51	128.50	127.06	163.80	56.66
Huw (kip)	-2112.02	-2468.56	-2607.74	-1993.98	-2508.11	-2678.50	-2522.45	-2051.49	-646.53	-984.85	-1010.57	-641.12	-973.20	-1141.37	-825.83	-837.59
Muw (k*ft)	660.02	422.32	329.54	738.71	395.96	282.36	386.40	700.37	155.85	131.63	72.82	217.29	124.51	127.92	55.39	258.36
Mu (k*ft)	788.13	737.71	690.25	829.50	644.85	533.13	726.20	812.25	219.94	284.16	246.69	263.81	253.02	254.98	219.19	315.02

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9551**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.49	37.98	40.12	30.68	38.59	41.21	38.81	31.56	9.95	15.15	15.55	9.86	14.97	17.56	12.71	12.89
PY1 (Vuw)	3.50	8.63	9.87	2.48	6.81	6.86	9.29	3.06	1.75	4.17	4.76	1.27	3.51	3.48	4.48	1.55
PX2 (Mu)	18.19	17.02	15.93	19.14	14.88	12.30	16.76	18.74	5.08	6.56	5.69	6.09	5.84	5.88	5.06	7.27
PY2 (Mu)	6.06	5.67	5.31	6.38	4.96	4.10	5.59	6.25	1.69	2.19	1.90	2.03	1.95	1.96	1.69	2.42
Pu (kip)	51.58	56.83	58.07	50.60	54.75	54.62	57.52	51.16	15.41	22.62	22.26	16.29	21.52	24.07	18.80	20.54

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4114.69	3015.38	96.25	62.65	39.96	5188.20	3015.38	OK
TF Inside	0.00	4189.50	2983.50	210.00	136.69	34.69	7749.71	2983.50	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3484.99	3898.13	OK
TF Inside	3548.36	3969.00	OK
BF Inside	3562.95	3638.25	OK
BF Outside	3470.40	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.63	45.90	46.58	42.08	44.40	44.08	46.31	42.41
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	641.26
Rr (kip)	1639.95
Check	OK

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Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R	L Factor	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.13	1.00	1.0	36.19
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3548.36	24.64	OK	1077.80	7.48	OK
BF	3562.95	26.99	OK	1519.65	11.51	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3484.99	24.20	1.47	164.79	OK
TF	7033.35	48.84	1.47	359.55	OK
TF Inside	3548.36	24.64	1.47	179.78	OK
BF Inside	3562.95	26.99	1.47	164.79	OK
BF	7033.35	53.28	1.47	359.55	OK
BF Outside	3470.40	26.29	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
58.07	29.03	OK	24.07	12.03	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	58.07	1.47	114.56	OK
Web SPL	29.03	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.12
TF Inside	NA	1.12
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.47	2.25	6.81
Web	1.25	1.69	1.97
BF	1.34	1.46	5.70

Plate	Shear	Flexure
Web	2.56	1.07

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-8.33	-17.78	-15.10	-22.78	-16.03	-20.06	-7.55	-20.81	-12.76	-20.33	-12.48	-19.94	-15.79	-19.01	-8.07	-23.60
ϕf Fnc (ksi)	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47	69.47
f / ϕf Fnc	0.12	0.26	0.22	0.33	0.23	0.29	0.11	0.30	0.18	0.29	0.18	0.29	0.23	0.27	0.12	0.34
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)		-17.78		-22.78		-20.06		-20.81		-20.33		-19.94		-19.01		-23.60
Fcf (ksi)		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10
Fcf (kip)		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35
fncf (ksi)	-8.33		-15.10		-16.03		-7.55		-12.76		-12.48		-15.79		-8.07	
Rcf	2.21		2.21		2.21		2.21		2.21		2.21		2.21		2.21	
Fncf (ksi)	-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10		-52.10	
Fncf (kip)	-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35		-7033.35	

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-6.253205	-13.07972	-10.96395	-16.72985	-11.61765	-14.80751	-5.700638	-15.21873	-9.701662	-15.15571	-9.549005	-15.15227	-11.52234	-13.94846	-5.99	-17.31
Fs (ksi)	-6.25	-13.08	-10.96	-16.73	-11.62	-14.81	-5.70	-15.22	-9.70	-15.16	-9.55	-15.15	-11.52	-13.95	-5.99	-17.31
Fs (kip)	-844.18	-1765.76	-1480.13	-2258.53	-1568.38	-1999.01	-769.59	-2054.53	-1309.72	-2046.02	-1289.12	-2045.56	-1555.52	-1883.04	-809.01	-2336.77

Vu (kip)	151.83	373.79	427.51	107.60	294.98	297.20	402.73	132.59	113.94	271.15	309.10	82.69	228.45	225.89	291.21	100.73
Vuw (kip)	227.75	560.69	641.26	161.40	442.46	445.80	604.10	198.88	---	---	---	---	---	---	---	---
Mv (k*ft)	128.11	315.39	360.71	90.79	248.89	250.76	339.80	111.87	64.09	152.52	173.87	46.51	128.50	127.06	163.80	56.66
Huw (kip)	-2102.72	-2551.32	-2612.59	-2050.93	-2395.83	-2377.51	-2596.60	-2085.36	-579.99	-830.81	-792.75	-627.58	-745.72	-741.04	-764.12	-699.06
Muw (k*ft)	666.22	367.15	326.31	700.75	470.81	483.02	336.97	677.79	136.53	115.32	63.80	190.36	109.08	112.07	48.52	226.33
Mu (k*ft)	794.33	682.54	687.02	791.54	719.70	733.79	676.77	789.67	200.62	267.84	237.67	236.88	237.58	239.13	212.33	283.00

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	32.35	39.25	40.19	31.55	36.86	36.58	39.95	32.08	8.92	12.78	12.20	9.66	11.47	11.40	11.76	10.75
PY1 (Vuw)	3.50	8.63	9.87	2.48	6.81	6.86	9.29	3.06	1.75	4.17	4.76	1.27	3.51	3.48	4.48	1.55
PX2 (Mu)	18.33	15.75	15.85	18.27	16.61	16.93	15.62	18.22	4.63	6.18	5.48	5.47	5.48	5.52	4.90	6.53
PY2 (Mu)	6.11	5.25	5.28	6.09	5.54	5.64	5.21	6.07	1.54	2.06	1.83	1.82	1.83	1.84	1.63	2.18
Pu (kip)	51.58	56.73	58.06	50.55	54.87	54.95	57.43	51.13	13.95	19.96	18.87	15.43	17.78	17.73	17.74	17.68

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.65	45.73	46.57	41.96	44.63	44.71	46.16	42.34
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For	Cleveland InnerBelt : Field Splice - Node 9551	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
58.06	29.03	OK	19.96	9.98	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	58.06	1.47	114.56	OK
Web SPL	29.03	1.47	91.65	OK

Field Splice

Type LL

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 1556	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type LL

Field Splice - Node 1556

Node 1556

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	192
Web	78
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
1556 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
1556 R	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 1556 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	94.75	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	94.75	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
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For	**Cleveland InnerBelt : Field Splice - Node 1556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.35	-7.18	-30.02	-16.65	-18.85	-17.09	-38.48	-8.40	-37.63	-9.58	-19.89	-16.78	-38.02	4.78	-19.41	-18.94
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.42	0.10	0.43	0.24	0.27	0.25	0.55	0.12	0.54	0.14	0.29	0.24	0.55	0.07	0.28	0.27
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.35		-30.02		-18.85		-38.48		-37.63		-19.89		-38.02		-19.41	
Fcf (ksi)	-52.17		-52.17		-52.17		-54.14		-53.71		-52.17		-53.91		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7309.23		-7251.36		-7043.57		-7278.09		-7043.57	
fncf (ksi)		-7.18		-16.65		-17.09		-8.40		-9.58		-16.78		4.78		-18.94
Rcf		1.36		1.36		1.36		1.41		1.40		1.36		1.40		1.36
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		5161.76		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.48	-4.45	-22.66	-12.31	-13.65	-11.87	-28.98	-6.14	-28.33	-7.02	-15.16	-12.37	-27.82	3.46	-14.90	-14.19
Fs (ksi)	-21.48	-4.45	-22.66	-12.31	-13.65	-11.87	-28.98	-6.14	-28.33	-7.02	-15.16	-12.37	-27.82	3.46	-14.90	-14.19
Fs (kip)	-2900.34	-601.03	-3058.84	-1662.02	-1842.95	-1602.35	-3911.93	-828.62	-3825.03	-947.05	-2046.75	-1670.11	-3755.88	466.70	-2011.26	-1916.02

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5161.76	0.00	466.70
Comp	7309.23	7043.57	3911.93	1916.02

