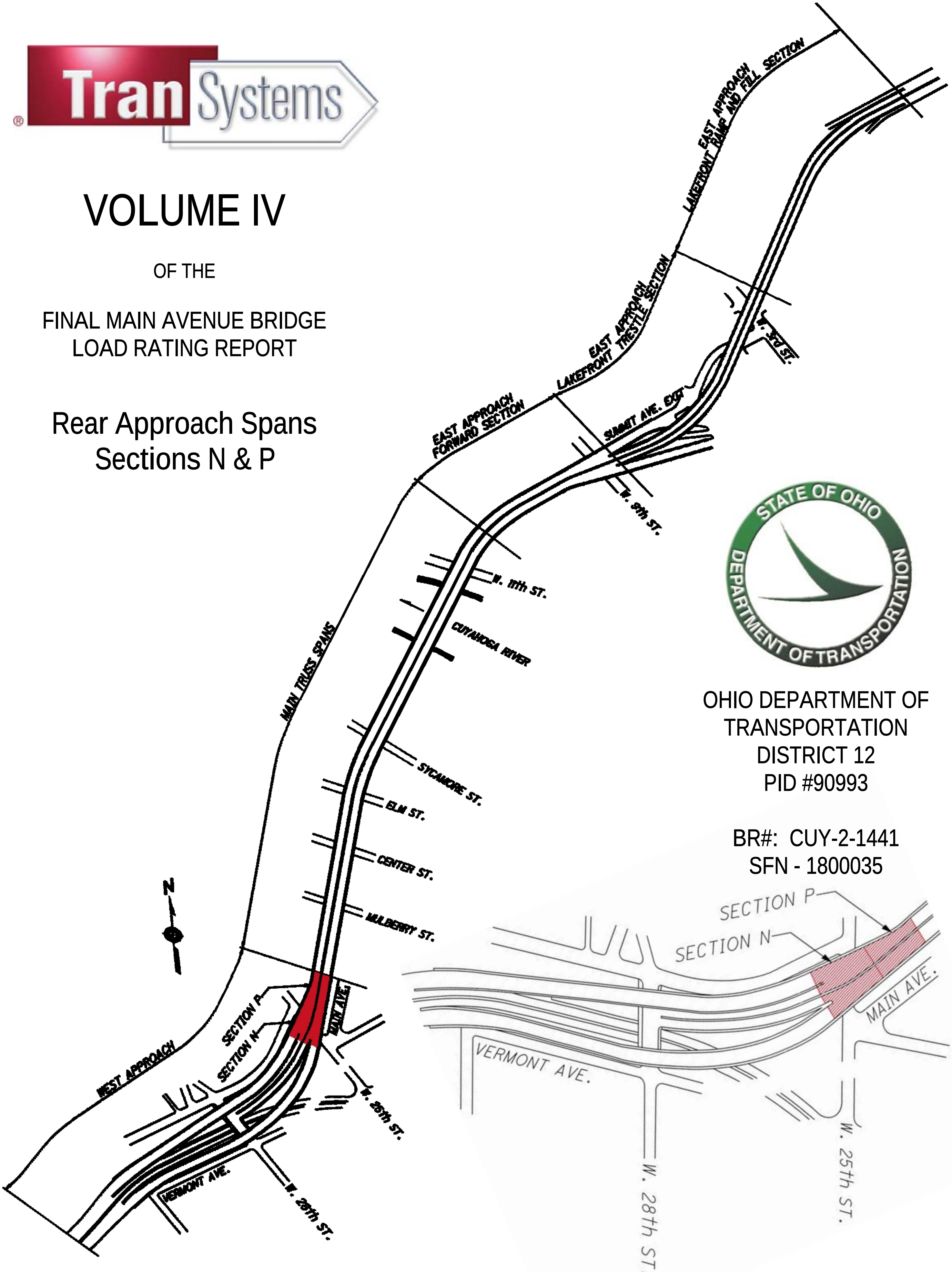
VOLUME IV

OF THE

FINAL MAIN AVENUE BRIDGE
LOAD RATING REPORT

Rear Approach Spans
Sections N & P



OHIO DEPARTMENT OF
TRANSPORTATION
DISTRICT 12
PID #90993

BR#: CUY-2-1441
SFN - 1800035

Volume IV - Section Description

The CUY-2-1441 (Main Avenue) Bridge carries four to six lanes of State Route 2 traffic for 6580 feet through downtown Cleveland, over numerous local streets, RTA railroad tracks, Norfolk Southern/CSX railroad tracks and the Cuyahoga River. The bridge was fabricated and erected from 1938 to 1940. The West Approach, Main Truss Spans, and East Approach – Forward sections were opened to traffic on October 6, 1939; and the Lakefront Trestle and Lakefront Ramp were opened to traffic in 1940. The bridge was closed for a major rehabilitation project from April 13, 1991 to October 6, 1992. Work included replacing and widening of the deck, updating safety features, improving the drainage system, installing new floor system members, and strengthening or replacing deteriorated sections. The Main Avenue Bridge consists of five distinct sections (West Approach, Main Truss Spans, East Approach – Forward Section, East Approach – Lakefront Trestle, East Approach – Lakefront Ramp Section) of varying structure types within each section.

The West Approach section consists of similar eastbound and westbound structures, each carrying three lanes of traffic from West 29th Street to 250' east of West 25th Street. These structures merge into one structure near West 25th Street. Sections N and P are in the West Approach and form the six-lane divided rear approach spans to the main truss spans.

Section N consists of steel stringers supported on steel floorbeams that frame into steel girders supported by steel columns and concrete columns. There are three stringer units with simple span, 2-span continuous, and 3-span continuous stringer types in each unit. The span lengths are typically around 25'-0". The fascia stringers are plate girders, while the interior stringers are rolled beams. The number of stringers varies by unit. The floorbeams are rolled steel beams. There are three plate girders in Section N; two are simple span and one is 2-span continuous. The spans range between 45'-0" and 82'-0". The steel columns are rolled shapes. The other columns are reinforced concrete.

Section P is composed of reinforced concrete stringers and diaphragms supported by reinforced concrete floorbeams and reinforced concrete columns. The concrete stringers frame into the floorbeams and typically span 38'-0". The concrete floorbeams are haunched and typically span 21'-0" between the columns.

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BRIDGE LOAD RATING SUMMARY REPORT

CUY-2-1441

SECTION N

SFN	BRIDGE NUMBER	DISTRICT
1800035	CUY-2-1441	12
ORIGINAL CONSTRUCTION YEAR	**REHABILITATION YEAR**	**OVERALL STRUCTURE LENGTH (FT)**
1938 - 1940	1991 - 1992	6580
FEATURE INTERSECTED:	NUMEROUS LOCAL STREETS, RTA RAILROAD TRACKS AND THE CUYAHOGA RIVER	
SPECIAL ASSUMPTIONS & COMMENTS		
RATING & ANALYSIS OPTION:		
LOAD RATING PURPOSE:	LOAD RATING FOR FUTURE REHABILITATION RECOMMENDATIONS	
RATING SOFTWARE:	PCA COLUMN, MDX	
BASIS OF ANALYSIS:	EXISTING PLANS AND FIELD MEASUREMENTS	
METHOD OF ANALYSIS:	LOAD FACTOR	
DESIGN LOADING (ORIGINAL):	H20-33	
STRUCTURE RATING SUMMARY		
LOADING & RATING TYPE	**RATING FACTOR - RF (ROUNDED TO 2 DECIMAL POINTS**	**RATING LOAD**
INVENTORY CURRENT DESIGN	0.83	HS16.6
OPERATING CURRENT DESIGN	1.38	
OHIO LEGAL - 2F1	2.79	**OHIO LEGAL LOADS OVERALL MINIMUM RATING FACTOR**
OHIO LEGAL - 3F1	1.96	1.71
OHIO LEGAL - 4F1	1.74	**OHIO LEGAL LOADS OVERALL CONTROLLING TRUCK**
OHIO LEGAL - 5C1	1.71	5C1
RATED BY, PE#	**REVIEWED BY, PE#**	**REPORT DATE**
George Dai, PE 73577	Don Pawlowski, EI	3/2/2012
AGENCY/FIRM	**PHONE NUMBER**	**EMAIL**
TranSystems	216-861-1780	hgdai@transystems.com

SFN: 1800035 **BRIDGE NO.:** CUY-2-1441

SUMMARY SHEET

West Approach - Section N

CUY-2-1441 Load Rating Analysis
Main Ave Bridge

Calculated:	GHD	2/16/2012
Checked:	DMP	2/25/2012
Revised:	CTG	5/14/2012

As-Built Controlling Rating Factor Summary

Item	Location/ Member	HS20 Inventory	HS20 Operating	2F1 Operating	3F1 Operating	4F1 Operating	5C1 Operating	Fatigue
Deck		1.22	2.03	3.25	3.82	4.64	3.82	
Stringer	Unit 2 Stringer S3-2	1.14	1.91	2.83	2.02	1.91	2.15	112 Years
Floorbeam	FB-13	0.84	1.40	2.79	1.96	1.75	2.00	70 Years
Girder	G2	0.83	1.38	3.00	1.99	1.74	1.71	167 Years
Column	CN23	1.05	1.75	3.45	2.44	2.19	2.51	---

As-Inspected Controlling Rating Factor Summary

Item	Location/ Member	HS20 Inventory	HS20 Operating	2F1 Operating	3F1 Operating	4F1 Operating	5C1 Operating	Fatigue
Deck		1.22	2.03	3.25	3.82	4.64	3.82	
Stringer	Unit 2 Stringer S3-2	1.14	1.91	2.83	2.02	1.91	2.15	112 Years
Floorbeam	FB-13	0.84	1.40	2.79	1.96	1.75	2.00	70 Years
Girder	G2	0.83	1.38	3.00	1.99	1.74	1.71	167 Years
Column	CN23	1.05	1.75	3.45	2.44	2.19	2.51	---

Overall Summary

Case	Rating Factor	Tonnage	HS equivalent or Ohio Legal Load %
HS20 Inventory	0.83	29.88	HS16.6
HS20 Operating	1.38	49.68	HS27.6
2F1	2.79	41.85	*170%*
3F1	1.96	45.08	
4F1	1.74	46.98	
5C1	1.71	68.40	
Fatigue	70 years		

WEST APPROACH – SECTION N

DECK

DECK - WEST APPROACH - SECTION N.

1. MATERIAL PROPERTIES:

CONCRETE: $f_c' = 4500$ psi (C.A.B. PLAN. G7/93)
$W_c = 112$ pcf (C.A.B. PLAN. G9/93)

REBAR: $f_s' = 24$ ksi $f_y = 60$ ksi (G7/93)

2. DECK GEOMETRY:

BEAM SPACING: 7.0 FT. STRINGERS: W18×76 (162/991)
$b_f = 11"$

EFFECTIVE SPAN LENGTH $= 7.0' - \frac{11"}{12} \times \frac{1}{2} = 6.542'$

DECK THICKNESS = 6.75" LIGHTWEIGHT CONCRETE (183/991)

WEARING SURFACE = 1.25" LATEX CONCRETE

REBAR COVER: TOP: 3" − 1.25" = 1.75" CLR.
BOTTOM: 1" CLR

TRANSVERSE REBAR: TOP: #6 @ 7" BOTTOM: #5 @ 7" (178A/991)

3. DEAD LOAD:

$SLAB = \frac{6.75"}{12"} \times 1.0' \times 0.112 = 0.063$ k/ft
$WS = 1.25" \times \frac{1}{12} \times 1.0 \times 0.15 = 0.016$ k/ft

TOTAL = 0.079 k/ft

DL MOMENT $= \frac{1}{8} \times 0.079 \times 6.542^2 \times 0.8 = 0.338$ k-ft

4. LIVE LOADS:

HS20: $P = 16\ K$ $\quad M_{HS} = \left(\frac{S+2}{32}\right) \cdot P \cdot (1+I) \cdot 0.8$

$$= \left(\frac{6.542+2}{32}\right) \times 16 \times 1.30 \times 0.8 = 4.442\ k\text{-}ft$$

2F1: $P = 10\ K$ $\quad M_{2F1} = 2.776\ k\text{-}ft$

3F1: $P = 8.5\ K$ $\quad M_{3F1} = 2.360\ k\text{-}ft$

4F1: $P = 7.0\ K$ $\quad M_{4F1} = 1.943\ k\text{-}ft$

5C1: $P = 8.5\ K$ $\quad M_{5C1} = 2.360\ k\text{-}ft$

5: MOMENT CAPACITY:

CHECK REINFORCEMENT RATIO:

BALANCED RATIO:

$$\rho_b = \frac{0.85\beta_1 f_c'}{f_y}\left(\frac{87000}{87000+f_y}\right) = \frac{0.85 \cdot 0.825 \cdot 4.5}{60}\left(\frac{87000}{87000+60{,}000}\right)$$

$$= 0.031 \qquad 0.75\rho_b = 0.023$$

ACTUAL RATIO:

TOP: $A_s = 0.44 \times \frac{12''}{7''} = 0.754\ in^2/ft$

$$d_t = 6.75'' - 1.75'' - 0.5'' - \frac{0.75''}{2} = 4.125''$$

$$\rho_1 = \frac{A_s}{bd_t} = \frac{0.754}{12'' \times 4.125''} = 0.015 < 0.023 \quad \text{REBAR CONTROLS}$$

BOTTOM: $A_s = 0.31 \times \frac{12''}{7''} = 0.531\ in^2/ft$

$$d_t = 6.75'' - 1.0'' - \frac{0.625''}{2} = 5.438''$$

$$\rho_2 = \frac{A_s}{bd_t} = \frac{0.531}{12 \times 5.438} = 0.008 < 0.023 \quad \text{REBAR CONTROLS}$$

Made By: GHD	Date: 2-7-12	Job No:
Checked By: DMP	Date: 2/8/12	Sheet No. 3/3

NEGATIVE MOMENT CAPACITY:

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{0.754 \times 60}{0.85 \times 4.5 \times 12} = 0.986 \text{ in}$$

$$\phi M_n^- = \phi A_s f_y (d - \frac{a}{2})$$

$$= 0.9 \times 0.754 \times 60 \times (4.125 - \frac{0.986}{2}) \times \frac{1}{12} = 12.32 \text{ k-ft}$$

POSITIVE MOMENT CAPACITY:

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{0.531 \times 60}{0.85 \times 4.5 \times 12} = 0.694 \text{ in}$$

$$\phi M_n^+ = \phi A_s f_y (d - \frac{a}{2})$$

$$= 0.9 \times 0.531 \times 60 \times (5.438 - \frac{0.694}{2}) \times \frac{1}{12} = 12.16 \text{ k-ft}$$

CONTROLING MOMENT CAPACITY = 12.16 k-ft

6. RATING FACTORS:

HS20: INVENTORY: $R = \frac{C - 1.3D}{2.17(L+I)} = \frac{12.16 - 1.3 \times 0.338}{2.17 \times 4.442} = \underline{1.22}$

OPERATING: $R = \frac{C - 1.3D}{1.3(L+I)} = \underline{2.03}$

2F1: $R = \frac{C - 1.3D}{1.3(L+I)} = \frac{12.16 - 1.3 \times 0.338}{1.3 \times 2.776} = \underline{3.25}$

3F1: $R = \frac{12.16 - 1.3 \times 0.338}{1.3 \times 2.360} = \underline{3.82}$

4F1: $R = \frac{12.16 - 1.3 \times 0.338}{1.3 \times 1.943} = \underline{4.64}$

5C1: $R = \underline{3.82}$

Calculations for 1/4 US Grid

WEST APPROACH – SECTION N

STRINGERS

TranSystems

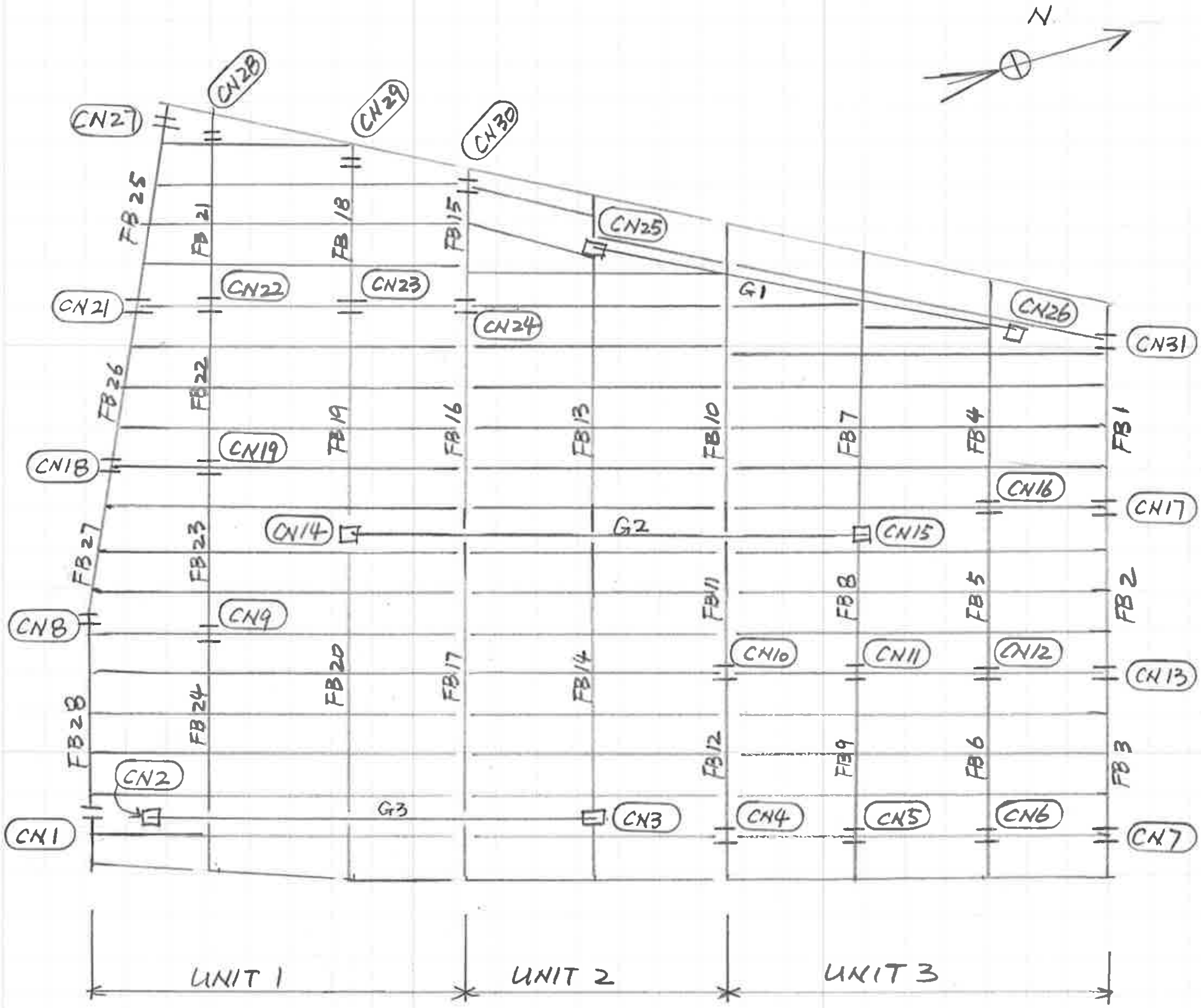
Made By: GHD Date: 2/23/2012 Job No.: ______

Checked By: DMP Date: 2/25/2012 Sheet No.: ______

Stringners Rating Summary - As Built

STRINGERS:		RATING FACTORS - WEST APPROACH - SECTION N															
		HS20								OHIO LEGAL LOADS							
		MOMENT		SHEAR		FATIGUE				2F1		3F1		4F1		5C1	
		Inv.	Opr.	Inv.	Opr.	Sr (ksi)	Cat.	Fsr (ksi)	Fat.	M	V	M	V	M	V	M	V
INTERIOR STRINGERS	SIMPLE SPAN	1.14	1.91	1.61	2.69	9.66	C	21	2.17	2.83	4.72	2.02	3.76	1.91	3.61	2.15	3.86
	TWO-SPAN	1.28	2.13	1.31	2.19	11.26	C	21	1.87	3.21	3.95	2.40	3.04	2.26	2.88	2.50	3.13
	THREE-SPAN	1.28	2.14	1.32	2.20	10.47	C	21	2.01	3.21	3.96	2.40	3.04	2.26	2.88	2.51	3.19
FASCIA STRINGERS	F1-1	3.66	6.11	2.65	4.42	5.36	C	21	3.92	6.84	8.36	5.10	5.96	4.78	5.56	5.32	6.13
	F1-2	2.57	4.29	1.52	2.53	5.14	C	21	4.09	7.70	4.85	5.34	3.43	4.81	3.18	5.35	3.69
	F1-3	1.69	2.82	1.57	2.62	3.44	C	21	6.10	6.34	4.96	4.39	3.54	3.65	3.30	3.97	3.71
	F2-1	4.14	6.91	1.58	2.63	3.09	C	21	6.80	10.11	4.66	7.30	3.49	6.90	3.28	7.78	3.59
	F2-2	3.92	6.54	2.25	3.75	2.54	C	21	8.27	11.98	7.00	8.29	5.00	7.39	4.60	8.15	5.16
	F2-3	2.57	4.29	2.42	4.04	1.84	C	21	11.41	9.43	7.41	6.52	5.36	5.45	4.97	6.13	5.66

FRAMING - WEST APPROACH - SECTION N



Made By: GHD	Date: 2-9-12	Job No:
Checked By: DMP	Date: 2/13/12	Sheet No. 1

INTERIOR STRINGERS - WEST APPROACH - SECTION N.

1. SIMPLE SPAN STRINGERS:

MAX SPAN LENGTH $= 25'-5\frac{3}{4}'' = 25.48'$ (S1-2, S3-2, S2-2, S2-3)

BEAM: W18×76 - A36 STEEL NON-COMPOSITE

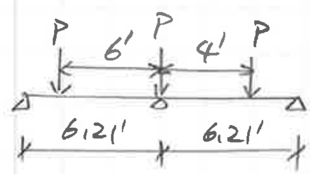
SPACING: S3-2 GOVERNS. LEFT: $7' \times \frac{25}{25.48} = 6.87'$, RIGHT: $\frac{8' + 3.08'}{2} = 5.54'$

$$AVERAGE = \frac{6.87 + 5.54}{2} = 6.21'$$

DISTRIBUTION FACTOR:

$$STRESS: \frac{S}{5.5} = \frac{6.21}{5.5} = 1.129$$

END SHEAR AND REACTION:



$$DF = 1 + \frac{0.21 + 2.21}{6.21} = 1.39$$

CONCRETE UNIT WEIGHT: 112 PCF

SLAB THICKNESS: 6.75"

$$\text{EFFECTIVE SLAB WIDTH} = \begin{cases} \frac{1}{4} \times 25.48' = 6.37' \\ 6.21' \\ 12 \times 6.75'' = 6.75' \end{cases} \Rightarrow 6.21' \quad (74.52'')$$

HAUNCH WIDTH = 11" + 3" × 2 = 17" THICKNESS = 9" - 1.25" - 6.75" = 1.0"

MODULAR RATIO: $E_c = W_c^{1.5} \cdot 33\sqrt{f'_c} = 2623.9$ ksi

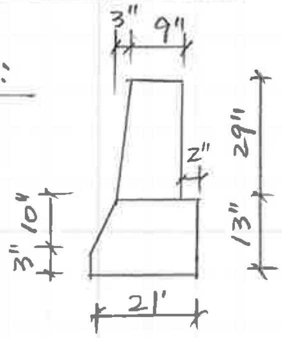
$$n = \frac{E_s}{E_c} = \frac{29000}{2623.9} = 11$$

DEAD LOADS:

STAY-IN-PLACE FORM: 2PSF. $2 \times 6.21' = \underline{0.012}$ K/ft

WEARING SURFACE: $1.25'' \times \frac{1}{12} \times 0.15 \times 6.21' = \underline{0.097}$ K/ft

PARAPET:

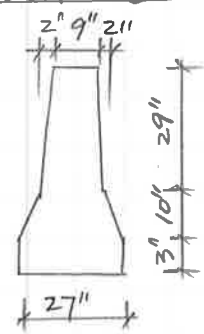


OUTSIDE

$AREA = (9''+12'') \times 29'' \times \frac{1}{2} + (11''+21'') \times 10'' \times \frac{1}{2} + 3'' \times 21''$

$= 527.5 \ in^2$

$W_t = 527.5 \times \frac{1}{144} \times 0.112 = \underline{0.41}$ K/ft



MEDIAN

$AREA = (9''+13'') \times 29'' \times \frac{1}{2} + (13''+27'') \times 10'' \times \frac{1}{2} + 3'' \times 27''$

$= 600 \ in^2$

$W_t = 600 \times \frac{1}{144} \times 0.112 = 0.467$ K/ft

MINIMUM NUMBER OF STRINGERS = 16

TOTAL:

DC1 = $\underline{0.012}$ K/ft

DC2 = $0.097 + (2 \times 0.41 + 0.467) \times \frac{1}{16} = \underline{0.177}$ K/ft

Calculations for 1/4 US Grid

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (HS20)
Line Girder : Input File : Definition
Thu Feb 09 12:36:48 2012

```
ID: INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NONCOMPOSITE GIRDER
  RATE MODE
  ROLLED SHAPES GIRDER
  SELF WEIGHT FOR DEAD LOAD 1
  W18X76
DATA
  BR  0.0001
  ESLABW 74.52
  FILLET 1.
  FPC 4.5
  HAUNCW 17.
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPN 25.48
  TSLABW 74.52
  WAC  0.012
  WAS  0.
  WCONC 112.
  WHEELD 1.129
  WHEELF  0.887
  WHEELR 1.39
  WHEELS 1.129
  WSDL  0.177
GO
```

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 12:36:17 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	489.0 C	149.5	>999.	>999.	1.61	2.69
2.55	489.0 C	149.5	2.65	4.42	2.12	3.54
5.10	489.0 C	149.5	1.50	2.51	2.55	4.25
7.64	489.0 C	149.5	1.19	1.99	3.16	5.28
10.19	489.0 C	149.5	1.14	1.91	4.13	6.89
12.74	489.0 C	149.5	1.18	1.97	5.87	9.80
15.29	489.0 C	149.5	1.14	1.91	4.13	6.89
17.84	489.0 C	149.5	1.19	1.99	3.16	5.28
20.38	489.0 C	149.5	1.50	2.51	2.55	4.25
22.93	489.0 C	149.5	2.65	4.42	2.12	3.54
25.48	489.0 C	149.5	>999.	>999.	1.61	2.69

****
Minimum rating is 1.14 at location 10.19 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Thu Feb 09 12:36:14 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.55	A	74.83 T	6150.	24000.	0.256
Base metal *	2.55	A	58.79 T	4832.	24000.	0.201
Base metal	5.10	A	125.72 T	10333.	24000.	0.431
Base metal *	5.10	A	98.77 T	8118.	24000.	0.338
Base metal	7.64	A	152.68 T	12549.	24000.	0.523
Base metal *	7.64	A	119.95 T	9859.	24000.	0.411
Base metal	10.19	A	155.70 T	12798.	24000.	0.533
Base metal *	10.19	A	122.33 T	10054.	24000.	0.419
Base metal	12.74	A	149.59 T	12295.	24000.	0.512
Base metal *	12.74	A	117.52 T	9660.	24000.	0.402
Base metal	15.29	A	155.70 T	12798.	24000.	0.533
Base metal *	15.29	A	122.33 T	10054.	24000.	0.419
Base metal	17.84	A	152.68 T	12549.	24000.	0.523
Base metal *	17.84	A	119.95 T	9859.	24000.	0.411
Base metal	20.38	A	125.72 T	10333.	24000.	0.431
Base metal *	20.38	A	98.77 T	8118.	24000.	0.338
Base metal	22.93	A	74.83 T	6150.	24000.	0.256
Base metal *	22.93	A	58.79 T	4832.	24000.	0.201
Base metal	2.55	A	44.01 L	3618.	37000.	0.098
Base metal	5.10	A	78.25 L	6431.	37000.	0.174
Base metal	7.64	A	102.70 L	8441.	37000.	0.228
Base metal	10.19	A	117.37 L	9647.	37000.	0.261
Base metal	12.74	A	122.26 L	10049.	37000.	0.272
Base metal	15.29	A	117.37 L	9647.	37000.	0.261
Base metal	17.84	A	102.70 L	8441.	37000.	0.228
Base metal	20.38	A	78.25 L	6431.	37000.	0.174
Base metal	22.93	A	44.01 L	3618.	37000.	0.098

* Single truck, one traffic lane, >2,000,000 cycles

T - truck loading
L - lane loading

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 12:47:08 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.83	4.72
2.55	489.0 C	149.5	4.59	7.66	3.82	6.38
5.10	489.0 C	149.5	2.51	4.20	4.46	7.46
7.64	489.0 C	149.5	1.90	3.18	5.33	8.90
10.19	489.0 C	149.5	1.69	2.83	6.57	10.97
12.74	489.0 C	149.5	1.71	2.85	8.47	14.15
15.29	489.0 C	149.5	1.69	2.83	7.35	12.28
17.84	489.0 C	149.5	1.90	3.18	5.84	9.76
20.38	489.0 C	149.5	2.51	4.20	4.82	8.06
22.93	489.0 C	149.5	4.59	7.66	4.09	6.83
25.48	489.0 C	149.5	>999.	>999.	2.83	4.72

****
Minimum rating is 1.69 at location 10.19 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 12:49:32 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.25	3.76
2.55	489.0 C	149.5	3.39	5.65	2.82	4.71
5.10	489.0 C	149.5	1.85	3.09	3.36	5.61
7.64	489.0 C	149.5	1.42	2.37	4.12	6.89
10.19	489.0 C	149.5	1.26	2.11	5.25	8.76
12.74	489.0 C	149.5	1.21	2.02	7.01	11.71
15.29	489.0 C	149.5	1.26	2.11	5.64	9.42
17.84	489.0 C	149.5	1.42	2.37	4.34	7.25
20.38	489.0 C	149.5	1.85	3.09	3.51	5.86
22.93	489.0 C	149.5	3.39	5.65	2.93	4.88
25.48	489.0 C	149.5	>999.	>999.	2.25	3.76

****
Minimum rating is 1.21 at location 12.74 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 12:50:44 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Rating Factors Bending Op	Rating Factors Shear Inv	Rating Factors Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.16	3.61
2.55	489.0 C	149.5	3.27	5.47	2.73	4.56
5.10	489.0 C	149.5	1.81	3.02	3.32	5.54
7.64	489.0 C	149.5	1.38	2.30	3.99	6.67
10.19	489.0 C	149.5	1.18	1.97	5.00	8.35
12.74	489.0 C	149.5	1.15	1.91	7.16	11.95
15.29	489.0 C	149.5	1.18	1.97	5.41	9.03
17.84	489.0 C	149.5	1.38	2.30	4.28	7.14
20.38	489.0 C	149.5	1.81	3.02	3.42	5.72
22.93	489.0 C	149.5	3.27	5.47	2.79	4.66
25.48	489.0 C	149.5	>999.	>999.	2.16	3.61

****
Minimum rating is 1.15 at location 12.74 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 12:52:14 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.31	3.86
2.55	489.0 C	149.5	3.49	5.83	2.91	4.86
5.10	489.0 C	149.5	1.92	3.20	3.48	5.82
7.64	489.0 C	149.5	1.48	2.47	4.31	7.19
10.19	489.0 C	149.5	1.33	2.22	5.21	8.71
12.74	489.0 C	149.5	1.29	2.15	6.75	11.27
15.29	489.0 C	149.5	1.33	2.22	5.68	9.49
17.84	489.0 C	149.5	1.48	2.47	4.53	7.56
20.38	489.0 C	149.5	1.92	3.20	3.64	6.08
22.93	489.0 C	149.5	3.49	5.83	3.02	5.04
25.48	489.0 C	149.5	>999.	>999.	2.31	3.86

****
Minimum rating is 1.29 at location 12.74 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGERS – WEST APPROACH – SECTION N.

2. 2-SPAN CONTINUOUS STRINGERS: UNIT 2.

SPAN LENGTH: 25' – 25'

BEAM: W18×76. A36 STEEL NON-COMPOSITE

SPACING: 7.0'

DISTRIBUTION FACTOR: STRESS: $\frac{7.0}{5.5} = 1.272$

END SHEAR AND REACTION: $= 1 + \frac{1.43'}{7'} = 1.571$

CONCRETE UNIT WEIGHT: 112 pcf

SLAB THICKNESS: 6.75"

EFFECTIVE SLAB WIDTH: $\begin{cases} \frac{1}{4} \times 25' = 6.25' \\ 7.0' \\ 12 \times 6.75'' = 6.75' \end{cases} \Rightarrow 6.25' \ (75'')$

HAUNCH WIDTH = 11" + 3" × 2 = 17" THICKNESS = 1.0"

MODULAR RATIO = 11.

DEAD LOADS: (SEE CALCS FOR SIMPLE SPAN)

STAY-IN-PLACE FORM: 2 × 7' = 0.014 k/ft

WEARING SURFACE: $1.25'' \times \frac{1}{12} \times 0.15 \times 7' = 0.109$ k/ft

OUTSIDE BARRIER: 0.4 k/ft

MEDIAN BARRIER: 0.467 k/ft

TOTAL: DC1 = 0.014 k/ft

DC2 = $0.109 + (0.4 \times 2 + 0.467) \times \frac{1}{16} = 0.189$ k/ft

```
INTERIOR STRINGER (2-SPAN) - SECTION N (HS20)
Line Girder : Input File : Definition
Thu Feb 09 16:40:03 2012


ID: INTERIOR STRINGER (2-SPAN) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NONCOMPOSITE GIRDER
  RATE MODE
  ROLLED SHAPES GIRDER
  SELF WEIGHT FOR DEAD LOAD 1
  W18X76
DATA
  BR 12.5 25.
  ESLABW 75.
  FILLET 1.
  FPC 4.5
  HAUNCW 17.
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPN 25. 25.
  TSLABW 84.
  WAC  0.014
  WAS  0.
  WCONC 112.
  WHEELD 1.272
  WHEELF 1.
  WHEELR 1.571
  WHEELS 1.272
  WSDL  0.189
GO
```

INTERIOR STRINGER (2-SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 13:55:40 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	1.56	2.61
2.50	489.0 C	149.5	2.65	4.42	2.21	3.70
5.00	489.0 C	149.5	1.57	2.62	2.77	4.63
7.50	489.0 C	149.5	1.30	2.17	3.58	5.99
10.00	489.0 C	149.5	1.28	2.13	4.47	7.47
12.50	489.0 C	149.5	1.37	2.29	3.70	6.18
15.00	489.0 C	149.5	1.46	2.44	3.11	5.19
17.50	489.0 C	149.5	1.74	2.90	2.51	4.19
20.00	489.0 C	149.5	3.72	6.21	2.04	3.40
22.50	489.0 C	149.5	2.76	4.62	1.73	2.88
25.00	489.0 C	149.5	1.54	2.58	1.31	2.19

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	1.54	2.58	1.31	2.19
2.50	489.0 C	149.5	2.76	4.62	1.73	2.88
5.00	489.0 C	149.5	3.72	6.21	2.04	3.40
7.50	489.0 C	149.5	1.74	2.90	2.51	4.19
10.00	489.0 C	149.5	1.46	2.44	3.11	5.19
12.50	489.0 C	149.5	1.37	2.29	3.70	6.18
15.00	489.0 C	149.5	1.28	2.13	4.47	7.47
17.50	489.0 C	149.5	1.30	2.17	3.58	5.99
20.00	489.0 C	149.5	1.57	2.62	2.77	4.63
22.50	489.0 C	149.5	2.65	4.42	2.21	3.70
25.00	489.0 C	149.5	>999.	>999.	1.56	2.61

****
Minimum rating is 1.28 at location 10.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (2-SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Thu Feb 09 13:55:44 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.50	A	82.71 T	6798.	24000.	0.283
Base metal *	2.50	A	65.03 T	5345.	24000.	0.223
Base metal	5.00	A	137.62 T	11311.	24000.	0.471
Base metal *	5.00	A	108.19 T	8892.	24000.	0.371
Base metal	7.50	A	167.58 T	13773.	24000.	0.574
Base metal *	7.50	A	131.74 T	10828.	24000.	0.451
Base metal	10.00	A	176.24 T	14485.	24000.	0.604
Base metal *	10.00	A	138.55 T	11388.	24000.	0.474
Base metal	12.50	A	174.30 T	14326.	24000.	0.597
Base metal *	12.50	A	137.03 T	11263.	24000.	0.469
Base metal	15.00	A	175.75 T	14445.	24000.	0.602
Base metal *	15.00	A	138.17 T	11356.	24000.	0.473
Base metal	17.50	A	165.57 T	13608.	24000.	0.567
Base metal *	17.50	A	130.16 T	10698.	24000.	0.446
Base metal	20.00	A	136.10 T	11186.	24000.	0.466
Base metal *	20.00	A	107.00 T	8794.	24000.	0.366
Base metal	22.50	A	116.25 T	9555.	24000.	0.398
Base metal *	22.50	A	91.39 T	7512.	24000.	0.313
Base metal *	25.00	A	101.13 T	8312.	24000.	0.346
Base metal	27.50	A	116.25 T	9555.	24000.	0.398
Base metal *	27.50	A	91.39 T	7512.	24000.	0.313
Base metal	30.00	A	136.10 T	11186.	24000.	0.466
Base metal *	30.00	A	107.00 T	8794.	24000.	0.366
Base metal	32.50	A	165.57 T	13608.	24000.	0.567
Base metal *	32.50	A	130.16 T	10698.	24000.	0.446
Base metal	35.00	A	175.75 T	14445.	24000.	0.602
Base metal *	35.00	A	138.17 T	11356.	24000.	0.473
Base metal	37.50	A	174.30 T	14326.	24000.	0.597
Base metal *	37.50	A	137.03 T	11263.	24000.	0.469
Base metal	40.00	A	176.24 T	14485.	24000.	0.604
Base metal *	40.00	A	138.55 T	11388.	24000.	0.474
Base metal	42.50	A	167.58 T	13773.	24000.	0.574
Base metal *	42.50	A	131.74 T	10828.	24000.	0.451
Base metal	45.00	A	137.62 T	11311.	24000.	0.471
Base metal *	45.00	A	108.19 T	8892.	24000.	0.371
Base metal	47.50	A	82.71 T	6798.	24000.	0.283
Base metal *	47.50	A	65.03 T	5345.	24000.	0.223
Base metal	2.50	A	51.02 L	4193.	37000.	0.113
Base metal	5.00	A	89.56 L	7361.	37000.	0.199
Base metal	7.50	A	115.96 L	9531.	37000.	0.258
Base metal	10.00	A	130.77 L	10748.	37000.	0.290
Base metal	12.50	A	134.77 L	11077.	37000.	0.299
Base metal	15.00	A	128.98 L	10601.	37000.	0.287
Base metal	17.50	A	114.62 L	9420.	37000.	0.255
Base metal	20.00	A	93.13 L	7655.	37000.	0.207
Base metal	22.50	A	77.48 L	6368.	37000.	0.172
Base metal	25.00	A	76.65 L	6300.	37000.	0.170
Base metal	27.50	A	77.48 L	6368.	37000.	0.172
Base metal	30.00	A	93.13 L	7655.	37000.	0.207
Base metal	32.50	A	114.62 L	9420.	37000.	0.255
Base metal	35.00	A	128.98 L	10601.	37000.	0.287
Base metal	37.50	A	134.77 L	11077.	37000.	0.299
Base metal	40.00	A	130.77 L	10748.	37000.	0.290
Base metal	42.50	A	115.96 L	9531.	37000.	0.258
Base metal	45.00	A	89.56 L	7361.	37000.	0.199
Base metal	47.50	A	51.02 L	4193.	37000.	0.113

* Single truck, one traffic lane, >2,000,000 cycles

T - truck loading
L - lane loading

INTERIOR STRINGER (2-SPAN) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:03:38 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.62	4.38
2.50	489.0 C	149.5	4.43	7.40	3.69	6.16
5.00	489.0 C	149.5	2.55	4.26	4.48	7.48
7.50	489.0 C	149.5	2.04	3.40	5.58	9.32
10.00	489.0 C	149.5	1.92	3.21	7.15	11.95
12.50	489.0 C	149.5	2.01	3.36	7.03	11.74
15.00	489.0 C	149.5	2.17	3.63	5.41	9.04
17.50	489.0 C	149.5	2.71	4.53	4.38	7.32
20.00	489.0 C	149.5	5.90	9.86	3.70	6.18
22.50	489.0 C	149.5	4.79	7.99	3.22	5.38
25.00	489.0 C	149.5	3.90	6.51	2.37	3.95

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	3.90	6.51	2.37	3.95
2.50	489.0 C	149.5	4.79	7.99	3.08	5.14
5.00	489.0 C	149.5	5.90	9.86	3.48	5.82
7.50	489.0 C	149.5	2.71	4.53	4.06	6.77
10.00	489.0 C	149.5	2.17	3.63	4.90	8.18
12.50	489.0 C	149.5	2.01	3.36	6.22	10.39
15.00	489.0 C	149.5	1.92	3.21	8.24	13.76
17.50	489.0 C	149.5	2.04	3.40	6.28	10.48
20.00	489.0 C	149.5	2.55	4.26	4.95	8.26
22.50	489.0 C	149.5	4.43	7.40	4.02	6.72
25.00	489.0 C	149.5	>999.	>999.	2.62	4.38

****
Minimum rating is 1.92 at location 15.00 in span 2.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (2-SPAN) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:05:28 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.15	3.60
2.50	489.0 C	149.5	3.38	5.65	2.82	4.71
5.00	489.0 C	149.5	1.93	3.22	3.51	5.86
7.50	489.0 C	149.5	1.55	2.59	4.47	7.47
10.00	489.0 C	149.5	1.44	2.40	5.67	9.47
12.50	489.0 C	149.5	1.47	2.46	5.21	8.70
15.00	489.0 C	149.5	1.68	2.81	4.13	6.90
17.50	489.0 C	149.5	2.12	3.53	3.23	5.39
20.00	489.0 C	149.5	4.06	6.78	2.66	4.44
22.50	489.0 C	149.5	3.32	5.55	2.28	3.80
25.00	489.0 C	149.5	2.61	4.35	1.82	3.04

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.61	4.35	1.82	3.04
2.50	489.0 C	149.5	3.32	5.55	2.27	3.78
5.00	489.0 C	149.5	4.06	6.78	2.62	4.38
7.50	489.0 C	149.5	2.12	3.53	3.15	5.26
10.00	489.0 C	149.5	1.68	2.81	3.86	6.44
12.50	489.0 C	149.5	1.47	2.46	4.96	8.29
15.00	489.0 C	149.5	1.44	2.40	6.33	10.56
17.50	489.0 C	149.5	1.55	2.59	4.71	7.86
20.00	489.0 C	149.5	1.93	3.22	3.64	6.08
22.50	489.0 C	149.5	3.38	5.65	2.92	4.87
25.00	489.0 C	149.5	>999.	>999.	2.15	3.59

****
Minimum rating is 1.44 at location 10.00 in span 1.
****

Moment Capacity Codes
- C - Compact
- B - Braced non-compact
- U - Unbraced non-compact
- T - Transition between compact and braced non-compact
- S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (2-SPAN) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:06:38 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.09	3.50
2.50	489.0 C	149.5	3.32	5.55	2.77	4.63
5.00	489.0 C	149.5	1.91	3.19	3.40	5.68
7.50	489.0 C	149.5	1.50	2.51	4.30	7.18
10.00	489.0 C	149.5	1.35	2.26	5.62	9.38
12.50	489.0 C	149.5	1.40	2.33	5.15	8.61
15.00	489.0 C	149.5	1.58	2.64	3.89	6.50
17.50	489.0 C	149.5	2.07	3.46	3.14	5.24
20.00	489.0 C	149.5	3.81	6.36	2.56	4.28
22.50	489.0 C	149.5	3.12	5.21	2.15	3.59
25.00	489.0 C	149.5	2.15	3.60	1.73	2.88

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.15	3.60	1.73	2.88
2.50	489.0 C	149.5	3.12	5.21	2.15	3.58
5.00	489.0 C	149.5	3.81	6.36	2.48	4.13
7.50	489.0 C	149.5	2.07	3.46	2.93	4.90
10.00	489.0 C	149.5	1.58	2.64	3.66	6.11
12.50	489.0 C	149.5	1.40	2.33	4.93	8.23
15.00	489.0 C	149.5	1.35	2.26	6.50	10.85
17.50	489.0 C	149.5	1.50	2.51	4.72	7.89
20.00	489.0 C	149.5	1.91	3.19	3.56	5.94
22.50	489.0 C	149.5	3.32	5.55	2.81	4.70
25.00	489.0 C	149.5	>999.	>999.	2.09	3.49

****
Minimum rating is 1.35 at location 10.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb \; - \; \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGER (2-SPAN) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:07:48 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.21	3.69
2.50	489.0 C	149.5	3.48	5.81	2.91	4.85
5.00	489.0 C	149.5	1.98	3.31	3.62	6.05
7.50	489.0 C	149.5	1.60	2.67	4.68	7.82
10.00	489.0 C	149.5	1.50	2.50	5.89	9.84
12.50	489.0 C	149.5	1.53	2.56	4.69	7.83
15.00	489.0 C	149.5	1.75	2.92	3.92	6.55
17.50	489.0 C	149.5	2.22	3.71	3.32	5.55
20.00	489.0 C	149.5	4.50	7.51	2.77	4.63
22.50	489.0 C	149.5	3.32	5.54	2.36	3.94
25.00	489.0 C	149.5	2.13	3.55	1.87	3.13

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.13	3.55	1.87	3.13
2.50	489.0 C	149.5	3.32	5.54	2.34	3.92
5.00	489.0 C	149.5	4.50	7.51	2.73	4.56
7.50	489.0 C	149.5	2.22	3.71	3.16	5.27
10.00	489.0 C	149.5	1.75	2.92	3.78	6.32
12.50	489.0 C	149.5	1.53	2.56	4.68	7.81
15.00	489.0 C	149.5	1.50	2.50	5.88	9.82
17.50	489.0 C	149.5	1.60	2.67	4.85	8.10
20.00	489.0 C	149.5	1.98	3.31	3.76	6.27
22.50	489.0 C	149.5	3.48	5.81	3.01	5.02
25.00	489.0 C	149.5	>999.	>999.	2.21	3.68

****
Minimum rating is 1.50 at location 10.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

INTERIOR STRINGERS - WEST APPROACH - SECTION N.

3. 3-SPAN CONTINUOUS STRINGERS. UNIT 1, UNIT 3

SPAN LENGTH: 25' - 25' - 25'.

BEAM: W18x76 A36 STEEL. NON-COMPOSITE

SPACING: 7'

DISTRIBUTION FACTOR: STRESS: 1.272
END SHEAR AND REACTION: 1.571

CONCRETE DECK: 112 pcf

SLAB THICKNESS: 6.75"

EFFECTIVE SLAB WIDTH: 75"

HAUNCH WIDTH: 17" THICKNESS: 1"

DEAD LOADS: DC1 = 0.014 k/ft

DC2 = 0.189 k/ft

```
INTERIOR STRINGER (3-SPAN) - SECTION N (HS20)
Line Girder : Input File : Definition
Thu Feb 09 16:45:39 2012


ID: INTERIOR STRINGER (3-SPAN) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NONCOMPOSITE GIRDER
  RATE MODE
  ROLLED SHAPES GIRDER
  SELF WEIGHT FOR DEAD LOAD 1
  W18X76
DATA
  BR 12.5 25. 25.
  ESLABW 75.
  FILLET 1.
  FPC 4.5
  HAUNCW 17.
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPN 25. 25. 25.
  TSLABW 84.
  WAC  0.014
  WAS  0.
  WCONC 112.
  WHEELD 1.272
  WHEELF 1.
  WHEELR 1.571
  WHEELS 1.272
  WSDL  0.189
GO
```

INTERIOR STRINGER (3-SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Thu Feb 09 14:27:49 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.50	A	80.13 T	6586.	24000.	0.274
Base metal *	2.50	A	62.99 T	5178.	24000.	0.216
Base metal	5.00	A	132.36 T	10879.	24000.	0.453
Base metal *	5.00	A	104.06 T	8552.	24000.	0.356
Base metal	7.50	A	159.74 T	13129.	24000.	0.547
Base metal *	7.50	A	125.58 T	10322.	24000.	0.430
Base metal	10.00	A	166.17 T	13658.	24000.	0.569
Base metal *	10.00	A	130.64 T	10737.	24000.	0.447
Base metal	12.50	A	162.07 T	13321.	24000.	0.555
Base metal *	12.50	A	127.42 T	10473.	24000.	0.436
Base metal	15.00	A	160.47 T	13190.	24000.	0.550
Base metal *	15.00	A	126.16 T	10369.	24000.	0.432
Base metal	17.50	A	147.24 T	12102.	24000.	0.504
Base metal *	17.50	A	115.76 T	9514.	24000.	0.396
Base metal	20.00	A	119.05 T	9785.	24000.	0.408
Base metal *	20.00	A	93.59 T	7692.	24000.	0.321
Base metal	22.50	A	117.99 T	9698.	24000.	0.404
Base metal *	22.50	A	92.76 T	7624.	24000.	0.318
Base metal	25.00	A	144.83 T	11904.	24000.	0.496
Base metal *	25.00	A	113.86 T	9359.	24000.	0.390
Base metal	27.50	A	125.17 T	10288.	24000.	0.429
Base metal *	27.50	A	98.40 T	8088.	24000.	0.337
Base metal	30.00	A	136.16 T	11191.	24000.	0.466
Base metal *	30.00	A	107.04 T	8798.	24000.	0.367
Base metal	32.50	A	152.72 T	12552.	24000.	0.523
Base metal *	32.50	A	120.06 T	9868.	24000.	0.411
Base metal	35.00	A	153.73 T	12635.	24000.	0.526
Base metal *	35.00	A	120.86 T	9933.	24000.	0.414
Base metal	37.50	A	140.95 T	11585.	24000.	0.483
Base metal *	37.50	A	110.81 T	9108.	24000.	0.379
Base metal	40.00	A	153.67 T	12630.	24000.	0.526
Base metal *	40.00	A	120.81 T	9929.	24000.	0.414
Base metal	42.50	A	152.63 T	12545.	24000.	0.523
Base metal *	42.50	A	119.99 T	9862.	24000.	0.411
Base metal	45.00	A	136.04 T	11182.	24000.	0.466
Base metal *	45.00	A	106.95 T	8791.	24000.	0.366
Base metal	47.50	A	125.11 T	10283.	24000.	0.428
Base metal *	47.50	A	98.36 T	8084.	24000.	0.337
Base metal	50.00	A	144.82 T	11903.	24000.	0.496
Base metal *	50.00	A	113.85 T	9358.	24000.	0.390
Base metal	52.50	A	120.00 T	9863.	24000.	0.411
Base metal *	52.50	A	94.34 T	7754.	24000.	0.323
Base metal	55.00	A	121.96 T	10024.	24000.	0.418
Base metal *	55.00	A	95.88 T	7881.	24000.	0.328
Base metal	57.50	A	147.34 T	12110.	24000.	0.505
Base metal *	57.50	A	115.84 T	9521.	24000.	0.397
Base metal	60.00	A	160.55 T	13196.	24000.	0.550
Base metal *	60.00	A	126.22 T	10374.	24000.	0.432
Base metal	62.50	A	162.14 T	13326.	24000.	0.555
Base metal *	62.50	A	127.47 T	10477.	24000.	0.437
Base metal	65.00	A	166.22 T	13662.	24000.	0.569
Base metal *	65.00	A	130.68 T	10741.	24000.	0.448
Base metal	67.50	A	159.78 T	13133.	24000.	0.547
Base metal *	67.50	A	125.62 T	10325.	24000.	0.430
Base metal	70.00	A	132.39 T	10881.	24000.	0.453
Base metal *	70.00	A	104.08 T	8554.	24000.	0.356
Base metal	72.50	A	80.14 T	6587.	24000.	0.274
Base metal *	72.50	A	63.00 T	5178.	24000.	0.216
Base metal	2.50	A	50.36 L	4139.	37000.	0.112
Base metal	5.00	A	88.12 L	7243.	37000.	0.196
Base metal	7.50	A	113.65 L	9341.	37000.	0.252
Base metal	10.00	A	127.53 L	10482.	37000.	0.283
Base metal	12.50	A	130.61 L	10735.	37000.	0.290
Base metal	15.00	A	123.95 L	10187.	37000.	0.275
Base metal	17.50	A	108.86 L	8947.	37000.	0.242
Base metal	20.00	A	87.02 L	7152.	37000.	0.193
Base metal	22.50	A	73.13 L	6011.	37000.	0.162
Base metal	25.00	A	91.30 L	7504.	37000.	0.203
Base metal	27.50	A	81.24 L	6677.	37000.	0.180
Base metal	30.00	A	93.17 L	7658.	37000.	0.207
Base metal	32.50	A	111.18 L	9138.	37000.	0.247
Base metal	35.00	A	130.19 L	10701.	37000.	0.289
Base metal	37.50	A	135.03 L	11099.	37000.	0.300
Base metal	40.00	A	130.17 L	10699.	37000.	0.289
Base metal	42.50	A	111.12 L	9133.	37000.	0.247

INTERIOR STRINGER (3-SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:19:06 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	489.0 C	149.5	>999.	>999.	1.56	2.61
2.50	489.0 C	149.5	2.66	4.45	2.22	3.71
5.00	489.0 C	149.5	1.58	2.63	2.78	4.65
7.50	489.0 C	149.5	1.30	2.18	3.61	6.03
10.00	489.0 C	149.5	1.28	2.14	4.57	7.63
12.50	489.0 C	149.5	1.37	2.29	3.77	6.30
15.00	489.0 C	149.5	1.47	2.46	3.16	5.27
17.50	489.0 C	149.5	1.77	2.96	2.50	4.18
20.00	489.0 C	149.5	2.61	4.36	2.04	3.40
22.50	489.0 C	149.5	3.10	5.18	1.73	2.89
25.00	489.0 C	149.5	1.68	2.80	1.32	2.20

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	489.0 C	149.5	1.68	2.80	1.41	2.36
2.50	489.0 C	149.5	2.87	4.80	1.91	3.20
5.00	489.0 C	149.5	3.85	6.42	2.31	3.86
7.50	489.0 C	149.5	1.87	3.12	2.85	4.76
10.00	489.0 C	149.5	1.65	2.76	3.40	5.68
12.50	489.0 C	149.5	1.66	2.78	4.21	7.02
15.00	489.0 C	149.5	1.65	2.76	3.40	5.68
17.50	489.0 C	149.5	1.87	3.12	2.85	4.76
20.00	489.0 C	149.5	3.85	6.43	2.31	3.86
22.50	489.0 C	149.5	2.88	4.80	1.91	3.20
25.00	489.0 C	149.5	1.68	2.81	1.41	2.36

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	489.0 C	149.5	1.68	2.81	1.32	2.20
2.50	489.0 C	149.5	3.10	5.18	1.73	2.89
5.00	489.0 C	149.5	2.52	4.21	2.04	3.40
7.50	489.0 C	149.5	1.77	2.96	2.50	4.18
10.00	489.0 C	149.5	1.47	2.46	3.16	5.27
12.50	489.0 C	149.5	1.37	2.29	3.77	6.30
15.00	489.0 C	149.5	1.28	2.14	4.57	7.63
17.50	489.0 C	149.5	1.30	2.17	3.61	6.03
20.00	489.0 C	149.5	1.58	2.63	2.78	4.65
22.50	489.0 C	149.5	2.66	4.44	2.22	3.71
25.00	489.0 C	149.5	>999.	>999.	1.56	2.61

****
Minimum rating is 1.28 at location 15.00 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

INTERIOR STRINGER (3-SPAN) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:20:27 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.61	4.37
2.50	489.0 C	149.5	4.44	7.41	3.69	6.17
5.00	489.0 C	149.5	2.55	4.26	4.49	7.50
7.50	489.0 C	149.5	2.04	3.40	5.62	9.38
10.00	489.0 C	149.5	1.92	3.21	7.28	12.16
12.50	489.0 C	149.5	2.01	3.36	6.98	11.66
15.00	489.0 C	149.5	2.18	3.64	5.38	8.98
17.50	489.0 C	149.5	2.75	4.60	4.36	7.28
20.00	489.0 C	149.5	4.28	7.15	3.69	6.16
22.50	489.0 C	149.5	6.19	10.34	3.21	5.37
25.00	489.0 C	149.5	3.78	6.31	2.37	3.96

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	3.78	6.31	2.48	4.14
2.50	489.0 C	149.5	4.75	7.94	3.32	5.54
5.00	489.0 C	149.5	6.12	10.22	3.87	6.46
7.50	489.0 C	149.5	2.84	4.75	4.67	7.79
10.00	489.0 C	149.5	2.43	4.06	5.86	9.78
12.50	489.0 C	149.5	2.39	3.99	7.74	12.93
15.00	489.0 C	149.5	2.43	4.06	6.62	11.05
17.50	489.0 C	149.5	2.84	4.75	5.14	8.59
20.00	489.0 C	149.5	6.12	10.23	4.18	6.98
22.50	489.0 C	149.5	4.76	7.94	3.53	5.89
25.00	489.0 C	149.5	3.78	6.31	2.48	4.14

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	3.78	6.31	2.37	3.96
2.50	489.0 C	149.5	6.19	10.33	3.07	5.13
5.00	489.0 C	149.5	4.28	7.14	3.47	5.80
7.50	489.0 C	149.5	2.75	4.60	4.04	6.74
10.00	489.0 C	149.5	2.18	3.64	4.87	8.13
12.50	489.0 C	149.5	2.01	3.36	6.18	10.32
15.00	489.0 C	149.5	1.92	3.21	8.40	14.03
17.50	489.0 C	149.5	2.04	3.40	6.33	10.57
20.00	489.0 C	149.5	2.55	4.26	4.97	8.30
22.50	489.0 C	149.5	4.44	7.41	4.03	6.73
25.00	489.0 C	149.5	>999.	>999.	2.61	4.37

****

Minimum rating is 1.92 at location 15.00 in span 3.

****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

INTERIOR STRINGER (3-SPAN) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:21:30 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.15	3.60
2.50	489.0 C	149.5	3.39	5.66	2.82	4.71
5.00	489.0 C	149.5	1.93	3.22	3.52	5.88
7.50	489.0 C	149.5	1.56	2.60	4.50	7.51
10.00	489.0 C	149.5	1.44	2.41	5.77	9.64
12.50	489.0 C	149.5	1.48	2.47	5.17	8.63
15.00	489.0 C	149.5	1.70	2.83	4.10	6.85
17.50	489.0 C	149.5	2.15	3.59	3.21	5.36
20.00	489.0 C	149.5	3.54	5.92	2.65	4.42
22.50	489.0 C	149.5	4.29	7.16	2.27	3.79
25.00	489.0 C	149.5	2.60	4.35	1.82	3.04

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.60	4.35	1.95	3.26
2.50	489.0 C	149.5	3.29	5.49	2.49	4.15
5.00	489.0 C	149.5	4.19	7.00	2.97	4.97
7.50	489.0 C	149.5	2.24	3.73	3.61	6.02
10.00	489.0 C	149.5	1.89	3.15	4.61	7.70
12.50	489.0 C	149.5	1.78	2.97	6.42	10.72
15.00	489.0 C	149.5	1.89	3.15	5.06	8.44
17.50	489.0 C	149.5	2.24	3.74	3.83	6.39
20.00	489.0 C	149.5	4.20	7.01	3.05	5.09
22.50	489.0 C	149.5	3.29	5.50	2.53	4.22
25.00	489.0 C	149.5	2.61	4.35	1.95	3.26

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.61	4.35	1.82	3.04
2.50	489.0 C	149.5	4.28	7.15	2.26	3.78
5.00	489.0 C	149.5	3.54	5.91	2.62	4.37
7.50	489.0 C	149.5	2.15	3.59	3.13	5.24
10.00	489.0 C	149.5	1.70	2.83	3.84	6.41
12.50	489.0 C	149.5	1.48	2.47	4.92	8.21
15.00	489.0 C	149.5	1.44	2.40	6.45	10.78
17.50	489.0 C	149.5	1.55	2.60	4.75	7.93
20.00	489.0 C	149.5	1.93	3.22	3.66	6.12
22.50	489.0 C	149.5	3.39	5.66	2.93	4.89
25.00	489.0 C	149.5	>999.	>999.	2.15	3.59

****
Minimum rating is 1.44 at location 15.00 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

INTERIOR STRINGER (3-SPAN) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:22:36 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.10	3.50
2.50	489.0 C	149.5	3.33	5.56	2.78	4.64
5.00	489.0 C	149.5	1.92	3.20	3.42	5.71
7.50	489.0 C	149.5	1.50	2.51	4.34	7.24
10.00	489.0 C	149.5	1.35	2.26	5.74	9.58
12.50	489.0 C	149.5	1.40	2.34	5.11	8.54
15.00	489.0 C	149.5	1.59	2.66	3.86	6.45
17.50	489.0 C	149.5	2.11	3.52	3.12	5.21
20.00	489.0 C	149.5	3.38	5.65	2.55	4.26
22.50	489.0 C	149.5	4.03	6.73	2.15	3.58
25.00	489.0 C	149.5	2.16	3.60	1.73	2.88

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.16	3.60	1.87	3.13
2.50	489.0 C	149.5	3.10	5.17	2.33	3.89
5.00	489.0 C	149.5	3.96	6.61	2.76	4.61
7.50	489.0 C	149.5	2.17	3.63	3.42	5.71
10.00	489.0 C	149.5	1.77	2.95	4.51	7.54
12.50	489.0 C	149.5	1.70	2.85	6.60	11.03
15.00	489.0 C	149.5	1.77	2.95	5.17	8.64
17.50	489.0 C	149.5	2.17	3.63	3.82	6.38
20.00	489.0 C	149.5	3.96	6.61	2.96	4.94
22.50	489.0 C	149.5	3.10	5.17	2.41	4.02
25.00	489.0 C	149.5	2.16	3.61	1.87	3.13

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.16	3.61	1.73	2.88
2.50	489.0 C	149.5	4.03	6.73	2.14	3.57
5.00	489.0 C	149.5	3.38	5.65	2.48	4.13
7.50	489.0 C	149.5	2.11	3.52	2.93	4.89
10.00	489.0 C	149.5	1.59	2.66	3.63	6.07
12.50	489.0 C	149.5	1.40	2.34	4.88	8.15
15.00	489.0 C	149.5	1.35	2.26	6.61	11.05
17.50	489.0 C	149.5	1.50	2.51	4.76	7.95
20.00	489.0 C	149.5	1.92	3.20	3.58	5.98
22.50	489.0 C	149.5	3.33	5.56	2.82	4.72
25.00	489.0 C	149.5	>999.	>999.	2.09	3.50

****
Minimum rating is 1.35 at location 15.00 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

INTERIOR STRINGER (3-SPAN) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Thu Feb 09 14:23:48 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	>999.	>999.	2.21	3.69
2.50	489.0 C	149.5	3.49	5.83	2.91	4.86
5.00	489.0 C	149.5	1.99	3.32	3.64	6.08
7.50	489.0 C	149.5	1.60	2.68	4.72	7.88
10.00	489.0 C	149.5	1.50	2.51	6.05	10.11
12.50	489.0 C	149.5	1.54	2.57	4.81	8.03
15.00	489.0 C	149.5	1.72	2.87	3.97	6.63
17.50	489.0 C	149.5	2.12	3.54	3.35	5.59
20.00	489.0 C	149.5	2.95	4.93	2.79	4.66
22.50	489.0 C	149.5	4.08	6.82	2.39	4.00
25.00	489.0 C	149.5	2.44	4.08	1.91	3.19

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.44	4.08	2.01	3.35
2.50	489.0 C	149.5	3.51	5.86	2.57	4.30
5.00	489.0 C	149.5	4.58	7.65	3.08	5.15
7.50	489.0 C	149.5	2.34	3.91	3.78	6.31
10.00	489.0 C	149.5	1.95	3.26	4.74	7.91
12.50	489.0 C	149.5	1.91	3.18	5.80	9.68
15.00	489.0 C	149.5	1.95	3.26	4.81	8.04
17.50	489.0 C	149.5	2.35	3.92	3.85	6.43
20.00	489.0 C	149.5	4.59	7.66	3.16	5.27
22.50	489.0 C	149.5	3.51	5.87	2.61	4.36
25.00	489.0 C	149.5	2.44	4.08	2.01	3.35

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	489.0 C	149.5	2.44	4.08	1.91	3.19
2.50	489.0 C	149.5	4.08	6.81	2.39	3.98
5.00	489.0 C	149.5	2.95	4.93	2.75	4.59
7.50	489.0 C	149.5	2.12	3.54	3.16	5.27
10.00	489.0 C	149.5	1.71	2.86	3.77	6.30
12.50	489.0 C	149.5	1.54	2.57	4.77	7.97
15.00	489.0 C	149.5	1.50	2.51	6.11	10.21
17.50	489.0 C	149.5	1.60	2.68	4.89	8.16
20.00	489.0 C	149.5	1.99	3.32	3.78	6.31
22.50	489.0 C	149.5	3.49	5.83	3.01	5.03
25.00	489.0 C	149.5	>999.	>999.	2.20	3.68

****
Minimum rating is 1.50 at location 15.00 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

FASCIA STRINGER – WEST APPROACH – SECTION N:

1. F1-1.

SPAN LENGTH: 7.51' – 25.48' – 25.48' (AS PER TABLE ON SHEET 162)

GIRDER DETAIL: FLANGES: 8" × 3/4" WEB: 3/8" A36 STEEL NON-COMPOSITE. (162/991)

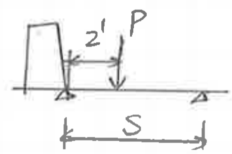
GIRDER DEPTH: 2.71' – 2.71' – 2.67' – 2.78'.

WEB DEPTH: 31.02" – 31.02" – 30.54" – 31.86" USE MIN. 30.54"

SPACING: $(7.5 + 3.82) \times \frac{1}{2} = 5.66'$

DISTRIBUTION FACTOR:

LEVER RULE:



$$DF = \frac{5.66 - 2'}{5.66} = 0.65$$

$$\frac{S}{5.5} = \frac{5.66}{5.5} = 1.029 \rightarrow \text{USE THIS}$$

CONCRETE: 112 PCF

SLAB: 6.75" THICK

EFFECTIVE SLAB WIDTH = $\begin{cases} \frac{1}{4} \times 25.48' \\ 5.66'/2 + 1.58' \\ 12 \times 6.75" = 6.75' \end{cases} \Rightarrow 4.41'$ (53")

HAUNCH WIDTH = 3' + 8" + (1'-7") = 30" THICKNESS: 1"

DEAD LOADS:

$$DC1 = \text{STAY-IN-PLACE FORM} = 2\,PSF \times \frac{5.66'}{2} = 0.006\ k/ft$$

$$\text{WEARING SURFACE} = 1.25" \times \frac{1}{12} \times 0.15 \times \frac{5.66'}{2} = 0.044\ k/ft$$

$$DC2 = 0.044 + (0.41 \times 2 + 0.467) \times \frac{1}{16} = 0.124\ k/ft$$

```
ID: FASCIA STRINGER (F1-1) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  A36 STIFFENER STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NO INTERMEDIATE TRANSVERSE STIFFENERS
  NONCOMPOSITE GIRDER
  RATE MODE
  SELF WEIGHT FOR DEAD LOAD 1
DATA
  BR 7.51 25.48
  ESLABW 53.
  FILLET 1.
  FPC 4.5
  HAUNCW 30.
  NBSTIFF 1 1 1 1
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPLBFT  0.75
  SPLBFW 8.
  SPLTFT  0.75
  SPLTFW 8.
  SPLWD 30.54
  SPLWT  0.375
  SPN 7.51 25.48 25.48
  SS 1.
  SUPBST  0.5
  SUPBSW 4.
  TSLABW 53.
  WAC  0.006
  WAS  0.
  WCONC 112.
  WHEELD 1.029
  WHEELF  0.809
  WHEELR 1.029
  WHEELS 1.029
  WSDL  0.124
GO
```

FASCIA STRINGER (F1-1) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Fri Feb 10 11:58:53 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	0.75	B	22.25 T	1118.	18000.	0.062
Base metal *	0.75	B	17.50 T	879.	16000.	0.055
Base metal	1.50	B	41.99 T	2109.	18000.	0.117
Base metal *	1.50	B	33.01 T	1658.	16000.	0.104
Base metal	2.25	B	58.37 T	2932.	18000.	0.163
Base metal *	2.25	B	45.89 T	2305.	16000.	0.144
Base metal	3.00	B	74.47 T	3740.	18000.	0.208
Base metal *	3.00	B	58.55 T	2941.	16000.	0.184
Base metal	3.76	B	84.66 T	4252.	18000.	0.236
Base metal *	3.76	B	66.56 T	3343.	16000.	0.209
Base metal	4.51	B	94.65 T	4754.	18000.	0.264
Base metal *	4.51	B	74.42 T	3737.	16000.	0.234
Base metal	5.26	B	102.72 T	5159.	18000.	0.287
Base metal *	5.26	B	80.76 T	4056.	16000.	0.253
Base metal	6.01	B	103.12 T	5179.	18000.	0.288
Base metal *	6.01	B	81.07 T	4072.	16000.	0.254
Base metal	6.76	B	109.52 T	5500.	18000.	0.306
Base metal *	6.76	B	86.11 T	4324.	16000.	0.270
Base metal	7.51	B	121.69 T	6112.	18000.	0.340
Base metal *	7.51	B	95.68 T	4805.	16000.	0.300
Base metal	10.06	B	74.42 T	3737.	18000.	0.208
Base metal *	10.06	B	58.51 T	2938.	16000.	0.184
Base metal	12.61	B	61.43 T	3085.	18000.	0.171
Base metal *	12.61	B	48.30 T	2426.	16000.	0.152
Base metal	15.15	B	68.80 T	3455.	18000.	0.192
Base metal *	15.15	B	54.09 T	2717.	16000.	0.170
Base metal	17.70	B	92.91 T	4666.	18000.	0.259
Base metal *	17.70	B	73.05 T	3669.	16000.	0.229
Base metal	20.25	B	110.35 T	5542.	18000.	0.308
Base metal *	20.25	B	86.76 T	4357.	16000.	0.272
Base metal	22.80	B	123.13 T	6184.	18000.	0.344
Base metal *	22.80	B	96.81 T	4862.	16000.	0.304
Base metal	25.35	B	126.06 T	6331.	18000.	0.352
Base metal *	25.35	B	99.11 T	4977.	16000.	0.311
Base metal	27.89	B	114.58 T	5754.	18000.	0.320
Base metal *	27.89	B	90.08 T	4524.	16000.	0.283
Base metal	30.44	B	99.38 T	4991.	18000.	0.277
Base metal *	30.44	B	78.14 T	3924.	16000.	0.245
Base metal	32.99	B	99.72 T	5008.	18000.	0.278
Base metal *	32.99	B	78.40 T	3937.	16000.	0.246
Base metal	35.54	B	87.48 T	4393.	18000.	0.244
Base metal *	35.54	B	68.78 T	3454.	16000.	0.216
Base metal	38.09	B	91.72 T	4606.	18000.	0.256
Base metal *	38.09	B	72.11 T	3621.	16000.	0.226
Base metal	40.63	B	120.00 T	6027.	18000.	0.335
Base metal *	40.63	B	94.35 T	4738.	16000.	0.296
Base metal	43.18	B	131.70 T	6614.	18000.	0.367
Base metal *	43.18	B	103.54 T	5200.	16000.	0.325
Base metal	45.73	B	131.11 T	6584.	18000.	0.366
Base metal *	45.73	B	103.08 T	5177.	16000.	0.324
Base metal	48.28	B	135.85 T	6823.	18000.	0.379
Base metal *	48.28	B	106.81 T	5364.	16000.	0.335
Base metal	50.83	B	130.96 T	6577.	18000.	0.365
Base metal *	50.83	B	102.96 T	5171.	16000.	0.323
Base metal	53.37	B	108.76 T	5462.	18000.	0.303
Base metal *	53.37	B	85.51 T	4294.	16000.	0.268
Base metal	55.92	B	65.97 T	3313.	18000.	0.184
Base metal *	55.92	B	51.87 T	2605.	16000.	0.163
Near flg-web weld	0.75	B	22.25 T	1065.	18000.	0.059
Near flg-web weld *	0.75	B	17.50 T	838.	16000.	0.052
Near flg-web weld	1.50	B	41.99 T	2010.	18000.	0.112
Near flg-web weld *	1.50	B	33.01 T	1580.	16000.	0.099
Near flg-web weld	2.25	B	58.37 T	2794.	18000.	0.155
Near flg-web weld *	2.25	B	45.89 T	2197.	16000.	0.137
Near flg-web weld	3.00	B	74.47 T	3565.	18000.	0.198
Near flg-web weld *	3.00	B	58.55 T	2803.	16000.	0.175
Near flg-web weld	3.76	B	84.66 T	4053.	18000.	0.225
Near flg-web weld *	3.76	B	66.56 T	3186.	16000.	0.199
Near flg-web weld	4.51	B	94.65 T	4531.	18000.	0.252
Near flg-web weld *	4.51	B	74.42 T	3562.	16000.	0.223
Near flg-web weld	5.26	B	102.72 T	4917.	18000.	0.273
Near flg-web weld *	5.26	B	80.76 T	3866.	16000.	0.242
Near flg-web weld	6.01	B	103.12 T	4936.	18000.	0.274
Near flg-web weld *	6.01	B	81.07 T	3881.	16000.	0.243
Near flg-web weld	6.76	B	109.52 T	5243.	18000.	0.291

Near flg-web weld	30.44	B	65.74 L	3147.	29000.	0.109
Near flg-web weld	32.99	B	64.60 L	3093.	29000.	0.107
Near flg-web weld	35.54	B	52.22 L	2500.	29000.	0.086
Near flg-web weld	38.09	B	63.55 L	3042.	29000.	0.105
Near flg-web weld	40.63	B	82.48 L	3948.	29000.	0.136
Near flg-web weld	43.18	B	96.07 L	4599.	29000.	0.159
Near flg-web weld	45.73	B	102.72 L	4917.	29000.	0.170
Near flg-web weld	48.28	B	101.33 L	4851.	29000.	0.167
Near flg-web weld	50.83	B	90.98 L	4355.	29000.	0.150
Near flg-web weld	53.37	B	70.94 L	3396.	29000.	0.117
Near flg-web weld	55.92	B	40.72 L	1949.	29000.	0.067
Brng Stf - Brng A	0.00	C	30.37 L	10125.	13000.	0.779
Brng Stf - Col A	0.00	C	30.37 L	4651.	13000.	0.358

Reaction
Range
(k)

* Single truck, one traffic lane, >2,000,000 cycles

T - truck loading
L - lane loading

FASCIA STRINGER (F1-1) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:58:57 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	>999.	>999.	4.45	7.44
0.75	825.5 C	207.6	28.45	47.50	5.01	8.36
1.50	825.5 C	207.6	15.88	26.51	5.71	9.54
2.25	825.5 C	207.6	12.34	20.61	5.77	9.63
3.00	825.5 C	207.6	10.43	17.42	5.04	8.42
3.76	825.5 C	207.6	8.31	13.89	4.48	7.48
4.51	825.5 C	207.6	6.90	11.52	4.08	6.82
5.26	825.5 C	207.6	5.89	9.83	3.76	6.28
6.01	825.5 C	207.6	5.12	8.56	3.50	5.85
6.76	825.5 C	207.6	4.53	7.56	3.31	5.52
7.51	825.5 C	207.6	4.05	6.77	3.15	5.26

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	4.05	6.77	2.88	4.81
2.55	825.5 C	207.6	10.60	17.70	3.20	5.34
5.10	825.5 C	207.6	6.01	10.04	3.79	6.33
7.64	573.5 S	207.6	4.60	7.69	4.69	7.83
10.19	573.5 S	207.6	3.73	6.22	6.12	10.22
12.74	573.5 S	207.6	3.47	5.79	7.47	12.47
15.29	573.5 S	207.6	3.41	5.69	6.13	10.23
17.84	573.5 S	207.6	3.73	6.23	5.09	8.50
20.38	825.5 C	207.6	7.41	12.38	4.24	7.09
22.93	825.5 C	207.6	5.69	9.50	3.49	5.82
25.48	825.5 C	207.6	3.66	6.11	2.96	4.95

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	3.66	6.11	2.65	4.42
2.55	825.5 C	207.6	6.59	11.00	2.97	4.96
5.10	825.5 C	207.6	7.97	13.32	3.44	5.74
7.64	573.5 S	207.6	3.59	6.00	4.14	6.91
10.19	573.5 S	207.6	3.04	5.08	5.27	8.80
12.74	573.5 S	207.6	2.93	4.89	6.57	10.97
15.29	573.5 S	207.6	2.71	4.53	7.92	13.23
17.84	573.5 S	207.6	2.75	4.59	6.10	10.19
20.38	573.5 S	207.6	3.28	5.47	4.73	7.89
22.93	825.5 C	207.6	5.41	9.03	3.79	6.32
25.48	825.5 C	207.6	>999.	>999.	3.24	5.40

****
Minimum rating is 2.65 at location 0.00 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASCIA STRINGER (F1-1) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:59:34 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	>999.	>999.	7.56	12.62
0.75	825.5 C	207.6	41.74	69.70	8.01	13.37
1.50	825.5 C	207.6	24.18	40.38	9.14	15.26
2.25	825.5 C	207.6	19.13	31.95	10.63	17.75
3.00	825.5 C	207.6	17.17	28.67	12.51	20.89
3.76	825.5 C	207.6	13.67	22.83	10.33	17.25
4.51	825.5 C	207.6	11.34	18.93	8.83	14.74
5.26	825.5 C	207.6	9.67	16.14	7.74	12.93
6.01	825.5 C	207.6	8.41	14.05	6.95	11.61
6.76	825.5 C	207.6	7.43	12.41	6.36	10.62
7.51	825.5 C	207.6	6.64	11.09	5.71	9.54

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	6.64	11.09	5.13	8.57
2.55	825.5 C	207.6	16.76	28.00	5.62	9.38
5.10	825.5 C	207.6	11.47	19.16	6.36	10.62
7.64	573.5 S	207.6	7.19	12.01	7.47	12.48
10.19	573.5 S	207.6	5.66	9.46	9.17	15.31
12.74	573.5 S	207.6	5.26	8.79	11.78	19.68
15.29	573.5 S	207.6	5.24	8.75	12.89	21.52
17.84	573.5 S	207.6	5.85	9.77	9.76	16.30
20.38	825.5 C	207.6	12.30	20.54	7.79	13.00
22.93	825.5 C	207.6	9.51	15.89	6.48	10.81
25.48	825.5 C	207.6	7.68	12.83	5.29	8.84

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	7.68	12.83	5.00	8.36
2.55	825.5 C	207.6	14.64	24.45	5.46	9.13
5.10	825.5 C	207.6	12.17	20.32	6.11	10.20
7.64	573.5 S	207.6	5.72	9.56	7.03	11.74
10.19	573.5 S	207.6	4.60	7.68	8.39	14.01
12.74	573.5 S	207.6	4.27	7.12	10.54	17.60
15.29	573.5 S	207.6	4.09	6.84	14.35	23.96
17.84	573.5 S	207.6	4.31	7.20	10.99	18.35
20.38	573.5 S	207.6	5.32	8.88	8.68	14.50
22.93	825.5 C	207.6	9.04	15.10	7.09	11.84
25.48	825.5 C	207.6	>999.	>999.	5.50	9.19

****
Minimum rating is 4.09 at location 15.29 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASCIA STRINGER (F1-1) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:00:09 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	>999.	>999.	6.39	10.67
0.75	825.5 C	207.6	36.64	61.19	6.93	11.57
1.50	825.5 C	207.6	23.91	39.92	8.33	13.92
2.25	825.5 C	207.6	15.89	26.54	8.84	14.76
3.00	825.5 C	207.6	11.88	19.83	8.82	14.73
3.76	825.5 C	207.6	9.46	15.80	7.90	13.19
4.51	825.5 C	207.6	7.85	13.11	7.53	12.57
5.26	573.5 S	207.6	6.70	11.19	6.78	11.33
6.01	573.5 S	207.6	5.83	9.74	6.07	10.13
6.76	573.5 S	207.6	5.15	8.60	5.28	8.81
7.51	825.5 C	207.6	4.61	7.70	4.49	7.51

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	4.61	7.70	3.73	6.23
2.55	825.5 C	207.6	11.91	19.88	4.11	6.86
5.10	825.5 C	207.6	10.25	17.12	4.76	7.96
7.64	825.5 C	207.6	5.78	9.65	5.76	9.62
10.19	573.5 S	207.6	4.48	7.48	7.23	12.07
12.74	573.5 S	207.6	3.98	6.65	9.50	15.86
15.29	573.5 S	207.6	4.04	6.75	9.91	16.55
17.84	573.5 S	207.6	4.60	7.69	7.36	12.29
20.38	825.5 C	207.6	8.41	14.05	5.75	9.61
22.93	825.5 C	207.6	6.57	10.97	4.70	7.85
25.48	825.5 C	207.6	5.33	8.89	3.87	6.47

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	5.33	8.89	3.57	5.96
2.55	825.5 C	207.6	10.14	16.93	3.96	6.62
5.10	825.5 C	207.6	10.38	17.34	4.53	7.56
7.64	573.5 S	207.6	4.46	7.45	5.35	8.94
10.19	573.5 S	207.6	3.57	5.96	6.64	11.09
12.74	573.5 S	207.6	3.13	5.23	8.43	14.07
15.29	573.5 S	207.6	3.06	5.10	11.19	18.68
17.84	573.5 S	207.6	3.28	5.48	8.29	13.84
20.38	573.5 S	207.6	4.00	6.68	6.43	10.74
22.93	825.5 C	207.6	6.81	11.38	5.17	8.63
25.48	825.5 C	207.6	>999.	>999.	4.27	7.14

****
Minimum rating is 3.06 at location 15.29 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

FASCIA STRINGER (F1-1) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:01:02 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	>999.	>999.	8.21	13.71
0.75	825.5 C	207.6	44.20	73.82	8.20	13.69
1.50	825.5 C	207.6	22.05	36.82	8.18	13.66
2.25	825.5 C	207.6	14.65	24.47	7.84	13.10
3.00	825.5 C	207.6	10.95	18.29	7.82	13.07
3.76	825.5 C	207.6	8.73	14.58	6.68	11.15
4.51	825.5 C	207.6	7.24	12.10	6.57	10.97
5.26	825.5 C	207.6	6.18	10.32	5.99	10.01
6.01	573.5 S	207.6	5.38	8.98	5.54	9.25
6.76	573.5 S	207.6	4.75	7.94	5.52	9.22
7.51	573.5 S	207.6	4.25	7.10	4.78	7.98

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	4.25	7.10	3.49	5.82
2.55	825.5 C	207.6	10.42	17.41	3.96	6.61
5.10	825.5 C	207.6	10.26	17.13	4.64	7.75
7.64	825.5 C	207.6	5.68	9.49	5.53	9.24
10.19	573.5 S	207.6	4.21	7.03	7.01	11.71
12.74	573.5 S	207.6	3.79	6.33	9.67	16.15
15.29	573.5 S	207.6	3.79	6.33	10.04	16.77
17.84	573.5 S	207.6	4.44	7.42	7.35	12.28
20.38	825.5 C	207.6	7.84	13.10	5.65	9.43
22.93	825.5 C	207.6	6.12	10.22	4.40	7.35
25.48	825.5 C	207.6	4.51	7.52	3.67	6.14

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	4.51	7.52	3.33	5.56
2.55	825.5 C	207.6	9.47	15.82	3.78	6.31
5.10	825.5 C	207.6	11.38	19.01	4.36	7.28
7.64	573.5 S	207.6	4.35	7.26	5.10	8.51
10.19	573.5 S	207.6	3.33	5.56	6.26	10.46
12.74	573.5 S	207.6	2.97	4.96	8.32	13.90
15.29	573.5 S	207.6	2.86	4.78	11.55	19.28
17.84	573.5 S	207.6	3.15	5.26	8.34	13.92
20.38	573.5 S	207.6	3.97	6.62	6.34	10.59
22.93	825.5 C	207.6	6.72	11.23	5.01	8.37
25.48	825.5 C	207.6	>999.	>999.	4.09	6.83

****
Minimum rating is 2.86 at location 15.29 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASCIA STRINGER (F1-1) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:01:34 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	>999.	>999.	5.39	9.00
0.75	825.5 C	207.6	31.19	52.08	6.00	10.02
1.50	825.5 C	207.6	17.86	29.82	6.81	11.37
2.25	825.5 C	207.6	14.60	24.37	8.13	13.58
3.00	825.5 C	207.6	12.56	20.98	9.33	15.58
3.76	825.5 C	207.6	10.01	16.72	9.30	15.54
4.51	825.5 C	207.6	8.31	13.87	8.25	13.77
5.26	573.5 S	207.6	7.08	11.83	7.19	12.00
6.01	825.5 C	207.6	6.17	10.30	6.12	10.21
6.76	825.5 C	207.6	5.45	9.10	5.29	8.83
7.51	825.5 C	207.6	4.87	8.14	4.53	7.56

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	4.87	8.14	3.85	6.43
2.55	825.5 C	207.6	12.79	21.35	4.25	7.10
5.10	825.5 C	207.6	8.61	14.38	4.94	8.26
7.64	573.5 S	207.6	5.86	9.79	5.99	10.00
10.19	573.5 S	207.6	4.59	7.66	7.63	12.74
12.74	573.5 S	207.6	4.17	6.96	9.72	16.23
15.29	573.5 S	207.6	4.23	7.06	8.90	14.86
17.84	573.5 S	207.6	4.92	8.21	7.23	12.07
20.38	825.5 C	207.6	9.09	15.18	5.86	9.78
22.93	825.5 C	207.6	7.03	11.74	4.85	8.10
25.48	825.5 C	207.6	5.15	8.60	4.00	6.68

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	825.5 C	207.6	5.15	8.60	3.67	6.13
2.55	825.5 C	207.6	9.02	15.07	4.10	6.85
5.10	825.5 C	207.6	9.97	16.65	4.72	7.88
7.64	573.5 S	207.6	4.62	7.71	5.52	9.22
10.19	573.5 S	207.6	3.71	6.20	6.53	10.91
12.74	573.5 S	207.6	3.27	5.46	8.09	13.51
15.29	573.5 S	207.6	3.19	5.32	10.21	17.05
17.84	573.5 S	207.6	3.38	5.65	8.54	14.27
20.38	573.5 S	207.6	4.12	6.88	6.63	11.07
22.93	825.5 C	207.6	7.02	11.72	5.32	8.89
25.48	825.5 C	207.6	>999.	>999.	4.39	7.34

****
Minimum rating is 3.19 at location 15.29 in span 3.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

FASCIA STRINGER - WEST APPROACH - SECTION N.