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	446.70	511.28	330.14	633.00	558.22	374.54	610.09	347.54	325.92	373.53	243.57	459.52	406.69	274.94	441.36	257.84
Vuw (kip)	670.05	766.92	495.21	949.49	837.34	561.82	915.13	521.31	---	---	---	---	---	---	---	---
Mv (k*ft)	376.90	431.39	278.56	534.09	471.00	316.02	514.76	293.24	183.33	210.11	137.01	258.48	228.77	154.65	248.26	145.04
Huw (kip)	-1478.19	-1786.40	-1800.60	-1575.06	-1602.21	-1790.43	-1125.29	-1860.91	-622.47	-839.26	-612.50	-842.76	-848.37	-660.77	-584.74	-698.18
Muw (k*ft)	673.78	468.30	458.84	671.78	640.05	465.62	964.29	418.63	272.51	165.55	28.52	365.43	341.09	44.64	500.45	11.29
Mu (k*ft)	1050.68	899.70	737.40	1205.87	1111.05	781.64	1479.05	711.87	455.84	375.66	165.52	623.91	569.86	199.29	748.72	156.32

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.95	22.90	23.08	20.19	20.54	22.95	14.43	23.86	7.98	10.76	7.85	10.80	10.88	8.47	7.50	8.95
PY1 (Vuw)	8.59	9.83	6.35	12.17	10.74	7.20	11.73	6.68	4.18	4.79	3.12	5.89	5.21	3.52	5.66	3.31
PX2 (Mu)	19.11	16.36	13.41	21.93	20.21	14.22	26.90	12.95	8.29	6.83	3.01	11.35	10.37	3.62	13.62	2.84
PY2 (Mu)	7.96	6.82	5.59	9.14	8.42	5.92	11.21	5.40	3.45	2.85	1.25	4.73	4.32	1.51	5.67	1.18
Pu (kip)	41.51	42.65	38.40	47.21	45.03	39.42	47.27	38.74	17.97	19.18	11.71	24.57	23.28	13.10	23.96	12.62

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4862.81	3563.63	146.66	93.13	47.23	6884.56	3563.63	OK
TF Inside	0.00	4887.75	3480.75	315.88	200.59	40.47	10663.29	3480.75	OK
BF Inside	2614.84	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2546.92	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3645.27	4606.88	OK
TF Inside	3663.96	4630.50	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.53	41.05	37.75	45.03	43.33	38.57	45.40	37.94
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	949.49
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 1556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3663.96	19.08	OK	1960.97	10.21	OK
BF	3568.13	27.03	OK	970.62	7.35	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3645.27	18.99	1.47	194.76	OK
TF	7309.23	38.07	1.47	359.55	OK
TF Inside	3663.96	19.08	1.47	209.74	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
47.27	23.63	OK	24.57	12.28	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	47.27	1.47	91.65	OK
Web SPL	23.63	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.26
TF Inside	NA	1.26
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.90	1.65	9.44
Web	1.33	1.58	1.98
BF	1.34	2.29	5.69

Plate	Shear	Flexure
Web	1.73	1.14

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 1556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.59	-3.04	-26.30	-13.92	-17.47	-15.83	-32.10	-4.23	-29.35	-3.36	-19.04	-16.16	-31.41	-1.35	-18.06	-17.62
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.34	0.04	0.38	0.20	0.25	0.23	0.46	0.06	0.42	0.05	0.27	0.23	0.45	0.02	0.26	0.25
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-23.59		-26.30		-17.47		-32.10		-29.35		-19.04		-31.41		-18.06	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-3.04		-13.92		-15.83		-4.23		-3.36		-16.16		-1.35		-17.62
Rcf		1.63		1.63		1.63		1.63		1.63		1.63		1.63		1.63
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.29991	-2.379024	-19.25421	-10.18981	-12.97633	-11.41499	-23.34991	-3.341459	-21.40769	-2.731608	-14.08768	-11.64352	-22.82924	-1.18323	-13.43	-12.81
Fs (ksi)	-17.30	-2.38	-19.25	-10.19	-12.98	-11.41	-23.35	-3.34	-21.41	-2.73	-14.09	-11.64	-22.83	-1.18	-13.43	-12.81
Fs (kip)	-2335.49	-321.17	-2599.32	-1375.62	-1751.80	-1541.02	-3152.24	-451.10	-2890.04	-368.77	-1901.84	-1571.87	-3081.95	-159.74	-1812.52	-1729.09

Vu (kip)	446.70	511.28	330.14	633.00	558.22	374.54	610.09	347.54	325.92	373.53	243.57	459.52	406.69	274.94	441.36	257.84
Vuw (kip)	670.05	766.92	495.21	949.49	837.34	561.82	915.13	521.31	---	---	---	---	---	---	---	---
Mv (k*ft)	376.90	431.39	278.56	534.09	471.00	316.02	514.76	293.24	183.33	210.11	137.01	258.48	228.77	154.65	248.26	145.04
Huw (kip)	-1363.19	-1787.35	-1862.06	-1409.26	-1375.59	-1874.68	-1297.17	-1931.91	-472.29	-706.66	-585.39	-640.59	-579.34	-617.55	-576.30	-629.62
Muw (k*ft)	750.45	467.67	417.87	719.74	742.18	409.46	794.46	371.30	238.73	145.03	24.98	320.14	298.82	39.11	346.34	9.89
Mu (k*ft)	1127.35	899.07	696.42	1253.83	1213.18	725.48	1309.22	664.54	422.06	355.14	161.99	578.62	527.58	193.76	594.60	154.92

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.48	22.91	23.87	18.07	17.64	24.03	16.63	24.77	6.06	9.06	7.51	8.21	7.43	7.92	7.39	8.07
PY1 (Vuw)	8.59	9.83	6.35	12.17	10.74	7.20	11.73	6.68	4.18	4.79	3.12	5.89	5.21	3.52	5.66	3.31
PX2 (Mu)	20.51	16.35	12.67	22.81	22.07	13.20	23.81	12.09	7.68	6.46	2.95	10.52	9.60	3.52	10.81	2.82
PY2 (Mu)	8.54	6.81	5.28	9.50	9.19	5.50	9.92	5.04	3.20	2.69	1.23	4.39	4.00	1.47	4.51	1.17
Pu (kip)	41.67	42.65	38.34	46.26	44.42	39.34	45.88	38.67	15.59	17.23	11.32	21.37	19.36	12.48	20.85	11.78

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	40.77	41.05	37.62	44.04	42.76	38.40	43.86	37.79
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
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Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.26	23.13	OK	21.37	10.69	OK

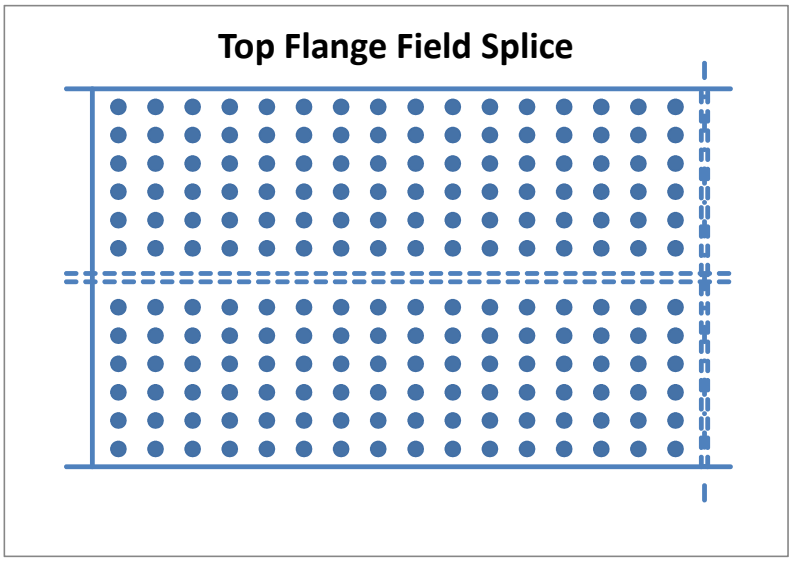
	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.26	1.47	91.65	OK
Web SPL	23.13	1.47	91.65	OK

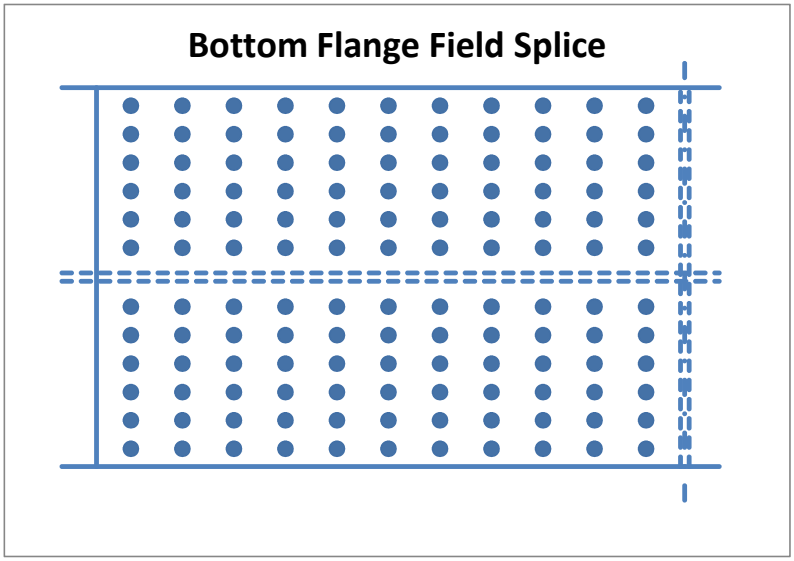
HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
For	Cleveland InnerBelt : Field Splice - Node 1556	Backchk'd	SAE	Date	6/10/2011	Sheet No.	
		Revised	DJG	Date	5/15/2012		
		Checked	SJL	Date	5/16/2012		
		Backchk'd	DJG	Date	5/16/2012		

Flange Bolt Pattern - Node 1556

TF Bolt Coordinates (in)		BF Bolt Coordinates (in)	
x (long)	y (trans)	x (long)	y (trans)
0	0	0	0
0	3.375	0	3.375
0	6.75	0	6.75
0	10.125	0	10.125
0	13.5	0	13.5
0	16.875	0	16.875
0	23.875	0	23.875
0	27.25	0	27.25
0	30.625	0	30.625
0	34	0	34
0	37.375	0	37.375
0	40.75	0	40.75
2.875	0	3	0
2.875	3.375	3	3.375
2.875	6.75	3	6.75
2.875	10.125	3	10.125
2.875	13.5	3	13.5
2.875	16.875	3	16.875
2.875	23.875	3	23.875
2.875	27.25	3	27.25
2.875	30.625	3	30.625
2.875	34	3	34
2.875	37.375	3	37.375
2.875	40.75	3	40.75
5.75	0	6	0
5.75	3.375	6	3.375
5.75	6.75	6	6.75
5.75	10.125	6	10.125
5.75	13.5	6	13.5
5.75	16.875	6	16.875
5.75	23.875	6	23.875
5.75	27.25	6	27.25
5.75	30.625	6	30.625
5.75	34	6	34
5.75	37.375	6	37.375
5.75	40.75	6	40.75
8.625	0	9	0
8.625	3.375	9	3.375
8.625	6.75	9	6.75
8.625	10.125	9	10.125
8.625	13.5	9	13.5
8.625	16.875	9	16.875
8.625	23.875	9	23.875
8.625	27.25	9	27.25
8.625	30.625	9	30.625
8.625	34	9	34
8.625	37.375	9	37.375
8.625	40.75	9	40.75
11.5	0	12	0
11.5	3.375	12	3.375
11.5	6.75	12	6.75
11.5	10.125	12	10.125
11.5	13.5	12	13.5
11.5	16.875	12	16.875
11.5	23.875	12	23.875
11.5	27.25	12	27.25
11.5	30.625	12	30.625
11.5	34	12	34
11.5	37.375	12	37.375

	Top Flange		Bottom Flange	
No. Bolts =	192.0		132.0	
Splice Plate to First Column (in) =	2.000	OK	2.000	OK
No. Longitudinal Space =	15.0		10.0	
Longitudinal Spacing (in) =	2.875	NG	3.000	OK
Last Column to End Girder (in) =	2.000	OK	2.000	OK
Gap (in) =	0.500		0.500	
Edge Flange to First Row (in) =	2.125	OK	2.125	OK
No. Trans Space (per side of web) =	5.0		5.0	
Transverse Spacing (in) =	3.375	OK	3.375	OK
Center Row to CL Web (in) =	3.500		3.500	
Bolt Stagger =	NO		NO	





11.5	40.75	12	40.75
14.375	0	15	0
14.375	3.375	15	3.375
14.375	6.75	15	6.75
14.375	10.125	15	10.125
14.375	13.5	15	13.5
14.375	16.875	15	16.875
14.375	23.875	15	23.875
14.375	27.25	15	27.25
14.375	30.625	15	30.625
14.375	34	15	34
14.375	37.375	15	37.375
14.375	40.75	15	40.75
17.25	0	18	0
17.25	3.375	18	3.375
17.25	6.75	18	6.75
17.25	10.125	18	10.125
17.25	13.5	18	13.5
17.25	16.875	18	16.875
17.25	23.875	18	23.875
17.25	27.25	18	27.25
17.25	30.625	18	30.625
17.25	34	18	34
17.25	37.375	18	37.375
17.25	40.75	18	40.75
20.125	0	21	0
20.125	3.375	21	3.375
20.125	6.75	21	6.75
20.125	10.125	21	10.125
20.125	13.5	21	13.5
20.125	16.875	21	16.875
20.125	23.875	21	23.875
20.125	27.25	21	27.25
20.125	30.625	21	30.625
20.125	34	21	34
20.125	37.375	21	37.375
20.125	40.75	21	40.75
23	0	24	0
23	3.375	24	3.375
23	6.75	24	6.75
23	10.125	24	10.125
23	13.5	24	13.5
23	16.875	24	16.875
23	23.875	24	23.875
23	27.25	24	27.25
23	30.625	24	30.625
23	34	24	34
23	37.375	24	37.375
23	40.75	24	40.75
25.875	0	27	0
25.875	3.375	27	3.375
25.875	6.75	27	6.75
25.875	10.125	27	10.125
25.875	13.5	27	13.5
25.875	16.875	27	16.875
25.875	23.875	27	23.875
25.875	27.25	27	27.25
25.875	30.625	27	30.625
25.875	34	27	34
25.875	37.375	27	37.375
25.875	40.75	27	40.75
28.75	0	30	0
28.75	3.375	30	3.375
28.75	6.75	30	6.75
28.75	10.125	30	10.125
28.75	13.5	30	13.5

Flange Bolt Pattern Cont. - Node 1556

28.75	16.875	30	16.875
28.75	23.875	30	23.875
28.75	27.25	30	27.25
28.75	30.625	30	30.625
28.75	34	30	34
28.75	37.375	30	37.375
28.75	40.75	30	40.75
31.625	0		
31.625	3.375		
31.625	6.75		
31.625	10.125		
31.625	13.5		
31.625	16.875		
31.625	23.875		
31.625	27.25		
31.625	30.625		
31.625	34		
31.625	37.375		
31.625	40.75		
34.5	0		
34.5	3.375		
34.5	6.75		
34.5	10.125		
34.5	13.5		
34.5	16.875		
34.5	23.875		
34.5	27.25		
34.5	30.625		
34.5	34		
34.5	37.375		
34.5	40.75		
37.375	0		
37.375	3.375		
37.375	6.75		
37.375	10.125		
37.375	13.5		
37.375	16.875		
37.375	23.875		
37.375	27.25		
37.375	30.625		
37.375	34		
37.375	37.375		
37.375	40.75		
40.25	0		
40.25	3.375		
40.25	6.75		
40.25	10.125		
40.25	13.5		
40.25	16.875		
40.25	23.875		
40.25	27.25		
40.25	30.625		
40.25	34		
40.25	37.375		
40.25	40.75		
43.125	0		
43.125	3.375		
43.125	6.75		
43.125	10.125		
43.125	13.5		
43.125	16.875		
43.125	23.875		
43.125	27.25		
43.125	30.625		
43.125	34		
43.125	37.375		

Flange Bolt Pattern Cont. - Node

43.125	40.75		

Flange Bolt Pattern Cont. - Node 1556

HNTB	The HNTB Companies Engineers Architects Planners	Made	SAE	Date	6/10/2011	Job Number	49633
		Checked	MCC	Date	6/10/2011		
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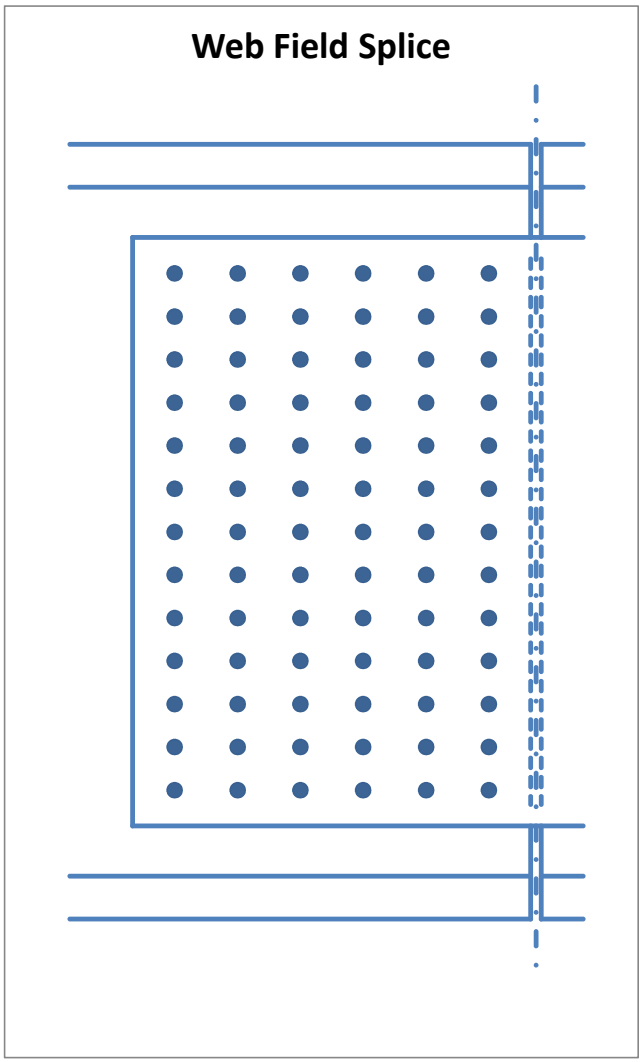
Web Bolt Pattern - Node 1556