2. F1-2

SPAN LENGTH: 25.48' - 25.48' (162/991)

GIRDER DETAIL: FLANGES: 8" × 3/4" WEB THICKNESS: 3/8"

GIRDER TOTAL DEPTH: 2.78' - 2.81' / 4.17' - 4.23'

WEB DEPTH: 31.86" - 32.22" / 48.54" - 49.26"

A36 STEEL.

SPACING: MAX. = 6.46'

DISTRIBUTION FACTOR: $\frac{S}{4+0.25S} = 1.150$

CONCRETE: 112 PCF SLAB: 6.75" THICK

EFFECTIVE SLAB WIDTH: $= \begin{cases} \frac{1}{4} \times 25.48 = 6.37' \\ 6.46' \times \frac{1}{2} + (1'-7") = 4.81' \\ 12 \times 6.75" = 6.75' \end{cases} \Rightarrow 4.81'$ (57.72")

HAUNCH WIDTH = 3" + 8" + (1'-7") = 30" THICKNESS: 1"

DEAD LOADS:

$DC1$ = STAY-IN-PLACE FORM $= 2 \times \frac{6.46}{2} =$ 0.006 k/ft

$W.S. = 1.25" \times \frac{1}{12} \times 0.15 \times \frac{6.46}{2} = 0.05$ k/ft

$DC2 = 0.05 + (0.4 \times 2 + 0.467) \times \frac{1}{16} =$ 0.13 k/ft

```
FASICA STRINGER (F1-2) - SECTION N (HS20)
Line Girder : Input File : Definition
Fri Feb 10 11:34:07 2012


ID: FASICA STRINGER (F1-2) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  A36 STIFFENER STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NO INTERMEDIATE TRANSVERSE STIFFENERS
  NONCOMPOSITE GIRDER
  RATE MODE
  SELF WEIGHT FOR DEAD LOAD 1
DATA
  BR 25.48
  ESLABW 57.22
  FILLET 1.
  FPC 4.5
  HAUNCW 30.
  NBSTIFF 1 1 1
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPLBFT  0.75
  SPLBFW 8.
  SPLTFT  0.75
  SPLTFW 8.
  SPLWT  0.375
  SPN 25.48 25.48
  SS 1.
  SUPBST  0.5
  SUPBSW 4.
  TSLABW 57.22
  WAC  0.006
  WAS  0.
  WCONC 112.
  WEBSP 22.31  0.5 28.15
  WEBV 31.86 32.22 48.54 49.26
  WHEELD 1.15
  WHEELF  0.923
  WHEELR 1.15
  WHEELS 1.15
  WSDL  0.13
GO
```

FASICA STRINGER (F1-2) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Fri Feb 10 11:34:12 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.55	B	70.03 T	3331.	18000.	0.185
Base metal *	2.55	B	56.20 T	2673.	16000.	0.167
Base metal	5.10	B	113.63 T	5396.	18000.	0.300
Base metal *	5.10	B	91.20 T	4331.	16000.	0.271
Base metal	7.64	B	135.05 T	6403.	18000.	0.356
Base metal *	7.64	B	108.40 T	5139.	16000.	0.321
Base metal	10.19	B	138.73 T	6567.	18000.	0.365
Base metal *	10.19	B	111.35 T	5271.	16000.	0.329
Base metal	12.74	B	131.49 T	6214.	18000.	0.345
Base metal *	12.74	B	105.53 T	4987.	16000.	0.312
Base metal	15.29	B	126.40 T	5964.	18000.	0.331
Base metal *	15.29	B	101.45 T	4787.	16000.	0.299
Base metal	17.84	B	106.71 T	5027.	18000.	0.279
Base metal *	17.84	B	85.65 T	4035.	16000.	0.252
Base metal	20.38	B	91.50 T	4304.	18000.	0.239
Base metal *	20.38	B	73.44 T	3454.	16000.	0.216
Base metal	22.93	B	107.23 T	2964.	18000.	0.165
Base metal *	22.93	B	86.07 T	2379.	16000.	0.149
Base metal *	25.48	B	107.17 T	2957.	16000.	0.185
Base metal	28.03	B	151.61 T	4175.	18000.	0.232
Base metal *	28.03	B	121.68 T	3351.	16000.	0.209
Base metal	30.58	B	186.51 T	5127.	18000.	0.285
Base metal *	30.58	B	149.69 T	4115.	16000.	0.257
Base metal	33.12	B	207.87 T	5704.	18000.	0.317
Base metal *	33.12	B	166.84 T	4578.	16000.	0.286
Base metal	35.67	B	207.50 T	5683.	18000.	0.316
Base metal *	35.67	B	166.54 T	4562.	16000.	0.285
Base metal	38.22	B	193.78 T	5298.	18000.	0.294
Base metal *	38.22	B	155.53 T	4252.	16000.	0.266
Base metal	40.77	B	191.73 T	5233.	18000.	0.291
Base metal *	40.77	B	153.89 T	4200.	16000.	0.262
Base metal	43.32	B	177.98 T	4849.	18000.	0.269
Base metal *	43.32	B	142.85 T	3892.	16000.	0.243
Base metal	45.86	B	142.80 T	3883.	18000.	0.216
Base metal *	45.86	B	114.61 T	3117.	16000.	0.195
Base metal	48.41	B	84.04 T	2281.	18000.	0.127
Base metal *	48.41	B	67.45 T	1831.	16000.	0.114
Near flg-web weld	2.55	B	70.03 T	3181.	18000.	0.177
Near flg-web weld *	2.55	B	56.20 T	2553.	16000.	0.160
Near flg-web weld	5.10	B	113.63 T	5154.	18000.	0.286
Near flg-web weld *	5.10	B	91.20 T	4137.	16000.	0.259
Near flg-web weld	7.64	B	135.05 T	6116.	18000.	0.340
Near flg-web weld *	7.64	B	108.40 T	4909.	16000.	0.307
Near flg-web weld	10.19	B	138.73 T	6273.	18000.	0.348
Near flg-web weld *	10.19	B	111.35 T	5035.	16000.	0.315
Near flg-web weld	12.74	B	131.49 T	5936.	18000.	0.330
Near flg-web weld *	12.74	B	105.53 T	4765.	16000.	0.298
Near flg-web weld	15.29	B	126.40 T	5698.	18000.	0.317
Near flg-web weld *	15.29	B	101.45 T	4573.	16000.	0.286
Near flg-web weld	17.84	B	106.71 T	4803.	18000.	0.267
Near flg-web weld *	17.84	B	85.65 T	3855.	16000.	0.241
Near flg-web weld	20.38	B	91.50 T	4112.	18000.	0.228
Near flg-web weld *	20.38	B	73.44 T	3300.	16000.	0.206
Near flg-web weld	22.93	B	107.23 T	2875.	18000.	0.160
Near flg-web weld *	22.93	B	86.07 T	2307.	16000.	0.144
Near flg-web weld *	25.48	B	107.17 T	2868.	16000.	0.179
Near flg-web weld	28.03	B	151.61 T	4050.	18000.	0.225
Near flg-web weld *	28.03	B	121.68 T	3251.	16000.	0.203
Near flg-web weld	30.58	B	186.51 T	4974.	18000.	0.276
Near flg-web weld *	30.58	B	149.69 T	3992.	16000.	0.249
Near flg-web weld	33.12	B	207.87 T	5534.	18000.	0.307
Near flg-web weld *	33.12	B	166.84 T	4441.	16000.	0.278
Near flg-web weld	35.67	B	207.50 T	5514.	18000.	0.306
Near flg-web weld *	35.67	B	166.54 T	4426.	16000.	0.277
Near flg-web weld	38.22	B	193.78 T	5141.	18000.	0.286
Near flg-web weld *	38.22	B	155.53 T	4126.	16000.	0.258
Near flg-web weld	40.77	B	191.73 T	5077.	18000.	0.282
Near flg-web weld *	40.77	B	153.89 T	4075.	16000.	0.255
Near flg-web weld	43.32	B	177.98 T	4705.	18000.	0.261
Near flg-web weld *	43.32	B	142.85 T	3776.	16000.	0.236
Near flg-web weld	45.86	B	142.80 T	3768.	18000.	0.209
Near flg-web weld *	45.86	B	114.61 T	3025.	16000.	0.189
Near flg-web weld	48.41	B	84.04 T	2214.	18000.	0.123
Near flg-web weld *	48.41	B	67.45 T	1777.	16000.	0.111
Base metal	2.55	B	43.81 L	[illegible]	[illegible]000.	0.072

FASICA STRINGER (F1-2) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:34:16 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	872.5 C	207.6	>999.	>999.	2.99	5.00
2.55	820.3 C	207.6	5.48	9.16	3.56	5.95
5.10	875.4 C	207.6	3.41	5.69	4.54	7.58
7.64	876.9 C	207.6	2.93	4.89	5.99	10.00
10.19	878.4 C	207.6	2.97	4.95	6.66	11.13
12.74	879.9 C	207.6	3.34	5.57	5.54	9.25
15.29	881.3 C	207.6	3.74	6.25	4.39	7.33
17.84	882.8 C	207.6	5.15	8.60	3.47	5.80
20.38	601.8 C	207.6	5.64	9.42	2.91	4.86
22.93	809.0 C	141.8	4.11	6.87	1.70	2.84
25.48	809.8 C	141.6	2.57	4.29	1.52	2.53

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	809.8 C	141.6	2.57	4.29	1.60	2.67
2.55	810.7 C	141.4	3.19	5.32	1.83	3.06
5.10	1309.7 B	141.2	3.70	6.17	2.15	3.59
7.64	1312.0 B	141.0	4.98	8.32	2.62	4.38
10.19	1314.4 B	140.8	4.49	7.50	3.17	5.30
12.74	1316.7 B	140.6	4.51	7.53	3.72	6.21
15.29	1319.1 B	140.4	4.18	6.97	4.44	7.42
17.84	1321.4 B	140.3	4.23	7.06	3.47	5.80
20.38	1323.8 B	140.1	5.07	8.47	2.70	4.51
22.93	1326.1 B	139.9	8.43	14.09	2.17	3.63
25.48	1328.5 B	139.7	>999.	>999.	1.86	3.11

****
Minimum rating is 1.52 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASICA STRINGER (F1-2) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:34:42 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	872.5 C	207.6	>999.	>999.	5.01	8.36
2.55	824.8 C	207.6	8.99	15.01	6.01	10.04
5.10	875.4 C	207.6	5.43	9.07	7.41	12.38
7.64	876.9 C	207.6	4.55	7.59	9.44	15.77
10.19	878.4 C	207.6	4.49	7.49	12.43	20.75
12.74	879.9 C	207.6	4.84	8.08	9.92	16.57
15.29	881.3 C	207.6	5.64	9.42	7.67	12.82
17.84	882.8 C	207.6	8.02	13.40	6.33	10.58
20.38	601.8 C	207.6	11.08	18.50	5.47	9.14
22.93	809.0 C	141.8	9.14	15.26	3.25	5.42
25.48	809.8 C	141.6	4.61	7.70	2.90	4.85

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	809.8 C	141.6	4.61	7.70	2.99	5.00
2.55	810.7 C	141.4	5.32	8.88	3.34	5.58
5.10	1309.7 B	141.2	6.17	10.31	3.80	6.35
7.64	1312.0 B	141.0	7.90	13.19	4.44	7.42
10.19	1314.4 B	140.8	6.67	11.15	5.38	8.98
12.74	1316.7 B	140.6	6.43	10.74	6.83	11.41
15.29	1319.1 B	140.4	6.22	10.38	7.84	13.09
17.84	1321.4 B	140.3	6.66	11.12	6.11	10.20
20.38	1323.8 B	140.1	8.33	13.92	4.91	8.20
22.93	1326.1 B	139.9	14.31	23.90	4.06	6.78
25.48	1328.5 B	139.7	>999.	>999.	3.20	5.35

****
Minimum rating is 2.90 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASICA STRINGER (F1-2) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:35:15 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	872.5 C	207.6	>999.	>999.	3.96	6.62
2.55	821.8 C	207.6	6.85	11.43	4.58	7.65
5.10	875.4 C	207.6	4.13	6.89	5.78	9.66
7.64	876.9 C	207.6	3.49	5.83	7.55	12.62
10.19	878.4 C	207.6	3.36	5.61	9.85	16.44
12.74	879.9 C	207.6	3.62	6.04	7.33	12.23
15.29	881.3 C	207.6	4.48	7.48	5.86	9.79
17.84	882.8 C	207.6	6.57	10.97	4.66	7.79
20.38	601.8 C	207.6	7.68	12.83	3.92	6.55
22.93	809.0 C	141.8	6.51	10.87	2.29	3.83
25.48	809.8 C	141.6	3.20	5.34	2.05	3.43

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	809.8 C	141.6	3.20	5.34	2.15	3.59
2.55	810.7 C	141.4	3.69	6.16	2.44	4.07
5.10	1309.7 B	141.2	4.28	7.15	2.83	4.73
7.64	1312.0 B	141.0	6.02	10.06	3.41	5.69
10.19	1314.4 B	140.8	5.08	8.48	4.27	7.13
12.74	1316.7 B	140.6	4.65	7.76	5.58	9.32
15.29	1319.1 B	140.4	4.64	7.75	6.04	10.09
17.84	1321.4 B	140.3	5.03	8.39	4.58	7.64
20.38	1323.8 B	140.1	6.21	10.37	3.60	6.02
22.93	1326.1 B	139.9	10.69	17.85	2.94	4.90
25.48	1328.5 B	139.7	>999.	>999.	2.45	4.10

****
Minimum rating is 2.05 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASICA STRINGER (F1-2) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:35:59 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	872.5 C	207.6	>999.	>999.	3.82	6.38
2.55	823.6 C	207.6	6.82	11.39	4.56	7.62
5.10	875.4 C	207.6	4.14	6.91	5.71	9.53
7.64	876.9 C	207.6	3.35	5.60	7.41	12.38
10.19	878.4 C	207.6	3.16	5.28	10.13	16.92
12.74	879.9 C	207.6	3.47	5.79	7.28	12.15
15.29	881.3 C	207.6	4.23	7.07	5.56	9.29
17.84	882.8 C	207.6	6.47	10.80	4.56	7.61
20.38	601.8 C	207.6	7.10	11.85	3.80	6.34
22.93	809.0 C	141.8	5.65	9.44	2.16	3.61
25.48	809.8 C	141.6	2.88	4.81	1.90	3.18

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	809.8 C	141.6	2.88	4.81	2.02	3.38
2.55	810.7 C	141.4	3.42	5.71	2.32	3.88
5.10	1309.7 B	141.2	3.96	6.62	2.68	4.47
7.64	1312.0 B	141.0	5.88	9.81	3.20	5.35
10.19	1314.4 B	140.8	4.76	7.94	4.04	6.75
12.74	1316.7 B	140.6	4.41	7.36	5.53	9.23
15.29	1319.1 B	140.4	4.35	7.26	6.30	10.53
17.84	1321.4 B	140.3	4.85	8.10	4.61	7.69
20.38	1323.8 B	140.1	6.13	10.23	3.54	5.91
22.93	1326.1 B	139.9	10.46	17.48	2.83	4.72
25.48	1328.5 B	139.7	>999.	>999.	2.33	3.89

****
Minimum rating is 1.90 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASICA STRINGER (F1-2) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:36:35 2012

Load Factor Ratings

Span 1

Location	Moment Capacity		Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	872.5	C	207.6	>999.	>999.	4.07	6.80
2.55	822.6	C	207.6	7.05	11.77	4.72	7.88
5.10	875.4	C	207.6	4.24	7.09	5.95	9.94
7.64	876.9	C	207.6	3.58	5.99	7.80	13.03
10.19	878.4	C	207.6	3.49	5.82	8.74	14.60
12.74	879.9	C	207.6	3.75	6.26	6.83	11.41
15.29	881.3	C	207.6	4.74	7.91	5.69	9.51
17.84	882.8	C	207.6	7.00	11.69	4.84	8.09
20.38	601.8	C	207.6	6.52	10.88	4.08	6.82
22.93	809.0	C	141.8	5.06	8.45	2.38	3.97
25.48	809.8	C	141.6	3.20	5.35	2.11	3.53

Span 2

Location	Moment Capacity		Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	809.8	C	141.6	3.20	5.35	2.21	3.69
2.55	810.7	C	141.4	3.89	6.50	2.52	4.20
5.10	1309.7	B	141.2	4.60	7.68	2.94	4.90
7.64	1312.0	B	141.0	6.62	11.06	3.41	5.70
10.19	1314.4	B	140.8	5.43	9.07	4.08	6.81
12.74	1316.7	B	140.6	4.90	8.18	4.68	7.81
15.29	1319.1	B	140.4	4.86	8.12	5.57	9.30
17.84	1321.4	B	140.3	5.21	8.71	4.75	7.93
20.38	1323.8	B	140.1	6.42	10.71	3.73	6.22
22.93	1326.1	B	139.9	11.02	18.40	3.03	5.05
25.48	1328.5	B	139.7	>999.	>999.	2.52	4.21

****
Minimum rating is 2.11 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER – WEST APPROACH – SECTION N.

3. F1-3

SPAN LENGTH: 25.48' – 25.48' – 25.48'

GIRDER: FLANGES: 8" x 3/4" WEB THICKNESS: 3/8"

GIRDER DEPTH: 4.23' – 4.19' – 4.17 – 4.18' (MIN. 4.17')

GIRDER WEB DEPTH: MIN = 4.17' x 12 – 3/4" x 2 = 48.54"

A36 STEEL

SPACING: 6.46'

DISTRIBUTION FACTOR: $\frac{S}{4+0.25S} = 1.150$

CONCRETE: 112 pcf. SLAB: 6.75" THICK

EFFECTIVE SLAB WIDTH: (SEE F1-2 CALC) 57.22"

HAUNCH: WIDTH: 30" THICKNESS: 1"

DEAD LOADS: (SEE F1-2 CALC)

DC1 = 0.006 k/ft

DC2 = 0.13 k/ft

FASICA STRINGER (F1-3) - SECTION N (HS20)
Line Girder : Input File : Definition
Fri Feb 10 11:37:09 2012

```
ID: FASICA STRINGER (F1-3) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  A36 STIFFENER STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NO INTERMEDIATE TRANSVERSE STIFFENERS
  NONCOMPOSITE GIRDER
  RATE MODE
  SELF WEIGHT FOR DEAD LOAD 1
DATA
  BR 25.48 25.48
  ESLABW 57.22
  FILLET 1.
  FPC 4.5
  HAUNCW 30.
  NBSTIFF 1 1 1 1
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPLBFT  0.75
  SPLBFW 8.
  SPLTFT  0.75
  SPLTFW 8.
  SPLWD 48.54
  SPLWT  0.375
  SPN 25.48 25.48 25.48
  SS 1.
  SUPBST  0.5
  SUPBSW 4.
  TSLABW 57.22
  WAC  0.006
  WAS  0.
  WCONC 112.
  WHEELD 1.15
  WHEELF  0.923
  WHEELR 1.15
  WHEELS 1.15
  WSDL  0.13
GO
```

FASICA STRINGER (F1-3) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Fri Feb 10 11:37:27 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)		Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.55	B	74.59	T	2062.	18000.	0.115
Base metal *	2.55	B	59.87	T	1655.	16000.	0.103
Base metal	5.10	B	123.33	T	3409.	18000.	0.189
Base metal *	5.10	B	98.99	T	2736.	16000.	0.171
Base metal	7.64	B	149.00	T	4118.	18000.	0.229
Base metal *	7.64	B	119.59	T	3305.	16000.	0.207
Base metal	10.19	B	155.15	T	4288.	18000.	0.238
Base metal *	10.19	B	124.53	T	3442.	16000.	0.215
Base metal	12.74	B	150.45	T	4158.	18000.	0.231
Base metal *	12.74	B	120.76	T	3338.	16000.	0.209
Base metal	15.29	B	152.22	T	4207.	18000.	0.234
Base metal *	15.29	B	122.17	T	3377.	16000.	0.211
Base metal	17.84	B	140.28	T	3877.	18000.	0.215
Base metal *	17.84	B	112.59	T	3112.	16000.	0.194
Base metal	20.38	B	111.01	T	3068.	18000.	0.170
Base metal *	20.38	B	89.09	T	2462.	16000.	0.154
Base metal	22.93	B	109.02	T	3013.	18000.	0.167
Base metal *	22.93	B	87.50	T	2418.	16000.	0.151
Base metal	25.48	B	134.09	T	3706.	18000.	0.206
Base metal *	25.48	B	107.62	T	2975.	16000.	0.186
Base metal	28.03	B	116.38	T	3216.	18000.	0.179
Base metal *	28.03	B	93.40	T	2582.	16000.	0.161
Base metal	30.58	B	128.09	T	3540.	18000.	0.197
Base metal *	30.58	B	102.81	T	2841.	16000.	0.178
Base metal	33.12	B	145.17	T	4012.	18000.	0.223
Base metal *	33.12	B	116.52	T	3220.	16000.	0.201
Base metal	35.67	B	144.67	T	3998.	18000.	0.222
Base metal *	35.67	B	116.11	T	3209.	16000.	0.201
Base metal	38.22	B	131.99	T	3648.	18000.	0.203
Base metal *	38.22	B	105.94	T	2928.	16000.	0.183
Base metal	40.77	B	144.60	T	3997.	18000.	0.222
Base metal *	40.77	B	116.06	T	3208.	16000.	0.200
Base metal	43.32	B	145.09	T	4010.	18000.	0.223
Base metal *	43.32	B	116.45	T	3218.	16000.	0.201
Base metal	45.86	B	127.99	T	3537.	18000.	0.197
Base metal *	45.86	B	102.72	T	2839.	16000.	0.177
Base metal	48.41	B	116.28	T	3214.	18000.	0.179
Base metal *	48.41	B	93.33	T	2580.	16000.	0.161
Base metal	50.96	B	134.08	T	3706.	18000.	0.206
Base metal *	50.96	B	107.61	T	2974.	16000.	0.186
Base metal	53.51	B	109.05	T	3014.	18000.	0.167
Base metal *	53.51	B	87.52	T	2419.	16000.	0.151
Base metal	56.06	B	111.09	T	3070.	18000.	0.171
Base metal *	56.06	B	89.16	T	2464.	16000.	0.154
Base metal	58.60	B	140.37	T	3880.	18000.	0.216
Base metal *	58.60	B	112.66	T	3114.	16000.	0.195
Base metal	61.15	B	152.29	T	4209.	18000.	0.234
Base metal *	61.15	B	122.23	T	3378.	16000.	0.211
Base metal	63.70	B	150.51	T	4160.	18000.	0.231
Base metal *	63.70	B	120.80	T	3339.	16000.	0.209
Base metal	66.25	B	155.21	T	4290.	18000.	0.238
Base metal *	66.25	B	124.57	T	3443.	16000.	0.215
Base metal	68.80	B	149.04	T	4119.	18000.	0.229
Base metal *	68.80	B	119.62	T	3306.	16000.	0.207
Base metal	71.34	B	123.36	T	3409.	18000.	0.189
Base metal *	71.34	B	99.01	T	2736.	16000.	0.171
Base metal	73.89	B	74.60	T	2062.	18000.	0.115
Base metal *	73.89	B	59.88	T	1655.	16000.	0.103
Near flg-web weld	2.55	B	74.59	T	2000.	18000.	0.111
Near flg-web weld *	2.55	B	59.87	T	1605.	16000.	0.100
Near flg-web weld	5.10	B	123.33	T	3306.	18000.	0.184
Near flg-web weld *	5.10	B	98.99	T	2654.	16000.	0.166
Near flg-web weld	7.64	B	149.00	T	3995.	18000.	0.222
Near flg-web weld *	7.64	B	119.59	T	3206.	16000.	0.200
Near flg-web weld	10.19	B	155.15	T	4160.	18000.	0.231
Near flg-web weld *	10.19	B	124.53	T	3339.	16000.	0.209
Near flg-web weld	12.74	B	150.45	T	4034.	18000.	0.224
Near flg-web weld *	12.74	B	120.76	T	3237.	16000.	0.202
Near flg-web weld	15.29	B	152.22	T	4081.	18000.	0.227
Near flg-web weld *	15.29	B	122.17	T	3275.	16000.	0.205
Near flg-web weld	17.84	B	140.28	T	3761.	18000.	0.209
Near flg-web weld *	17.84	B	112.59	T	3019.	16000.	0.189
Near flg-web weld	20.38	B	111.01	T	2976.	18000.	0.165
Near flg-web weld *	20.38	B	89.09	T	2389.	16000.	0.149
Near flg-web weld	22.93	B	109.02	T	[illegible]	[illegible]	0.162

Near flg-web weld	53.51	B	67.93 L	1821.	29000.	0.063
Near flg-web weld	56.06	B	80.72 L	2164.	29000.	0.075
Near flg-web weld	58.60	B	100.99 L	2708.	29000.	0.093
Near flg-web weld	61.15	B	114.97 L	3082.	29000.	0.106
Near flg-web weld	63.70	B	121.13 L	3247.	29000.	0.112
Near flg-web weld	66.25	B	118.25 L	3170.	29000.	0.109
Near flg-web weld	68.80	B	105.36 L	2825.	29000.	0.097
Near flg-web weld	71.34	B	81.68 L	2190.	29000.	0.076
Near flg-web weld	73.89	B	46.67 L	1251.	29000.	0.043

* Single truck, one traffic lane, >2,000,000 cycles

T - truck loading
L - lane loading

FASICA STRINGER (F1-3) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:37:32 2012

Load Factor Ratings

Span 1

Location	Moment Capacity		Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1302.5	B	141.8	>999.	>999.	1.93	3.22
2.55	1302.5	B	141.8	8.64	14.42	2.27	3.79
5.10	1302.5	B	141.8	5.27	8.80	2.84	4.75
7.64	1302.5	B	141.8	4.45	7.44	3.69	6.16
10.19	1302.5	B	141.8	4.44	7.42	4.77	7.96
12.74	1302.5	B	141.8	4.84	8.09	3.95	6.60
15.29	1302.5	B	141.8	5.05	8.43	3.21	5.36
17.84	1302.5	B	141.8	6.03	10.07	2.51	4.18
20.38	1302.5	B	141.8	9.53	15.92	2.07	3.45
22.93	808.9	C	141.8	5.17	8.64	1.78	2.97
25.48	462.3	C	141.8	1.69	2.82	1.57	2.62

Span 2

Location	Moment Capacity		Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.3	C	141.8	1.69	2.82	1.72	2.86
2.55	462.3	C	141.8	2.65	4.42	2.01	3.36
5.10	1302.5	B	141.8	3.28	5.49	2.42	4.04
7.64	1302.5	B	141.8	6.49	10.84	3.00	5.01
10.19	1302.5	B	141.8	5.82	9.72	3.58	5.98
12.74	1302.5	B	141.8	5.93	9.90	4.32	7.21
15.29	1302.5	B	141.8	5.82	9.72	3.58	5.98
17.84	1302.5	B	141.8	6.49	10.84	3.00	5.01
20.38	1302.5	B	141.8	3.29	5.49	2.42	4.04
22.93	462.3	C	141.8	2.65	4.43	2.01	3.36
25.48	462.3	C	141.8	1.69	2.82	1.72	2.86

Span 3

Location	Moment Capacity		Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.3	C	141.8	1.69	2.82	1.57	2.62
2.55	808.9	C	141.8	5.17	8.64	1.78	2.97
5.10	1302.5	B	141.8	9.52	15.91	2.07	3.46
7.64	1302.5	B	141.8	6.03	10.06	2.51	4.18
10.19	1302.5	B	141.8	5.05	8.43	3.21	5.36
12.74	1302.5	B	141.8	4.84	8.09	3.96	6.62
15.29	1302.5	B	141.8	4.44	7.41	4.79	8.01
17.84	1302.5	B	141.8	4.45	7.44	3.69	6.16
20.38	1302.5	B	141.8	5.27	8.80	2.84	4.75
22.93	1302.5	B	141.8	8.63	14.42	2.27	3.79
25.48	1302.5	B	141.8	>999.	>999.	1.93	3.22

****
Minimum rating is 1.57 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1302.5 B	141.8	>999.	>999.	3.28	5.48
2.55	1302.5 B	141.8	14.43	24.09	3.89	6.50
5.10	1302.5 B	141.8	8.54	14.27	4.72	7.88
7.64	1302.5 B	141.8	6.96	11.63	5.88	9.82
10.19	1302.5 B	141.8	6.65	11.10	7.60	12.69
12.74	1302.5 B	141.8	6.97	11.64	7.38	12.32
15.29	1302.5 B	141.8	7.54	12.60	5.64	9.41
17.84	1302.5 B	141.8	9.51	15.88	4.59	7.66
20.38	1302.5 B	141.8	15.27	25.51	3.90	6.51
22.93	808.9 C	141.8	10.37	17.32	3.41	5.70
25.48	462.4 C	141.8	3.79	6.33	2.97	4.96

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.4 C	141.8	3.79	6.33	3.11	5.19
2.55	462.4 C	141.8	4.56	7.61	3.51	5.86
5.10	1302.5 B	141.8	5.52	9.22	4.08	6.81
7.64	1302.5 B	141.8	9.92	16.57	4.90	8.18
10.19	1302.5 B	141.8	8.45	14.11	6.12	10.23
12.74	1302.5 B	141.8	8.32	13.89	8.07	13.47
15.29	1302.5 B	141.8	8.45	14.12	6.92	11.56
17.84	1302.5 B	141.8	9.92	16.57	5.40	9.01
20.38	1302.5 B	141.8	5.53	9.23	4.40	7.35
22.93	462.4 C	141.8	4.56	7.62	3.73	6.23
25.48	462.4 C	141.8	3.79	6.34	3.11	5.19

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.4 C	141.8	3.79	6.34	2.97	4.96
2.55	808.9 C	141.8	10.36	17.31	3.26	5.45
5.10	1302.5 B	141.8	15.26	25.48	3.67	6.14
7.64	1302.5 B	141.8	9.50	15.87	4.25	7.10
10.19	1302.5 B	141.8	7.54	12.59	5.11	8.53
12.74	1302.5 B	141.8	6.97	11.63	6.45	10.78
15.29	1302.5 B	141.8	6.64	11.09	8.77	14.64
17.84	1302.5 B	141.8	6.96	11.63	6.62	11.06
20.38	1302.5 B	141.8	8.54	14.26	5.22	8.71
22.93	1302.5 B	141.8	14.42	24.09	4.24	7.09
25.48	1302.5 B	141.8	>999.	>999.	3.28	5.48

****
Minimum rating is 2.97 at location 25.48 in span 1.
****

Moment Capacity Codes
- C - Compact
- B - Braced non-compact
- U - Unbraced non-compact
- T - Transition between compact and braced non-compact
- S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASICA STRINGER (F1-3) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:38:51 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1302.5 B	141.8	>999.	>999.	2.55	4.26
2.55	1302.5 B	141.8	10.87	18.15	2.93	4.90
5.10	1302.5 B	141.8	6.42	10.72	3.63	6.07
7.64	1302.5 B	141.8	5.30	8.85	4.66	7.79
10.19	1302.5 B	141.8	4.96	8.29	6.08	10.15
12.74	1302.5 B	141.8	5.11	8.54	5.46	9.12
15.29	1302.5 B	141.8	5.85	9.77	4.32	7.21
17.84	1302.5 B	141.8	7.41	12.38	3.39	5.66
20.38	1302.5 B	141.8	12.69	21.19	2.81	4.69
22.93	808.9 C	141.8	7.20	12.02	2.41	4.03
25.48	462.4 C	141.8	2.63	4.39	2.12	3.53

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.4 C	141.8	2.63	4.39	2.25	3.76
2.55	462.4 C	141.8	3.16	5.28	2.59	4.33
5.10	1302.5 B	141.8	3.83	6.39	3.08	5.15
7.64	1302.5 B	141.8	7.79	13.02	3.80	6.35
10.19	1302.5 B	141.8	6.55	10.93	4.85	8.10
12.74	1302.5 B	141.8	6.17	10.31	6.75	11.27
15.29	1302.5 B	141.8	6.55	10.93	5.31	8.87
17.84	1302.5 B	141.8	7.80	13.02	4.03	6.73
20.38	1302.5 B	141.8	3.83	6.40	3.22	5.38
22.93	462.4 C	141.8	3.16	5.28	2.68	4.47
25.48	462.4 C	141.8	2.63	4.39	2.25	3.76

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.4 C	141.8	2.63	4.39	2.12	3.54
2.55	808.9 C	141.8	7.19	12.01	2.37	3.95
5.10	1302.5 B	141.8	12.67	21.16	2.72	4.55
7.64	1302.5 B	141.8	7.41	12.37	3.24	5.41
10.19	1302.5 B	141.8	5.85	9.77	4.05	6.76
12.74	1302.5 B	141.8	5.11	8.53	5.17	8.63
15.29	1302.5 B	141.8	4.96	8.29	6.77	11.31
17.84	1302.5 B	141.8	5.30	8.84	4.99	8.34
20.38	1302.5 B	141.8	6.42	10.72	3.86	6.45
22.93	1302.5 B	141.8	10.87	18.15	3.09	5.17
25.48	1302.5 B	141.8	>999.	>999.	2.55	4.25

****
Minimum rating is 2.12 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASICA STRINGER (F1-3) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:39:35 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1302.5 B	141.8	>999.	>999.	2.44	4.07
2.55	1302.5 B	141.8	10.73	17.92	2.90	4.84
5.10	1302.5 B	141.8	6.38	10.65	3.58	5.98
7.64	1302.5 B	141.8	5.10	8.52	4.53	7.56
10.19	1302.5 B	141.8	4.66	7.78	6.02	10.05
12.74	1302.5 B	141.8	4.86	8.12	5.43	9.07
15.29	1302.5 B	141.8	5.48	9.16	4.10	6.85
17.84	1302.5 B	141.8	7.28	12.16	3.32	5.54
20.38	1302.5 B	141.8	12.35	20.63	2.72	4.55
22.93	808.9 C	141.8	6.64	11.09	2.28	3.81
25.48	462.4 C	141.8	2.18	3.65	1.98	3.30

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.4 C	141.8	2.18	3.65	2.14	3.58
2.55	462.4 C	141.8	2.92	4.87	2.47	4.12
5.10	1302.5 B	141.8	3.54	5.91	2.91	4.86
7.64	1302.5 B	141.8	7.62	12.73	3.59	6.00
10.19	1302.5 B	141.8	6.15	10.28	4.73	7.90
12.74	1302.5 B	141.8	5.95	9.93	6.90	11.53
15.29	1302.5 B	141.8	6.15	10.28	5.48	9.15
17.84	1302.5 B	141.8	7.62	12.73	4.03	6.74
20.38	1302.5 B	141.8	3.54	5.91	3.15	5.26
22.93	462.4 C	141.8	2.92	4.88	2.55	4.25
25.48	462.4 C	141.8	2.19	3.65	2.14	3.58

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	462.4 C	141.8	2.19	3.65	1.98	3.30
2.55	808.9 C	141.8	6.63	11.08	2.26	3.77
5.10	1302.5 B	141.8	12.34	20.61	2.62	4.37
7.64	1302.5 B	141.8	7.28	12.15	3.08	5.15
10.19	1302.5 B	141.8	5.48	9.15	3.82	6.37
12.74	1302.5 B	141.8	4.86	8.12	5.11	8.53
15.29	1302.5 B	141.8	4.66	7.78	7.00	11.68
17.84	1302.5 B	141.8	5.10	8.51	5.02	8.39
20.38	1302.5 B	141.8	6.38	10.65	3.81	6.35
22.93	1302.5 B	141.8	10.73	17.92	3.00	5.01
25.48	1302.5 B	141.8	>999.	>999.	2.43	4.07

****
Minimum rating is 1.98 at location 25.48 in span 1.
****

Moment Capacity Codes
- C - Compact
- B - Braced non-compact
- U - Unbraced non-compact
- T - Transition between compact and braced non-compact
- S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASICA STRINGER (F1-3) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 11:40:16 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	1302.5 B	141.8	>999.	>999.	2.62	4.38
2.55	1302.5 B	141.8	11.20	18.70	3.02	5.05
5.10	1302.5 B	141.8	6.62	11.06	3.75	6.27
7.64	1302.5 B	141.8	5.47	9.13	4.82	8.05
10.19	1302.5 B	141.8	5.19	8.66	6.38	10.66
12.74	1302.5 B	141.8	5.35	8.93	5.03	8.40
15.29	1302.5 B	141.8	6.01	10.03	4.17	6.97
17.84	1302.5 B	141.8	7.54	12.59	3.52	5.87
20.38	1302.5 B	141.8	10.89	18.18	2.94	4.91
22.93	808.9 C	141.8	6.68	11.16	2.54	4.24
25.48	462.3 C	141.8	2.38	3.97	2.22	3.71

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	462.3 C	141.8	2.38	3.97	2.32	3.88
2.55	462.3 C	141.8	3.28	5.48	2.68	4.47
5.10	1302.5 B	141.8	4.08	6.81	3.19	5.33
7.64	1302.5 B	141.8	8.44	14.09	3.88	6.47
10.19	1302.5 B	141.8	6.91	11.54	4.71	7.86
12.74	1302.5 B	141.8	6.75	11.27	5.66	9.46
15.29	1302.5 B	141.8	6.91	11.54	4.99	8.34
17.84	1302.5 B	141.8	8.44	14.09	4.04	6.74
20.38	1302.5 B	141.8	4.08	6.81	3.31	5.53
22.93	462.3 C	141.8	3.28	5.48	2.77	4.62
25.48	462.3 C	141.8	2.38	3.97	2.32	3.88

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Op	Shear Inv	Op
0.00	462.3 C	141.8	2.38	3.97	2.22	3.71
2.55	808.9 C	141.8	6.68	11.16	2.49	4.16
5.10	1302.5 B	141.8	10.88	18.17	2.86	4.78
7.64	1302.5 B	141.8	7.54	12.59	3.34	5.57
10.19	1302.5 B	141.8	6.01	10.03	3.97	6.64
12.74	1302.5 B	141.8	5.34	8.92	4.92	8.21
15.29	1302.5 B	141.8	5.18	8.66	6.15	10.28
17.84	1302.5 B	141.8	5.47	9.13	5.15	8.60
20.38	1302.5 B	141.8	6.62	11.06	3.98	6.65
22.93	1302.5 B	141.8	11.20	18.70	3.18	5.32
25.48	1302.5 B	141.8	>999.	>999.	2.62	4.37

****
Minimum rating is 2.22 at location 25.48 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

FASCIA STRINGER – WEST APPROACH – SECTION N.

4. F2A-1, F2B-1, F2C-1. (F2-1)

SPAN LENGTH: 25.0' (F2C-1 GOVERNS FOR LARGE SPACING)

GIRDER: FLANGES: 8"×3/4" WEB THICKNESS: 3/8"

GIRDE DEPTH: 4.54' WEB DEPTH: 52.98"

A36 STEEL. NON-COMPOSITE

SPACING: 6'-8 9/16" = 6.71'

DISTRIBUTION FACTOR: $\frac{S}{4+0.25S} = 1.182$

CONCRETE: 112 PCF SLAB: 6.75"

EFFECTIVE SLAB WIDTH: $\begin{cases} \frac{1}{4} \times 25' = 6.25' \\ 6.71 \times \frac{1}{2} + 11" = 4.27' \\ 12 \times 6.75" = 6.75' \end{cases} \Rightarrow 4.27'$ (51.24")

HAUNCH WIDTH: = 3"+8"+11" = 22" THICKNESS: 1"

DEAD LOADS:

$DC1 = \text{STAY-IN-PLACE FORM} = 2 \times \frac{6.71'}{2} = \underline{0.007\ k/ft}$

$W.S. = 1.25" \times \frac{1}{12} \times 0.15 \times \frac{6.71'}{2} = 0.052\ k/ft$

$DC2 = 0.052 + (0.41 \times 2 + 0.467) \times \frac{1}{16} = \underline{0.132\ k/ft}$

```
FASCIA STRINGER (F2-1) - SECTION N (HS20)
Line Girder : Input File : Definition
Fri Feb 10 12:02:54 2012


ID: FASCIA STRINGER (F2-1) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  A36 STIFFENER STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NO INTERMEDIATE TRANSVERSE STIFFENERS
  NONCOMPOSITE GIRDER
  RATE MODE
  SELF WEIGHT FOR DEAD LOAD 1
DATA
  BR  0.001
  ESLABW 51.24
  FILLET 1.
  FPC 4.5
  HAUNCW 22.
  NBSTIFF 1 1
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPLBFT  0.75
  SPLBFW 8.
  SPLTFT  0.75
  SPLTFW 8.
  SPLWD 52.98
  SPLWT  0.375
  SPN 25.
  SS 1.
  SUPBST  0.5
  SUPBSW 4.
  TSLABW 51.24
  WAC  0.007
  WAS  0.
  WCONC 112.
  WHEELD 1.182
  WHEELF  0.959
  WHEELR 1.182
  WHEELS 1.182
  WSDL  0.132
GO
```

FASCIA STRINGER (F2-1) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Fri Feb 10 12:02:59 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.50	B	76.22 T	1872.	18000.	0.104
Base metal *	2.50	B	61.84 T	1519.	16000.	0.095
Base metal	5.00	B	127.85 T	3140.	18000.	0.174
Base metal *	5.00	B	103.73 T	2548.	16000.	0.159
Base metal	7.50	B	154.89 T	3804.	18000.	0.211
Base metal *	7.50	B	125.67 T	3087.	16000.	0.193
Base metal	10.00	B	157.35 T	3865.	18000.	0.215
Base metal *	10.00	B	127.66 T	3136.	16000.	0.196
Base metal	12.50	B	153.66 T	3774.	18000.	0.210
Base metal *	12.50	B	124.67 T	3062.	16000.	0.191
Base metal	15.00	B	157.35 T	3865.	18000.	0.215
Base metal *	15.00	B	127.66 T	3136.	16000.	0.196
Base metal	17.50	B	154.89 T	3804.	18000.	0.211
Base metal *	17.50	B	125.67 T	3087.	16000.	0.193
Base metal	20.00	B	127.85 T	3140.	18000.	0.174
Base metal *	20.00	B	103.73 T	2548.	16000.	0.159
Base metal	22.50	B	76.22 T	1872.	18000.	0.104
Base metal *	22.50	B	61.84 T	1519.	16000.	0.095
Near flg-web weld	2.50	B	76.22 T	1820.	18000.	0.101
Near flg-web weld *	2.50	B	61.84 T	1477.	16000.	0.092
Near flg-web weld	5.00	B	127.85 T	3054.	18000.	0.170
Near flg-web weld *	5.00	B	103.73 T	2478.	16000.	0.155
Near flg-web weld	7.50	B	154.89 T	3700.	18000.	0.206
Near flg-web weld *	7.50	B	125.67 T	3002.	16000.	0.188
Near flg-web weld	10.00	B	157.35 T	3758.	18000.	0.209
Near flg-web weld *	10.00	B	127.66 T	3049.	16000.	0.191
Near flg-web weld	12.50	B	153.66 T	3670.	18000.	0.204
Near flg-web weld *	12.50	B	124.67 T	2978.	16000.	0.186
Near flg-web weld	15.00	B	157.35 T	3758.	18000.	0.209
Near flg-web weld *	15.00	B	127.66 T	3049.	16000.	0.191
Near flg-web weld	17.50	B	154.89 T	3700.	18000.	0.206
Near flg-web weld *	17.50	B	125.67 T	3002.	16000.	0.188
Near flg-web weld	20.00	B	127.85 T	3054.	18000.	0.170
Near flg-web weld *	20.00	B	103.73 T	2478.	16000.	0.155
Near flg-web weld	22.50	B	76.22 T	1820.	18000.	0.101
Near flg-web weld *	22.50	B	61.84 T	1477.	16000.	0.092
Base metal	2.50	B	44.95 L	1104.	29000.	0.038
Base metal	5.00	B	79.90 L	1963.	29000.	0.068
Base metal	7.50	B	104.87 L	2576.	29000.	0.089
Base metal	10.00	B	119.85 L	2944.	29000.	0.102
Base metal	12.50	B	124.85 L	3067.	29000.	0.106
Base metal	15.00	B	119.85 L	2944.	29000.	0.102
Base metal	17.50	B	104.87 L	2576.	29000.	0.089
Base metal	20.00	B	79.90 L	1963.	29000.	0.068
Base metal	22.50	B	44.95 L	1104.	29000.	0.038
Near flg-web weld	2.50	B	44.95 L	1074.	29000.	0.037
Near flg-web weld	5.00	B	79.90 L	1909.	29000.	0.066
Near flg-web weld	7.50	B	104.87 L	2505.	29000.	0.086
Near flg-web weld	10.00	B	119.85 L	2863.	29000.	0.099
Near flg-web weld	12.50	B	124.85 L	2982.	29000.	0.103
Near flg-web weld	15.00	B	119.85 L	2863.	29000.	0.099
Near flg-web weld	17.50	B	104.87 L	2505.	29000.	0.086
Near flg-web weld	20.00	B	79.90 L	1909.	29000.	0.066
Near flg-web weld	22.50	B	44.95 L	1074.	29000.	0.037

* Single truck, one traffic lane, >2,000,000 cycles

T - truck loading
L - lane loading

FASCIA STRINGER (F2-1) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:03:03 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1465.7 B	129.9	>999.	>999.	1.58	2.63
2.50	1465.7 B	129.9	8.74	14.59	1.84	3.08
5.00	1465.7 B	129.9	5.15	8.61	2.22	3.71
7.50	1465.7 B	129.9	4.22	7.05	2.79	4.65
10.00	1465.7 B	129.9	4.14	6.91	3.69	6.17
12.50	1465.7 B	129.9	4.23	7.06	4.87	8.13
15.00	1465.7 B	129.9	4.14	6.91	3.75	6.26
17.50	1465.7 B	129.9	4.22	7.05	2.79	4.65
20.00	1465.7 B	129.9	5.15	8.61	2.22	3.71
22.50	1465.7 B	129.9	8.74	14.59	1.84	3.08
25.00	1465.7 B	129.9	>999.	>999.	1.58	2.63

****
Minimum rating is 1.58 at location 0.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-1) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:04:35 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1465.7 B	129.9	>999.	>999.	2.79	4.66
2.50	1465.7 B	129.9	15.08	25.18	3.20	5.35
5.00	1465.7 B	129.9	8.58	14.32	3.74	6.24
7.50	1465.7 B	129.9	6.68	11.15	4.46	7.44
10.00	1465.7 B	129.9	6.05	10.11	5.49	9.16
12.50	1465.7 B	129.9	6.15	10.27	7.08	11.82
15.00	1465.7 B	129.9	6.05	10.11	6.15	10.26
17.50	1465.7 B	129.9	6.68	11.15	4.89	8.16
20.00	1465.7 B	129.9	8.58	14.32	4.04	6.75
22.50	1465.7 B	129.9	15.08	25.18	3.43	5.72
25.00	1465.7 B	129.9	>999.	>999.	2.79	4.66

****
Minimum rating is 2.79 at location 0.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-1) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:05:43 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1465.7 B	129.9	>999.	>999.	2.09	3.49
2.50	1465.7 B	129.9	11.29	18.85	2.40	4.00
5.00	1465.7 B	129.9	6.36	10.62	2.86	4.78
7.50	1465.7 B	129.9	5.01	8.37	3.52	5.88
10.00	1465.7 B	129.9	4.53	7.56	4.35	7.26
12.50	1465.7 B	129.9	4.37	7.30	5.95	9.94
15.00	1465.7 B	129.9	4.53	7.56	4.71	7.86
17.50	1465.7 B	129.9	5.01	8.37	3.62	6.05
20.00	1465.7 B	129.9	6.36	10.62	2.93	4.89
22.50	1465.7 B	129.9	11.29	18.85	2.45	4.08
25.00	1465.7 B	129.9	>999.	>999.	2.09	3.49

****
Minimum rating is 2.09 at location 0.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-1) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:06:57 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1465.7 B	129.9	>999.	>999.	1.96	3.28
2.50	1465.7 B	129.9	10.97	18.31	2.33	3.89
5.00	1465.7 B	129.9	6.23	10.41	2.78	4.64
7.50	1465.7 B	129.9	4.87	8.13	3.34	5.58
10.00	1465.7 B	129.9	4.25	7.10	4.16	6.94
12.50	1465.7 B	129.9	4.13	6.90	5.95	9.94
15.00	1465.7 B	129.9	4.25	7.10	4.46	7.45
17.50	1465.7 B	129.9	4.87	8.13	3.54	5.91
20.00	1465.7 B	129.9	6.23	10.41	2.85	4.76
22.50	1465.7 B	129.9	10.97	18.31	2.33	3.89
25.00	1465.7 B	129.9	>999.	>999.	1.96	3.28

****
Minimum rating is 1.96 at location 0.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-1) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 12:08:18 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1465.7 B	129.9	>999.	>999.	2.15	3.59
2.50	1465.7 B	129.9	11.65	19.46	2.48	4.13
5.00	1465.7 B	129.9	6.60	11.01	2.97	4.96
7.50	1465.7 B	129.9	5.23	8.74	3.59	6.00
10.00	1465.7 B	129.9	4.77	7.97	4.35	7.26
12.50	1465.7 B	129.9	4.66	7.78	5.55	9.26
15.00	1465.7 B	129.9	4.77	7.97	4.71	7.86
17.50	1465.7 B	129.9	5.23	8.74	3.80	6.34
20.00	1465.7 B	129.9	6.60	11.01	3.04	5.08
22.50	1465.7 B	129.9	11.65	19.46	2.53	4.22
25.00	1465.7 B	129.9	>999.	>999.	2.15	3.59

****
Minimum rating is 2.15 at location 0.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of
allowable stress and LL+I section modulus.

FASCIA STRINGER – WEST APPROACH – SECTION N

5. F2-2

SPAN LENGTH: 25'–25'.

GIRDER: FLANGES: 8" × 3/4" WEB THICKNESS: 1/2"

GIRDER DEPTH: 4.54'–4.43'/6.88'–6.74'

WEB DEPTH: $4.43 \times 12 - \frac{3}{4} \times 2 = 51.66"$
$6.74 \times 12 - \frac{3}{4} \times 2 = 79.38"$

A36 STEEL. NON-COMPOSITE

SPACING: 6.71'

DISTRIBUTION FACTOR: $\frac{S}{4 + 0.25S} = 1.182$.

CONCRETE: 112 PCF. SLAB: 6.75"

EFFECTIVE SLAB WIDTH: 51.24" (SAME AS F2-1)

HAUNCH WIDTH: 3" + 8" + 11" = 22" THICKNESS = 1"

DEAD LOADS: (SAME AS F2-1)

DC1 = 0.007 k/ft

DC2 = 0.132 k/ft.

```
FASCIA STRINGER (F2-2) - SECTION N (HS20)
Line Girder : Input File : Definition
Fri Feb 10 13:52:57 2012


ID: FASCIA STRINGER (F2-2) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  A36 STIFFENER STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NO INTERMEDIATE TRANSVERSE STIFFENERS
  NONCOMPOSITE GIRDER
  RATE MODE
  SELF WEIGHT FOR DEAD LOAD 1
DATA
  BR 25.
  ESLABW 51.24
  FILLET 1.
  FPC 4.5
  HAUNCW 22.
  NBSTIFF 1 1 1
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPLBFT  0.75
  SPLBFW 8.
  SPLTFT  0.75
  SPLTFW 8.
  SPLWT  0.5
  SPN 25. 25.
  SS 1.
  SUPBST  0.5
  SUPBSW 4.
  TSLABW 51.24
  WAC  0.007
  WAS  0.
  WCONC 112.
  WEBSP 18.67  0.5 30.83
  WEBV 51.66 51.66 79.38 79.38
  WHEELD 1.182
  WHEELF  0.959
  WHEELR 1.182
  WHEELS 1.182
  WSDL  0.132
GO
```

FASCIA STRINGER (F2-2) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Fri Feb 10 13:53:03 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)	Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.50	B	69.67 T	1589.	18000.	0.088
Base metal *	2.50	B	56.53 T	1289.	16000.	0.081
Base metal	5.00	B	113.33 T	2585.	18000.	0.144
Base metal *	5.00	B	91.95 T	2097.	16000.	0.131
Base metal	7.50	B	134.74 T	3073.	18000.	0.171
Base metal *	7.50	B	109.32 T	2493.	16000.	0.156
Base metal	10.00	B	137.31 T	3132.	18000.	0.174
Base metal *	10.00	B	111.41 T	2541.	16000.	0.159
Base metal	12.50	B	129.85 T	2961.	18000.	0.165
Base metal *	12.50	B	105.35 T	2403.	16000.	0.150
Base metal	15.00	B	121.75 T	2777.	18000.	0.154
Base metal *	15.00	B	98.78 T	2253.	16000.	0.141
Base metal	17.50	B	105.68 T	2410.	18000.	0.134
Base metal *	17.50	B	85.74 T	1955.	16000.	0.122
Base metal	20.00	B	104.28 T	1262.	18000.	0.070
Base metal *	20.00	B	84.61 T	1024.	16000.	0.064
Base metal	22.50	B	121.49 T	1470.	18000.	0.082
Base metal *	22.50	B	98.57 T	1193.	16000.	0.075
Base metal *	25.00	B	117.90 T	1427.	16000.	0.089
Base metal	27.50	B	153.96 T	1863.	18000.	0.104
Base metal *	27.50	B	124.92 T	1512.	16000.	0.094
Base metal	30.00	B	183.51 T	2221.	18000.	0.123
Base metal *	30.00	B	148.88 T	1802.	16000.	0.113
Base metal	32.50	B	204.24 T	2471.	18000.	0.137
Base metal *	32.50	B	165.71 T	2005.	16000.	0.125
Base metal	35.00	B	204.79 T	2478.	18000.	0.138
Base metal *	35.00	B	166.15 T	2011.	16000.	0.126
Base metal	37.50	B	194.59 T	2355.	18000.	0.131
Base metal *	37.50	B	157.88 T	1910.	16000.	0.119
Base metal	40.00	B	190.95 T	2311.	18000.	0.128
Base metal *	40.00	B	154.93 T	1875.	16000.	0.117
Base metal	42.50	B	177.25 T	2145.	18000.	0.119
Base metal *	42.50	B	143.81 T	1740.	16000.	0.109
Base metal	45.00	B	142.38 T	1723.	18000.	0.096
Base metal *	45.00	B	115.52 T	1398.	16000.	0.087
Base metal	47.50	B	83.93 T	1016.	18000.	0.056
Base metal *	47.50	B	68.10 T	824.	16000.	0.052
Near flg-web weld	2.50	B	69.67 T	1544.	18000.	0.086
Near flg-web weld *	2.50	B	56.53 T	1253.	16000.	0.078
Near flg-web weld	5.00	B	113.33 T	2512.	18000.	0.140
Near flg-web weld *	5.00	B	91.95 T	2038.	16000.	0.127
Near flg-web weld	7.50	B	134.74 T	2986.	18000.	0.166
Near flg-web weld *	7.50	B	109.32 T	2423.	16000.	0.151
Near flg-web weld	10.00	B	137.31 T	3043.	18000.	0.169
Near flg-web weld *	10.00	B	111.41 T	2469.	16000.	0.154
Near flg-web weld	12.50	B	129.85 T	2878.	18000.	0.160
Near flg-web weld *	12.50	B	105.35 T	2335.	16000.	0.146
Near flg-web weld	15.00	B	121.75 T	2698.	18000.	0.150
Near flg-web weld *	15.00	B	98.78 T	2189.	16000.	0.137
Near flg-web weld	17.50	B	105.68 T	2342.	18000.	0.130
Near flg-web weld *	17.50	B	85.74 T	1900.	16000.	0.119
Near flg-web weld	20.00	B	104.28 T	1238.	18000.	0.069
Near flg-web weld *	20.00	B	84.61 T	1005.	16000.	0.063
Near flg-web weld	22.50	B	121.49 T	1443.	18000.	0.080
Near flg-web weld *	22.50	B	98.57 T	1171.	16000.	0.073
Near flg-web weld *	25.00	B	117.90 T	1400.	16000.	0.088
Near flg-web weld	27.50	B	153.96 T	1828.	18000.	0.102
Near flg-web weld *	27.50	B	124.92 T	1484.	16000.	0.093
Near flg-web weld	30.00	B	183.51 T	2179.	18000.	0.121
Near flg-web weld *	30.00	B	148.88 T	1768.	16000.	0.111
Near flg-web weld	32.50	B	204.24 T	2426.	18000.	0.135
Near flg-web weld *	32.50	B	165.71 T	1968.	16000.	0.123
Near flg-web weld	35.00	B	204.79 T	2432.	18000.	0.135
Near flg-web weld *	35.00	B	166.15 T	1973.	16000.	0.123
Near flg-web weld	37.50	B	194.59 T	2311.	18000.	0.128
Near flg-web weld *	37.50	B	157.88 T	1875.	16000.	0.117
Near flg-web weld	40.00	B	190.95 T	2268.	18000.	0.126
Near flg-web weld *	40.00	B	154.93 T	1840.	16000.	0.115
Near flg-web weld	42.50	B	177.25 T	2105.	18000.	0.117
Near flg-web weld *	42.50	B	143.81 T	1708.	16000.	0.107
Near flg-web weld	45.00	B	142.38 T	1691.	18000.	0.094
Near flg-web weld *	45.00	B	115.52 T	1372.	16000.	0.086
Near flg-web weld	47.50	B	83.93 T	997.	18000.	0.055
Near flg-web weld *	47.50	B	68.10 T	809.	16000.	0.051
Base metal	2.50	B	43.93 L	[illegible]	[illegible]	0.035

FASCIA STRINGER (F2-2) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 13:53:07 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1578.5 B	315.8	>999.	>999.	4.58	7.64
2.50	1578.5 B	315.8	11.25	18.78	5.59	9.34
5.00	1578.5 B	315.8	7.01	11.71	7.06	11.78
7.50	1578.5 B	315.8	6.06	10.11	9.22	15.39
10.00	1578.5 B	315.8	6.21	10.38	9.55	15.95
12.50	1578.5 B	315.8	7.03	11.74	8.01	13.38
15.00	1578.5 B	315.8	8.17	13.64	6.89	11.50
17.50	1578.5 B	315.8	6.31	10.54	5.46	9.12
20.00	1306.2 C	205.5	10.12	16.89	2.92	4.88
22.50	1306.2 C	205.5	5.92	9.88	2.53	4.22
25.00	1306.2 C	205.5	3.92	6.54	2.25	3.75

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1306.2 C	205.5	3.92	6.54	2.34	3.91
2.50	1306.2 C	205.5	5.05	8.43	2.67	4.47
5.00	1306.2 C	205.5	5.79	9.66	3.15	5.26
7.50	2975.1 B	205.5	11.97	19.99	3.84	6.42
10.00	2975.1 B	205.5	10.66	17.81	4.46	7.44
12.50	2975.1 B	205.5	10.41	17.39	5.20	8.68
15.00	2975.1 B	205.5	9.71	16.22	6.15	10.27
17.50	2975.1 B	205.5	9.77	16.32	5.09	8.50
20.00	2975.1 B	205.5	11.64	19.44	3.99	6.67
22.50	2975.1 B	205.5	19.18	32.02	3.25	5.42
25.00	2975.1 B	205.5	>999.	>999.	2.75	4.59

****
Minimum rating is 2.25 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-2) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 13:54:52 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1578.5 B	315.8	>999.	>999.	7.57	12.64
2.50	1578.5 B	315.8	18.33	30.62	9.12	15.22
5.00	1578.5 B	315.8	11.21	18.73	11.28	18.84
7.50	1578.5 B	315.8	9.46	15.80	14.41	24.06
10.00	1578.5 B	315.8	9.35	15.61	18.97	31.68
12.50	1578.5 B	315.8	10.25	17.12	14.47	24.16
15.00	1578.5 B	315.8	12.03	20.09	11.25	18.80
17.50	1578.5 B	315.8	9.90	16.52	9.36	15.64
20.00	1306.2 C	205.5	21.92	36.60	5.24	8.75
22.50	1306.2 C	205.5	13.07	21.83	4.69	7.83
25.00	1306.2 C	205.5	7.17	11.98	4.19	7.00

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1306.2 C	205.5	7.17	11.98	4.33	7.24
2.50	1306.2 C	205.5	8.16	13.62	4.81	8.03
5.00	1306.2 C	205.5	9.35	15.62	5.45	9.11
7.50	2975.1 B	205.5	18.43	30.78	6.35	10.61
10.00	2975.1 B	205.5	15.51	25.91	7.66	12.79
12.50	2975.1 B	205.5	14.91	24.90	9.71	16.22
15.00	2975.1 B	205.5	14.36	23.99	11.40	19.03
17.50	2975.1 B	205.5	15.29	25.54	8.88	14.83
20.00	2975.1 B	205.5	18.98	31.70	7.15	11.93
22.50	2975.1 B	205.5	32.30	53.94	5.92	9.89
25.00	2975.1 B	205.5	>999.	>999.	4.68	7.82

****
Minimum rating is 4.19 at location 25.00 in span 1.
****

Moment Capacity Codes
- C - Compact
- B - Braced non-compact
- U - Unbraced non-compact
- T - Transition between compact and braced non-compact
- S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-2) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 13:55:54 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1578.5 B	315.8	>999.	>999.	6.00	10.03
2.50	1578.5 B	315.8	14.21	23.73	7.07	11.80
5.00	1578.5 B	315.8	8.58	14.32	8.98	15.00
7.50	1578.5 B	315.8	7.30	12.19	11.57	19.32
10.00	1578.5 B	315.8	7.05	11.78	14.05	23.47
12.50	1578.5 B	315.8	7.66	12.80	10.54	17.60
15.00	1578.5 B	315.8	9.50	15.87	8.56	14.30
17.50	1578.5 B	315.8	8.31	13.87	6.87	11.47
20.00	1306.2 C	205.5	15.24	25.45	3.74	6.25
22.50	1306.2 C	205.5	9.35	15.61	3.30	5.51
25.00	1306.2 C	205.5	4.97	8.29	2.99	5.00

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1306.2 C	205.5	4.97	8.29	3.15	5.26
2.50	1306.2 C	205.5	5.65	9.43	3.56	5.94
5.00	1306.2 C	205.5	6.47	10.81	4.13	6.89
7.50	2975.1 B	205.5	14.17	23.67	4.96	8.28
10.00	2975.1 B	205.5	11.89	19.85	6.04	10.09
12.50	2975.1 B	205.5	10.82	18.07	7.85	13.10
15.00	2975.1 B	205.5	10.76	17.97	8.74	14.60
17.50	2975.1 B	205.5	11.61	19.38	6.63	11.08
20.00	2975.1 B	205.5	14.26	23.81	5.24	8.74
22.50	2975.1 B	205.5	24.52	40.94	4.28	7.14
25.00	2975.1 B	205.5	>999.	>999.	3.58	5.98

****
Minimum rating is 2.99 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-2) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 13:57:01 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1578.5 B	315.8	>999.	>999.	5.76	9.63
2.50	1578.5 B	315.8	13.99	23.37	6.96	11.62
5.00	1578.5 B	315.8	8.65	14.44	8.75	14.62
7.50	1578.5 B	315.8	7.06	11.78	11.43	19.08
10.00	1578.5 B	315.8	6.71	11.20	15.15	25.31
12.50	1578.5 B	315.8	7.40	12.36	10.41	17.38
15.00	1578.5 B	315.8	9.07	15.14	8.03	13.42
17.50	1578.5 B	315.8	8.07	13.48	6.65	11.10
20.00	1306.2 C	205.5	14.15	23.62	3.61	6.02
22.50	1306.2 C	205.5	8.06	13.46	3.10	5.17
25.00	1306.2 C	205.5	4.43	7.39	2.75	4.60

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1306.2 C	205.5	4.43	7.39	2.94	4.92
2.50	1306.2 C	205.5	5.29	8.83	3.33	5.57
5.00	1306.2 C	205.5	6.06	10.12	3.84	6.41
7.50	2975.1 B	205.5	13.94	23.29	4.58	7.65
10.00	2975.1 B	205.5	11.19	18.69	5.74	9.59
12.50	2975.1 B	205.5	10.27	17.15	7.81	13.04
15.00	2975.1 B	205.5	10.13	16.91	9.06	15.13
17.50	2975.1 B	205.5	11.28	18.84	6.64	11.09
20.00	2975.1 B	205.5	14.12	23.59	5.12	8.55
22.50	2975.1 B	205.5	24.17	40.36	4.11	6.86
25.00	2975.1 B	205.5	>999.	>999.	3.40	5.67

****
Minimum rating is 2.75 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER (F2-2) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 13:58:22 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1578.5 B	315.8	>999.	>999.	6.16	10.29
2.50	1578.5 B	315.8	14.60	24.39	7.26	12.13
5.00	1578.5 B	315.8	8.80	14.70	9.22	15.41
7.50	1578.5 B	315.8	7.50	12.53	12.26	20.48
10.00	1578.5 B	315.8	7.32	12.23	12.47	20.83
12.50	1578.5 B	315.8	7.99	13.35	9.85	16.46
15.00	1578.5 B	315.8	9.86	16.47	8.30	13.86
17.50	1578.5 B	315.8	8.46	14.13	7.15	11.95
20.00	1306.2 C	205.5	12.17	20.33	3.91	6.53
22.50	1306.2 C	205.5	7.38	12.32	3.42	5.72
25.00	1306.2 C	205.5	4.88	8.15	3.09	5.16

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	1306.2 C	205.5	4.88	8.15	3.24	5.41
2.50	1306.2 C	205.5	6.01	10.03	3.68	6.15
5.00	1306.2 C	205.5	7.03	11.75	4.19	7.00
7.50	2975.1 B	205.5	15.21	25.40	4.87	8.13
10.00	2975.1 B	205.5	12.49	20.86	5.88	9.82
12.50	2975.1 B	205.5	11.40	19.04	6.74	11.25
15.00	2975.1 B	205.5	11.28	18.84	8.00	13.35
17.50	2975.1 B	205.5	12.04	20.10	6.88	11.49
20.00	2975.1 B	205.5	14.74	24.62	5.41	9.04
22.50	2975.1 B	205.5	25.29	42.24	4.41	7.36
25.00	2975.1 B	205.5	>999.	>999.	3.69	6.15

****
Minimum rating is 3.09 at location 25.00 in span 1.
****

Moment Capacity Codes
- C - Compact
- B - Braced non-compact
- U - Unbraced non-compact
- T - Transition between compact and braced non-compact
- S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

Noncompact shapes ratings based on stress, as

$$IR = \frac{Fb - \text{Dead load factored stress}}{\text{LL+I factored stress}}$$

Noncompact shape moment capacity is the product of allowable stress and LL+I section modulus.

FASCIA STRINGER - WEST APPROACH - SECTION N

6. F2-3.

SPAN LENGTH: 25'-25'-25'

GIRDER: FLANGES: 8"×3/4" WEB THICKNESS: 1/2"

GIRDER DEPTH: 6.74'-6.55'-6.13'-5.66'

WEB DEPTH: 79.38"-77.10"-72.06"-66.42"

A36 STEEL. NON-COMPOSITE

SPACING: 6.71'

DISTRIBUTION FACTOR: $\frac{S}{4+0.25S} = 1.182$

CONCRETE: 112 PCF. SLAB: 6.75'

EFFECTIVE SLAB WIDTH: 51.24" (SAME AS F2-2)

HAUNCH WIDTH: 22" THICKNESS: 1"

DEAD LOADS: (SAME AS F2-2)

DC1 = 0.007 K/ft

DC2 = 0.132 K/ft

FASCIA STRINGER (F2-3) - SECTION N (HS20)
Line Girder : Input File : Definition
Fri Feb 10 14:10:33 2012

```
ID: FASCIA STRINGER (F2-3) - SECTION N (HS20)
CONDITIONS
  A36 STEEL
  A36 STIFFENER STEEL
  ENGLISH INPUT
  ENGLISH OUTPUT
  HS20 LOADING
  LFD METHOD
  NO INTERMEDIATE TRANSVERSE STIFFENERS
  NONCOMPOSITE GIRDER
  RATE MODE
  SELF WEIGHT FOR DEAD LOAD 1
DATA
  BR 25. 25.
  ESLABW 51.24
  FILLET 1.
  FPC 4.5
  HAUNCW 22.
  NBSTIFF 1 1 1 1
  NMOD 11
  SLABT 6.75
  SLABWEAR 1.
  SPLBFT  0.75
  SPLBFW 8.
  SPLTFT  0.75
  SPLTFW 8.
  SPLWT  0.5
  SPN 25. 25. 25.
  SS 1.
  SUPBST  0.5
  SUPBSW 4.
  TSLABW 51.24
  WAC  0.007
  WAS  0.
  WCONC 112.
  WEBSP 25. 25. 25.
  WEBV 79.38 77.1 72.06 66.42
  WHEELD 1.182
  WHEELF  0.959
  WHEELR 1.182
  WHEELS 1.182
  WSDL  0.132
GO
```

FASCIA STRINGER (F2-3) - SECTION N (HS20)
Line Girder : Rating Output : Fatigue Stress
Fri Feb 10 14:10:39 2012

Fatigue Summary

Condition	Location from Left End of Girder	Category (Table 10.3.1A)	Force Range (k-ft)		Actual Stress Range	Allowable Stress Range	Ratio
Base metal	2.50	B	75.14	T	913.	18000.	0.051
Base metal *	2.50	B	60.97	T	741.	16000.	0.046
Base metal	5.00	B	124.41	T	1519.	18000.	0.084
Base metal *	5.00	B	100.94	T	1232.	16000.	0.077
Base metal	7.50	B	150.54	T	1846.	18000.	0.103
Base metal *	7.50	B	122.14	T	1498.	16000.	0.094
Base metal	10.00	B	157.02	T	1934.	18000.	0.107
Base metal *	10.00	B	127.40	T	1569.	16000.	0.098
Base metal	12.50	B	153.70	T	1901.	18000.	0.106
Base metal *	12.50	B	124.70	T	1543.	16000.	0.096
Base metal	15.00	B	153.09	T	1902.	18000.	0.106
Base metal *	15.00	B	124.21	T	1543.	16000.	0.096
Base metal	17.50	B	141.74	T	1769.	18000.	0.098
Base metal *	17.50	B	115.00	T	1435.	16000.	0.090
Base metal	20.00	B	115.42	T	1447.	18000.	0.080
Base metal *	20.00	B	93.64	T	1174.	16000.	0.073
Base metal	22.50	B	112.33	T	1415.	18000.	0.079
Base metal *	22.50	B	91.14	T	1148.	16000.	0.072
Base metal	25.00	B	138.43	T	1751.	18000.	0.097
Base metal *	25.00	B	112.32	T	1421.	16000.	0.089
Base metal	27.50	B	115.04	T	1470.	18000.	0.082
Base metal *	27.50	B	93.34	T	1193.	16000.	0.075
Base metal	30.00	B	123.26	T	1591.	18000.	0.088
Base metal *	30.00	B	100.00	T	1291.	16000.	0.081
Base metal	32.50	B	139.06	T	1813.	18000.	0.101
Base metal *	32.50	B	112.82	T	1471.	16000.	0.092
Base metal	35.00	B	141.39	T	1862.	18000.	0.103
Base metal *	35.00	B	114.72	T	1511.	16000.	0.094
Base metal	37.50	B	132.54	T	1763.	18000.	0.098
Base metal *	37.50	B	107.54	T	1431.	16000.	0.089
Base metal	40.00	B	145.97	T	1962.	18000.	0.109
Base metal *	40.00	B	118.43	T	1592.	16000.	0.099
Base metal	42.50	B	146.82	T	1994.	18000.	0.111
Base metal *	42.50	B	119.12	T	1618.	16000.	0.101
Base metal	45.00	B	133.14	T	1827.	18000.	0.102
Base metal *	45.00	B	108.02	T	1482.	16000.	0.093
Base metal	47.50	B	120.17	T	1666.	18000.	0.093
Base metal *	47.50	B	97.50	T	1352.	16000.	0.085
Base metal	50.00	B	132.79	T	1861.	18000.	0.103
Base metal *	50.00	B	107.74	T	1510.	16000.	0.094
Base metal	52.50	B	109.74	T	1556.	18000.	0.086
Base metal *	52.50	B	89.04	T	1263.	16000.	0.079
Base metal	55.00	B	106.97	T	1535.	18000.	0.085
Base metal *	55.00	B	86.79	T	1245.	16000.	0.078
Base metal	57.50	B	129.74	T	1884.	18000.	0.105
Base metal *	57.50	B	105.27	T	1529.	16000.	0.096
Base metal	60.00	B	143.43	T	2108.	18000.	0.117
Base metal *	60.00	B	116.37	T	1710.	16000.	0.107
Base metal	62.50	B	146.16	T	2175.	18000.	0.121
Base metal *	62.50	B	118.59	T	1764.	16000.	0.110
Base metal	65.00	B	150.65	T	2269.	18000.	0.126
Base metal *	65.00	B	122.23	T	1841.	16000.	0.115
Base metal	67.50	B	145.40	T	2217.	18000.	0.123
Base metal *	67.50	B	117.97	T	1799.	16000.	0.112
Base metal	70.00	B	120.94	T	1867.	18000.	0.104
Base metal *	70.00	B	98.12	T	1515.	16000.	0.095
Base metal	72.50	B	73.47	T	1148.	18000.	0.064
Base metal *	72.50	B	59.61	T	932.	16000.	0.058
Near flg-web weld	2.50	B	75.14	T	896.	18000.	0.050
Near flg-web weld *	2.50	B	60.97	T	727.	16000.	0.045
Near flg-web weld	5.00	B	124.41	T	1490.	18000.	0.083
Near flg-web weld *	5.00	B	100.94	T	1209.	16000.	0.076
Near flg-web weld	7.50	B	150.54	T	1811.	18000.	0.101
Near flg-web weld *	7.50	B	122.14	T	1470.	16000.	0.092
Near flg-web weld	10.00	B	157.02	T	1898.	18000.	0.105
Near flg-web weld *	10.00	B	127.40	T	1540.	16000.	0.096
Near flg-web weld	12.50	B	153.70	T	1866.	18000.	0.104
Near flg-web weld *	12.50	B	124.70	T	1514.	16000.	0.095
Near flg-web weld	15.00	B	153.09	T	1866.	18000.	0.104
Near flg-web weld *	15.00	B	124.21	T	1514.	16000.	0.095
Near flg-web weld	17.50	B	141.74	T	1736.	18000.	0.096
Near flg-web weld *	17.50	B	115.00	T	1408.	16000.	0.088
Near flg-web weld	20.00	B	115.42	T	1420.	18000.	0.079
Near flg-web weld *	20.00	B	93.64	T	1152.	16000.	0.072
Near flg-web weld	22.50	B	112.33	T	1388.	18000.	0.077

Near flg-web weld	52.50	B	64.70	L	899.	29000.	0.031
Near flg-web weld	55.00	B	75.85	L	1066.	29000.	0.037
Near flg-web weld	57.50	B	95.90	L	1364.	29000.	0.047
Near flg-web weld	60.00	B	110.42	L	1589.	29000.	0.055
Near flg-web weld	62.50	B	117.32	L	1708.	29000.	0.059
Near flg-web weld	65.00	B	115.32	L	1700.	29000.	0.059
Near flg-web weld	67.50	B	103.32	L	1541.	29000.	0.053
Near flg-web weld	70.00	B	80.48	L	1215.	29000.	0.042
Near flg-web weld	72.50	B	46.16	L	706.	29000.	0.024

* Single truck, one traffic lane, >2,000,000 cycles

T - truck loading
L - lane loading

FASCIA STRINGER (F2-3) - SECTION N (HS20)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 14:10:42 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	2975.1 B	205.5	>999.	>999.	2.78	4.65
2.50	2962.0 B	206.1	19.69	32.89	3.35	5.59
5.00	2949.0 B	206.7	10.98	18.33	4.17	6.97
7.50	2936.0 B	207.3	10.14	16.93	5.38	8.99
10.00	2923.0 B	207.9	10.07	16.81	6.82	11.39
12.50	2910.1 B	208.5	10.82	18.06	5.69	9.50
15.00	2897.2 B	209.1	11.44	19.10	4.83	8.06
17.50	2884.3 B	209.7	13.50	22.54	3.88	6.47
20.00	2871.4 B	210.3	20.27	33.85	3.18	5.31
22.50	1276.7 C	211.0	8.13	13.58	2.73	4.56
25.00	729.1 C	211.6	2.74	4.58	2.42	4.04

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	729.1 C	211.6	2.74	4.58	2.57	4.30
2.50	724.9 C	213.0	4.39	7.33	2.99	5.00
5.00	2789.3 B	214.4	5.42	9.06	3.60	6.01
7.50	2761.4 B	215.8	14.36	23.98	4.48	7.48
10.00	2733.5 B	217.3	12.46	20.81	5.34	8.91
12.50	2705.7 B	218.7	12.42	20.74	6.57	10.98
15.00	2678.1 B	220.2	12.05	20.13	5.45	9.09
17.50	2650.6 B	221.7	13.33	22.26	4.62	7.71
20.00	2623.3 B	223.3	4.74	7.92	3.84	6.41
22.50	691.9 C	224.8	3.84	6.41	3.22	5.38
25.00	687.7 C	226.4	2.57	4.29	2.80	4.67

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	687.7 C	226.4	2.57	4.29	2.58	4.32
2.50	1193.2 C	228.2	7.56	12.63	2.94	4.91
5.00	2508.8 B	230.0	8.62	14.39	3.46	5.77
7.50	2478.9 B	231.8	12.39	20.70	4.24	7.09
10.00	2449.2 B	233.7	10.08	16.83	5.41	9.03
12.50	2419.6 B	235.6	9.24	15.43	6.43	10.73
15.00	2390.3 B	237.5	8.41	14.05	7.80	13.02
17.50	2361.0 B	239.5	8.30	13.86	6.36	10.62
20.00	2332.0 B	241.5	9.64	16.11	4.98	8.31
22.50	2303.1 B	243.5	15.49	25.86	4.03	6.73
25.00	2274.3 B	245.6	>999.	>999.	3.38	5.65

****
Minimum rating is 2.42 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

FASCIA STRINGER (F2-3) - SECTION N (2F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 14:12:00 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	2975.1 B	205.5	>999.	>999.	4.71	7.87
2.50	2962.0 B	206.1	32.79	54.75	5.57	9.30
5.00	2949.0 B	206.7	17.72	29.60	6.74	11.25
7.50	2936.0 B	207.3	15.77	26.34	8.38	13.99
10.00	2923.0 B	207.9	14.97	25.01	10.79	18.03
12.50	2910.1 B	208.5	15.60	26.05	10.77	17.98
15.00	2897.2 B	209.1	16.66	27.82	8.26	13.80
17.50	2884.3 B	209.7	20.64	34.47	6.76	11.29
20.00	2871.4 B	210.3	32.35	54.02	5.77	9.64
22.50	1276.7 C	211.0	15.46	25.81	5.08	8.49
25.00	754.9 C	211.6	6.70	11.20	4.44	7.41

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	754.9 C	211.6	6.70	11.20	4.61	7.69
2.50	750.6 C	213.0	7.83	13.08	5.20	8.68
5.00	2789.3 B	214.4	9.27	15.48	6.03	10.08
7.50	2761.4 B	215.8	21.31	35.58	7.23	12.08
10.00	2733.5 B	217.3	17.85	29.80	9.03	15.08
12.50	2705.7 B	218.7	17.27	28.84	11.88	19.83
15.00	2678.1 B	220.2	17.21	28.74	10.83	18.08
17.50	2650.6 B	221.7	19.71	32.91	8.49	14.18
20.00	2623.3 B	223.3	8.11	13.54	6.98	11.65
22.50	716.3 C	224.8	6.72	11.23	5.95	9.94
25.00	712.1 C	226.4	5.65	9.43	4.99	8.33

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	712.1 C	226.4	5.65	9.43	4.75	7.94
2.50	1193.2 C	228.2	16.65	27.81	5.23	8.74
5.00	2508.8 B	230.0	14.74	24.62	5.90	9.85
7.50	2478.9 B	231.8	18.88	31.52	6.84	11.42
10.00	2449.2 B	233.7	14.70	24.55	8.23	13.74
12.50	2419.6 B	235.6	13.36	22.32	10.42	17.40
15.00	2390.3 B	237.5	12.54	20.94	14.33	23.92
17.50	2361.0 B	239.5	12.90	21.55	11.17	18.65
20.00	2332.0 B	241.5	15.53	25.93	8.88	14.84
22.50	2303.1 B	243.5	25.69	42.90	7.30	12.19
25.00	2274.3 B	245.6	>999.	>999.	5.70	9.52

****
Minimum rating is 4.44 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASCIA STRINGER (F2-3) - SECTION N (3F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 14:12:56 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	2975.1 B	205.5	>999.	>999.	3.65	6.09
2.50	2962.0 B	206.1	25.05	41.84	4.26	7.11
5.00	2949.0 B	206.7	13.40	22.37	5.28	8.82
7.50	2936.0 B	207.3	12.04	20.10	6.71	11.21
10.00	2923.0 B	207.9	11.22	18.74	8.55	14.28
12.50	2910.1 B	208.5	11.45	19.13	7.88	13.15
15.00	2897.2 B	209.1	12.96	21.64	6.31	10.53
17.50	2884.3 B	209.7	16.14	26.95	4.98	8.31
20.00	2871.4 B	210.3	26.82	44.80	4.15	6.93
22.50	1276.7 C	211.0	10.75	17.95	3.59	6.00
25.00	750.8 C	211.6	4.53	7.56	3.21	5.36

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	750.8 C	211.6	4.53	7.56	3.38	5.64
2.50	746.6 C	213.0	5.41	9.04	3.89	6.49
5.00	2789.3 B	214.4	6.41	10.70	4.62	7.72
7.50	2761.4 B	215.8	16.86	28.16	5.61	9.36
10.00	2733.5 B	217.3	13.90	23.21	7.10	11.86
12.50	2705.7 B	218.7	12.86	21.48	9.79	16.34
15.00	2678.1 B	220.2	13.37	22.33	8.28	13.82
17.50	2650.6 B	221.7	15.51	25.91	6.33	10.57
20.00	2623.3 B	223.3	5.61	9.37	5.09	8.51
22.50	712.5 C	224.8	4.65	7.76	4.27	7.13
25.00	708.3 C	226.4	3.90	6.52	3.67	6.13

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	708.3 C	226.4	3.90	6.52	3.43	5.72
2.50	1193.2 C	228.2	11.57	19.32	3.84	6.42
5.00	2508.8 B	230.0	12.60	21.04	4.44	7.41
7.50	2478.9 B	231.8	14.89	24.87	5.30	8.85
10.00	2449.2 B	233.7	11.48	19.17	6.48	10.82
12.50	2419.6 B	235.6	9.85	16.45	8.26	13.80
15.00	2390.3 B	237.5	9.41	15.71	11.26	18.80
17.50	2361.0 B	239.5	9.87	16.48	8.39	14.01
20.00	2332.0 B	241.5	11.77	19.65	6.56	10.95
22.50	2303.1 B	243.5	19.68	32.86	5.31	8.87
25.00	2274.3 B	245.6	>999.	>999.	4.42	7.39

****
Minimum rating is 3.21 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

FASCIA STRINGER (F2-3) - SECTION N (4F1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 14:13:59 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	2975.1 B	205.5	>999.	>999.	3.47	5.79
2.50	2962.0 B	206.1	24.66	41.17	4.19	7.00
5.00	2949.0 B	206.7	13.34	22.28	5.12	8.55
7.50	2936.0 B	207.3	11.68	19.50	6.46	10.78
10.00	2923.0 B	207.9	10.57	17.66	8.49	14.17
12.50	2910.1 B	208.5	10.90	18.21	7.79	13.01
15.00	2897.2 B	209.1	12.22	20.40	5.94	9.92
17.50	2884.3 B	209.7	15.98	26.68	4.84	8.08
20.00	2871.4 B	210.3	25.63	42.81	4.02	6.71
22.50	1276.7 C	211.0	9.97	16.65	3.39	5.67
25.00	747.6 C	211.6	3.73	6.23	2.98	4.97

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	747.6 C	211.6	3.73	6.23	3.20	5.34
2.50	743.4 C	213.0	5.00	8.36	3.65	6.10
5.00	2789.3 B	214.4	5.92	9.89	4.30	7.18
7.50	2761.4 B	215.8	16.62	27.76	5.29	8.84
10.00	2733.5 B	217.3	13.13	21.93	6.93	11.58
12.50	2705.7 B	218.7	12.44	20.78	10.03	16.76
15.00	2678.1 B	220.2	12.63	21.09	8.47	14.15
17.50	2650.6 B	221.7	15.29	25.54	6.30	10.52
20.00	2623.3 B	223.3	5.18	8.66	4.96	8.29
22.50	709.4 C	224.8	4.30	7.18	4.05	6.77
25.00	705.2 C	226.4	3.26	5.45	3.46	5.79

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	705.2 C	226.4	3.26	5.45	3.17	5.30
2.50	1193.2 C	228.2	10.72	17.90	3.63	6.06
5.00	2508.8 B	230.0	12.20	20.37	4.20	7.02
7.50	2478.9 B	231.8	14.74	24.62	4.95	8.27
10.00	2449.2 B	233.7	10.83	18.09	6.13	10.24
12.50	2419.6 B	235.6	9.39	15.67	8.20	13.70
15.00	2390.3 B	237.5	8.87	14.81	11.54	19.27
17.50	2361.0 B	239.5	9.57	15.98	8.39	14.01
20.00	2332.0 B	241.5	11.74	19.61	6.44	10.75
22.50	2303.1 B	243.5	19.37	32.34	5.13	8.57
25.00	2274.3 B	245.6	>999.	>999.	4.22	7.04

****
Minimum rating is 2.98 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual
for Condition Evaluation of Bridges.

FASCIA STRINGER (F2-3) - SECTION N (5C1)
Line Girder : Rating Output : Load Factor Ratings
Fri Feb 10 14:16:18 2012

Load Factor Ratings

Span 1

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	2975.1 B	205.5	>999.	>999.	3.75	6.26
2.50	2962.0 B	206.1	25.84	43.15	4.39	7.33
5.00	2949.0 B	206.7	13.83	23.09	5.46	9.11
7.50	2936.0 B	207.3	12.44	20.77	7.03	11.74
10.00	2923.0 B	207.9	11.73	19.60	8.99	15.02
12.50	2910.1 B	208.5	11.99	20.02	7.27	12.13
15.00	2897.2 B	209.1	13.11	21.90	6.08	10.16
17.50	2884.3 B	209.7	15.84	26.46	5.20	8.69
20.00	2871.4 B	210.3	21.74	36.31	4.37	7.30
22.50	1276.7 C	211.0	10.53	17.58	3.79	6.34
25.00	737.7 C	211.6	4.04	6.75	3.39	5.66

Span 2

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	737.7 C	211.6	4.04	6.75	3.48	5.82
2.50	733.5 C	213.0	5.49	9.17	4.02	6.72
5.00	2789.3 B	214.4	6.76	11.29	4.80	8.01
7.50	2761.4 B	215.8	17.87	29.85	5.88	9.82
10.00	2733.5 B	217.3	14.48	24.17	7.36	12.29
12.50	2705.7 B	218.7	13.94	23.28	8.99	15.01
15.00	2678.1 B	220.2	13.93	23.27	7.81	13.05
17.50	2650.6 B	221.7	16.53	27.60	6.35	10.61
20.00	2623.3 B	223.3	5.85	9.76	5.27	8.80
22.50	700.1 C	224.8	4.88	8.14	4.41	7.37
25.00	695.9 C	226.4	3.67	6.13	3.78	6.32

Span 3

Location	Moment Capacity	Shear Capacity	Rating Factors Bending Inv	Bending Op	Shear Inv	Shear Op
0.00	695.9 C	226.4	3.67	6.13	3.60	6.01
2.50	1193.2 C	228.2	10.29	17.19	4.04	6.75
5.00	2508.8 B	230.0	10.17	16.99	4.68	7.81
7.50	2478.9 B	231.8	14.69	24.53	5.35	8.94
10.00	2449.2 B	233.7	11.67	19.49	6.37	10.64
12.50	2419.6 B	235.6	10.29	17.19	8.03	13.40
15.00	2390.3 B	237.5	9.83	16.41	10.41	17.39
17.50	2361.0 B	239.5	10.19	17.01	8.65	14.44
20.00	2332.0 B	241.5	12.14	20.27	6.76	11.28
22.50	2303.1 B	243.5	20.29	33.88	5.47	9.13
25.00	2274.3 B	245.6	>999.	>999.	4.55	7.59

****
Minimum rating is 3.39 at location 25.00 in span 1.
****

Moment Capacity Codes
C - Compact
B - Braced non-compact
U - Unbraced non-compact
T - Transition between compact and braced non-compact
S - Serviceability

This table is based on eq. (6-1a) of the AASHTO Manual for Condition Evaluation of Bridges.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:41:23 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	8.83	2.93	85.74 T	0.00 T	97.50	11.76
Steel	1.35					
Conc	7.47					
25.48	8.83	2.93	85.74 T	0.00 T	97.50	11.76
Steel	1.35					
Conc	7.47					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	6.79	2.25	39.49 T	0.00 T	48.54	9.05
Steel	1.04					
Conc	5.75					
25.48	6.79	2.25	39.49 T	0.00 T	48.54	9.05
Steel	1.04					
Conc	5.75					

Reactions in girder output include weight in girder extensions
at abutments.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (2F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:10:43 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	8.83	2.93	48.91 N	0.00 N	60.67	11.76
Steel	1.35					
Conc	7.47					
25.48	8.83	2.93	48.91 N	0.00 N	60.67	11.76
Steel	1.35					
Conc	7.47					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	6.79	2.25	22.53 N	0.00 N	31.57	9.05
Steel	1.04					
Conc	5.75					
25.48	6.79	2.25	22.53 N	0.00 N	31.57	9.05
Steel	1.04					
Conc	5.75					

Reactions in girder output include weight in girder extensions
at abutments.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (3F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:10:55 2012

Factored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		8.83	2.93	61.37 N	0.00 N	73.13	11.76
	Steel	1.35					
	Conc	7.47					
25.48		8.83	2.93	61.37 N	0.00 N	73.13	11.76
	Steel	1.35					
	Conc	7.47					

Unfactored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		6.79	2.25	28.27 N	0.00 N	37.31	9.05
	Steel	1.04					
	Conc	5.75					
25.48		6.79	2.25	28.27 N	0.00 N	37.31	9.05
	Steel	1.04					
	Conc	5.75					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (4F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:11:07 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	8.83	2.93	63.89 N	0.00 N	75.65	11.76
Steel	1.35					
Conc	7.47					
25.48	8.83	2.93	63.89 N	0.00 N	75.65	11.76
Steel	1.35					
Conc	7.47					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	6.79	2.25	29.43 N	0.00 N	38.48	9.05
Steel	1.04					
Conc	5.75					
25.48	6.79	2.25	29.43 N	0.00 N	38.48	9.05
Steel	1.04					
Conc	5.75					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (SIMPLE SPAN) - SECTION N (5C1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:11:19 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	8.83	2.93	59.87 N	0.00 N	71.63	11.76
Steel	1.35					
Conc	7.47					
25.48	8.83	2.93	59.87 N	0.00 N	71.63	11.76
Steel	1.35					
Conc	7.47					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	6.79	2.25	27.58 N	0.00 N	36.62	9.05
Steel	1.04					
Conc	5.75					
25.48	6.79	2.25	27.58 N	0.00 N	36.62	9.05
Steel	1.04					
Conc	5.75					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (2-SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:40:53 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.34	2.30	89.95 T	-7.31 T	99.60	-1.08 *
Steel	1.03					
Conc	6.32					
25.00	22.41	7.68	115.91 T	0.00 T	146.00	30.09
Steel	3.08					
Conc	19.33					
50.00	7.34	2.30	89.95 T	-7.31 T	99.60	-1.08 *
Steel	1.03					
Conc	6.32					

* D + 2L - 3.17.1(a)

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.65	1.77	41.43 T	-3.37 T	48.85	4.06
Steel	0.79					
Conc	4.86					
25.00	17.24	5.91	53.39 T	0.00 T	76.53	23.14
Steel	2.37					
Conc	14.87					
50.00	5.65	1.77	41.43 T	-3.37 T	48.85	4.06
Steel	0.79					
Conc	4.86					

Reactions in girder output include weight in girder extensions
at abutments.

INTERIOR STRINGER (2-SPAN) - SECTION N (2F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:08:56 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.34	2.30	53.60 N	-4.43 N	63.25	5.22
Steel	1.03					
Conc	6.32					
25.00	22.41	7.68	58.36 N	0.00 N	88.45	30.09
Steel	3.08					
Conc	19.33					
50.00	7.34	2.30	53.60 N	-4.43 N	63.25	5.22
Steel	1.03					
Conc	6.32					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.65	1.77	24.69 N	-2.04 N	32.11	5.38
Steel	0.79					
Conc	4.86					
25.00	17.24	5.91	26.88 N	0.00 N	50.03	23.14
Steel	2.37					
Conc	14.87					
50.00	5.65	1.77	24.69 N	-2.04 N	32.11	5.38
Steel	0.79					
Conc	4.86					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (2-SPAN) - SECTION N (3F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:09:11 2012

Factored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total	
0.00		7.34	2.30	65.30 N	-6.37 N	74.95	-0.22	*
	Steel	1.03						
	Conc	6.32						
25.00		22.41	7.68	83.14 N	0.00 N	113.22	30.09	
	Steel	3.08						
	Conc	19.33						
50.00		7.34	2.30	65.30 N	-6.37 N	74.95	-0.22	*
	Steel	1.03						
	Conc	6.32						

* D + 2L - 3.17.1(a)

Unfactored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		5.65	1.77	30.08 N	-2.93 N	37.50	4.49
	Steel	0.79					
	Conc	4.86					
25.00		17.24	5.91	38.29 N	0.00 N	61.44	23.14
	Steel	2.37					
	Conc	14.87					
50.00		5.65	1.77	30.08 N	-2.93 N	37.50	4.49
	Steel	0.79					
	Conc	4.86					

Reactions in girder output include weight in girder extensions
at abutments.

INTERIOR STRINGER (2-SPAN) - SECTION N (4F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:09:23 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total	
0.00	7.34	2.30	67.15 N	-6.90 N	76.80	-0.71	*
Steel	1.03						
Conc	6.32						
25.00	22.41	7.68	92.95 N	0.00 N	123.03	30.09	
Steel	3.08						
Conc	19.33						
50.00	7.34	2.30	67.15 N	-6.90 N	76.80	-0.71	*
Steel	1.03						
Conc	6.32						

* D + 2L - 3.17.1(a)

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.65	1.77	30.93 N	-3.18 N	38.35	4.24
Steel	0.79					
Conc	4.86					
25.00	17.24	5.91	42.81 N	0.00 N	65.96	23.14
Steel	2.37					
Conc	14.87					
50.00	5.65	1.77	30.93 N	-3.18 N	38.35	4.24
Steel	0.79					
Conc	4.86					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (2-SPAN) - SECTION N (5C1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:09:35 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.34	2.30	63.69 N	-5.82 N	73.34	3.83
Steel	1.03					
Conc	6.32					
25.00	22.41	7.68	81.50 N	0.00 N	111.59	30.09
Steel	3.08					
Conc	19.33					
50.00	7.34	2.30	63.69 N	-5.82 N	73.34	3.83
Steel	1.03					
Conc	6.32					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.65	1.77	29.34 N	-2.68 N	36.76	4.74
Steel	0.79					
Conc	4.86					
25.00	17.24	5.91	37.54 N	0.00 N	60.68	23.14
Steel	2.37					
Conc	14.87					
50.00	5.65	1.77	29.34 N	-2.68 N	36.76	4.74
Steel	0.79					
Conc	4.86					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (3-SPAN) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:41:10 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.79	2.46	89.64 T	-5.51 T	99.89	4.73
Steel	1.09					
Conc	6.70					
25.00	19.74	6.76	115.53 T	-11.56 T	142.03	14.94
Steel	2.71					
Conc	17.03					
50.00	19.74	6.76	115.53 T	-11.56 T	142.03	14.93
Steel	2.71					
Conc	17.03					
75.00	7.79	2.46	89.65 T	-5.52 T	99.89	4.73
Steel	1.09					
Conc	6.70					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.99	1.89	41.29 T	-2.54 T	49.17	5.34
Steel	0.84					
Conc	5.16					
25.00	15.19	5.20	53.22 T	-5.32 T	73.60	15.06
Steel	2.08					
Conc	13.10					
50.00	15.19	5.20	53.21 T	-5.33 T	73.60	15.06
Steel	2.08					
Conc	13.10					
75.00	5.99	1.89	41.29 T	-2.54 T	49.18	5.34
Steel	0.84					
Conc	5.16					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (3-SPAN) - SECTION N (2F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:09:48 2012

Factored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		7.79	2.46	53.50 N	-3.64 N	63.75	6.60
	Steel	1.09					
	Conc	6.70					
25.00		19.74	6.76	58.59 N	-7.01 N	85.09	19.49
	Steel	2.71					
	Conc	17.03					
50.00		19.74	6.76	58.59 N	-7.01 N	85.09	19.49
	Steel	2.71					
	Conc	17.03					
75.00		7.79	2.46	53.50 N	-3.65 N	63.75	6.60
	Steel	1.09					
	Conc	6.70					

Unfactored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		5.99	1.89	24.64 N	-1.68 N	32.52	6.20
	Steel	0.84					
	Conc	5.16					
25.00		15.19	5.20	26.99 N	-3.23 N	47.37	17.16
	Steel	2.08					
	Conc	13.10					
50.00		15.19	5.20	26.99 N	-3.23 N	47.37	17.15
	Steel	2.08					
	Conc	13.10					
75.00		5.99	1.89	24.64 N	-1.68 N	32.53	6.20
	Steel	0.84					
	Conc	5.16					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (3-SPAN) - SECTION N (3F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:10:02 2012

Factored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		7.79	2.46	65.04 N	-5.24 N	75.29	5.01
	Steel	1.09					
	Conc	6.70					
25.00		19.74	6.76	82.81 N	-10.08 N	109.31	16.42
	Steel	2.71					
	Conc	17.03					
50.00		19.74	6.76	82.81 N	-10.08 N	109.31	16.41
	Steel	2.71					
	Conc	17.03					
75.00		7.79	2.46	65.04 N	-5.24 N	75.29	5.00
	Steel	1.09					
	Conc	6.70					

Unfactored Reactions - k

Loc		Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00		5.99	1.89	29.96 N	-2.41 N	37.84	5.47
	Steel	0.84					
	Conc	5.16					
25.00		15.19	5.20	38.15 N	-4.64 N	58.53	15.74
	Steel	2.08					
	Conc	13.10					
50.00		15.19	5.20	38.15 N	-4.64 N	58.53	15.74
	Steel	2.08					
	Conc	13.10					
75.00		5.99	1.89	29.96 N	-2.42 N	37.84	5.47
	Steel	0.84					
	Conc	5.16					

Reactions in girder output include weight in girder extensions at abutments.

INTERIOR STRINGER (3-SPAN) - SECTION N (4F1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:10:17 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.79	2.46	66.81 N	-5.65 N	77.06	4.59
Steel	1.09					
Conc	6.70					
25.00	19.74	6.76	92.30 N	-10.91 N	118.80	15.59
Steel	2.71					
Conc	17.03					
50.00	19.74	6.76	92.30 N	-10.92 N	118.80	15.58
Steel	2.71					
Conc	17.03					
75.00	7.79	2.46	66.82 N	-5.66 N	77.07	4.59
Steel	1.09					
Conc	6.70					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.99	1.89	30.78 N	-2.60 N	38.66	5.28
Steel	0.84					
Conc	5.16					
25.00	15.19	5.20	42.52 N	-5.02 N	62.90	15.36
Steel	2.08					
Conc	13.10					
50.00	15.19	5.20	42.51 N	-5.03 N	62.90	15.35
Steel	2.08					
Conc	13.10					
75.00	5.99	1.89	30.78 N	-2.61 N	38.66	5.28
Steel	0.84					
Conc	5.16					

Reactions in girder output include weight in girder extensions
at abutments.

INTERIOR STRINGER (3-SPAN) - SECTION N (5C1)
Line Girder : Rating Output : Reactions
Mon Feb 13 12:10:29 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.79	2.46	63.44 N	-4.85 N	73.69	5.40
Steel	1.09					
Conc	6.70					
25.00	19.74	6.76	80.56 N	-8.51 N	107.06	17.99
Steel	2.71					
Conc	17.03					
50.00	19.74	6.76	80.56 N	-8.51 N	107.05	17.99
Steel	2.71					
Conc	17.03					
75.00	7.79	2.46	63.44 N	-4.85 N	73.69	5.39
Steel	1.09					
Conc	6.70					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.99	1.89	29.22 N	-2.23 N	37.10	5.65
Steel	0.84					
Conc	5.16					
25.00	15.19	5.20	37.11 N	-3.92 N	57.49	16.47
Steel	2.08					
Conc	13.10					
50.00	15.19	5.20	37.11 N	-3.92 N	57.49	16.46
Steel	2.08					
Conc	13.10					
75.00	5.99	1.89	29.22 N	-2.24 N	37.11	5.65
Steel	0.84					
Conc	5.16					

Reactions in girder output include weight in girder extensions
at abutments.

FASCIA STRINGER (F1-1) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:38:17 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total	
0.00	-0.13	-0.18	46.47 T	-26.42 T	46.16	-24.44	*
Steel	-0.01						
Conc	-0.12						
7.51	10.19	3.22	87.04 T	-18.04 T	100.45	-8.78	*
Steel	2.07						
Conc	8.13						
32.99	15.18	4.79	83.96 T	-0.98 T	103.92	18.98	
Steel	3.08						
Conc	12.10						
58.47	5.50	1.60	62.10 T	-4.14 T	69.20	2.95	
Steel	1.14						
Conc	4.36						

* D + 2L - 3.17.1(a)

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	-0.10	-0.14	21.40 T	-12.17 T	21.17	-12.41
Steel	0.00					
Conc	-0.09					
7.51	7.84	2.47	40.09 T	-8.31 T	50.41	2.00
Steel	1.59					
Conc	6.25					
32.99	11.68	3.68	38.67 T	-0.45 T	54.03	14.90
Steel	2.37					
Conc	9.31					
58.47	4.23	1.23	28.60 T	-1.91 T	34.06	3.55
Steel	0.87					
Conc	3.36					

Reactions in girder output include weight in girder extensions
at abutments.

FASICA STRINGER (F1-2) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:38:34 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.43	1.56	67.15 T	-4.37 T	74.14	2.61
Steel	1.06					
Conc	4.37					
25.48	18.16	5.50	98.79 T	0.00 T	122.45	23.66
Steel	3.97					
Conc	14.19					
50.96	5.81	1.56	71.35 T	-10.60 T	78.71	-5.30 *
Steel	1.44					
Conc	4.37					

* D + 2L - 3.17.1(a)

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	4.18	1.20	30.93 T	-2.01 T	36.30	3.36
Steel	0.82					
Conc	3.36					
25.48	13.97	4.23	45.50 T	0.00 T	63.70	18.20
Steel	3.05					
Conc	10.91					
50.96	4.47	1.20	32.86 T	-4.88 T	38.53	0.78
Steel	1.11					
Conc	3.36					

Reactions in girder output include weight in girder extensions
at abutments.

FASICA STRINGER (F1-3) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:43:08 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	6.29	1.72	69.57 T	-5.12 T	77.59	2.90
Steel	1.50					
Conc	4.79					
25.48	15.97	4.74	94.43 T	-10.68 T	115.14	10.03
Steel	3.74					
Conc	12.23					
50.96	15.97	4.74	94.43 T	-10.69 T	115.14	10.02
Steel	3.74					
Conc	12.23					
76.44	6.29	1.72	69.57 T	-5.12 T	77.59	2.89
Steel	1.50					
Conc	4.80					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	4.84	1.32	32.05 T	-2.36 T	38.21	3.81
Steel	1.15					
Conc	3.69					
25.48	12.29	3.64	43.50 T	-4.92 T	59.43	11.01
Steel	2.88					
Conc	9.41					
50.96	12.29	3.64	43.49 T	-4.92 T	59.42	11.01
Steel	2.88					
Conc	9.41					
76.44	4.84	1.32	32.05 T	-2.36 T	38.21	3.81
Steel	1.15					
Conc	3.69					

Reactions in girder output include weight in girder extensions at abutments.

FASCIA STRINGER (F2-1) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:40:36 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	7.07	2.14	76.86 T	0.00 T	86.07	9.21
Steel	1.90					
Conc	5.16					
25.00	7.07	2.14	76.86 T	0.00 T	86.07	9.21
Steel	1.90					
Conc	5.16					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.43	1.65	35.40 T	0.00 T	42.49	7.08
Steel	1.46					
Conc	3.97					
25.00	5.43	1.65	35.40 T	0.00 T	42.49	7.08
Steel	1.46					
Conc	3.97					

Reactions in girder output include weight in girder extensions at abutments.

FASCIA STRINGER (F2-2) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:38:55 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total	
0.00	5.31	1.50	67.63 T	-4.85 T	74.44	-0.38	*
Steel	1.59						
Conc	3.72						
25.00	19.32	5.57	102.67 T	0.00 T	127.57	24.90	
Steel	6.71						
Conc	12.61						
50.00	6.09	1.50	72.26 T	-11.15 T	79.86	-5.58	*
Steel	2.37						
Conc	3.72						

* D + 2L - 3.17.1(a)

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	4.09	1.16	31.15 T	-2.23 T	36.39	3.01
Steel	1.23					
Conc	2.86					
25.00	14.86	4.29	47.29 T	0.00 T	66.44	19.15
Steel	5.16					
Conc	9.70					
50.00	4.69	1.16	33.28 T	-5.13 T	39.13	0.71
Steel	1.83					
Conc	2.86					

Reactions in girder output include weight in girder extensions at abutments.

FASCIA STRINGER (F2-3) - SECTION N (HS20)
Line Girder : Rating Output : Reactions
Fri Feb 10 16:40:20 2012

Factored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	6.73	1.72	70.95 T	-5.45 T	79.41	3.01
Steel	2.52					
Conc	4.22					
25.00	16.76	4.69	96.40 T	-11.79 T	117.85	9.67
Steel	6.13					
Conc	10.63					
50.00	16.58	4.75	96.76 T	-10.02 T	118.09	11.31
Steel	5.82					
Conc	10.76					
75.00	6.39	1.70	70.39 T	-4.74 T	78.48	3.35
Steel	2.22					
Conc	4.17					

Unfactored Reactions - k

Loc	Noncomp Dead	Comp Dead	LL+I Max	LL+I Min	Max Total	Min Total
0.00	5.18	1.33	32.68 T	-2.51 T	39.19	3.99
Steel	1.94					
Conc	3.24					
25.00	12.89	3.61	44.40 T	-5.43 T	60.91	11.07
Steel	4.72					
Conc	8.18					
50.00	12.76	3.65	44.57 T	-4.62 T	60.98	11.80
Steel	4.48					
Conc	8.28					
75.00	4.92	1.31	32.42 T	-2.18 T	38.65	4.04
Steel	1.71					
Conc	3.21					

Reactions in girder output include weight in girder extensions at abutments.

WEST APPROACH – SECTION N

FLOOR BEAMS

Made By: GHD Date: 2/23/2012 Job No.: ______
Checked By: DMP Date: 2/25/2012 Sheet No.: ______

Floor Beams and Girders Rating Summary - As Built

Floor Beams and Girders		MEMBER CAPACITY			SERVICE LOADS													RATING FACTORS - WEST APPROACH - SECTION N																
																		HS20								OHIO LEGAL LOADS							
					DEAD LOAD		HS20		2F1		3F1		4F1		5C1		FATIGUE	MOMENT		SHEAR		FATIGUE				2F1		3F1		4F1		5C1	
		M (k-ft)	V (k)	Sx (in^3)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	Inv.	Opr.	Inv.	Opr.	Sr (ksi)	Cat.	Fsr (ksi)	Fat.	M	V	M	V	M	V	M	V
FLOOR BEAMS	FB-1	1542.00	396.40	448	146.62	28.34	504.89	78.86	301.14	47.03	366.31	57.21	376.30	58.77	357.32	55.81	327.56	1.23	2.06	2.10	3.51	8.77	A	24	2.74	3.45	5.88	2.84	4.83	2.76	4.71	2.91	4.96
	FB-2	1542.00	396.40	448	124.08	13.79	471.13	72.59	281.00	43.30	341.81	52.67	351.13	54.10	333.42	51.37	287.53	1.35	2.26	2.40	4.01	7.70	A	24	3.12	3.78	6.72	3.11	5.53	3.02	5.38	3.19	5.67
	FB-3	1542.00	396.40	448	101.54	23.29	471.13	72.59	281.00	43.30	341.81	52.67	351.13	54.10	333.42	51.37	287.53	1.38	2.30	2.32	3.88	7.70	A	24	3.12	3.86	6.50	3.17	5.35	3.09	5.21	3.25	5.48
	FB-4	2829.00	529.70	837	341.39	61.79	896.21	130.01	454.51	65.93	642.50	93.20	716.02	103.87	624.95	90.66	550.60	1.23	2.05	1.59	2.66	7.89	A	24	3.04	4.04	5.24	2.86	3.71	2.56	3.33	2.94	3.81
	FB-5	2004.00	482.32	580	302.19	32.97	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60	0.99	1.65	1.75	2.93	9.47	A	24	2.53	3.26	5.77	2.31	4.08	2.07	3.66	2.37	4.20
	FB-6	1872.00	461.04	542	244.09	57.29	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60	0.96	1.60	1.54	2.58	10.13	A	24	2.37	3.14	5.08	2.22	3.59	2.00	3.22	2.29	3.69
	FB-7	3676.69	623.52	1082	593.60	69.92	1246.33	148.67	632.07	75.40	893.50	106.58	995.75	118.78	869.10	103.67	711.18	1.07	1.79	1.65	2.76	7.89	A	24	3.04	3.54	5.43	2.50	3.84	2.24	3.45	2.57	3.95
	FB-8	1743.00	443.31	504	245.63	36.13	632.66	113.92	320.85	57.77	453.56	81.67	505.46	91.01	441.17	79.44	293.48	1.04	1.73	1.60	2.68	6.99	A	24	3.43	3.41	5.28	2.41	3.73	2.17	3.35	2.48	3.84
	FB-9	1743.00	443.31	504	243.11	57.15	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60	0.88	1.46	1.47	2.46	10.90	A	24	2.20	2.89	4.84	2.04	3.43	1.83	3.08	2.10	3.52
	FB-10	5149.65	669.57	1533	580.11	60.54	1487.60	156.61	749.10	78.86	1066.98	112.33	1192.75	125.57	1045.79	110.10	819.84	1.36	2.27	1.74	2.90	6.42	D	8	1.25	4.51	5.76	3.17	4.05	2.83	3.62	3.23	4.13
	FB-11	1743.00	443.31	504	187.18	27.58	634.82	114.31	319.67	57.56	455.33	81.99	509.00	91.65	446.28	80.36	294.48	1.09	1.82	1.64	2.74	7.01	A	24	3.42	3.61	5.45	2.53	3.82	2.27	3.42	2.58	3.90
	FB-12	1872.00	461.04	542	186.48	43.59	752.36	115.92	378.86	58.37	539.63	83.14	603.24	92.95	528.91	81.49	459.16	1.00	1.67	1.61	2.68	10.17	A	24	2.36	3.31	5.33	2.32	3.74	2.08	3.35	2.37	3.82
	FB-13	4787.17	629.44	1448	1086.04	100.00	1850.22	163.39	931.70	82.28	1327.07	117.19	1483.50	131.00	1300.71	114.86	913.48	0.84	1.40	1.41	2.35	7.57	D	8	1.06	2.79	4.67	1.96	3.28	1.75	2.93	2.00	3.34
	FB-14	5550.44	625.48	1799	1011.08	98.18	1846.34	162.74	929.75	81.95	1324.29	116.73	1480.39	130.49	1297.99	114.41	906.06	1.06	1.77	1.41	2.35	6.04	D	8	1.32	3.50	4.67	2.46	3.28	2.20	2.93	2.51	3.35
	FB-15	2572.08	485.58	718	98.70	34.89	421.06	103.97	212.03	52.36	302.01	74.58	337.61	83.37	296.01	73.09	308.69	2.67	4.47	1.95	3.26	5.16	A	24	4.65	8.87	6.47	6.22	4.54	5.57	4.06	6.35	4.63
	FB-16	4253.45	680.26	1213	322.50	48.87	1230.89	144.98	619.83	73.01	882.86	103.99	986.93	116.25	869.14	101.92	678.09	1.44	2.40	1.96	3.27	6.71	A	24	3.58	4.76	6.50	3.34	4.56	2.99	4.08	3.39	4.65
	FB-17	6688.33	758.12	2172	730.90	70.36	1846.34	162.74	929.75	81.95	1324.29	116.73	1480.39	130.49	1297.99	114.41	906.06	1.43	2.39	1.89	3.15	5.01	D	8	1.60	4.75	6.26	3.33	4.39	2.98	3.93	3.40	4.48
	FB-18	2572.08	485.58	718	229.54	39.07	673.53	118.42	341.58	60.06	482.86	84.90	538.11	94.61	469.67	82.58	422.52	1.56	2.60	1.69	2.83	7.06	A	24	3.40	5.12	5.57	3.62	3.94	3.25	3.54	3.72	4.05
	FB-19	3676.69	623.52	1082	586.12	62.36	1226.70	144.49	622.12	73.28	879.43	103.58	980.07	115.44	855.41	100.76	675.78	1.09	1.83	1.73	2.89	7.49	A	24	3.20	3.60	5.69	2.55	4.03	2.29	3.61	2.62	4.14
	FB-20	5550.44	625.48	1799	922.75	108.88	1840.05	162.19	933.18	82.28	1319.14	82.25	1470.10	129.58	1283.12	113.10	902.97	1.09	1.82	1.38	2.30	6.02	D	8	1.33	3.59	4.52	2.54	4.53	2.28	2.87	2.61	3.29
	FB-21	2879.39	555.85	807	362.12	51.63	878.84	125.82	445.70	63.81	630.04	90.20	702.14	100.53	612.84	87.74	321.48	1.26	2.11	1.79	2.99	4.78	A	24	5.02	4.16	5.89	2.94	4.17	2.64	3.74	3.02	4.28
	FB-22	2721.37	520.93	763	309.62	34.04	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60	1.43	2.38	1.90	3.18	7.20	A	24	3.33	4.69	6.26	3.32	4.43	2.98	3.97	3.41	4.55
	FB-23	4856.09	626.88	1395	319.42	35.44	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60	2.73	4.56	2.32	3.87	3.94	A	24	6.10	8.98	7.63	6.36	5.39	5.70	4.84	6.53	5.55
	FB-24	2801.48	381.47	806	301.85	76.97	900.40	128.08	456.63	64.95	645.50	91.82	719.37	102.33	627.87	89.31	539.66	1.23	2.06	1.01	1.69	8.03	A	24	2.99	4.06	3.33	2.87	2.36	2.58	2.12	2.95	2.42
	FB-25	1542.00	396.40	448	168.69	18.96	604.17	83.31	360.35	49.69	438.34	60.44	450.29	62.09	427.58	58.96	356.68	1.01	1.68	2.06	3.43	9.55	A	24	2.51	2.82	5.75	2.32	4.73	2.26	4.61	2.38	4.85
	FB-26	1542.00	396.40	448	126.73	13.83	487.30	73.80	290.65	44.02	353.55	53.55	363.19	55.01	344.87	52.23	592.65	1.30	2.18	2.36	3.95	15.87	A	24	1.51	3.65	6.61	3.00	5.44	2.92	5.29	3.07	5.57
	FB-27	1542.00	396.40	448	107.57	14.82	405.41	72.79	241.80	43.42	294.13	52.81	302.15	54.25	286.92	51.52	424.22	1.59	2.66	2.39	3.99	11.36	A	24	2.11	4.46	6.68	3.67	5.49	3.57	5.35	3.76	5.63
	FB-28	1872.00	461.04	542	149.01	32.34	634.91	84.92	378.68	50.65	460.64	61.61	473.20	63.29	449.33	60.10	371.24	1.22	2.03	2.27	3.80	8.22	A	24	2.92	3.41	6.36	2.80	5.23	2.73	5.09	2.87	5.36
	BRACKETS	2283.52	270.00	532	296.70	46.54	389.42	83.95	196.10	42.28	279.31	60.22	312.23	67.31	273.76	59.02	389.42	2.25	3.75	1.15	1.92	8.78	B	16	1.82	7.44	3.81	5.23	2.68	4.68	2.39	5.33	2.73
GIRDERS	G1	11177	620	4064	3686.08	212.55	2789.23	145.62	1313.89	66.09	1940.88	98.84	2225.72	112.82	2101.30	124.82	1408.70	1.05	1.76	1.09	1.82	4.16	D	8	1.92	3.74	4.00	2.53	2.68	2.21	2.34	2.34	2.12
	G2	20901	1206	7601	8057.50	237.13	5804.27	180.54	2673.02	82.10	4032.44	122.73	4605.23	140.00	4700.70	155.11	1854.40	0.83	1.38	2.29	3.83	2.93	D	8	2.73	3.00	8.41	1.99	5.63	1.74	4.93	1.71	4.45
	G3	15888	1034	5678	5586.00	206.47	3801.99	144.63	1768.06	65.75	3013.19	112.13	2648.94	98.31	3521.32	124.25	1674.89	1.05	1.75	2.44	4.07	3.54	D	8	2.26	3.75	8.95	2.20	5.25	2.50	5.99	1.88	4.74

Made By: GHD Date: 2/23/2012 Job No.:

Checked By: DMP Date: 2/25/2012 Sheet No.:

Floor Beams and Girders Rating Summary - As Inspected

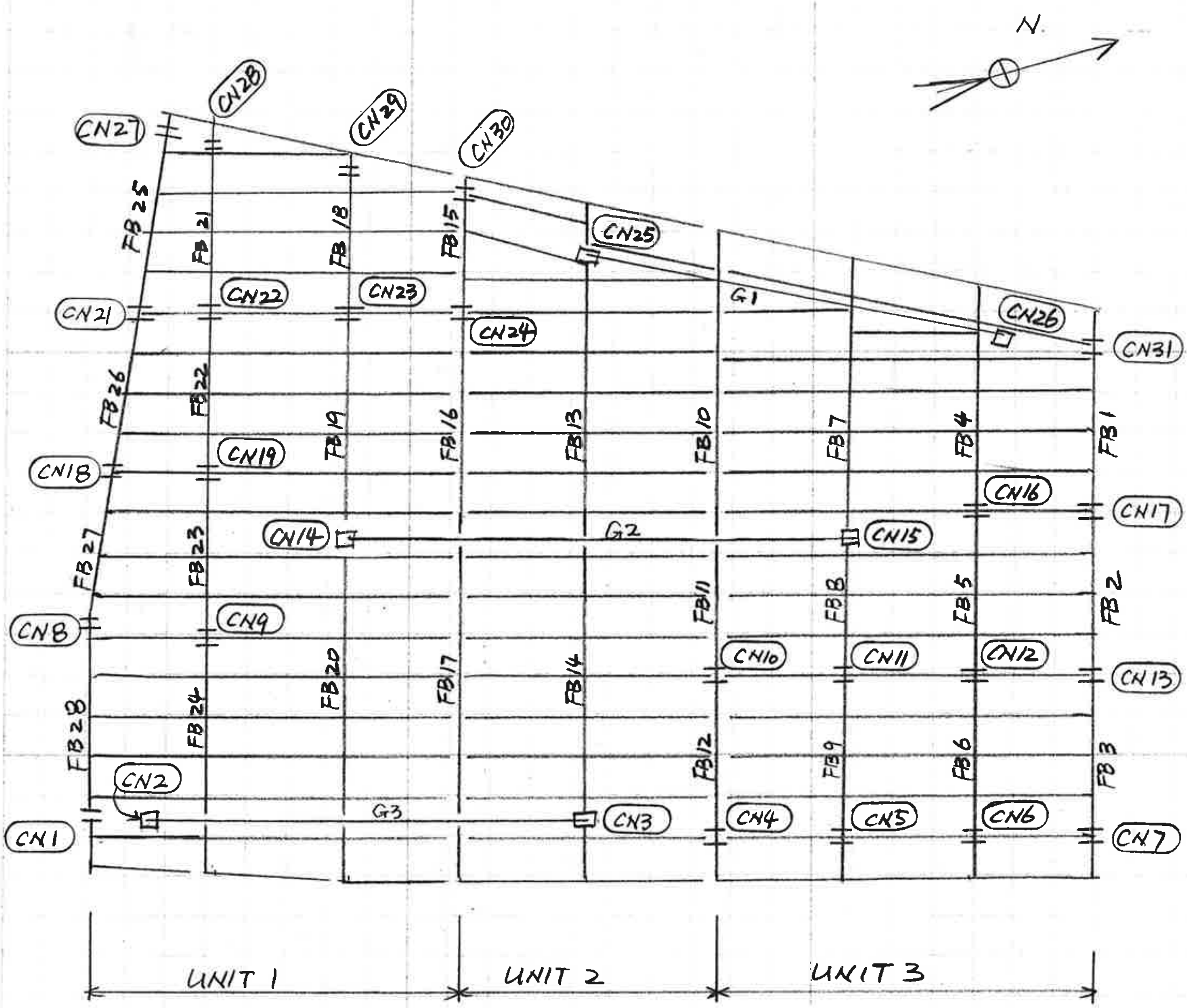
Floor Beams and Girders		MEMBER CAPACITY			SERVICE LOADS												
					DEAD LOAD		HS20		2F1		3F1		4F1		5C1		FATIGUE
		M (k-ft)	V (k)	Sx (in^3)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)	V (k)	M (k-ft)
FLOOR BEAMS	FB-1	1542.00	396.40	448	146.62	28.34	504.89	78.86	301.14	47.03	366.31	57.21	376.30	58.77	357.32	55.81	327.56
	FB-2	1542.00	396.40	448	124.08	13.79	471.13	72.59	281.00	43.30	341.81	52.67	351.13	54.10	333.42	51.37	287.53
	FB-3	1542.00	396.40	448	101.54	23.29	471.13	72.59	281.00	43.30	341.81	52.67	351.13	54.10	333.42	51.37	287.53
	FB-4	2829.00	529.70	837	341.39	61.79	896.21	130.01	454.51	65.93	642.50	93.20	716.02	103.87	624.95	90.66	550.60
	FB-5	2004.00	482.32	580	302.19	32.97	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60
	FB-6	1872.00	461.04	542	244.09	57.29	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60
	FB-7	3676.69	623.52	1082	593.60	69.92	1246.33	148.67	632.07	75.40	893.50	106.58	995.75	118.78	869.10	103.67	711.18
	FB-8	1743.00	443.31	504	245.63	36.13	632.66	113.92	320.85	57.77	453.56	81.67	505.46	91.01	441.17	79.44	293.48
	FB-9	1743.00	443.31	504	243.11	57.15	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60
	FB-10	5149.65	669.57	1533	580.11	60.54	1487.60	156.61	749.10	78.86	1066.98	112.33	1192.75	125.57	1045.79	110.10	819.84
	FB-11	1743.00	443.31	504	187.18	27.58	634.82	114.31	319.67	57.56	455.33	81.99	509.00	91.65	446.28	80.36	294.48
	FB-12	1872.00	461.04	542	186.48	43.59	752.36	115.92	378.86	58.37	539.63	83.14	603.24	92.95	528.91	81.49	459.16
	FB-13	4787.17	629.44	1448	1086.04	100.00	1850.22	163.39	931.70	82.28	1327.07	117.19	1483.50	131.00	1300.71	114.86	913.48
	FB-14	5550.44	625.48	1799	1011.08	98.18	1846.34	162.74	929.75	81.95	1324.29	116.73	1480.39	130.49	1297.99	114.41	906.06
	FB-15	2572.08	485.58	718	98.70	34.89	421.06	103.97	212.03	52.36	302.01	74.58	337.61	83.37	296.01	73.09	308.69
	FB-16	4253.45	680.26	1213	322.50	48.87	1230.89	144.98	619.83	73.01	882.86	103.99	986.93	116.25	869.14	101.92	678.09
	FB-17	6688.33	758.12	2172	730.90	70.36	1846.34	162.74	929.75	81.95	1324.29	116.73	1480.39	130.49	1297.99	114.41	906.06
	FB-18	2572.08	485.58	718	229.54	39.07	673.53	118.42	341.58	60.06	482.86	84.90	538.11	94.61	469.67	82.58	422.52
	FB-19	3676.69	623.52	1082	586.12	62.36	1226.70	144.49	622.12	73.28	879.43	103.58	980.07	115.44	855.41	100.76	675.78
	FB-20	5550.44	625.48	1799	922.75	108.88	1840.05	162.19	933.18	82.28	1319.14	82.25	1470.10	129.58	1283.12	113.10	902.97
	FB-21	2879.39	555.85	807	362.12	51.63	878.84	125.82	445.70	63.81	630.04	90.20	702.14	100.53	612.84	87.74	321.48
	FB-22	2347.24	502.94	628	309.62	34.04	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60
	FB-23	4856.09	626.88	1395	319.42	35.44	749.79	115.53	380.26	58.59	537.53	82.82	599.04	92.30	522.85	80.56	457.60
	FB-24	2801.48	381.47	806	301.85	76.97	900.40	128.08	456.63	64.95	645.50	91.82	719.37	102.33	627.87	89.31	539.66
	FB-25	1542.00	396.40	448	168.69	18.96	604.17	83.31	360.35	49.69	438.34	60.44	450.29	62.09	427.58	58.96	356.68
	FB-26	1542.00	396.40	448	126.73	13.83	487.30	73.80	290.65	44.02	353.55	53.55	363.19	55.01	344.87	52.23	592.65
	FB-27	1542.00	396.40	448	107.57	14.82	405.41	72.79	241.80	43.42	294.13	52.81	302.15	54.25	286.92	51.52	424.22
	FB-28	1872.00	461.04	542	149.01	32.34	634.91	84.92	378.68	50.65	460.64	61.61	473.20	63.29	449.33	60.10	371.24
	BRACKETS	2283.52	270.00	532	296.70	46.54	389.42	83.95	196.10	42.28	279.31	60.22	312.23	67.31	273.76	59.02	389.42
GIRDERS	G1	11177	620	4064	3686.08	212.55	2789.23	145.62	1313.89	66.09	1940.88	98.84	2225.72	112.82	2101.30	124.82	1408.70
	G2	20901	1206	7601	8057.50	237.13	5804.27	180.54	2673.02	82.10	4032.44	122.73	4605.23	140.00	4700.70	155.11	1854.40
	G3	15888	1034	5678	5586.00	206.47	3801.99	144.63	1768.06	65.75	3013.19	112.13	2648.94	98.31	3521.32	124.25	1674.89

Floor Beams and Girders		RATING FACTORS - WEST APPROACH - SECTION N															
		HS20								OHIO LEGAL LOADS							
		MOMENT		SHEAR		FATIGUE				2F1		3F1		4F1		5C1	
		Inv.	Opr.	Inv.	Opr.	Sr (ksi)	Cat.	Fsr (ksi)	Fat.	M	V	M	V	M	V	M	V
FLOOR BEAMS	FB-1	1.23	2.06	2.10	3.51	8.77	A	24	2.74	3.45	5.88	2.84	4.83	2.76	4.71	2.91	4.96
	FB-2	1.35	2.26	2.40	4.01	7.70	A	24	3.12	3.78	6.72	3.11	5.53	3.02	5.38	3.19	5.67
	FB-3	1.38	2.30	2.32	3.88	7.70	A	24	3.12	3.86	6.50	3.17	5.35	3.09	5.21	3.25	5.48
	FB-4	1.23	2.05	1.59	2.66	7.89	A	24	3.04	4.04	5.24	2.86	3.71	2.56	3.33	2.94	3.81
	FB-5	0.99	1.65	1.75	2.93	9.47	A	24	2.53	3.26	5.77	2.31	4.08	2.07	3.66	2.37	4.20
	FB-6	0.96	1.60	1.54	2.58	10.13	A	24	2.37	3.14	5.08	2.22	3.59	2.00	3.22	2.29	3.69
	FB-7	1.07	1.79	1.65	2.76	7.89	A	24	3.04	3.54	5.43	2.50	3.84	2.24	3.45	2.57	3.95
	FB-8	1.04	1.73	1.60	2.68	6.99	A	24	3.43	3.41	5.28	2.41	3.73	2.17	3.35	2.48	3.84
	FB-9	0.88	1.46	1.47	2.46	10.90	A	24	2.20	2.89	4.84	2.04	3.43	1.83	3.08	2.10	3.52
	FB-10	1.36	2.27	1.74	2.90	6.42	D	8	1.25	4.51	5.76	3.17	4.05	2.83	3.62	3.23	4.13
	FB-11	1.09	1.82	1.64	2.74	7.01	A	24	3.42	3.61	5.45	2.53	3.82	2.27	3.42	2.58	3.90
	FB-12	1.00	1.67	1.61	2.68	10.17	A	24	2.36	3.31	5.33	2.32	3.74	2.08	3.35	2.37	3.82
	FB-13	0.84	1.40	1.41	2.35	7.57	D	8	1.06	2.79	4.67	1.96	3.28	1.75	2.93	2.00	3.34
	FB-14	1.06	1.77	1.41	2.35	6.04	D	8	1.32	3.50	4.67	2.46	3.28	2.20	2.93	2.51	3.35
	FB-15	2.67	4.47	1.95	3.26	5.16	A	24	4.65	8.87	6.47	6.22	4.54	5.57	4.06	6.35	4.63
	FB-16	1.44	2.40	1.96	3.27	6.71	A	24	3.58	4.76	6.50	3.34	4.56	2.99	4.08	3.39	4.65
	FB-17	1.43	2.39	1.89	3.15	5.01	D	8	1.60	4.75	6.26	3.33	4.39	2.98	3.93	3.40	4.48
	FB-18	1.56	2.60	1.69	2.83	7.06	A	24	3.40	5.12	5.57	3.62	3.94	3.25	3.54	3.72	4.05
	FB-19	1.09	1.83	1.73	2.89	7.49	A	24	3.20	3.60	5.69	2.55	4.03	2.29	3.61	2.62	4.14
	FB-20	1.09	1.82	1.38	2.30	6.02	D	8	1.33	3.59	4.52	2.54	4.53	2.28	2.87	2.61	3.29
	FB-21	1.26	2.11	1.79	2.99	4.78	A	24	5.02	4.16	5.89	2.94	4.17	2.64	3.74	3.02	4.28
	FB-22	1.20	2.00	1.83	3.06	8.74	A	24	2.75	3.93	6.02	2.78	4.26	2.50	3.82	2.86	4.38
	FB-23	2.73	4.56	2.32	3.87	3.94	A	24	6.10	8.98	7.63	6.36	5.39	5.70	4.84	6.53	5.55
	FB-24	1.23	2.06	1.01	1.69	8.03	A	24	2.99	4.06	3.33	2.87	2.36	2.58	2.12	2.95	2.42
	FB-25	1.01	1.68	2.06	3.43	9.55	A	24	2.51	2.82	5.75	2.32	4.73	2.26	4.61	2.38	4.85
	FB-26	1.30	2.18	2.36	3.95	15.87	A	24	1.51	3.65	6.61	3.00	5.44	2.92	5.29	3.07	5.57
	FB-27	1.59	2.66	2.39	3.99	11.36	A	24	2.11	4.46	6.68	3.67	5.49	3.57	5.35	3.76	5.63
	FB-28	1.22	2.03	2.27	3.80	8.22	A	24	2.92	3.41	6.36	2.80	5.23	2.73	5.09	2.87	5.36
	BRACKETS	2.25	3.75	1.15	1.92	8.78	B	16	1.82	7.44	3.81	5.23	2.68	4.68	2.39	5.33	2.73
GIRDERS	G1	1.05	1.76	1.09	1.82	4.16	D	8	1.92	3.74	4.00	2.53	2.68	2.21	2.34	2.34	2.12
	G2	0.83	1.38	2.29	3.83	2.93	D	8	2.73	3.00	8.41	1.99	5.63	1.74	4.93	1.71	4.45
	G3	1.05	1.75	2.44	4.07	3.54	D	8	2.26	3.75	8.95	2.20	5.25	2.50	5.99	1.88	4.74

TranSystems

Made By: GHD	Date: 2-7-12	Job No:
Checked By: RMP	Date: 2/8/12	Sheet No. 1

FRAMING - WEST APPROACH - SECTION N



FLOOR BEAMS - WEST APPROACH - SECTION N.

1. FB-1:

① BEAM: W33×141. A36 STEEL (SHEET 168A/991)

② DEAD LOADS:

DL REACTIONS FROM MDX FOR STRINGERS (UNFACTORED):

3-SPAN STRINGER: $R1 = 5.99 + 1.89 = 7.88$ K.

F1-3 STRINGER: $R2 = 4.84 + 1.32 = 6.16$ K.

DL FROM SELFWEIGHT OF FB-1: 0.141 K/ft

DL REACTION AT COLUMNS:

$$N_{17} = \left[R1 \times (2.03 + 3.09 + 9.76 + 16.76 + 23.76) - R2 \times 4.56 + 0.141 \times (30.76^2 - 4.56^2) \times \tfrac{1}{2}\right] \times \frac{1}{30.76}$$

$$= \underline{15.40 \text{ K}}$$

$$N_{31} = (5 \times R1 + R2 + 0.141 \times 35.32) - 15.40 = \underline{35.14 \text{ K}}$$

MAX DL MOMENT:

$$M_{DL} = N_{17} \times 14' - R1 \times 7 - 0.141 \times 14^2 \times \tfrac{1}{2} = \underline{146.62 \text{ K-ft}}$$

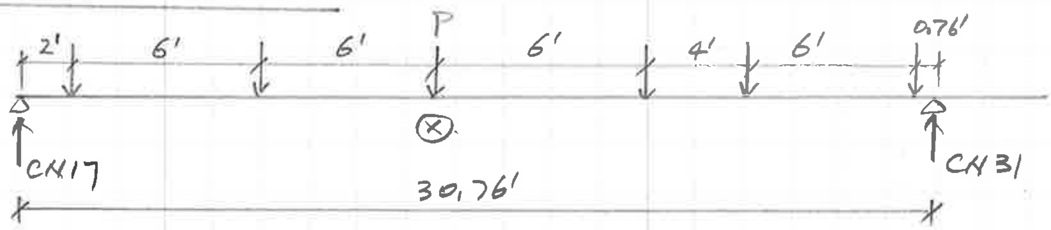
MAX DL SHEAR:

$$V_{DL} = N_{31} - R2 - 0.141 \times 4.56 = \underline{28.34 \text{ K}}$$ (AT CN31)

③ LIVE LOADS:

12' LANE — 12' LANE — 12' LANE

MAX LIVE LOAD MOMENT:



LL REACTION AT COLUMNS:

$N_{17} = P \times (0.76 + 6.76 + 10.76 + 16.76 + 22.76 + 28.76) \times \frac{1}{30.76} = 2.81\,P$

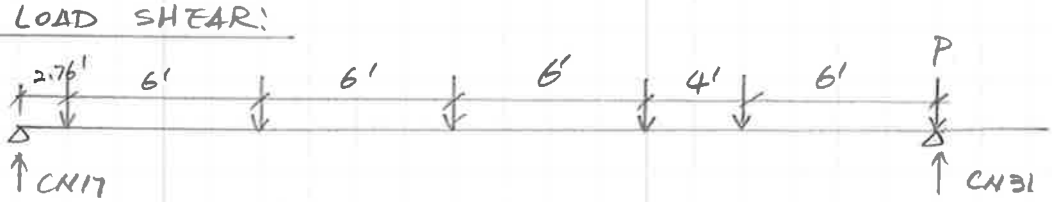
$N_{31} = 6P - 2.81\,P = 3.19\,P$

LL IMPACT: $I = \frac{50}{L+125} = 32\% \Rightarrow$ USE 30%

LL REDUCTION FOR 3 LANES: 90%

MAX LL+I MOMENT: $M_{L+I} = [N_{17} \cdot 14 - P \cdot (6+12)] \times 1.30 \times 0.9 = \underline{24.97\,P}$

MAX LIVE LOAD SHEAR:



LL REACTION AT COLUMNS:

$N_{31} = P\,(2.76 + 8.76 + 14.76 + 20.76 + 24.76 + 30.76) \times \frac{1}{30.76} = 3.33\,P$

MAX LL+I SHEAR: $V_{L+I} = 3.33\,P \times 1.3 \times 0.9 = \underline{3.90\,P}$

P: 3-SPAN STRINGER LIVE LOAD REACTION AT FB-1 WITH D.F.=1.0.
(FROM MDX OUTPUTS)

	P (k)	M_{L+I} (k-ft)	V_{L+I} (k)
HS20	41.29/(1.3×1.571)=20.22	504.89	78.86
2F1	24.64/(1.3×1.571)=12.06	301.14	47.03
3F1	29.96/(1.3×1.571)=14.67	366.31	57.21
4F1	30.78/(1.3×1.571)=15.07	376.30	58.77
5C1	29.22/(1.3×1.571)=14.31	357.32	55.81

(4) FLOOR BEAM CAPACITY: W33×141.

MOMENT CAPACITY:

CHECK IF COMPACT SECTIONS:

(a). $\frac{b}{t} = \frac{11.5}{0.96} = 11.98 < \frac{4110}{\sqrt{36,000}} = 21.67$. ok.

(b). $\frac{D}{t_w} = \frac{31.38}{0.605} = 51.87 < \frac{19230}{\sqrt{36,000}} = 101.35$ ok

(c). $\frac{L_b}{r_y} = \frac{7' \times 12}{2.43} = 34.57 < 38.89$. ok

$\frac{3.6 - 2.2\,(M_1/M_u)}{F_y} \times 10^6 = 38.89$ (ASSUME $M_1/M_u = 1.0$).

SECTION IS COMPACT

$M_u = F_y Z = 36 \times 514 \times \frac{1}{12} = 1542$ k-ft

SHEAR CAPACITY:

$V_u = C V_p$. $\frac{D}{t_w} = \frac{31.38}{0.605} = 51.87 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71$ ($k=5$)

$C = 1.0$

$V_u = 1.0 \times 0.58\, F_y D t_w = 1.0 \times 0.58 \times 36 \times 31.38 \times 0.605 = 396.40$ K

ELASTIC SECTION MODULUS:

$S_x = 448$ in^3

(5) FATIGUE:

USE SINGE LANE OF TRAFFIC PER BDM 302.4.1.9.a

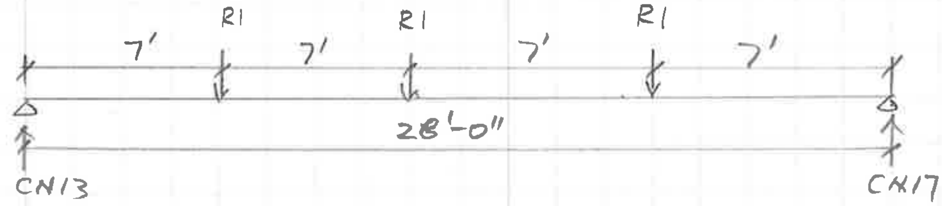
$N17 = P\,(10.76 + 16.76)/30.76 = 0.89P$

$M_{FAT} = N17 \cdot 14' \cdot 1.3 = 16.2P = 16.2 \times 20.22 = 327.56$ k-ft

FLOOR BEAMS – WEST APPROACH – SECTION N

2. FB-2 (W33×141)

(1) DEAD LOADS:



DL REACTION FROM STRINGERS (UNFACTORED):

3-SPAN STRINGER : $R1 = 5.99 + 1.89 = 7.88\,K$ (FROM MDX)

DL FROM FB-2 SELFWEIGHT: $0.141\,K/ft$ W33×141

DL REACTION AT COLUMNS:

$$N13 = [R1\cdot(7+14+21) + 0.141 \times 28^2 \times \tfrac{1}{2}] \times \frac{1}{28} = \underline{13.79K}$$

$$N17 = 3R1 + 0.141 \times 28' - 13.79 = \underline{13.79\,K}$$

MAX DL MOMENT:

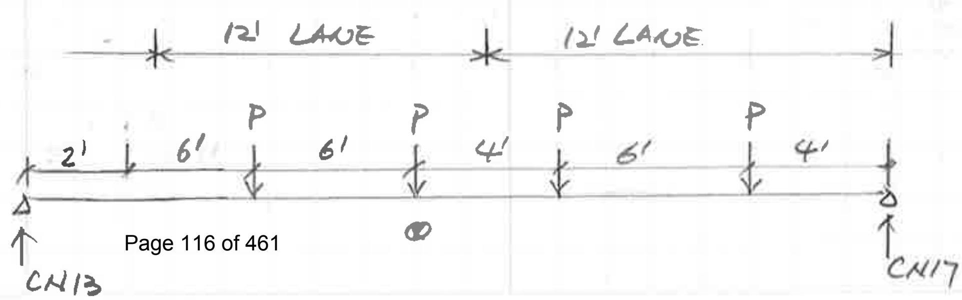
$$M_{DL} = N13 \times 14' - R1 \times 7' - 0.141 \times 14^2 \times \tfrac{1}{2} = \underline{124.08\ K\text{-}ft}$$

MAX DL SHEAR:

$$V_{DL} = N13 = \underline{13.79\ K}$$

(2). LIVE LOADS:

MAX LIVE LOAD MOMENT:



LL REACTION AT COLUMNS:

$N_{13} = P \cdot (4' + 10' + 14' + 20')/28 = 1.71P$

$N_{17} = 4P - 1.71P = 2.29P$

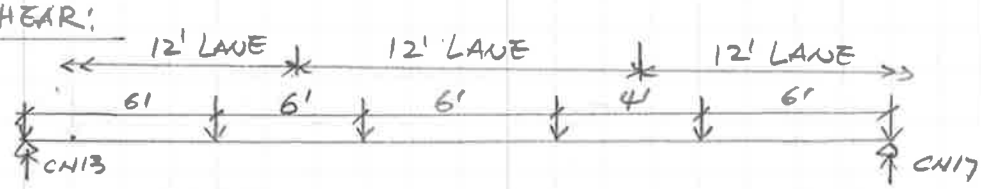
LL IMPACT = 30%

LL REDUCTION FOR 2 LANES: 1.0

MAX LL+I MOMENT:

$M_{L+I} = [N_{13} \cdot 14 - P \cdot 6] \times 1.3 \times 1.0 = 23.3 \cdot P$

MAX LIVE LOAD SHEAR:



$V_{L+I} = N_{17} \times 1.30 \times 0.9 = 3.59P$ $N17 = 3.07P$

P: 3-SPAN STRINGER LIVE LOAD REACTION AT FB-2 WITH. D.F. = 1.0 (FROM MDX OUTPUT). (SAME AS FB-1)

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS 20	20.22	471.13	72.59
2F1	12.06	281.00	43.30
3F1	14.67	341.81	52.67
4F1	15.07	351.13	54.10
5C1	14.31	333.42	51.37

(3) FLOOR BEAM CAPACITY: W33×141

SEE CALCULATIONS FOR FB-1

(4) FATIGUE: (SINGLE LANE)

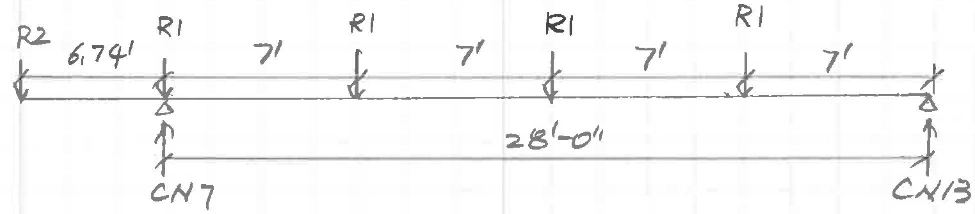
$N13 = P(14+20)/28 = 1.21P$

$M_{FAT} = (N13 \cdot 14 - P \cdot 6) \times 1.3 = 14.22P = 287.53$ k-ft

FLOOR BEAMS – WEST APPROACH – SECTION N.

3. FB-3 (W33×141)

(1) DEAD LOADS:



DL REACTION FROM STRINGERS: (UNFACTORED). (FROM MDX)

3-SPAN STRINGER: $R1 = 5.99 + 1.89 = 7.88\ K$

F2-3 FASCIA STRINGER: $R2 = 4.92 + 1.31 = 6.23\ K$

SELFWEIGHT OF FB-3: 0.141 K/ft

DL REACTION AT COLUMNS:

$$N7 = [R2 \times 34.74 + R1 \times (7+14+21+28) + 0.141 \times 34.74^2 \times \tfrac{1}{2}] \times \tfrac{1}{28} = 30.47\ K$$

$$N13 = R2 + 4 \cdot R1 + 0.141 \times 34.74 - N7 = 12.18\ K$$

MAX DL MOMENT:

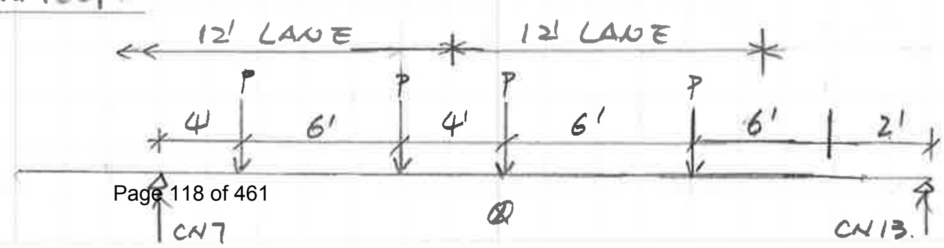
$$M_{DL} = N13 \cdot 14 - R1 \cdot 7 - 0.141 \times 14^2 \times \tfrac{1}{2} = \underline{101.54\ K\text{-}ft}$$

MAX DL SHEAR:

$$V_{DL} = N7 - R2 - 0.141 \times 6.74' = \underline{23.29\ K}$$

(2) LIVE LOADS:

MAX LIVE LOAD MOMENT:



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FB-3

Made By: GHD	Date: 2-13-12	Job No:
Checked By: DMP	Date: 2/14/12	Sheet No. 2.

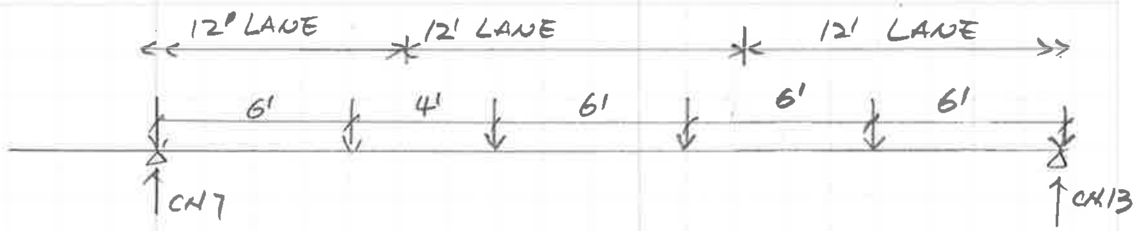
LL REACTION AT COLUMNS:

$$N7 = P(8+14+18+24) \times \frac{1}{28} = 2.29P$$

$$N13 = 4P - 2.29P = 1.71 \cdot P$$

MAX LL+I MOMENT: $M_{L+I} = [N13 \cdot 14 - P \cdot 6] \times 1.3 = 23.3P$

MAX LIVE LOAD SHEAR:



LL REACTION: $N7 = P \cdot (28+22+18+12+6) \times \frac{1}{28} = 3.07P$

$$V_{L+I} = N7 \times 1.3 \times 0.9 = \underline{3.59P}$$

P: 3-SPAN STRINGER LIVE LOAD REACTION AT FB-3 WITH DF = 1.0
(FROM MDX OUTPUT) (SAME AS FB-1)

	P (K)	M_{L+I} (k-ft)	V_{L+I} (K)
HS20	20.22	471.13	72.59
2F1	12.06	281.00	43.30
3F1	14.67	341.81	52.67
4F1	15.07	351.13	54.10
5C1	14.31	333.42	51.37

(3) FLOOR BEAM CAPACITY W33×141

SAME AS FB-1.

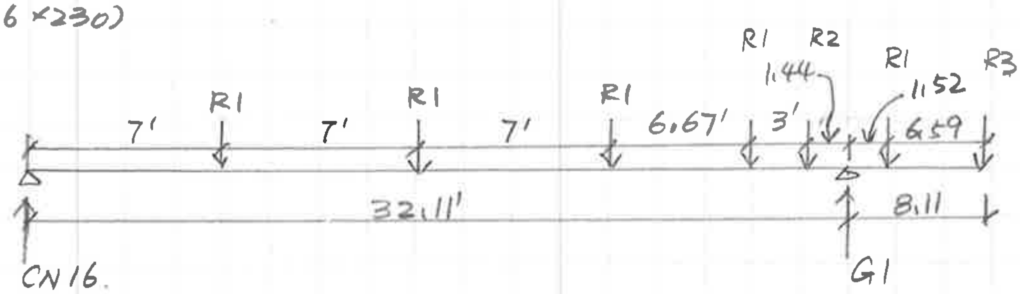
(4). FATIGUE: (SINGLE LANE)

SAME AS FB-2. $M_{FAT} = 287.53$ k-ft

FLOOR BEAMS - WEST APPROACH - SECTION N.

4. FB-4 (W36×230)

(1) DEAD LOADS:



DL REACTIONS FROM STRINGERS: (UNFACTORED)

3-SPAN STRINGER: $R1 = 15.19 + 5.20 = 20.39\ K$

SIMPLE SPAN STRINGER: $R2 = 6.79 + 2.25 = 9.04\ K$

F1-3 FASCIA STRINGER: $R3 = 12.29 + 3.64 = 15.93\ K$

SELF WEIGHT OF FB-4: 0.23 k/ft W36×230

DL REACTION AT COLUMNS:

$$N16 = [R1 \times (4.44 + 11.11 + 18.11 + 25.11 - 1.52) - R3 \times 8.11 + R2 \times 1.44 + 0.23 \times (32.11^2 - 8.11^2) \times \tfrac{1}{2}] \times \frac{1}{32.11} = 36.19\ K$$

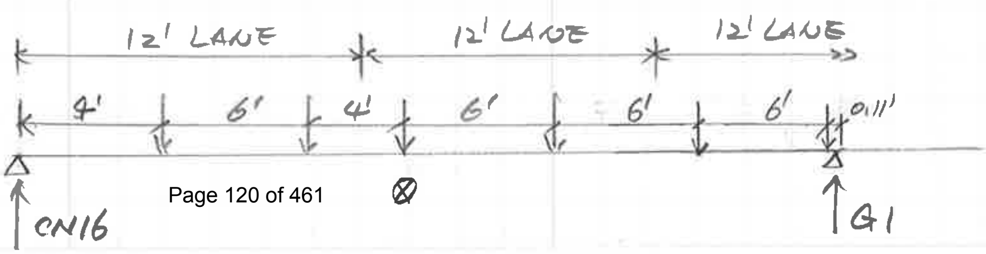
$$G1 = 5R1 + R2 + R3 + 0.23 \times 40.22' - N16 = 99.98\ K$$

MAX DL MOMENT: $M_{DL} = N16 \times 14 - R1 \cdot 7 - 0.23 \times 14^2 \times \tfrac{1}{2} = 341.39\ k\text{-}ft$

MAX DL SHEAR: $V_{DL} = G1 - R3 - R1 - 0.23 \times 8.11' = 61.79\ K$

(2) LIVE LOADS:

MAX LIVE LOAD MOMENT:



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Made By: GHD	Date: 2-13-12	Job No:
Checked By: DMP	Date: 2/14/12	Sheet No. 2

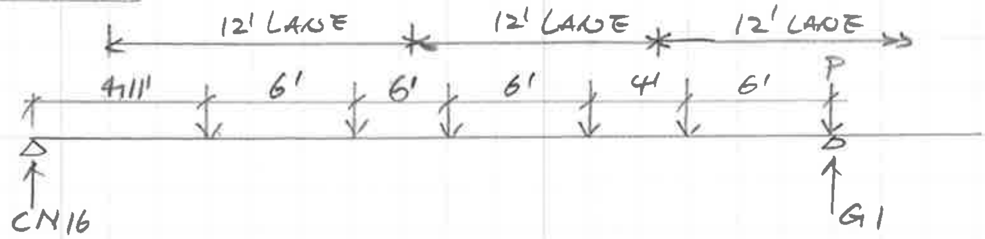
FB-4

REACTIONS: $G1 = P(4+10+14+20+26+32) \times \frac{1}{32.11} = 3.30P$

$N16 = 6P - 3.30P = 2.70P$

MAX LL+I MOMENT: $M_{L+I} = [N16 \times 14' - P \cdot (4+10)] \times 1.3 \times 0.9 = \underline{27.83P}$

MAX LIVE LOAD SHEAR:



$G1 = P(4.11 + 10.11 + 16.11 + 22.11 + 26.11 + 32.11) \times \frac{1}{32.11} = 3.45P$

$V_{L+I} = 3.45P \times 1.3 \times 0.9 = \underline{4.04P}$

P = 3-SPAN STRINGER LIVE LOAD REACTION AT FB-4 WITH D.F. = 1.0 (FROM MDX OUTPUT)

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS 20	53.21/(1.3×1.272) = 32.18	896.21	130.01
2F1	26.99/(1.3×1.272) = 16.32	454.51	65.93
3F1	38.15/(1.3×1.272) = 23.07	642.50	93.20
4F1	42.51/(1.3×1.272) = 25.71	716.02	103.87
5C1	37.11/(1.3×1.272) = 22.44	624.95	90.66

(3) FLOOR BEAM CAPACITY: W36×230 A36 STEEL

MOMENT CAPACITY:

CHECK IF COMPACT SECTIONS:

(a). $\frac{b}{t} = \frac{16.47}{1.26} = 13.07 < \frac{4100}{\sqrt{36,000}} = 21.61$ ok

(b). $\frac{D}{t_w} = \frac{33.38}{0.76} = 43.92 < \frac{19230}{\sqrt{F_y}} = 101.35$ ok

(c). $\frac{L_b}{r_y} = \frac{7' \times 12}{3.73} = 22.52 < \frac{3.6 - 2.2(M_1/M_u)}{F_y} \times 10^6 = 38.89$ ok

(ASSUME $M_1/M_u = 1.0$)

SECTION IS COMPACT

$M_u = F_y Z = 36 \times 943 \times \frac{1}{12} = 2829$ k-ft

SHEAR CAPACITY:

$V_u = C \cdot V_p$ $\quad k = 5 + \frac{5}{(d_o/D)^2}$ $\quad d_o = 7'$

$k = 5 + \frac{5}{(7 \times 12/33.38)^2} = 5.79$

$\frac{D}{t_w} = 43.92 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 76.09$ $\quad C = 1.0$

$V_u = 1.0 \cdot V_p = 1.0 \times 0.58 F_y D t_w$

$= 1.0 \times 0.58 \times 36 \times 33.38 \times 0.76$

$= 529.70$ k

ELASTIC SECTION MODULUS: $S_x = 837$ in³

(4) FATIGUE:

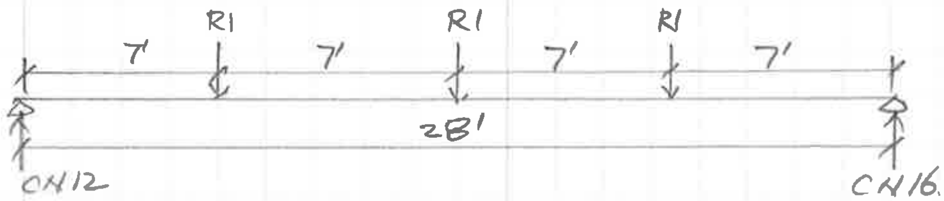
$G1 = P(14+20)/32.11 = 1.06P$ $\quad N16 = 2P - G1 = 0.94P$

$M_{FAT} = N16 \cdot 14' \times 1.3 = 17.11P = 550.60$ k-ft

FLOOR BEAMS – WEST APPROACH – SECTION N

5. FB-5: W 36×170 (SHEET 168I/99I)

(1). DEAD LOADS:



DL FROM STRINGERS: $R1 = 15.19 + 5.20 = 20.39 K$

SELFWEIGHT OF FB-5: $0.17 K/ft$

REACTIONS: $N12 = \frac{3R1}{2} + 0.17 \times 14' = 32.97K$

$N16 = N12 = 32.97 K$

MAX DL MOMENT: $M_{DL} = N12 \cdot 14 - R1 \cdot 7 - 0.17 \times 14^2 \times \frac{1}{2} = 302.19 \text{ K-ft}$

MAX DL SHEAR: $V_{DL} = 32.97 K$

(2) LIVE LOADS: SAME AS FB-2 CALCULATIONS.

MAX LIVE LOAD MOMENT:

$M_{L+I} = 23.3 P$

MAX LIVE LOAD SHEAR: $V_{L+I} = 3.59 P$

SUMMARY: P IS THE SAME AS FB-4

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.18	749.79	115.53
2F1	16.32	380.26	58.59
3F1	23.07	537.53	82.82
4F1	25.71	599.04	92.30
5C1	22.44	522.85	80.56

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Checked By:	DMP	Date:	2/18/12	Sheet No.	2

FB-5

(3) FLOOR BEAM CAPACITY : W36×170 A36 STEEL

MOMENT CAPACITY:

CHECK IF COMPACT:

(a) $\frac{b}{t} = \frac{12.03}{1.1} = 10.94 < \frac{4100}{\sqrt{F_y}} = 21.61$ ok

(b) $\frac{D}{t_w} = \frac{33.97}{0.68} = 49.96 < \frac{19230}{\sqrt{F_y}} = 101.35$ ok

(c) $\frac{L_b}{r_y} = \frac{7' \times 12}{2.53} = 33.20 < \frac{3.6 - 2.2(M_1/M_u)}{F_y} \times 10^6 = 38.89$ ok

SECTION IS COMPACT.

$M_u = F_y Z = 36 \times 668 \times \frac{1}{12} = 2004$ k-ft

SHEAR CAPACITY:

$V_u = C \cdot V_p$ $\quad k = 5 + \frac{5}{(7 \times 12/33.97)^2} = 5.82$

$\frac{D}{t_w} = 49.96 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 76.09 \Rightarrow C = 1.0$

$V_u = 1.0 \times 0.58 \times 36 \times 33.97 \times 0.68$
$= 482.32$ K

ELASTIC SECTION MODULUS: $S_x = 580$ in³

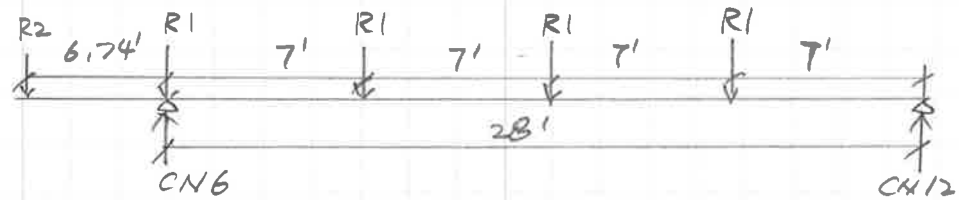
(4) FATIGUE:
SAME AS FB-2. $M_{FAT} = 14.22P = 14.22 \times 32.18 = 457.60$ k-ft

Calculations for 1/4 US Grid

FLOOR BEAMS – WEST APPROACH – SECTION N

6. FB-6 W36×160 (SHEET 168I/99I)

(1). DEAD LOADS:



DL FROM STRINGERS: (UNFACTORED)

3-SPAN STRINGER: $R1 = 15.19 + 5.20 = 20.39\,K$

F2-3 FASIA STRINGER: $R2 = 12.76 + 3.65 = 16.41\,K$

SELFWEIGHT: $0.16\,K/ft$

REACTIONS: $N6 = [R2 \cdot 34.74' + R1 \cdot (7+14+21+28) + 0.16 \times 34.74^2 \times \frac{1}{2}] \times \frac{1}{28}$
$= 74.78\,K.$

$N12 = R2 + 4R1 + 0.16 \times 34.74' - N6 = 28.75\,K$

MAX DL MOMENT: $M_{DL} = N12 \times 14 - R1 \cdot 7 - 0.16 \times 14^2 \times \frac{1}{2} = 244.09\,k\text{-}ft$

MAX DL SHEAR: $V_{DL} = N6 - R2 - 0.16 \times 6.74' = 57.29\,K$

(2) LIVE LOADS: SAME AS FB-3.

$M_{L+I} = 23.3\,P$ $V_{L+I} = 3.59\,P$ P: SAME AS FB-4

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.18	749.79	115.53
2F1	16.32	380.26	58.59
3F1	23.07	537.53	82.82
4F1	25.71	599.04	92.30
5C1	22.44	522.85	80.56

(3) FLOOR BEAM CAPACITY: W36x160.

MOMENT CAPACITY: $S_x = 542\ in^3$

CHECK IF COMPACT:

(a) $\frac{b}{t} = \frac{12}{1.02} = 11.76 < \frac{4100}{\sqrt{F_y}} = 21.61$ OK

(b) $\frac{D}{t_w} = \frac{33.97}{0.65} = 52.26 < \frac{19230}{\sqrt{F_y}} = 101.35$ OK

(c) $\frac{L_b}{r_y} = \frac{7' \times 12}{2.5} = 33.6 < \frac{3.6 - 2.2(M_1/M_u)}{F_y} \times 10^6 = 38.89$ OK

SECTION IS COMPACT.

$M_y = F_y Z = 36 \times 624 \times \frac{1}{12} = 1872\ k\text{-}ft$

SHEAR CAPACITY:

$V_u = C \cdot V_p.$ $\quad K = 5 + \frac{5}{(7 \times 12/33.97)^2} = 5.82.$

$\frac{D}{t_w} = 52.26 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 76.09 \Rightarrow C = 1.0$

$V_u = 1.0 \times 0.58 \times 36 \times 33.97 \times 0.65$

$= 461.04\ k$

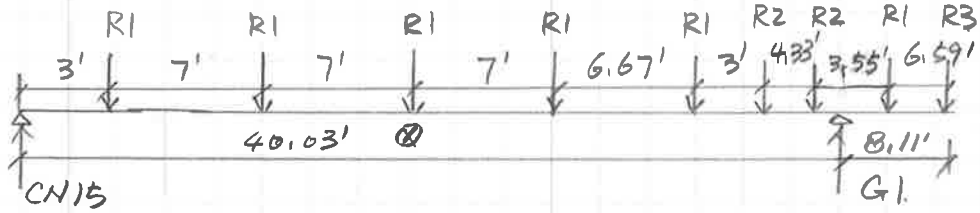
(4) FATIGUE:

SAME AS FB-5. $M_{FAT} = 14.22P = 457.60\ k\text{-}ft$

FLOOR BEAMS – WEST APPROACH – SECTION N.

7. FB-7   W12×87 AND 36WF230   (154/99I)

(1) DEAD LOADS:



DL FROM STRINGERS: (UNFACTORED)

3-SPAN STRINGER: $R1 = 15.19 + 5.20 = 20.39\ k$

SIMPLE SPAN STRINGERS: $R2 = 6.79 + 2.25 = 9.04\ k$

F1-3 FASCIA STRINGER: $R3 = 12.29 + 3.64 = 15.93\ k$

SELF WEIGHT: $0.087 + 0.23 = 0.317\ k/ft$

REACTIONS: $G1 = [R1 \cdot (3+10+17+24+30.67+41.55) + R2 (33.67+38.00) + R3 \cdot 48.14 + 0.317 \times 48.14^2 \times \frac{1}{2}] \times \frac{1}{40.03}$
$= 108.81\ k$

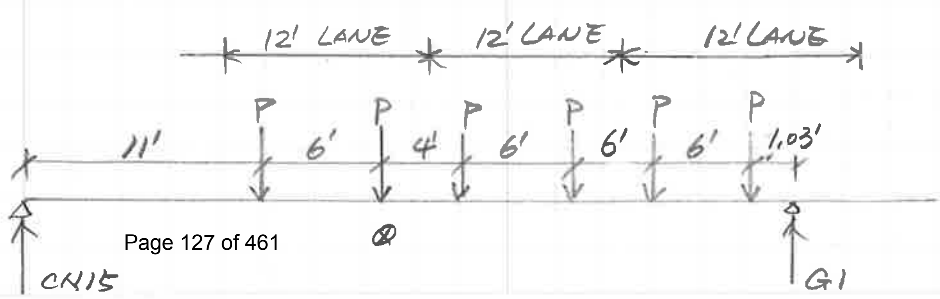
$N15 = 6R1 + 2R2 + R3 + 0.317 \times 48.14 - G1 = 62.80\ k$

MAX DL MOMENT: $M_{DL} = N15 \cdot 17 - R1 \cdot (7+14) - 0.317 \times 17^2 \times \frac{1}{2} = 593.60\ k\text{-}ft$

MAX DL SHEAR: $V_{DL} = G1 - R1 - R3 - 0.317 \times 8.11 = 69.92\ k$

(2) LIVE LOADS:

MAX LIVE LOAD MOMENT:



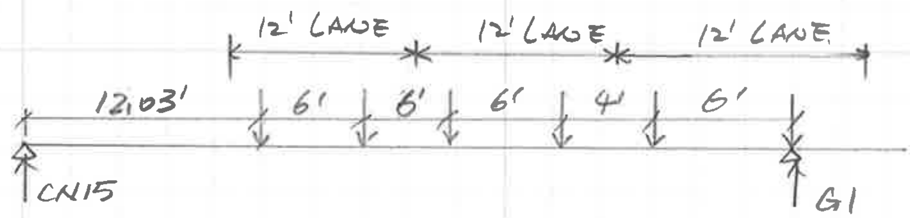
FB-7

REACTIONS: $N15 = P(1.03 + 7.03 + 13.03 + 19.03 + 23.03 + 29.03) \times \frac{1}{40.03}$
$= 2.30P$

$G1 = 6P - 2.3P = 3.7P$

MAX LL+I MOMENT: $M_{L+I} = (N15 \cdot 17 - P \cdot 6) \times 1.3 \times 0.9 = \underline{38.73\ P}$

MAX LIVE LOAD SHEAR:



$G1 = P(12.03 + 18.03 + 24.03 + 30.03 + 34.03 + 40.03) \times \frac{1}{40.03}$
$= 3.95P$

$\underline{V_{L+I}} = 3.95P \times 1.3 \times 0.9 = \underline{4.62\ P}$

NOTE: THIS BEAM COULD HAVE FOUR LANES, BUT THIS DOES NOT CONTROL DUE TO THE 0.75 REDUCTION FACTOR.

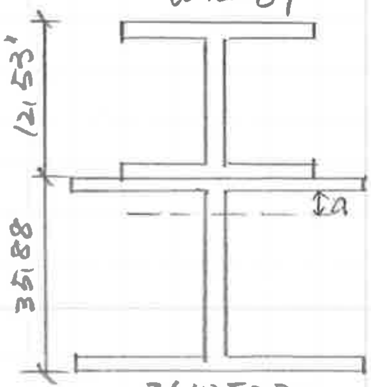
P: USE 3-SPAN STRINGER LIVE LOAD REACTION AT FB-7, WITH D.F. = 1.0 SAME AS FB-4.

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.18	1246.33	148.67
2F1	16.32	632.07	75.40
3F1	23.07	893.50	106.58
4F1	25.71	995.75	118.78
5C1	22.44	869.10	103.67

FB-7

(3) FLOOR BEAM CAPACITY.