Bolt Coordinates (in)			
x (long)	y (vert)	$(x-x_{bar})^2$	$(y-y_{bar})^2$
0	0	56.25	324
0	3	56.25	225
0	6	56.25	144
0	9	56.25	81
0	12	56.25	36
0	15	56.25	9
0	18	56.25	0
0	21	56.25	9
0	24	56.25	36
0	27	56.25	81
0	30	56.25	144
0	33	56.25	225
0	36	56.25	324
3	0	20.25	324
3	3	20.25	225
3	6	20.25	144
3	9	20.25	81
3	12	20.25	36
3	15	20.25	9
3	18	20.25	0
3	21	20.25	9
3	24	20.25	36
3	27	20.25	81
3	30	20.25	144
3	33	20.25	225
3	36	20.25	324
6	0	2.25	324
6	3	2.25	225
6	6	2.25	144
6	9	2.25	81
6	12	2.25	36
6	15	2.25	9
6	18	2.25	0
6	21	2.25	9
6	24	2.25	36
6	27	2.25	81
6	30	2.25	144
6	33	2.25	225
6	36	2.25	324
9	0	2.25	324
9	3	2.25	225
9	6	2.25	144
9	9	2.25	81
9	12	2.25	36
9	15	2.25	9
9	18	2.25	0
9	21	2.25	9
9	24	2.25	36
9	27	2.25	81
9	30	2.25	144
9	33	2.25	225
9	36	2.25	324
12	0	20.25	324
12	3	20.25	225
12	6	20.25	144
12	9	20.25	81
12	12	20.25	36
12	15	20.25	9
12	18	20.25	0

No. Bolts =	78.0	
Splice Plate to First Column (in) =	2.0	OK
No. Longitudinal Space =	5.0	
Longitudinal Spacing (in) =	3.000	OK
Last Column to End Girder (in) =	2.000	OK
Gap (in) =	0.500	
Top/Bot Web to First Row (in) =	6.000	OK
Splice Plate to First Row (in) =	2.500	OK
No. Vertical Space =	12.0	
Vertical Spacing (in) =	3.000	OK
Bolt Stagger =	NO	
x_{bar} (in) =	7.5	
y_{bar} (in) =	18	
$\Sigma(x\text{-}xbar)^2$ (in^2)=	2047.5	
$\Sigma(y\text{-}ybar)^2$ (in^2) =	9828	
Σd^2 (in^2) =	11875.5	



12	21	20.25	9
12	24	20.25	36
12	27	20.25	81
12	30	20.25	144
12	33	20.25	225
12	36	20.25	324
15	0	56.25	324
15	3	56.25	225
15	6	56.25	144
15	9	56.25	81
15	12	56.25	36
15	15	56.25	9
15	18	56.25	0
15	21	56.25	9
15	24	56.25	36
15	27	56.25	81
15	30	56.25	144
15	33	56.25	225
15	36	56.25	324

Web Bolt Pattern Cont. - Node 1556

Web Bolt Pattern Cont. - Node 1556

585	1404	2047.5	9828

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type LL

Field Splice - Node 3556

Node 3556

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	192
Web	78
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
3556 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
3556 R	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 3556 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	94.75	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	94.75	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-32.22	-9.22	-34.51	-18.86	-26.59	-18.69	-41.37	-8.73	-41.19	-12.95	-27.11	-18.03	-41.36	-7.48	-26.54	-20.38
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.46	0.13	0.50	0.27	0.38	0.27	0.59	0.13	0.59	0.19	0.39	0.26	0.59	0.11	0.38	0.29
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-32.22		-34.51		-26.59		-41.37		-41.19		-27.11		-41.36		-26.54	
Fcf (ksi)	-52.17		-52.17		-52.17		-55.60		-55.51		-52.17		-55.59		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7505.36		-7493.42		-7043.57		-7504.79		-7043.57	
fncf (ksi)		-9.22		-18.86		-18.69		-8.73		-12.95		-18.03		-7.48		-20.38
Rcf		1.26		1.26		1.26		1.34		1.34		1.26		1.34		1.26
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.73	-6.00	-25.67	-13.70	-19.91	-13.74	-30.39	-5.46	-30.65	-9.26	-20.37	-13.04	-30.41	-4.55	-19.85	-14.97
Fs (ksi)	-23.73	-6.00	-25.67	-13.70	-19.91	-13.74	-30.39	-5.46	-30.65	-9.26	-20.37	-13.04	-30.41	-4.55	-19.85	-14.97
Fs (kip)	-3203.31	-810.61	-3466.11	-1849.00	-2688.51	-1855.12	-4102.72	-737.40	-4137.70	-1250.70	-2749.49	-1760.60	-4105.37	-614.08	-2679.21	-2020.63

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7505.36	7043.57	4137.70	2020.63

ϕvVn (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	560.07	638.81	492.90	750.65	692.07	537.40	738.45	507.43	408.50	462.26	359.17	543.15	499.89	392.49	534.53	369.43
Vuw (kip)	840.11	958.22	739.36	1071.33	1038.10	806.10	1065.23	761.15	---	---	---	---	---	---	---	---
Mv (k*ft)	472.56	539.00	415.89	602.62	583.93	453.43	599.19	428.14	229.78	260.02	202.03	305.52	281.19	220.77	300.67	207.81
Huw (kip)	-1523.58	-1815.20	-1810.34	-1607.71	-1740.86	-1790.30	-1567.06	-1861.35	-713.59	-944.91	-807.76	-860.47	-957.94	-801.79	-839.01	-835.53
Muw (k*ft)	643.52	449.10	452.35	696.21	604.63	465.71	723.18	418.34	283.58	191.66	98.77	398.85	342.16	117.20	413.78	78.05
Mu (k*ft)	1116.08	988.10	868.24	1298.83	1188.57	919.14	1322.37	846.49	513.36	451.68	300.80	704.38	623.35	337.98	714.46	285.86

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 3556	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.53	23.27	23.21	20.61	22.32	22.95	20.09	23.86	9.15	12.11	10.36	11.03	12.28	10.28	10.76	10.71
PY1 (Vuw)	10.77	12.28	9.48	13.73	13.31	10.33	13.66	9.76	5.24	5.93	4.60	6.96	6.41	5.03	6.85	4.74
PX2 (Mu)	20.30	17.97	15.79	23.62	21.62	16.72	24.05	15.40	9.34	8.22	5.47	12.81	11.34	6.15	13.00	5.20
PY2 (Mu)	8.46	7.49	6.58	9.84	9.01	6.97	10.02	6.42	3.89	3.42	2.28	5.34	4.72	2.56	5.41	2.17
Pu (kip)	44.23	45.74	42.18	50.13	49.28	43.28	50.09	42.46	20.62	22.38	17.26	26.83	26.11	18.10	26.73	17.34

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4862.81	3563.63	146.66	93.13	47.23	6884.56	3563.63	OK
TF Inside	0.00	4887.75	3480.75	315.88	200.59	40.47	10663.29	3480.75	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3743.08	4606.88	OK
TF Inside	3762.28	4630.50	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.48	43.30	40.67	47.42	46.68	41.52	47.43	40.83
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1071.33
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 3556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3762.28	19.60	OK	2074.14	10.80	OK
BF	3568.13	27.03	OK	1023.61	7.75	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3743.08	19.50	1.47	194.76	OK
TF	7505.36	39.09	1.47	359.55	OK
TF Inside	3762.28	19.60	1.47	209.74	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.13	25.06	OK	26.83	13.41	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.13	1.47	91.65	OK
Web SPL	25.06	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.23
TF Inside	NA	1.23
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.85	1.56	9.20
Web	1.26	1.36	1.87
BF	1.34	2.17	5.69