W12×87



36WF230

$A = 25.6$
$b_f = 12.125$
$t_f = 0.81$
$t_w = 0.515$

$A = 67.73$
$b_f = 16.475$
$t_f = 1.26$
$t_w = 0.765$

CHECK IF COMPACT:

(a) $\frac{b_1}{t_1} = \frac{12.125}{0.81} = 14.97 < \frac{4100}{\sqrt{F_y}} = 21.67$ OK

$\frac{b_2}{t_2} = \frac{16.475}{1.26} = 13.08 < \frac{4100}{\sqrt{33k}} = 22.57$ OK

(b). AVERAGE $t_w = \frac{10.91 \times 0.515 + 0.765 \times 33.36}{10.91 + 33.36}$

$= 0.703''$

$D = 12.53 + 35.88 - 1.26 - 0.81 = 46.34''$

$\frac{D}{t_w} = 65.92 < \frac{19230}{\sqrt{F_y}} = 101.35$ OK

(c) $\frac{L_b}{r_y}$: $L_b = 7' \times 12'' = 84''$

$r_y = \sqrt{\frac{I_y}{A}} = \sqrt{\frac{241 + 879.9}{25.6 + 67.73}} = 3.46$

$\frac{L_b}{r_y} = 24.28 < \frac{3.6 - 2.2(M_1/M_u)}{F_y} \times 10^6 = 38.89$. OK

SECTION IS COMPACT

PLASTIC SECTION MODULUS:

$25.6 + 16.475 \times 1.26 + a \times 0.765 = (35.88 - 2 \times 1.26 - a) \times 0.765 + 16.475 \times 1.26$

$a \approx 0''$

$Z = 25.6 \times (12.53 \times \frac{1}{2} + 1.26) + 33.36 \times 0.765 \times 33.36 \times \frac{1}{2} + 16.475 \times 1.26 \times (\frac{1.26}{2} + 33.99)$

$= 1336.98 \ in^3$

$M_u = F_y Z = 33 \times 1336.98 \times \frac{1}{12} = 3676.69$ K-ft

$V_u = C \cdot V_p$ $\frac{D}{t_w} = 65.92 < \frac{6000\sqrt{5}}{\sqrt{F_y}} = 70.71 \Rightarrow C = 1.0$

$V_u = 1.0 \times 0.58 \times 33 \times 46.34 \times 0.703 = 623.52$ K

FB-7

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12x87	25.6	42.15	1079.04	17.56	7894	740
36WF230	67.73	17.94	1215.61	6.65	2995	14988
	93.33	24.59	2294.65		10889	15728

$I_{TOT} = 10889 + 15728 = 26617 \text{ in}^4$

$S_T = 26617/(12.53+35.88-24.59) = 1117 \text{ in}^3$

$S_B = 26617/24.59 = 1082 \text{ in}^3$ GOVERNS: $F_y = 33$ ksi

$F_y S_T = 36 \times 1117/12 = 3351$ k-ft

$F_y S_B = 33 \times 1082/12 = 2975.5$ k-ft GOVERNS

(4) FATIGUE:

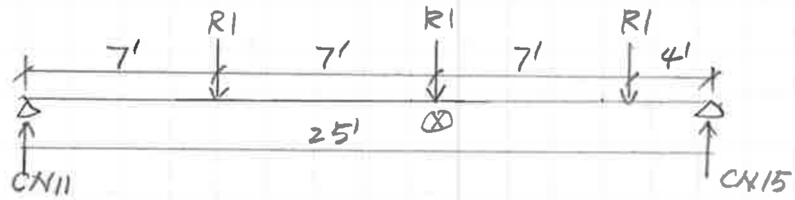
$N15 = P(17.03 + 23.03)/40.03 = 1.0P$

$M_{FAT} = N15 \cdot 17 \cdot 1.3 = 22.1P = 22.1 \times 32.18 = 711.18$ k-ft

FLOOR BEAM - WEST APPROACH - SECTION N

8. FB-8. W36x150 (168H/99I)

(1) DEAD LOADS:



DL FROM STRINGERS: (3-SPAN): $R1 = 15.19 + 5.20 = 20.39\,K$

SELFWEIGHT: $0.15\,K/ft$

REACTIONS: $N11 = [R1 \cdot (4+11+18) + 0.15 \times 25^2 \times \frac{1}{2}] \times \frac{1}{25} = 28.79\,K$

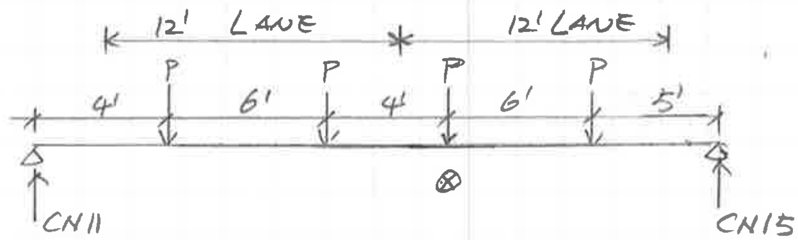
$N15 = 3R + 0.15 \times 25 - N11 = 36.13\,K$

MAX DL MOMENT: $M_{DL} = N11 \cdot 14 - R1 \cdot 7 - 0.15 \times 14^2 \times \frac{1}{2} = \underline{245.63\,K\text{-}ft}$

MAX DL SHEAR: $V_{DL} = N15 = \underline{36.13\,K}$

(2) LIVE LOADS:

MAX LL MOMENT:

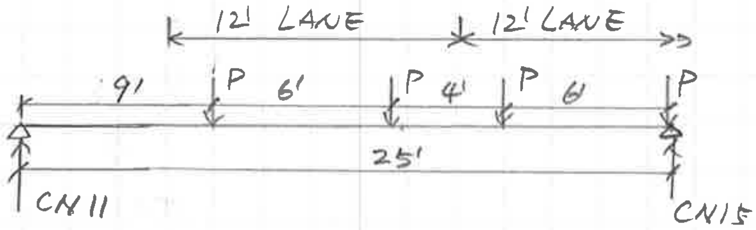


$N11 = P(5+11+15+21) \times \frac{1}{25} = 2.08\,P$

$N15 = 4P - N11 = 1.92P$ NO REDUCTION FOR TWO LANES

$M_{L+I} = [N11 \cdot 14 - P(4+10)] \times 1.3 = \underline{19.66\,P}$

MAX LL SHEAR:



$$N15 = P(9' + 15' + 19' + 25') \times \frac{1}{25} = 2.72P$$

$$V_{L+I} = 2.72P \times 1.30 = 3.54P$$

P: SAME AS FB-4.

	P (k)	M_{L+I} (k-ft)	V_{L+I} (k)
HS20	32.18	632.66	113.92
2F1	16.32	320.85	57.77
3F1	23.07	453.56	81.67
4F1	25.71	505.46	91.01
5C1	22.44	441.17	79.44

(3) FLOOR BEAM CAPACITY: W36x150 $S_x = 504\ in^3$

MOMENT CAPACITY:

(a) $\frac{b}{t} = \frac{11.975}{0.94} = 12.74 < \frac{4100}{\sqrt{F_y}} = 21.67$ ok

(b) $\frac{D}{t_w} = \frac{33.97}{0.625} = 54.35 < \frac{19230}{\sqrt{F_y}} = 101.35$ ok

(c) $\frac{L_b}{r_y} = \frac{7' \times 12}{2.47} = 34 < \frac{3.6 - 2.2(M_1/M_u) \times 10^6}{F_y} = 38.89$ ok

$$M_u = F_y Z = 36 \times 581 \times \frac{1}{12} = 1743 \text{ k-ft}$$

SHEAR CAPACITY:

$$k = 5 + \frac{5}{(7\times12/33.97)^2} = 5.82. \quad \frac{D}{t_w} = 54.35 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 76.09 \Rightarrow C = 1.0$$

$$V_u = C \cdot V_p = 1.0 \times 0.58 \times 36 \times 33.97 \times 0.625 = 443.31 \text{ k}$$

(4) FATIGUE:

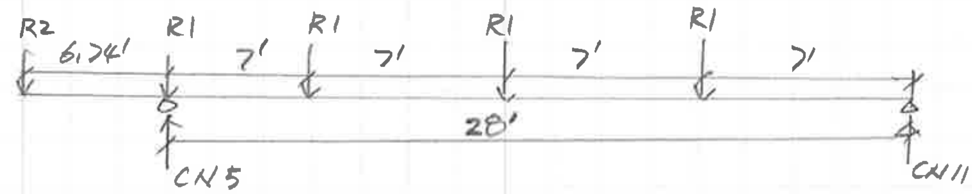
$$N11 = P(11 + 17)/25 = 1.08P$$

$$M_{FAT} = N11 \cdot 14 - P \cdot 6 = 9.12P = 293.48 \text{ k-ft}$$

FLOOR BEAM - WEST APPROACH - SECTION N

9: FB-9 W36x150 (168H/99I)

(1) DEAD LOADS:



DL FROM STRINGERS: 3-SPAN: R1 = 20.39 K

F2-3: R2 = 16.41 K

SELFWEIGHT: 0.15 K/ft

REACTIONS: $N5 = [R2 \cdot 34.74 + R1 \cdot (7+14+21+28) + 0.15 \times 34.74^2 \times \frac{1}{2}] \times \frac{1}{28}$
$= 74.57$ K

$N11 = R2 + 4R1 + 0.15 \times 34.74 - N5 = 28.61$ K

MAX DL MOMENT: $M_{DL} = N11 \cdot 14 - R1 \cdot 7 - 0.15 \times 14^2 \times \frac{1}{2} = 243.11$ k-ft

MAX DL SHEAR: $V_{DL} = N5 - R2 - 0.15 \times 6.74 = 57.15$ K

(2) LIVE LOADS:

M_{L+I}, V_{L+I}, SAME AS FB-6

P: SAME AS FB-6

(3) FLOOR BEAM CAPACITY: W36x150

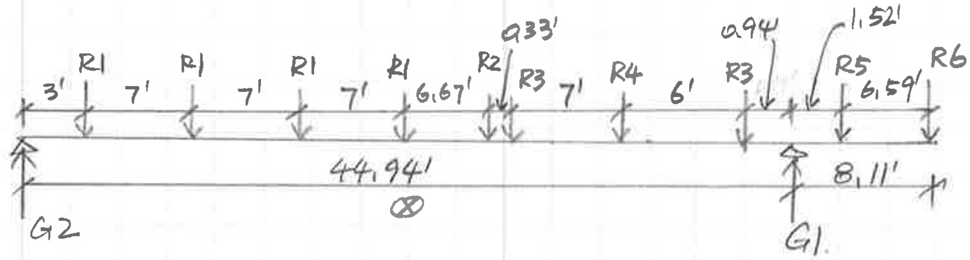
SAME AS FB-8

(4) FATIGUE: SAME AS FB-6. $M_{FAT} = 457.60$ k-ft

FLOOR BEAM - WEST APPROACH - SECTION N

10. FB-10 W12x87 AND 36WF250

(1) DEAD LOADS:



R1: DL FROM 2-SPAN STRINGER + 3-SPAN STRINGER

R1 = (5.65+1.77) + (5.99+1.89) = 15.3 K

R2: DL FROM END REACTION OF 3-SPAN STRINGER:

R2 = 5.99 + 1.89 = 7.88 K

R3: DL FROM END REACTION OF 2-SPAN STRINGER

R3 = 5.65 + 1.77 = 7.42 K

R4: DL FROM 2-SPAN STRINGER + SIMPLE SPAN STRINGER

R4 = (5.65+1.77) + (6.79+2.25) = 16.46 K

R5: DL FROM 3-SPAN STRINGER + SIMPLE SPAN STRINGER

R5 = (5.99+1.89) + (6.79+2.25) = 16.92 K

R6: DL FROM FASCIA STRINGER F1-3 + F1-2

R6 = (4.84+1.32) + (4.18+1.20) = 11.54

$$G1 = [R1\cdot(3+10+17+24) + R2\cdot 30.67 + R3\cdot 31 + R4\cdot 38 + R3\cdot 44 + R5\cdot 46.46' + R6\cdot 53.05' + (0.087+0.25)\times 53.05^2\times\tfrac{1}{2}]\times\frac{1}{44.94}$$

$= 91.73$ K

$$G2 = 4R1 + R2 + 2R3 + R4 + R5 + R6 + (0.087+0.25)\times 53.05 - G1$$

$= 54.99$ K

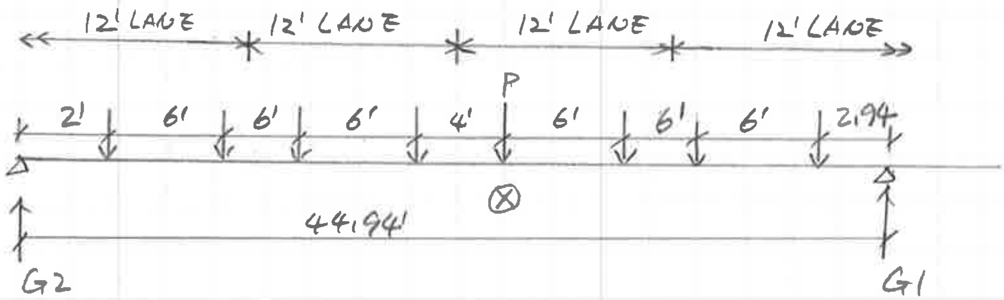
MAX DL MOMENT: $M_{DL} = G2\cdot 24 - R_1(7+14+21) - 0.337\times 24^2\times\frac{1}{2} = 580.11$ k-ft

MAX DL SHEAR: $V_{DL} = G1 - R6 - R5 - 0.337\times 8.11 = 60.54$ K

(2) LIVE LOADS:

MAX LL MOMENT:

(a)



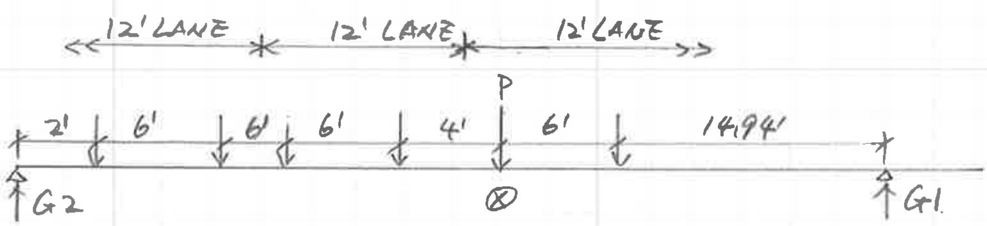
4 LANES OPTION

$$G2 = P(2.94 + 8.94 + 14.94 + 20.94 + 24.94 + 30.94 + 36.94 + 42.94) \times \frac{1}{44.94}$$
$$= 4.08P$$

$$\text{IMPACT} = 1 + \frac{50}{L + 125} = 1.29$$ FOUR LANES REDUCTION: 0.75

$$M_{L+I} = [G2 \cdot 24' - P \cdot (4 + 10 + 16 + 22)] \times 1.29 \times 0.75 = 44.43P$$

(b)



3 LANES OPTION

$$G2 = P(14.94 + 20.94 + 24.94 + 30.94 + 36.94 + 42.94) \times \frac{1}{44.94} = 3.82P$$

$$M_{L+I} = [G2 \cdot 24' - P(4 + 10 + 16 + 22)] \times 1.29 \times 0.9 = \underline{46.07P}$$

THREE LANES GOVERNS

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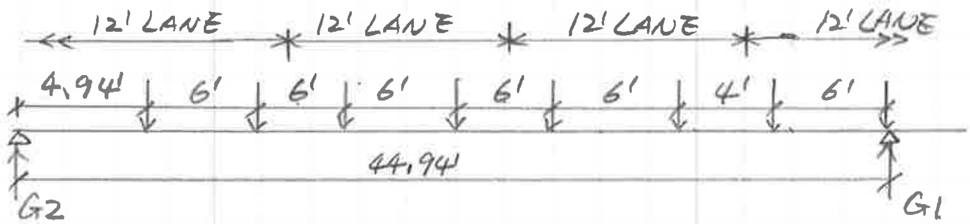
FB-10

MAX LL SHEAR:

(a).



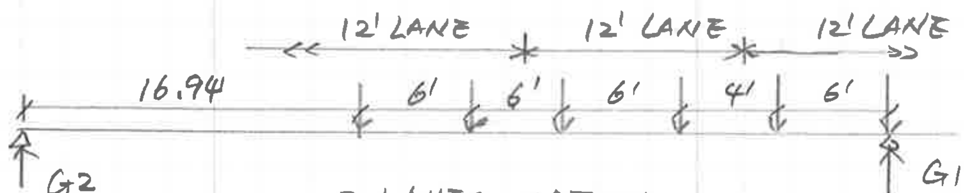
4 LANES OPTION:

$$G2 = P(6+10+16+22+28+34+40) \times \frac{1}{44.94} = 3.47P$$

$$G1 = 8P - G2 = 4.53P$$

$$V_{L+I} = G1 \times 1.29 \times 0.75 = 4.38P$$

(b).



3 LANES OPTION

$$G2 = P(6+10+16+22+28) \times \frac{1}{44.94} = 1.82P$$

$$G1 = 6P - 1.82P = 4.18P$$

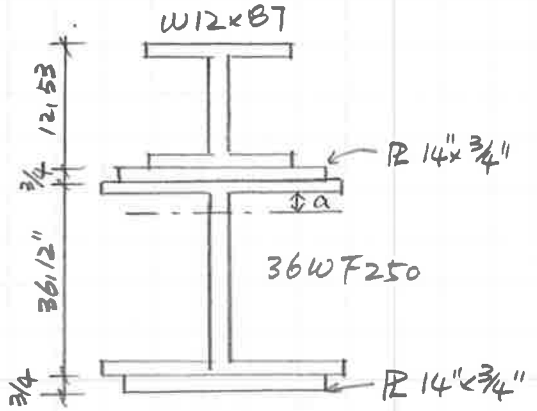
$$\underline{V_{L+I}} = G1 \times 1.29 \times 0.9 = \underline{4.85P}$$ 3 LANES GOVERNS

P: USE 2-SPAN STRINGER PIER REACTION WITH D.F.=1.0

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	53.39/(1.3×1.272) = 32.29	1487.60	156.61
2F1	26.88/(1.3×1.272) = 16.26	749.10	78.86
3F1	38.29/(1.3×1.272) = 23.16	1066.98	112.33
4F1	42.81/(1.3×1.272) = 25.89	1192.75	125.57
5C1	37.54/(1.3×1.272) = 22.70	1045.79	110.10

FB-10

(3) FLOOR BEAM CAPACITY:



W12×87: $F_y = 36$ ksi
$A = 25.6$ $b_f = 12.125$
$t_f = 0.81$ $t_w = 0.515$

36WF250: $F_y = 33$ KSI (1938 CONSTRUCTION)
$A = 73.49$ $b_f = 16.525$
$t_f = 1.38$ $t_w = 0.815$.

BY INSPECTION AND SIMILARITY TO FB-7

SECTION IS COMPACT.

PLASTIC SECTION MODULUS:

$$25.6 + 14\times\tfrac{3}{4} + 16.525\times1.38 + a\times0.815 = 14\times\tfrac{3}{4} + 16.525\times1.38 + (36.12 - 1.38\times2 - a)\times0.815$$

$a = 0.97"$

$$Z = 25.6\times(12.53\times\tfrac{1}{2}+\tfrac{3}{4}+1.38+0.97) + 14\times\tfrac{3}{4}\times(\tfrac{3}{4}\times\tfrac{1}{2}+1.38+0.97) + 16.525\times1.38\times(1.38\times\tfrac{1}{2}+0.97) + 33.36\times0.815\times33.36\times\tfrac{1}{2} + 16.525\times1.38\times(1.38\times\tfrac{1}{2}+33.36-0.97) + 14\times\tfrac{3}{4}\times(\tfrac{3}{4}\times\tfrac{1}{2}+1.38+33.36-0.97)$$

$$= 239.74 + 28.61 + 37.86 + 453.50 + 754.37 + 358.52$$

$$= 1872.6 \text{ in}^3$$

$M_u = F_y Z = 33\times1872.6\times\frac{1}{12} = 5149.65$ k-ft

$V_u = C\cdot V_p$. AVERAGE $t_w = (0.515\times10.91 + 0.815\times33.36)/(10.91+33.36)$
$= 0.741"$

$\frac{D}{t_w} = (12.53+0.75+36.12-0.81-1.38)/0.741$
$= 63.71 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71 \Rightarrow C = 1.0$

$V_u = 1.0\times0.58\times33\times47.21\times0.741 = 669.57$ K

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FB-10

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ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12x87	25.6	43.89	1124	19.74	9975	740
PL 14x3/4	10.5	37.25	391	13.1	1802	0.5
36WF250	73.49	18.81	1382	5.34	2096	16466
PL 14x3/4	10.5	0.375	3.9	23.78	5938	0.5
	120.1	24.15	2901		19811	17207

$I_{TOT} = 37018 \text{ in}^4$

$S_T = 37018/(12.53+1.5+36.12-24.15) = 1424 \text{ in}^3$

$S_B = 37018/24.15 = 1533 \text{ in}^3$ GOVERNS.

$S_T \cdot F_y = 1424 \times 36 \times \frac{1}{12} = 4272 \text{ k-ft}$

$S_B \cdot F_y = 1533 \times 33 \times \frac{1}{12} = 4216 \text{ k-f}$ GOVERNS

(4) FATIGUE:

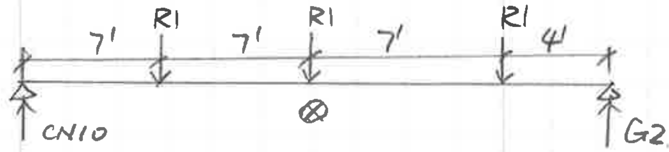
$G2 = P(20.94+26.94)/44.94 = 1.07P$

$M_{FAT} = (G2 \cdot 24 - P \cdot 6) \times 1.29 = 25.39P = 25.39 \times 32.29 = 819.84 \text{ k-ft}$

FLOOR BEAMS – WEST APPROACH – SECTION N

11. FB-11 W36×150 (168G/99I)

(1) DEAD LOADS:



R1: DL FROM 2-SPAN STRINGERS + 3-SPAN STRINGERS

$R1 = (5.65+1.77)+(5.99+1.89) = 15.3\ K$

$N10 = (R1\cdot(4+11+18)+0.15\times25^2\times\frac{1}{2})\times\frac{1}{25} = 22.07\ K$

$G2 = 3R1 + 0.15\times25 - N10 = 27.58\ K$

$M_{DL} = N10\times14 - R1\cdot7 - 0.15\times14^2\times\frac{1}{2} = 187.18\ k\text{-}ft$

$V_{DL} = G2 = 27.58\ K$

(2) LIVE LOADS:

SAME AS FB-8

$M_{L+I} = 19.66\,P$ $V_{L+I} = 3.54\,P$

P: SAME AS FB-10.

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.29	634.82	114.31
2F1	16.26	319.67	57.56
3F1	23.16	455.33	81.99
4F1	25.89	509.00	91.65
5C1	22.70	446.28	80.36

(3) FLOOR BEAM CAPACITY: W36×150, SAME AS FB-8.

(4) FATIGUE. FROM FB-8. $M_{FAT} = 9.12\,P = 9.12\times32.29 = 294.48\ k\text{-}ft$

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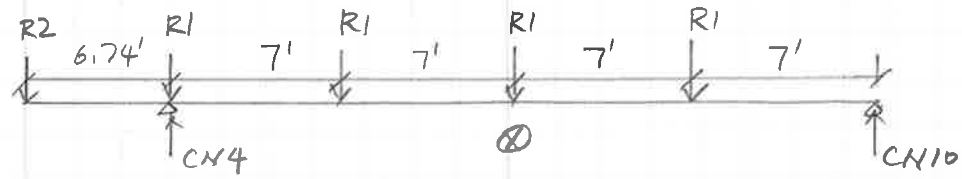
FLOOR BEAMS - WEST APPROACH - SECTION N

12. FB-12 $\quad$ W36×160 $\quad$ (168G/992)

① DEAD LOADS.



R1: DL FROM 2-SPAN AND 3-SPAN STRINGERS

$$R1 = (5.65+1.77)+(5.99+1.89) = 15.3\ K$$

R2: DL FROM F2-2 AND F2-3

$$R2 = (4.69+1.16)+(5.18+1.33) = 12.36\ K$$

$$N4 = \left(R1\cdot(7+14+21+28)+R2\cdot 34.74 + 0.16\times 34.74^2\times\tfrac{1}{2}\right)\times\tfrac{1}{28} = 57.03\ K$$

$$N10 = R2+4R1+0.16\times 34.74 - N4 = 22.09\ K$$

$$M_{DL} = N10\times 14 - R1\times 7 - 0.16\times 14^2\times\tfrac{1}{2} = 186.48\ K\text{-ft}$$

$$V_{DL} = N4 - R2 - 0.16\times 6.74' = 43.59\ K$$

(2) LIVE LOADS:

SAME AS FB-3. $\quad M_{L+I} = 23.3P \quad V_{L+I} = 3.59P$

P: SAME AS FB-10

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.29	752.36	115.92
2F1	16.26	378.86	58.37
3F1	23.16	539.63	83.14
4F1	25.89	603.24	92.95
5C1	22.70	528.91	81.49

(3) FLOOR BEAM CAPACITY: $\quad$ W36×160 $\quad$ SAME AS FB-6

(4) FATIGUE: $\quad$ FROM FB-3 $\quad M_{FAT} = 14.22P = 14.22\times 32.29 = 459.16\ K\text{-ft}$

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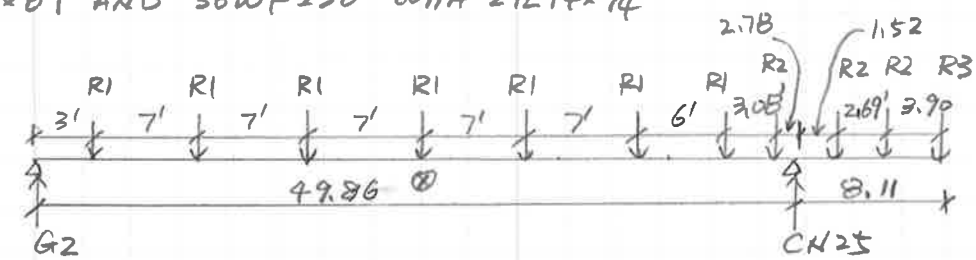
FLOOR BEAM - WEST APPROACH - SECTION N

13 FB-13 W12×87 AND 36WF230 WITH 2 PL 14×3/4

(1) DEAD LOADS:



R1: DL FROM 2-SPAN STRINGERS AT FB-13.

$R1 = 17.24 + 5.91 = 23.15\ K$

R2: DL FROM SIMPLE SPAN STRINGER.

$R2 = 6.79 + 2.25 = 9.04\ K$

R3: DL FROM F1-2: $R3 = 13.97 + 4.23 = 18.20\ K$

S.W: $0.087 + 0.23 + 2 \times 14 \times 0.75 \times \frac{1}{144} \times 0.49 = 0.388\ K/ft$

$N25 = [R1 \times (3+10+17+24+31+38+44) + R2 \times (47.08 + 51.38 + 54.07) + R3 \times 57.97 + 0.388 \times 57.97^2 \times \frac{1}{2}] \times \frac{1}{49.86}$

$= 139.43\ K$

$G2 = 7R1 + 3R2 + R3 + 0.388 \times 57.97 - N25 = 90.42\ K$

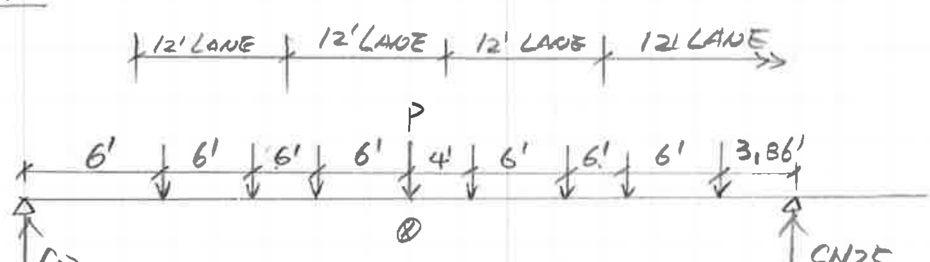
$M_{DL} = G2 \times 24' - R1 \times (7 + 14 + 21) - 0.388 \times 24^2 \times \frac{1}{2} = 1086.04\ k\text{-}ft$

$V_{DL} = N25 - R3 - 2 \cdot R2 - 0.388 \times 8.11' = 100.00\ K$

(2) LIVE LOADS:

MAX LL MOMENT:

(a)



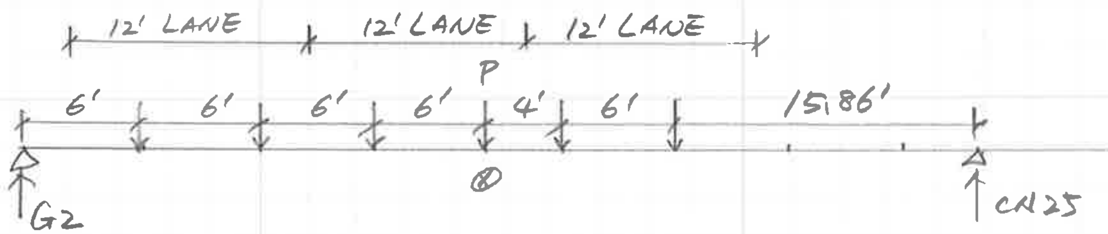
FOUR LANES OPTION.

$$N25 = P(6+12+18+24+28+34+40+46) \times \frac{1}{49.86} = 4.17\,P$$

$$IMPACT = 1 + \frac{50}{L+125} = 1.29 \qquad \text{REDUCTION FACTOR: } 0.75$$

$$M_{L+I} = [N25 \times 25.86 - P(4+10+16+22)] \times 1.29 \times 0.75 = 54.02\,P$$

(b).



THREE LANES OPTION.

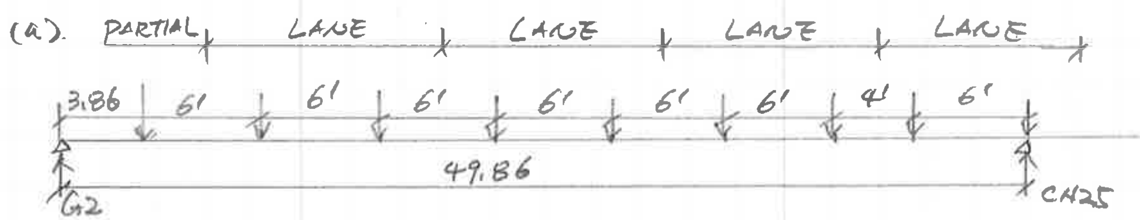
$$N25 = P(6+12+18+24+28+34) \times \frac{1}{49.86} = 2.45\,P$$

$$\underline{M_{L+I}} = [N25 \times 25.86 - P(4+10)] \times 1.29 \times 0.9 = \underline{57.30\,P}$$

THREE LANES GOVERNS.

MAX LL SHEAR:

(a).



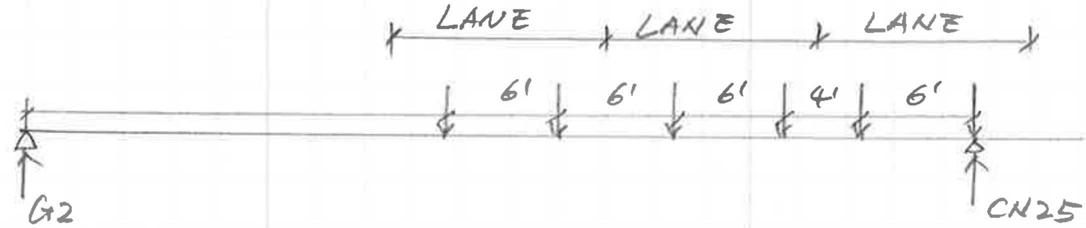
FOUR LANES OPTION

$$G2 = P(6+10+16+22+28+34+40+46) \times \frac{1}{49.86} = 4.05\,P$$

$$N25 = 9P - G2 = 4.95\,P$$

$$V_{L+I} = N25 \times 1.29 \times 0.75 = 4.79\,P$$

(b)



THREE LANES OPTION

$$G2 = P(6+10+16+22+28) \times \frac{1}{49.86} = 1.64P$$

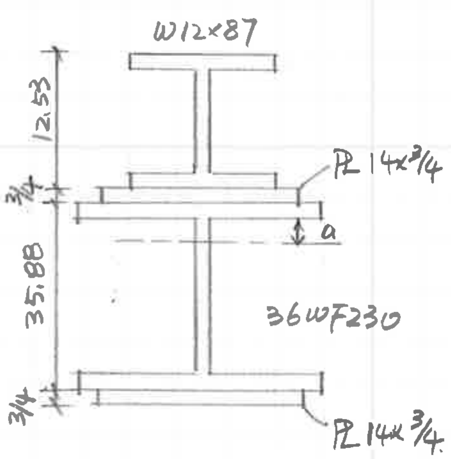
$$N25 = 6P - G2 = 4.36P$$

$\underline{V_{L+I}} = N25 \times 1.29 \times 0.9 = \underline{5.06\ P}$ THREE LANES GOVERNS

P: 2-SPAN STRINGER PIER REACTION WITH P.F. = 1.0
(SAME AS FB-10)

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.29	1850.22	163.39
2F1	16.26	931.70	82.28
3F1	23.16	1327.07	117.19
4F1	25.89	1483.50	131.00
5C1	22.76	1300.71	114.86

(3) <u>FLOOR BEAM CAPACITY:</u>



W12×87 $F_y = 36$ KSI
A = 25.6 $b_f = 12.125$
$t_f = 0.81$ $t_w = 0.515$

36WF230: $F_y = 33$ KSI
A = 67.73 $b_f = 16.475$
$t_f = 1.26$ $t_w = 0.765$

BY INSPECTION AND SIMILARITY TO FB-7

SECTION IS COMPACT

Made By:	GHD	Date:	2-16-12	Job No:	
Checked By:	DMP	Date:	2/20/12	Sheet No.	4

FB-13

NEUTRAL AXIS: THE SAME AS FB-7 $Q=0$

$$Z = 25.6\times(12.53\times\tfrac{1}{2}+0.75+1.26) + 14\times0.75\times(\tfrac{0.75}{2}+1.26) + 16.475\times1.26\times\tfrac{1.26}{2}$$

$$+ 33.36\times0.765\times\tfrac{33.36}{2} + 16.475\times1.26\times33.99 + 14\times0.75\times(\tfrac{0.75}{2}+1.26+33.36)$$

$$= 1740.79\ in^3$$

$$M_u = F_y Z = 33\times1740.79\times\tfrac{1}{12} = 4787.17\ k\text{-}ft$$

$V_u = C\cdot V_p$ $\quad t_w = (0.515\times10.91 + 0.765\times33.36)/(10.91+33.36) = 0.703''$

$$D = 12.53+35.88+0.75-1.26-1.125 = 46.78''$$

$$\frac{D}{t_w} = 66.54 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71 \Rightarrow C = 1.0$$

$$V_u = 1.0\times0.58\times33\times46.78\times0.703 = 629.44\ k$$

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12x87	25.6	43.65	1117.44	19.37	9605	740
PL 14x3/4	10.5	37	388.5	12.72	1699	0.5
36WF230	67.73	18.69	1265.87	5.59	2116	14988
PL 14x3/4	10.5	0.375	3.9	23.91	6003	0.5
	114.33	24.28	2775.71		19423	15729

$$I_{TOT} = 35152\ in^4$$

$$S_T = 35152/(12.53+1.5+35.88-24.28) = 1372\ in^3$$

$$S_B = 35152/24.28 = 1448\ in^3$$

(4) FATIGUE: $\quad N25 = P(24+30)/49.86 = 1.08P$

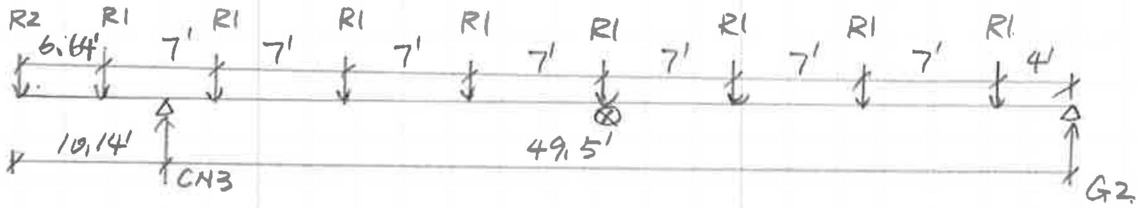
$$M_{FAT} = (N25\cdot25.86 - P\cdot6)\times1.29 = 28.29P = 913.48\ k\text{-}ft$$

TranSystems	Made By: GHD	Date: 2-16-12	Job No:
	Checked By: DMP	Date: 2/20/12	Sheet No. 1

FLOOR BEAMS - WEST APPROACH - SECTION N

14. FB-14 W24×117 AND 36WF230 WITH 2 PL14×3/4 (154/99I)

(1) DEAD LOADS:



R1: DL FROM 2-SPAN STRINGER AT FB-14. R1 = 23.15 K
(SAME AS FB-13)

R2: DL FROM F2-2. R2 = 14.86 + 4.29 = 19.15 K.

S.W: $0.117 + 0.23 + 14 \times \frac{3}{4} \times 2 \times \frac{1}{144} \times 0.49 = 0.418$ K/ft

$N3 = [R1 \times (4+11+18+25+32+39+46+53) + R2 \times 59.64' + 0.418 \times 59.64^2 \times \frac{1}{2}] \times \frac{1}{49.5}$

$= 144.72$ K

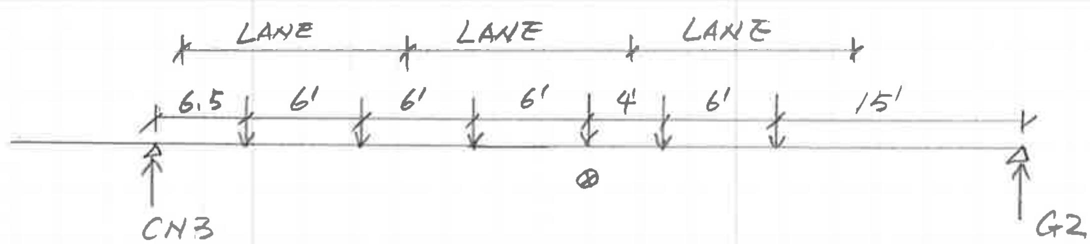
$G2 = 8R1 + R2 + 0.418 \times 59.64 - N3 = 84.56$ K

$M_{DL} = G2 \times 25 - R1 \times (7+14+21) - 0.418 \times 25^2 \times \frac{1}{2} = 1011.08$ K-ft

$V_{DL} = N3 - R2 - R1 - 0.418 \times 10.14' = 98.18$ K

(2) LIVE LOADS:

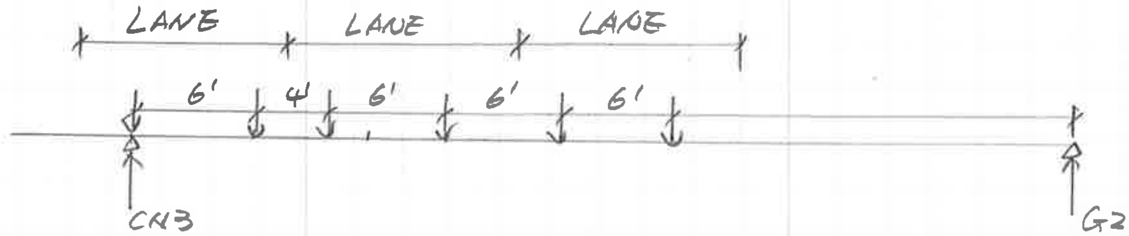
MAX LIVE LOAD MOMENT: (THREE LANE WILL GOVERN BY SIMILARITY TO FB-13)



$N3 = P(15+21+25+31+37+43) \times \frac{1}{49.5} = 3.47P$ $G2 = 2.53P$

$M_{LL+I} = [G2 \times 25 - P \times (4+10)] \times 1.29 \times 0.9 = 57.18P$

MAX LL SHEAR: (THREE LANES)



$$G2 = P(6+10+16+22+28) \times \frac{1}{49.5} = 1.66P$$

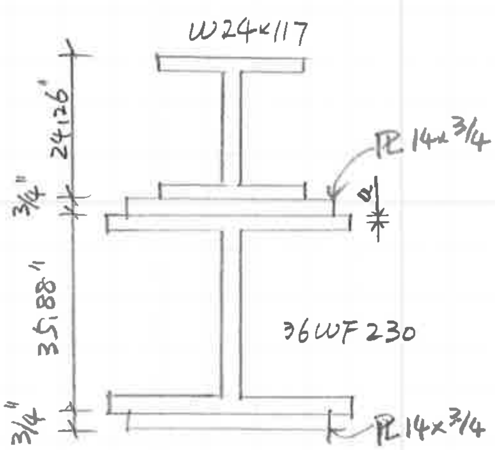
$$N3 = 6P - G2 = 4.34P$$

$$V_{L+I} = N3 \times 1.29 \times 0.9 = 5.04P$$

P: 2-SPAN STRINGER PIER REACTION WITH D.F. = 1.0
SAME AS FB-10.

	P(K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.29	1846.34	162.74
2F1	16.26	929.75	81.95
3F1	23.16	1324.29	116.73
4F1	25.89	1480.39	130.49
5C1	22.70	1297.99	114.41

(3) FLOOR BEAM CAPACITY



W24×117 $F_y = 36$ KSI
$A = 34.4$ $b_f = 12.8$
$t_f = 0.85$ $t_w = 0.55$

36 WF 230 $F_y = 33$ KSI
$A = 67.73$ $b_f = 16.475$
$t_f = 1.26$ $t_w = 0.765$

BY INSPECTION AND SIMILARITY TO FB-7.
SECTION IS COMPACT.

$34.4 + 14\times\frac{3}{4} + 16.475\times a = 67.73 + 14\times\frac{3}{4} - 16.475\times a$

$a = 1.01''$

$Z = 34.4\times(24.26\times\frac{1}{2}+0.75+1.01) + 14\times\frac{3}{4}\times(\frac{0.75}{2}+1.01) + 16.475\times1.26\times\frac{1.26}{2}$
$+ 33.36\times0.765\times(33.36\times\frac{1}{2}+0.25) + 16.475\times1.26\times(\frac{1.26}{2}+33.36+0.25)$
$+ 14\times3/4\times(\frac{0.75}{2}+1.26+33.36+0.25)$

$= 477.82 + 14.54 + 13.08 + 432.06 + 710.77 + 370.07 = 2018.34\ in^3$

$Mu = F_y Z = 33\times2018.34\times\frac{1}{12} = 5550.44\ k\text{-}ft$

$Vu = C\,V_p$. $\quad D = 24.26+0.75+35.88-0.85-1.26 = 58.78''$

$t_w = (0.55\times22.56 + 0.765\times33.36)/(22.56+33.36)$
$= 0.678''$

$\frac{D}{t_w} = 86.70 > \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71$

$< \frac{7500\sqrt{k}}{\sqrt{F_y}} = 88.39$

$C = \frac{6000\sqrt{k}}{(\frac{D}{t_w})\sqrt{F_y}} = 0.82$

$Vu = 0.82\times0.58\times58.78\times0.678\times33 = 625.48\ K$

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W24x117	34.4	49.51	1703	22.21	16969	3540
PL14x3/4	10.5	37.01	389	9.71	990	0.5
36WF230	67.73	18.69	1266	8.61	5021	14988
PL14x3/4	10.5	0.375	3.9	26.93	7615	0.5
	123.13	27.3	3362		30595	18529

$I_{TOT} = 49124\ in^4$

$S_T = 49124/(24.26+1.5+35.88-27.3) = 1431\ in^3$

$S_B = 49124/27.3 = 1799\ in^3$

(4) FATIGUE:

$G2 = P(18.5 + 24.5)/49.5 = 0.87\,P$

$M_{FAT} = G2 \cdot 25 \cdot 1.29 = 28.06\,P = 28.06 \times 32.29 = 906.06$ k-ft

Made By: GHD	Date: 2-16-12	Job No:
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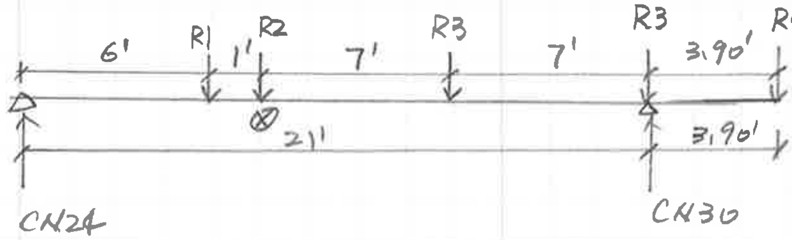
FLOOR BEAM – WEST APPROACH – SECTION N

15. FB-15: W12×87 AND 36WF150

① DEAD LOADS:



R1: DL FROM 2-SPAN STRINGER END REACTION.

$R1 = 5.65 + 1.77 = 7.42\,K$

R2: DL FROM 3-SPAN STRINGER END REACTION.

$R2 = 5.99 + 1.89 = 7.88\,K$

R3: DL FROM END REACTION OF 2-SPAN + 3-SPAN STRINGER

$R3 = 15.30\,K$

R4: DL FROM END REACTION OF FI-1 + FI-2. FASCIA STRINGER.

$R4 = (4.23 + 1.23) + (4.47 + 1.20) = 11.13\,K.$

$N30 = (R1 \cdot 6 + R2 \cdot 7 + R3\,(14+21) + R4 \cdot 24.90 + 0.237 \times 24.9^2 \times \frac{1}{2}) \times \frac{1}{21} = 46.94\,K$

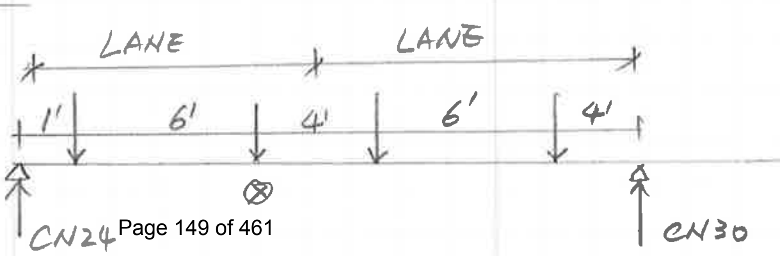
$N24 = R1 + R2 + 2R3 + R4 + 0.237 \times 24.9 - N30 = 15.99\,K$

$M_{DL} = N24 \times 7 - R1 \cdot 1 - 0.237 \times 7^2 \times \frac{1}{2} = \underline{98.7\ K\text{-}ft}$

$V_{DL} = N30 - R4 - 0.237 \times 3.90 = \underline{34.89\ K}$

(2). LIVE LOADS:

MAX LL MOMENT:

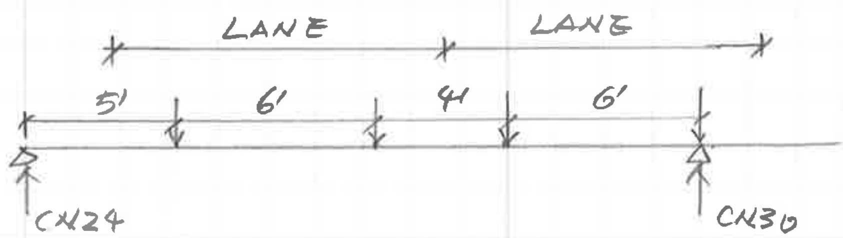


FB-15

$N24 = P(4+10+14+20) \times \frac{1}{21} = 2.29\,P$

$\underline{M_{L+I}} = (N24 \times 7 - P \cdot 6) \times 1.3 \times 1.0 = \underline{13.04\,P}$

MAX LL SHEAR:



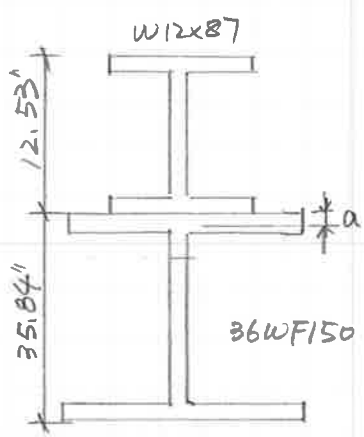
$N30 = P(5+11+15+21) \times \frac{1}{21} = 2.48\,P$

$\underline{V_{L+I}} = N30 \times 1.30 = \underline{3.22\,P}$

P: USE 2-SPAN STRINGE PIER REACTIONS: SAME AS FB-10

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.29	421.06	103.97
2F1	16.26	212.03	52.36
3F1	23.16	302.01	74.58
4F1	25.89	337.61	83.37
5C1	22.70	296.01	73.09

(3) FLOOR BEAM CAPACITY:



W12x87 $F_y = 36$ KSI

$A = 25.6$ $b_f = 12.125$

$t_f = 0.81$ $t_w = 0.515$

36WF150 $F_y = 33$ KSI

$A = 44.16$ $b_f = 11.972$

$t_f = 0.94$ $t_w = 0.625$

(a). $b_1/t_1 = 12.125/0.81 = 14.97 < \frac{4100}{\sqrt{F_y}} = 21.67$ ok

$b_2/t_2 = 11.972/0.94 = 12.74 < \frac{4100}{\sqrt{33000}} = 22.57$ ok (b). $t_w = (10.91 \times 0.515 + 33.96 \times 0.625)/(10.91 + 33.96) = 0.598''$

$D = 12.53 + 35.84 - 0.81 - 0.94 = 46.62''$

$\frac{D}{t_w} = 77.96 < \frac{19230}{\sqrt{F_y}} = 101.35$ ok

(c). $r_y = \sqrt{\frac{I_y}{A}} = \sqrt{\frac{241 + 250.4}{25.6 + 44.16}} = 2.65''$

$\frac{L_B}{r_y} = (7 \times 12)/2.65 = 31.70 < \frac{3.6 - 2.2(M_1/M_u)}{F_y} \times 10^6 = 38.89$ ok

SECTION IS COMPACT.

NEUTRAL AXIS:

$25.6 + 11.972 \cdot a = 44.16 - 11.972 \cdot a$ $a = 0.78''$

$Z = 25.6 \times (12.53 \times \frac{1}{2} + 0.78) + 11.972 \times 0.94^2 \times \frac{1}{2} + 33.96^2 \times 0.625 \times \frac{1}{2} + 11.972 \times 0.94 \times (\frac{0.94}{2}$
$+ 33.96 + 0.16)$
$= 180.35 + 5.29 + 360.40 + 389.26 = 935.30 \text{ in}^3$

$M_u = F_y Z = 33 \times 935.3 \times \frac{1}{12} = 2572.08$ K-ft

$\frac{D}{t_w} = 77.96 > \frac{6000\sqrt{K}}{\sqrt{F_y}} = 70.71$
$< \frac{7500\sqrt{K}}{\sqrt{F_y}} = 88.39$

$C = \frac{6000\sqrt{K}}{(\frac{D}{t_w})\sqrt{F_y}} = 0.91$

$V_u = C \cdot V_p = 0.91 \times 0.58 \times 33 \times 46.62 \times 0.598 = 485.58$ K

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12x87	25.6	42.11	1078.02	15.31	6001	740
36WF150	44.16	17.92	791.35	8.88	3482	9012
	69.76	26.8	1869.37		9483	9752

$I_{TOT} = 19235 \text{ in}^4$

$S_T = 19235/(12.53 + 35.84 - 26.8) = 891.75 \text{ in}^3$

$S_B = 19235/26.8 = 717.72 \text{ in}^3$

(4) FATIGUE:

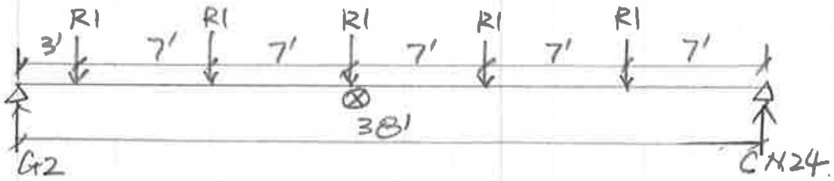
$M24 = P(8+14)/21 = 1.05P$

$M_{FAT} = M24 \cdot 7 \cdot 1.3 = 9.56P = 308.69\ k\text{-}ft$

FLOOR BEAM - WEST APPROACH - SECTION N

16. FB-16   W12×87 AND 36WF260

(1) DEAD LOADS:



R1: DL FROM 2-SPAN AND 3-SPAN END REACTION.   SAME AS FB-11

$R1 = 15.3\,K$

$N24 = \left[R1\cdot(3+10+17+24+31) + 0.347\times38^2\times\frac{1}{2}\right)\times\frac{1}{38} = 40.82\,K$

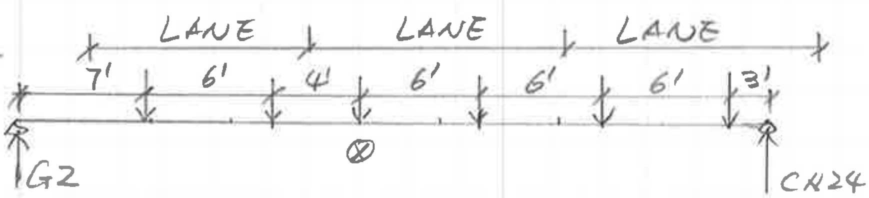
$G2 = 5R1 + 0.347\times38' - N24 = 48.87\,K$

$M_{DL} = G2\times17 - R1\cdot(7+14) - 0.347\times17^2\times\frac{1}{2} = \underline{322.50\,K\text{-}ft}$

$V_{DL} = G2 = \underline{48.87\,K}$

(2) LIVE LOADS:

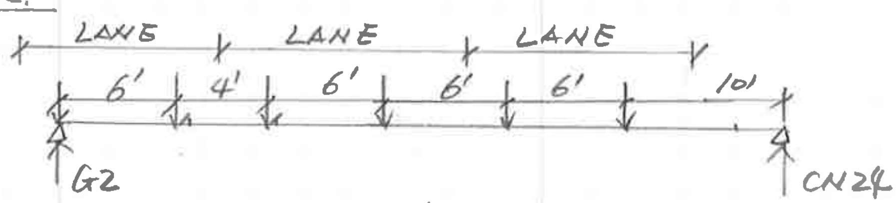
MAX LL MOMENT:



$N24 = P(7+13+17+23+29+35)\times\frac{1}{38} = 3.26P$ $G2 = 6P - 3.26P = 2.74P$

$M_{L+I} = (G2\times17 - P(4+10))\times1.30\times0.9 = \underline{38.12P}$

MAX LL SHEAR:



$G2 = P(10+16+22+28+32+38)\times\frac{1}{38} = 3.84P$

$V_{L+I} = G2\times1.3\times0.9 = \underline{4.49P}$

TranSystems

FB-16

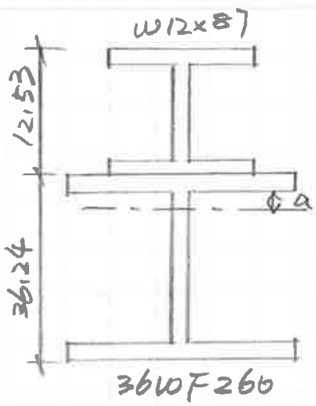
Made By: GHD Date: 2-16-12 Job No:

Checked By: DMP Date: 2/20/12 Sheet No. 2

P: SAME AS FB-15.

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.29	1230.89	144.98
2F1	16.26	619.83	73.01
3F1	23.16	882.86	103.99
4F1	25.89	986.93	116.25
5C1	22.70	869.14	101.92

(3). FLOOR BEAM CAPACITY:



W12x87: $F_y = 36$ KSI

$A = 25.6$. $b_f = 12.125$

$t_f = 0.81$ $t_w = 0.515$

36WF260: $F_y = 33$ KSI

$A = 76.56$ $b_f = 16.555$

$t_f = 1.44$ $t_w = 0.845$

SECTION IS SIMILAR TO FB-4. COMPACT

NEUTRAL AXIS: $25.6 + 16.555 \times 1.44 + a \cdot 0.845 = 76.56 - 16.555 \times 1.44 - a \cdot 0.845$

$a = 1.94''$

$$Z = 25.6 \times (12.53 \times \tfrac{1}{2} + 1.44 + 1.94) + 16.555 \times 1.44 \times (\tfrac{1.44}{2} + 1.94) + 33.36^2 \times 0.845 \times \tfrac{1}{2}$$
$$+ 16.555 \times 1.44 \times (\tfrac{1.44}{2} + 33.36 - 1.94)$$
$$= 246.91 + 63.41 + 470.20 + 766.19 = 1546.71 \text{ in}^3$$

$M_u = F_y Z = 33 \times 1546.71 \times \frac{1}{12} = 4253.45$ k-ft

$D = 12.53 + 36.24 - 0.81 - 1.44 = 46.52$.

$t_w = (0.515 \times 10.91 + 0.845 \times 33.36) / (10.91 + 33.36) = 0.764''$

$\frac{D}{t_w} = 60.89 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71 \Rightarrow C = 1.0$

$V_u = C \cdot V_p = 1.0 \times 0.58 \times 33 \times 46.52 \times 0.764 = 680.26$ K

Made By: GHD Date: 2-22-12 Job No:

Checked By: DMP Date: 2/27/12 Sheet No. 3

FB-16

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12x87	25.6	42.51	1088.3	18.28	8554	740
36WF260	76.56	18.12	1387.3	6.11	2858	17234
	102.16	24.23	2475.6		11412	17974

$I_{TOT} = 29386 \text{ in}^4$

$S_T = 29386/(12.53+36.24-24.23) = 1197.5 \text{ in}^3$

$S_B = 29386/24.23 = 1212.8 \text{ in}^3$

(4) FATIGUE:

$G2 = P(15+21)/38 = 0.95P$

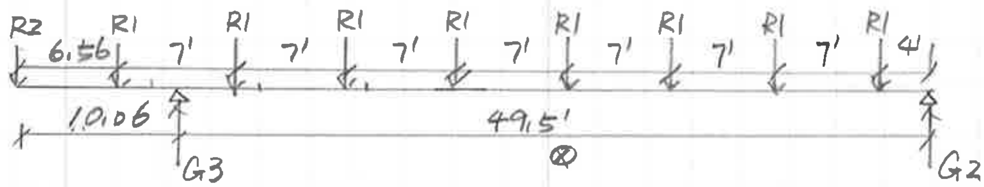
$M_{FAT} = G2 \cdot 17 \cdot 1.3 = 21.00P = 678.09 \text{ k-ft}$

Calculations for 1/4 US Grid

FLOOR BEAM – WEST APPROACH – SECTION N

17: FB-17   W24×117 AND 36WF280 WITH 2 PL 14"×1"

(1) DEAD LOADS:



R1: DL FROM 2-SPAN AND 3-SPAN STRINGER, SAME AS FB-11

$R1 = 15.3\ k$

R2: DL FROM F2-1 AND F2-2

$R2 = (5.43 + 1.65) + (4.09 + 1.16) = 12.33\ k$

S.W. $0.117 + 0.28 + 14" \times 1" \times 2 \times \frac{1}{144} \times 0.49 = 0.492\ k/ft$

$G3 = \left[R1 \times (4 + 11 + 18 + 25 + 32 + 39 + 46 + 53) + R2 \times 59.56 + 0.492 \times 59.56^2 \times \frac{1}{2}\right] \times \frac{1}{49.5}$

$= 102.94\ k$

$G2 = 8R1 + R2 + 0.492 \times 59.56 - G3 = 61.09\ k$

$M_{DL} = G2 \times 25 - R1 \times (7 + 14 + 21) - 0.492 \times 25^2 \times \frac{1}{2} = \underline{730.90\ k\text{-}ft}$

$V_{DL} = G3 - R2 - R1 - 0.492 \times 10.06 = \underline{70.36\ k}$

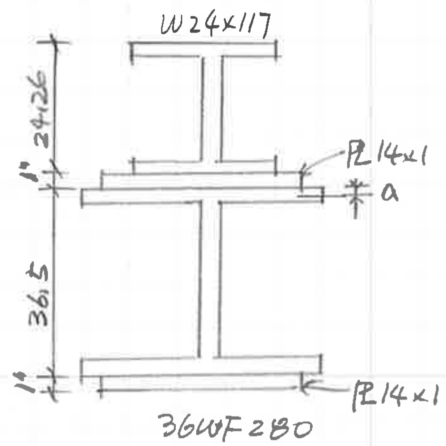
(2) LIVE LOADS: SAME AS FB-14

$M_{L+I} = 57.18\ P$ $V_{L+I} = 5.04\ P$

P: SAME AS: FB-10

	P (k)	M_{L+I} (k-ft)	V_{L+I} (k)
HS20	32.29	1846.34	162.74
2F1	16.26	929.75	81.95
3F1	23.16	1324.29	116.73
4F1	25.89	1480.39	130.49
5C1	22.70	1297.99	114.41

(3) FLOOR BEAM CAPACITY:



W24x117: $F_y = 36$ ksi.
$A = 34.4$ $b_f = 12.8$
$t_f = 0.85$ $t_w = 0.55$

36WF280: $F_y = 33$ ksi
$A = 82.32$ $b_f = 16.595$
$t_f = 1.57$ $t_w = 0.885$

BY INSPECTION AND SIMILARITY TO FB-7

SECTION IS COMPACT.

NEUTRAL AXIS:

$$34.4 + 14\times1 + 16.595\times a = 82.32 - 16.595\times a + 14\times1$$
$$a = 1.44"$$

$$Z = 34.4\times(24.26\times\tfrac{1}{2} + 1 + 1.44) + 14\times1\times(0.5+1.44) + 16.595\times1.57^2\times\tfrac{1}{2} + 0.885\times33.36^2\times\tfrac{1}{2}$$
$$+ 14\times1\times(0.5 + 36.5 - 1.44) + 16.595\times1.57\times(33.36 + 0.13 + 1.57/2)$$
$$= 501.21 + 27.16 + 20.45 + 492.45 + 497.84 + 893.01 = 2432.12\ in^3$$

$$\underline{M_u = F_y \cdot Z} = 33\times2432.12\times\frac{1}{12} = \underline{6688.33\ k\text{-}ft}$$

$V_u = C \cdot V_p$. $D = 24.26 + 1 + 36.5 - 0.85 - 1.57 = 59.34"$

$$t_w = (0.55\times22.56 + 0.885\times33.36)/(22.56+33.36)$$
$$= 0.75"$$

$$\frac{D}{t_w} = 79.12 > \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71$$
$$< \frac{7500\sqrt{k}}{\sqrt{F_y}} = 88.39$$

$$C = \frac{6000\sqrt{k}}{(\frac{D}{t_w})\sqrt{F_y}} = 0.89$$

$$\underline{V_u} = 0.89\times0.58\times33\times59.34\times0.75 = \underline{758.12\ k}$$

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FB-17

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W24x117	34.4	50.63	1742	23.92	19683	3540
PL 14x1	14	38	532	11.29	1784	1.2
36WF280	82.32	19.25	1585	7.46	4581	18819
PL 14x1	14	0.5	7	26.21	9617	1.2
	144.72	26.71	3866		35665	22361

$I_{TOT} = 58026$

$S_T = 58026/(24.26+2+36.5-26.71) = 1610 \text{ in}^3$

$S_B = 58026/26.71 = 2172 \text{ in}^3$

(4) FATIGUE:

FROM FB-14, $M_{FAT} = 28.06P = 28.06 \times 32.29 = 906.06 \text{ k-ft}$

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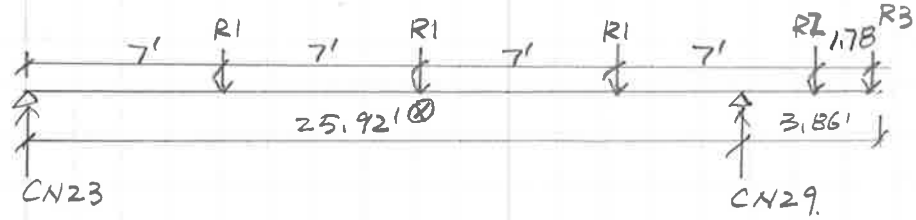
FLOOR BEAM – WEST APPROACH – SECTION N

18: FB-18 W12×87 AND 36WF150

(1) DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER PIER REACTION:

$R1 = 15.19 + 5.20 = 20.39$ K.

R2: DL FROM 2-SPAN STRINGER END REACTION:

$R2 = 5.65 + 1.77 = 7.42$ K

R3: DL FROM F1-1 AT FB-18

$R3 = 11.68 + 3.68 = 15.36$ K

S.W.: $0.087 + 0.15 = 0.237$ K/ft

$N29 = (R1 \times (7+14+21) + R2 \times 28 + R3 \times 29.78 + 0.237 \times 29.78^2 \times \frac{1}{2}) \times \frac{1}{25.92}$
$= 62.76$ K

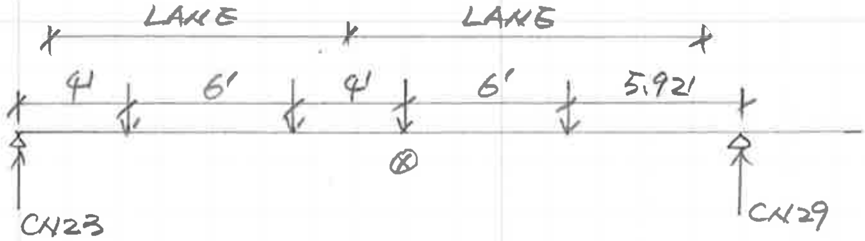
$N23 = 3R1 + R2 + R3 + 0.237 \times 29.78 - N29 = 28.25$ K

$M_{DL} = N23 \times 14 - R1 \times 7 - 0.237 \times 14^2 \times \frac{1}{2} = 229.54$ K-ft

$V_{DL} = N29 - R2 - R3 - 0.237 \times 3.86 = 39.07$ K

(2) LIVE LOADS:

MAX LL MOMENT:



$N29 = P(4+10+14+20) \times \frac{1}{25.92} = 1.85P$

$N23 = 4P - N29 = 2.15P$

$M_{L+I} = [N23 \times 14 - P \times (4+10)] \times 1.3 \times 1.0 = 20.93P$

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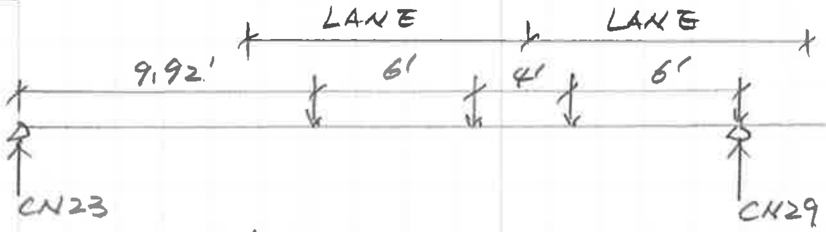
FB-18

MAX LL SHEAR:



$N23 = P(6+16+16) \times \frac{1}{25.92} = 1.23P$

$N29 = 4P - N23 = 2.77P$

$\underline{V_{L+I}} = N29 \cdot 1.3 = \underline{3.68P}$

P: 3-SPAN STRINGER PIER REACTIONS WITH D.F.=1.0
SAME AS FB-4.

	P (K)	M_{L+I} (k-ft)	V_{L+I} (k)
HS20	32.18	673.53	118.42
2F1	16.32	341.58	60.06
3F1	23.07	482.86	84.90
4F1	25.71	538.11	94.61
5C1	22.44	469.67	82.58

(3) FLOOR BEAM CAPACITY: W12x87 AND 36WF150

SAME AS FB-15.

(4) FATIGUE:

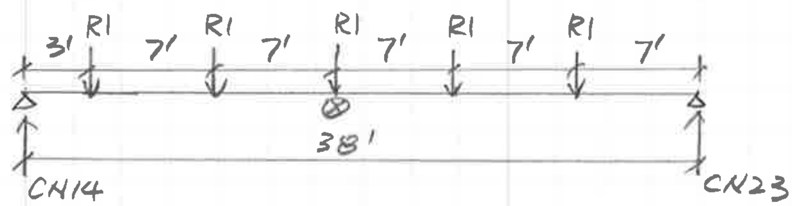
$N23 = P(11.92 + 17.92)/25.92 = 1.15P$

$\underline{M_{FAT}} = (N23 \cdot 14 - P \cdot 6) \times 1.3 = 13.13P = 13.13 \times 32.18 = \underline{422.52\ k\text{-}ft}$

FLOOR BEAM - WEST APPROACH - SECTION N

19. FB-19: W12×87 AND 36WF230

(1) DEAD LOADS:



R1: DL REACTION FROM 3-SPAN STRINGER:

$R1 = 15.19 + 5.20 = 20.39\ k$

S.W.: $0.087 + 0.23 = 0.317\ k/ft$

$N14 = [R1 \times (7+14+21+28+35) + 0.317 \times 38^2 \times \frac{1}{2}] \times \frac{1}{38} = 62.36\ k$

$N23 = 5R1 + 0.317 \times 38 - N14 = 51.64\ k$

$M_{DL} = N14 \times 17 - R1 \times (7+14) - 0.317 \times 17^2 \times \frac{1}{2} = 586.12\ k\text{-}ft$

$V_{DL} = N14 = 62.36\ k$

(2) LIVE LOADS:

SAME AS FB-16.

$M_{L+I} = 38.12\,P$ $\quad V_{L+I} = 4.49\,P$

P: SAME AS FB-18.

	P(k)	M_{L+I} (k-ft)	V_{L+I} (k)
HS20	32.18	1226.70	144.49
2F1	16.32	622.12	73.28
3F1	23.07	879.43	103.58
4F1	25.71	980.07	115.44
5C1	22.44	855.41	100.76

(3) FLOOR BEAM CAPACITY:

SAME AS FB-7.

(4) FATIGUE: FROM FB-16. $M_{FAT} = 21.0P = 21.0 \times 32.18 = 675.78\ k\text{-}ft$

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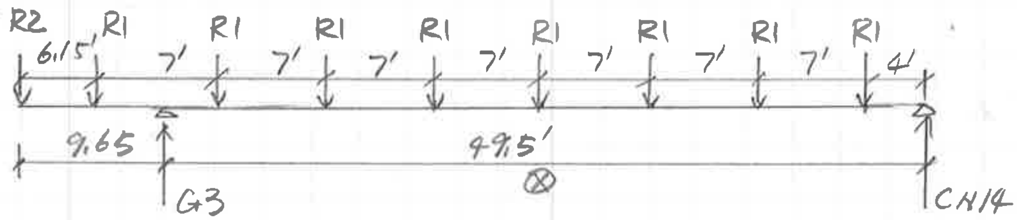
FLOOR BEAM – WEST APPROACH – SECTION N

20. FB-20: W24×117 AND 36WF230 WITH 2 PL 14×3/4.

(1) DEAD LOADS:



R1: DL FROM 3-SPAN STRINGERS AT FB-20

$R1 = 15.19 + 5.20 = 20.39\ K$

R2: DL FROM FZ-1 STRINGER: $R2 = (5.43 + 1.65) \times 2 = 14.16\ K$

S.W.: $0.117 + 0.23 + 14 \times 0.75 \times 2 \times \frac{1}{144} \times 0.49 = 0.418\ K/ft$

$$G3 = \frac{\left(R1 \cdot (4+11+18+25+32+39+46+53) + R2 \cdot 59.15 + 0.418 \times 59.15^2 \times \frac{1}{2}\right)}{49.5}$$

$= 125.61\ K$

$N14 = 8R1 + R2 + 0.418 \times 59.15 - G3 = 76.39\ K$

$M_{DL} = N14 \times 25 - R1 \times (7+14+21) - 0.418 \times 25^2 \times \frac{1}{2} = 922.75\ K\text{-}ft$

$V_{DL} = G3 - R2 - 0.418 \times 6.15' = 108.88\ K$

(2) LIVE LOADS:

SAME AS FB-17. $M_{L+I} = 57.18P$ $V_{L+I} = 5.04P$

P: SAME AS FB-19.

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.18	1840.05	162.19
2F1	16.32	933.18	82.25
3F1	23.07	1319.14	82.25
4F1	25.71	1470.10	129.58
5C1	22.44	1283.12	113.10

(3) FLOOR BEAM CAPACITY: SAME AS FB-14

(4) FATIGUE: FROM FB-17. $M_{FAT} = 28.06P = 28.06 \times 32.18 = 902.97\ K\text{-}ft$

FLOOR BEAM - WEST APPROACH - SECTION N

21: FB-21 W12x87 AND 36WF170

(1) DEAD LOADS:

R1: DL FROM 3-SPAN STRINGER: $R1 = 15.19 + 5.20 = 20.39\ k$

R2: DL FROM F1-1 STRINGER: $R2 = 7.84 + 2.47 = 10.31\ K$

S.W.: $0.087 + 0.17 = 0.257\ k/ft$

$$N28 = \left[R1 \cdot (7+14+21+28) + R2 \cdot 34.73 + 0.257 \times 34.73^2 \times \frac{1}{2}\right] \times \frac{1}{30.83}$$
$$= 62.94\ k$$

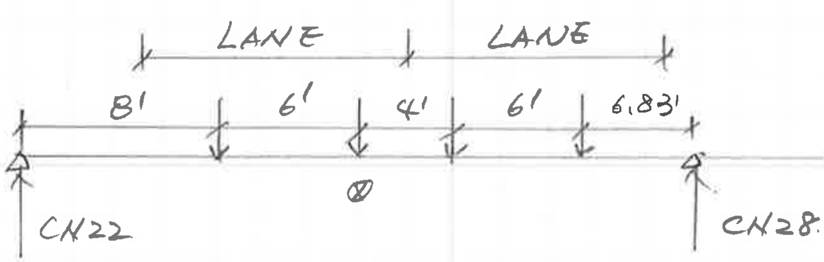
$$N22 = 4R1 + R2 + 0.257 \times 34.73 - N28 = 37.86\ k$$

$$M_{DL} = N22 \times 14 - R1 \cdot 7 - 0.257 \times 14^2 \times \frac{1}{2} = 362.12\ k\text{-}ft$$

$$V_{DL} = N28 - R2 - 0.257 \times 3.9 = 51.63\ K$$

(2) LIVE LOADS:

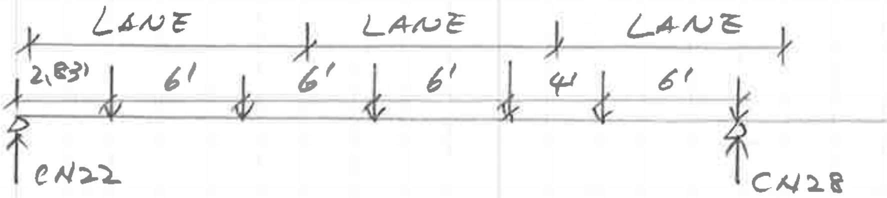
MAX LL MOMENT:



$$N28 = P(8+14+18+24) \times \frac{1}{30.83} = 2.08\ P$$

$$M_{L+I} = [N28 \times 16.83' - P \cdot (4+10)] \times 1.30 = 27.31\ P$$

MAX LL SHEAR:



$$N22 = P(6+10+16+22+28) \times \frac{1}{30.83} = 2.66P$$

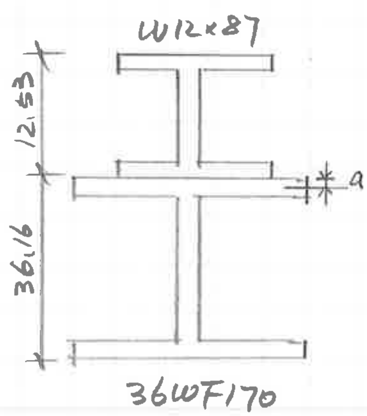
$$N28 = 6P - N22 = 3.34P$$

$$\underline{V_{L+I} = N28 \times 1.3 \times 0.9 = \underline{3.91\,K}}$$

P: SAME AS FB-20:

	P(K)	M_{L+I} (K-FT)	V_{L+I} (K)
HS20	32.18	878.84	125.82
2F1	16.32	445.70	63.81
3F1	23.07	630.04	90.20
4F1	25.71	702.14	100.53
5C1	22.44	612.84	87.74

(3) FLOOR BEAM CAPACITY:



W12x87: $F_y = 36\,KSI$ $A = 25.6$ $b_f = 12.125$
$t_f = 0.81$ $t_w = 0.515$

36WF170: $F_y = 33\,KSI$ $A = 49.98$ $b_f = 12.027$
$t_f = 1.1$ $t_w = 0.68$

BY SIMILARITY TO FB-15. SECTION IS COMPACT.

NEUTRAL AXIS: $25.6 + a \cdot 12.027 = 49.98 - 12.027 \cdot a$. $a = 1.014''$

$$Z = 25.6 \times (12.53 \times \tfrac{1}{2} + 1.014) + 12.027 \times 1.1^2 \times \tfrac{1}{2} + 33.96 \times 0.68 \times (33.96 \times \tfrac{1}{2} + 0.086)$$
$$+ 12.027 \times 1.1 \times (1.1 \times \tfrac{1}{2} + 33.96 + 0.086) = 186.34 + 7.28 + 394.10 + 459.33$$
$$= 1047.05$$

$$\underline{M_u = F_y \cdot Z = 33 \times 1047.05 \times \frac{1}{12} = \underline{2879.39\ K\text{-}FT}}$$

$t_w = (10.91 \times 0.515 + 33.96 \times 0.68) / (10.91 + 33.96) = 0.64''$

$D = 12.53 + 36.16 - 0.81 - 1.1 = 46.78''$

$\frac{D}{t_w} = 73.09$ $> 6000\sqrt{k}/\sqrt{F_y} = 70.91$
$< 7500\sqrt{k}/\sqrt{F_y} = 88.39$ $\Rightarrow C = \frac{6000\sqrt{k}}{(\frac{D}{t_w})\sqrt{F_y}} = 0.97$

$\underline{V_u = C\,V_p}$
$= 0.97 \times 0.58 \times 33 \times 46.78 \times 0.64$
$= \underline{555.85\,K}$

TranSystems

FB-21

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ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12x87	25.6	42.43	1086	16.1	6636	740
36WF170	49.98	18.08	904	8.25	3402	10470
	75.58	26.33	1990		10038	11210

$I_{TOT} = 21248 \text{ in}^4$

$S_T = I_{TOT} / (12.53 + 36.16 - 26.33) = 950.27 \text{ in}^3$

$S_B = I_{TOT} / 26.33 = 806.99 \text{ in}^3$

(4) FATIGUE:

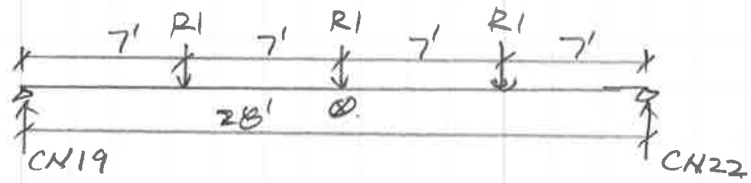
$N28 = P(14+20)/30.83 = 1.10P$

$M_{FAT} = (N28 \times 16.83 - P \times 10.83) \times 1.3 = 9.99P = 9.99 \times 32.18 = 321.48 \text{ k-ft}$

FLOOR BEAM - WEST APPROACH - SECTION N

22. FB-22. W12x87 AND 36WF160

① DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER. $R1 = 20.39\,K$

S.W.: $0.087 + 0.16 = 0.247\ K/ft$

$N19 = N22 = (3R1 + 0.247 \times 28') \times \frac{1}{2} = 34.04\ K$

$\underline{M_{DL}} = N19 \times 14 - R1 \cdot 7 - 0.247 \times 14^2 \times \frac{1}{2} = \underline{309.62\ K}$

$\underline{V_{DL}} = N19 = \underline{34.04K}$

(2) LIVE LOAD:

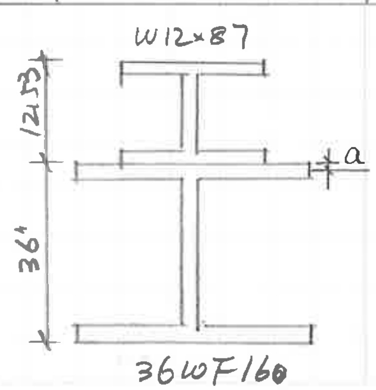
SAME AS FB-5. $\underline{M_{L+I} = 23.3\,P}$

$\underline{V_{L+I} = 3.59P}$

P: SAME AS FB-5

	P(K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.18	749.79	115.53
2F1	16.32	380.26	58.59
3F1	23.07	537.53	82.82
4F1	25.71	599.04	92.30
5C1	22.44	522.85	80.56

(3) FLOOR BEAM CAPACITY:



W12x87: $F_y = 36\,KSI$

$A = 25.6$ $b_f = 12.125$

$t_f = 0.81$ $t_w = 0.515$

36WF160: $F_y = 33\ KSI$

$A = 47.09$ $b_f = 12$

$t_f = 1.02$ $t_w = 0.653$

SECTION IS COMPACT BY SIMILARITY TO FB-15.

NEUTRAL AXIS: $25.6 + 12 \times a = 47.09 - 12 \times a \qquad a = 0.9"$

$$Z = 25.6 \times \left(\frac{12.53}{2} + 0.9"\right) + 12 \times 1.02^2 \times \frac{1}{2} + 33.96^2 \times 0.653 \times \frac{1}{2} + 12 \times 1.02 \times \left(\frac{1.02}{2} + 33.96 + 0.12\right)$$
$$= 183.42 + 6.24 + 376.55 + 423.38$$
$$= 989.59 \text{ in}^3$$

$\underline{M_u = F_y Z} = 33 \times 989.59 \times \frac{1}{12} = \underline{2721.37 \text{ k-ft}}$

$t_w = (0.515 \times 10.91 + 33.96 \times 0.653)/(10.91 + 33.96) = 0.62"$

$D = 12.53 + 36 - 0.81 - 1.02 = 46.7"$

$\frac{D}{t_w} = 75.32 \quad > \frac{6000\sqrt{K}}{\sqrt{F_y}} = 70.71 \quad < \frac{7500\sqrt{K}}{\sqrt{F_y}} = 88.39 \quad \Rightarrow \quad C = \frac{6000\sqrt{K}}{\left(\frac{D}{t_w}\right)\sqrt{F_y}} = 0.94$

$\underline{V_u = C \cdot V_p} = 0.94 \times 0.58 \times 33 \times 46.7 \times 0.62 = \underline{520.93 \text{ K}}$

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W12×87	25.6	42.27	1082	15.72	6326	740
36WF160	47.09	18	848	8.55	3442	9739
	72.69	26.55	1930		9768	10479

$I_{TOT} = 20247 \text{ in}^4$

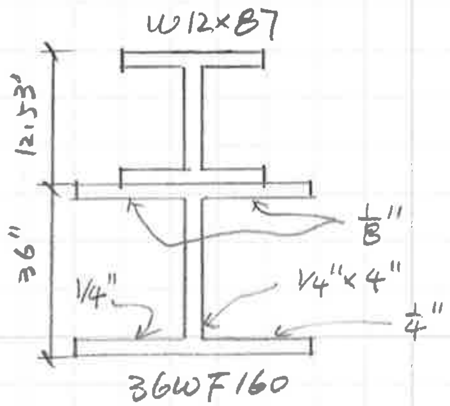
$\underline{S_T} = 20247/(12.53 + 36 - 26.55) = \underline{921.2 \text{ in}^3}$

$\underline{S_B} = 20247/26.55 = \underline{762.6 \text{ in}^3}$

(4) FATIGUE:

FROM FB-5. $\underline{M_{FAT} = 14.22P} = 14.22 \times 32.18 = \underline{457.60 \text{ k-ft}}$

AS-INSPECTED SECTION PROPERTIES:



SECTION LOSS: FOR 36WF160

	A	d	Ad	y	Ay^2	I
W12×87	25.6	42.27	1082	14.41	5316	740
36WF160	47.09	18	848	9.86	4578	9739
LOSS 1	-1.5	35.04	-52.56	7.18	-77	–
LOSS 2	-1.0	3.02	-3.02	24.84	-617	1
LOSS 3	-3.0	0.9	-2.7	26.96	-2181	–
	67.19	27.86	1871.72		7019	10480

$I_{TOT} = 17499 \text{ in}^4$

$S_B = 17499/27.86 = 628.1 \text{ in}^3$

PLASTIC SECTION MODULUS:

NEUTRAL AXIS: $25.6 + 12\times a = 47.09 - 1.5 - 1.0 - 3.0 - 12\times a$

$a = 0.67"$

$Z = 989.59 - 1.5\times(1.02 - a - \frac{1}{16}) - 1.0\times(1.02 - a + 33.96 - \frac{4"}{2}) - 3.0\times(1.02 - a + 33.96 + \frac{1}{8})$

$= 989.59 - 0.43 - 32.31 - 103.31 = 853.54 \text{ in}^3$

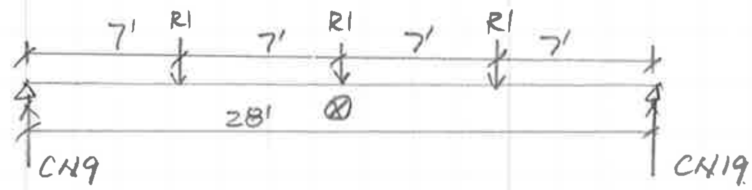
$M_u = F_y Z = 33\times 853.54 \times \frac{1}{12} = 2347.24 \text{ k-ft}$

$V_u = CV_p = 0.94\times 0.58\times 33\times(46.7\times 0.62 - \frac{1}{4}\times 4) = 502.94K$

FLOOR BEAM - WEST APPROACH - SECTION N

23. FB-23 W24x117 AND 36WF230

(1). DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER: R1 = 20.39 K

S.W.: 0.117 + 0.23 = 0.347 k/ft

$N19 = N9 = (3R1 + 0.347 \times 28') \times \frac{1}{2} = 35.44\ k$

$M_{DL} = N9 \cdot 14 - R1 \cdot 7 - 0.347 \times 14^2 \times \frac{1}{2} = 319.42\ k\text{-}ft$

$V_{DL} = N9 = 35.44\ k$

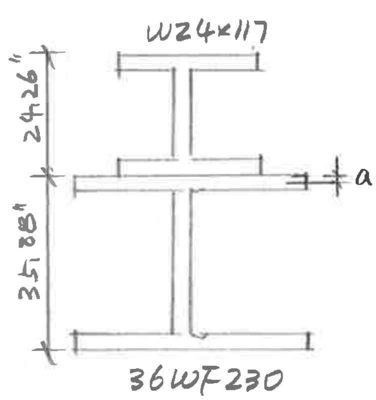
(2) LIVE LOADS:

SAME AS FB-5 $M_{L+I} = 23.3\ P$ $V_{L+I} = 3.59P$

P: SAME AS FB-5

	P(K)	M_{L+I} (k-ft)	V_{L+I} (K)
HS 20	32.18	749.79	115.53
2F1	16.32	380.26	58.59
3F1	23.07	537.53	82.82
4F1	25.71	599.04	92.30
5C1	22.44	522.85	80.56

(3) FLOOR BEAM CAPACITY:



W24x117 $F_y = 36ksi$ $A = 34.4$ $b_f = 12.8$
$t_f = 0.85$ $t_w = 0.55$

36WF230 $F_y = 33\ ksi$ $A = 67.73$ $b_f = 16.475$
$t_f = 1.26$ $t_w = 0.765$

SECTION 23 COMPACT BY SIMILARITY TO FB-7.

NEUTRAL AXIS: $34.4 + 16.475 \cdot a = 67.73 - 16.475 \cdot a$ $\quad a = 1.01''$

$$Z = 34.4 \times \left(\frac{24.26}{2} + 1.01\right) + 16.475^2 \times 1.26 \times \frac{1}{2} + 33.36 \times 0.765 \times \left(33.36 \times \frac{1}{2} + 0.25\right)$$
$$+ 16.475 \times 1.26 \times \left(1.26 \times \frac{1}{2} + 33.36 + 0.25\right)$$
$$= 452.02 + 171.00 + 432.06 + 710.77$$
$$= 1765.85 \text{ in}^3$$

$\underline{M_u = F_y Z} = 33 \times 1765.85 \times \frac{1}{12} = \underline{4856.09 \text{ k-ft}}$

$D = 24.26 + 35.88 - 0.85 - 1.26 = 58.03''$

$t_w = (0.55 \times 22.56 + 0.765 \times 33.36)/(22.56 + 33.36) = 0.68''$

$\frac{D}{t_w} = 85.34 \; > \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71$
$\quad\quad\quad\quad < \frac{7500\sqrt{k}}{\sqrt{F_y}} = 88.39 \quad \Rightarrow \quad C = \frac{6000\sqrt{k}}{\left(\frac{D}{t_w}\right)\sqrt{F_y}} = 0.83$

$\underline{V_u = C \cdot V_p} = 0.83 \times 0.58 \times 33 \times 58.03 \times 0.68 = \underline{626.88 \text{ k}}$

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay^2	I
W24x117	34.4	48.01	1652	19.94	13678	3540
36WF230	67.73	17.94	1215	10.13	6950	14988
	102.13	28.07	2867		20628	18528

$I_{TOT} = 39156 \text{ in}^4$

$\underline{S_T} = 39156/(24.26 + 35.88 - 28.07) = \underline{1221 \text{ in}^3}$

$\underline{S_B} = 39156/28.07 = \underline{1395 \text{ in}^3}$

(4) FATIGUE:

FROM FB-5 $\quad \underline{M_{FAT}} = 14.22p = 14.22 \times 32.18 = \underline{457.60 \text{ k-ft}}$

TranSystems

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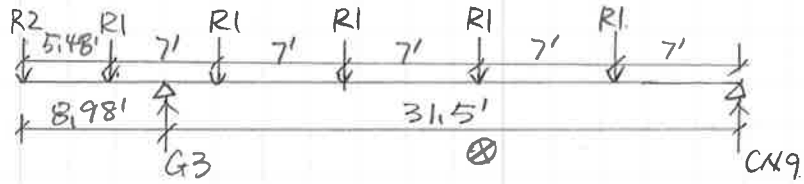
FLOOR BEAM – WEST APPROACH – SECTION N

24. FB-24   W24×117 AND 33WF125

(1) DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER: $R1 = 20.39\ K$

R2: DL FROM F2-1 STRINGER: $R2 = (5.43 + 1.65) \times 2 = 14.16\ K$

$$G3 = \left(R1 \cdot (7+14+21+28+35) + R2 \times 40.48' + 0.242 \times 40.48^2 \times \tfrac{1}{2}\right) \times \frac{1}{31.5}$$
$$= 92.46\ K$$

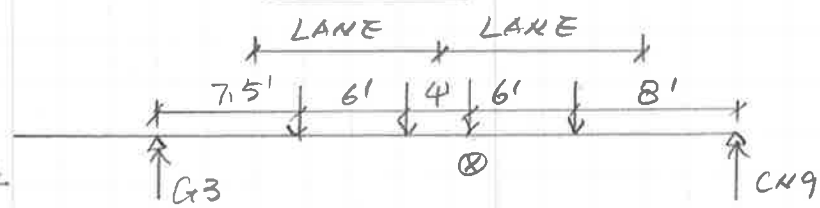
$$N9 = 5R1 + R2 + 0.242 \times 40.48 - G3 = 33.45\ K$$

$$M_{DL} = N9 \times 14 - R1 \times 7 - 0.242 \times 14^2 \times \tfrac{1}{2} = 301.85\ K$$

$$V_{DL} = G3 - R2 - 0.242 \times 5.48' = 76.97\ K$$

(2) LIVE LOADS:

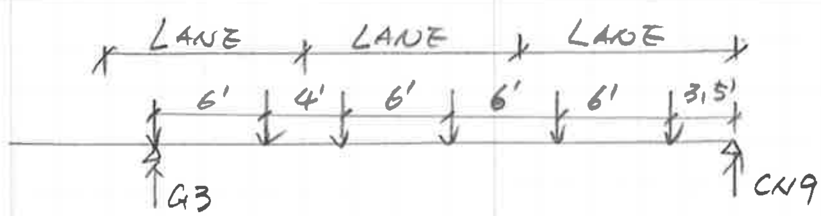
MAX LL MOMENT:



$$G3 = P(8 + 14 + 18 + 24) \times \frac{1}{31.5} = 2.03\ P$$

$$M_{L+I} = (G3 \times 17.5 - P(4+10)) \times 1.3 = 27.98\ P$$

MAX LL SHEAR:



$$N9 = P(6+10+16+22+28) \times \frac{1}{31.5} = 2.60 \qquad G3 = 6P - N9 = 3.40\ P$$

$$V_{L+I} = G3 \times 1.3 \times 0.9 = 3.98\ P$$

Tran Systems

FB-24

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P: 3-SPAN STRINGER CENTER REACTION WITH D.F.=1.0

	P(K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	32.18	900.40	128.08
2F1	16.32	456.63	64.95
3F1	23.07	645.50	91.82
4F1	25.71	719.37	102.33
5C1	22.44	627.87	89.31

(3) FATIGUE:

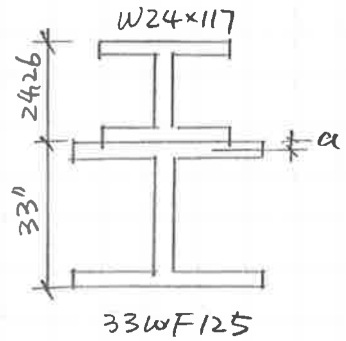
$G3 = P(14+20)/31.5 = 1.08P$

$M_{FAT} = (G3 \cdot 17.5 - P \times 6) \times 1.3 = 16.77P = 539.66$ k-ft

Calculations for 1/4 US Grid

FB-24

(4) FLOOR BEAM CAPACITY:



W24×117 $F_y = 36$ KSI $A = 34.4$ $b_f = 12.8$
$t_f = 0.85$ $t_w = 0.55$

33WF125 $F_y = 33$ KSI $A = 36.78$ $b_f = 11.5$
$t_f = 0.805$ $t_w = 0.57$

BY INSPECTION AND SIMILARITY TO FB-15.

SECTION IS COMPACT.

NEUTRAL AXIS: $34.4 + 11.5 \times a = 36.78 - 11.5 \times a$ $a = 0.10''$

$$Z = 34.4 \times (24.26 \times \tfrac{1}{2} + 0.1) + 11.5 \times 0.805^2 \times \tfrac{1}{2} + 31.39 \times 0.57 \times (31.39 \times \tfrac{1}{2} + 0.705)$$
$$+ 11.5 \times 0.805 \times (0.805 \times \tfrac{1}{2} + 31.39 + 0.705)$$
$$= 420.71 + 3.73 + 293.43 + 300.85 = 1018.72 \text{ in}^3$$

$$M_u = F_y Z = 33 \times 1018.72 \times \tfrac{1}{12} = 2801.48 \text{ k-ft}$$

$$D = 24.26 + 33 - 0.85 - 0.805 = 55.61''$$

$$t_w = (0.55 \times 22.56 + 0.57 \times 31.39)/(22.56 + 31.39) = 0.56''$$

$$\frac{D}{t_w} = 99 > \frac{7500\sqrt{k}}{\sqrt{F_y}} = 88.39. \qquad C = \frac{4.5 \times 10^7 \times k}{(\frac{D}{t_w})^2 F_y} = 0.64$$

$$V_u = C \cdot V_p = 0.64 \times 0.58 \times 55.61 \times 0.56 \times 33 = 381.47 \text{ K}$$

ELASTIC SECTION MODULUS:

	A	d	Ad	y	Ay²	I
W24×117	34.4	45.13	1552.5	14.79	7525	3540
33WF125	36.78	16.5	607	13.84	7045	6355
	71.18	30.34	2159.5		14570	9895

$I_{TOT} = 24465 \text{ in}^4$

$$S_T = 24465 / (24.26 + 33 - 30.34) = 909 \text{ in}^3$$

$$S_B = 24465 / 30.34 = 806 \text{ in}^3$$

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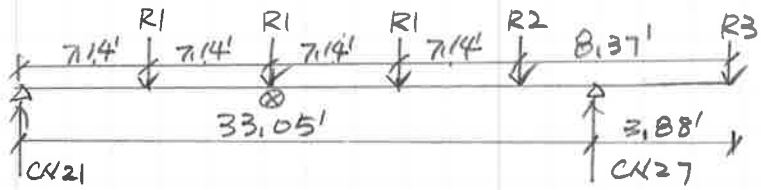
FLOOR BEAM – WEST APPROACH – SECTION N.

25. FB-25 W33×141 C168E/992)

(1) DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER END REACTION.

$R1 = 5.99 + 1.89 = 7.88\ K$

R2: DL FROM 2-SPAN STRINGER END REACTION

$R2 = 5.65 + 1.77 = 7.42\ K$

R3: DL FROM F1-1 STRINGER AT FB-25

$R3 = -0.1 - 0.14 = -0.24\ K$

$N27 = [R1 \cdot (7.14 + 14.28 + 21.42) + R2 \times 28.56 + R3 \times 36.93 + 0.141 \times 36.93^2 \times \frac{1}{2}] \times \frac{1}{33.05}$

$= 19.27\ K$

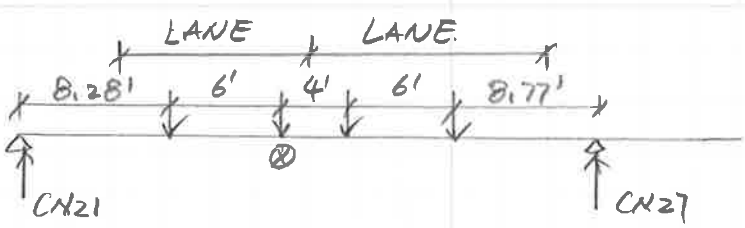
$N21 = 3R1 + R2 + R3 + 0.141 \times 36.93 - N27 = 16.76\ K$

$M_{DL} = N21 \times 14.28 - R1 \times 7.14 - 0.141 \times 14.28^2 \times \frac{1}{2} = 168.69\ K\text{-}ft$

$V_{DL} = N27 - R3 - 0.141 \times 3.88 = 18.96\ K$

(2) LIVE LOADS:

MAX LL MOMENT:

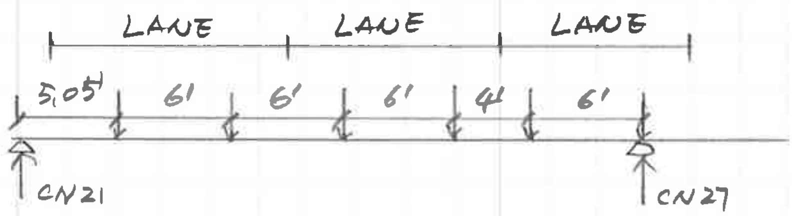


$N21 = P(8.77 + 14.77 + 18.77 + 24.77) \times \frac{1}{33.05} = 2.03\ P$

$M_{L+I} = (N21 \times 14.28 - P \cdot 6) \times 1.3 = 29.88\ P$

FB-25

MAX LL SHEAR:



$N21 = P(6+10+16+22+28) \times \frac{1}{33.05} = 2.48P$ $N27 = 3.52P$

$V_{L+I} = N27 \times 1.3 \times 0.9 = 4.12P$

P: 3-SPAN STRINGER END REACTION WITH D.F. = 1.0, SAME AS FB-1

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K-ft)
HS20	20.22	604.17	83.31
2F1	12.06	360.35	49.69
3F1	14.67	438.34	60.44
4F1	15.07	450.29	62.09
5C1	14.31	427.58	58.96

(3) FLOOR BEAM CAPACITY: W33×141 A36 STEEL

$S_x = 448\ in^3$

COMPACT SECTION:

$M_u = F_y Z = 36 \times 514 \times \frac{1}{12} = 1542$ k-ft

$\frac{D}{t_w} = \frac{33.3 - 0.96 \times 2}{0.605} = 51.87 < \frac{6000\sqrt{k}}{\sqrt{F_y}} = 70.71 \Rightarrow C = 1.0$

$V_u = C \cdot V_p = 1.0 \times 0.58 \times 36 \times 31.38 \times 0.605 = 396.40K$

(4) FATIGUE:

$N21 = P(12.77 + 18.77) / 33.05 = 0.95P$

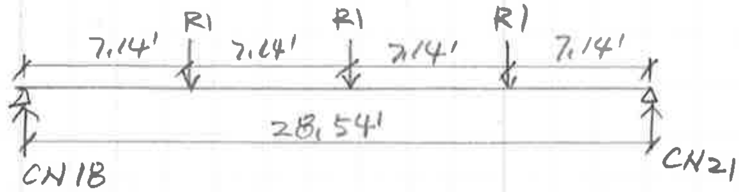
$M_{FAT} = N21 \cdot 14.28 \cdot 1.3 = 17.64P = 356.68$ K-ft

FLOOR BEAM - WEST APPROACH - SECTION N

26. FB-26

W33x141

(1) DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER END REACTION:

$R1 = 5.99 + 1.89 = 7.88\ k$

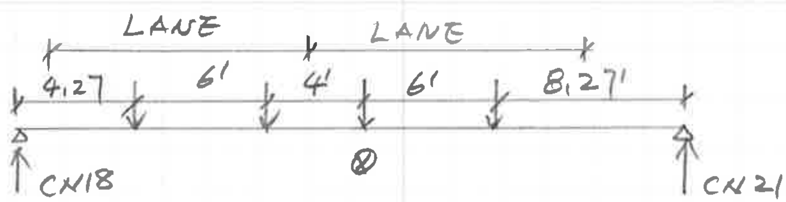
$N18 = N21 = (3R1 + 0.141 \times 28.54') \times \frac{1}{2} = 13.83\ k$

$\underline{M_{DL}} = N18 \times 14.27' - R1 \times 7.14 - 0.141 \times 14.27^2 \times \frac{1}{2} = \underline{126.73\ k\text{-}ft}$

$\underline{V_{DL}} = N18 = \underline{13.83\ k}$

(2) LIVE LOADS:

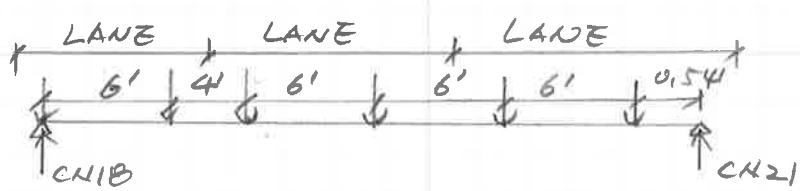
MAX LL MOMENT:



$N18 = P(8.27 + 14.27 + 18.27 + 24.27) \times \frac{1}{28.54} = 2.28\ P$

$\underline{M_{L+I}} = (N18 \times 14.27 - P(4+10)) \times 1.3 = \underline{24.10\ P}$

MAX LL SHEAR:



$N21 = P(6+10+16+22+28) \times \frac{1}{28.54} = 2.88\ P$ $\quad N18 = 3.12P$

$\underline{V_{L+I} = N18 \times 1.3 \times 0.9 = 3.65P}$

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FB-26

P: SAME AS FB-25.

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	20.22	487.30	73.80
2F1	12.06	290.65	44.02
3F1	14.67	353.55	53.55
4F1	15.07	363.19	55.01
5C1	14.31	344.87	52.23

(3) FLOOR BEAM CAPACITY: W33×141 A36 STEEL

SAME AS FB-25.

(4) FATIGUE:

$$N18 = P(8.27 + 14.27)/28.54 = 0.79\,P$$

$$M_{FAT} = N18 \cdot 28.54 \cdot 1.3 = 29.31\,P = \underline{592.65 \text{ k-ft}}$$

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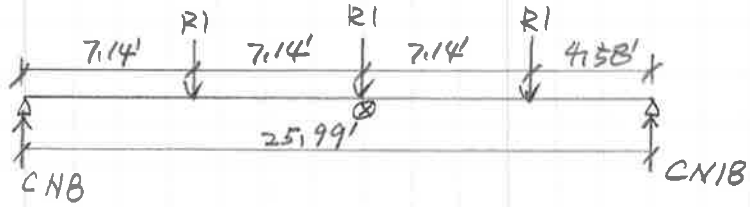
FLOOR BEAM – WEST APPROACH – SECTION N

27. FB-27

W33×141

① DEAD LOADS:



R1: DL FROM 3-SPAN STRINGER END REACTION.

$R1 = 5.99 + 1.89 = 7.88\,K$

$N18 = (R1\cdot(7.14 + 14.28 + 21.42) + 0.141 \times 25.99^2 \times \frac{1}{2}) \times \frac{1}{25.99} = 14.82\,K$

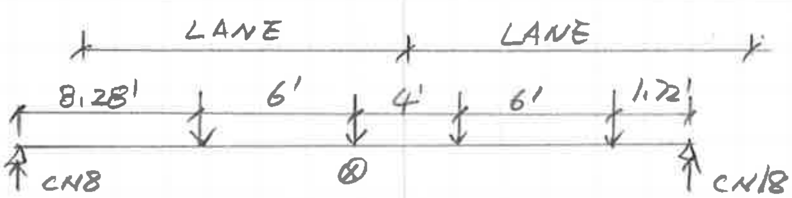
$N8 = 3R1 + 0.141 \times 25.99 - N18 = 12.48\,K$

$M_{DL} = N8 \times 14.28 - R1 \times 7.14 - 0.141 \times 14.28^2 \times \frac{1}{2} = 107.57\ k\text{-}ft$

$V_{DL} = N18 = 14.82\,K$

(2) LIVE LOADS:

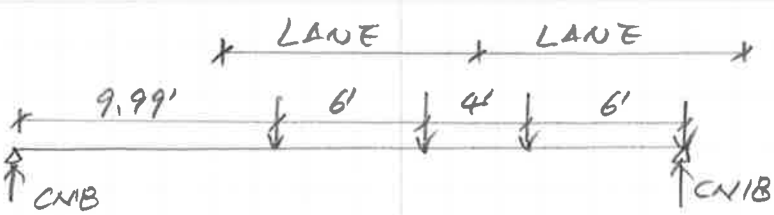
MAX LL MOMENT:



$N8 = P(1.72 + 7.72 + 11.72 + 17.72) \times \frac{1}{25.99} = 1.50\,P$

$M_{L+I} = (N8 \times 14.28 - P\cdot 6) \times 1.3 = 20.05\,P$

MAX LL SHEAR:



$N8 = P(6 + 10 + 16) \times \frac{1}{25.99} = 1.23P,\quad N18 = 2.77\,P$

$V_{L+I} = N18 \times 1.3 = 3.60\,P$

P: SAME AS FB-26

	P(K)	M_{L+I} (K-ft)	V_{L+I} (K-ft)
HS20	20.22	405.41	72.79
2F1	12.06	241.80	43.42
3F1	14.67	294.13	52.81
4F1	15.07	302.15	54.25
5C1	14.31	286.92	51.52

(3) FLOOR BEAM CAPACITY W33x141 A36 STEEL

SAME AS FB-25

(4) FATIGUE:

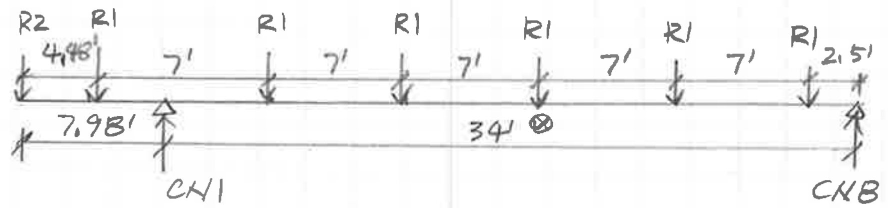
$$N8 = P(11.72 + 17.72)/25.99 = 1.13P$$

$$M_{FAT} = N8 \times 14.28 \times 1.3 = 20.98P = 424.22 \text{ K-ft}$$

FLOOR BEAM - WEST APPROACH - SECTION N.

28. FB-28: W36×160

(1) DEAD LOADS:



R1: DL FROM 3-SPAN STRINGE END REACTION:

$R1 = 5.99 + 1.89 = 7.88\ K$

R2: DL FROM F2-1 STRINGER: $R2 = 5.43 + 1.65 = 7.08\ K$

$$N1 = \frac{R1\cdot(2.5 + 9.5 + 16.5 + 23.5 + 30.5 + 37.5) + 41.98\times R2 + 0.160\times 41.98^2\times\frac{1}{2}}{34}$$

$= 40.70K$

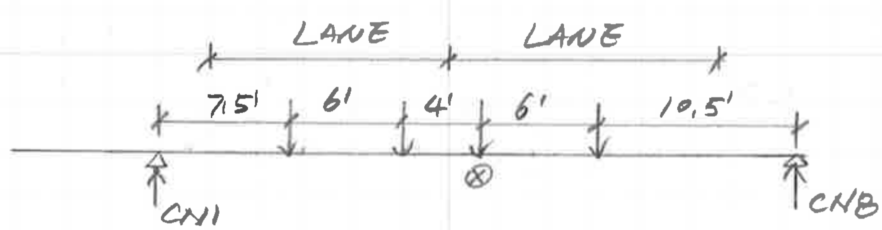
$NB = 6R1 + R2 + 0.160\times 41.98 - N1 = 20.38\ K$

$M_{DL} = NB\times 16.5 - R1(7+14) - 0.16\times 16.5^2\times\frac{1}{2} = \underline{149.01\ k\text{-}ft}$

$V_{DL} = N1 - R2 - 0.16\times 7.98 = \underline{32.34K}$

(2) LIVE LOADS

MAX LL MOMENT:



$N1 = P(10.5 + 16.5 + 20.5 + 26.5)\times\frac{1}{34} = 2.18P$

$M_{L+I} = (N1\cdot 17.5 - P\times(4+10))\times 1.3 = \underline{31.40P}$

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MAX LL SHEAR!

$N1 = P(6+12+18+24+28+34) \times \frac{1}{34} = 3.59P$

$\underline{V_{L+I}} = N1 \times 1.3 \times 0.9 = \underline{4.20P}$

P: SAME AS FB-27.

	P (K)	M_{L+I} (K-ft)	V_{L+I} (K)
HS20	20.22	634.91	84.92
2F1	12.06	378.68	50.65
3F1	14.67	460.64	61.61
4F1	15.07	473.20	63.29
5C1	14.31	449.33	60.10

(3) FLOOR BEAM CAPACITY: W36×160

SAME AS FB-12.

(4) FATIGUE:

$N1 = P(16.5+22.5)/34 = 1.15P$

$\underline{M_{FAT}} = (N1 \cdot 17.5 - P \cdot 6) \cdot 1.3 = 18.36P = \underline{371.24 \text{ k-ft}}$

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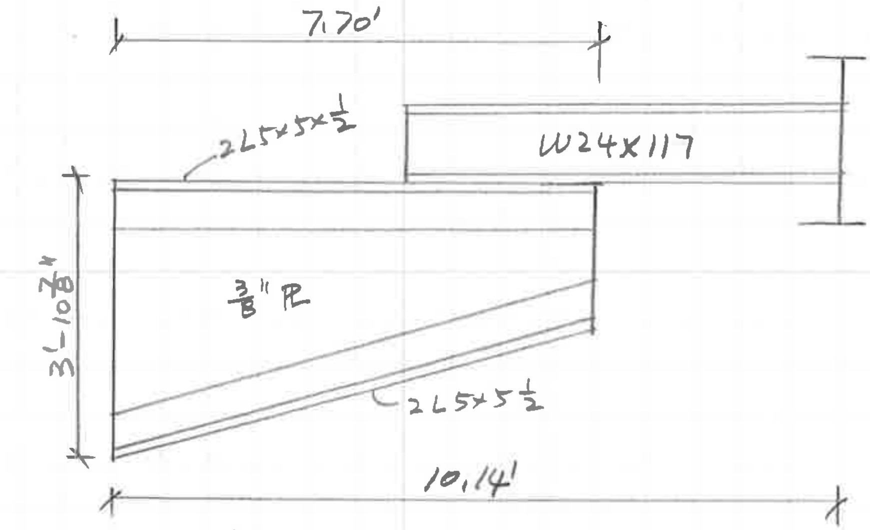
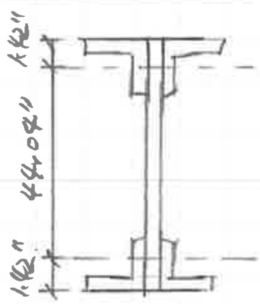
BRACKET - WEST APPROACH - SECTION H.

CHECK THE BRACKET WITH MAX OVERHANG: BR-13



(1) CAPACITY



$I = \frac{1}{12} \times \frac{3}{8} \times 46.875^3 + (4.75 \times 4) \times \left(\frac{44.04}{2}\right)^2 + 4 \times 11.3$

$= 12476.58 \text{ in}^4$ D: USE CLEAR DISTANCE

$\frac{D}{t_w} = \frac{36.875}{0.375} = 98.33 < \frac{19230}{\sqrt{F_y}} = 105.86.$ OK

SECTION IS COMPACT

$Z = 4.75 \times \frac{44.04}{2} \times 4 + 46.875 \times 0.375 \times 46.875 \times \frac{1}{2} = 830.37 \text{ in}^3$

$M_u = F_y \cdot Z = 33 \times 830.37 \times \frac{1}{12} = 2283.52 \text{ k-ft}$

$\frac{D}{t_w} = 98.33 > \frac{7500\sqrt{k}}{\sqrt{F_y}} = 92.32$ $k = 5 + \frac{5}{(7.7 \times 12/36.875)^2} = 5.8$

$C = \frac{4.5 \times 10^7 \times k}{\left(\frac{D}{t_w}\right)^2 F_y} = 0.82$

$V_u = C \cdot V_p = 0.82 \times 0.58 \times 33 \times (46.875 - 0.5'' \times 2) \times 0.375$

$= 270.00 \text{ K}$

Calculations for 1/4 US Grid

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BR-14.

(2) DEAD LOADS:

FROM FB-14 ANALYSIS,

$M_{DL} = R1 \times 3.5 + R2 \times 10.14 + 0.448 \times 10.14^2 \times \frac{1}{2} = 296.70$ k-ft

$V_{DL} = R1 + R2 + 0.448 \times 10.14 = 46.54$ K

(3) LIVE LOADS:

$M_{L+I} = P(1.64' + 7.64') \times 1.3 = 12.06\ P$

$V_{L+I} = 2P \times 1.3 = 2.6P$

P: SAME AS FB-14

	P(K)	M_{L+I} (k-ft)	V_{L+I} (K)
HS20	32.29	389.42	83.95
2F1	16.26	196.10	42.28
3F1	23.16	279.31	60.22
4F1	25.89	312.23	67.31
5C1	22.70	273.76	59.02

(4) ELASTIC SECTION MODULUS:

$S = I/y = 12476.58 / 23.44 = 532.3\ in^3$

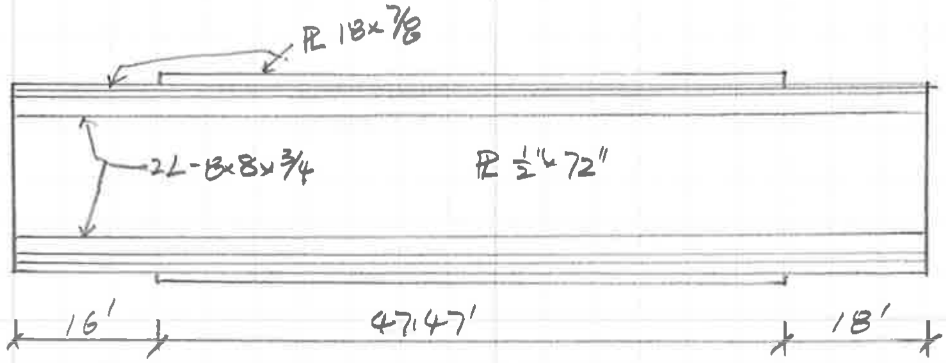
(5) FATIGUE:

$M_{FAT} = 12.06\ P = 389.42$ k-ft

GIRDER – WEST APPROACH – SECTION N.

GIRDER 1:

① DEAD LOADS:



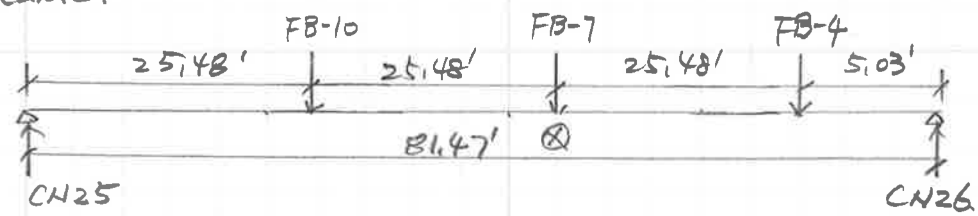
S.W.:

$$\left(18\times\tfrac{7}{8}\times2\times(47.47'+81.47)\times\tfrac{1}{144}\times0.49+0.5\times72\times81.47)\times\tfrac{1}{144}\times0.49 + 0.039\times81.47\times4\right)\times1.20$$

$= 43.81$ K (ADD 20% FOR STIFFENERS AND BOLTS)

$43.81 / 81.47 = 0.54$ K/ft

DL FROM FLOOR BEAMS:



FROM FB-10 CALCULATIONS: $R_{10} = 91.73$ K

FROM FB-7 CALCULATIONS: $R_7 = 108.81$ K

FROM FB-4 CALCULATIONS: $R_4 = 99.98$ K

$$N25 = \left(R_4\times5.03 + R_7\times30.51 + R_{10}\times55.99 + 0.54\times81.47^2\times\tfrac{1}{2}\right)\times\frac{1}{81.47}$$
$$= 131.96 \text{ K}$$

$$N26 = R_4 + R_7 + R_{10} + 0.54\times81.47 - N25 = 212.55 \text{ K}$$

$$M_{DL} = N26\times30.51' - R_4\times25.48 - 0.54\times30.51^2\times\tfrac{1}{2} = \underline{3686.08 \text{ K-ft}}$$

$$V_{DL} = N26 = \underline{212.55 \text{ K}}$$

TranSystems

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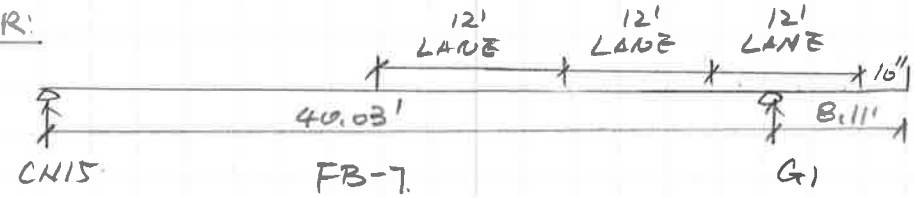
G1

(2) LIVE LOADS:

DISTRIBUTION FACTOR:

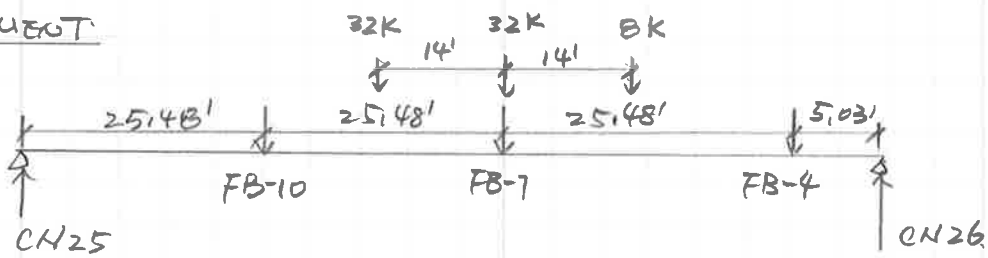


$$G1 = (41.31 + 29.31 + 17.31) \times \frac{1}{40.03} \times 0.9$$ (3 LANES REDUCTION)

$= \underline{1.98}$ (AXLE D.F.)

ASSUME SIMPLE SPAN STRINGER BETWEEN FLOOR BEAMS.

HS20: MAX MOMENT



$P_7 = 32 + 32 \times 11.48/25.48 + 8 \times 11.48/25.48 = 50.02\ K$

$P_{10} = 32 \times 14/25.48 = 17.58\ K$

$P_4 = 8 \times 14/25.48 = 4.40\ K$

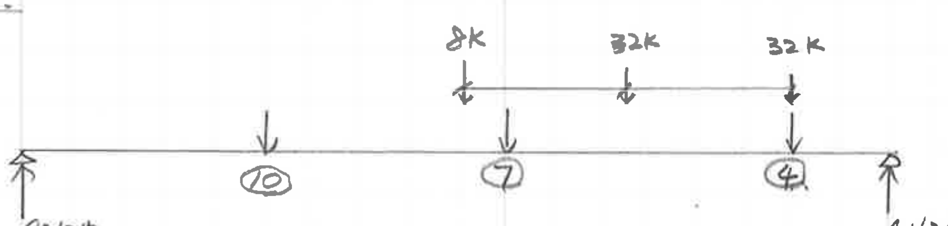
LL IMPACT FOR G1 $= 1 + 50/(L+125) = 1.24$

$N26 = (P_{10} \times 25.48 + P_7 \times 50.96 + P_4 \times 76.44)/81.47 = 40.91$

$N25 = (32+32+8) - N26 = 31.09$

$M_{L+I} = (N26 \times 30.51 - P_4 \times 25.48) \times D.F \times IM = \underline{2789.23\ k\text{-}ft}$

MAX SHEAR:



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TranSystems

G1

$P_4 = 32 + 32 \times 11.48/25.48 = 46.42 \text{ k}$

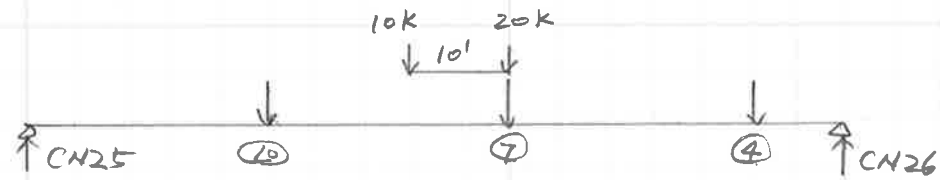
$P_7 = 32 \times 14/25.48 + 8 \times 22.96/25.48 = 24.79 \text{ k}$

$P_{10} = 8 \times 2.52/25.48 = 0.79 \text{ k}$

$N26 = 59.31 \text{ k}$

$V_{L+I} = N26 \times D.F. \times IM = 145.62 \text{ k}$

2F1: MAX MOMENT:



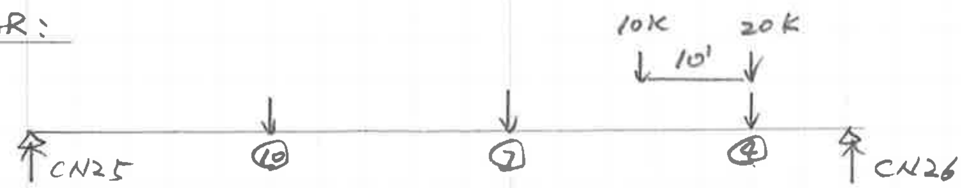
$P_7 = 20 + 10 \times 15.48/25.48 = 26.08 \text{ k}$ $\quad P_4 = 0$

$P_{10} = 10 \times 10/25.48 = 3.92 \text{ k}$

$N26 = 17.54 \text{ k}$

$M_{L+I} = (N26 \times 30.51 - P_4 \times 25.48) \times D.F. \times IM = 1313.89 \text{ k-ft}$

MAX SHEAR:

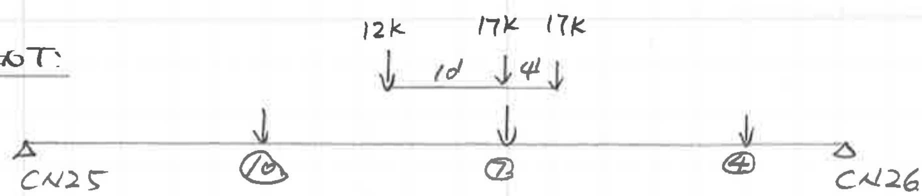


$P_4 = 20 + 10 \times 15.48/25.48 = 26.08 \text{ k}$ $\quad P_7 = 3.92 \text{ k}$ $\quad P_{10} = 0$

$N26 = (P_{10} \times 25.48 + P_7 \times 50.96 + P_4 \times 76.44)/81.47 = 26.92 \text{ k}$

$V_{L+I} = N26 \times D.F. \times IM = 66.09 \text{ k}$

3F1: MAX MOMENT:



$P_7 = 17 + 17 \times 21.48/25.48 + 12 \times 15.48/25.48 = 38.62 \text{ k}$

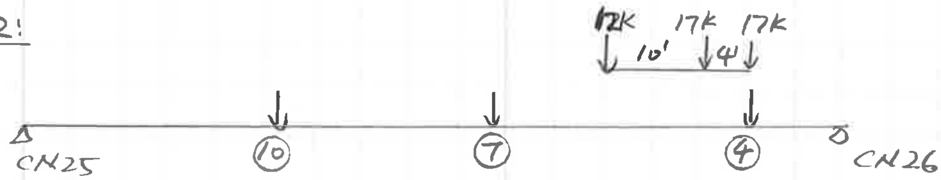
$P_4 = 17 \times 4/25.48 = 2.67 \text{ k}$ $\quad P_{10} = 12 \times 10/25.48 = 4.71 \text{ k}$

$N26 = 28.14 \text{ k}$

$M_{L+I} = 1940.88 \text{ k-ft}$

G1

3F1: MAX SHEAR:



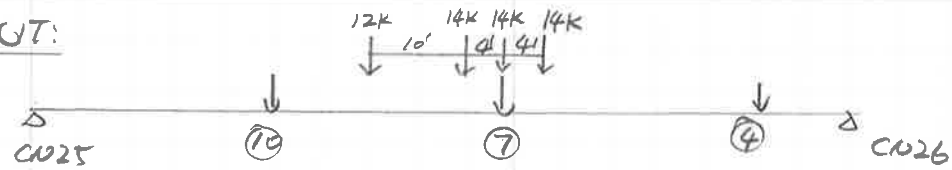
$P4 = 17 + 17 \times 21.48/25.48 + 12 \times 11.48/25.48 = 36.74\ K$

$P_7 = 12 + 17 \times 2 - P_4 = 9.26\ K$

$N26 = 40.26\ K$

$\underline{V_{L+I}} = N26 \times D.F. \times IM = \underline{98.84\ K}$

4F1: MAX MOMENT:



$P_4 = 14 \times 4/25.48 = 2.20\ K$

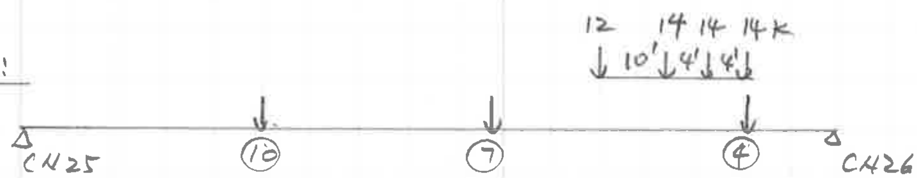
$P7 = 14 + 14 \times 21/25.48 \times 2 + 12 \times 11.48/25.48 = 42.48\ K$

$P_{10} = 12 + 14 \times 3 - P_4 - P_7 = 9.32\ K$

$N26 = 31.55\ K$

$\underline{M_{L+I} = 2225.72\ K\text{-}ft}$

MAX SHEAR:

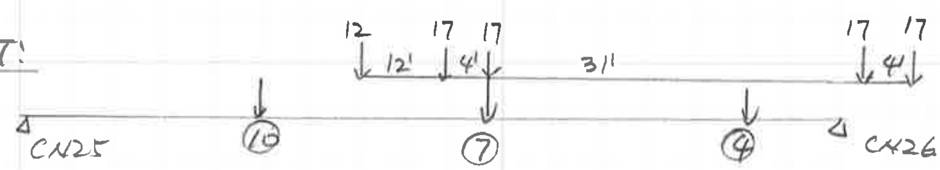


$P_4 = 14 + 14 \times 21.48/25.48 + 14 \times 17.48/25.48 + 12 \times 7.48/25.48 = 38.93\ K$

$P_7 = 12 + 14 \times 3 - P_4 = 15.07\ K$ $\qquad P_{10} = 0$

$N26 = 45.95\ K$ $\qquad \underline{V_{L+I} = 112.82\ K}$

5C1: MAX MOMENT:



$P4 = 17 \times (19.96/25.48 + 15.96/25.48) = 23.97\ K$

$P_7 = 17 + 17 \times 21.48/25.48 + 12 \times 9.48/25.48 = 35.80\ K$

$P_{10} = 12 + 17 \times 2 - P_7 = 10.2\ K$ $\qquad N26 = 48.07$

$\underline{M_{L+I} = 2101.30\ K\text{-}ft}$

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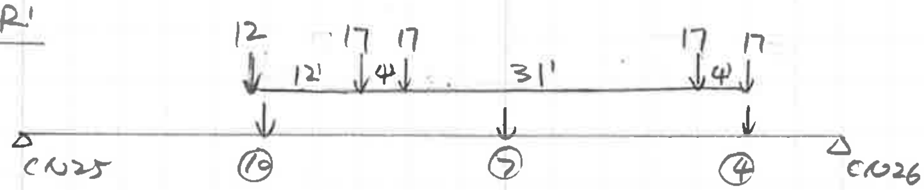
G1

5(c): MAX SHEAR:



$P_4 = 17 + 17 \times 21/25 = 31.28k$

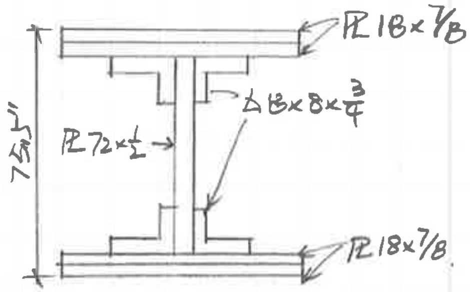
$P_7 = 17 \times (4 + 15 + 11)/25 = 20.44k$

$P_{10} = 17 \times (10 + 14)/25 + 12 \times 24/25 = 27.84k$

$N26 = 50.84k$

$V_{L+I} = 124.82\ K$

(3) GIRDER CAPACITY:



D: USE CLEAR DISTANCE FOR COMPACT CHECK:

$D = 72'' - 8'' \times 2 = 56''$

$\frac{D}{t_w} = \frac{56}{0.5} = 112 > \frac{19230}{\sqrt{F_y}} = 105.86$ NON-COMPACT

CHECK IF $L_b \leq \frac{20 \times 10^6 A_f}{F_y d}$

$\frac{20 \times 10^6 \times [18 \times 0.875 \times 2 + (8'' \times 2 + 0.5'') \times 0.75'']}{33000 \times 75.5''} = 352$

$L_b = 25' \times 12 = 300'' < 352$ ok.

$I_x = 18 \times 1.75 \times (75.5 \times \frac{1}{2} - 0.875)^2 \times 2 + 11.4 \times (75.5 \times \frac{1}{2} - 1.75'' - 2.26'')^2 \times 4$
$+ \frac{1}{12} \times 18 \times 1.75^3 \times 2 + 69.9 \times 4 + \frac{1}{12} \times 72^3 \times 0.5$

$= 85665.23 + 51910.47 + 16.08 + 279.6 + 15552$

$= 153423\ in^4$

$S_x = I/y = 4064.19\ in^3$ $M_u = F_y S_x = 33 \times 4064.19 \times \frac{1}{12} = 11176.52\ k\text{-}ft$

$k = 5 + 5/(5' \times 12/56)^2 = 9.36$ $\frac{D}{t_w} = 112 > \frac{6000\sqrt{k}}{\sqrt{F_y}} = 101.05$

$< \frac{7500\sqrt{k}}{\sqrt{F_y}} = 126.31$

$C = \frac{6000\sqrt{k}}{(\frac{D}{t_w})\sqrt{F_y}} = 0.90$

$V_u = C\,V_p = 0.9 \times 0.58 \times 33 \times 72 \times 0.5 = 620.14\ K$

(4) FATIGUE:

ASSUME AXLE D.F. = 1.0 FOR HS20 LOADING:

$M_{FAT} = (N26 \times 30.51 - P4 \times 25.48) \times D.F. \times IM$

$= 1408.70$ k-ft

TranSystems

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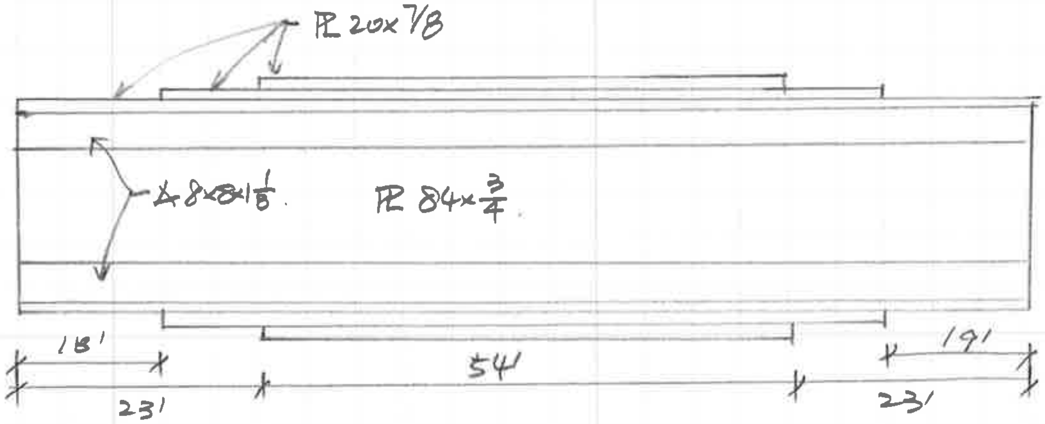
GIRDER - WEST APPROACH - SECTION N

GIRDER 2:

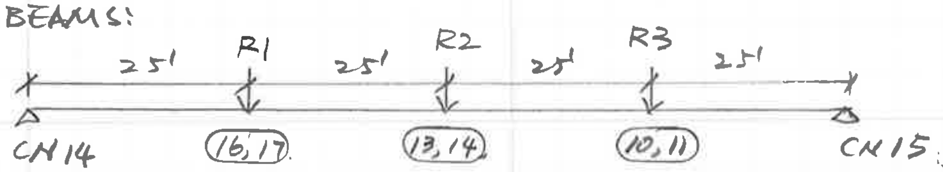
(1) DEAD LOADS:



S.W.: $\left[20\times\frac{7}{8}\times\frac{1}{144}\times(54'+63'+100')\times2\times0.49+0.057\times4\times100'+84\times\frac{3}{4}\times\frac{1}{144}\times100'\times0.49\right]\times1.120 = 84.10\text{ k}$

$84.10/100' = 0.84\text{ k/ft}$

DL FROM FLOOR BEAMS:



$R1 = (FB-16)+(FB-17) = 48.87+61.09 = 109.96\text{ k}$

$R2 = (FB-13)+(FB-14) = 99.47+84.56 = 184.03\text{ k}$

$R3 = (FB-10)+(FB-11) = 54.99+27.58 = 82.57\text{ k}$

$N14 = (R3\times25+R2\times50+R1\times75+0.84\times100^2\times\frac{1}{2})/100 = 237.13\text{ K}$

$N15 = R1+R2+R3+0.84\times100-N14 = 223.43\text{ K}$

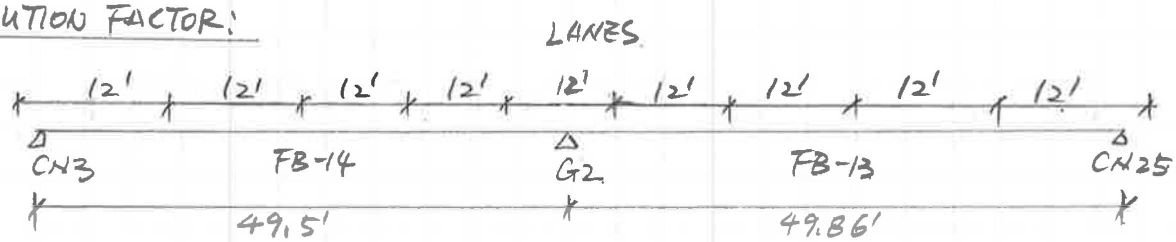
$\underline{M_{DL}} = N14\times50 - R1\times25 - 0.84\times50^2\times\frac{1}{2} = \underline{8057.50\text{ k-ft}}$

$\underline{V_{DL}} = N14 = \underline{237.13\text{ k}}$

G2.

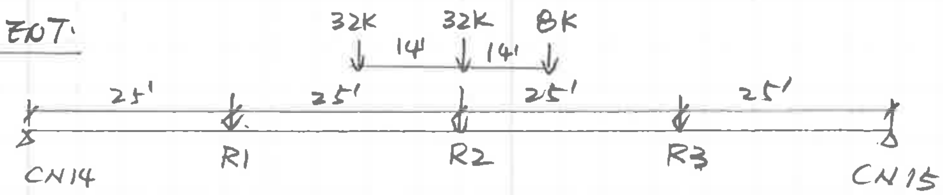
(2) LIVE LOADS:

DISTRIBUTION FACTOR:



$G2 = [1 + (37.5+25.5+13.5+1.5)/49.5 + (37.86+25.86+13.86+1.86)/49.86]$
$\times 0.75$ (9 LANES)
$= 3.13$ (AXLE D.F.)

HS20: MAX MOMENT:



$R2 = 32 + 32\times 11/25 + 8\times 11/25 = 49.6$ k

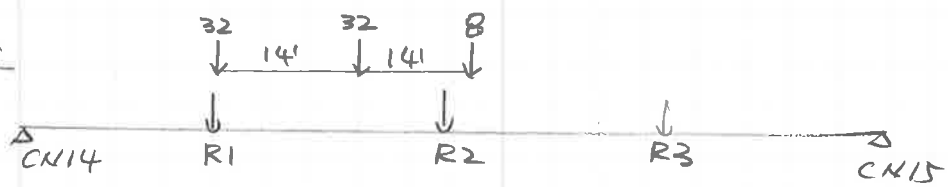
$R1 = 32\times 14/25 = 17.92$ k $R3 = 8\times 14/25 = 4.48$ k

LL IMPACT $= 1 + 50/(100+125) = 1.22$

$N14 = (R1\times 75 + R2\times 50 + R3\times 25)/100 = 39.36$ k

$M_{L+I} = (N14\times 50 - R1\times 25)\times D.F.\times IM = 5804.27$ k-ft

MAX SHEAR:



$R1 = 32 + 32\times 11/25 = 46.08$ k

$R2 = 32\times 14/25 + 8\times 22/25 = 24.96$ k $R3 = 8\times 3/25 = 0.96$

$N14 = 47.28$

$V_{L+I} = N14\times D.F.\times IM = 180.54$ k

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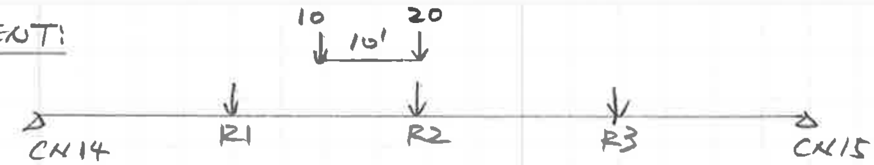
G2.

2F1: MAX MOMENT:

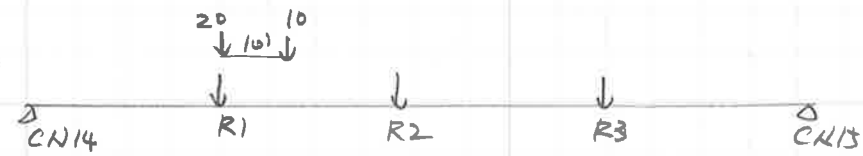


R1 = 10×10/25 = 4.0 R2 = 20 + 10×15/25 = 26.0 R3 = 0.

N14 = 16 K

M_{L+I} = 2673.02 k-ft

MAX SHEAR:

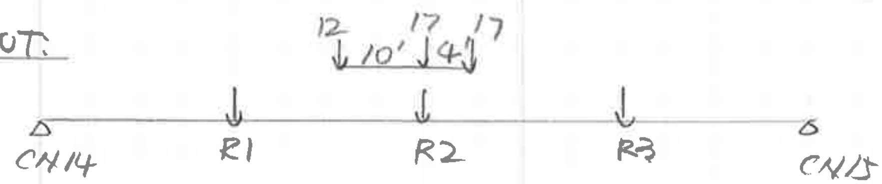


R1 = 20 + 10×15/25 = 26 K R2 = 10×10/25 = 4 K

N14 = 21.5 K

V_{L+I} = 82.10 K

3F1: MAX MOMENT:

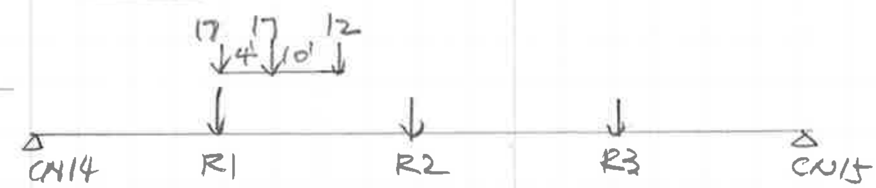


R1 = 12×10/25 = 4.8 K R2 = 17 + 17×21/25 + 12×15/25 = 38.48 K

R3 = 17×4/25 = 2.72 N14 = 23.52 K

M_{L+I} = 4032.44 k-ft

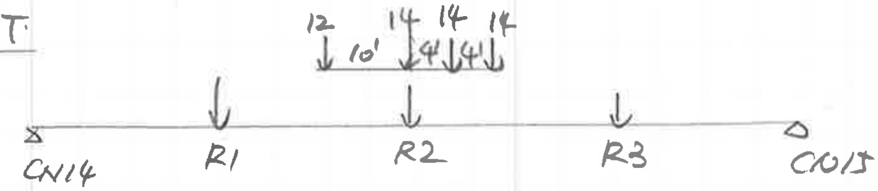
MAX SHEAR:



R1 = 17 + 17×21/25 + 12×11/25 = 36.56 K R2 = 17×2 + 12 − R1 = 9.44 K

R3 = 0 N14 = 32.14 K V_{L+I} = 122.73 K

4F1: MAX MOMENT:

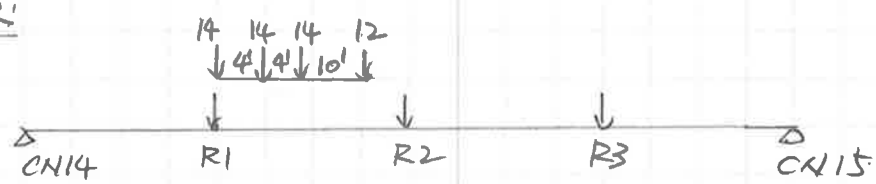


R1 = 12×10/25 = 4.8 K R2 = 14 + 12×15/25 + 14×21/25 + 14×17/25 = 42.48 K

R3 = 12 + 14×3 − R1 − R2 = 6.72 N14 = 26.52 K

M_{L+I} = 4605.23 k-ft

4FI: MAX SHEAR:



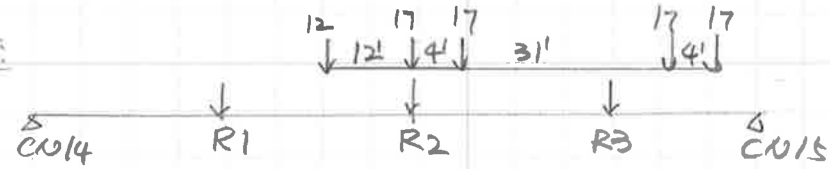
R1 = 14 + 14×21/25 + 14×17/25 + 12×7/25 = 38.64 K

R2 = 14×3 + 12 − R1 = 15.36 K   R3 = 0

N14 = 36.66 K

V_{L+I} = 140.00 K

5C1: MAX MOMENT:

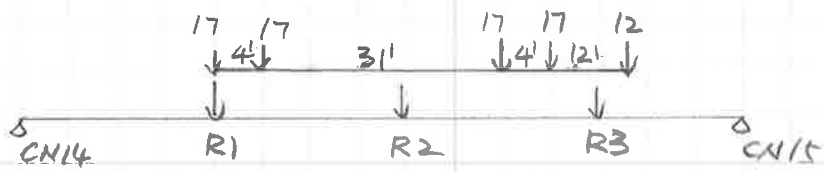


R1 = 12×12/25 = 5.76 K, R2 = 17 + 12×13/25 + 17×21/25 = 37.52 K

R3 = 17×15/25 + 17×11/25 = 17.68 K   N14 = 27.50 K

M_{L+I} = 4700.70 K-ft

MAX SHEAR:



R1 = 17 + 17×21/25 = 31.28 K

R2 = 17×4/25 + 17×15/25 + 17×11/25 = 20.4 K

R3 = 12×24/25 + 17×10/25 + 17×14/25 = 27.84 K

N14 = 40.62 K

V_{L+I} = 155.11 K.

FATIGUE: USE AXLE D.F. = 1.0 FOR HS 20

M_{FAT} = (N14×50 − R1×25) × D.F. × IM = 1854.40 K-ft

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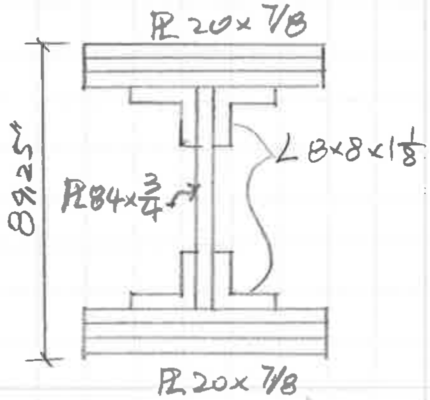
(3) GIRDER CAPACITY:



D: USE CLEAR DISTANCE FOR COMPACT CHECK:

$D = 84'' - 8'' \times 2 = 68''$

$\frac{D}{t_w} = \frac{68}{0.75} = 90.67 < \frac{19230}{\sqrt{F_y}} = 105.86$ OK

$L_b = 25' \times 12 = 300''$

$I_y = \frac{1}{12} \times \frac{7}{8} \times 20^3 \times 6 + \frac{1}{12} \times 1\frac{1}{8} \times (8'' \times 2 + \frac{3}{4})^3 \times 2$

$+ \frac{1}{12} \times (8 - 1\frac{1}{8}) \times (1\frac{1}{8} \times 2 + \frac{3}{4})^3 \times 2 + \frac{1}{12} \times (84 - 16'') \times (\frac{3}{4})^3$

$= 3500 + 881.14 + 30.94 + 2.39$

$= 4414.47 \text{ in}^4$

$A = 20 \times \frac{7}{8} \times 6 + 16.7 \times 4 + 84 \times \frac{3}{4} = 234.8 \text{ in}^2$

$r_y = \sqrt{\frac{I_y}{A}} = 4.34''$

$\frac{L_b}{r_y} = 69.12 > \frac{3.6 - 2.2 (M_1/M_u) \times 10^6}{F_y} = 42.42$ NON-COMPACT

$L_b = 300'' < \frac{20 \times 10^6 A_f}{F_y d} = \frac{20 \times 10^6 \times 20 \times \frac{7}{8} \times 3}{33 \times 10^3 \times 89.25''} = 356.51''$ OK

$M_u = F_y \cdot S_x$.

$I_x = \frac{1}{12} \times 20 \times (\frac{7}{8})^3 \times 6 + \frac{1}{12} \times \frac{3}{4} \times 84^3 + 98.1 \times 4 + 20 \times \frac{7}{8} \times 3 \times (\frac{89.25}{2} - \frac{7}{8} \times 1.5)^2 \times 2$

$+ 16.7 \times (\frac{84}{2} - 2.4)^2 \times 4 = 6.70 + 37044 + 392.4 + 196977.13$

$+ 104753.09 = 339173.32 \text{ in}^4$

$M_u = F_y \cdot I_x / y = 33 \times 339173.32 / (89.25/2) \times \frac{1}{12} = 20901.44$ K-ft

$K = 5 + \frac{5}{(5 \times 12/68)^2} = 11.42$ $\frac{D}{t_w} = 90.67 < \frac{6000\sqrt{K}}{\sqrt{F_y}} = 111.62 \Rightarrow C = 1.0$

$V_u = C \cdot V_p = 1.0 \times 0.58 \times 33 \times 84 \times \frac{3}{4} = 1205.82$ K

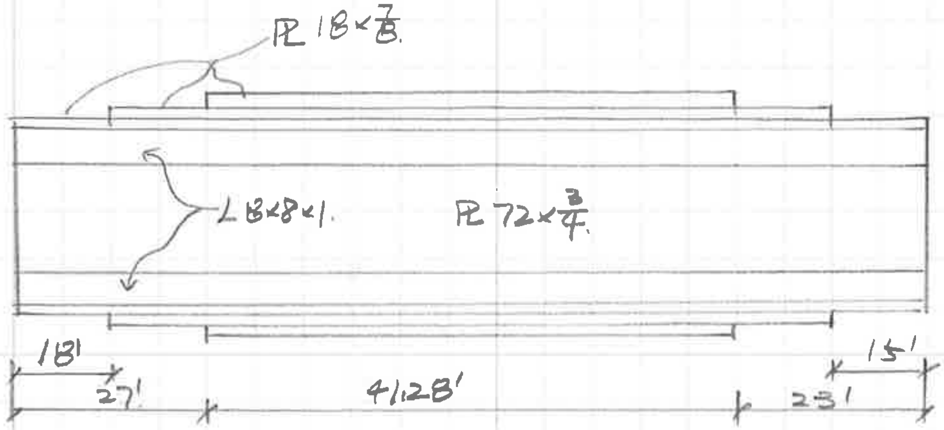
$S_x = 7600.5 \text{ in}^3$

Calculations for 1/4 US Grid

GIRDER - WEST APPROACH - SECTION N.

GIRDER 3:

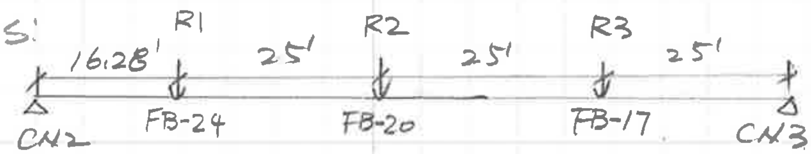
① DEAD LOADS:



$S.W.: \left(18\times\frac{7}{8}\times(41.28'+58.28'+91.28')\times2\times\frac{1}{144}\times0.49+0.051\times4\times91.28' + 72\times\frac{3}{4}\times91.28'\times\frac{1}{144}\times0.49\right)\times1.20 = 67.02\,k$

$67.02/91.28' = 0.734\ k/ft$

DL FROM FLOOR BEAMS:



$R1 = (FB-24) = 92.46\,k$

$R2 = (FB-20) = 125.61\,k$

$R3 = (FB-17) = 102.94\,k$

$N2 = \left(R3\times25 + R2\times50 + R1\times75 + 0.734\times91.28^2\times\frac{1}{2}\right)\times\frac{1}{91.28} = 206.47\,k$

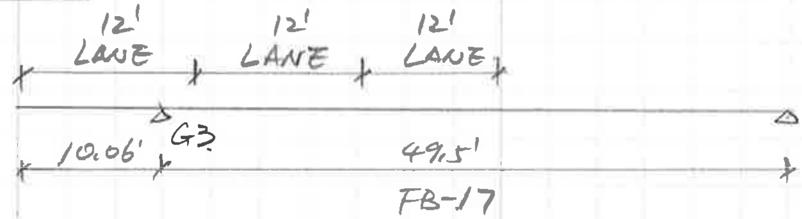
$N3 = R1 + R2 + R3 + 0.734\times91.28 - N2 = 181.54\,k$

$\underline{M_{DL}} = N3\times50 - R3\times25 - 0.734\times50^2\times\frac{1}{2} = \underline{5586\ k\text{-}ft}$

$\underline{V_{DL} = N2 = 206.47\,k.}$

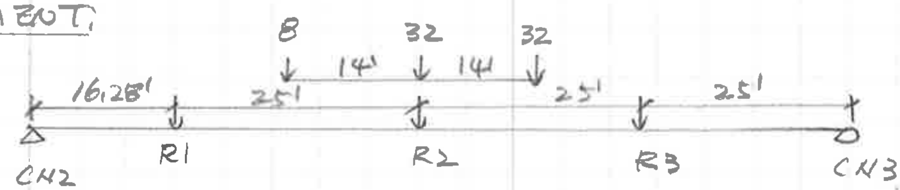
(2) LIVE LOADS:

DISTRIBUTION FACTOR:



$G3 = (53.56 + 41.56 + 29.56) \times \frac{1}{49.5} \times 0.9 = \underline{2.27}$ (AXLE D.F.)

HS20: MAX MOMENT:



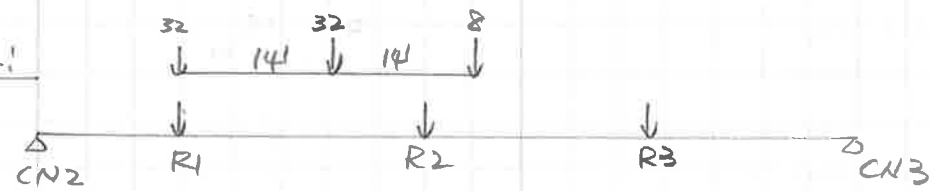
$R1 = 8 \times 14/25 = 4.48\,k$ $R2 = 32 + 32 \times 11/25 + 8 \times 11/25 = 49.6\,k$

$R3 = 32 \times 14/25 = 17.92\,K$ $\underline{IM} = 1 + \frac{50}{L+125} = \underline{1.23}$

$N2 = (R1 \times 75 + R2 \times 50 + R1 \times 25)/91.28 = 35.70\,K$

$\underline{M_{L+I}} = (N2 \times 41.28 - R1 \times 25) \times D.F. \times IM = \underline{3801.99\ k\text{-}ft}$

MAX SHEAR:

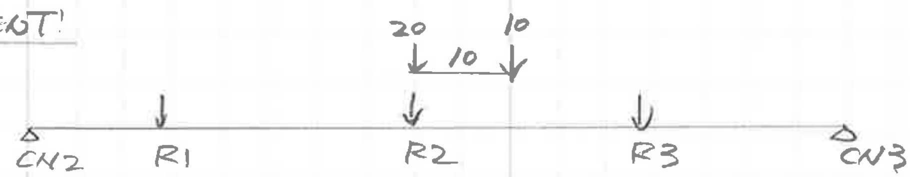


$R1 = 32 + 32 \times 11/25 = 46.08\,K$. $R2 = 32 \times 14/25 + 8 \times 22/25 = 24.96\,K$

$R3 = 8 \times 3/25 = 0.96\,K$

$N2 = 51.80\,K$ $\underline{V_{L+I}} = N2 \times D.F. \times IM = \underline{144.63\,K}$

2F1: MAX MOMENT:



$R1 = 0$ $R2 = 20 + 10 \times 15/25 = 26\,K$, $R3 = 10 \times 10/25 = 4\,K$

$N2 = 15.34\,K$

$\underline{M_{L+I} = 1768.06\ k\text{-}ft}$

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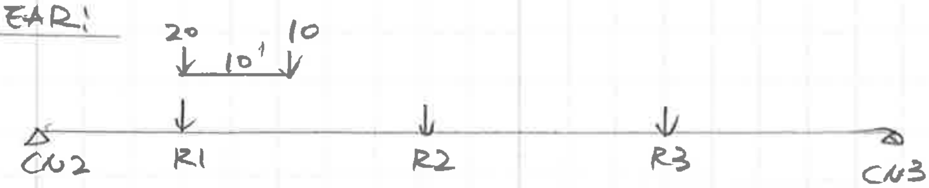
Made By: GHD	Date: 2-21-12	Job No:
Checked By: DMP	Date: 2/23/12	Sheet No. 3

G3

2FI: MAX SHEAR:

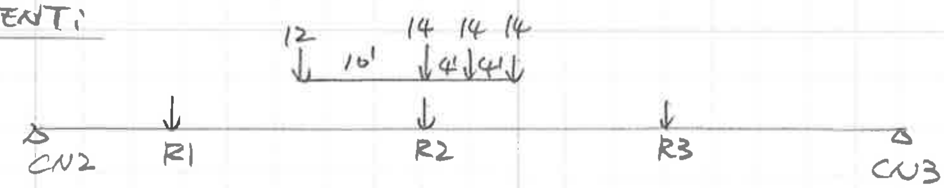


$R1 = 20 + 10 \times 15/25 = 26K$ $R2 = 10 \times 10/25 = 4K$ $R3 = 0$

$N2 = 23.55K$

$\underline{V_{L+I} = 65.75K}$

4FI: MAX MOMENT:



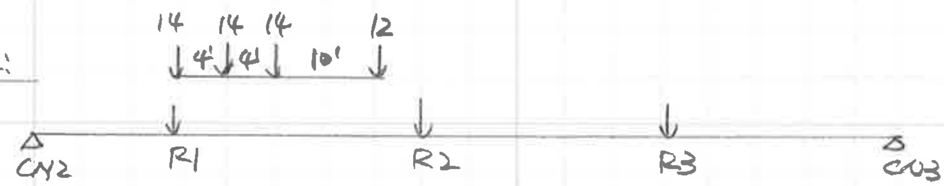
$R1 = 12 \times 10/25 = 4.8K$. $R2 = 14 + 12 \times 15/25 + 14 \times 21/25 + 14 \times 17/25 = 42.48K$

$R3 = 14 \times 4/25 + 14 \times 8/25 = 6.72K$

$N2 = 29.05K$

$\underline{M_{L+I} = 3013.19 \text{ K-ft}}$

MAX SHEAR:

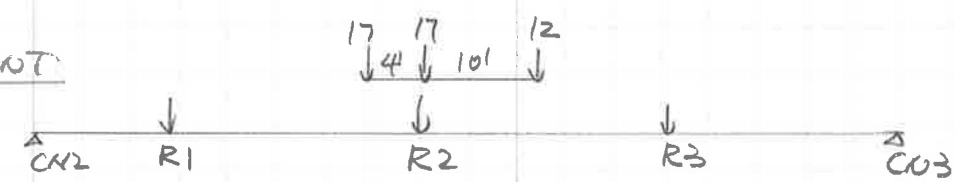


$R1 = 14 + 14 \times (21 + 17)/25 + 12 \times 7/25 = 38.64$. $R2 = 14 \times 3 + 12 - R1 = 15.36$. $R3 = 0$

$N2 = 40.16K$

$\underline{V_{L+I} = 112.13K}$

3FI: MAX MOMENT:



$R1 = 17 \times 4/25 = 2.72K$. $R2 = 17 + 17 \times 21/25 + 12 \times 15/25 = 38.48K$

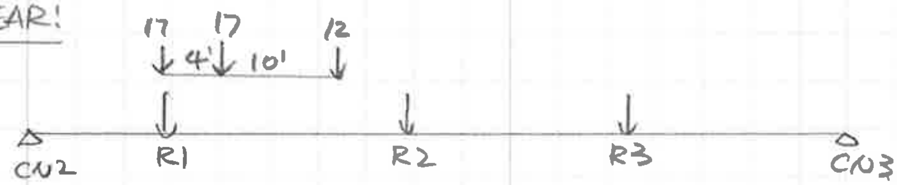
$R3 = 12 \times 10/25 = 4.8K$

$N2 = 24.63K$

$\underline{M_{L+I} = 2648.94 \text{ K-ft}}$

G3

3FI: MAX SHEAR:

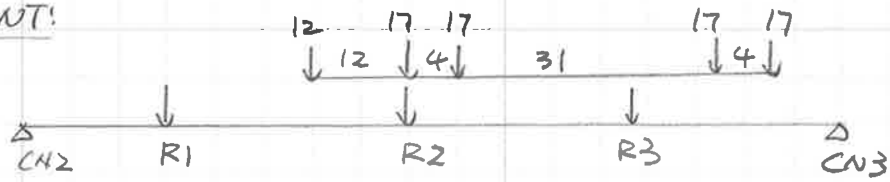


$R1 = 17 + 17 \times 21/25 + 12 \times 11/25 = 36.56K$, $R2 = 17 \times 2 + 12 - R1 = 9.44K$ $R3 = 0$

$N2 = 35.21$ K

$\underline{V_{L+I} = 98.31 \text{ K.}}$

5CI: MAX MOMENT:



$R1 = 12 \times 12/25 = 5.76$ K

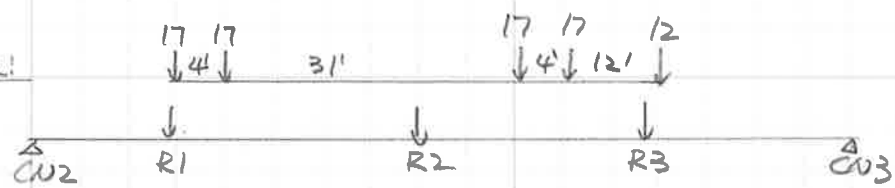
$R2 = 17 + 12 \times 13/25 + 17 \times 21/25 = 37.52$ K

$R3 = 17 \times (21 + 15 + 11)/25 = 31.96$ K

$N2 = 34.04$ K

$\underline{M_{L+I} = 3521.32 \text{ K.}}$

MAX SHEAR:



$R1 = 17 + 17 \times 21/25 = 31.28$ K

$R2 = 17 \times (4 + 15 + 11)/25 = 20.4$ K

$R3 = 17 \times (10 + 14)/25 + 12 \times 24/25 = 27.84$ K

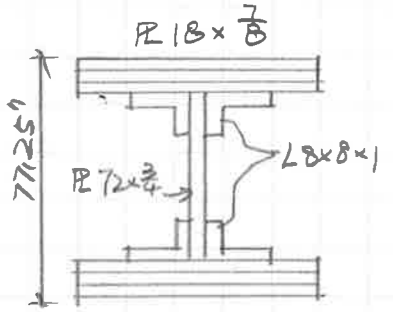
$N2 = 44.50$ K $\underline{V_{L+I} = 124.25 \text{ K}}$

FATIGUE: USE AXLE D.F. = 1.0 FOR HS20

$\underline{M_{FAT} = 1674.89 \text{ k-ft}}$

G3

(3) GIRDER CAPACITY:



D: USE CLEAR DISTANCE FOR COMPAT CHECK!

$D = 72'' - 8'' \times 2 = 56''$

$\frac{D}{t_w} = \frac{56}{0.75} = 74.67 < \frac{19230}{\sqrt{F_y}} = 105.86$ OK

$L_b = 25' \times 12 = 300''$

$I_y = \frac{1}{12} \times \frac{7}{8} \times 18^3 \times 6 + \frac{1}{12} \times 1 \times (8 \times 2 + \frac{3}{4})^3 \times 2 + \frac{1}{12} \times (8-1) \times (1 \times 2 + \frac{3}{4})^3$
$+ \frac{1}{12} \times (72 - 8 \times 2) \times (\frac{3}{4})^3$

$= 2551.5 + 783.24 + 12.13 + 1.97 = 3348.84 \ in^4$

$A = 18 \times \frac{7}{8} \times 6 + 72 \times \frac{3}{4} + 15 \times 4 = 208.5$ $r_y = \sqrt{I_y / A} = 4.01''$

$\frac{L_b}{r_y} = 74.81 > \frac{3.6 - 2.2 (M_1/M_u)}{F_y} \times 10^6 = 42.42$ NON-COMPACT

CHECK: $L_b = 300'' < \frac{20 \times 10^6 A_f}{F_y \, d} = \frac{20 \times 10^6 \times 18 \times 0.875 \times 3}{33000 \times 77.25} = 370.70$ OK

$M_u = F_y S_x$

$I_x = \frac{1}{12} \times 18 \times 0.875^3 \times 6 + \frac{1}{12} \times \frac{3}{4} \times 72^3 + 4 \times 89.1 + 18 \times \frac{7}{8} \times 3 \times (\frac{77.25}{2} - \frac{7}{8} \times 1.5)^2 \times 2$

$+ 15 \times (\frac{72}{2} - 2.36)^2 \times 4 = 6.03 + 23328 + 131565.04 + 67898.98 + 356.4$
$= 223154.45 \ in^4$

$M_u = F_y I_x / y = 33 \times 223154.45 / (77.25/2) \times \frac{1}{12} = 15888.02 \ k\text{-}ft$

$K = 5 + \frac{5}{(5' \times 12 / 56)^2} = 9.36$

$\frac{D}{t_w} = 74.67 < \frac{6000 \sqrt{K}}{\sqrt{F_y}} = 101.05 \Rightarrow C = 1.0$

$V_u = C \cdot V_p = 1.0 \times 0.58 \times 33 \times 72 \times 0.75 = 1033.56 \ k$

$S_x = 5678.23 \ in^3$

WEST APPROACH - SECTION N

FATIGUE CATEGORY:

(1) STRINGERS:

DIAPHRAGM GUSSET PLATES WELDED TO THE TOP/BOTTOM FLANGE.

USE CATEGORY C.

(2) FLOOR BEAMS:

(a) ALL EXISTING FLOOR BEAMS WITH BOTTOM PLATE STITCH WELDED TO THE BOTTOM FLANGE; USE CATEGORY D. (USE S_B FOR SECTION MODULUS).

INCLUDING FB-10, FB-13, FB-14, FB-17, FB-20.

(b) ALL OTHER FLOOR BEAMS. CATEGORY A

(c) BRACKETS; BOLTED CONNECTION. CAT. B.

(3) GIRDERS:

RIVETED CONNECTION. CAT. D.

MEMBER REDUNDANCY:

STRINGERS: REDUNDANT.

FLOOR BEAMS: NON-REDUNDANT.

GIRDERS: NON-REDUNDANT.

STRESS CYCLES: ADTT = < 2500

STRINGERS, GIRDERS: 500,000

FLOOR BEAMS: 2,000,000

WEST APPROACH – SECTION N

COLUMNS

TranSystems

Made By: GHD　Date: 2/23/2012　Job No.:

Checked By: DMP　Date: 2/25/2012　Sheet No.:

Columns Rating Summary - As Built

COLUMNS	MEMBER CAPACITY	SERVICE LOADS						RATING FACTORS					
		DEAD LOAD	HS20	2F1	3F1	4F1	5C1	HS20		OHIO LEGAL LOADS			
	Pu (k)	P (k)	P (k)	P (k)	P (k)	P (k)	P (k)	Inv.	Opr.	2F1	3F1	4F1	5C1
New Exterior Steel Columns	711.56	37.07	103.12	61.51	74.82	76.86	72.98	2.96	4.95	8.30	6.82	6.64	6.99
New Interior Steel Columns	711.56	89.55	165.73	84.05	118.81	132.41	115.57	1.65	2.76	5.45	3.85	3.46	3.96
Existing Steel Columns	511.51	100.28	167.34	84.86	119.96	133.69	116.69	1.05	1.75	3.45	2.44	2.19	2.51
Existing Concrete Columns								2.18	3.63	4.37	3.68	3.39	2.72

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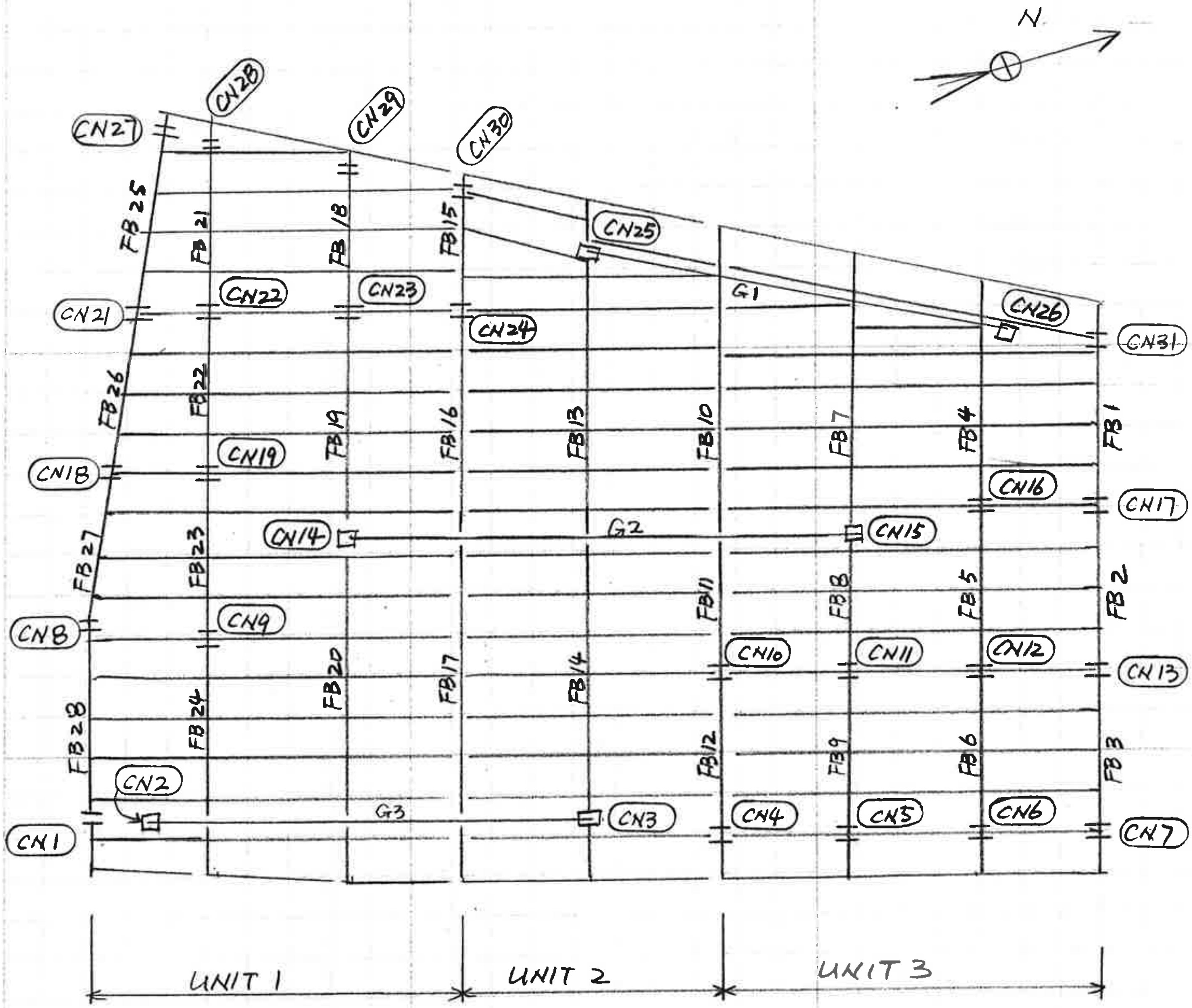
FRAMING - WEST APPROACH - SECTION N



COLUMNS – WEST APPROACH – SECTION N:

NEW COLUMNS – W14×90:

CN7, CN13, CN17, CN31, CN6, CN12, CN16.