Plate	Shear	Flexure
Web	1.53	1.08

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-28.25	-6.94	-31.53	-17.02	-24.57	-17.26	-36.95	-6.71	-35.00	-8.82	-26.07	-17.65	-36.58	-5.18	-25.04	-19.34
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.41	0.10	0.45	0.24	0.35	0.25	0.53	0.10	0.50	0.13	0.37	0.25	0.53	0.07	0.36	0.28
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-28.25		-31.53		-24.57		-36.95		-35.00		-26.07		-36.58		-25.04	
Fcf (ksi)	-52.17		-52.17		-52.17		-53.37		-52.39		-52.17		-53.19		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7205.51		-7072.83		-7043.57		-7180.29		-7043.57	
fncf (ksi)		-6.94		-17.02		-17.26		-6.71		-8.82		-17.65		-5.18		-19.34
Rcf		1.41		1.41		1.41		1.44		1.42		1.41		1.44		1.41
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-20.67872	-5.151827	-22.89992	-12.40606	-17.98649	-12.5784	-26.82686	-4.988338	-25.35098	-6.616392	-19.13907	-12.72188	-26.56456	-3.908607	-18.32	-14.04
Fs (ksi)	-20.68	-5.15	-22.90	-12.41	-17.99	-12.58	-26.83	-4.99	-25.35	-6.62	-19.14	-12.72	-26.56	-3.91	-18.32	-14.04
Fs (kip)	-2791.63	-695.50	-3091.49	-1674.82	-2428.18	-1698.08	-3621.63	-673.43	-3422.38	-893.21	-2583.77	-1717.45	-3586.22	-527.66	-2472.98	-1896.03

Vu (kip)	560.07	638.81	492.90	750.65	692.07	537.40	738.45	507.43	408.50	462.26	359.17	543.15	499.89	392.49	534.53	369.43
Vuw (kip)	840.11	958.22	739.36	1071.33	1038.10	806.10	1065.23	761.15	---	---	---	---	---	---	---	---
Mv (k*ft)	472.56	539.00	415.89	602.62	583.93	453.43	599.19	428.14	229.78	260.02	202.03	305.52	281.19	220.77	300.67	207.81
Huw (kip)	-1479.57	-1821.09	-1829.36	-1505.56	-1549.81	-1842.66	-1447.50	-1899.68	-619.93	-847.34	-733.56	-763.56	-767.22	-764.66	-731.36	-776.71
Muw (k*ft)	672.86	445.18	439.67	693.68	632.93	430.80	726.44	392.78	248.43	167.90	86.53	349.42	299.75	102.68	362.50	68.38
Mu (k*ft)	1145.42	984.18	855.56	1296.30	1216.86	884.24	1325.63	820.93	478.21	427.92	288.56	654.94	580.94	323.45	663.17	276.19

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For	Cleveland InnerBelt : Field Splice - Node 3556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.97	23.35	23.45	19.30	19.87	23.62	18.56	24.35	7.95	10.86	9.40	9.79	9.84	9.80	9.38	9.96
PY1 (Vuw)	10.77	12.28	9.48	13.73	13.31	10.33	13.66	9.76	5.24	5.93	4.60	6.96	6.41	5.03	6.85	4.74
PX2 (Mu)	20.83	17.90	15.56	23.58	22.13	16.08	24.11	14.93	8.70	7.78	5.25	11.91	10.57	5.88	12.06	5.02
PY2 (Mu)	8.68	7.46	6.48	9.82	9.22	6.70	10.05	6.22	3.62	3.24	2.19	4.96	4.40	2.45	5.03	2.09
Pu (kip)	44.30	45.73	42.15	48.93	47.66	43.21	48.81	42.41	18.86	20.78	16.15	24.76	23.09	17.38	24.51	16.46

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.57	43.29	40.63	46.12	44.96	41.41	46.04	40.75
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 3556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
48.93	24.46	OK	24.76	12.38	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	48.93	1.47	91.65	OK
Web SPL	24.46	1.47	91.65	OK

Field Splice - Node 5556

Node 5556

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	192
Web	78
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
5556 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
5556 R	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 5556 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	94.75	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	94.75	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-33.21	-8.70	-37.65	-18.60	-28.55	-18.37	-43.71	-7.98	-42.57	-13.11	-29.93	-16.37	-43.81	-6.48	-28.31	-20.14
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.48	0.13	0.54	0.27	0.41	0.26	0.63	0.11	0.61	0.19	0.43	0.24	0.63	0.09	0.41	0.29
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-33.21		-37.65		-28.55		-43.71		-42.57		-29.93		-43.81		-28.31	
Fcf (ksi)	-52.17		-53.72		-52.17		-56.77		-56.20		-52.17		-56.82		-52.17	
Fcf (kip)	-7043.57		-7252.68		-7043.57		-7664.39		-7587.23		-7043.57		-7671.35		-7043.57	
fncf (ksi)		-8.70		-18.60		-18.37		-7.98		-13.11		-16.37		-6.48		-20.14
Rcf		1.19		1.23		1.19		1.30		1.28		1.19		1.30		1.19
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-24.51	-5.62	-27.90	-13.40	-21.29	-13.42	-32.15	-4.88	-31.59	-9.30	-22.39	-11.69	-32.26	-3.79	-21.08	-14.71
Fs (ksi)	-24.51	-5.62	-27.90	-13.40	-21.29	-13.42	-32.15	-4.88	-31.59	-9.30	-22.39	-11.69	-32.26	-3.79	-21.08	-14.71
Fs (kip)	-3308.68	-758.84	-3766.38	-1808.63	-2873.94	-1811.28	-4340.65	-658.77	-4264.95	-1256.00	-3022.07	-1578.34	-4354.85	-511.71	-2845.64	-1985.97

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	0.00	0.00	0.00
Comp	7671.35	7043.57	4354.85	1985.97

$\phi v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	575.73	672.15	502.85	791.26	706.56	576.69	776.53	522.69	419.64	484.92	365.30	571.91	509.23	420.32	561.51	379.32
Vuw (kip)	863.60	1008.23	754.27	1091.63	1049.28	865.04	1084.27	784.04	---	---	---	---	---	---	---	---
Mv (k*ft)	485.77	567.13	424.28	614.04	590.22	486.59	609.90	441.02	236.05	272.77	205.48	321.70	286.44	236.43	315.85	213.37
Huw (kip)	-1493.08	-1828.72	-1769.45	-1602.15	-1743.98	-1712.41	-1557.05	-1820.13	-723.12	-991.11	-832.93	-888.79	-981.50	-817.85	-865.17	-858.95
Muw (k*ft)	663.85	489.35	479.61	737.38	624.65	517.63	769.09	445.82	302.20	232.03	125.94	436.37	356.62	171.11	455.48	101.89
Mu (k*ft)	1149.63	1056.48	903.89	1351.42	1214.87	1004.22	1378.99	886.84	538.25	504.79	331.43	758.07	643.06	407.54	771.33	315.25

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	19.14	23.45	22.69	20.54	22.36	21.95	19.96	23.34	9.27	12.71	10.68	11.39	12.58	10.49	11.09	11.01
PY1 (Vuw)	11.07	12.93	9.67	14.00	13.45	11.09	13.90	10.05	5.38	6.22	4.68	7.33	6.53	5.39	7.20	4.86
PX2 (Mu)	20.91	19.22	16.44	24.58	22.10	18.27	25.08	16.13	9.79	9.18	6.03	13.79	11.70	7.41	14.03	5.73
PY2 (Mu)	8.71	8.01	6.85	10.24	9.21	7.61	10.45	6.72	4.08	3.83	2.51	5.75	4.87	3.09	5.85	2.39
Pu (kip)	44.67	47.52	42.47	51.22	49.90	44.35	51.21	42.88	21.28	24.08	18.19	28.38	26.82	19.80	28.31	18.25

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4862.81	3563.63	146.66	93.13	47.23	6884.56	3563.63	OK
TF Inside	0.00	4887.75	3480.75	315.88	200.59	40.47	10663.29	3480.75	OK
BF Inside	0.00	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	0.00	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3825.87	4606.88	OK
TF Inside	3845.49	4630.50	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.83	44.93	40.94	48.48	47.29	42.39	48.52	41.19
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1091.63
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 5556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3845.49	20.03	OK	2182.99	11.37	OK
BF	3568.13	27.03	OK	1006.05	7.62	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3825.87	19.93	1.47	194.76	OK
TF	7671.35	39.95	1.47	359.55	OK
TF Inside	3845.49	20.03	1.47	209.74	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.22	25.61	OK	28.38	14.19	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.22	1.47	91.65	OK
Web SPL	25.61	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.20
TF Inside	NA	1.20
BF Inside	NA	1.02
BF Outside	NA	1.02

Bolt	Shear	Slip	Bearing
TF	1.81	1.48	9.00
Web	1.23	1.28	1.83
BF	1.34	2.21	5.69

Plate	Shear	Flexure
Web	1.50	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-29.61	-6.90	-34.07	-16.41	-25.95	-16.52	-39.48	-6.37	-36.40	-9.09	-28.61	-16.05	-39.06	-4.47	-26.62	-19.05
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.43	0.10	0.49	0.24	0.37	0.24	0.57	0.09	0.52	0.13	0.41	0.23	0.56	0.06	0.38	0.27
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-29.61		-34.07		-25.95		-39.48		-36.40		-28.61		-39.06		-26.62	
Fcf (ksi)	-52.17		-52.17		-52.17		-54.65		-53.10		-52.17		-54.44		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7377.45		-7168.30		-7043.57		-7348.99		-7043.57	
fncf (ksi)		-6.90		-16.41		-16.52		-6.37		-9.09		-16.05		-4.47		-19.05
Rcf		1.32		1.32		1.32		1.38		1.34		1.32		1.38		1.32
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.63518	-5.088548	-24.68532	-11.98092	-18.95136	-12.05545	-28.60737	-4.714569	-26.33591	-6.809942	-20.92312	-11.55437	-28.31138	-3.372139	-19.42	-13.84
Fs (ksi)	-21.64	-5.09	-24.69	-11.98	-18.95	-12.06	-28.61	-4.71	-26.34	-6.81	-20.92	-11.55	-28.31	-3.37	-19.42	-13.84
Fs (kip)	-2920.75	-686.95	-3332.52	-1617.42	-2558.43	-1627.49	-3861.99	-636.47	-3555.35	-919.34	-2824.62	-1559.84	-3822.04	-455.24	-2621.94	-1868.83

Vu (kip)	575.73	672.15	502.85	791.26	706.56	576.69	776.53	522.69	419.64	484.92	365.30	571.91	509.23	420.32	561.51	379.32
Vuw (kip)	863.60	1008.23	754.27	1091.63	1049.28	865.04	1084.27	784.04	---	---	---	---	---	---	---	---
Mv (k*ft)	485.77	567.13	424.28	614.04	590.22	486.59	609.90	441.02	236.05	272.77	205.48	321.70	286.44	236.43	315.85	213.37
Huw (kip)	-1463.12	-1764.98	-1768.33	-1514.89	-1560.01	-1753.36	-1446.17	-1848.58	-641.37	-879.99	-744.16	-799.73	-795.50	-779.46	-760.40	-798.36
Muw (k*ft)	683.83	482.59	480.35	727.96	648.62	490.33	767.07	426.86	264.75	203.27	110.33	382.28	312.42	149.90	399.03	89.26
Mu (k*ft)	1169.60	1049.71	904.63	1342.00	1238.84	976.92	1376.97	867.88	500.79	476.04	315.82	703.98	598.86	386.33	714.88	302.63

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 5556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	18.76	22.63	22.67	19.42	20.00	22.48	18.54	23.70	8.22	11.28	9.54	10.25	10.20	9.99	9.75	10.24
PY1 (Vuw)	11.07	12.93	9.67	14.00	13.45	11.09	13.90	10.05	5.38	6.22	4.68	7.33	6.53	5.39	7.20	4.86
PX2 (Mu)	21.27	19.09	16.45	24.41	22.53	17.77	25.05	15.79	9.11	8.66	5.74	12.80	10.89	7.03	13.00	5.50
PY2 (Mu)	8.86	7.96	6.86	10.17	9.39	7.40	10.44	6.58	3.80	3.61	2.39	5.34	4.54	2.93	5.42	2.29
Pu (kip)	44.72	46.65	42.47	50.05	48.28	44.29	49.92	42.84	19.61	22.23	16.84	26.31	23.82	18.94	26.02	17.29

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	42.89	44.00	40.94	47.21	45.56	42.30	47.13	41.13
Check	OK	OK	OK	OK	OK	OK	OK	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.05	25.03	OK	26.31	13.15	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.05	1.47	91.65	OK
Web SPL	25.03	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 7556	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

\\kcow00\Jobs\49633\Bridges\Design\Final Design\Unit 2\Walsh CW Check\[Field Splice Legs.xlsm]Type LL

Field Splice - Node 7556

Node 7556

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	192
Web	78
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
7556 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
7556 R	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 7556 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	94.75	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	94.75	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-33.57	-4.67	-37.94	-11.50	-29.49	-13.89	-42.60	-3.07	-41.18	-7.07	-31.71	-10.96	-43.15	2.97	-28.86	-15.38
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.48	0.07	0.55	0.17	0.42	0.20	0.61	0.04	0.59	0.10	0.46	0.16	0.62	0.04	0.41	0.22
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-33.57		-37.94		-29.49		-42.60		-41.18		-31.71		-43.15		-28.86	
Fcf (ksi)	-52.17		-53.87		-52.17		-56.22		-55.50		-52.17		-56.49		-52.17	
Fcf (kip)	-7043.57		-7272.38		-7043.57		-7589.26		-7492.70		-7043.57		-7626.48		-7043.57	
fncf (ksi)		-4.67		-11.50		-13.89		-3.07		-7.07		-10.96		2.97		-15.38
Rcf		1.21		1.25		1.21		1.30		1.29		1.21		1.31		1.21
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		5161.76		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.04	-2.68	-28.22	-8.05	-22.03	-9.96	-31.64	-1.33	-30.67	-4.76	-23.73	-7.46	-32.06	2.80	-21.55	-11.06
Fs (ksi)	-25.04	-2.68	-28.22	-8.05	-22.03	-9.96	-31.64	-1.33	-30.67	-4.76	-23.73	-7.46	-32.06	2.80	-21.55	-11.06
Fs (kip)	-3380.63	-362.40	-3810.05	-1086.84	-2974.58	-1344.51	-4271.62	-180.18	-4140.63	-643.25	-3203.32	-1006.95	-4328.26	378.47	-2908.66	-1492.61

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5161.76	0.00	378.47
Comp	7626.48	7043.57	4328.26	1492.61

$\phi v Vn$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	583.32	693.54	515.23	784.71	703.22	612.09	771.18	530.84	426.76	500.58	374.61	569.05	507.42	447.09	559.48	385.63
Vuw (kip)	874.99	1040.31	772.84	1088.36	1047.61	918.14	1081.59	796.26	---	---	---	---	---	---	---	---
Mv (k*ft)	492.18	585.17	434.73	612.20	589.28	516.45	608.39	447.90	240.05	281.58	210.72	320.09	285.43	251.49	314.71	216.92
Huw (kip)	-1380.01	-1629.47	-1647.49	-1436.82	-1542.12	-1562.58	-1254.03	-1690.77	-665.43	-870.56	-767.84	-791.43	-850.47	-748.49	-702.19	-782.45
Muw (k*ft)	739.23	626.83	560.91	829.91	736.96	617.52	960.54	532.06	357.72	322.75	193.19	484.91	414.51	260.31	557.83	167.83
Mu (k*ft)	1231.41	1212.00	995.64	1442.11	1326.24	1133.98	1568.93	979.95	597.77	604.33	403.91	805.00	699.93	511.80	872.54	384.75

Note: Mu = Muw + Mv

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.69	20.89	21.12	18.42	19.77	20.03	16.08	21.68	8.53	11.16	9.84	10.15	10.90	9.60	9.00	10.03
PY1 (Vuw)	11.22	13.34	9.91	13.95	13.43	11.77	13.87	10.21	5.47	6.42	4.80	7.30	6.51	5.73	7.17	4.94
PX2 (Mu)	22.40	22.04	18.11	26.23	24.12	20.63	28.54	17.82	10.87	10.99	7.35	14.64	12.73	9.31	15.87	7.00
PY2 (Mu)	9.33	9.19	7.55	10.93	10.05	8.59	11.89	7.43	4.53	4.58	3.06	6.10	5.30	3.88	6.61	2.92
Pu (kip)	45.05	48.48	42.94	51.12	49.78	45.47	51.52	43.26	21.83	24.73	18.90	28.18	26.42	21.21	28.44	18.76

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4862.81	3563.63	146.66	93.13	47.23	6884.56	3563.63	OK
TF Inside	0.00	4887.75	3480.75	315.88	200.59	40.47	10663.29	3480.75	OK
BF Inside	2614.84	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2546.92	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3803.49	4606.88	OK
TF Inside	3822.99	4630.50	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.20	45.83	41.41	48.41	47.21	43.34	48.89	41.61
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	1088.36
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 7556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3822.99	19.91	OK	2169.67	11.30	OK
BF	3568.13	27.03	OK	756.13	5.73	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3803.49	19.81	1.47	194.76	OK
TF	7626.48	39.72	1.47	359.55	OK
TF Inside	3822.99	19.91	1.47	209.74	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
51.52	25.76	OK	28.44	14.22	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	51.52	1.47	91.65	OK
Web SPL	25.76	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.21
TF Inside	NA	1.21
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.82	1.49	9.05
Web	1.23	1.28	1.83
BF	1.34	2.94	5.69