CN5, CN11, CN4, CN10, CN1, CN8, CN18, CN21, CN27.

EXISTING STEEL COLUMNS: 12WF65

CN9, CN19, CN22, CN23, CN24,

CN28, CN29, CN30

EXSTING CONCRETE COLUMNS:

CN2, CN3, CN14, CN15, CN25, CN26

COLUMNS – WEST APPROACH – SECTION N: NEW EXTERIOR COLUMNS:

CN7, CN13, CN17, CN31, CN1, CN8, CN18, CN21, CN27 (168A/992)

MAX LOADING ON CN17 W14×90.

(1) DEAD LOADS:

FROM FB-1, FB-2, AND END REACTION OF 3-SPAN STRINGER.

FB-1: R1 = 15.4 K

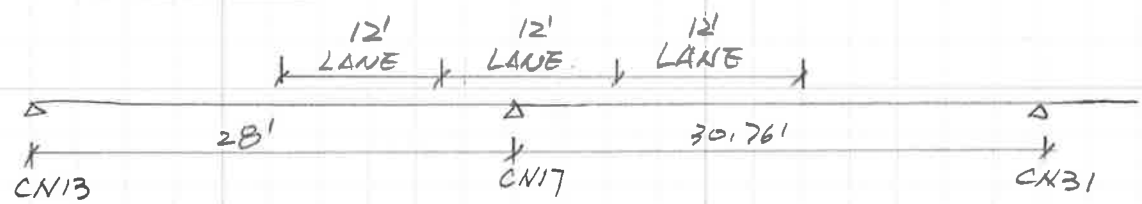
FB-2: R2 = 13.79 K

3-SPAN STRINGER: R3 = 7.88 K

$P_{DL} = R1 + R2 + R3 = 37.07$ K

(2) LIVE LOADS:

DISTRIBUTION FACTOR:



AXLE D.F. $= (1 + \frac{16}{28} + \frac{18.76}{30.76}) \times 0.9$ (3 LANES REDUCTION)

$= 1.96$

WHEEL D.F. $= 1.96 \times 2 = 3.92$

IMPACT

MAX LL+I AT CN17: $P_{L+I} = 3.92P \times 1.3 = 5.10P$

P: 3-SPAN STRINGER LL REACTION AT FB-1 WITH D.F. = 1.0

	P (K)	P_{L+I} (K)
HS20	20.22	103.12
2F1	12.06	61.51
3F1	14.67	74.82
4F1	15.07	76.86
5C1	14.31	72.98

CN17.

(3) COLUMN CAPACITY: W14x90. A36 STEEL

$A_s = 26.5 \ in^2$ $r = 3.7''$

$L_c = (678.25' - \frac{33.3}{12} - 649.8') \times 12 = 308.1''$

$\frac{KL_c}{r} = \frac{0.75 \times 308.1}{3.7} = 62.45 < \sqrt{\frac{2\pi^2 E}{F_y}} = 126.10$

$F_{cr} = F_y \left[1 - \frac{F_y}{4\pi^2 E}\left(\frac{KL_c}{r}\right)^2\right]$

$= 31.59$ ksi.

$\underline{P_u} = 0.85 A_s F_{cr} = \underline{711.56 \ k}$

Made By: GHD	Date: 2-22-12	Job No:
Checked By: DMP	Date: 2/24/12	Sheet No. 1

COLUMNS – WEST APPROACH – SECTION N.

CN6, CN12, CN16, CN5, CN11, CN4, CN10. – NEW INTERIOR COLUMNS

MAX LOADING ON CN16: W14×90

(1) DEAD LOADS:

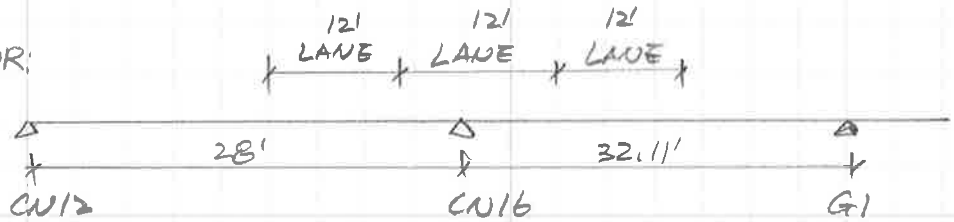
FROM CALCS OF FB-4, FB-5, PIER REACTION OF 3-SPAN STRINGER.

FB-4 = R1 = 36.19 K FB-5 = R2 = 32.97 K. R3 = 20.39 K.

$P_{DL} = R1 + R2 + R3 = 89.55\,K$

(2) LIVE LOADS:

DISTRIBUTION FACTOR:



AXLE $D.F. = (1 + \frac{16}{28} + \frac{20.11}{32.11}) \times 0.9$ (3 LANE REDUCTION)
$= 1.98$

WHEE $D.F. = 1.98 \times 2 = 3.96$

MAX L+I AT CN16 : $P_{L+I} = 3.96P \times 1.3 = 5.15P$

P: 3-SPAN STRINGER LL REACTION AT FB-4 WITH D.F. = 1.0

	P (K)	P_{L+I} (K)
HS20	32.18	165.73
2F1	16.32	84.05
3F1	23.07	118.81
4F1	25.71	132.41
5C1	22.44	115.57

(3) COLUMN CAPACITY: $L_c = (678.93 - \frac{35.91}{12} - 651.8) \times 12 = 289.66''$

Pu: SAME AS CN17 Pu = 711.56 K

COLUMNS - WEST APPROACH - SECTION N.

EXISTING STEEL COLUMNS: CN9, CN19, CN22, CN23, CN24, CN28, CN29, CN30
12WF65.

MAX LOADING ON CN23:

(1) DEAD LOADS:

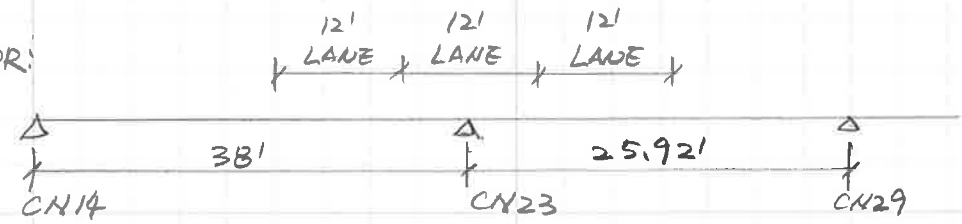
FROM CALCS OF FB-18, FB-19, AND PIER REACTION OF 3-SPAN STRINGER

FB-18 = R1 = 28.25K   FB-19 = R2 = 51.64K.   R3 = 20.39 K

P_{DL} = R1 + R2 + R3 = 100.28 K

(2) LIVE LOADS:

DISTRIBUTION FACTOR:



AXLE D.F. $= (1 + \frac{26}{38} + \frac{13.92}{25.92}) \times 0.9 = 2.00$

WHEEL D.F. = 2×2.0 = 4.00

MAX L+I AT CN 23 : $P_{L+I} = 4.0P \times 1.3 = 5.2P$

P: 3-SPAN STRINGER LL REACTION AT FB-18. WITH D.F. = 1.0

	P(K)	P_{L+I} (K)
HS20	32.18	167.34
2F1	16.32	84.86
3F1	23.07	119.96
4F1	25.71	133.69
5C1	22.44	116.69

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CN23

Made By: GHD | Date: 2-22-12 | Job No:

Checked By: DMP | Date: 2/24/12 | Sheet No. 2

(3) COLUMN CAPACITY: 12WF65.

$A_s = 19.11 \text{ in}^2$ $r = 3.02''$

$L_c = 16.3' - \frac{35.84''}{12} = 13.31'$

$\frac{KL_c}{r} = \frac{0.75 \times 13.31 \times 12}{3.01} = 39.80 < \sqrt{\frac{2\pi^2 E}{F_y}} = 131.71$ ($F_y = 33$ KSI)

$F_{cr} = F_y \left[1 - \frac{F_y}{4\pi^2 E}\left(\frac{KL_c}{r}\right)^2\right]$

$= 31.49$ KSI

$P_u = 0.85 A_s F_{cr} = 511.51$ K

Calculations for 1/4 US Grid

COLUMNS - WEST APPROACH - SECTION N

EXISTING CONCRETE COLUMNS - CN2, CN3, CN14, CN15, CN25, CN26.

MAX LOADING ON CN 14:

(1) DEAD LOADS:

FROM G2: 237.13 K FROM FB-19: 62.36K

FROM FB-20: 76.39 K

TOTAL $P_{DL} = 375.88$ K

(2) LIVE LOADS:

FROM G2 ANALYSIS, D.F. = 3.13 (AXLE) = 6.26 (WHEEL).

MAX LL AT CN14: $P_{LL} = 6.26\,P \times 1.3\,(2M) = 8.14\,P$

P: 3-SPAN STRINGER PIER REACTION WITH D.F. = 1.0

	P (K)	P_{LL} (K)
HS20	32.18	261.95
2F1	16.32	132.84
3F1	23.07	187.79
4F1	25.71	209.28
5C1	22.44	182.66

(3) LONGITUDINAL FORCE AASHTO 3.9

ASSUME THE LONGITUDINAL FORCES ON THE BRIDGE WILL BE RESISTED BY THE SIX CONCRETE COLUMNS.

L.F. PER LANE = $(0.64 \times 200' + 18) \times 0.05 = 7.3$ K/LANE

LF = $7.3 \times$ D.F. / 2 COLUMNS = 11.42 K

(4) CENTRIFUGAL FORCE AASHTO 3.10 $C = 6.68S^2/R$.

$C = 6.68 \times 50^2/1200 = 13.9$ CF = $13.9\% \times 72K \times$ D.F. / 2 = 15.68 K (HS20)

(4) COLUMN DATA:

RECTANGULAR SECTION: 4'x4'

REBAR: 12-#8 TIES: #4

COLUMN HEIGHT: L = 94.98 - 76 = 18.98'

EFFECTIVE LENGTH FACTOR: K = 2.0

(5) USE PCA-COL. FOR RATING:

LOAD COMBINATION III 1.3DL + 1.3LL + 1.3LF + 1.3CF

MOMENT AT BOTTOM OF COLUMN: LF x 2 = 216.75 k-ft
CF x L = 297.61 k-ft (HS20)

	CF	CF x L
2F1	6.53k	123.94 k-ft
3F1	10.01k	189.99 k-ft
4F1	11.75k	223.02 k-ft
5C1	17.41k	330.44 k-ft

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section N\PCA-COL\CN-14.col
Project: MAIN AVE_SECTION N
Column: CN14 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Architectural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 48 in — Depth = 48 in

Gross section area, Ag = 2304 in^2
Ix = 442368 in^4 — Iy = 442368 in^4
Xo = 0 in — Yo = 0 in

Reinforcement:

Rebar Database: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area, As = 9.48 in^2 at 0.41%
12 #8 Cover = 3 in

Slenderness:

Sway Criteria:

X-axis: Unbraced column. Sum of Pc = 1.00*Pc Sum of Pu = 1.00*Pu
Y-axis: Unbraced column. Sum of Pc = 1.00*Pc Sum of Pu = 1.00*Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	18.98	48	48	442368	3	3122.02
	Y	18.98	48	48	442368	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Braced)	k(Sway)	klu/r
X	0.000	0.000	1.000	2.000	32.87
Y	0.000	0.000	1.000	2.000	32.87

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 3.58e+008 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 3.58e+008 kip-in^2

X-axis	Braced				Sway	
Ld/Comb	Pc(kip)	Betad	Cm	Delta	Pc(kip)	Delta
1 U1	42799	0.589	0.600	1.000	17005	1.070
2 U1	39118	0.739	0.600	1.000	17005	1.055
3 U1	40808	0.667	0.600	1.000	17005	1.061
4 U1	41417	0.642	0.600	1.000	17005	1.063
5 U1	40659	0.673	0.600	1.000	17005	1.060

Y-axis	Braced				Sway	
Ld/Comb	Pc(kip)	Betad	Cm	Delta	Pc(kip)	Delta
1 U1	42799	0.589	0.600	1.000	17005	1.070
2 U1	39118	0.739	0.600	1.000	17005	1.055
3 U1	40808	0.667	0.600	1.000	17005	1.061
4 U1	41417	0.642	0.600	1.000	17005	1.063
5 U1	40659	0.673	0.600	1.000	17005	1.060

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	375.9	0.0	0.0	0.0	0.0
	Live	262.0	0.0	216.8	0.0	297.6
	Wind	0.0	0.0	0.0	0.0	0.0
	E.Q.	0.0	0.0	0.0	0.0	0.0
2	Dead	375.9	0.0	0.0	0.0	0.0
	Live	132.8	0.0	216.8	0.0	123.9
	Wind	0.0	0.0	0.0	0.0	0.0
	E.Q.	0.0	0.0	0.0	0.0	0.0

3	Dead	375.9	0.0	0.0	0.0	0.0
	Live	187.8	0.0	216.8	0.0	190.0
	Wind	0.0	0.0	0.0	0.0	0.0
	E.Q.	0.0	0.0	0.0	0.0	0.0
4	Dead	375.9	0.0	0.0	0.0	0.0
	Live	209.3	0.0	216.8	0.0	223.0
	Wind	0.0	0.0	0.0	0.0	0.0
	E.Q.	0.0	0.0	0.0	0.0	0.0
5	Dead	375.9	0.0	0.0	0.0	0.0
	Live	182.7	0.0	216.8	0.0	330.4
	Wind	0.0	0.0	0.0	0.0	0.0
	E.Q.	0.0	0.0	0.0	0.0	0.0

Factored Loads and Moments with Corresponding Capacities: (see user's manual for notation)
==

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu
1	1 U1	829.2	0.0	0.0	1129.2	0.0	999.999
2		829.2	-281.8	-386.9	-612.8	-841.5	2.175
3	2 U1	661.3	0.0	0.0	1244.4	0.0	999.999
4		661.3	-281.8	-161.1	-948.3	-542.2	3.365
5	3 U1	732.8	0.0	0.0	1201.0	0.0	999.999
6		732.8	-281.8	-247.0	-797.4	-699.0	2.830
7	4 U1	760.7	0.0	0.0	1182.2	0.0	999.999
8		760.7	-281.8	-289.9	-734.0	-755.3	2.605
9	5 U1	726.1	0.0	0.0	1205.3	0.0	999.999
10		726.1	-281.8	-429.6	-589.0	-898.0	2.090

*** Program completed as requested! ***

WEST APPROACH – SECTION N

REMAINING LIFE ANALYSIS

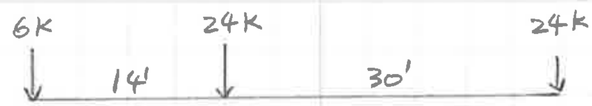
WEST APPROACH - SECTION N.

FATIGUE REMAINING LIFE ANALYSIS:

REFERENCE: GUIDE SPECIFICATIONS FOR FATIGUE EVALUATION OF EXISTING STEEL BRIDGES. 1990, AASHTO

BDM 2004. SECTION 402.2.6.

FATIGUE TRUCK: HS15



IMPACT: USE 15% PER BDM 402.2.6.

CONTROLLING MEMBERS FROM HS20 FATIGUE RATING:

STRINGERS: 2-SPAN STRINGER. R.F. = 1.87.

FLOOR BEAMS: FB-13. R.F. = 1.06

GIRDERS: G1: R.F. = 1.92.

(1) CALCULATE STRESS RANGE Sr:

2-SPAN STRINGER:

SPAN LENGTH = 25'. BEAM SPACING = 7.0'

$$\text{FATIGUE D.F.} = \frac{S}{17} = \frac{7.0}{17} = \underline{0.412} < \frac{S-3}{S} = 0.571 \text{ (AXLE)}$$

FROM HS20 RATING ANALYSIS OUTPUT: $D.F. = \frac{S}{7} = 1.0$ (WHEEL)
$S_r' = 11.26$ KSI

FOR FATIGUE REMAINING LIFE ANALYSIS:

$$\underline{S_r} = 11.26 \times \frac{0.41}{0.5} \times \frac{1.15}{1.30} \times \frac{54k}{72k} = \underline{6.13 \text{ KSI}}$$

FATIGUE REMAINING LIFE - WEST APPROACH - SECTION N

FB-13.

FROM HS20 FATIGUE RATING ANALYSIS: $S_r' = 7.57$ KSI

FOR FATIGUE REMAINING LIFE:

$$S_r = 7.57 \times \frac{1.15}{1.29} \times \frac{54K}{72K} = 5.02 \text{ KSI.}$$

G1:

FROM HS20 FATIGUE RATING ANALYSIS: $S_r' = 4.16$ KSI

FOR FATIGUE REMAINING LIFE:

$$S_r = 4.16 \times \frac{1.15}{1.24} \times \frac{54K}{72K} = 2.89 \text{ KSI}$$

(2) CHECK INFINITE REMAINING LIFE: $R_s S_r < S_{FL}$

2-SPAN STRINGER: CATEGORY C. REDUNDANT.

$R_s = 1.35$. $S_{FL} = 4.4$ (AT STIFFENERS)

$R_s \cdot S_r = 1.35 \times 6.13 > 4.4$. NO

FB-13: CATEGORY D. NON-REDUNDANT

$R_s = 1.75$. $S_{FL} = 2.6$

$R_s\ S_r = 1.75 \times 5.02 > 2.6$ NO.

G1: CATEGORY D. NON-REDUNDANT

$R_s = 1.75$. $S_{FL} = 2.6$

$R_s \cdot S_r = 1.75 \times 2.89 > 2.6$ NO

FATIGUE REMAINING LIFE.

(3) CALCULATE REMAINING LIFE:

FROM ODOT TRAFFIC SURVEY REPORT: ADTT=260 FOR YEAR 2010

PER BDM 402.2.6, THE PAST ADTT IS TO BE ESTIMATED USING THE CURRENT ADTT, THE FUTURE ADTT IS TO BE ESTIMATED USING 20 YEARS DESIGN ADTT × 1.85.

$T_p = ADTT \times F_L = 260 \times 0.40$ (6 LANES)
$= 104$

$T_N = 260 \times (1 + 1\% \times 20) \times 1.85 \times 0.4$ (ASSUME 1% GROWTH RATE)
$= 231$

(a) STRINGERS:

$f = 2.0$ FOR REDUNDANT MEMBERS (MEAN LIFE)

$C = 1.5$ FOR CONTINUOUS SPAN BELOW 40'

$W_p/W = 1.0 \quad W_N/W = 1.0 \quad R_s = 1.35, \quad k = 12$ FOR CATEGORY C

$$Y_1 = \frac{f k \times 10^6}{T_p C (R_s S_r W_p/W)^3} = \frac{2.0 \times 12 \times 10^6}{104 \times 1.5 \times (1.35 \times 6.13)^3} = 271 \text{ YRS.}$$

$$Y_N = \frac{f k \times 10^6}{T_N C (R_s S_r W_N/W)^3} = 122 \text{ YRS}$$

$Y_p = 2010 - 1992 = 18$ YRS

$Y_f = Y_N (1 - Y_p / Y_1) = 114$ YRS

REMAINING MEAN LIFE

$Y_{mf} = 114 - (2012 - 2010) = 112$ YEARS (2124)

FATIGUE REMAINING LIFE:

(b) FLOOR BEAMS:

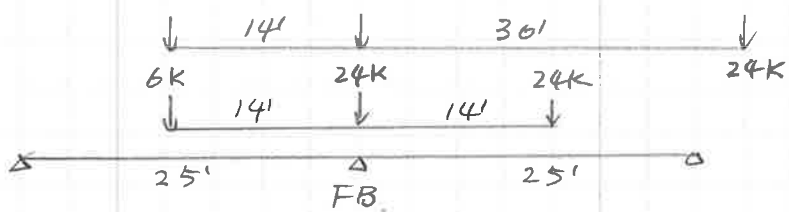
$f = 1.0$ FOR NON-REDUNDANT MEMBERS (SAFE LIFE)

$C = 1.0$ FOR TRANSVERSE MEMBERS ABOVE 20' SPACING

$K = 6.0$ FOR CATEGORY D. $R_s = 1.75$

$S_r = 5.02$ FOR HS15 TRUCK WITH 14' REAR AXLE SPACING.

REVISE TO 30' REAR AXLE SPACING:



$R1 = 24 + 6 \times 11/25 = 26.64K$

$R2 = 24 + 6 \times 11/25 + 24 \times 11/25 = 37.2K$

$S_r = 5.02 \times \frac{R1}{R2} = 3.6$ KSI

$$Y_1 = \frac{1.0 \times 6.0 \times 10^6}{104 \times 1.0 \times (1.75 \times 3.6)^3} = 231 \text{ YRS}$$

$$Y_N = \frac{1.0 \times 6.0 \times 10^6}{231 \times 1.0 \times (1.75 \times 3.6)^3} = 104 \text{ YRS.}$$

$Y_P = 2010 - 1939 = 71$ YRS

$Y_f = Y_N (1 - Y_P / Y_1) = 72$ YRS.

REMAINING SAFE LIFE $= 72 - 2 = 70$ YRS

FATIGUE REMAINING LIFE:

(C) GIRDERS:

$f = 1.0$. $C = 1.0$. FOR SIMPLE SPAN ABOVE 40'

$K = 6.0$ $R_S = 1.75$. $S_r = 2.89$ KSI

$$Y_1 = \frac{1.0 \times 6.0 \times 10^6}{104 \times 1.0 \times (1.75 \times 2.89)^3} = 446 \text{ YRS}$$

$$Y_N = \frac{1.0 \times 6.0 \times 10^6}{231 \times 1.0 \times (1.75 \times 2.89)^3} = 201 \text{ YRS}$$

$Y_P = 2010 - 1939 = 71$ YRS

$Y_f = Y_N (1 - Y_P / Y_1) = 169$ YRS

REMAINING SAFE LIFE = 169 − 2 = 167 YEARS

BRIDGE LOAD RATING SUMMARY REPORT CUY-2-1441 SECTION P		
SFN	**BRIDGE NUMBER**	**DISTRICT**
1800035	CUY-2-1441	12
ORIGINAL CONSTRUCTION YEAR	**REHABILITATION YEAR**	**OVERALL STRUCTURE LENGTH (FT)**
1938 - 1940	1991 - 1992	6580
FEATURE INTERSECTED:	NUMEROUS LOCAL STREETS, RTA RAILROAD TRACKS AND THE CUYAHOGA RIVER	
SPECIAL ASSUMPTIONS & COMMENTS		
RATING & ANALYSIS OPTION:		
LOAD RATING PURPOSE:	LOAD RATING FOR FUTURE REHABILITATION RECOMMENDATIONS	
RATING SOFTWARE:	STAAD, PCA COLUMN	
BASIS OF ANALYSIS:	EXISTING PLANS AND FIELD MEASUREMENTS	
METHOD OF ANALYSIS:	LOAD FACTOR	
DESIGN LOADING (ORIGINAL):	H20-33	
STRUCTURE RATING SUMMARY		
LOADING & RATING TYPE	**RATING FACTOR - RF (ROUNDED TO 2 DECIMAL POINTS**	**RATING LOAD**
INVENTORY CURRENT DESIGN	1.15	HS23.0
OPERATING CURRENT DESIGN	1.91	
OHIO LEGAL - 2F1	3.05	**OHIO LEGAL LOADS OVERALL MINIMUM RATING FACTOR**
OHIO LEGAL - 3F1	2.46	2.27
OHIO LEGAL - 4F1	2.27	**OHIO LEGAL LOADS OVERALL CONTROLLING TRUCK**
OHIO LEGAL - 5C1	2.59	4F1
RATED BY, PE#	**REVIEWED BY, PE#**	**REPORT DATE**
George Dai, PE 73577	Don Pawlowski, EI	3/2/2012
AGENCY/FIRM	**PHONE NUMBER**	**EMAIL**
TranSystems	216-861-1780	hgdai@transystems.com

SFN: 1800035 BRIDGE NO.: CUY-2-1441

SUMMARY SHEET

West Approach - Section P

CUY-2-1441 Load Rating Analysis
Main Ave Bridge

Calculated:	GHD/ADP	2/26/2012
Checked:	DMP	2/29/2012
Revised:	CTG	5/14/2012

As-Built Controlling Rating Factor Summary

Item	Location/ Member	HS20 Inventory	HS20 Operating	2F1 Operating	3F1 Operating	4F1 Operating	5C1 Operating
Deck	Deck	1.23	2.06	3.29	3.88	4.69	3.88
Stringer	S9, S14	**1.15**	**1.91**	3.86	**2.64**	**2.40**	**2.59**
	Fascia	1.36	2.27	**3.50**	3.61	4.15	3.68
Floorbeam	FB1	**1.44**	**2.41**	5.08	3.49	3.14	**3.26**
	FB10	1.48	2.48	**4.99**	**3.42**	**3.07**	3.42
Column	P16	1.59	2.21	3.05	2.59	2.45	2.61

As-Inspected Controlling Rating Factor Summary

Item	Location/ Member	HS20 Inventory	HS20 Operating	2F1 Operating	3F1 Operating	4F1 Operating	5C1 Operating
Deck	Deck	1.23	2.06	3.29	3.88	4.69	3.88
Stringer	S9, S14	**1.15**	**1.91**	3.86	**2.64**	**2.40**	**2.59**
	S10, S11	1.25	2.09	**3.50**	2.46	2.27	2.59
Floorbeam	FB1	**1.44**	**2.41**	5.08	3.49	3.14	**3.26**
	FB10	1.48	2.48	**4.99**	**3.42**	**3.07**	3.42
Column	P16	1.59	2.21	3.05	2.59	2.45	2.61

Overall Summary

Case	Rating Factor	Tonnage	HS equivalent or Ohio Legal Load %
HS20 Inventory	1.15	41.40	HS23.0
HS20 Operating	1.91	68.76	HS38.2
2F1	3.05	45.75	*225%*
3F1	2.46	56.58	
4F1	2.27	61.29	
5C1	2.59	103.60	

WEST APPROACH – SECTION P

DECK

Made By: DMP	Date: 2/25/12	Job No:
Checked By: GHD	Date: 3/1/12	Sheet No. 1

Deck – West Approach – Section P

Material Properties:

Concrete: $f'_c = 4500$ psi (A.B. Plan 67/93)
$W_c = 112$ pcf (69/93)

Rebar: $f_s' = 24$ Ksi f_y: 60 ksi (67/93)

Deck Geometry:

Beam Spacing: 7.0'

Stringers: Concrete 1'-8" x 3'-7½"

Effective Span Length: 7 − 1.5 = 5.5' (AASHTO 3.24.1)

Deck thickness = 6.75" Lightweight concrete

Wearing surface = 1.25" Latex Concrete

Rebar Cover: Top: 1.75" Bot = 1"

Transverse Rebar: Top: #6 @ 8" (179/991)
#5 @ 8"

Dead Load:

Slab: $\frac{6.75''}{12} \times 1' \times .112 = .063$ K/ft
wearing surface: $1.25'' \times \frac{1}{12} \times 1' \times .15 = .016$ K/ft

total = .079 K/ft

DL moment = $\frac{1}{8} \times .079 \times 5.5^2 \times .8 = .239$ K-ft

Live Loads:

HS20: $P = 16K$ $M_{HS} = \left(\frac{S+2}{32}\right) \cdot P \cdot (1+I) \cdot 0.8$

$= \left(\frac{5.5+2}{32}\right)(16)(1.3)(.8) = 3.9$ k-ft

2F1: $P = 10k$ $M_{2F1} = 2.44$ k-ft

3F1: $P = 8.5k$ $M_{3F1} = 2.07$ k-ft

4F1: $P = 7.0k$ $M_{4F1} = 1.71$ k-ft

5C1: $P = 8.5k$ $M_{5C1} = 2.07$ k-ft

Moment Capacity:

Check reinforcement ratio (balanced ratio):

$$\rho_b = \frac{.85 \beta_1 f'_c}{f_y}\left(\frac{87000}{87000+f_y}\right) = \frac{.85(.825)(4.5)}{60}\left(\frac{87000}{87000+60000}\right)$$

$= .031$ $.75\rho_b = .025$

Actual Ratio:

Top: $A_s = .44 \times \frac{12}{8} = .66$ in²/ft

$d_t = 6.75" - 1.75" - .5" - \frac{.75}{2} = 4.125"$

$\rho_1 = \frac{A_s}{b\,d_t} = \frac{.66}{(12")(4.125)} = .013 < .025$ rebar controls

Bot: $A_s = .31 \times \frac{12}{8} = .465$ in²/ft

$d_t = 6.75" - 1" - \frac{.625"}{2} = 5.438"$

$\rho_2 = \frac{A_s}{b d_t} = \frac{.465}{(12)(5.438)} = .007 < .025$ rebar controls

Negative Moment Capacity:

$$a = \frac{A_s f_y}{.85 f'_c b} = \frac{(.66)(60)}{.85(4.5)(12)} = .863$$

$$\phi M_n^- = \phi A_s f_y \left(d - \frac{a}{2}\right)$$

$$= (.9)(.66)(60)\left(4.125 - \frac{.863}{2}\right)\left(\frac{1}{12}\right) = 10.97 \text{ k-ft}$$

Positive Moment Capacity:

$$a = \frac{(.465)(60)}{.85(4.5)(12)} = .608$$

$$\phi M_n^+ = (.9)(.465)(60)\left(5.438 - \frac{.608}{2}\right)\left(\frac{1}{12}\right) = 10.74 \text{ k-ft} \quad \text{controls}$$

Rating Factors

HS20: Inventory $R = \frac{C - 1.3D}{2.17(L+I)} = \frac{10.74 - 1.3(.239)}{2.17(3.9)} = 1.23$

Operating $R = \frac{10.74 - 1.3(.239)}{1.3(3.9)} = 2.06$

2F1: $R = \frac{10.74 - 1.3(.239)}{1.3(2.44)} = 3.29$

3F1: $R = \frac{10.74 - 1.3(.239)}{1.3(2.07)} = 3.88$

4F1: $R = \frac{10.74 - 1.3(.239)}{1.3(1.71)} = 4.69$

5C1: $R = 3.88$

WEST APPROACH – SECTION P

STRINGERS

TranSystems

Made By: GHD Date: 2/23/2012 Job No.:

Checked By: DMP Date: 2/25/2012 Sheet No.:

Stringers Rating Summary - As Built

STRINGERS	RATING FACTORS - WEST APPROACH - SECTION P											
	HS20				OHIO LEGAL LOADS							
	MOMENT		SHEAR		2F1		3F1		4F1		5C1	
	Inv.	Opr.	Inv.	Opr.	M	V	M	V	M	V	M	V
S1,S2	2.92	4.88	2.26	3.77	8.42	7.62	5.88	5.27	5.38	4.81	6.06	5.37
S3,S4,S13	1.76	2.95	1.46	2.44	4.53	5.01	3.46	3.47	3.16	3.17	3.24	3.37
S5,S6	2.29	3.83	3.13	5.22	6.04	5.57	4.26	4.91	4.31	3.98	4.18	4.91
S7	2.46	4.11	3.83	6.40	7.19	11.30	5.04	8.15	4.60	7.79	5.16	8.39
S8,S12	3.08	5.14	2.80	4.68	8.78	9.60	6.18	6.52	5.79	5.69	7.68	6.32
S9,S14	2.86	4.78	1.15	1.91	7.78	3.86	5.51	2.64	5.11	2.40	6.69	2.59
S10,S11,S15	1.39	2.32	1.26	2.11	3.87	4.27	2.72	2.90	2.51	2.61	3.14	2.84
S16,S17,S18	1.91	3.19	2.19	3.66	5.03	3.95	3.53	3.48	3.56	2.83	3.46	3.47
Fascia	1.36	2.27	3.65	6.10	3.50	12.10	3.61	8.22	4.15	7.75	3.68	8.22

WEST APPROACH - SECTION P.

EFFECTIVE FLANGE WIDTH:

TYPICAL INTERIOR STRINGERS: (AASHTO 8.10.1.1)

$\frac{1}{4} \times SPAN = \frac{1}{4} \times 38' = 9.5'$

$6 \times T_S \times 2 + b_w = 6 \times 6.75'' \times \frac{1}{12} \times 2 + 1.5' = 8.25'$

STRINGER SPACING $= 7'$

USE 7.0'

TYPICAL FLOOR BEAMS: (AASHTO 8.10.1.4)

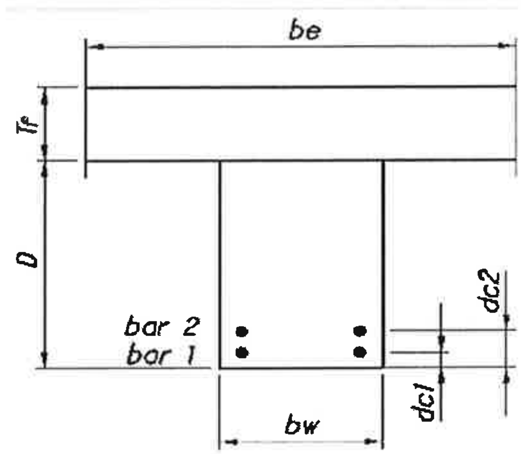
$6 \times T_S \times 2 + b_w = 6 \times 6.75'' \times \frac{1}{12} \times 2 + 2' = 8.75'$

$2 \times (\frac{1}{10} \times SPAN) + b_w \Rightarrow$ GOVERNS

TranSystems	Made By: GHD	Date: 2/27/2012	Job No.:
	Checked By: DMP	Date: 2/28/2012	Sheet No.:

Stringer S1, S2 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	84.00	in.
Tf =	6.75	in.
D =	52.25	in.
bw =	18.00	in.
dc1 =	3.31	in.
dc2 =	6.06	in.
bar1=	2.53	in^2 (2-#1.125")
bar2=	5.66	in^2 (2-#1.125" and 2-#1.25")

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

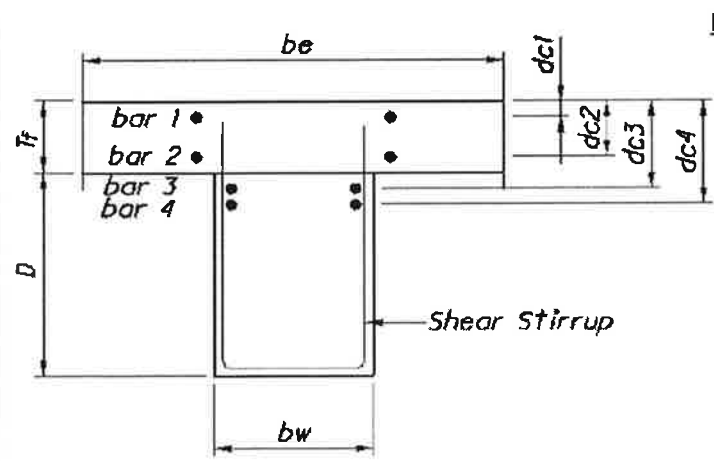
Check if can be analyzed as a rectangular section:

Beam total depth =	59.00	in.	(Tf+D)
Total rebar area As =	8.19	in^2	
Average dt =	53.79	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.92	in	0.92 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1178.84** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	84.00	in.	
Tf =	6.75	in.	
D =	52.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.53	in^2	2-#1.125" and 2-#1"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	6.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	59.00	in.	(Tf+D)
ΣAs fy=	431.25	kips	
Average dt =	51.43	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	9.40	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **1511.54** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Stringer S1, S2 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	101.42	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	123.44	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **191.13** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	131.48	k-ft	DL =	211.61	k-ft	DL =	34.00	k
HS 20 =	155.11	k-ft	HS 20 =	194.91	k-ft	HS 20 =	29.95	k
2F1 =	92.08	k-ft	2F1 =	93.87	k-ft	2F1 =	14.84	k
3F1 =	131.94	k-ft	3F1 =	129.84	k-ft	3F1 =	21.46	k
4F1 =	144.07	k-ft	4F1 =	127.38	k-ft	4F1 =	23.49	k
5C1 =	127.87	k-ft	5C1 =	142.42	k-ft	5C1 =	21.06	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
2.99	5.00	2.92	4.88	2.26	3.77

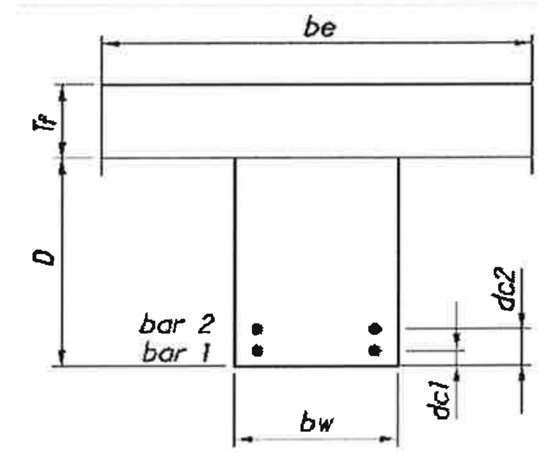
Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
8.42	10.13	7.62	5.88	7.33	5.27

4F1			5C1		
M+	M-	V	M+	M-	V
5.38	7.47	4.81	6.06	6.68	5.37

Stringer S3, S4, S13 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	84.00	in.
Tf =	6.75	in.
D =	52.25	in.
bw =	18.00	in.
dc1 =	3.31	in.
dc2 =	6.06	in.
bar1=	2.53	in^2 (2-#1.125")
bar2=	5.66	in^2 (2-#1.125" and 2-#1.25")

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

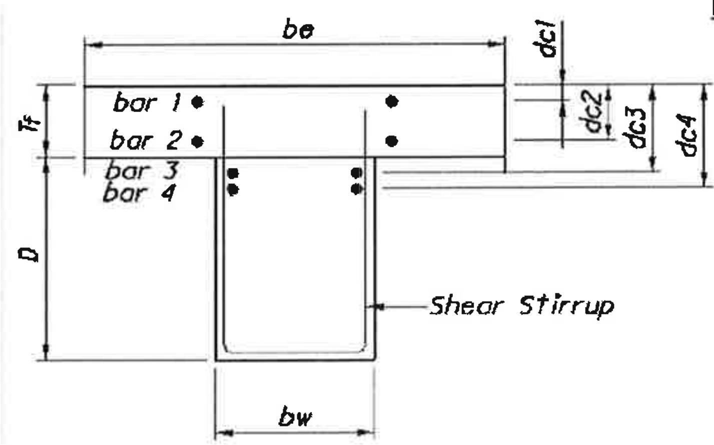
Check if can be analyzed as a rectangular section:

Beam total depth =	59.00	in.	(Tf+D)
Total rebar area As =	8.19	in^2	
Average dt =	53.79	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.92	in	0.92 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1178.84** k-ft ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	84.00	in.	
Tf =	6.75	in.	
D =	52.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.53	in^2	2-#1.125" and 2-#1"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	6.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	59.00	in.	(Tf+D)
ΣAs fy=	431.25	kips	
Average dt =	51.43	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	9.40	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **1511.54** k-ft ΦMn = Φ Σ(As fy)(dt-a/2)

Stringer S3, S4, S13 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	101.42	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	123.44	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **191.13** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	127.51	k-ft	DL =	206.70	k-ft	DL =	33.53	k
HS 20 =	264.70	k-ft	HS 20 =	301.87	k-ft	HS 20 =	46.57	k
2F1 =	156.50	k-ft	2F1 =	210.92	k-ft	2F1 =	22.65	k
3F1 =	224.92	k-ft	3F1 =	271.96	k-ft	3F1 =	32.71	k
4F1 =	246.53	k-ft	4F1 =	275.12	k-ft	4F1 =	35.79	k
5C1 =	218.15	k-ft	5C1 =	295.08	k-ft	5C1 =	33.69	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.76	2.95	1.90	3.17	1.46	2.44

Ohio Legal Loads:

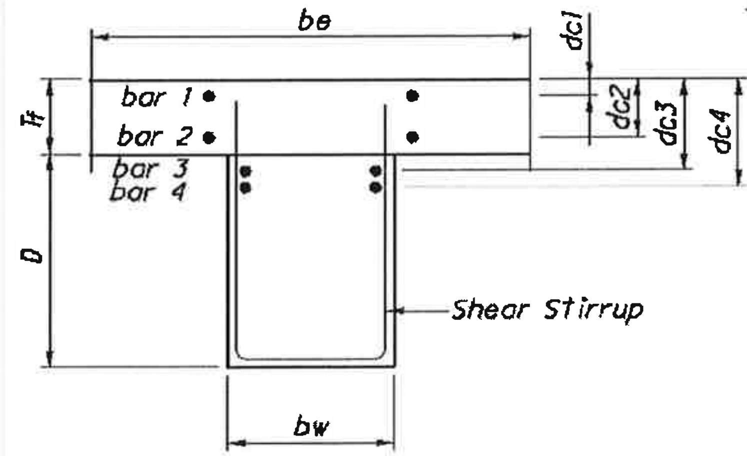
2F1			3F1		
M+	M-	V	M+	M-	V
4.98	4.53	5.01	3.46	3.52	3.47

4F1			5C1		
M+	M-	V	M+	M-	V
3.16	3.48	3.17	3.57	3.24	3.37

Made By:	GHD	Date:	2/27/2012	Job No.:	
Checked By:	DMP	Date:	2/28/2012	Sheet No.:	

Stringer S5,S6 - Section P - As Built

Negative Moment Capacity:



Dimensions:			Material Properties:		
be =	84.00	in.	fy1 =	60.00	ksi
Tf =	6.75	in.	fy2 =	36.00	ksi
D =	64.25	in.	fc' =	3000.00	psi
bw =	18.00	in.			
dc1 =	2.75	in.			
dc2 =	4.81	in.			
dc3 =	9.00	in.			
dc4 =	12.25	in.			
bar1=	1.40	in^2	7-#4		
bar2=	1.55	in^2	5-#5		
bar3=	5.06	in^2	2-#1.125" and 2-#1.125"		
bar4=	2.53	in^2	2-#1.125"		
Shear stirrup Av =	0.40	in^2	2 legs of #4		
Shear stirrup Spacing S =	6.00	in			

Beam total depth =	71.00	in.	(Tf+D)
ΣAs fy=	450.38	kips	
Average dt =	63.37	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	9.81	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn =	**1974.93**	k-ft	ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	124.96	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	152.09	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn =	**235.50**	k-ft	ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	0.00	k-ft	DL =	126.11	k-ft	DL =	20.57	k
HS 20 =	0.00	k-ft	HS 20 =	363.82	k-ft	HS 20 =	30.75	k
2F1 =	0.00	k-ft	2F1 =	230.66	k-ft	2F1 =	28.83	k
3F1 =	0.00	k-ft	3F1 =	326.76	k-ft	3F1 =	32.68	k
4F1 =	0.00	k-ft	4F1 =	322.92	k-ft	4F1 =	40.37	k
5C1 =	0.00	k-ft	5C1 =	333.63	k-ft	5C1 =	32.68	k

Stringer S5,S6 - Section P - As Built

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
-	-	2.29	3.83	3.13	5.22

Ohio Legal Loads:

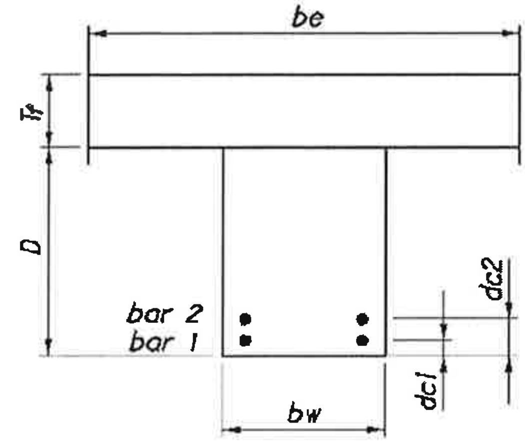
2F1			3F1		
M+	M-	V	M+	M-	V
-	6.04	5.57	-	4.26	4.91

4F1			5C1		
M+	M-	V	M+	M-	V
-	4.31	3.98	-	4.18	4.91

Made By:	GHD	Date:	2/27/2012	Job No.:	
Checked By:	DMP	Date:	2/28/2012	Sheet No.:	

Stringer S7 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	73.98	in.	
Tf =	6.75	in.	
D =	52.25	in.	
bw =	18.00	in.	
dc1 =	3.25	in.	
dc2 =	6.00	in.	
bar1=	2.00	in^2	2-#1"
bar2=	4.00	in^2	4-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

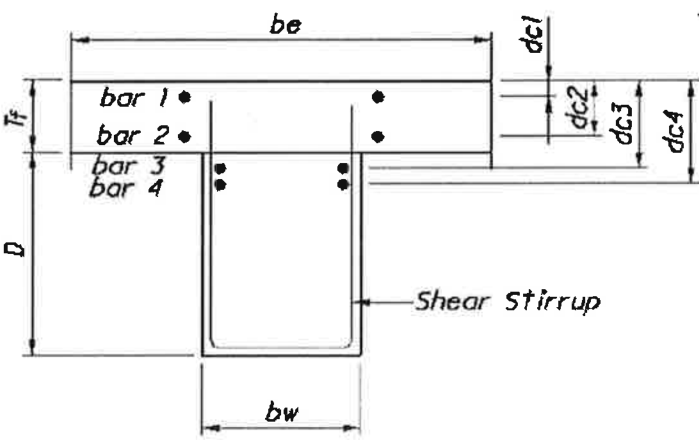
Check if can be analyzed as a rectangular section:

Beam total depth =	59.00	in.	(Tf+D)
Total rebar area As =	6.00	in^2	
Average dt =	53.92	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.76	in	0.76 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **867.29** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	73.98	in.	
Tf =	6.75	in.	
D =	64.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	5.06	in^2	4-#1.125"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	6.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	71.00	in.	(Tf+D)
ΣAs fy=	431.25	kips	
Average dt =	63.58	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	9.40	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **1904.33** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Stringer S7 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc = 125.36 kips Vc = 2 (fc')^0.5 bw d

Rebar shear strength Vs = 152.59 kips Vs = Av fy d / s

Shear Capacity:

ΦVn = **236.26** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	109.90	k-ft	DL =	161.76	k-ft	DL =	28.03	k
HS 20 =	135.74	k-ft	HS 20 =	209.91	k-ft	HS 20 =	24.04	k
2F1 =	77.49	k-ft	2F1 =	147.23	k-ft	2F1 =	13.61	k
3F1 =	110.59	k-ft	3F1 =	190.59	k-ft	3F1 =	18.85	k
4F1 =	121.08	k-ft	4F1 =	191.00	k-ft	4F1 =	19.72	k
5C1 =	108.01	k-ft	5C1 =	191.15	k-ft	5C1 =	18.32	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
2.46	4.11	3.72	6.21	3.83	6.40

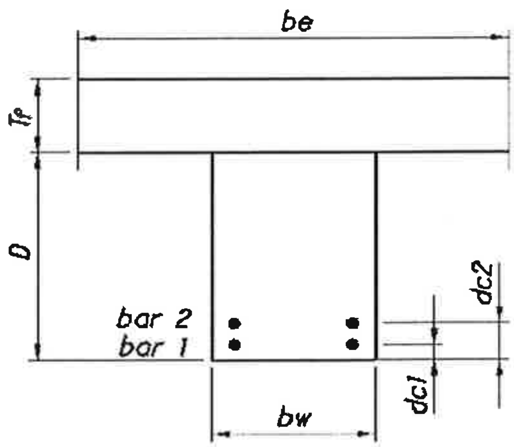
Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
7.19	8.85	11.30	5.04	6.84	8.15

4F1			5C1		
M+	M-	V	M+	M-	V
4.60	6.82	7.79	5.16	6.82	8.39

Stringer S8,S12 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	61.47	in.
Tf =	6.75	in.
D =	58.25	in.
bw =	18.00	in.
dc1 =	3.25	in.
dc2 =	6.00	in.
bar1=	2.00	in^2	2-#1"
bar2=	4.00	in^2	4-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

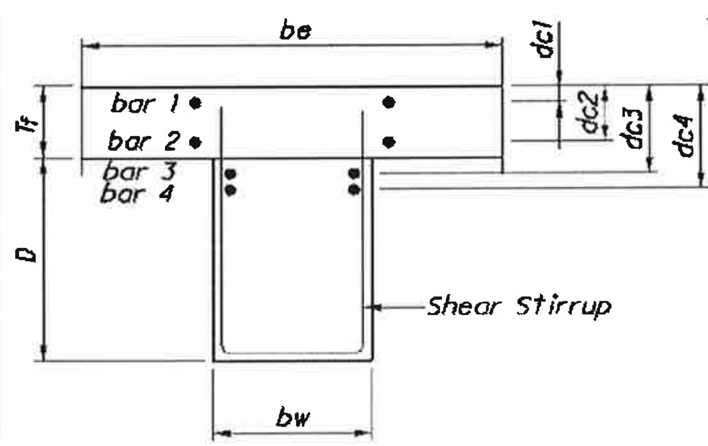
Check if can be analyzed as a rectangular section:

Beam total depth =	65.00	in.	(Tf+D)
Total rebar area As =	6.00	in^2	
Average dt =	59.92	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.92	in	0.92 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **963.20** k-ft ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	61.47	in.	
Tf =	6.75	in.	
D =	86.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.53	in^2	2-#1" and 2-#1.125"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	24.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	93.00	in.	(Tf+D)
ΣAs fy=	412.13	kips	
Average dt =	85.65	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	8.98	in	(a = Σ As fy / (0.85fc' bw))

Negative Moment Capacity:

ΦMn = **2508.64** k-ft ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	168.89	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	51.39	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn =	**187.24**	k-ft	ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	92.71	k-ft	DL =	233.47	k-ft	DL =	30.42	k
HS 20 =	126.22	k-ft	HS 20 =	102.16	k-ft	HS 20 =	24.27	k
2F1 =	73.83	k-ft	2F1 =	39.61	k-ft	2F1 =	11.84	k
3F1 =	104.97	k-ft	3F1 =	58.75	k-ft	3F1 =	17.43	k
4F1 =	111.94	k-ft	4F1 =	65.86	k-ft	4F1 =	19.98	k
5C1 =	84.41	k-ft	5C1 =	104.21	k-ft	5C1 =	17.99	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
3.08	5.14	9.95	16.61	2.80	4.68

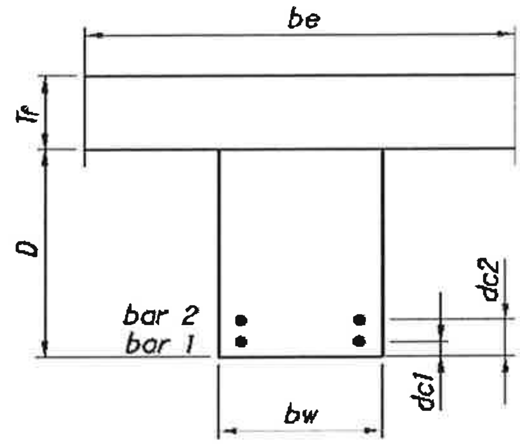
Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
8.78	42.83	9.60	6.18	28.87	6.52

4F1			5C1		
M+	M-	V	M+	M-	V
5.79	25.75	5.69	7.68	16.28	6.32

Stringer S9,S14 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	73.98	in.	
Tf =	6.75	in.	
D =	58.25	in.	
bw =	18.00	in.	
dc1 =	3.25	in.	
dc2 =	6.00	in.	
bar1=	6.53	in^2	4-#1.125" & 2-#1"
bar2=	4.00	in^2	4-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

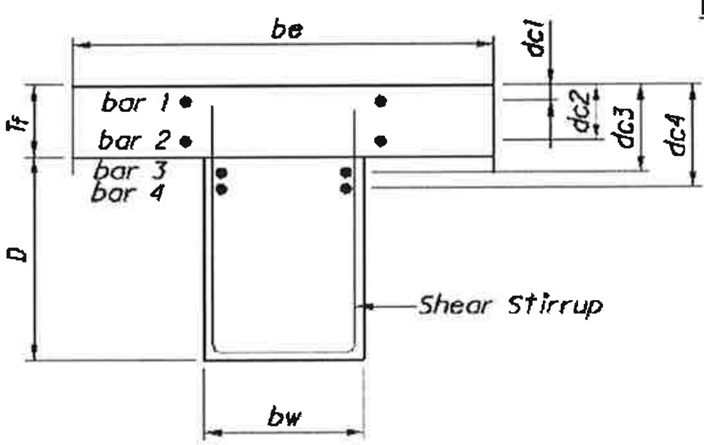
Check if can be analyzed as a rectangular section:

Beam total depth =	65.00	in.	(Tf+D)
Total rebar area As =	10.53	in^2	
Average dt =	60.71	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.34	in	1.34 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1707.07** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	73.98	in.	
Tf =	6.75	in.	
D =	86.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.53	in^2	2-#1" and 2-#1.125"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	24.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	93.00	in.	(Tf+D)
ΣAs fy=	412.13	kips	
Average dt =	85.65	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	8.98	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **2508.64** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Stringer S9,S14 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	168.89	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	51.39	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **187.24** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	91.11	k-ft	DL =	221.50	k-ft	DL =	32.65	k
HS 20 =	256.00	k-ft	HS 20 =	201.24	k-ft	HS 20 =	58.25	k
2F1 =	157.11	k-ft	2F1 =	103.34	k-ft	2F1 =	28.84	k
3F1 =	221.96	k-ft	3F1 =	154.34	k-ft	3F1 =	42.12	k
4F1 =	239.23	k-ft	4F1 =	174.17	k-ft	4F1 =	46.50	k
5C1 =	182.78	k-ft	5C1 =	225.26	k-ft	5C1 =	42.94	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
2.86	4.78	5.09	8.49	1.15	1.91

Ohio Legal Loads:

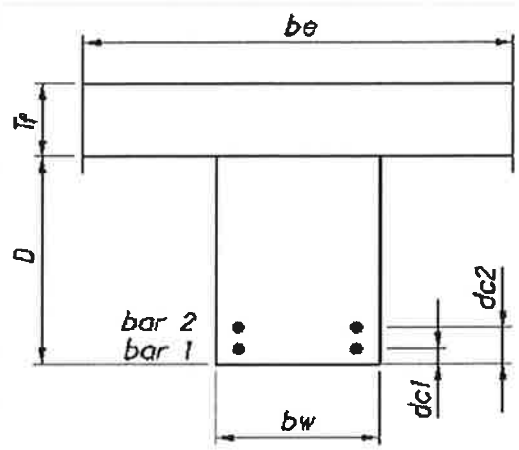
2F1			3F1		
M+	M-	V	M+	M-	V
7.78	16.53	3.86	5.51	11.07	2.64

4F1			5C1		
M+	M-	V	M+	M-	V
5.11	9.81	2.40	6.69	7.58	2.59

Made By: GHD	Date: 2/27/2012	Job No.:
Checked By: DMP	Date: 2/28/2012	Sheet No.:

Stringer S10,S11,S15,S19 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	73.98	in.
Tf =	6.75	in.
D =	58.25	in.
bw =	18.00	in.
dc1 =	3.25	in.
dc2 =	6.00	in.
bar1=	2.00	in^2	2-#1"
bar2=	4.00	in^2	4-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

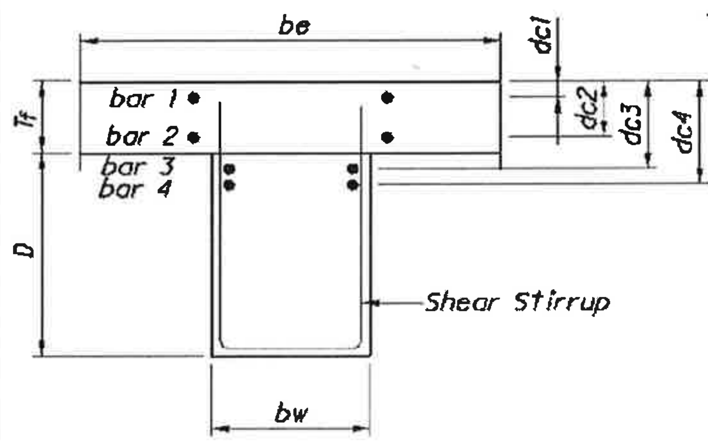
Check if can be analyzed as a rectangular section:

Beam total depth =	65.00	in.	(Tf+D)
Total rebar area As =	6.00	in^2	
Average dt =	59.92	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.76	in	0.76 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **964.49** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	73.98	in.	
Tf =	6.75	in.	
D =	86.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.00	in^2	4-#1"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	24.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	93.00	in.	(Tf+D)
ΣAs fy=	393.00	kips	
Average dt =	85.73	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	8.56	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **2400.78** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	169.05	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	51.44	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **187.41** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	121.25	k-ft	DL =	208.02	k-ft	DL =	32.55	k
HS 20 =	268.19	k-ft	HS 20 =	287.30	k-ft	HS 20 =	53.02	k
2F1 =	160.40	k-ft	2F1 =	175.51	k-ft	2F1 =	26.16	k
3F1 =	227.98	k-ft	3F1 =	248.36	k-ft	3F1 =	38.47	k
4F1 =	246.85	k-ft	4F1 =	245.01	k-ft	4F1 =	42.83	k
5C1 =	197.59	k-ft	5C1 =	280.39	k-ft	5C1 =	39.28	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.39	2.32	3.42	5.71	1.26	2.11

Ohio Legal Loads:

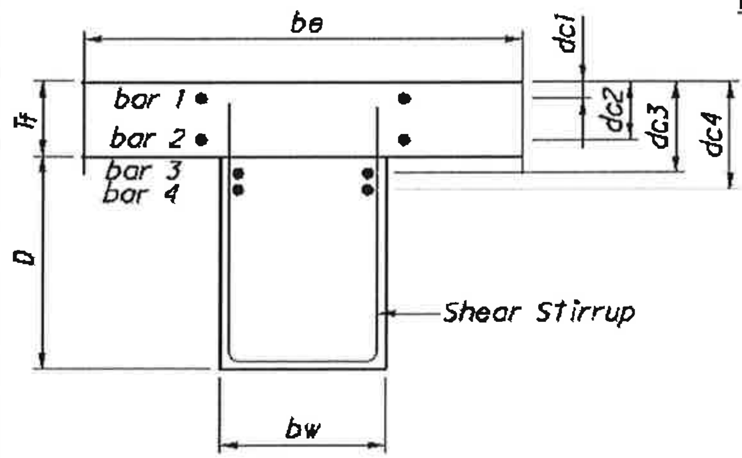
2F1			3F1		
M+	M-	V	M+	M-	V
3.87	9.34	4.27	2.72	6.60	2.90

4F1			5C1		
M+	M-	V	M+	M-	V
2.51	6.69	2.61	3.14	5.84	2.84

Made By: GHD	Date: 2/27/2012	Job No.:	
Checked By: DMP	Date: 2/28/2012	Sheet No.:	

Stringer S16,S17,S18 - Section P - As Built

Negative Moment Capacity:



Dimensions:				Material Properties:		
be =	73.98	in.		fy1 =	60.00	ksi
Tf =	6.75	in.		fy2 =	36.00	ksi
D =	64.25	in.		fc' =	3000.00	psi
bw =	18.00	in.				
dc1 =	2.75	in.				
dc2 =	4.81	in.				
dc3 =	9.00	in.				
dc4 =	12.25	in.				
bar1=	1.40	in^2	7-#4			
bar2=	1.55	in^2	5-#5			
bar3=	5.06	in^2	4-#1.125"			
bar4=	0.00	in^2				
Shear stirrup Av =	0.40	in^2	2 legs of #4			
Shear stirrup Spacing S =	12.00	in				

Beam total depth =	71.00	in.	(Tf+D)
ΣAs fy=	359.25	kips	
Average dt =	64.55	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	7.83	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn =	**1633.61**	k-ft	ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	127.27	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	77.45	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn =	**174.02**	k-ft	ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	0.00	k-ft	DL =	120.77	k-ft	DL =	19.70	k
HS 20 =	0.00	k-ft	HS 20 =	356.30	k-ft	HS 20 =	31.16	k
2F1 =	0.00	k-ft	2F1 =	225.77	k-ft	2F1 =	28.87	k
3F1 =	0.00	k-ft	3F1 =	321.43	k-ft	3F1 =	32.85	k
4F1 =	0.00	k-ft	4F1 =	318.66	k-ft	4F1 =	40.35	k
5C1 =	0.00	k-ft	5C1 =	327.97	k-ft	5C1 =	32.94	k

Stringer S16,S17,S18 - Section P - As Built

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
-	-	1.91	3.19	2.19	3.66

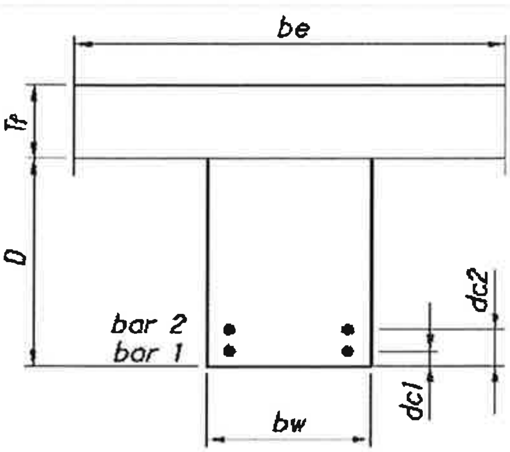
Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
-	5.03	3.95	-	3.53	3.48

4F1			5C1		
M+	M-	V	M+	M-	V
-	3.56	2.83	-	3.46	3.47

Fascia Stringers - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	59.02	in.
Tf =	6.75	in.
D =	41.25	in.
bw =	16.00	in.
dc1 =	3.31	in.
dc2 =	6.06	in.
bar1=	5.00	in^2	5-#9
bar2=	0.00	in^2

Material Properties:

fy =	60.00	ksi
fc' =	4500.00	psi

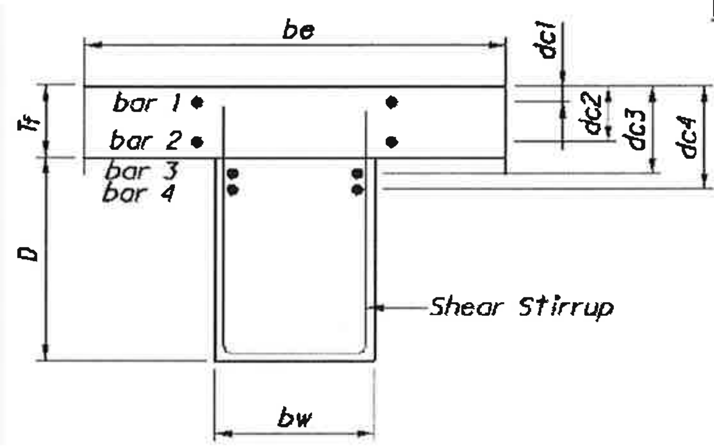
Check if can be analyzed as a rectangular section:

Beam total depth =	48.00	in.	(Tf+D)
Total rebar area As =	5.00	in^2	
Average dt =	44.69	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.33	in	1.33 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **990.47** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	59.02	in.	
Tf =	6.75	in.	
D =	41.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.74	in^2	2-#8 & 3-#9
bar2=	0.00	in^2	Not used
bar3=	0.00	in^2	Not used
bar4=	0.00	in^2	Not used
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	12.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	60.00	ksi
fc' =	4500.00	psi

Beam total depth =	48.00	in.	(Tf+D)
ΣAs fy=	284.40	kips	
Average dt =	45.25	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	4.13	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **921.14** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Fascia Stringers - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	109.28	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	90.50	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **169.81** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	83.67	k-ft	DL =	131.75	k-ft	DL =	22.23	k
HS 20 =	81.06	k-ft	HS 20 =	253.77	k-ft	HS 20 =	17.78	k
2F1 =	52.54	k-ft	2F1 =	164.97	k-ft	2F1 =	8.96	k
3F1 =	50.88	k-ft	3F1 =	159.84	k-ft	3F1 =	13.19	k
4F1 =	45.87	k-ft	4F1 =	139.04	k-ft	4F1 =	13.99	k
5C1 =	50.48	k-ft	5C1 =	156.89	k-ft	5C1 =	13.19	k

Rating Factors:

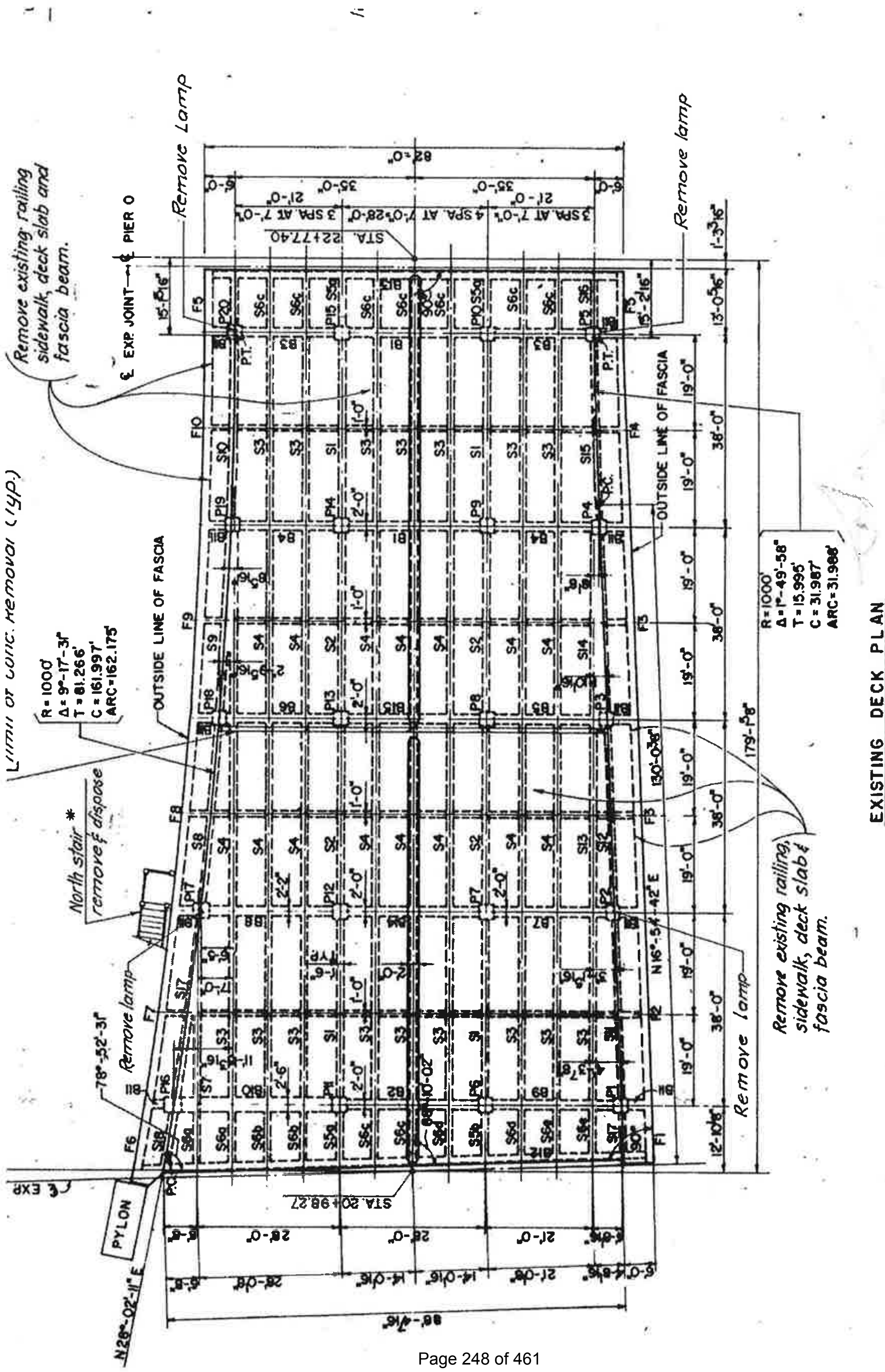
HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
5.01	8.37	1.36	2.27	3.65	6.10

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
12.91	3.50	12.10	13.33	3.61	8.22

4F1			5C1		
M+	M-	V	M+	M-	V
14.78	4.15	7.75	13.44	3.68	8.22


EXISTING DECK PLAN
Remove existing railing, sidewalk, deck slab and fascia beam.
Remove Lamp
Remove lamp
Remove lamp
Remove lamp
Limit of conc. Removal (typ.)
OUTSIDE LINE OF FASCIA
OUTSIDE LINE OF FASCIA
North stair * remove & dispose
PYLON
℄ EXP JOINT
℄ PIER 0
STA. 22+77.40
STA. 20+98.27
R=1000' Δ=9°-17'-31" T=81.266' C=161.997' ARC=162.175
R=1000' Δ=1°-49'-58" T=15.995' C=31.987' ARC=31.988'
N16°-54'-42" E
N28°-02'-11" E
78°-52'-31"
Remove existing railing, sidewalk, deck slab & fascia beam.

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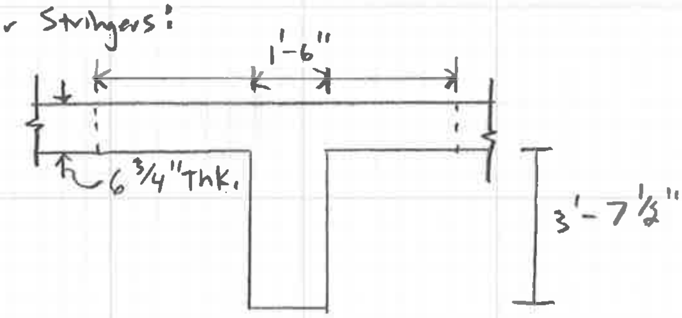
Made By: ADK	Date: 2/27/12	Job No: P402110046
Checked By: GHD	Date: 2/29/12	Sheet No. 1

Section P

STAAD, Pro Section Properties!

Interior Stringers:



$S = 7' - 1\frac{1}{2}' = \underline{5.5'}$

$L = \underline{38'}$

$b_w = 1'-6"$

① $b_e = \frac{1}{4}L = 9.5'$

② $= 12T_f + b_w = 8.25'$

③ $= S + b_w = \underline{\underline{7'}}$ ← Controls

$\boxed{b_e = 7' = 84"}$

→ For all closer spaced beams, Case ③ will control also. See attached Excel for breakdown.

"Stringer Beam Effective Width Non-Interior.xlsx

Floorbeams!

$L = 32.48'$ (max span) $S = 36'$ $b_w = 2'$

① $b_e = \frac{1}{4}L = \underline{8.12'}$ ← Always controls, with equal or lessar "L".

② $= 12T_f + b_w = 8.75'$

③ $= S + b_w = 38'$

For stand, only modeled rectangular section 66"x24"

Section P

Dead Load Calcs. (Calc. distributed then apply to be)

→ Slab = 6 3/4" L.W. (117 lb/ft³) = 66 lb/ft

→ Wearing Surface = 1 1/4" (150 lb/ft³) = 16 lb/ft

→ Parapet = 2 (3.77 ft²)(117) / 85.5' = 10 lb/ft

→ Median = 4.17 ft² (117) / 85.5' = 6 lb/ft

98 lb/ft

- Also apply beam self-weight

Stringers → 3'-7 1/2" × 1.5' × 150 lb/ft³ = 816 lb/ft

Floorbeams → (66" × 24") / 144 × 150 lb/ft³ = 1650 lb/ft ←

same as applying self-weight

* Apply self-weight to columns and FB's.

- Stringer Cantilevers -

4'-8" Deep to 2'-4 1/2" ⇒ Avg. depth = 3.52' ← Leave, close to 3'-7 1/2"

* Add 1' to Stringer Stems due to unknown superelevation.

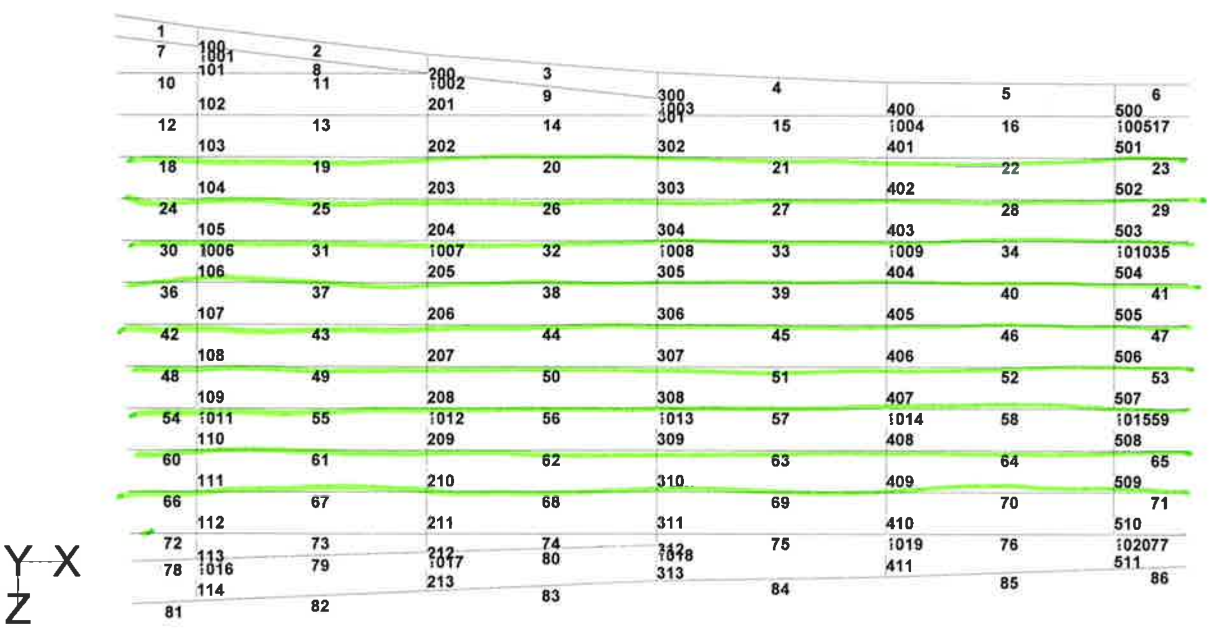
Stringer stems → 1.5 ft² × .117 = 0.176 k/ft

+0.816

.992 k/ft

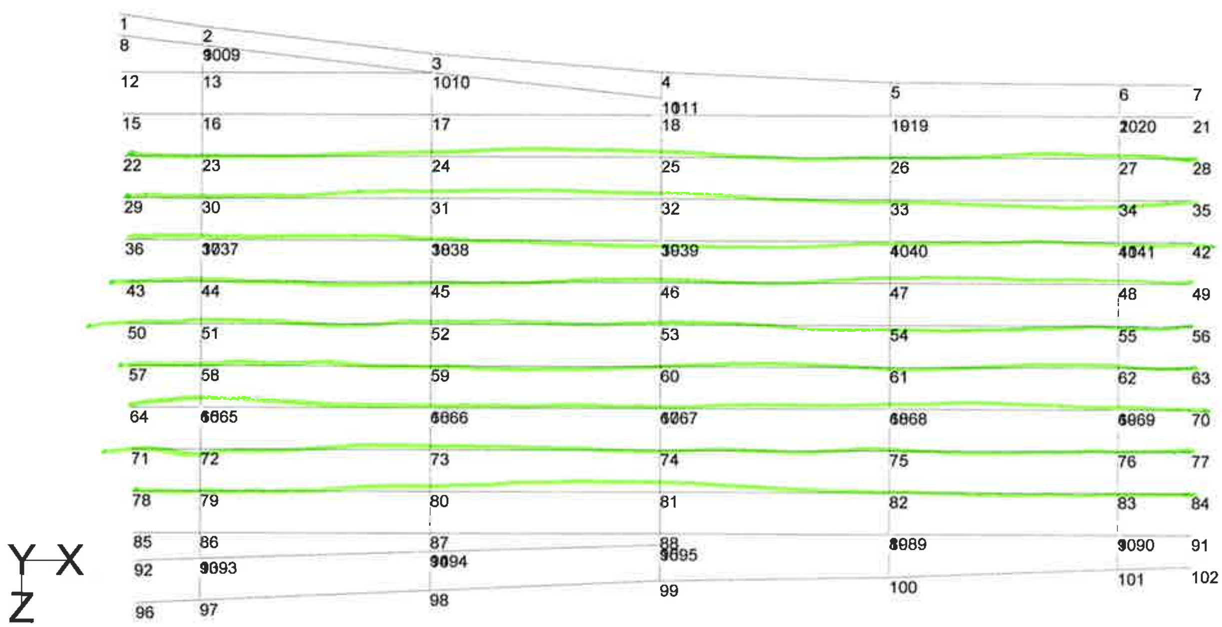
Software licensed to TranSystems	Job No **P402110046**	Sheet No **1**	Rev
	Part Section P		
Job Title Main Avenue Bridge Load Rating	Ref		
	By ADK	Date 24-Feb-12	Chd GHD
Client Ohio Department of Transportation	File Dead Load.std	Date/Time 27-Feb-2012 09:09	

Int. Stringer YD = 50.25" ZD = 84" YB = 43.5" ZB = 18"



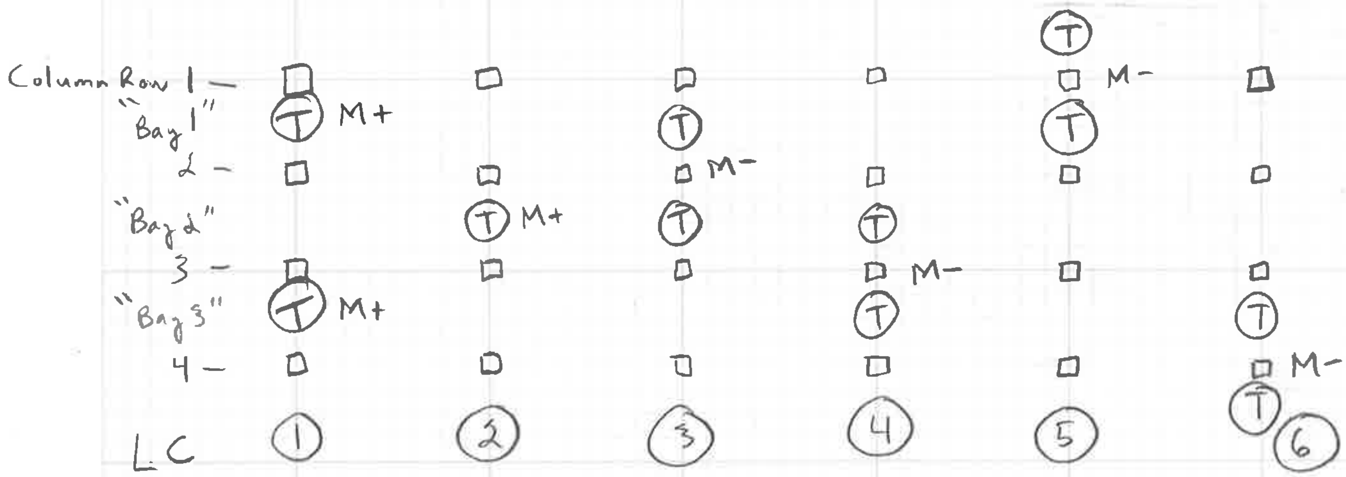
Software licensed to TranSystems

Job No P402110046	Sheet No 1	Rev		
Part Section P				
Job Title Main Avenue Bridge Load Rating	Ref			
By ADK	Date 24-Feb-12	Chd GHD		
Client Ohio Department of Transportation	File Dead Load.std	Date/Time 27-Feb-2012 07:59		



Section P

(T) = Trucks applied to Maximize



→ Structure on a slight curve, however will apply load generations liner (parallel w/ ℄ Bridge) in two separate layouts (1 b/w Bent A and C) (2nd b/w Bent C and Bent E)

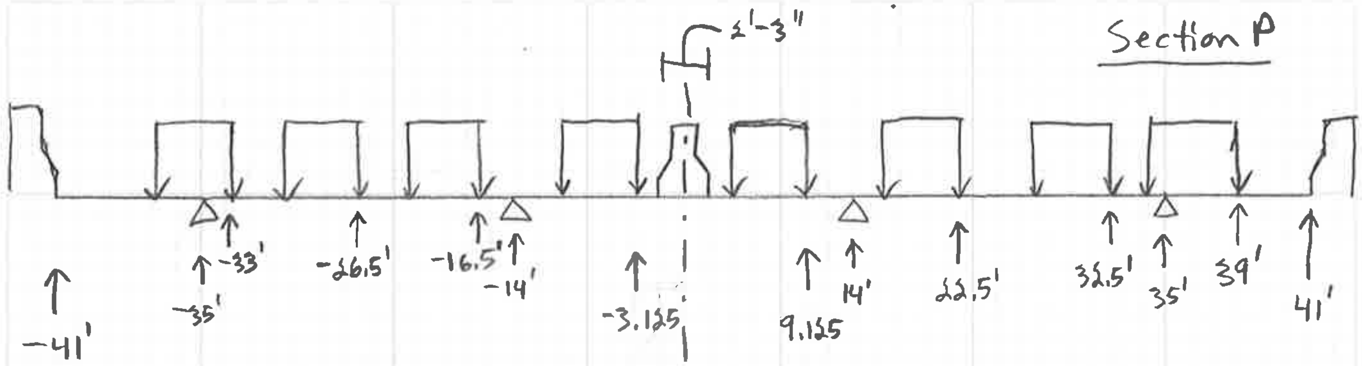
LG = Load Generation

C – E
- M(−) Row 1 Columns → Max LG b/w 601–700
- M(−) Row 4 Columns → Max LG b/w 701–800
- M(+) Bay 1 → Max LG b/w 1–100 or 201–300
- M(+) Bay 3 → Max LG b/w 101–200 or 201–300
- M(+) Bay 2 → Max LG b/w 301–400
- M(−) Row 2 Columns → 401–500
- M(−) Row 3 Columns → 501–600
- Reactions → Max of LC 1 – 6

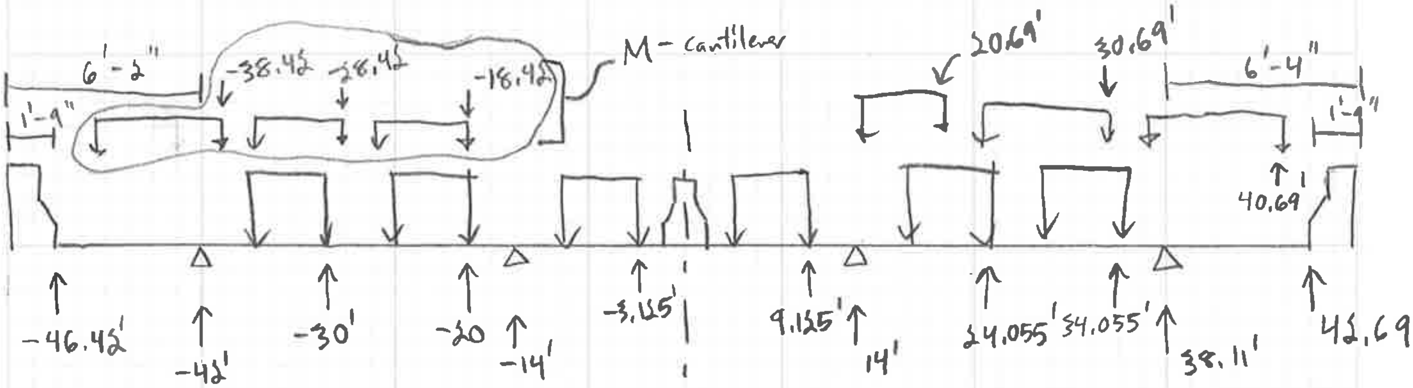
A + B
- M(−) Row 1 Columns → 1401–1500
- M(−) Row 4 → 1501–1600
- M(+) Bay 1 → 801–900 or 1001–1100
- M(+) Bay 3 → 901–1000 or 1001–1100
- M(+) Bay 2 → 1101–1200
- M(−) Row 2 → 1201–1300
- M(−) Row 3 → 1301–1400
- Reactions → Max LC 1 – 6

Made By: ADK	Date: 2/28/12	Job No: P402110046
Checked By: GHD	Date: 2/29/12	Sheet No. 2

Section P



Bent E
(Bent C + D Similar)
N.T.S.



Bent B
(Bent A Similar)
N.T.S.