Plate	Shear	Flexure
Web	1.51	1.06

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-30.05	-3.27	-35.18	-10.68	-26.68	-12.22	-39.15	-2.51	-36.06	-4.45	-30.52	-11.29	-38.85	-0.74	-27.03	-14.54
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.43	0.05	0.51	0.15	0.38	0.18	0.56	0.04	0.52	0.06	0.44	0.16	0.56	0.01	0.39	0.21
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-30.05		-35.18		-26.68		-39.15		-36.06		-30.52		-38.85		-27.03	
Fcf (ksi)	-52.17		-52.48		-52.17		-54.48		-52.93		-52.17		-54.33		-52.17	
Fcf (kip)	-7043.57		-7084.96		-7043.57		-7354.77		-7145.01		-7043.57		-7334.65		-7043.57	
fncf (ksi)		-3.27		-10.68		-12.22		-2.51		-4.45		-11.29		-0.74		-14.54
Rcf		1.33		1.34		1.33		1.39		1.35		1.33		1.39		1.33
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-21.99345	-2.407269	-25.51952	-7.847849	-19.51473	-8.9368	-28.4216	-1.871079	-26.14418	-3.448622	-22.32747	-8.074636	-28.21232	-0.62294	-19.76	-10.57
Fs (ksi)	-21.99	-2.41	-25.52	-7.85	-19.51	-8.94	-28.42	-1.87	-26.14	-3.45	-22.33	-8.07	-28.21	-0.62	-19.76	-10.57
Fs (kip)	-2969.12	-324.98	-3445.14	-1059.46	-2634.49	-1206.47	-3836.92	-252.60	-3529.46	-465.56	-3014.21	-1090.08	-3808.66	-84.10	-2668.14	-1427.61

Vu (kip)	583.32	693.54	515.23	784.71	703.22	612.09	771.18	530.84	426.76	500.58	374.61	569.05	507.42	447.09	559.48	385.63
Vuw (kip)	874.99	1040.31	772.84	1088.36	1047.61	918.14	1081.59	796.26	---	---	---	---	---	---	---	---
Mv (k*ft)	492.18	585.17	434.73	612.20	589.28	516.45	608.39	447.90	240.05	281.58	210.72	320.09	285.43	251.49	314.71	216.92
Huw (kip)	-1349.02	-1595.26	-1635.24	-1383.27	-1406.75	-1605.58	-1320.65	-1709.39	-585.62	-800.82	-682.84	-727.02	-710.23	-729.65	-692.05	-728.13
Muw (k*ft)	759.90	605.48	569.08	810.37	745.30	588.85	847.38	519.64	313.38	282.75	169.25	424.81	363.13	228.05	441.43	147.03
Mu (k*ft)	1252.08	1190.66	1003.81	1422.57	1334.58	1105.31	1455.77	967.54	553.43	564.33	379.96	744.90	648.55	479.53	756.14	363.94

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.30	20.45	20.96	17.73	18.04	20.58	16.93	21.92	7.51	10.27	8.75	9.32	9.11	9.35	8.87	9.34
PY1 (Vuw)	11.22	13.34	9.91	13.95	13.43	11.77	13.87	10.21	5.47	6.42	4.80	7.30	6.51	5.73	7.17	4.94
PX2 (Mu)	22.77	21.66	18.26	25.87	24.27	20.10	26.48	17.60	10.07	10.26	6.91	13.55	11.80	8.72	13.75	6.62
PY2 (Mu)	9.49	9.02	7.61	10.78	10.11	8.38	11.03	7.33	4.19	4.28	2.88	5.65	4.92	3.63	5.73	2.76
Pu (kip)	45.10	47.68	42.96	50.14	48.42	45.40	50.04	43.23	20.06	23.15	17.45	26.28	23.82	20.36	26.05	17.72

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	43.27	44.95	41.44	47.33	45.74	43.25	47.28	41.57
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 7556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
50.14	25.07	OK	26.28	13.14	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	50.14	1.47	91.65	OK
Web SPL	25.07	1.47	91.65	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

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Field Splice - Node 9556

Node 9556

Resisance Factors (6.5.4.2)

ϕf	1.00
ϕv	1.00
ϕc	0.90
ϕu	0.80
ϕy	0.95
ϕbb	0.80
ϕs	0.80
ϕbs	0.80
ϕvu	0.80

A325 Bolt

Dia. (in)	1.0
A (in2)	0.79
Fub (ksi)	120
Hole (in)	1.06

(6.13.2.4.2-1)

	No. Bolt
TF	192
Web	78
BF	132

Determine Controlling Section

	Top Flange			Bottom Flange			Web		
Section	Area	ϕf Fnc	A*Fnc	Area	ϕf Fnc	A*Fnc	Area	Fyw	A*Fyw
9556 L	135.00	69.57	9391.43	135.00	69.57	9391.43	48.00	50.00	2400.00
9556 R	144.00	68.43	9854.45	135.00	69.35	9362.40	72.00	50.00	3600.00

Rh = 0.99

Controlling Section = 9556 L

Section and Material Properties

		b (in)	t (in)	L (in)	Ag (in2)	An (in2)	Ae (in2)	Fy (ksi)	Fu (ksi)
Girder Section	TF	45.00	3.00	---	135.00	96.75	98.93	70	85
	Web	48.00	1.00	---	48.00	34.19	---	50	65
	BF	45.00	3.00	---	135.00	96.75	98.93	70	85
Splice Plates	TF Outside	45.00	1.625	94.75	73.13	52.41	---	70	85
	TF Inside	21.00	1.750	94.75	73.50	51.19	---	70	85
	BF Inside	21.00	1.375	68.50	57.75	40.22	---	70	85
	BF Outside	45.00	1.250	68.50	56.25	40.31	---	70	85
	Web	41.00	1.000	38.50	82.00	54.38	---	50	65

Max Outer to Inner stress ratio
0.888889

N.A. (from I 27 in
Outer to Inr 0.8888889
Outer to Inr 0.8888889

Outer to Mi 0.9444444
Outer to Mi 0.9444444

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-25.93	-2.35	-27.84	-11.64	-22.31	-11.16	-33.63	-3.01	-28.52	-6.37	-26.82	-9.78	-33.88	2.17	-22.46	-13.82
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.37	0.03	0.40	0.17	0.32	0.16	0.48	0.04	0.41	0.09	0.39	0.14	0.49	0.03	0.32	0.20
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-25.93		-27.84		-22.31		-33.63		-28.52		-26.82		-33.88		-22.46	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-2.35		-11.64		-11.16		-3.01		-6.37		-9.78		2.17		-13.82
Rcf		1.54		1.54		1.54		1.54		1.54		1.54		1.54		1.54
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		5161.76		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-19.57	-1.28	-20.75	-8.23	-16.73	-7.99	-25.15	-1.60	-21.35	-4.38	-20.08	-6.68	-25.39	2.10	-16.79	-9.93
Fs (ksi)	-19.57	-1.28	-20.75	-8.23	-16.73	-7.99	-25.15	-1.60	-21.35	-4.38	-20.08	-6.68	-25.39	2.10	-16.79	-9.93
Fs (kip)	-2642.05	-172.27	-2800.73	-1111.20	-2258.97	-1079.21	-3395.66	-215.55	-2882.17	-591.93	-2711.47	-901.68	-3428.14	284.11	-2265.98	-1340.12

Max Flange Design Forces

	Strength I		Service II	
Pu	TF	BF	TF	BF
Tension	0.00	5161.76	0.00	284.11
Comp	7043.57	7043.57	3428.14	1340.12

$\phi_v V_n$ (kip) = 1392.00

e_v (in) = 6.75

Web Design Forces (6.13.6.1.4b)

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Vu (kip)	464.74	536.33	417.16	640.52	517.52	504.78	624.80	432.20	342.79	389.72	305.53	466.98	376.44	371.07	455.87	316.16
Vuw (kip)	697.11	804.49	625.74	960.78	776.28	757.16	937.21	648.30	---	---	---	---	---	---	---	---
Mv (k*ft)	392.13	452.52	351.98	540.44	436.66	425.91	527.18	364.67	192.82	219.22	171.86	262.67	211.75	208.73	256.43	177.84
Huw (kip)	-1331.42	-1674.63	-1656.83	-1355.72	-1479.81	-1605.96	-1164.30	-1755.22	-500.32	-695.45	-593.45	-641.99	-617.62	-642.34	-558.94	-641.08
Muw (k*ft)	771.63	542.82	554.69	755.42	672.70	588.60	883.04	489.09	292.71	200.24	139.82	376.90	271.44	214.49	439.97	109.73
Mu (k*ft)	1163.75	995.34	906.67	1295.86	1109.36	1014.51	1410.22	853.76	485.53	419.46	311.69	639.58	483.18	423.22	696.40	287.57

Note: Mu = Muw + Mv

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	Cleveland InnerBelt : Field Splice - Node 9556	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Web Bolt Force

	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	17.07	21.47	21.24	17.38	18.97	20.59	14.93	22.50	6.41	8.92	7.61	8.23	7.92	8.24	7.17	8.22
PY1 (Vuw)	8.94	10.31	8.02	12.32	9.95	9.71	12.02	8.31	4.39	5.00	3.92	5.99	4.83	4.76	5.84	4.05
PX2 (Mu)	21.17	18.10	16.49	23.57	20.18	18.45	25.65	15.53	8.83	7.63	5.67	11.63	8.79	7.70	12.67	5.23
PY2 (Mu)	8.82	7.54	6.87	9.82	8.41	7.69	10.69	6.47	3.68	3.18	2.36	4.85	3.66	3.21	5.28	2.18
Pu (kip)	42.16	43.42	40.57	46.55	43.24	42.74	46.50	40.80	17.25	18.46	14.69	22.63	18.74	17.81	22.74	14.82

Note: $Pu = \sqrt{((PX1 + PX2)^2 + (PY1 + PY2)^2)}$

Splice Plate Design

Flange Splice Plates in Tension (6.13.5.2)

	Pu (kip)	Pry (kip)	Pru (kip)	Avg (in2)	Avn (in2)	Atn (in2)	Prbs (kip)	Rr (kip)	Check
TF Outside	0.00	4862.81	3563.63	146.66	93.13	47.23	6884.56	3563.63	OK
TF Inside	0.00	4887.75	3480.75	315.88	200.59	40.47	10663.29	3480.75	OK
BF Inside	2614.84	3840.38	2734.88	176.00	114.64	31.80	6683.61	2734.88	OK
BF Outside	2546.92	3740.63	2741.25	80.00	52.11	36.33	4525.51	2741.25	OK

Tension Plate Parameters

U	1.0	
Rp	1.0	assumed drilled holes
Ubs	1.0	

Flange Splice Plates in Compression (6.13.6.1.4c)

	Pu (kip)	Rr (kip)	Check
TF Outside	3512.78	4606.88	OK
TF Inside	3530.79	4630.50	OK
BF Inside	3568.13	3638.25	OK
BF Outside	3475.45	3543.75	OK

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.16	41.74	39.62	44.29	41.80	41.31	44.40	39.69
Check	OK	OK	OK	OK	OK	OK	OK	OK

S (in3) = 560.3

Web Splice Plates in Shear (6.13.5.3)

Vu (kip)	960.78
Rr (kip)	1639.95
Check	OK

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633	Revised	DJG	Date	5/15/2012
		Checked	MTB	Date	8/5/2011			Checked	SJL	Date	5/16/2012
For	**Cleveland InnerBelt : Field Splice - Node 9556**	Backchk'd	WME	Date	8/5/2011	Sheet No.		Backchk'd	DJG	Date	5/16/2012

Splice Bolt Design

Shear Resistance (6.13.2.7 & 6.13.6.1.5)

Ns = 1

	Fill Pl (in)	R_{fill}	R_{length}	Rr (kip)
TF	0.00	1.00	1.0	36.19
Web	0.25	0.85	1.0	30.78
BF	0.00	1.00	1.0	36.19

Slip Resistance (6.13.2.8)

Kh	1.0	
Ks	0.33	(Class A)
Ns	1.0	
Pt	51.0	
Rr	16.83	

0.48 Threads included set for flanges

0.48 Threads excluded set for webs

Flange Bolt

	Shear Resistance			Slip Resistance		
	Pu (kip)	Pu/Bolt	Check	Ps	Ps/Bolt	Check
TF	3530.79	18.39	OK	1718.45	8.95	OK
BF	3568.13	27.03	OK	678.87	5.14	OK

	Bearing Resistance (6.13.2.9)				
	Pu	Pu/Bolt	Lc	Rr (kip)	Check
TF Outside	3512.78	18.30	1.47	194.76	OK
TF	7043.57	36.69	1.47	359.55	OK
TF Inside	3530.79	18.39	1.47	209.74	OK
BF Inside	3568.13	27.03	1.47	164.79	OK
BF	7043.57	53.36	1.47	359.55	OK
BF Outside	3475.45	26.33	1.47	149.81	OK

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.55	23.28	OK	22.74	11.37	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.55	1.47	91.65	OK
Web SPL	23.28	1.47	91.65	OK

Design Factor of Safety Summary

Plate	Tension	Comp
TF Outside	NA	1.31
TF Inside	NA	1.31
BF Inside	1.05	1.02
BF Outside	1.08	1.02

Bolt	Shear	Slip	Bearing
TF	1.97	1.88	9.80
Web	1.32	1.58	1.97
BF	1.34	3.27	5.69

Plate	Shear	Flexure
Web	1.71	1.13

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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For use in Web Splice MY components of stress in flanges not included for web splices.

Flange Design Forces Strength I-V (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-23.73	-1.87	-26.68	-11.67	-21.17	-10.84	-31.57	-3.20	-25.67	-5.13	-25.66	-9.87	-31.22	-0.04	-21.68	-13.68
ϕf Fnc (ksi)	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57	69.57
f / ϕf Fnc	0.34	0.03	0.38	0.17	0.30	0.16	0.45	0.05	0.37	0.07	0.37	0.14	0.45	0.00	0.31	0.20
α	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
fcf (ksi)	-23.73		-26.68		-21.17		-31.57		-25.67		-25.66		-31.22		-21.68	
Fcf (ksi)	-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17	
Fcf (kip)	-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57	
fncf (ksi)		-1.87		-11.67		-10.84		-3.20		-5.13		-9.87		-0.04		-13.68
Rcf		1.65		1.65		1.65		1.65		1.65		1.65		1.65		1.65
Fncf (ksi)		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17		-52.17
Fncf (kip)		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57		-7043.57

Flange Design Forces - Service II (6.13.6.1.4c)

	MAX FX		MIN FX		MAX FY		MIN FY		MAX MY		MIN MY		MAX MZ		MIN MZ	
	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF	TF	BF
f (ksi)	-17.49181	-1.464716	-19.49261	-8.528815	-15.59662	-7.940823	-23.03515	-2.398466	-18.77463	-3.912562	-18.85705	-7.112783	-22.7832	-0.169576	-15.96	-9.95
Fs (ksi)	-17.49	-1.46	-19.49	-8.53	-15.60	-7.94	-23.04	-2.40	-18.77	-3.91	-18.86	-7.11	-22.78	-0.17	-15.96	-9.95
Fs (kip)	-2361.39	-197.74	-2631.50	-1151.39	-2105.54	-1072.01	-3109.75	-323.79	-2534.58	-528.20	-2545.70	-960.23	-3075.73	-22.89	-2154.67	-1343.57

Vu (kip)	464.74	536.33	417.16	640.52	517.52	504.78	624.80	432.20	342.79	389.72	305.53	466.98	376.44	371.07	455.87	316.16
Vuw (kip)	697.11	804.49	625.74	960.78	776.28	757.16	937.21	648.30	---	---	---	---	---	---	---	---
Mv (k*ft)	392.13	452.52	351.98	540.44	436.66	425.91	527.18	364.67	192.82	219.22	171.86	262.67	211.75	208.73	256.43	177.84
Huw (kip)	-1318.75	-1707.18	-1674.18	-1371.16	-1448.06	-1635.79	-1246.05	-1787.09	-454.96	-672.51	-564.90	-610.41	-544.49	-623.28	-550.87	-621.91
Muw (k*ft)	780.08	521.12	543.12	745.13	693.87	568.72	828.54	467.85	256.43	175.42	122.49	330.19	237.79	187.91	361.82	96.13
Mu (k*ft)	1172.20	973.64	895.10	1285.57	1130.52	994.62	1355.72	832.52	449.25	394.64	294.36	592.86	449.54	396.63	618.25	273.97

HNTB	The HNTB Companies Engineers Architects Planners	Made	WME	Date	8/5/2011	Job Number	49633
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	Strength I								Service II							
	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
PX1 (Huw)	16.91	21.89	21.46	17.58	18.56	20.97	15.97	22.91	5.83	8.62	7.24	7.83	6.98	7.99	7.06	7.97
PY1 (Vuw)	8.94	10.31	8.02	12.32	9.95	9.71	12.02	8.31	4.39	5.00	3.92	5.99	4.83	4.76	5.84	4.05
PX2 (Mu)	21.32	17.71	16.28	23.38	20.56	18.09	24.66	15.14	8.17	7.18	5.35	10.78	8.18	7.21	11.25	4.98
PY2 (Mu)	8.88	7.38	6.78	9.74	8.57	7.54	10.27	6.31	3.40	2.99	2.23	4.49	3.41	3.01	4.69	2.08
Pu (kip)	42.18	43.37	40.54	46.52	43.29	42.70	46.35	40.77	16.03	17.70	14.02	21.36	17.25	17.07	21.12	14.33

Web Splice Plates in Axial Flexure (6.13.6.1.4b)

	MAX FX	MIN FX	MAX FY	MIN FY	MAX MY	MIN MY	MAX MZ	MIN MZ
Stress (ksi)	41.19	41.67	39.59	44.25	41.87	41.25	44.23	39.62
Check	OK	OK	OK	OK	OK	OK	OK	OK

HNTB The HNTB Companies Engineers Architects Planners		Made	WME	Date	8/5/2011	Job Number	49633
		Checked	MTB	Date	8/5/2011		
For	Cleveland InnerBelt : Field Splice - Node 9556	Backchk'd	WME	Date	8/5/2011	Sheet No.	

Web Bolt

Shear Resistance			Slip Resistance		
Pu (dbl)	Pu (sngl)	Check	Ps (dbl)	Ps (sngl)	Check
46.52	23.26	OK	21.36	10.68	OK

	Bearing Resistance (6.13.2.9)			
	Pu/Bolt	Lc	Rr (kip)	Check
Web	46.52	1.47	91.65	OK
Web SPL	23.26	1.47	91.65	OK