Calculations for 1/8 US Grid

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 24-Feb-12
JOB NAME Main Avenue Bridge Load Rating
JOB CLIENT Ohio Department of Transportation
JOB NO P402110046
JOB PART Section P
ENGINEER NAME ADK
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 -178.06 0 -51.64; 2 -164.26 0 -49.64; 3 -126.26 0 -45.16; 4 -88.26 0 -42.14;
5 -50.26 0 -40.58; 6 -12.26 0 -40.33; 7 0 0 -40.33; 8 -177.95 0 -48.1;
9 -164.26 0 -46.48; 10 -126.26 0 -42; 11 -88.26 0 -37.83; 12 -177.75 0 -42;
13 -164.26 0 -42; 15 -177.52 0 -35; 16 -164.26 0 -35; 17 -126.26 0 -35;
18 -88.26 0 -35; 19 -50.26 0 -35; 20 -12.26 0 -35; 21 0 0 -35;
22 -177.29 0 -28; 23 -164.26 0 -28; 24 -126.26 0 -28; 25 -88.26 0 -28;
26 -50.26 0 -28; 27 -12.26 0 -28; 28 0 0 -28; 29 -177.06 0 -21;
30 -164.26 0 -21; 31 -126.26 0 -21; 32 -88.26 0 -21; 33 -50.26 0 -21;
34 -12.26 0 -21; 35 0 0 -21; 36 -176.84 0 -14; 37 -164.26 0 -14;
38 -126.26 0 -14; 39 -88.26 0 -14; 40 -50.26 0 -14; 41 -12.26 0 -14;
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47 -50.26 0 -7; 48 -12.26 0 -7; 49 0 0 -7; 50 -176.38 0 0; 51 -164.26 0 0;
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62 -12.26 0 7; 63 0 0 7; 64 -175.92 0 14; 65 -164.26 0 14; 66 -126.26 0 14;
67 -88.26 0 14; 68 -50.26 0 14; 69 -12.26 0 14; 70 0 0 14; 71 -175.69 0 21;
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76 -12.26 0 21; 77 0 0 21; 78 -175.47 0 28; 79 -164.26 0 28; 80 -126.26 0 28;
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90 -12.26 0 35; 91 0 0 35; 92 -175.09 0 39.67; 93 -164.26 0 39.32;
94 -126.26 0 38.11; 95 -88.26 0 36.89; 96 -174.85 0 46.77; 97 -164.26 0 46.3;
98 -126.26 0 44.6; 99 -88.26 0 42.92; 100 -50.26 0 42.18; 101 -12.26 0 40.78;
102 0 0 40.33; 1009 -164.26 -23.857 -46.48; 1010 -126.26 -28 -42;
1011 -88.26 -28 -37.83; 1019 -50.26 -31 -35; 1020 -12.26 -33.5 -35;
1037 -164.26 -23.857 -14; 1038 -126.26 -28 -14; 1039 -88.26 -28 -14;
1040 -50.26 -31 -14; 1041 -12.26 -33.5 -14; 1065 -164.26 -23.857 14;
1066 -126.26 -28 14; 1067 -88.26 -28 14; 1068 -50.26 -31 14;
1069 -12.26 -33.5 14; 1089 -50.26 -31 35; 1090 -12.26 -33.5 35;
1093 -164.26 -23.857 39.32; 1094 -126.26 -28 38.11; 1095 -88.26 -28 36.89;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 8 9; 8 9 10; 9 10 11; 10 12 13;
11 13 10; 12 15 16; 13 16 17; 14 17 18; 15 18 19; 16 19 20; 17 20 21; 18 22 23;
19 23 24; 20 24 25; 21 25 26; 22 26 27; 23 27 28; 24 29 30; 25 30 31; 26 31 32;
27 32 33; 28 33 34; 29 34 35; 30 36 37; 31 37 38; 32 38 39; 33 39 40; 34 40 41;
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1015 1069 69; 1016 1093 93; 1017 1094 94; 1018 1095 95; 1019 1089 89;
1020 1090 90;
SUPPORTS
1009 TO 1011 1019 1020 1037 TO 1041 1065 TO 1069 1089 1090 1093 TO 1095 FIXED
UNIT INCHES KIP
DEFINE MATERIAL START
ISOTROPIC CONCRETE
```

```
8 UNI GY -0.265
9 UNI GY -0.424
10 UNI GY -0.602
11 UNI GY -0.453
12 UNI GY -0.686
13 UNI GY -0.686
14 UNI GY -0.584
15 UNI GY -0.655
16 UNI GY -0.610
17 UNI GY -0.604
72 UNI GY -0.563
73 UNI GY -0.525
74 UNI GY -0.465
75 UNI GY -0.713
76 UNI GY -0.661
77 UNI GY -0.615
78 UNI GY -0.565
79 UNI GY -0.512
80 UNI GY -0.429
81 UNI GY -0.345
82 UNI GY -0.330
83 UNI GY -0.307
84 UNI GY -0.370
85 UNI GY -0.318
86 UNI GY -0.272

UNIT INCHES KIP
PERFORM ANALYSIS
FINISH
```

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 24-Feb-12
JOB NAME Main Avenue Bridge Load Rating
JOB CLIENT Ohio Department of Transportation
JOB NO P402110046
JOB PART Section P
ENGINEER NAME ADK
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 -178.06 0 -51.64; 2 -164.26 0 -49.64; 3 -126.26 0 -45.16; 4 -88.26 0 -42.14;
5 -50.26 0 -40.58; 6 -12.26 0 -40.33; 7 0 0 -40.33; 8 -177.95 0 -48.1;
9 -164.26 0 -46.48; 10 -126.26 0 -42; 11 -88.26 0 -37.83; 12 -177.75 0 -42;
13 -164.26 0 -42; 15 -177.52 0 -35; 16 -164.26 0 -35; 17 -126.26 0 -35;
18 -88.26 0 -35; 19 -50.26 0 -35; 20 -12.26 0 -35; 21 0 0 -35;
22 -177.29 0 -28; 23 -164.26 0 -28; 24 -126.26 0 -28; 25 -88.26 0 -28;
26 -50.26 0 -28; 27 -12.26 0 -28; 28 0 0 -28; 29 -177.06 0 -21;
30 -164.26 0 -21; 31 -126.26 0 -21; 32 -88.26 0 -21; 33 -50.26 0 -21;
34 -12.26 0 -21; 35 0 0 -21; 36 -176.84 0 -14; 37 -164.26 0 -14;
38 -126.26 0 -14; 39 -88.26 0 -14; 40 -50.26 0 -14; 41 -12.26 0 -14;
42 0 0 -14; 43 -176.61 0 -7; 44 -164.26 0 -7; 45 -126.26 0 -7; 46 -88.26 0 -7;
47 -50.26 0 -7; 48 -12.26 0 -7; 49 0 0 -7; 50 -176.38 0 0; 51 -164.26 0 0;
52 -126.26 0 0; 53 -88.26 0 0; 54 -50.26 0 0; 55 -12.26 0 0; 56 0 0 0;
57 -176.15 0 7; 58 -164.26 0 7; 59 -126.26 0 7; 60 -88.26 0 7; 61 -50.26 0 7;
62 -12.26 0 7; 63 0 0 7; 64 -175.92 0 14; 65 -164.26 0 14; 66 -126.26 0 14;
67 -88.26 0 14; 68 -50.26 0 14; 69 -12.26 0 14; 70 0 0 14; 71 -175.69 0 21;
72 -164.26 0 21; 73 -126.26 0 21; 74 -88.26 0 21; 75 -50.26 0 21;
76 -12.26 0 21; 77 0 0 21; 78 -175.47 0 28; 79 -164.26 0 28; 80 -126.26 0 28;
81 -88.26 0 28; 82 -50.26 0 28; 83 -12.26 0 28; 84 0 0 28; 85 -175.24 0 35;
86 -164.26 0 35; 87 -126.26 0 35; 88 -88.26 0 35; 89 -50.26 0 35;
90 -12.26 0 35; 91 0 0 35; 92 -175.09 0 39.67; 93 -164.26 0 39.32;
94 -126.26 0 38.11; 95 -88.26 0 36.89; 96 -174.85 0 46.77; 97 -164.26 0 46.3;
98 -126.26 0 44.6; 99 -88.26 0 42.92; 100 -50.26 0 42.18; 101 -12.26 0 40.78;
102 0 0 40.33; 1009 -164.26 -23.857 -46.48; 1010 -126.26 -28 -42;
1011 -88.26 -28 -37.83; 1019 -50.26 -31 -35; 1020 -12.26 -33.5 -35;
1037 -164.26 -23.857 -14; 1038 -126.26 -28 -14; 1039 -88.26 -28 -14;
1040 -50.26 -31 -14; 1041 -12.26 -33.5 -14; 1065 -164.26 -23.857 14;
1066 -126.26 -28 14; 1067 -88.26 -28 14; 1068 -50.26 -31 14;
1069 -12.26 -33.5 14; 1089 -50.26 -31 35; 1090 -12.26 -33.5 35;
1093 -164.26 -23.857 39.32; 1094 -126.26 -28 38.11; 1095 -88.26 -28 36.89;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 8 9; 8 9 10; 9 10 11; 10 12 13;
11 13 10; 12 15 16; 13 16 17; 14 17 18; 15 18 19; 16 19 20; 17 20 21; 18 22 23;
19 23 24; 20 24 25; 21 25 26; 22 26 27; 23 27 28; 24 29 30; 25 30 31; 26 31 32;
27 32 33; 28 33 34; 29 34 35; 30 36 37; 31 37 38; 32 38 39; 33 39 40; 34 40 41;
35 41 42; 36 43 44; 37 44 45; 38 45 46; 39 46 47; 40 47 48; 41 48 49; 42 50 51;
43 51 52; 44 52 53; 45 53 54; 46 54 55; 47 55 56; 48 57 58; 49 58 59; 50 59 60;
51 60 61; 52 61 62; 53 62 63; 54 64 65; 55 65 66; 56 66 67; 57 67 68; 58 68 69;
59 69 70; 60 71 72; 61 72 73; 62 73 74; 63 74 75; 64 75 76; 65 76 77; 66 78 79;
67 79 80; 68 80 81; 69 81 82; 70 82 83; 71 83 84; 72 85 86; 73 86 87; 74 87 88;
75 88 89; 76 89 90; 77 90 91; 78 92 93; 79 93 94; 80 94 95; 81 96 97; 82 97 98;
83 98 99; 84 99 100; 85 100 101; 86 101 102; 100 2 9; 101 9 13; 102 13 16;
103 16 23; 104 23 30; 105 30 37; 106 37 44; 107 44 51; 108 51 58; 109 58 65;
110 65 72; 111 72 79; 112 79 86; 113 86 93; 114 93 97; 200 3 10; 201 10 17;
202 17 24; 203 24 31; 204 31 38; 205 38 45; 206 45 52; 207 52 59; 208 59 66;
209 66 73; 210 73 80; 211 80 87; 212 87 94; 213 94 98; 300 4 11; 301 11 18;
302 18 25; 303 25 32; 304 32 39; 305 39 46; 306 46 53; 307 53 60; 308 60 67;
309 67 74; 310 74 81; 311 81 88; 312 88 95; 313 95 99; 400 5 19; 401 19 26;
402 26 33; 403 33 40; 404 40 47; 405 47 54; 406 54 61; 407 61 68; 408 68 75;
409 75 82; 410 82 89; 411 89 100; 500 6 20; 501 20 27; 502 27 34; 503 34 41;
504 41 48; 505 48 55; 506 55 62; 507 62 69; 508 69 76; 509 76 83; 510 83 90;
511 90 101; 1001 1009 9; 1002 1010 10; 1003 1011 11; 1004 1019 19;
1005 1020 20; 1006 1037 37; 1007 1038 38; 1008 1039 39; 1009 1040 40;
1010 1041 41; 1011 1065 65; 1012 1066 66; 1013 1067 67; 1014 1068 68;
1015 1069 69; 1016 1093 93; 1017 1094 94; 1018 1095 95; 1019 1089 89;
1020 1090 90;
SUPPORTS
1009 TO 1011 1019 1020 1037 TO 1041 1065 TO 1069 1089 1090 1093 TO 1095 FIXED
UNIT INCHES KIP
DEFINE MATERIAL START
ISOTROPIC CONCRETE
```

```
E 3150
POISSON 0.17
DENSITY 8.7e-005
ALPHA 5e-006
DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1001 TO 1020 PRIS YD 30 ZD 30
MEMBER PROPERTY AMERICAN
1 PRIS YD 50.25 ZD 20.1 YB 43.5 ZB 18
2 PRIS YD 50.25 ZD 18.96 YB 43.5 ZB 18
3 PRIS YD 50.25 ZD 22.43 YB 43.5 ZB 18
4 PRIS YD 50.25 ZD 38.17 YB 43.5 ZB 18
5 PRIS YD 50.25 ZD 32.73 YB 43.5 ZB 18
6 PRIS YD 50.25 ZD 32 YB 43.5 ZB 18
7 PRIS YD 50.25 ZD 51.85 YB 43.5 ZB 18
8 PRIS YD 50.25 ZD 32.42 YB 43.5 ZB 18
9 PRIS YD 50.25 ZD 51.91 YB 43.5 ZB 18
10 PRIS YD 50.25 ZD 73.75 YB 43.5 ZB 18
11 PRIS YD 50.25 ZD 55.45 YB 43.5 ZB 18
12 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
13 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
14 PRIS YD 50.25 ZD 71.48 YB 43.5 ZB 18
15 PRIS YD 50.25 ZD 80.17 YB 43.5 ZB 18
16 PRIS YD 50.25 ZD 74.73 YB 43.5 ZB 18
17 PRIS YD 50.25 ZD 74 YB 43.5 ZB 18
72 PRIS YD 50.25 ZD 68.97 YB 43.5 ZB 18
73 PRIS YD 50.25 ZD 64.29 YB 43.5 ZB 18
74 PRIS YD 50.25 ZD 57 YB 43.5 ZB 18
75 PRIS YD 50.25 ZD 87.32 YB 43.5 ZB 18
76 PRIS YD 50.25 ZD 80.9 YB 43.5 ZB 18
77 PRIS YD 50.25 ZD 75.35 YB 43.5 ZB 18
78 PRIS YD 50.25 ZD 69.2 YB 43.5 ZB 18
79 PRIS YD 50.25 ZD 62.7 YB 43.5 ZB 18
80 PRIS YD 50.25 ZD 52.54 YB 43.5 ZB 18
81 PRIS YD 50.25 ZD 42.23 YB 43.5 ZB 18
82 PRIS YD 50.25 ZD 40.41 YB 43.5 ZB 18
83 PRIS YD 50.25 ZD 37.54 YB 43.5 ZB 18
84 PRIS YD 50.25 ZD 45.32 YB 43.5 ZB 18
85 PRIS YD 50.25 ZD 38.9 YB 43.5 ZB 18
86 PRIS YD 50.25 ZD 33.35 YB 43.5 ZB 18
*Interior Stringers
18 TO 71 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
MEMBER PROPERTY AMERICAN
100 TO 114 PRIS YD 66 ZD 24
200 TO 213 PRIS YD 66 ZD 24
300 TO 313 PRIS YD 66 ZD 24
400 TO 411 PRIS YD 66 ZD 24
500 TO 511 PRIS YD 66 ZD 24
CONSTANTS
MATERIAL CONCRETE ALL

UNIT FEET KIP
**DEFINE LOADINGS
***LLDF OF 1.0 FOR 2 TRUCKS APPLIED***
*HS20
DEFINE MOVING LOAD
TYPE 1 LOAD 16 16 4
DIST 14 14 WID 6
*2F1
TYPE 2 LOAD 10 5
DIST 10 WID 6
*3F1
TYPE 3 LOAD 8.5 8.5 6
DIST 4 10 WID 6
*4F1
TYPE 4 LOAD 7 7 7 6
DIST 4 4 10 WID 6
*5C1
TYPE 5 LOAD 8.5 8.5 8.5 8.5 6
DIST 4 31 4 12 WID 6

***LLDF OF 0.9 FOR 3 TRUCKS APPLIED***
```

```
*HS20
TYPE 6 LOAD 14.4 14.4 3.6
DIST 14 14 WID 6
*2F1
TYPE 7 LOAD 9 4.5
DIST 10 WID 6
*3F1
TYPE 8 LOAD 7.65 7.65 5.4
DIST 4 10 WID 6
*4F1
TYPE 9 LOAD 6.3 6.3 6.3 5.4
DIST 4 4 10 WID 6
*5C1
TYPE 10 LOAD 7.65 7.65 7.65 7.65 5.4
DIST 4 31 4 12 WID 6

***LLDF OF 0.75 FOR >3 TRUCKS APPLIED***
*HS20
TYPE 11 LOAD 12 12 3
DIST 14 14 WID 6
*2F1
TYPE 12 LOAD 7.5 3.75
DIST 10 WID 6
*3F1
TYPE 13 LOAD 6.375 6.375 4.5
DIST 4 10 WID 6
*4F1
TYPE 14 LOAD 5.25 5.25 5.25 4.5
DIST 4 4 10 WID 6
*5C1
TYPE 15 LOAD 6.375 6.375 6.375 6.375 4.5
DIST 4 31 4 12 WID 6

***************************BENT C THROUGH E**************************

**HS20***

**LOAD CASE 1***
*LC 1 Westbound
*Load Generation 1-100
LOAD GENERATION 100
TYPE 1 -116.26 0 -16.5 XINC 1.17
TYPE 1 -116.26 0 -26.5 XINC 1.17
*
**LC 1 Eastbound
*Load Generation 101-200
LOAD GENERATION 100
TYPE 1 -116.26 0 22.5 XINC 1.17
TYPE 1 -116.26 0 32.5 XINC 1.17
*
**LC 1 Both Directions
**Load Generation 201-300
LOAD GENERATION 100
TYPE 11 -116.26 0 -16.5 XINC 1.17
TYPE 11 -116.26 0 -26.5 XINC 1.17
TYPE 11 -116.26 0 22.5 XINC 1.17
TYPE 11 -116.26 0 32.5 XINC 1.17
*
****LOAD CASE 2***
**Load Generation 301-400
LOAD GENERATION 100
TYPE 1 -116.26 0 -3.125 XINC 1.17
TYPE 1 -116.26 0 9.125 XINC 1.17
*
****LOAD CASE 3***
**Load Generation 401-500
LOAD GENERATION 100
TYPE 11 -116.26 0 -26.5 XINC 1.17
TYPE 11 -116.26 0 -16.5 XINC 1.17
TYPE 11 -116.26 0 -3.125 XINC 1.17
TYPE 11 -116.26 0 9.125 XINC 1.17
*
****LOAD CASE 4***
```

```
**Load Generation 501-600
LOAD GENERATION 100
TYPE 11 -116.26 0 -3.125 XINC 1.17
TYPE 11 -116.26 0 9.125 XINC 1.17
TYPE 11 -116.26 0 22.5 XINC 1.17
TYPE 11 -116.26 0 32.5 XINC 1.17
*
****LOAD CASE 5***
**Load Generation 601-700
LOAD GENERATION 100
TYPE 6 -116.26 0 -33 XINC 1.17
TYPE 6 -116.26 0 -26.5 XINC 1.17
TYPE 6 -116.26 0 -16.5 XINC 1.17
*
****LOAD CASE 6***
**Load Generation 701-800
LOAD GENERATION 100
TYPE 6 -116.26 0 22.5 XINC 1.17
TYPE 6 -116.26 0 32.5 XINC 1.17
TYPE 6 -116.26 0 39.0 XINC 1.17
*
****************************BENT A AND B*************************
*
****HS20***
*
****LOAD CASE 1***
**LC 1 Westbound
**Load Generation 801-900
LOAD GENERATION 100
TYPE 1 -206 0 -30 XINC 1.17
TYPE 1 -206 0 -20 XINC 1.17
*
**LC 1 Eastbound
**Load Generation 901-1000
LOAD GENERATION 100
TYPE 1 -206 0 24.05 XINC 1.17
TYPE 1 -206 0 34.05 XINC 1.17
*
**LC 1 Both Directions
**Load Generation 1001-1100
LOAD GENERATION 100
TYPE 11 -206 0 -30 XINC 1.17
TYPE 11 -206 0 -20 XINC 1.17
TYPE 11 -206 0 24.05 XINC 1.17
TYPE 11 -206 0 34.05 XINC 1.17
**
*****LOAD CASE 2***
***Load Generation 1101-1200
LOAD GENERATION 100
TYPE 1 -206 0 -3.125 XINC 1.17
TYPE 1 -206 0 9.125 XINC 1.17
**
*****LOAD CASE 3***
**Load Generation 1201-1300
LOAD GENERATION 100
TYPE 11 -206 0 -30 XINC 1.17
TYPE 11 -206 0 -20 XINC 1.17
TYPE 11 -206 0 -3.125 XINC 1.17
TYPE 11 -206 0 9.125 XINC 1.17
*
****LOAD CASE 4***
**Load Generation 1301-1400
LOAD GENERATION 100
TYPE 11 -206 0 -3.125 XINC 1.17
TYPE 11 -206 0 9.125 XINC 1.17
TYPE 11 -206 0 24.05 XINC 1.17
TYPE 11 -206 0 34.05 XINC 1.17
*
****LOAD CASE 5***
**Load Generation 1401-1500
LOAD GENERATION 100
TYPE 6 -206 0 -38.42 XINC 1.17
TYPE 6 -206 0 -28.42 XINC 1.17
```

```
TYPE 6 -206 0 -18.42 XINC 1.17
*
****LOAD CASE 6***
**Load Generation 1501-1600
LOAD GENERATION 100
TYPE 6 -206 0 20.69 XINC 1.17
TYPE 6 -206 0 30.69 XINC 1.17
TYPE 6 -206 0 40.69 XINC 1.17
*
*


PERFORM ANALYSIS
FINISH
```

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 24-Feb-12
JOB NAME Main Avenue Bridge Load Rating
JOB CLIENT Ohio Department of Transportation
JOB NO P402110046
JOB PART Section P
ENGINEER NAME ADK
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 -178.06 0 -51.64; 2 -164.26 0 -49.64; 3 -126.26 0 -45.16; 4 -88.26 0 -42.14;
5 -50.26 0 -40.58; 6 -12.26 0 -40.33; 7 0 0 -40.33; 8 -177.95 0 -48.1;
9 -164.26 0 -46.48; 10 -126.26 0 -42; 11 -88.26 0 -37.83; 12 -177.75 0 -42;
13 -164.26 0 -42; 15 -177.52 0 -35; 16 -164.26 0 -35; 17 -126.26 0 -35;
18 -88.26 0 -35; 19 -50.26 0 -35; 20 -12.26 0 -35; 21 0 0 -35;
22 -177.29 0 -28; 23 -164.26 0 -28; 24 -126.26 0 -28; 25 -88.26 0 -28;
26 -50.26 0 -28; 27 -12.26 0 -28; 28 0 0 -28; 29 -177.06 0 -21;
30 -164.26 0 -21; 31 -126.26 0 -21; 32 -88.26 0 -21; 33 -50.26 0 -21;
34 -12.26 0 -21; 35 0 0 -21; 36 -176.84 0 -14; 37 -164.26 0 -14;
38 -126.26 0 -14; 39 -88.26 0 -14; 40 -50.26 0 -14; 41 -12.26 0 -14;
42 0 0 -14; 43 -176.61 0 -7; 44 -164.26 0 -7; 45 -126.26 0 -7; 46 -88.26 0 -7;
47 -50.26 0 -7; 48 -12.26 0 -7; 49 0 0 -7; 50 -176.38 0 0; 51 -164.26 0 0;
52 -126.26 0 0; 53 -88.26 0 0; 54 -50.26 0 0; 55 -12.26 0 0; 56 0 0 0;
57 -176.15 0 7; 58 -164.26 0 7; 59 -126.26 0 7; 60 -88.26 0 7; 61 -50.26 0 7;
62 -12.26 0 7; 63 0 0 7; 64 -175.92 0 14; 65 -164.26 0 14; 66 -126.26 0 14;
67 -88.26 0 14; 68 -50.26 0 14; 69 -12.26 0 14; 70 0 0 14; 71 -175.69 0 21;
72 -164.26 0 21; 73 -126.26 0 21; 74 -88.26 0 21; 75 -50.26 0 21;
76 -12.26 0 21; 77 0 0 21; 78 -175.47 0 28; 79 -164.26 0 28; 80 -126.26 0 28;
81 -88.26 0 28; 82 -50.26 0 28; 83 -12.26 0 28; 84 0 0 28; 85 -175.24 0 35;
86 -164.26 0 35; 87 -126.26 0 35; 88 -88.26 0 35; 89 -50.26 0 35;
90 -12.26 0 35; 91 0 0 35; 92 -175.09 0 39.67; 93 -164.26 0 39.32;
94 -126.26 0 38.11; 95 -88.26 0 36.89; 96 -174.85 0 46.77; 97 -164.26 0 46.3;
98 -126.26 0 44.6; 99 -88.26 0 42.92; 100 -50.26 0 42.18; 101 -12.26 0 40.78;
102 0 0 40.33; 1009 -164.26 -23.857 -46.48; 1010 -126.26 -28 -42;
1011 -88.26 -28 -37.83; 1019 -50.26 -31 -35; 1020 -12.26 -33.5 -35;
1037 -164.26 -23.857 -14; 1038 -126.26 -28 -14; 1039 -88.26 -28 -14;
1040 -50.26 -31 -14; 1041 -12.26 -33.5 -14; 1065 -164.26 -23.857 14;
1066 -126.26 -28 14; 1067 -88.26 -28 14; 1068 -50.26 -31 14;
1069 -12.26 -33.5 14; 1089 -50.26 -31 35; 1090 -12.26 -33.5 35;
1093 -164.26 -23.857 39.32; 1094 -126.26 -28 38.11; 1095 -88.26 -28 36.89;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 8 9; 8 9 10; 9 10 11; 10 12 13;
11 13 10; 12 15 16; 13 16 17; 14 17 18; 15 18 19; 16 19 20; 17 20 21; 18 22 23;
19 23 24; 20 24 25; 21 25 26; 22 26 27; 23 27 28; 24 29 30; 25 30 31; 26 31 32;
27 32 33; 28 33 34; 29 34 35; 30 36 37; 31 37 38; 32 38 39; 33 39 40; 34 40 41;
35 41 42; 36 43 44; 37 44 45; 38 45 46; 39 46 47; 40 47 48; 41 48 49; 42 50 51;
43 51 52; 44 52 53; 45 53 54; 46 54 55; 47 55 56; 48 57 58; 49 58 59; 50 59 60;
51 60 61; 52 61 62; 53 62 63; 54 64 65; 55 65 66; 56 66 67; 57 67 68; 58 68 69;
59 69 70; 60 71 72; 61 72 73; 62 73 74; 63 74 75; 64 75 76; 65 76 77; 66 78 79;
67 79 80; 68 80 81; 69 81 82; 70 82 83; 71 83 84; 72 85 86; 73 86 87; 74 87 88;
75 88 89; 76 89 90; 77 90 91; 78 92 93; 79 93 94; 80 94 95; 81 96 97; 82 97 98;
83 98 99; 84 99 100; 85 100 101; 86 101 102; 100 2 9; 101 9 13; 102 13 16;
103 16 23; 104 23 30; 105 30 37; 106 37 44; 107 44 51; 108 51 58; 109 58 65;
110 65 72; 111 72 79; 112 79 86; 113 86 93; 114 93 97; 200 3 10; 201 10 17;
202 17 24; 203 24 31; 204 31 38; 205 38 45; 206 45 52; 207 52 59; 208 59 66;
209 66 73; 210 73 80; 211 80 87; 212 87 94; 213 94 98; 300 4 11; 301 11 18;
302 18 25; 303 25 32; 304 32 39; 305 39 46; 306 46 53; 307 53 60; 308 60 67;
309 67 74; 310 74 81; 311 81 88; 312 88 95; 313 95 99; 400 5 19; 401 19 26;
402 26 33; 403 33 40; 404 40 47; 405 47 54; 406 54 61; 407 61 68; 408 68 75;
409 75 82; 410 82 89; 411 89 100; 500 6 20; 501 20 27; 502 27 34; 503 34 41;
504 41 48; 505 48 55; 506 55 62; 507 62 69; 508 69 76; 509 76 83; 510 83 90;
511 90 101; 1001 1009 9; 1002 1010 10; 1003 1011 11; 1004 1019 19;
1005 1020 20; 1006 1037 37; 1007 1038 38; 1008 1039 39; 1009 1040 40;
1010 1041 41; 1011 1065 65; 1012 1066 66; 1013 1067 67; 1014 1068 68;
1015 1069 69; 1016 1093 93; 1017 1094 94; 1018 1095 95; 1019 1089 89;
1020 1090 90;
SUPPORTS
1009 TO 1011 1019 1020 1037 TO 1041 1065 TO 1069 1089 1090 1093 TO 1095 FIXED
UNIT INCHES KIP
DEFINE MATERIAL START
ISOTROPIC CONCRETE
```

```
E 3150
POISSON 0.17
DENSITY 8.7e-005
ALPHA 5e-006
DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1001 TO 1020 PRIS YD 30 ZD 30
MEMBER PROPERTY AMERICAN
1 PRIS YD 50.25 ZD 20.1 YB 43.5 ZB 18
2 PRIS YD 50.25 ZD 18.96 YB 43.5 ZB 18
3 PRIS YD 50.25 ZD 22.43 YB 43.5 ZB 18
4 PRIS YD 50.25 ZD 38.17 YB 43.5 ZB 18
5 PRIS YD 50.25 ZD 32.73 YB 43.5 ZB 18
6 PRIS YD 50.25 ZD 32 YB 43.5 ZB 18
7 PRIS YD 50.25 ZD 51.85 YB 43.5 ZB 18
8 PRIS YD 50.25 ZD 32.42 YB 43.5 ZB 18
9 PRIS YD 50.25 ZD 51.91 YB 43.5 ZB 18
10 PRIS YD 50.25 ZD 73.75 YB 43.5 ZB 18
11 PRIS YD 50.25 ZD 55.45 YB 43.5 ZB 18
12 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
13 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
14 PRIS YD 50.25 ZD 71.48 YB 43.5 ZB 18
15 PRIS YD 50.25 ZD 80.17 YB 43.5 ZB 18
16 PRIS YD 50.25 ZD 74.73 YB 43.5 ZB 18
17 PRIS YD 50.25 ZD 74 YB 43.5 ZB 18
72 PRIS YD 50.25 ZD 68.97 YB 43.5 ZB 18
73 PRIS YD 50.25 ZD 64.29 YB 43.5 ZB 18
74 PRIS YD 50.25 ZD 57 YB 43.5 ZB 18
75 PRIS YD 50.25 ZD 87.32 YB 43.5 ZB 18
76 PRIS YD 50.25 ZD 80.9 YB 43.5 ZB 18
77 PRIS YD 50.25 ZD 75.35 YB 43.5 ZB 18
78 PRIS YD 50.25 ZD 69.2 YB 43.5 ZB 18
79 PRIS YD 50.25 ZD 62.7 YB 43.5 ZB 18
80 PRIS YD 50.25 ZD 52.54 YB 43.5 ZB 18
81 PRIS YD 50.25 ZD 42.23 YB 43.5 ZB 18
82 PRIS YD 50.25 ZD 40.41 YB 43.5 ZB 18
83 PRIS YD 50.25 ZD 37.54 YB 43.5 ZB 18
84 PRIS YD 50.25 ZD 45.32 YB 43.5 ZB 18
85 PRIS YD 50.25 ZD 38.9 YB 43.5 ZB 18
86 PRIS YD 50.25 ZD 33.35 YB 43.5 ZB 18
*Interior Stringers
18 TO 71 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
MEMBER PROPERTY AMERICAN
100 TO 114 PRIS YD 66 ZD 24
200 TO 213 PRIS YD 66 ZD 24
300 TO 313 PRIS YD 66 ZD 24
400 TO 411 PRIS YD 66 ZD 24
500 TO 511 PRIS YD 66 ZD 24
CONSTANTS
MATERIAL CONCRETE ALL
**DEFINE LOADINGS
***LLDF OF 1.0 FOR 2 TRUCKS APPLIED***
*HS20
UNIT FEET KIP
DEFINE MOVING LOAD
TYPE 1 LOAD 16 16 4
DIST 14 14 WID 6
*2F1
TYPE 2 LOAD 10 5
DIST 10 WID 6
*3F1
TYPE 3 LOAD 8.5 8.5 6
DIST 4 10 WID 6
*4F1
TYPE 4 LOAD 7 7 7 6
DIST 4 4 10 WID 6
*5C1
TYPE 5 LOAD 8.5 8.5 8.5 8.5 6
DIST 4 31 4 12 WID 6
***LLDF OF 0.9 FOR 3 TRUCKS APPLIED***
*HS20
TYPE 6 LOAD 14.4 14.4 3.6
```

```
DIST 14 14 WID 6
*2F1
TYPE 7 LOAD 9 4.5
DIST 10 WID 6
*3F1
TYPE 8 LOAD 7.65 7.65 5.4
DIST 4 10 WID 6
*4F1
TYPE 9 LOAD 6.3 6.3 6.3 5.4
DIST 4 4 10 WID 6
*5C1
TYPE 10 LOAD 7.65 7.65 7.65 7.65 5.4
DIST 4 31 4 12 WID 6
***LLDF OF 0.75 FOR >3 TRUCKS APPLIED***
*HS20
TYPE 11 LOAD 12 12 3
DIST 14 14 WID 6
*2F1
TYPE 12 LOAD 7.5 3.75
DIST 10 WID 6
*3F1
TYPE 13 LOAD 6.375 6.375 4.5
DIST 4 10 WID 6
*4F1
TYPE 14 LOAD 5.25 5.25 5.25 4.5
DIST 4 4 10 WID 6
*5C1
TYPE 15 LOAD 6.375 6.375 6.375 6.375 4.5
DIST 4 31 4 12 WID 6
***************************BENT C THROUGH E**************************

**LOAD CASE 1***
*LC 1 Westbound
*Load Generation 1-100
LOAD GENERATION 100
TYPE 2 -98.26 0 -16.5 XINC 1
TYPE 2 -98.26 0 -26.5 XINC 1
*
**LC 1 Eastbound
*Load Generation 101-200
LOAD GENERATION 100
TYPE 2 -98.26 0 22.5 XINC 1
TYPE 2 -98.26 0 32.5 XINC 1
*
**LC 1 Both Directions
**Load Generation 201-300
LOAD GENERATION 100
TYPE 12 -98.26 0 -16.5 XINC 1
TYPE 12 -98.26 0 -26.5 XINC 1
TYPE 12 -98.26 0 22.5 XINC 1
TYPE 12 -98.26 0 32.5 XINC 1
*
****LOAD CASE 2***
**Load Generation 301-400
LOAD GENERATION 100
TYPE 2 -98.26 0 -3.125 XINC 1
TYPE 2 -98.26 0 9.125 XINC 1
*
****LOAD CASE 3***
**Load Generation 401-500
LOAD GENERATION 100
TYPE 12 -98.26 0 -26.5 XINC 1
TYPE 12 -98.26 0 -16.5 XINC 1
TYPE 12 -98.26 0 -3.125 XINC 1
TYPE 12 -98.26 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 501-600
LOAD GENERATION 100
TYPE 12 -98.26 0 -3.125 XINC 1
TYPE 12 -98.26 0 9.125 XINC 1
TYPE 12 -98.26 0 22.5 XINC 1
TYPE 12 -98.26 0 32.5 XINC 1
```

```
*
****LOAD CASE 5***
**Load Generation 601-700
LOAD GENERATION 100
TYPE 7 -98.26 0 -33 XINC 1
TYPE 7 -98.26 0 -26.5 XINC 1
TYPE 7 -98.26 0 -16.5 XINC 1
*
****LOAD CASE 6***
**Load Generation 701-800
LOAD GENERATION 100
TYPE 7 -98.26 0 22.5 XINC 1
TYPE 7 -98.26 0 32.5 XINC 1
TYPE 7 -98.26 0 39 XINC 1
*
****************************BENT A AND B*************************
*

*
****LOAD CASE 1***
**LC 1 Westbound
**Load Generation 801-900
LOAD GENERATION 100
TYPE 2 -188 0 -30 XINC 1
TYPE 2 -188 0 -20 XINC 1
*
**LC 1 Eastbound
**Load Generation 901-1000
LOAD GENERATION 100
TYPE 2 -188 0 24.05 XINC 1
TYPE 2 -188 0 34.05 XINC 1
*
**LC 1 Both Directions
**Load Generation 1001-1100
LOAD GENERATION 100
TYPE 12 -188 0 -30 XINC 1
TYPE 12 -188 0 -20 XINC 1
TYPE 12 -188 0 24.05 XINC 1
TYPE 12 -188 0 34.05 XINC 1
**
*****LOAD CASE 2***
***Load Generation 1101-1200
LOAD GENERATION 100
TYPE 2 -188 0 -3.125 XINC 1
TYPE 2 -188 0 9.125 XINC 1
**
*****LOAD CASE 3***
**Load Generation 1201-1300
LOAD GENERATION 100
TYPE 12 -188 0 -30 XINC 1
TYPE 12 -188 0 -20 XINC 1
TYPE 12 -188 0 -3.125 XINC 1
TYPE 12 -188 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 1301-1400
LOAD GENERATION 100
TYPE 12 -188 0 -3.125 XINC 1
TYPE 12 -188 0 9.125 XINC 1
TYPE 12 -188 0 24.05 XINC 1
TYPE 12 -188 0 34.05 XINC 1
*
****LOAD CASE 5***
**Load Generation 1401-1500
LOAD GENERATION 100
TYPE 7 -188 0 -38.42 XINC 1
TYPE 7 -188 0 -28.42 XINC 1
TYPE 7 -188 0 -18.42 XINC 1
*
****LOAD CASE 6***
**Load Generation 1501-1600
LOAD GENERATION 100
TYPE 7 -188 0 20.69 XINC 1
```

```
TYPE 7 -188 0 30.69 XINC 1
TYPE 7 -188 0 40.69 XINC 1
*
*
PERFORM ANALYSIS
FINISH
```

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 24-Feb-12
JOB NAME Main Avenue Bridge Load Rating
JOB CLIENT Ohio Department of Transportation
JOB NO P402110046
JOB PART Section P
ENGINEER NAME ADK
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 -178.06 0 -51.64; 2 -164.26 0 -49.64; 3 -126.26 0 -45.16; 4 -88.26 0 -42.14;
5 -50.26 0 -40.58; 6 -12.26 0 -40.33; 7 0 0 -40.33; 8 -177.95 0 -48.1;
9 -164.26 0 -46.48; 10 -126.26 0 -42; 11 -88.26 0 -37.83; 12 -177.75 0 -42;
13 -164.26 0 -42; 15 -177.52 0 -35; 16 -164.26 0 -35; 17 -126.26 0 -35;
18 -88.26 0 -35; 19 -50.26 0 -35; 20 -12.26 0 -35; 21 0 0 -35;
22 -177.29 0 -28; 23 -164.26 0 -28; 24 -126.26 0 -28; 25 -88.26 0 -28;
26 -50.26 0 -28; 27 -12.26 0 -28; 28 0 0 -28; 29 -177.06 0 -21;
30 -164.26 0 -21; 31 -126.26 0 -21; 32 -88.26 0 -21; 33 -50.26 0 -21;
34 -12.26 0 -21; 35 0 0 -21; 36 -176.84 0 -14; 37 -164.26 0 -14;
38 -126.26 0 -14; 39 -88.26 0 -14; 40 -50.26 0 -14; 41 -12.26 0 -14;
42 0 0 -14; 43 -176.61 0 -7; 44 -164.26 0 -7; 45 -126.26 0 -7; 46 -88.26 0 -7;
47 -50.26 0 -7; 48 -12.26 0 -7; 49 0 0 -7; 50 -176.38 0 0; 51 -164.26 0 0;
52 -126.26 0 0; 53 -88.26 0 0; 54 -50.26 0 0; 55 -12.26 0 0; 56 0 0 0;
57 -176.15 0 7; 58 -164.26 0 7; 59 -126.26 0 7; 60 -88.26 0 7; 61 -50.26 0 7;
62 -12.26 0 7; 63 0 0 7; 64 -175.92 0 14; 65 -164.26 0 14; 66 -126.26 0 14;
67 -88.26 0 14; 68 -50.26 0 14; 69 -12.26 0 14; 70 0 0 14; 71 -175.69 0 21;
72 -164.26 0 21; 73 -126.26 0 21; 74 -88.26 0 21; 75 -50.26 0 21;
76 -12.26 0 21; 77 0 0 21; 78 -175.47 0 28; 79 -164.26 0 28; 80 -126.26 0 28;
81 -88.26 0 28; 82 -50.26 0 28; 83 -12.26 0 28; 84 0 0 28; 85 -175.24 0 35;
86 -164.26 0 35; 87 -126.26 0 35; 88 -88.26 0 35; 89 -50.26 0 35;
90 -12.26 0 35; 91 0 0 35; 92 -175.09 0 39.67; 93 -164.26 0 39.32;
94 -126.26 0 38.11; 95 -88.26 0 36.89; 96 -174.85 0 46.77; 97 -164.26 0 46.3;
98 -126.26 0 44.6; 99 -88.26 0 42.92; 100 -50.26 0 42.18; 101 -12.26 0 40.78;
102 0 0 40.33; 1009 -164.26 -23.857 -46.48; 1010 -126.26 -28 -42;
1011 -88.26 -28 -37.83; 1019 -50.26 -31 -35; 1020 -12.26 -33.5 -35;
1037 -164.26 -23.857 -14; 1038 -126.26 -28 -14; 1039 -88.26 -28 -14;
1040 -50.26 -31 -14; 1041 -12.26 -33.5 -14; 1065 -164.26 -23.857 14;
1066 -126.26 -28 14; 1067 -88.26 -28 14; 1068 -50.26 -31 14;
1069 -12.26 -33.5 14; 1089 -50.26 -31 35; 1090 -12.26 -33.5 35;
1093 -164.26 -23.857 39.32; 1094 -126.26 -28 38.11; 1095 -88.26 -28 36.89;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 8 9; 8 9 10; 9 10 11; 10 12 13;
11 13 10; 12 15 16; 13 16 17; 14 17 18; 15 18 19; 16 19 20; 17 20 21; 18 22 23;
19 23 24; 20 24 25; 21 25 26; 22 26 27; 23 27 28; 24 29 30; 25 30 31; 26 31 32;
27 32 33; 28 33 34; 29 34 35; 30 36 37; 31 37 38; 32 38 39; 33 39 40; 34 40 41;
35 41 42; 36 43 44; 37 44 45; 38 45 46; 39 46 47; 40 47 48; 41 48 49; 42 50 51;
43 51 52; 44 52 53; 45 53 54; 46 54 55; 47 55 56; 48 57 58; 49 58 59; 50 59 60;
51 60 61; 52 61 62; 53 62 63; 54 64 65; 55 65 66; 56 66 67; 57 67 68; 58 68 69;
59 69 70; 60 71 72; 61 72 73; 62 73 74; 63 74 75; 64 75 76; 65 76 77; 66 78 79;
67 79 80; 68 80 81; 69 81 82; 70 82 83; 71 83 84; 72 85 86; 73 86 87; 74 87 88;
75 88 89; 76 89 90; 77 90 91; 78 92 93; 79 93 94; 80 94 95; 81 96 97; 82 97 98;
83 98 99; 84 99 100; 85 100 101; 86 101 102; 100 2 9; 101 9 13; 102 13 16;
103 16 23; 104 23 30; 105 30 37; 106 37 44; 107 44 51; 108 51 58; 109 58 65;
110 65 72; 111 72 79; 112 79 86; 113 86 93; 114 93 97; 200 3 10; 201 10 17;
202 17 24; 203 24 31; 204 31 38; 205 38 45; 206 45 52; 207 52 59; 208 59 66;
209 66 73; 210 73 80; 211 80 87; 212 87 94; 213 94 98; 300 4 11; 301 11 18;
302 18 25; 303 25 32; 304 32 39; 305 39 46; 306 46 53; 307 53 60; 308 60 67;
309 67 74; 310 74 81; 311 81 88; 312 88 95; 313 95 99; 400 5 19; 401 19 26;
402 26 33; 403 33 40; 404 40 47; 405 47 54; 406 54 61; 407 61 68; 408 68 75;
409 75 82; 410 82 89; 411 89 100; 500 6 20; 501 20 27; 502 27 34; 503 34 41;
504 41 48; 505 48 55; 506 55 62; 507 62 69; 508 69 76; 509 76 83; 510 83 90;
511 90 101; 1001 1009 9; 1002 1010 10; 1003 1011 11; 1004 1019 19;
1005 1020 20; 1006 1037 37; 1007 1038 38; 1008 1039 39; 1009 1040 40;
1010 1041 41; 1011 1065 65; 1012 1066 66; 1013 1067 67; 1014 1068 68;
1015 1069 69; 1016 1093 93; 1017 1094 94; 1018 1095 95; 1019 1089 89;
1020 1090 90;
SUPPORTS
1009 TO 1011 1019 1020 1037 TO 1041 1065 TO 1069 1089 1090 1093 TO 1095 FIXED
UNIT INCHES KIP
DEFINE MATERIAL START
ISOTROPIC CONCRETE
```

```
E 3150
POISSON 0.17
DENSITY 8.7e-005
ALPHA 5e-006
DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1001 TO 1020 PRIS YD 30 ZD 30
MEMBER PROPERTY AMERICAN
1 PRIS YD 50.25 ZD 20.1 YB 43.5 ZB 18
2 PRIS YD 50.25 ZD 18.96 YB 43.5 ZB 18
3 PRIS YD 50.25 ZD 22.43 YB 43.5 ZB 18
4 PRIS YD 50.25 ZD 38.17 YB 43.5 ZB 18
5 PRIS YD 50.25 ZD 32.73 YB 43.5 ZB 18
6 PRIS YD 50.25 ZD 32 YB 43.5 ZB 18
7 PRIS YD 50.25 ZD 51.85 YB 43.5 ZB 18
8 PRIS YD 50.25 ZD 32.42 YB 43.5 ZB 18
9 PRIS YD 50.25 ZD 51.91 YB 43.5 ZB 18
10 PRIS YD 50.25 ZD 73.75 YB 43.5 ZB 18
11 PRIS YD 50.25 ZD 55.45 YB 43.5 ZB 18
12 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
13 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
14 PRIS YD 50.25 ZD 71.48 YB 43.5 ZB 18
15 PRIS YD 50.25 ZD 80.17 YB 43.5 ZB 18
16 PRIS YD 50.25 ZD 74.73 YB 43.5 ZB 18
17 PRIS YD 50.25 ZD 74 YB 43.5 ZB 18
72 PRIS YD 50.25 ZD 68.97 YB 43.5 ZB 18
73 PRIS YD 50.25 ZD 64.29 YB 43.5 ZB 18
74 PRIS YD 50.25 ZD 57 YB 43.5 ZB 18
75 PRIS YD 50.25 ZD 87.32 YB 43.5 ZB 18
76 PRIS YD 50.25 ZD 80.9 YB 43.5 ZB 18
77 PRIS YD 50.25 ZD 75.35 YB 43.5 ZB 18
78 PRIS YD 50.25 ZD 69.2 YB 43.5 ZB 18
79 PRIS YD 50.25 ZD 62.7 YB 43.5 ZB 18
80 PRIS YD 50.25 ZD 52.54 YB 43.5 ZB 18
81 PRIS YD 50.25 ZD 42.23 YB 43.5 ZB 18
82 PRIS YD 50.25 ZD 40.41 YB 43.5 ZB 18
83 PRIS YD 50.25 ZD 37.54 YB 43.5 ZB 18
84 PRIS YD 50.25 ZD 45.32 YB 43.5 ZB 18
85 PRIS YD 50.25 ZD 38.9 YB 43.5 ZB 18
86 PRIS YD 50.25 ZD 33.35 YB 43.5 ZB 18
*Interior Stringers
18 TO 71 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
MEMBER PROPERTY AMERICAN
100 TO 114 PRIS YD 66 ZD 24
200 TO 213 PRIS YD 66 ZD 24
300 TO 313 PRIS YD 66 ZD 24
400 TO 411 PRIS YD 66 ZD 24
500 TO 511 PRIS YD 66 ZD 24
CONSTANTS
MATERIAL CONCRETE ALL
**DEFINE LOADINGS
***LLDF OF 1.0 FOR 2 TRUCKS APPLIED***
*HS20
UNIT FEET KIP
DEFINE MOVING LOAD
TYPE 1 LOAD 16 16 4
DIST 14 14 WID 6
*2F1
TYPE 2 LOAD 10 5
DIST 10 WID 6
*3F1
TYPE 3 LOAD 8.5 8.5 6
DIST 4 10 WID 6
*4F1
TYPE 4 LOAD 7 7 7 6
DIST 4 4 10 WID 6
*5C1
TYPE 5 LOAD 8.5 8.5 8.5 8.5 6
DIST 4 31 4 12 WID 6
***LLDF OF 0.9 FOR 3 TRUCKS APPLIED***
*HS20
TYPE 6 LOAD 14.4 14.4 3.6
```

```
DIST 14 14 WID 6
*2F1
TYPE 7 LOAD 9 4.5
DIST 10 WID 6
*3F1
TYPE 8 LOAD 7.65 7.65 5.4
DIST 4 10 WID 6
*4F1
TYPE 9 LOAD 6.3 6.3 6.3 5.4
DIST 4 4 10 WID 6
*5C1
TYPE 10 LOAD 7.65 7.65 7.65 7.65 5.4
DIST 4 31 4 12 WID 6
***LLDF OF 0.75 FOR >3 TRUCKS APPLIED***
*HS20
TYPE 11 LOAD 12 12 3
DIST 14 14 WID 6
*2F1
TYPE 12 LOAD 7.5 3.75
DIST 10 WID 6
*3F1
TYPE 13 LOAD 6.375 6.375 4.5
DIST 4 10 WID 6
*4F1
TYPE 14 LOAD 5.25 5.25 5.25 4.5
DIST 4 4 10 WID 6
*5C1
TYPE 15 LOAD 6.375 6.375 6.375 6.375 4.5
DIST 4 31 4 12 WID 6
***************************BENT C THROUGH E**************************
**LOAD CASE 1***
*LC 1 Westbound
*Load Generation 1-100
LOAD GENERATION 100
TYPE 3 -98.26 0 -16.5 XINC 1
TYPE 3 -98.26 0 -26.5 XINC 1
*
**LC 1 Eastbound
*Load Generation 101-200
LOAD GENERATION 100
TYPE 3 -98.26 0 22.5 XINC 1
TYPE 3 -98.26 0 32.5 XINC 1
*
**LC 1 Both Directions
**Load Generation 201-300
LOAD GENERATION 100
TYPE 13 -98.26 0 -16.5 XINC 1
TYPE 13 -98.26 0 -26.5 XINC 1
TYPE 13 -98.26 0 22.5 XINC 1
TYPE 13 -98.26 0 32.5 XINC 1
*
****LOAD CASE 2***
**Load Generation 301-400
LOAD GENERATION 100
TYPE 3 -98.26 0 -3.125 XINC 1
TYPE 3 -98.26 0 9.125 XINC 1
*
****LOAD CASE 3***
**Load Generation 401-500
LOAD GENERATION 100
TYPE 13 -98.26 0 -26.5 XINC 1
TYPE 13 -98.26 0 -16.5 XINC 1
TYPE 13 -98.26 0 -3.125 XINC 1
TYPE 13 -98.26 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 501-600
LOAD GENERATION 100
TYPE 13 -98.26 0 -3.125 XINC 1
TYPE 13 -98.26 0 9.125 XINC 1
TYPE 13 -98.26 0 22.5 XINC 1
TYPE 13 -98.26 0 32.5 XINC 1
*
```

```
****LOAD CASE 5***
**Load Generation 601-700
LOAD GENERATION 100
TYPE 8 -98.26 0 -33 XINC 1
TYPE 8 -98.26 0 -26.5 XINC 1
TYPE 8 -98.26 0 -16.5 XINC 1
*
****LOAD CASE 6***
**Load Generation 701-800
LOAD GENERATION 100
TYPE 8 -98.26 0 22.5 XINC 1
TYPE 8 -98.26 0 32.5 XINC 1
TYPE 8 -98.26 0 39 XINC 1
*
****************************BENT A AND B**************************
*
*
****LOAD CASE 1***
**LC 1 Westbound
**Load Generation 801-900
LOAD GENERATION 100
TYPE 3 -188 0 -30 XINC 1
TYPE 3 -188 0 -20 XINC 1
*
**LC 1 Eastbound
**Load Generation 901-1000
LOAD GENERATION 100
TYPE 3 -188 0 24.05 XINC 1
TYPE 3 -188 0 34.05 XINC 1
*
**LC 1 Both Directions
**Load Generation 1001-1100
LOAD GENERATION 100
TYPE 13 -188 0 -30 XINC 1
TYPE 13 -188 0 -20 XINC 1
TYPE 13 -188 0 24.05 XINC 1
TYPE 13 -188 0 34.05 XINC 1
**
*****LOAD CASE 2***
***Load Generation 1101-1200
LOAD GENERATION 100
TYPE 3 -188 0 -3.125 XINC 1
TYPE 3 -188 0 9.125 XINC 1
**
*****LOAD CASE 3***
**Load Generation 1201-1300
LOAD GENERATION 100
TYPE 13 -188 0 -30 XINC 1
TYPE 13 -188 0 -20 XINC 1
TYPE 13 -188 0 -3.125 XINC 1
TYPE 13 -188 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 1301-1400
LOAD GENERATION 100
TYPE 13 -188 0 -3.125 XINC 1
TYPE 13 -188 0 9.125 XINC 1
TYPE 13 -188 0 24.05 XINC 1
TYPE 13 -188 0 34.05 XINC 1
*
****LOAD CASE 5***
**Load Generation 1401-1500
LOAD GENERATION 100
TYPE 8 -188 0 -38.42 XINC 1
TYPE 8 -188 0 -28.42 XINC 1
TYPE 8 -188 0 -18.42 XINC 1
*
****LOAD CASE 6***
**Load Generation 1501-1600
LOAD GENERATION 100
TYPE 8 -188 0 20.69 XINC 1
TYPE 8 -188 0 30.69 XINC 1
TYPE 8 -188 0 40.69 XINC 1
```

```
*
*
PERFORM ANALYSIS
FINISH
```

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 24-Feb-12
JOB NAME Main Avenue Bridge Load Rating
JOB CLIENT Ohio Department of Transportation
JOB NO P402110046
JOB PART Section P
ENGINEER NAME ADK
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 -178.06 0 -51.64; 2 -164.26 0 -49.64; 3 -126.26 0 -45.16; 4 -88.26 0 -42.14;
5 -50.26 0 -40.58; 6 -12.26 0 -40.33; 7 0 0 -40.33; 8 -177.95 0 -48.1;
9 -164.26 0 -46.48; 10 -126.26 0 -42; 11 -88.26 0 -37.83; 12 -177.75 0 -42;
13 -164.26 0 -42; 15 -177.52 0 -35; 16 -164.26 0 -35; 17 -126.26 0 -35;
18 -88.26 0 -35; 19 -50.26 0 -35; 20 -12.26 0 -35; 21 0 0 -35;
22 -177.29 0 -28; 23 -164.26 0 -28; 24 -126.26 0 -28; 25 -88.26 0 -28;
26 -50.26 0 -28; 27 -12.26 0 -28; 28 0 0 -28; 29 -177.06 0 -21;
30 -164.26 0 -21; 31 -126.26 0 -21; 32 -88.26 0 -21; 33 -50.26 0 -21;
34 -12.26 0 -21; 35 0 0 -21; 36 -176.84 0 -14; 37 -164.26 0 -14;
38 -126.26 0 -14; 39 -88.26 0 -14; 40 -50.26 0 -14; 41 -12.26 0 -14;
42 0 0 -14; 43 -176.61 0 -7; 44 -164.26 0 -7; 45 -126.26 0 -7; 46 -88.26 0 -7;
47 -50.26 0 -7; 48 -12.26 0 -7; 49 0 0 -7; 50 -176.38 0 0; 51 -164.26 0 0;
52 -126.26 0 0; 53 -88.26 0 0; 54 -50.26 0 0; 55 -12.26 0 0; 56 0 0 0;
57 -176.15 0 7; 58 -164.26 0 7; 59 -126.26 0 7; 60 -88.26 0 7; 61 -50.26 0 7;
62 -12.26 0 7; 63 0 0 7; 64 -175.92 0 14; 65 -164.26 0 14; 66 -126.26 0 14;
67 -88.26 0 14; 68 -50.26 0 14; 69 -12.26 0 14; 70 0 0 14; 71 -175.69 0 21;
72 -164.26 0 21; 73 -126.26 0 21; 74 -88.26 0 21; 75 -50.26 0 21;
76 -12.26 0 21; 77 0 0 21; 78 -175.47 0 28; 79 -164.26 0 28; 80 -126.26 0 28;
81 -88.26 0 28; 82 -50.26 0 28; 83 -12.26 0 28; 84 0 0 28; 85 -175.24 0 35;
86 -164.26 0 35; 87 -126.26 0 35; 88 -88.26 0 35; 89 -50.26 0 35;
90 -12.26 0 35; 91 0 0 35; 92 -175.09 0 39.67; 93 -164.26 0 39.32;
94 -126.26 0 38.11; 95 -88.26 0 36.89; 96 -174.85 0 46.77; 97 -164.26 0 46.3;
98 -126.26 0 44.6; 99 -88.26 0 42.92; 100 -50.26 0 42.18; 101 -12.26 0 40.78;
102 0 0 40.33; 1009 -164.26 -23.857 -46.48; 1010 -126.26 -28 -42;
1011 -88.26 -28 -37.83; 1019 -50.26 -31 -35; 1020 -12.26 -33.5 -35;
1037 -164.26 -23.857 -14; 1038 -126.26 -28 -14; 1039 -88.26 -28 -14;
1040 -50.26 -31 -14; 1041 -12.26 -33.5 -14; 1065 -164.26 -23.857 14;
1066 -126.26 -28 14; 1067 -88.26 -28 14; 1068 -50.26 -31 14;
1069 -12.26 -33.5 14; 1089 -50.26 -31 35; 1090 -12.26 -33.5 35;
1093 -164.26 -23.857 39.32; 1094 -126.26 -28 38.11; 1095 -88.26 -28 36.89;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 8 9; 8 9 10; 9 10 11; 10 12 13;
11 13 10; 12 15 16; 13 16 17; 14 17 18; 15 18 19; 16 19 20; 17 20 21; 18 22 23;
19 23 24; 20 24 25; 21 25 26; 22 26 27; 23 27 28; 24 29 30; 25 30 31; 26 31 32;
27 32 33; 28 33 34; 29 34 35; 30 36 37; 31 37 38; 32 38 39; 33 39 40; 34 40 41;
35 41 42; 36 43 44; 37 44 45; 38 45 46; 39 46 47; 40 47 48; 41 48 49; 42 50 51;
43 51 52; 44 52 53; 45 53 54; 46 54 55; 47 55 56; 48 57 58; 49 58 59; 50 59 60;
51 60 61; 52 61 62; 53 62 63; 54 64 65; 55 65 66; 56 66 67; 57 67 68; 58 68 69;
59 69 70; 60 71 72; 61 72 73; 62 73 74; 63 74 75; 64 75 76; 65 76 77; 66 78 79;
67 79 80; 68 80 81; 69 81 82; 70 82 83; 71 83 84; 72 85 86; 73 86 87; 74 87 88;
75 88 89; 76 89 90; 77 90 91; 78 92 93; 79 93 94; 80 94 95; 81 96 97; 82 97 98;
83 98 99; 84 99 100; 85 100 101; 86 101 102; 100 2 9; 101 9 13; 102 13 16;
103 16 23; 104 23 30; 105 30 37; 106 37 44; 107 44 51; 108 51 58; 109 58 65;
110 65 72; 111 72 79; 112 79 86; 113 86 93; 114 93 97; 200 3 10; 201 10 17;
202 17 24; 203 24 31; 204 31 38; 205 38 45; 206 45 52; 207 52 59; 208 59 66;
209 66 73; 210 73 80; 211 80 87; 212 87 94; 213 94 98; 300 4 11; 301 11 18;
302 18 25; 303 25 32; 304 32 39; 305 39 46; 306 46 53; 307 53 60; 308 60 67;
309 67 74; 310 74 81; 311 81 88; 312 88 95; 313 95 99; 400 5 19; 401 19 26;
402 26 33; 403 33 40; 404 40 47; 405 47 54; 406 54 61; 407 61 68; 408 68 75;
409 75 82; 410 82 89; 411 89 100; 500 6 20; 501 20 27; 502 27 34; 503 34 41;
504 41 48; 505 48 55; 506 55 62; 507 62 69; 508 69 76; 509 76 83; 510 83 90;
511 90 101; 1001 1009 9; 1002 1010 10; 1003 1011 11; 1004 1019 19;
1005 1020 20; 1006 1037 37; 1007 1038 38; 1008 1039 39; 1009 1040 40;
1010 1041 41; 1011 1065 65; 1012 1066 66; 1013 1067 67; 1014 1068 68;
1015 1069 69; 1016 1093 93; 1017 1094 94; 1018 1095 95; 1019 1089 89;
1020 1090 90;
SUPPORTS
1009 TO 1011 1019 1020 1037 TO 1041 1065 TO 1069 1089 1090 1093 TO 1095 FIXED
UNIT INCHES KIP
DEFINE MATERIAL START
ISOTROPIC CONCRETE
```

```
E 3150
POISSON 0.17
DENSITY 8.7e-005
ALPHA 5e-006
DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1001 TO 1020 PRIS YD 30 ZD 30
MEMBER PROPERTY AMERICAN
1 PRIS YD 50.25 ZD 20.1 YB 43.5 ZB 18
2 PRIS YD 50.25 ZD 18.96 YB 43.5 ZB 18
3 PRIS YD 50.25 ZD 22.43 YB 43.5 ZB 18
4 PRIS YD 50.25 ZD 38.17 YB 43.5 ZB 18
5 PRIS YD 50.25 ZD 32.73 YB 43.5 ZB 18
6 PRIS YD 50.25 ZD 32 YB 43.5 ZB 18
7 PRIS YD 50.25 ZD 51.85 YB 43.5 ZB 18
8 PRIS YD 50.25 ZD 32.42 YB 43.5 ZB 18
9 PRIS YD 50.25 ZD 51.91 YB 43.5 ZB 18
10 PRIS YD 50.25 ZD 73.75 YB 43.5 ZB 18
11 PRIS YD 50.25 ZD 55.45 YB 43.5 ZB 18
12 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
13 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
14 PRIS YD 50.25 ZD 71.48 YB 43.5 ZB 18
15 PRIS YD 50.25 ZD 80.17 YB 43.5 ZB 18
16 PRIS YD 50.25 ZD 74.73 YB 43.5 ZB 18
17 PRIS YD 50.25 ZD 74 YB 43.5 ZB 18
72 PRIS YD 50.25 ZD 68.97 YB 43.5 ZB 18
73 PRIS YD 50.25 ZD 64.29 YB 43.5 ZB 18
74 PRIS YD 50.25 ZD 57 YB 43.5 ZB 18
75 PRIS YD 50.25 ZD 87.32 YB 43.5 ZB 18
76 PRIS YD 50.25 ZD 80.9 YB 43.5 ZB 18
77 PRIS YD 50.25 ZD 75.35 YB 43.5 ZB 18
78 PRIS YD 50.25 ZD 69.2 YB 43.5 ZB 18
79 PRIS YD 50.25 ZD 62.7 YB 43.5 ZB 18
80 PRIS YD 50.25 ZD 52.54 YB 43.5 ZB 18
81 PRIS YD 50.25 ZD 42.23 YB 43.5 ZB 18
82 PRIS YD 50.25 ZD 40.41 YB 43.5 ZB 18
83 PRIS YD 50.25 ZD 37.54 YB 43.5 ZB 18
84 PRIS YD 50.25 ZD 45.32 YB 43.5 ZB 18
85 PRIS YD 50.25 ZD 38.9 YB 43.5 ZB 18
86 PRIS YD 50.25 ZD 33.35 YB 43.5 ZB 18
*Interior Stringers
18 TO 71 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
MEMBER PROPERTY AMERICAN
100 TO 114 PRIS YD 66 ZD 24
200 TO 213 PRIS YD 66 ZD 24
300 TO 313 PRIS YD 66 ZD 24
400 TO 411 PRIS YD 66 ZD 24
500 TO 511 PRIS YD 66 ZD 24
CONSTANTS
MATERIAL CONCRETE ALL
**DEFINE LOADINGS
***LLDF OF 1.0 FOR 2 TRUCKS APPLIED***
*HS20
UNIT FEET KIP
DEFINE MOVING LOAD
TYPE 1 LOAD 16 16 4
DIST 14 14 WID 6
*2F1
TYPE 2 LOAD 10 5
DIST 10 WID 6
*3F1
TYPE 3 LOAD 8.5 8.5 6
DIST 4 10 WID 6
*4F1
TYPE 4 LOAD 7 7 7 6
DIST 4 4 10 WID 6
*5C1
TYPE 5 LOAD 8.5 8.5 8.5 8.5 6
DIST 4 31 4 12 WID 6
***LLDF OF 0.9 FOR 3 TRUCKS APPLIED***
*HS20
TYPE 6 LOAD 14.4 14.4 3.6
```

```
DIST 14 14 WID 6
*2F1
TYPE 7 LOAD 9 4.5
DIST 10 WID 6
*3F1
TYPE 8 LOAD 7.65 7.65 5.4
DIST 4 10 WID 6
*4F1
TYPE 9 LOAD 6.3 6.3 6.3 5.4
DIST 4 4 10 WID 6
*5C1
TYPE 10 LOAD 7.65 7.65 7.65 7.65 5.4
DIST 4 31 4 12 WID 6
***LLDF OF 0.75 FOR >3 TRUCKS APPLIED***
*HS20
TYPE 11 LOAD 12 12 3
DIST 14 14 WID 6
*2F1
TYPE 12 LOAD 7.5 3.75
DIST 10 WID 6
*3F1
TYPE 13 LOAD 6.375 6.375 4.5
DIST 4 10 WID 6
*4F1
TYPE 14 LOAD 5.25 5.25 5.25 4.5
DIST 4 4 10 WID 6
*5C1
TYPE 15 LOAD 6.375 6.375 6.375 6.375 4.5
DIST 4 31 4 12 WID 6
***************************BENT C THROUGH E**************************
**LOAD CASE 1***
*LC 1 Westbound
*Load Generation 1-100
LOAD GENERATION 100
TYPE 4 -102.26 0 -16.5 XINC 1
TYPE 4 -102.26 0 -26.5 XINC 1
*
**LC 1 Eastbound
*Load Generation 101-200
LOAD GENERATION 100
TYPE 4 -102.26 0 22.5 XINC 1
TYPE 4 -102.26 0 32.5 XINC 1
*
**LC 1 Both Directions
**Load Generation 201-300
LOAD GENERATION 100
TYPE 14 -102.26 0 -16.5 XINC 1
TYPE 14 -102.26 0 -26.5 XINC 1
TYPE 14 -102.26 0 22.5 XINC 1
TYPE 14 -102.26 0 32.5 XINC 1
*
****LOAD CASE 2***
**Load Generation 301-400
LOAD GENERATION 100
TYPE 4 -102.26 0 -3.125 XINC 1
TYPE 4 -102.26 0 9.125 XINC 1
*
****LOAD CASE 3***
**Load Generation 401-500
LOAD GENERATION 100
TYPE 14 -102.26 0 -26.5 XINC 1
TYPE 14 -102.26 0 -16.5 XINC 1
TYPE 14 -102.26 0 -3.125 XINC 1
TYPE 14 -102.26 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 501-600
LOAD GENERATION 100
TYPE 14 -102.26 0 -3.125 XINC 1
TYPE 14 -102.26 0 9.125 XINC 1
TYPE 14 -102.26 0 22.5 XINC 1
TYPE 14 -102.26 0 32.5 XINC 1
*
```

```
****LOAD CASE 5***
**Load Generation 601-700
LOAD GENERATION 100
TYPE 9 -102.26 0 -33 XINC 1
TYPE 9 -102.26 0 -26.5 XINC 1
TYPE 9 -102.26 0 -16.5 XINC 1
*
****LOAD CASE 6***
**Load Generation 701-800
LOAD GENERATION 100
TYPE 9 -102.26 0 22.5 XINC 1
TYPE 9 -102.26 0 32.5 XINC 1
TYPE 9 -102.26 0 39 XINC 1
*
****************************BENT A AND B*************************
*
*
****LOAD CASE 1***
**LC 1 Westbound
**Load Generation 801-900
LOAD GENERATION 100
TYPE 4 -192 0 -30 XINC 1
TYPE 4 -192 0 -20 XINC 1
*
**LC 1 Eastbound
**Load Generation 901-1000
LOAD GENERATION 100
TYPE 4 -192 0 24.05 XINC 1
TYPE 4 -192 0 34.05 XINC 1
*
**LC 1 Both Directions
**Load Generation 1001-1100
LOAD GENERATION 100
TYPE 14 -192 0 -30 XINC 1
TYPE 14 -192 0 -20 XINC 1
TYPE 14 -192 0 24.05 XINC 1
TYPE 14 -192 0 34.05 XINC 1
**
*****LOAD CASE 2***
***Load Generation 1101-1200
LOAD GENERATION 100
TYPE 4 -192 0 -3.125 XINC 1
TYPE 4 -192 0 9.125 XINC 1
**
*****LOAD CASE 3***
**Load Generation 1201-1300
LOAD GENERATION 100
TYPE 14 -192 0 -30 XINC 1
TYPE 14 -192 0 -20 XINC 1
TYPE 14 -192 0 -3.125 XINC 1
TYPE 14 -192 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 1301-1400
LOAD GENERATION 100
TYPE 14 -192 0 -3.125 XINC 1
TYPE 14 -192 0 9.125 XINC 1
TYPE 14 -192 0 24.05 XINC 1
TYPE 14 -192 0 34.05 XINC 1
*
****LOAD CASE 5***
**Load Generation 1401-1500
LOAD GENERATION 100
TYPE 9 -192 0 -38.42 XINC 1
TYPE 9 -192 0 -28.42 XINC 1
TYPE 9 -192 0 -18.42 XINC 1
*
****LOAD CASE 6***
**Load Generation 1501-1600
LOAD GENERATION 100
TYPE 9 -192 0 20.69 XINC 1
TYPE 9 -192 0 30.69 XINC 1
TYPE 9 -192 0 40.69 XINC 1
```

```
*
*
PERFORM ANALYSIS
FINISH
```

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 24-Feb-12
JOB NAME Main Avenue Bridge Load Rating
JOB CLIENT Ohio Department of Transportation
JOB NO P402110046
JOB PART Section P
ENGINEER NAME ADK
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 -178.06 0 -51.64; 2 -164.26 0 -49.64; 3 -126.26 0 -45.16; 4 -88.26 0 -42.14;
5 -50.26 0 -40.58; 6 -12.26 0 -40.33; 7 0 0 -40.33; 8 -177.95 0 -48.1;
9 -164.26 0 -46.48; 10 -126.26 0 -42; 11 -88.26 0 -37.83; 12 -177.75 0 -42;
13 -164.26 0 -42; 15 -177.52 0 -35; 16 -164.26 0 -35; 17 -126.26 0 -35;
18 -88.26 0 -35; 19 -50.26 0 -35; 20 -12.26 0 -35; 21 0 0 -35;
22 -177.29 0 -28; 23 -164.26 0 -28; 24 -126.26 0 -28; 25 -88.26 0 -28;
26 -50.26 0 -28; 27 -12.26 0 -28; 28 0 0 -28; 29 -177.06 0 -21;
30 -164.26 0 -21; 31 -126.26 0 -21; 32 -88.26 0 -21; 33 -50.26 0 -21;
34 -12.26 0 -21; 35 0 0 -21; 36 -176.84 0 -14; 37 -164.26 0 -14;
38 -126.26 0 -14; 39 -88.26 0 -14; 40 -50.26 0 -14; 41 -12.26 0 -14;
42 0 0 -14; 43 -176.61 0 -7; 44 -164.26 0 -7; 45 -126.26 0 -7; 46 -88.26 0 -7;
47 -50.26 0 -7; 48 -12.26 0 -7; 49 0 0 -7; 50 -176.38 0 0; 51 -164.26 0 0;
52 -126.26 0 0; 53 -88.26 0 0; 54 -50.26 0 0; 55 -12.26 0 0; 56 0 0 0;
57 -176.15 0 7; 58 -164.26 0 7; 59 -126.26 0 7; 60 -88.26 0 7; 61 -50.26 0 7;
62 -12.26 0 7; 63 0 0 7; 64 -175.92 0 14; 65 -164.26 0 14; 66 -126.26 0 14;
67 -88.26 0 14; 68 -50.26 0 14; 69 -12.26 0 14; 70 0 0 14; 71 -175.69 0 21;
72 -164.26 0 21; 73 -126.26 0 21; 74 -88.26 0 21; 75 -50.26 0 21;
76 -12.26 0 21; 77 0 0 21; 78 -175.47 0 28; 79 -164.26 0 28; 80 -126.26 0 28;
81 -88.26 0 28; 82 -50.26 0 28; 83 -12.26 0 28; 84 0 0 28; 85 -175.24 0 35;
86 -164.26 0 35; 87 -126.26 0 35; 88 -88.26 0 35; 89 -50.26 0 35;
90 -12.26 0 35; 91 0 0 35; 92 -175.09 0 39.67; 93 -164.26 0 39.32;
94 -126.26 0 38.11; 95 -88.26 0 36.89; 96 -174.85 0 46.77; 97 -164.26 0 46.3;
98 -126.26 0 44.6; 99 -88.26 0 42.92; 100 -50.26 0 42.18; 101 -12.26 0 40.78;
102 0 0 40.33; 1009 -164.26 -23.857 -46.48; 1010 -126.26 -28 -42;
1011 -88.26 -28 -37.83; 1019 -50.26 -31 -35; 1020 -12.26 -33.5 -35;
1037 -164.26 -23.857 -14; 1038 -126.26 -28 -14; 1039 -88.26 -28 -14;
1040 -50.26 -31 -14; 1041 -12.26 -33.5 -14; 1065 -164.26 -23.857 14;
1066 -126.26 -28 14; 1067 -88.26 -28 14; 1068 -50.26 -31 14;
1069 -12.26 -33.5 14; 1089 -50.26 -31 35; 1090 -12.26 -33.5 35;
1093 -164.26 -23.857 39.32; 1094 -126.26 -28 38.11; 1095 -88.26 -28 36.89;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 8 9; 8 9 10; 9 10 11; 10 12 13;
11 13 10; 12 15 16; 13 16 17; 14 17 18; 15 18 19; 16 19 20; 17 20 21; 18 22 23;
19 23 24; 20 24 25; 21 25 26; 22 26 27; 23 27 28; 24 29 30; 25 30 31; 26 31 32;
27 32 33; 28 33 34; 29 34 35; 30 36 37; 31 37 38; 32 38 39; 33 39 40; 34 40 41;
35 41 42; 36 43 44; 37 44 45; 38 45 46; 39 46 47; 40 47 48; 41 48 49; 42 50 51;
43 51 52; 44 52 53; 45 53 54; 46 54 55; 47 55 56; 48 57 58; 49 58 59; 50 59 60;
51 60 61; 52 61 62; 53 62 63; 54 64 65; 55 65 66; 56 66 67; 57 67 68; 58 68 69;
59 69 70; 60 71 72; 61 72 73; 62 73 74; 63 74 75; 64 75 76; 65 76 77; 66 78 79;
67 79 80; 68 80 81; 69 81 82; 70 82 83; 71 83 84; 72 85 86; 73 86 87; 74 87 88;
75 88 89; 76 89 90; 77 90 91; 78 92 93; 79 93 94; 80 94 95; 81 96 97; 82 97 98;
83 98 99; 84 99 100; 85 100 101; 86 101 102; 100 2 9; 101 9 13; 102 13 16;
103 16 23; 104 23 30; 105 30 37; 106 37 44; 107 44 51; 108 51 58; 109 58 65;
110 65 72; 111 72 79; 112 79 86; 113 86 93; 114 93 97; 200 3 10; 201 10 17;
202 17 24; 203 24 31; 204 31 38; 205 38 45; 206 45 52; 207 52 59; 208 59 66;
209 66 73; 210 73 80; 211 80 87; 212 87 94; 213 94 98; 300 4 11; 301 11 18;
302 18 25; 303 25 32; 304 32 39; 305 39 46; 306 46 53; 307 53 60; 308 60 67;
309 67 74; 310 74 81; 311 81 88; 312 88 95; 313 95 99; 400 5 19; 401 19 26;
402 26 33; 403 33 40; 404 40 47; 405 47 54; 406 54 61; 407 61 68; 408 68 75;
409 75 82; 410 82 89; 411 89 100; 500 6 20; 501 20 27; 502 27 34; 503 34 41;
504 41 48; 505 48 55; 506 55 62; 507 62 69; 508 69 76; 509 76 83; 510 83 90;
511 90 101; 1001 1009 9; 1002 1010 10; 1003 1011 11; 1004 1019 19;
1005 1020 20; 1006 1037 37; 1007 1038 38; 1008 1039 39; 1009 1040 40;
1010 1041 41; 1011 1065 65; 1012 1066 66; 1013 1067 67; 1014 1068 68;
1015 1069 69; 1016 1093 93; 1017 1094 94; 1018 1095 95; 1019 1089 89;
1020 1090 90;
SUPPORTS
1009 TO 1011 1019 1020 1037 TO 1041 1065 TO 1069 1089 1090 1093 TO 1095 FIXED
UNIT INCHES KIP
DEFINE MATERIAL START
ISOTROPIC CONCRETE
```

```
E 3150
POISSON 0.17
DENSITY 8.7e-005
ALPHA 5e-006
DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1001 TO 1020 PRIS YD 30 ZD 30
MEMBER PROPERTY AMERICAN
1 PRIS YD 50.25 ZD 20.1 YB 43.5 ZB 18
2 PRIS YD 50.25 ZD 18.96 YB 43.5 ZB 18
3 PRIS YD 50.25 ZD 22.43 YB 43.5 ZB 18
4 PRIS YD 50.25 ZD 38.17 YB 43.5 ZB 18
5 PRIS YD 50.25 ZD 32.73 YB 43.5 ZB 18
6 PRIS YD 50.25 ZD 32 YB 43.5 ZB 18
7 PRIS YD 50.25 ZD 51.85 YB 43.5 ZB 18
8 PRIS YD 50.25 ZD 32.42 YB 43.5 ZB 18
9 PRIS YD 50.25 ZD 51.91 YB 43.5 ZB 18
10 PRIS YD 50.25 ZD 73.75 YB 43.5 ZB 18
11 PRIS YD 50.25 ZD 55.45 YB 43.5 ZB 18
12 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
13 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
14 PRIS YD 50.25 ZD 71.48 YB 43.5 ZB 18
15 PRIS YD 50.25 ZD 80.17 YB 43.5 ZB 18
16 PRIS YD 50.25 ZD 74.73 YB 43.5 ZB 18
17 PRIS YD 50.25 ZD 74 YB 43.5 ZB 18
72 PRIS YD 50.25 ZD 68.97 YB 43.5 ZB 18
73 PRIS YD 50.25 ZD 64.29 YB 43.5 ZB 18
74 PRIS YD 50.25 ZD 57 YB 43.5 ZB 18
75 PRIS YD 50.25 ZD 87.32 YB 43.5 ZB 18
76 PRIS YD 50.25 ZD 80.9 YB 43.5 ZB 18
77 PRIS YD 50.25 ZD 75.35 YB 43.5 ZB 18
78 PRIS YD 50.25 ZD 69.2 YB 43.5 ZB 18
79 PRIS YD 50.25 ZD 62.7 YB 43.5 ZB 18
80 PRIS YD 50.25 ZD 52.54 YB 43.5 ZB 18
81 PRIS YD 50.25 ZD 42.23 YB 43.5 ZB 18
82 PRIS YD 50.25 ZD 40.41 YB 43.5 ZB 18
83 PRIS YD 50.25 ZD 37.54 YB 43.5 ZB 18
84 PRIS YD 50.25 ZD 45.32 YB 43.5 ZB 18
85 PRIS YD 50.25 ZD 38.9 YB 43.5 ZB 18
86 PRIS YD 50.25 ZD 33.35 YB 43.5 ZB 18
*Interior Stringers
18 TO 71 PRIS YD 50.25 ZD 84 YB 43.5 ZB 18
MEMBER PROPERTY AMERICAN
100 TO 114 PRIS YD 66 ZD 24
200 TO 213 PRIS YD 66 ZD 24
300 TO 313 PRIS YD 66 ZD 24
400 TO 411 PRIS YD 66 ZD 24
500 TO 511 PRIS YD 66 ZD 24
CONSTANTS
MATERIAL CONCRETE ALL
**DEFINE LOADINGS
***LLDF OF 1.0 FOR 2 TRUCKS APPLIED***
*HS20
UNIT FEET KIP
DEFINE MOVING LOAD
TYPE 1 LOAD 16 16 4
DIST 14 14 WID 6
*2F1
TYPE 2 LOAD 10 5
DIST 10 WID 6
*3F1
TYPE 3 LOAD 8.5 8.5 6
DIST 4 10 WID 6
*4F1
TYPE 4 LOAD 7 7 7 6
DIST 4 4 10 WID 6
*5C1
TYPE 5 LOAD 8.5 8.5 8.5 8.5 6
DIST 4 31 4 12 WID 6
***LLDF OF 0.9 FOR 3 TRUCKS APPLIED***
*HS20
TYPE 6 LOAD 14.4 14.4 3.6
```

```
DIST 14 14 WID 6
*2F1
TYPE 7 LOAD 9 4.5
DIST 10 WID 6
*3F1
TYPE 8 LOAD 7.65 7.65 5.4
DIST 4 10 WID 6
*4F1
TYPE 9 LOAD 6.3 6.3 6.3 5.4
DIST 4 4 10 WID 6
*5C1
TYPE 10 LOAD 7.65 7.65 7.65 7.65 5.4
DIST 4 31 4 12 WID 6
***LLDF OF 0.75 FOR >3 TRUCKS APPLIED***
*HS20
TYPE 11 LOAD 12 12 3
DIST 14 14 WID 6
*2F1
TYPE 12 LOAD 7.5 3.75
DIST 10 WID 6
*3F1
TYPE 13 LOAD 6.375 6.375 4.5
DIST 4 10 WID 6
*4F1
TYPE 14 LOAD 5.25 5.25 5.25 4.5
DIST 4 4 10 WID 6
*5C1
TYPE 15 LOAD 6.375 6.375 6.375 6.375 4.5
DIST 4 31 4 12 WID 6
***************************BENT C THROUGH E***************************
**LOAD CASE 1***
*LC 1 Westbound
*Load Generation 1-100
LOAD GENERATION 100
TYPE 5 -135 0 -16.5 XINC 1.35
TYPE 5 -135 0 -26.5 XINC 1.35
*
**LC 1 Eastbound
*Load Generation 101-200
LOAD GENERATION 100
TYPE 5 -135 0 22.5 XINC 1.35
TYPE 5 -135 0 32.5 XINC 1.35
*
**LC 1 Both Directions
**Load Generation 201-300
LOAD GENERATION 100
TYPE 15 -135 0 -16.5 XINC 1.35
TYPE 15 -135 0 -26.5 XINC 1.35
TYPE 15 -135 0 22.5 XINC 1.35
TYPE 15 -135 0 32.5 XINC 1.35
*
****LOAD CASE 2***
**Load Generation 301-400
LOAD GENERATION 100
TYPE 5 -135 0 -3.125 XINC 1.35
TYPE 5 -135 0 9.125 XINC 1.35
*
****LOAD CASE 3***
**Load Generation 401-500
LOAD GENERATION 100
TYPE 15 -135 0 -26.5 XINC 1.35
TYPE 15 -135 0 -16.5 XINC 1.35
TYPE 15 -135 0 -3.125 XINC 1.35
TYPE 15 -135 0 9.125 XINC 1.35
*
****LOAD CASE 4***
**Load Generation 501-600
LOAD GENERATION 100
TYPE 15 -135 0 -3.125 XINC 1.35
TYPE 15 -135 0 9.125 XINC 1.35
TYPE 15 -135 0 22.5 XINC 1.35
TYPE 15 -135 0 32.5 XINC 1.35
*
```

```
****LOAD CASE 5***
**Load Generation 601-700
LOAD GENERATION 100
TYPE 10 -135 0 -33 XINC 1.35
TYPE 10 -135 0 -26.5 XINC 1.35
TYPE 10 -135 0 -16.5 XINC 1.35
*
****LOAD CASE 6***
**Load Generation 701-800
LOAD GENERATION 100
TYPE 10 -135 0 22.5 XINC 1.35
TYPE 10 -135 0 32.5 XINC 1.35
TYPE 10 -135 0 39 XINC 1.35
*
****************************BENT A AND B*************************
*
*
****LOAD CASE 1***
**LC 1 Westbound
**Load Generation 801-900
LOAD GENERATION 100
TYPE 5 -225 0 -30 XINC 1
TYPE 5 -225 0 -20 XINC 1
*
**LC 1 Eastbound
**Load Generation 901-1000
LOAD GENERATION 100
TYPE 5 -225 0 24.05 XINC 1
TYPE 5 -225 0 34.05 XINC 1
*
**LC 1 Both Directions
**Load Generation 1001-1100
LOAD GENERATION 100
TYPE 15 -225 0 -30 XINC 1
TYPE 15 -225 0 -20 XINC 1
TYPE 15 -225 0 24.05 XINC 1
TYPE 15 -225 0 34.05 XINC 1
**
*****LOAD CASE 2***
***Load Generation 1101-1200
LOAD GENERATION 100
TYPE 5 -225 0 -3.125 XINC 1
TYPE 5 -225 0 9.125 XINC 1
**
*****LOAD CASE 3***
**Load Generation 1201-1300
LOAD GENERATION 100
TYPE 15 -225 0 -30 XINC 1
TYPE 15 -225 0 -20 XINC 1
TYPE 15 -225 0 -3.125 XINC 1
TYPE 15 -225 0 9.125 XINC 1
*
****LOAD CASE 4***
**Load Generation 1301-1400
LOAD GENERATION 100
TYPE 15 -225 0 -3.125 XINC 1
TYPE 15 -225 0 9.125 XINC 1
TYPE 15 -225 0 24.05 XINC 1
TYPE 15 -225 0 34.05 XINC 1
*
****LOAD CASE 5***
**Load Generation 1401-1500
LOAD GENERATION 100
TYPE 10 -225 0 -38.42 XINC 1
TYPE 10 -225 0 -28.42 XINC 1
TYPE 10 -225 0 -18.42 XINC 1
*
****LOAD CASE 6***
**Load Generation 1501-1600
LOAD GENERATION 100
TYPE 10 -225 0 20.69 XINC 1
TYPE 10 -225 0 30.69 XINC 1
TYPE 10 -225 0 40.69 XINC 1
```

```
*
*
PERFORM ANALYSIS
FINISH
```

WEST APPROACH – SECTION P

FLOOR BEAMS

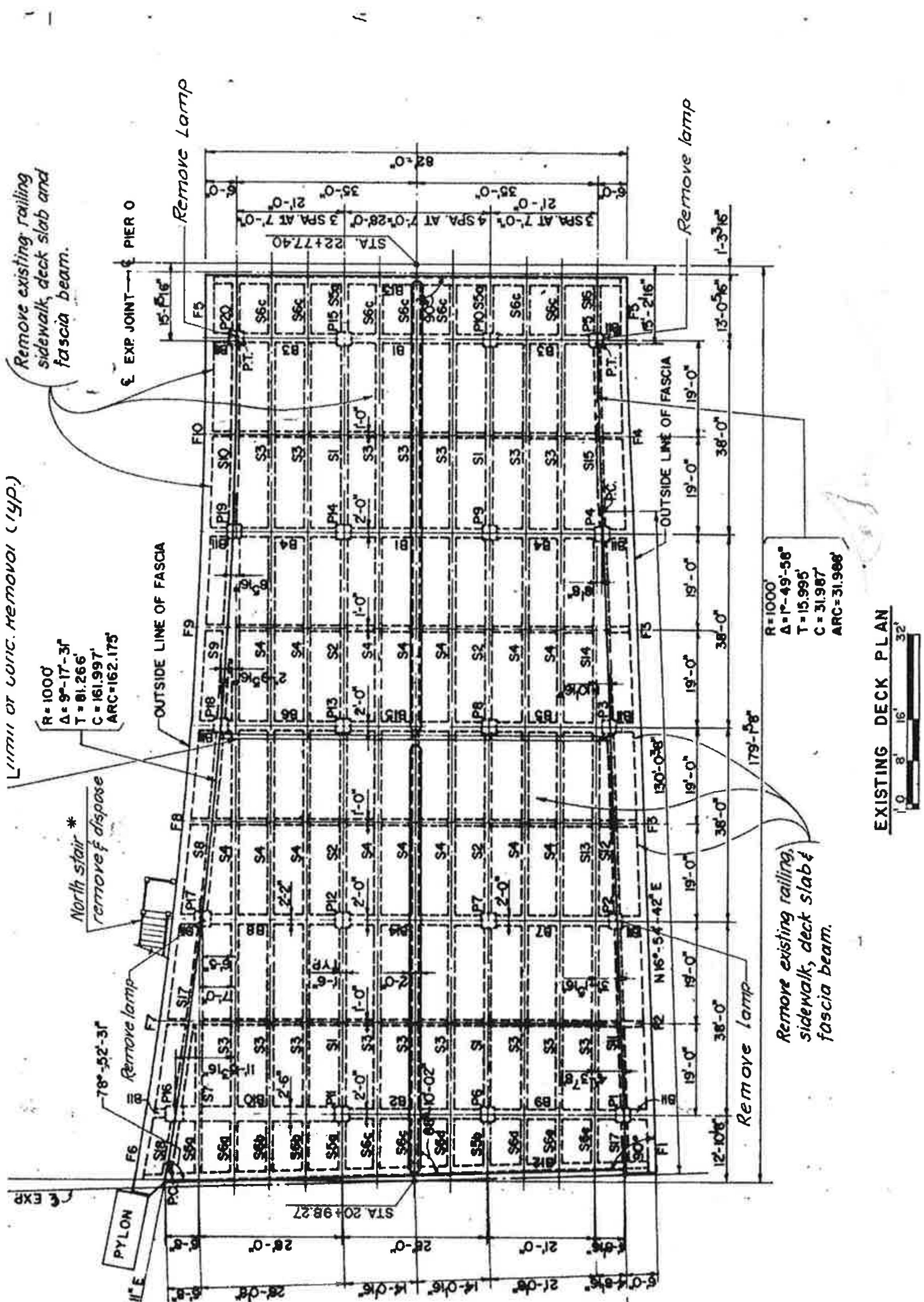
TranSystems

Made By: GHD Date: 2/23/2012 Job No.:

Checked By: DMP Date: 2/25/2012 Sheet No.:

Floor Beams Rating Summary - As Built

FLOOR BEAMS	RATING FACTORS - WEST APPROACH - SECTION P											
	HS20				OHIO LEGAL LOADS							
	MOMENT		SHEAR		2F1		3F1		4F1		5C1	
	Inv.	Opr.	Inv.	Opr.	M	V	M	V	M	V	M	V
B1	1.44	2.41	2.53	4.22	5.08	8.39	3.49	6.05	3.14	5.50	3.26	5.74
B2	1.73	2.88	3.33	5.56	5.69	10.15	3.93	7.35	3.53	6.66	3.98	7.44
B3	1.66	2.78	3.25	5.42	5.74	8.07	4.00	6.52	3.58	6.29	3.77	7.39
B4	1.89	3.16	3.62	6.05	6.60	8.66	4.51	6.85	3.98	6.38	4.06	7.76
B5	1.68	2.80	2.41	4.03	6.20	8.47	4.09	5.71	3.53	5.04	3.81	5.11
B6	1.59	2.65	2.55	4.26	5.91	8.99	3.89	6.07	3.36	5.34	3.41	5.26
B7	1.83	3.06	3.27	5.46	6.83	12.19	4.50	8.03	3.88	6.93	3.93	7.02
B8	1.73	2.88	3.23	5.39	6.01	11.23	3.96	7.39	3.41	6.38	3.41	6.42
B9	1.51	2.52	3.16	5.28	5.15	10.94	3.49	7.58	3.12	6.82	3.54	7.64
B10	1.48	2.48	2.34	3.91	4.99	7.45	3.42	5.22	3.07	4.73	3.42	5.22
B11	5.26	8.78	2.44	4.07	14.81	6.52	12.50	5.74	11.35	5.23	12.50	5.74
B14	1.89	3.15	3.69	6.17	7.06	13.79	4.65	9.08	4.01	7.83	3.99	7.88
B15	1.71	2.85	3.64	6.08	6.34	12.06	4.18	8.29	3.61	7.32	3.66	7.89



Remove existing railing, sidewalk, deck slab and fascia beam.
Limit of Conc. Removal (typ.)
℄ EXP. JOINT — ℄ PIER O
Remove Lamp
Remove lamp
STA. 22+77.40
STA. 20+98.27
OUTSIDE LINE OF FASCIA
R=1000' Δ=9°-17'-31" T=81.266' C=161.997' ARC=162.175'
R=1000' Δ=1°-49'-58" T=15.995' C=31.987' ARC=31.988'
North stair * remove & dispose
PYLON
Remove existing railing, sidewalk, deck slab & fascia beam.
Remove lamp
EXISTING DECK PLAN

Made By: GHD	Date: 2/27/2012	Job No.:
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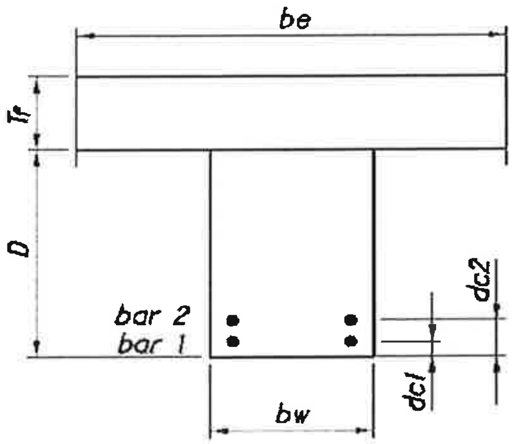
Floor Beam B1 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	91.20	in.
Tf =	6.75	in.
D =	76.31	in.
bw =	24.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	9.81	in^2
bar2=	0.00	in^2

5-#1.25" & 2-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

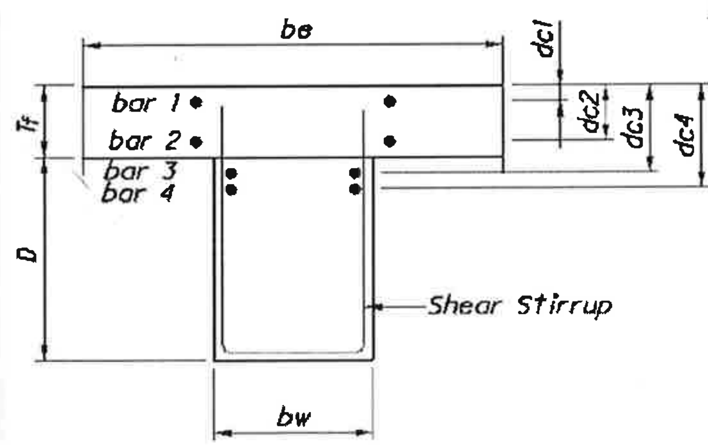
Check if can be analyzed as a rectangular section:

Beam total depth =	83.06	in.	(Tf+D)
Total rebar area As =	9.81	in^2	
Average dt =	79.55	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.01	in	1.01 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **2094.28** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	91.20	in.	
Tf =	6.75	in.	
D =	87.55	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	5.02	in^2	#6 @ 8"
bar2=	3.53	in^2	#5 @ 8"
bar3=	3.80	in^2	3-#1.125"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	1.58	in^2	2-#8 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	94.30	in.	(Tf+D)
ΣAs fy=	721.69	kips	
Average dt =	88.82	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	11.79	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **4488.19** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Floor Beam B1 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	233.50	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	462.88	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **591.92** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	528.72	k-ft	DL =	580.40	k-ft	DL =	125.49	k
HS 20 =	448.80	k-ft	HS 20 =	297.80	k-ft	HS 20 =	78.12	k
2F1 =	213.21	k-ft	2F1 =	144.63	k-ft	2F1 =	39.29	k
3F1 =	309.76	k-ft	3F1 =	205.28	k-ft	3F1 =	54.54	k
4F1 =	344.73	k-ft	4F1 =	228.11	k-ft	4F1 =	60.02	k
5C1 =	332.22	k-ft	5C1 =	219.28	k-ft	5C1 =	57.51	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.44	2.41	5.78	9.65	2.53	4.22

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
5.08	19.86	8.39	3.49	13.99	6.05

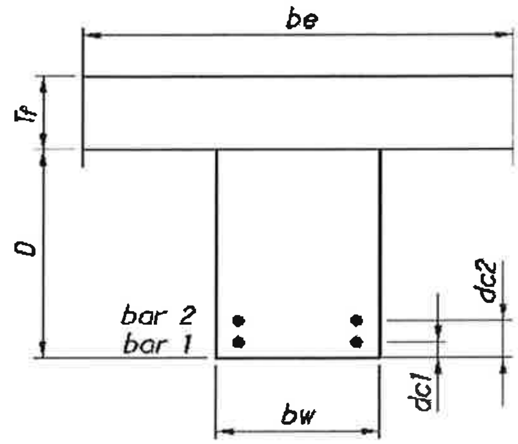
4F1			5C1		
M+	M-	V	M+	M-	V
3.14	12.59	5.50	3.26	13.10	5.74

Made By: GHD | Date: 2/27/2012 | Job No.:

Checked By: DMP | Date: 2/29/2012 | Sheet No.:

Floor Beam B2 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	91.20	in.
Tf =	6.75	in.
D =	90.65	in.
bw =	24.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	8.25	in^2
bar2=	0.00	in^2

4-#1.25" & 2-#1.125"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

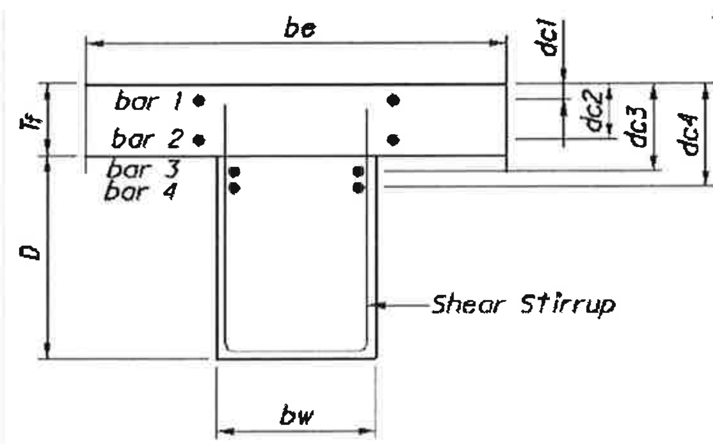
Check if can be analyzed as a rectangular section:

Beam total depth =	97.40	in.	(Tf+D)
Total rebar area As =	8.25	in^2	
Average dt =	93.89	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.85	in	0.85 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **2081.85** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	91.20	in.	
Tf =	6.75	in.	
D =	99.67	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	5.02	in^2	#6 @ 8"
bar2=	3.53	in^2	#5 @ 8"
bar3=	9.38	in^2	6-#1.25"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	106.42	in.	(Tf+D)
ΣAs fy=	941.63	kips	
Average dt =	100.04	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	15.39	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **6521.79** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Floor Beam B2 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	263.02	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	610.53	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **742.51** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	252.22	k-ft	DL =	785.88	k-ft	DL =	112.66	k
HS 20 =	468.43	k-ft	HS 20 =	514.76	k-ft	HS 20 =	82.45	k
2F1 =	237.13	k-ft	2F1 =	258.22	k-ft	2F1 =	45.15	k
3F1 =	343.52	k-ft	3F1 =	379.62	k-ft	3F1 =	62.36	k
4F1 =	382.30	k-ft	4F1 =	424.76	k-ft	4F1 =	68.85	k
5C1 =	339.34	k-ft	5C1 =	374.94	k-ft	5C1 =	61.62	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.73	2.88	4.92	8.22	3.33	5.56

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
5.69	16.38	10.15	3.93	11.15	7.35

4F1			5C1		
M+	M-	V	M+	M-	V
3.53	9.96	6.66	3.98	11.28	7.44

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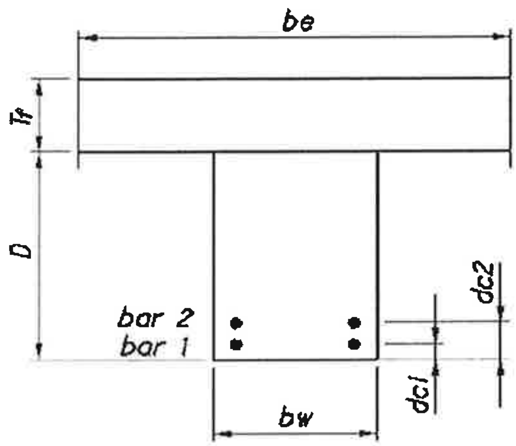
Floor Beam B3 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	74.40	in.
Tf =	6.75	in.
D =	74.27	in.
bw =	24.00	in.
dc1 =	3.44	in.
dc2 =	6.06	in.
bar1=	7.06	in^2
bar2=	0.00	in^2

4-#1.125" & 2-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

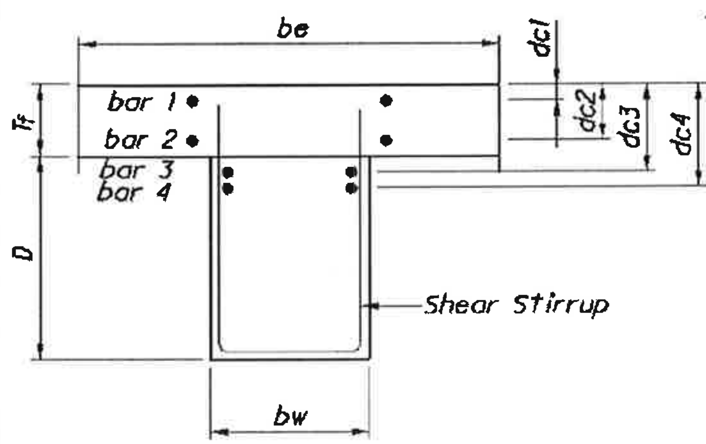
Check if can be analyzed as a rectangular section:

Beam total depth =	81.02	in.	(Tf+D)
Total rebar area As =	7.06	in^2	
Average dt =	77.58	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.89	in	0.89 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1470.86** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	74.40	in.	
Tf =	6.75	in.	
D =	86.29	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.09	in^2	#6 @ 8"
bar2=	2.88	in^2	#5 @ 8"
bar3=	3.80	in^2	3-#1.125"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	1.58	in^2	2-#8 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	93.04	in.	(Tf+D)
ΣAs fy=	627.19	kips	
Average dt =	87.27	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	10.25	in	(a = Σ As fy / (0.85fc' bw))

Negative Moment Capacity:

ΦMn = **3863.83** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Floor Beam B3 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	229.43	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	454.80	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **581.60** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	135.74	k-ft	DL =	446.75	k-ft	DL =	79.87	k
HS 20 =	358.64	k-ft	HS 20 =	289.91	k-ft	HS 20 =	67.82	k
2F1 =	173.46	k-ft	2F1 =	141.23	k-ft	2F1 =	45.52	k
3F1 =	248.70	k-ft	3F1 =	199.82	k-ft	3F1 =	56.33	k
4F1 =	277.98	k-ft	4F1 =	222.04	k-ft	4F1 =	58.45	k
5C1 =	263.77	k-ft	5C1 =	213.79	k-ft	5C1 =	49.75	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.66	2.78	5.22	8.72	3.25	5.42

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
5.74	17.88	8.07	4.00	12.64	6.52

4F1			5C1		
M+	M-	V	M+	M-	V
3.58	11.37	6.29	3.77	11.81	7.39

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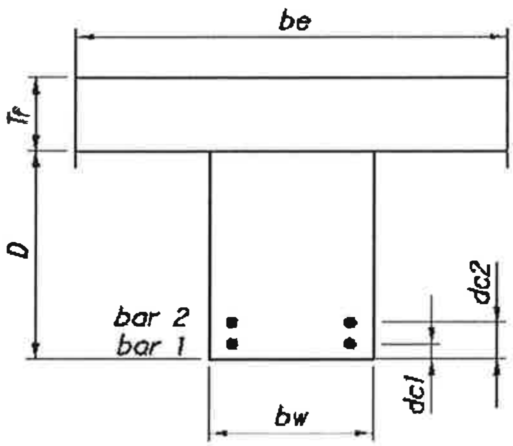
Floor Beam B4 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	74.40	in.
Tf =	6.75	in.
D =	74.96	in.
bw =	24.00	in.
dc1 =	3.44	in.
dc2 =	6.06	in.
bar1=	7.06	in^2
bar2=	0.00	in^2

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

4-#1.125" & 2-#1"

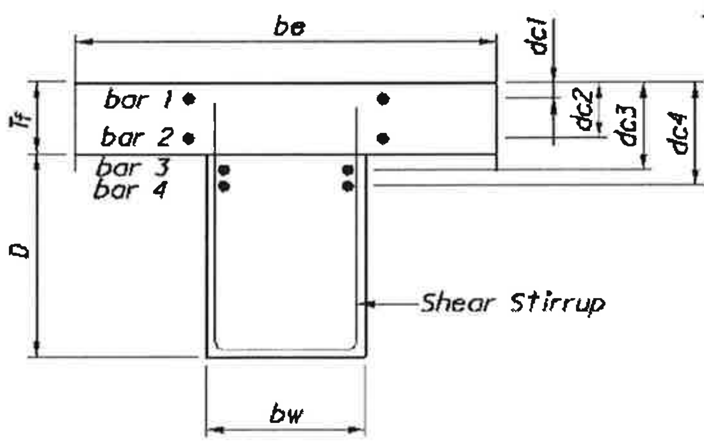
Check if can be analyzed as a rectangular section:

Beam total depth =	81.71	in.	(Tf+D)
Total rebar area As =	7.06	in^2	
Average dt =	78.27	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.89	in	0.89 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1484.11** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	74.40	in.	
Tf =	6.75	in.	
D =	87.55	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.09	in^2	#6 @ 8"
bar2=	2.88	in^2	#5 @ 8"
bar3=	3.80	in^2	3-#1.125"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	1.58	in^2	2-#8 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	94.30	in.	(Tf+D)
ΣAs fy=	627.19	kips	
Average dt =	88.53	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	10.25	in	(a = Σ As fy / (0.85fc' bw))

Negative Moment Capacity:

ΦMn = **3923.35** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	232.75	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	461.40	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **590.03** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	165.67	k-ft	DL =	555.31	k-ft	DL =	97.85	k
HS 20 =	309.00	k-ft	HS 20 =	249.58	k-ft	HS 20 =	58.89	k
2F1 =	147.96	k-ft	2F1 =	121.36	k-ft	2F1 =	41.09	k
3F1 =	216.20	k-ft	3F1 =	178.15	k-ft	3F1 =	51.99	k
4F1 =	245.28	k-ft	4F1 =	203.25	k-ft	4F1 =	55.80	k
5C1 =	240.54	k-ft	5C1 =	197.35	k-ft	5C1 =	45.88	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.89	3.16	5.91	9.87	3.62	6.05

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
6.60	20.29	8.66	4.51	13.82	6.85

4F1			5C1		
M+	M-	V	M+	M-	V
3.98	12.12	6.38	4.06	12.48	7.76

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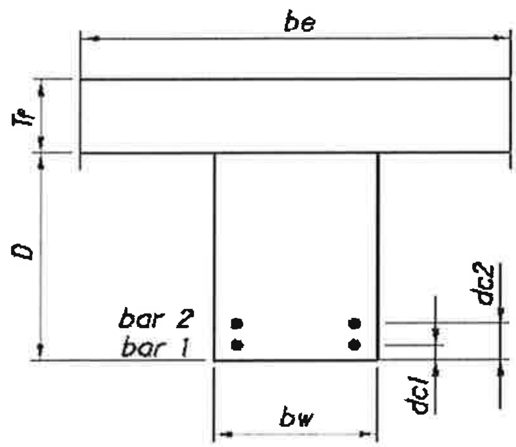
Floor Beam B5 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	78.94	in.
Tf =	6.75	in.
D =	81.89	in.
bw =	24.00	in.
dc1 =	3.44	in.
dc2 =	6.06	in.
bar1=	7.59	in^2	4-#1.125 & 2-#1.125
bar2=	0.00	in^2

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

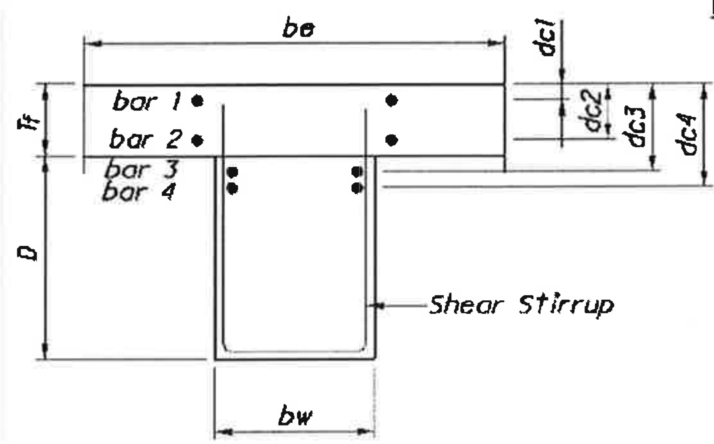
Check if can be analyzed as a rectangular section:

Beam total depth =	88.64	in.	(Tf+D)
Total rebar area As =	7.59	in^2	
Average dt =	85.20	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.91	in	0.91 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1737.63** k-ft ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	78.94	in.	
Tf =	6.75	in.	
D =	92.66	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.34	in^2	#6 @ 8"
bar2=	3.06	in^2	#5 @ 8"
bar3=	2.53	in^2	2-#1.125
bar4=	4.00	in^2	4-#1"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	99.41	in.	(Tf+D)
ΣAs fy=	679.14	kips	
Average dt =	93.25	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	11.10	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **4467.16** k-ft ΦMn = Φ Σ(As fy)(dt-a/2)

Floor Beam B5 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc =	245.17	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	569.09	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **692.11** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	251.71	k-ft	DL =	572.32	k-ft	DL =	124.95	k
HS 20 =	387.82	k-ft	HS 20 =	279.54	k-ft	HS 20 =	101.24	k
2F1 =	174.97	k-ft	2F1 =	130.19	k-ft	2F1 =	48.12	k
3F1 =	265.42	k-ft	3F1 =	192.81	k-ft	3F1 =	71.32	k
4F1 =	307.20	k-ft	4F1 =	221.06	k-ft	4F1 =	80.92	k
5C1 =	284.84	k-ft	5C1 =	208.77	k-ft	5C1 =	79.66	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.68	2.80	6.14	10.25	2.41	4.03

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
6.20	22.00	8.47	4.09	14.85	5.71

4F1			5C1		
M+	M-	V	M+	M-	V
3.53	12.96	5.04	3.81	13.72	5.11

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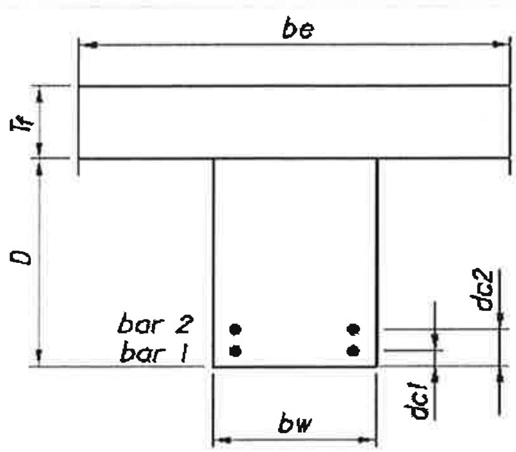
Floor Beam B6 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	81.19	in.
Tf =	6.75	in.
D =	76.39	in.
bw =	24.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	8.78	in^2
bar2=	0.00	in^2

4-#1.25" & 2-#1.125"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

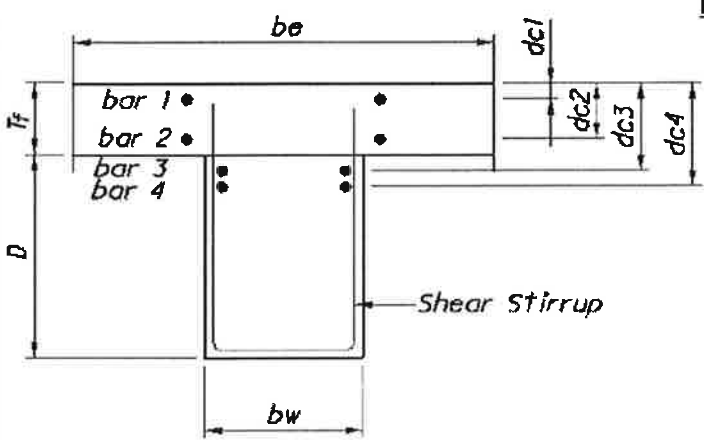
Check if can be analyzed as a rectangular section:

Beam total depth =	83.14	in.	(Tf+D)
Total rebar area As =	8.78	in^2	
Average dt =	79.63	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.02	in	1.02 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1876.00** k-ft　　ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	81.19	in.	
Tf =	6.75	in.	
D =	89.79	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.47	in^2	#6 @ 8"
bar2=	3.15	in^2	#5 @ 8"
bar3=	5.06	in^2	4-#1.125"
bar4=	2.53	in^2	2-#1.125
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	96.54	in.	(Tf+D)
ΣAs fy=	730.08	kips	
Average dt =	90.51	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	11.93	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **4629.44** k-ft　　ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	237.96	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	552.36	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **671.77** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	369.61	k-ft	DL =	624.68	k-ft	DL =	117.26	k
HS 20 =	405.50	k-ft	HS 20 =	295.64	k-ft	HS 20 =	93.85	k
2F1 =	181.73	k-ft	2F1 =	135.09	k-ft	2F1 =	44.43	k
3F1 =	275.82	k-ft	3F1 =	201.82	k-ft	3F1 =	65.82	k
4F1 =	319.51	k-ft	4F1 =	233.76	k-ft	4F1 =	74.79	k
5C1 =	314.50	k-ft	5C1 =	217.93	k-ft	5C1 =	75.98	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.59	2.65	5.95	9.94	2.55	4.26

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
5.91	21.74	8.99	3.89	14.55	6.07

4F1			5C1		
M+	M-	V	M+	M-	V
3.36	12.56	5.34	3.41	13.47	5.26

TranSystems	Made By: GHD	Date: 2/27/2012	Job No.:
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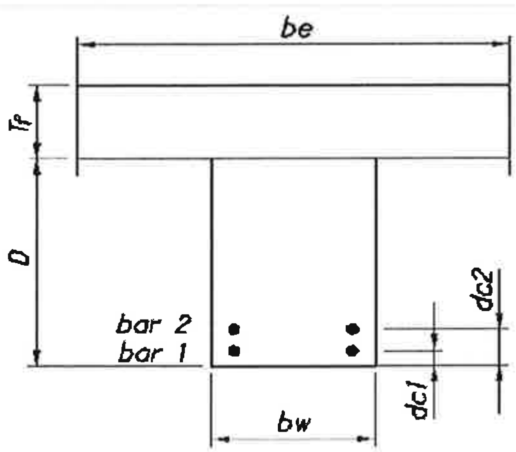
Floor Beam B7 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	81.86	in.
Tf =	6.75	in.
D =	88.01	in.
bw =	24.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	8.78	in^2	4-#1.25" & 2-#1.125"
bar2=	0.00	in^2

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

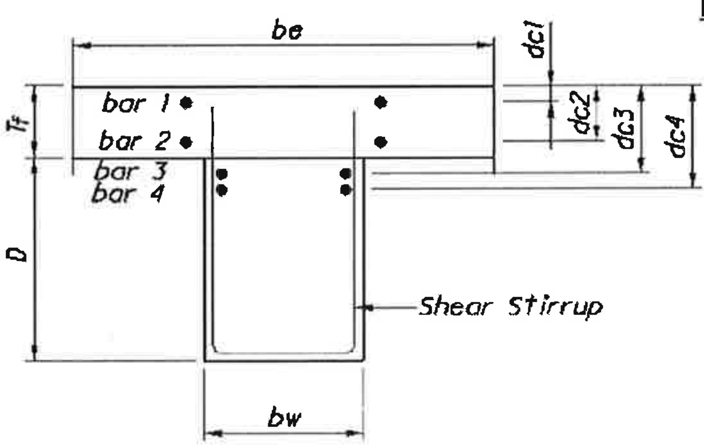
Check if can be analyzed as a rectangular section:

Beam total depth =	94.76	in.	(Tf+D)
Total rebar area As =	8.78	in^2	
Average dt =	91.25	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.01	in	1.01 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **2151.50** k-ft ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	81.86	in.	
Tf =	6.75	in.	
D =	98.33	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.50	in^2	#6 @ 8"
bar2=	3.17	in^2	#5 @ 8"
bar3=	4.00	in^2	4-#1"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	105.08	in.	(Tf+D)
ΣAs fy=	695.61	kips	
Average dt =	99.23	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	11.37	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **4880.07** k-ft ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	260.87	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	605.54	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **736.45** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	336.71	k-ft	DL =	612.03	k-ft	DL =	124.53	k
HS 20 =	430.98	k-ft	HS 20 =	303.90	k-ft	HS 20 =	80.91	k
2F1 =	193.12	k-ft	2F1 =	135.83	k-ft	2F1 =	36.25	k
3F1 =	293.17	k-ft	3F1 =	206.27	k-ft	3F1 =	55.04	k
4F1 =	339.71	k-ft	4F1 =	239.11	k-ft	4F1 =	63.78	k
5C1 =	335.70	k-ft	5C1 =	238.51	k-ft	5C1 =	62.93	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.83	3.06	6.19	10.34	3.27	5.46

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
6.83	23.13	12.19	4.50	15.23	8.03

4F1			5C1		
M+	M-	V	M+	M-	V
3.88	13.14	6.93	3.93	13.17	7.02

Made By:	GHD	Date:	2/27/2012	Job No.:	
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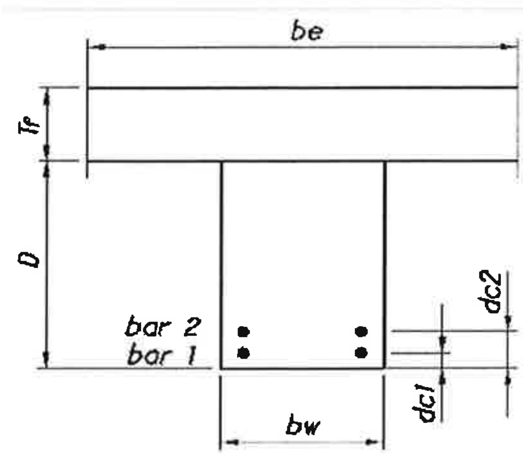
Floor Beam B8 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	89.81	in.		
Tf =	6.75	in.		
D =	80.20	in.		
bw =	24.00	in.		
dc1 =	3.51	in.		
dc2 =	6.06	in.		
bar1=	8.78	in^2	4-#1.25" & 2-#1.125"	
bar2=	2.53	in^2	2-#1.125"	

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

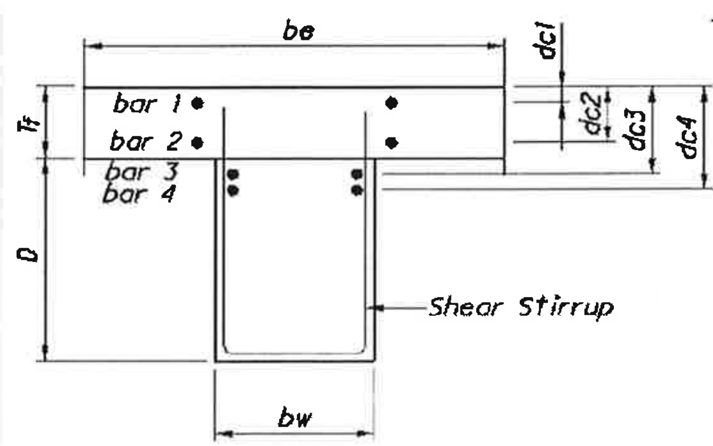
Check if can be analyzed as a rectangular section:

Beam total depth =	86.95	in.	(Tf+D)
Total rebar area As =	11.31	in^2	
Average dt =	82.87	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.19	in	1.19 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **2513.01** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	89.81	in.	
Tf =	6.75	in.	
D =	94.40	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.94	in^2	#6 @ 8"
bar2=	3.48	in^2	#5 @ 8"
bar3=	4.00	in^2	4-#1"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	101.15	in.	(Tf+D)
ΣAs fy=	740.30	kips	
Average dt =	95.44	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	12.10	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **4962.98** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Floor Beam B8 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc = 250.91 kips   Vc = 2 (fc')^0.5 bw d

Rebar shear strength Vs = 582.42 kips   Vs = Av fy d / s

Shear Capacity:

ΦVn = **708.33** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	588.42	k-ft	DL =	797.35	k-ft	DL =	144.83	k
HS 20 =	466.76	k-ft	HS 20 =	363.89	k-ft	HS 20 =	74.28	k
2F1 =	223.74	k-ft	2F1 =	162.66	k-ft	2F1 =	35.63	k
3F1 =	339.79	k-ft	3F1 =	247.03	k-ft	3F1 =	54.10	k
4F1 =	393.87	k-ft	4F1 =	286.35	k-ft	4F1 =	62.70	k
5C1 =	394.09	k-ft	5C1 =	285.69	k-ft	5C1 =	62.33	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.73	2.88	4.97	8.30	3.23	5.39

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
6.01	18.57	11.23	3.96	12.23	7.39

4F1			5C1		
M+	M-	V	M+	M-	V
3.41	10.55	6.38	3.41	10.57	6.42

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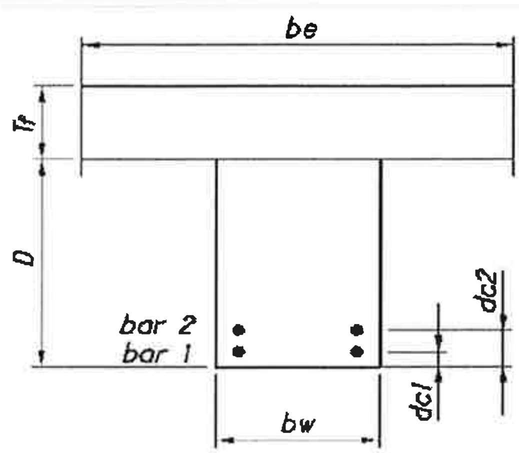
Floor Beam B9 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	84.72	in.
Tf =	6.75	in.
D =	95.86	in.
bw =	24.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	8.19	in^2
bar2=	0.00	in^2

4-#1.125" & 2-#1.25"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

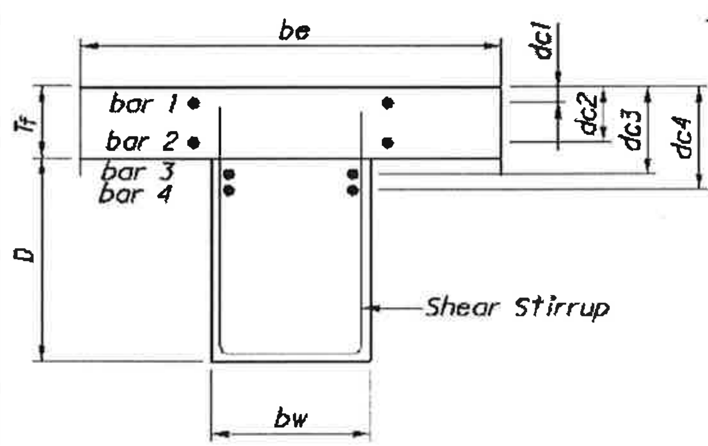
Check if can be analyzed as a rectangular section:

Beam total depth =	102.61	in.	(Tf+D)
Total rebar area As =	8.19	in^2	
Average dt =	99.10	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.91	in	0.91 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **2180.69** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	84.72	in.	
Tf =	6.75	in.	
D =	105.63	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	4.66	in^2	#6 @ 8"
bar2=	3.28	in^2	#5 @ 8"
bar3=	6.33	in^2	5-#1.125"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	112.38	in.	(Tf+D)
ΣAs fy=	795.49	kips	
Average dt =	106.24	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	13.00	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **5950.48** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	279.31	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	648.33	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **788.49** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	305.55	k-ft	DL =	476.76	k-ft	DL =	94.24	k
HS 20 =	545.34	k-ft	HS 20 =	391.53	k-ft	HS 20 =	96.99	k
2F1 =	266.59	k-ft	2F1 =	199.09	k-ft	2F1 =	46.81	k
3F1 =	392.79	k-ft	3F1 =	291.92	k-ft	3F1 =	67.57	k
4F1 =	439.86	k-ft	4F1 =	326.01	k-ft	4F1 =	75.12	k
5C1 =	387.81	k-ft	5C1 =	288.21	k-ft	5C1 =	67.08	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.51	2.52	6.27	10.48	3.16	5.28

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
5.15	20.60	10.94	3.49	14.05	7.58

4F1			5C1		
M+	M-	V	M+	M-	V
3.12	12.58	6.82	3.54	14.23	7.64

Made By: GHD Date: 2/27/2012 Job No.: ____________

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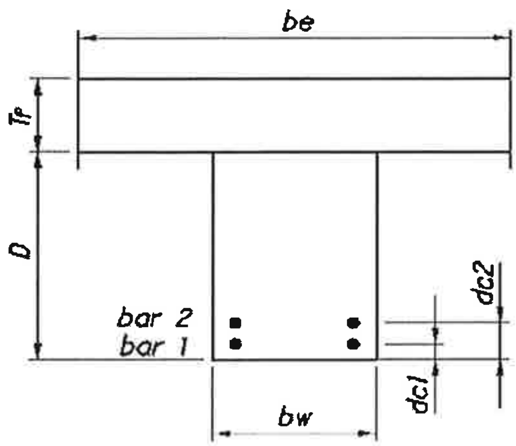
Floor Beam B9 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	102.00	in.
Tf =	6.75	in.
D =	84.95	in.
bw =	30.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	9.38	in^2	6-#1.25"
bar2=	5.06	in^2	4-#1.125"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

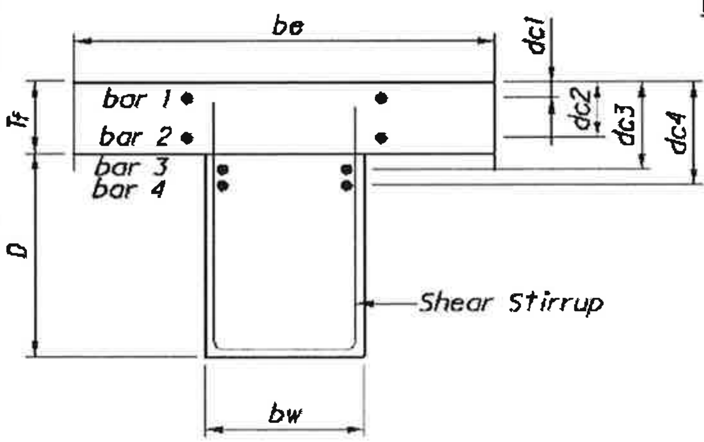
Check if can be analyzed as a rectangular section:

Beam total depth =	91.70	in.	(Tf+D)
Total rebar area As =	14.44	in^2	
Average dt =	87.30	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.33	in	1.33 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **3377.05** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	102.00	in.	
Tf =	6.75	in.	
D =	99.67	in.	
bw =	30.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	5.61	in^2	#6 @ 8"
bar2=	3.95	in^2	#5 @ 8"
bar3=	9.38	in^2	6-#1.25"
bar4=	3.13	in^2	2-#1.25"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	106.42	in.	(Tf+D)
ΣAs fy=	1023.75	kips	
Average dt =	100.08	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	13.38	in	(a = Σ As fy / (0.85fc' bw))

Negative Moment Capacity:

ΦMn = **7170.96** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Floor Beam B9 - Section P - As Built

Shear Capacity:

Concrete shear strength Vc = 328.91 kips   Vc = 2 (fc')^0.5 bw d

Rebar shear strength Vs = 610.78 kips   Vs = Av fy d / s

Shear Capacity:

ΦVn = **798.74** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	685.56	k-ft	DL =	840.01	k-ft	DL =	144.53	k
HS 20 =	771.71	k-ft	HS 20 =	566.22	k-ft	HS 20 =	120.38	k
2F1 =	383.38	k-ft	2F1 =	291.12	k-ft	2F1 =	63.09	k
3F1 =	558.99	k-ft	3F1 =	418.52	k-ft	3F1 =	89.96	k
4F1 =	622.64	k-ft	4F1 =	463.69	k-ft	4F1 =	99.44	k
5C1 =	558.99	k-ft	5C1 =	418.52	k-ft	5C1 =	89.96	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.48	2.48	4.95	8.26	2.34	3.91

Ohio Legal Loads:

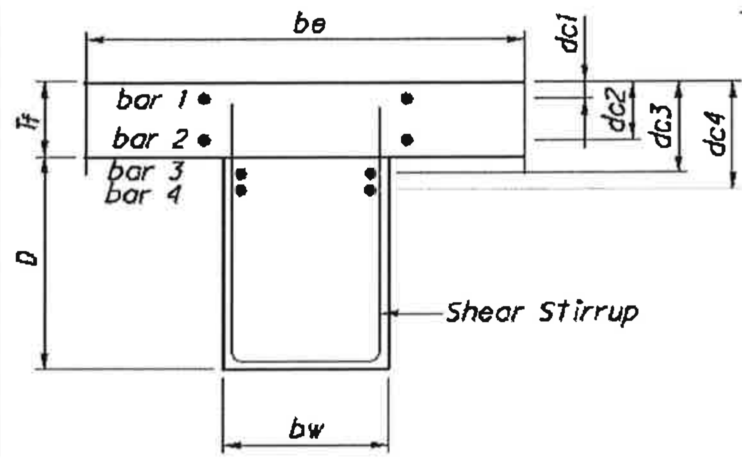
2F1			3F1		
M+	M-	V	M+	M-	V
4.99	16.06	7.45	3.42	11.17	5.22

4F1			5C1		
M+	M-	V	M+	M-	V
3.07	10.08	4.73	3.42	11.17	5.22

Made By:	GHD	Date:	2/27/2012	Job No.:	
Checked By:	DMP	Date:	2/29/2012	Sheet No.:	

Floor Beam B11 - Section P - As Built

Negative Moment Capacity:



Dimensions:					
be =	49.58	in.			
Tf =	6.75	in.			
D =	86.38	in.			
bw =	24.00	in.			
dc1 =	2.75	in.			
dc2 =	4.81	in.			
dc3 =	9.00	in.			
dc4 =	12.25	in.			
bar1=	2.73	in^2	#6 @ 8"		
bar2=	1.92	in^2	#5 @ 8"		
bar3=	2.53	in^2	2-#1.125"		
bar4=	2.53	in^2	2-#1.125"		
Shear stirrup Av =	0.62	in^2	2 legs of #5		
Shear stirrup Spacing S =	12.00	in			

Material Properties:		
fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	93.13	in.	(Tf+D)
ΣAs fy=	461.16	kips	
Average dt =	86.75	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	7.54	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn =	**2869.93**	k-ft	ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	228.06	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	161.35	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn =	**331.00**	k-ft	ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	6.37	k-ft	DL =	412.11	k-ft	DL =	65.06	k
HS 20 =	47.91	k-ft	HS 20 =	204.54	k-ft	HS 20 =	46.63	k
2F1 =	30.41	k-ft	2F1 =	121.23	k-ft	2F1 =	29.08	k
3F1 =	42.55	k-ft	3F1 =	143.60	k-ft	3F1 =	33.03	k
4F1 =	41.43	k-ft	4F1 =	158.16	k-ft	4F1 =	36.25	k
5C1 =	43.51	k-ft	5C1 =	143.60	k-ft	5C1 =	33.03	k

Floor Beam B11 - Section P - As Built

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
-	-	5.26	8.78	2.44	4.07

Ohio Legal Loads:

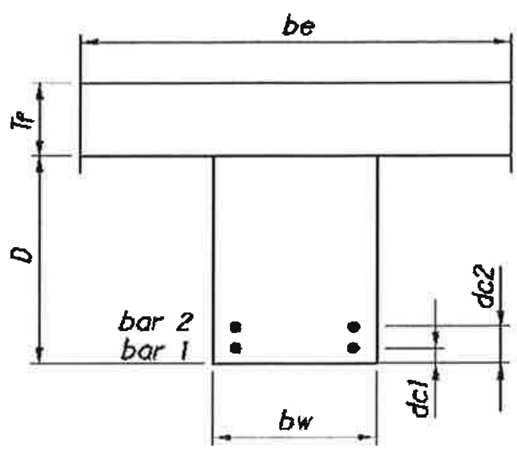
2F1			3F1		
M+	M-	V	M+	M-	V
-	14.81	6.52	-	12.50	5.74

4F1			5C1		
M+	M-	V	M+	M-	V
-	11.35	5.23	-	12.50	5.74

TranSystems	Made By: GHD	Date: 2/27/2012	Job No.:
	Checked By: DMP	Date: 2/29/2012	Sheet No.:

Floor Beam B14 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:

be =	91.20	in.
Tf =	6.75	in.
D =	84.65	in.
bw =	24.00	in.
dc1 =	3.51	in.
dc2 =	6.06	in.
bar1=	8.78	in^2	4-#1.25" & 2-#1.125"
bar2=	0.00	in^2

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

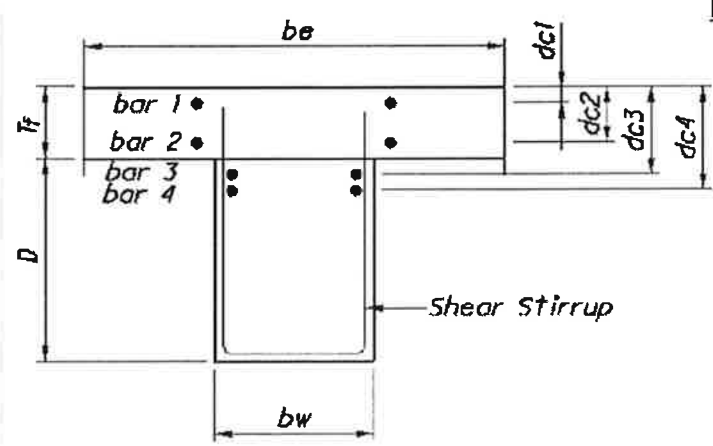
Check if can be analyzed as a rectangular section:

Beam total depth =	91.40	in.	(Tf+D)
Total rebar area As =	8.78	in^2	
Average dt =	87.89	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.91	in	0.91 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **2072.95** k-ft ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	91.20	in.	
Tf =	6.75	in.	
D =	94.40	in.	
bw =	24.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	5.02	in^2	#6 @ 8"
bar2=	3.53	in^2	#5 @ 8"
bar3=	6.53	in^2	4-#1" & 2-#1.125"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.62	in^2	2 legs of #5
Shear stirrup Spacing S =	12.00	in	
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	101.15	in.	(Tf+D)
ΣAs fy=	839.25	kips	
Average dt =	95.10	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	13.71	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **5554.51** k-ft ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc = 250.03 kips   Vc = 2 (fc')^0.5 bw d

Rebar shear strength Vs = 580.37 kips   Vs = Av fy d / s

Shear Capacity:

ΦVn = **705.83** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	403.72	k-ft	DL =	780.52	k-ft	DL =	130.72	k
HS 20 =	377.77	k-ft	HS 20 =	355.90	k-ft	HS 20 =	66.84	k
2F1 =	168.68	k-ft	2F1 =	159.11	k-ft	2F1 =	29.90	k
3F1 =	256.21	k-ft	3F1 =	241.63	k-ft	3F1 =	45.40	k
4F1 =	297.07	k-ft	4F1 =	280.08	k-ft	4F1 =	52.63	k
5C1 =	298.38	k-ft	5C1 =	279.16	k-ft	5C1 =	52.31	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.89	3.15	5.88	9.82	3.69	6.17

Ohio Legal Loads:

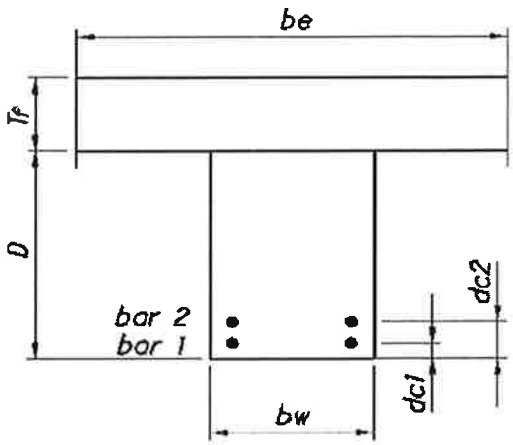
2F1			3F1		
M+	M-	V	M+	M-	V
7.06	21.95	13.79	4.65	14.45	9.08

4F1			5C1		
M+	M-	V	M+	M-	V
4.01	12.47	7.83	3.99	12.51	7.88

Made By:	GHD	Date: 2/27/2012	Job No.:
Checked By:	DMP	Date: 2/29/2012	Sheet No.:

Floor Beam B15 - Section P - As Built

Posivitve Moment Capacity:



Dimensions:			Material Properties:		
be =	91.20	in.	fy =	36.00	ksi
Tf =	6.75	in.	fc' =	4500.00	psi
D =	79.43	in.			
bw =	24.00	in.			
dc1 =	3.51	in.			
dc2 =	6.06	in.			
bar1=	8.78	in^2	4-#1.25" & 2-#1.125"		
bar2=	0.00	in^2			

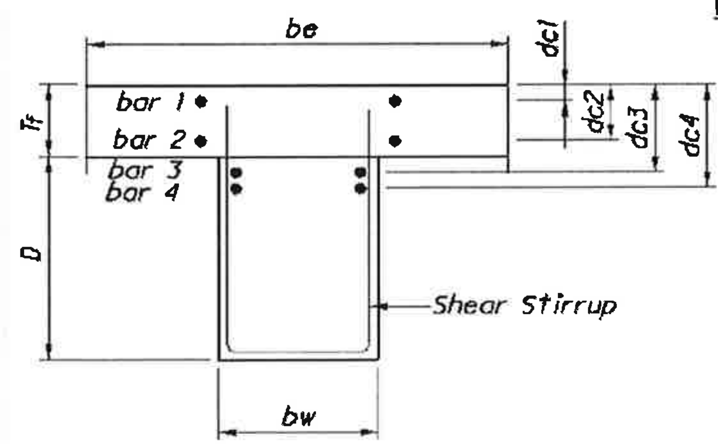
Check if can be analyzed as a rectangular section:

Beam total depth =	86.18	in.	(Tf+D)
Total rebar area As =	8.78	in^2	
Average dt =	82.67	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.91	in	0.91 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn =	**1949.31**	k-ft	ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:				Material Properties:	
be =	91.20	in.	fy1 =	60.00	ksi
Tf =	6.75	in.	fy2 =	36.00	ksi
D =	89.79	in.	fc' =	3000.00	psi
bw =	24.00	in.			
dc1 =	2.75	in.			
dc2 =	4.81	in.			
dc3 =	9.00	in.			
dc4 =	12.25	in.			
bar1=	5.02	in^2	#6 @ 8"		
bar2=	3.53	in^2	#5 @ 8"		
bar3=	5.06	in^2	4-#1.125"		
bar4=	2.53	in^2	2-#1.125"		
Shear stirrup Av =	0.62	in^2	2 legs of #5		
Shear stirrup Spacing S =	12.00	in			
Drapped bars for shear Avd =	2.00	in^2	2-#9 @ 45 degree		

Beam total depth =	96.54	in.	(Tf+D)
ΣAs fy=	786.38	kips	
Average dt =	90.69	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	12.85	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn =	**4969.52**	k-ft	ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	238.42	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	553.42	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **673.06** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	460.74	k-ft	DL =	633.55	k-ft	DL =	123.14	k
HS 20 =	364.53	k-ft	HS 20 =	297.29	k-ft	HS 20 =	64.89	k
2F1 =	163.73	k-ft	2F1 =	135.75	k-ft	2F1 =	32.72	k
3F1 =	248.57	k-ft	3F1 =	202.96	k-ft	3F1 =	47.57	k
4F1 =	287.91	k-ft	4F1 =	235.07	k-ft	4F1 =	53.94	k
5C1 =	283.85	k-ft	5C1 =	219.39	k-ft	5C1 =	50.04	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.71	2.85	6.43	10.73	3.64	6.08

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
6.34	23.49	12.06	4.18	15.71	8.29

4F1			5C1		
M+	M-	V	M+	M-	V
3.61	13.57	7.32	3.66	14.54	7.89

Tran Systems

Made By: GHD	Date: 2/27/2012	Job No.:
Checked By: DMP	Date: 2/29/2012	Sheet No.:

BENT A		
Stem at P16 (in.)		14.75
Stem at P1 (in.)		33.00
Total Distance From P16 to P1 (ft.)		85.75
Distance from P16 (ft.)		Stem (in.)
B11 -	0.00	14.75
B10 +	19.75	18.95
B10 -	32.50	21.67
B2-	32.50	21.67
B2+	46.50	24.65
B9-	60.50	27.63
B9+	71.00	29.86
B11-	85.75	33.00

BENT B		
Stem at P17 (in.)		12.00
Stem at P2 (in.)		24.75
Total Distance From P17 to P2 (ft.)		79.61
Distance from P17 (ft.)		Stem (in.)
B11 -	0.00	12.00
B8 +	13.75	14.20
B8 -	27.50	16.40
B14-	27.50	16.40
B14+	41.50	18.65
B7-	52.00	20.33
B7+	62.50	22.01
B11-	79.61	24.75

BENT C		
Stem at P18 (in.)		9.00
Stem at P3 (in.)		17.75
Total Distance From P18 to P3 (ft.)		74.65
Distance from P18 (ft.)		Stem (in.)
B11 -	0.00	9.00
B6 +	11.90	10.39
B6 -	23.81	11.79
B15-	23.81	11.79
B15+	37.81	13.43
B5-	48.31	14.66
B5+	58.81	15.89
B11-	74.65	17.75

BENT D		
Stem at P19 (in.)		8.38
Stem at P4 (in.)		12.25
Total Distance From P19 to P4 (ft.)		71.36
Distance from P19 (ft.)		Stem (in.)
B11 -	0.00	8.38
B4 +	10.84	8.96
B4 -	21.69	9.55
B1-	21.69	9.55
B1+	35.69	10.31
B4-	46.19	10.88
B4+	56.69	11.45
B11-	71.36	12.25

BENT E		
Stem at P20 (in.)		8.25
Stem at P5 (in.)		8.38
Total Distance From P20 to P5 (ft.)		70.00
Distance from P20 (ft.)		Stem (in.)
B11 -	0.00	8.25
B3 +	10.50	8.27
B3 -	21.00	8.29
B1-	21.00	8.29
B1+	35.00	8.31
B3-	45.50	8.33
B3+	56.00	8.35
B11-	70.00	8.38

(These stems are added to the floor beam depth)

WEST APPROACH – SECTION P

COLUMNS

Tran Systems

Made By: GHD

Checked By: ADP

Date: 2/23/2012

Date: 3/2/2012

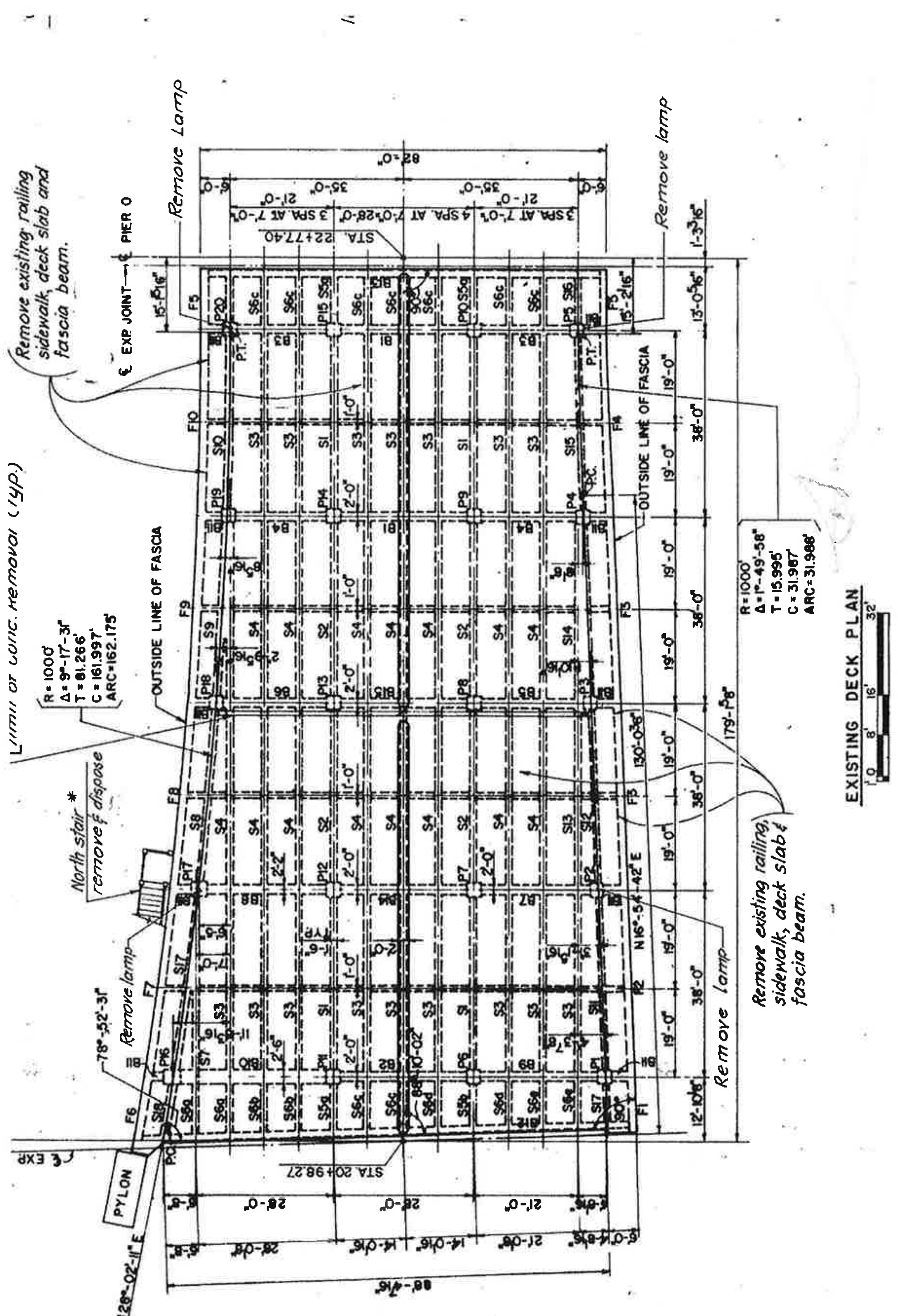
Job No.:

Sheet No.:

Columns Rating Summary - As Built

COLUMNS	Column Length	SERVICE LOADS (From STAAD Output)														
		DEAD LOAD					HS20					2F1				
		Axial	Top		Bottom		Axial	Top		Bottom		Axial	Top		Bottom	
	L (ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)
P1	28.86	210.01	33.56	33.56	22.37	14.60	130.69	68.75	50.28	30.95	19.42	64.27	33.23	38.87	14.81	15.05
P2	33.02	275.72	24.83	6.53	15.40	4.42	118.39	46.55	36.78	22.19	20.28	52.88	20.88	19.11	9.97	10.42
P3	34.67	238.35	17.15	21.34	10.41	11.62	127.19	40.16	37.54	19.18	17.88	57.48	18.72	17.21	8.95	8.11
P4	38.83	239.99	2.04	2.78	0.30	0.50	143.39	4.13	52.08	2.46	26.28	64.28	14.23	23.11	1.56	13.30
P5	45.49	191.62	4.18	22.28	1.83	11.73	166.07	3.63	80.34	3.78	37.91	78.95	1.76	50.88	1.83	24.01
P6	28.86	255.93	12.12	33.20	11.98	15.44	176.98	48.66	65.94	23.56	29.21	81.98	25.20	33.80	12.22	13.68
P7	32.02	326.73	15.04	4.24	10.63	2.60	134.82	34.35	32.59	16.82	17.89	60.20	15.36	17.07	7.52	9.24
P8	36.17	313.35	21.84	0.76	12.74	0.86	134.74	33.13	26.22	16.25	12.67	60.60	15.47	13.31	7.09	6.82
P9	41.33	313.18	27.65	3.83	14.34	1.51	132.42	31.09	24.84	15.32	12.41	59.61	14.53	13.21	7.16	6.54
P10	45.49	262.34	19.18	20.49	9.25	10.43	155.28	25.48	50.61	13.46	23.74	73.81	12.41	32.05	6.51	15.03
P11	28.86	331.17	52.13	27.83	31.68	14.19	191.54	100.96	90.45	54.89	40.11	90.50	51.64	32.43	28.21	13.63
P12	30.02	367.19	16.92	2.89	11.63	0.94	136.05	44.95	23.92	23.06	12.66	60.70	20.04	12.33	10.26	6.51
P13	36.17	328.66	8.24	0.31	1.99	0.36	137.07	33.40	28.53	16.42	13.85	61.64	15.59	14.24	7.66	6.88
P14	41.33	318.49	23.44	5.16	10.83	2.98	132.50	31.09	30.92	15.32	15.57	59.65	14.53	15.56	7.16	7.87
P15	45.49	263.87	19.66	19.43	9.93	9.21	155.37	34.82	50.64	17.20	23.75	73.85	16.54	32.07	8.17	15.04
P16	28.86	231.39	109.71	11.91	47.09	8.32	135.13	131.68	46.61	58.40	21.33	68.70	65.52	24.47	28.84	11.10
P17	28.02	262.74	68.44	19.73	30.24	8.02	126.58	62.31	31.07	29.60	16.01	56.57	27.88	15.71	13.27	9.33
P18	29.67	222.34	32.35	19.71	13.80	8.15	145.81	43.67	27.77	20.84	13.65	65.99	20.38	13.97	9.74	6.82
P19	35.33	227.56	6.59	6.34	2.51	4.29	143.55	29.28	51.44	14.11	25.97	64.36	14.33	26.04	6.90	13.15
P20	45.49	187.15	8.27	17.85	4.30	7.82	165.76	30.87	81.88	14.39	38.67	78.81	15.43	51.87	7.24	24.50

COLUMNS	SERVICE LOADS (From STAAD Output)															RATING FACTORS					
	3F1					4F1					5C1					HS20		OHIO LEGAL LOADS			
	Axial	Top		Bottom		Axial	Top		Bottom		Axial	Top		Bottom							
	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	Inv.	Opr.	2F1	3F1	4F1	5C1
P1	94.63	49.14	46.49	21.97	17.88	105.61	55.28	40.50	24.89	15.39	93.34	48.55	44.10	21.72	16.92	3.37	4.67	5.95	5.21	5.28	5.31
P2	80.32	31.69	28.52	15.13	15.59	93.12	36.71	32.27	17.52	17.67	92.97	36.08	27.59	16.99	15.11	4.12	6.12	9.71	7.63	6.98	7.35
P3	87.10	28.02	25.58	13.40	12.07	100.87	32.17	28.84	15.38	13.63	97.30	30.26	22.68	14.31	12.03	4.22	6.07	9.31	7.60	7.06	7.67
P4	97.63	20.95	34.22	2.20	19.93	113.14	23.86	38.39	2.16	22.63	111.99	22.31	28.33	10.61	13.52	6.25	10.40	16.36	11.60	10.41	12.67
P5	114.22	2.37	72.94	2.47	34.42	126.64	2.38	73.26	2.48	34.56	121.39	2.28	74.37	2.38	35.09	3.64	5.64	7.43	5.92	5.95	5.86
P6	120.29	36.15	41.01	20.79	16.14	134.13	43.10	42.36	23.10	18.33	118.67	35.73	38.77	20.66	15.71	2.91	4.39	6.65	5.73	5.40	5.86
P7	91.44	23.33	25.45	11.42	13.80	106.02	27.04	28.76	13.24	15.63	106.06	27.01	24.57	13.22	13.37	5.30	8.20	13.62	10.41	9.45	9.96
P8	92.38	23.23	19.75	10.55	10.24	106.75	26.67	22.21	12.09	11.65	104.01	25.70	18.17	12.60	9.65	5.65	8.49	13.29	10.58	9.73	10.34
P9	90.43	21.71	19.63	10.70	9.73	104.51	24.90	22.10	12.27	10.97	104.60	24.56	16.54	12.10	8.06	5.51	8.61	11.58	9.55	8.88	9.45
P10	106.94	17.56	46.11	9.21	21.61	118.72	19.52	46.61	10.17	21.83	114.28	19.05	46.99	10.22	22.03	4.15	6.07	8.26	6.75	6.62	6.61
P11	132.32	74.42	40.51	40.62	16.87	147.88	82.45	37.15	44.89	15.31	130.59	73.79	38.49	40.25	16.00	1.64	2.58	4.28	3.58	3.47	3.62
P12	92.22	30.45	18.43	15.59	9.73	106.94	35.31	20.87	18.08	11.03	107.39	36.12	17.93	18.85	9.44	4.91	7.71	13.20	10.06	9.08	9.23
P13	93.93	23.41	21.33	11.51	10.33	108.59	26.88	24.26	13.21	11.75	105.97	25.96	14.80	13.58	6.76	6.18	9.99	18.28	13.24	11.83	14.03
P14	90.49	21.71	23.33	10.70	11.78	104.57	24.90	26.50	12.27	13.39	104.71	24.58	18.38	12.11	9.33	5.27	7.77	11.90	9.55	8.80	9.74
P15	106.98	24.06	46.13	11.89	21.63	118.76	26.81	46.64	13.24	21.85	114.32	25.77	47.01	12.73	22.04	3.84	5.69	7.97	6.42	6.26	6.28
P16	99.38	95.39	36.85	42.08	16.72	110.57	106.36	41.36	47.07	18.80	98.95	94.25	35.78	41.62	16.25	1.59	2.21	3.05	2.59	2.45	2.61
P17	85.90	42.34	23.52	20.15	12.14	99.57	49.07	26.71	23.34	13.78	100.42	48.78	15.04	22.85	10.92	2.81	3.78	5.11	4.42	4.17	4.42
P18	100.05	30.69	20.93	14.67	10.24	115.75	35.35	23.76	16.89	11.64	106.09	33.54	13.90	15.85	7.38	4.09	5.67	7.94	6.70	6.27	6.93
P19	97.76	21.10	39.00	10.17	19.70	113.28	24.01	44.28	11.58	22.36	112.06	22.50	30.62	10.70	15.55	4.74	7.48	12.89	9.50	8.57	10.62
P20	114.09	21.92	74.23	10.36	35.05	126.56	24.38	74.46	11.52	35.16	121.17	22.53	75.70	10.34	35.75	3.19	4.91	7.04	5.44	5.36	5.36


EXISTING DECK PLAN
Remove existing railing, sidewalk, deck slab and fascia beam.
Remove Lamp
Remove lamp
Remove existing railing, sidewalk, deck slab & fascia beam.
Remove lamp
Remove lamp
North stair *
remove & dispose
Limit of conc. removal (typ.)
OUTSIDE LINE OF FASCIA
OUTSIDE LINE OF FASCIA
℄ EXP. JOINT — ℄ PIER O
STA. 22+77.40
STA 20+98.27
PYLON
℄ EXR
R = 1000'
Δ = 9°-17-31"
T = 81.266'
C = 161.997'
ARC = 162.175'
R = 1000'
Δ = 1°-49'-58"
T = 15.995'
C = 31.987'
ARC = 31.988'
N 16°-54'-42" E
N 28°-02'-11" E
78°-52'-31"
179'-5/8"
130'-0 3/8"
88'-0"
88'-4/16"

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                     oooooo                o
                    oo    oo              oo
 ooooo    oooooo    oo          ooooo     oo      oo   oo   o oooooooooo    o ooooo
oo    o   oo   oo   oo         oo   oo    oo      oo   oo    oo   oo   oo    oo   oo
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 ooooo    oo         oooooo     ooooo      ooo     ooooo o   oo   oo   oo    oo   oo (TM)
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spColumn v4.50 (TM)
Computer program for the Strength Design of Reinforced Concrete Sections

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P1-Inv.col
Project: MAIN AVE_SECTION P
Column: P1 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 36 in

Gross section area, Ag = 1080 in^2
Ix = 116640 in^4 Iy = 81000 in^4
rx = 10.3923 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: User-defined

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.17%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	210.01	33.56	22.37	33.56	14.60
	Live	130.69	68.75	30.95	50.28	19.42
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	36	116640	3	3122.02
	Y	28.86	30	36	81000	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	39.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 1.26e+008 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 8.39e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	556.61	6946.23	0.490	0.400	1.000	556.61	4823.77	4823.77	0.490	1.182

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	556.61	4632.37	0.490	0.440	1.000	556.61	3216.92	3216.92	0.490	1.300

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.68 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				--2nd Order-	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	192.82	0.00	192.82	(N/A)	192.82	(N/A)
	-96.24	0.00	-96.24	(N/A)	-96.24	(N/A)

Y-axis	1st Order				--2nd Order-	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	152.74	0.00	152.74	(N/A)	152.74	(N/A)
	-61.12	0.00	-61.12	(N/A)	-61.12	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	556.61	192.82	152.74	648.97	514.07	3.366	20.65	41.21	0.00299	0.766
2		556.61	-96.24	-61.12	-716.65	-455.13	7.446	20.64	41.62	0.00305	0.770

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P1-Opr.col
Project: MAIN AVE_SECTION P
Column: P1 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 36 in

Gross section area, Ag = 1080 in^2
Ix = 116640 in^4 Iy = 81000 in^4
rx = 10.3923 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.17%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	210.01	33.56	22.37	33.56	14.60
	Live	130.69	68.75	30.95	50.28	19.42
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	210.01	33.56	22.37	33.56	14.60
	Live	64.27	33.23	14.81	38.87	15.05
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	210.01	33.56	22.37	33.56	14.60
	Live	94.63	49.14	21.97	46.49	17.88
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	210.01	33.56	22.37	33.56	14.60
	Live	105.61	55.28	24.89	40.50	15.39
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	210.01	33.56	22.37	33.56	14.60
	Live	93.34	48.55	21.72	44.10	16.92
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	36	116640	3	3122.02
	Y	28.86	30	36	81000	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	39.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 1.26e+008 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 8.39e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	442.91	6405.13	0.616	0.400	1.000	442.91	4448.01	4448.01	0.616	1.153
2 U1	356.56	5863.65	0.766	0.400	1.000	356.56	4071.98	4071.98	0.766	1.132
3 U1	396.03	6128.50	0.689	0.400	1.000	396.03	4255.90	4255.90	0.689	1.142
4 U1	410.31	6216.75	0.665	0.400	1.000	410.31	4317.19	4317.19	0.665	1.145
5 U1	394.35	6117.88	0.692	0.400	1.000	394.35	4248.53	4248.53	0.692	1.141

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	442.91	4271.51	0.616	0.438	1.000	442.91	2966.33	2966.33	0.616	1.249
2 U1	356.56	3910.40	0.766	0.436	1.000	356.56	2715.56	2715.56	0.766	1.212
3 U1	396.03	4087.03	0.689	0.438	1.000	396.03	2838.21	2838.21	0.689	1.229
4 U1	410.31	4145.88	0.665	0.438	1.000	410.31	2879.09	2879.09	0.665	1.235

5 U1	394.35	4079.95	0.692	0.438	1.000	394.35	2833.30	2833.30	0.692	1.228

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.68 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	133.00	0.00	133.00	(N/A)	133.00	(N/A)
	-69.32	0.00	-69.32	(N/A)	-69.32	(N/A)
2 U1	86.83	0.00	86.83	(N/A)	86.83	(N/A)
	-48.33	0.00	-48.33	(N/A)	-48.33	(N/A)
3 U1	107.51	0.00	107.51	(N/A)	107.51	(N/A)
	-57.64	0.00	-57.64	(N/A)	-57.64	(N/A)
4 U1	115.49	0.00	115.49	(N/A)	115.49	(N/A)
	-61.44	0.00	-61.44	(N/A)	-61.44	(N/A)
5 U1	106.74	0.00	106.74	(N/A)	106.74	(N/A)
	-57.32	0.00	-57.32	(N/A)	-57.32	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	108.99	0.00	108.99	(N/A)	108.99	(N/A)
	-44.23	0.00	-44.23	(N/A)	-44.23	(N/A)
2 U1	94.16	0.00	94.16	(N/A)	94.16	(N/A)
	-38.54	0.00	-38.54	(N/A)	-38.54	(N/A)
3 U1	104.07	0.00	104.07	(N/A)	104.07	(N/A)
	-42.22	0.00	-42.22	(N/A)	-42.22	(N/A)
4 U1	96.28	0.00	96.28	(N/A)	96.28	(N/A)
	-38.99	0.00	-38.99	(N/A)	-38.99	(N/A)
5 U1	100.96	0.00	100.96	(N/A)	100.96	(N/A)
	-40.98	0.00	-40.98	(N/A)	-40.98	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	442.91	133.00	108.99	621.72	509.48	4.674	18.82	41.07	0.00355	0.803
2		442.91	-69.32	-44.23	-697.56	-445.07	10.063	18.82	41.67	0.00364	0.810
3	2 U1	356.56	86.83	94.16	516.99	560.65	5.954	16.48	39.37	0.00417	0.845
4		356.56	-48.33	-38.54	-610.97	-487.23	12.641	17.51	41.19	0.00406	0.837
5	3 U1	396.03	107.51	104.07	560.17	542.22	5.210	17.51	40.10	0.00387	0.825
6		396.03	-57.64	-42.22	-645.86	-473.11	11.205	18.11	41.39	0.00386	0.824
7	4 U1	410.31	115.49	96.28	609.57	508.16	5.278	18.23	40.96	0.00374	0.816
8		410.31	-61.44	-38.99	-692.05	-439.16	11.264	18.29	41.71	0.00384	0.823
9	5 U1	394.35	106.74	100.96	566.95	536.23	5.311	17.56	40.23	0.00388	0.825
10		394.35	-57.32	-40.98	-652.80	-466.69	11.389	18.07	41.45	0.00388	0.826

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P2-Inv.col
Project: MAIN AVE_SECTION P
Column: P2 | Engineer: GHD
Code: ACI 318-02 | Units: English

Run Option: Investigation | Slenderness: Considered
Run Axis: Biaxial | Column Type: Structural

Material Properties:

f'c = 3 ksi | fy = 36 ksi
Ec = 3122.02 ksi | Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in | Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 | Iy = 67500 in^4
rx = 8.66025 in | ry = 8.66025 in
Xo = 0 in | Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	275.72	24.83	15.40	6.53	4.42
	Live	118.39	46.55	22.19	36.78	20.28
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	33.02	30	30	67500	3	3122.02
	Y	33.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	54.90
Y	0.000	0.000	1.000	1.200	54.90

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	615.34	2998.10	0.582	0.400	1.000	615.34	2082.01	2082.01	0.582	1.650

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	615.34	2998.10	0.582	0.400	1.000	615.34	2082.01	2082.01	0.582	1.650

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	133.29	0.00	133.29	(N/A)	133.29	(N/A)
	-68.17	0.00	-68.17	(N/A)	-68.17	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	88.30	0.00	88.30	(N/A)	88.30	(N/A)
	-49.75	0.00	-49.75	(N/A)	-49.75	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	615.34	133.29	88.30	548.69	363.49	4.116	21.11	36.93	0.00225	0.717
2		615.34	-68.17	-49.75	-529.51	-386.45	7.767	21.33	37.16	0.00223	0.716

*** End of output ***

General Information:
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File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P2-Opr.col
Project: MAIN AVE_SECTION P
Column: P2 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	275.72	24.83	15.40	6.53	4.42
	Live	118.39	46.55	22.19	36.78	20.28
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	275.72	24.83	15.40	6.53	4.42
	Live	52.88	20.88	9.97	19.11	10.42
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	275.72	24.83	15.40	6.53	4.42
	Live	80.32	31.69	15.13	28.52	15.59
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	275.72	24.83	15.40	6.53	4.42
	Live	93.12	36.71	17.52	32.27	17.67
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	275.72	24.83	15.40	6.53	4.42
	Live	92.97	36.08	16.99	27.59	15.11
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	33.02	30	30	67500	3	3122.02
	Y	33.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	54.90
Y	0.000	0.000	1.000	1.200	54.90

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	512.34	2791.53	0.700	0.400	1.000	512.34	1938.56	1938.56	0.700	1.544
2 U1	427.18	2579.83	0.839	0.400	1.000	427.18	1791.54	1791.54	0.839	1.466
3 U1	462.85	2673.85	0.774	0.400	1.000	462.85	1856.84	1856.84	0.774	1.498
4 U1	479.49	2714.97	0.748	0.400	1.000	479.49	1885.39	1885.39	0.748	1.513
5 U1	479.30	2714.49	0.748	0.400	1.000	479.30	1885.06	1885.06	0.748	1.513

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	512.34	2791.53	0.700	0.400	1.000	512.34	1938.56	1938.56	0.700	1.544
2 U1	427.18	2579.83	0.839	0.400	1.000	427.18	1791.54	1791.54	0.839	1.466
3 U1	462.85	2673.85	0.774	0.400	1.000	462.85	1856.84	1856.84	0.774	1.498
4 U1	479.49	2714.97	0.748	0.400	1.000	479.49	1885.39	1885.39	0.748	1.513

5 U1	479.30	2714.49	0.748	0.400	1.000	479.30	1885.06	1885.06	0.748	1.513

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	92.79	0.00	92.79	(N/A)	92.79	(N/A)
	-48.87	0.00	-48.87	(N/A)	-48.87	(N/A)
2 U1	59.42	0.00	59.42	(N/A)	59.42	(N/A)
	-32.98	0.00	-32.98	(N/A)	-32.98	(N/A)
3 U1	73.48	0.00	73.48	(N/A)	73.48	(N/A)
	-39.69	0.00	-39.69	(N/A)	-39.69	(N/A)
4 U1	80.00	0.00	80.00	(N/A)	80.00	(N/A)
	-42.80	0.00	-42.80	(N/A)	-42.80	(N/A)
5 U1	79.18	0.00	79.18	(N/A)	79.18	(N/A)
	-42.11	0.00	-42.11	(N/A)	-42.11	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	56.30	0.00	56.30	(N/A)	56.30	(N/A)
	-32.11	0.00	-32.11	(N/A)	-32.11	(N/A)
2 U1	33.33	0.00	33.33	(N/A)	33.33	(N/A)
	-19.29	0.00	-19.29	(N/A)	-19.29	(N/A)
3 U1	45.56	0.00	45.56	(N/A)	45.56	(N/A)
	-26.01	0.00	-26.01	(N/A)	-26.01	(N/A)
4 U1	50.44	0.00	50.44	(N/A)	50.44	(N/A)
	-28.72	0.00	-28.72	(N/A)	-28.72	(N/A)
5 U1	44.36	0.00	44.36	(N/A)	44.36	(N/A)
	-25.39	0.00	-25.39	(N/A)	-25.39	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	512.34	92.79	56.30	567.80	344.52	6.119	19.13	36.64	0.00275	0.750
2		512.34	-48.87	-32.11	-551.93	-362.67	11.295	19.33	36.82	0.00272	0.748
3	2 U1	427.18	59.42	33.33	577.02	323.67	9.710	17.43	36.32	0.00325	0.784
4		427.18	-32.98	-19.29	-568.92	-332.79	17.250	17.54	36.43	0.00323	0.783
5	3 U1	462.85	73.48	45.56	560.43	347.54	7.627	18.33	36.64	0.00300	0.767
6		462.85	-39.69	-26.01	-549.34	-360.05	13.841	18.48	36.77	0.00297	0.765
7	4 U1	479.49	80.00	50.44	558.39	352.06	6.980	18.66	36.69	0.00290	0.760
8		479.49	-42.80	-28.72	-545.83	-366.26	12.754	18.82	36.84	0.00288	0.759
9	5 U1	479.30	79.18	44.36	581.61	325.80	7.345	18.36	36.41	0.00295	0.764
10		479.30	-42.11	-25.39	-567.25	-342.03	13.472	18.54	36.59	0.00292	0.762

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P3-Inv.col
Project: MAIN AVE_SECTION P
Column: P3 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	238.35	17.15	10.41	21.34	11.62
	Live	127.19	40.16	19.18	37.54	17.88
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	34.67	30	30	67500	3	3122.02
	Y	34.67	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	57.65
Y	0.000	0.000	1.000	1.200	57.65

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	585.86	2814.88	0.529	0.400	1.000	585.86	1954.78	1954.78	0.529	1.666

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	585.86	2814.88	0.529	0.403	1.000	585.86	1954.78	1954.78	0.529	1.666

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				--2nd Order-	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	109.44	0.00	109.44	(N/A)	109.44	(N/A)
	-55.15	0.00	-55.15	(N/A)	-55.15	(N/A)

Y-axis	1st Order				--2nd Order-	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	109.20	0.00	109.20	(N/A)	109.20	(N/A)
	-53.91	0.00	-53.91	(N/A)	-53.91	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	585.86	109.44	109.20	461.70	460.69	4.219	21.01	37.33	0.00233	0.722
2		585.86	-55.15	-53.91	-466.47	-455.92	8.458	21.01	37.33	0.00233	0.722

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P3-Opr.col
Project: MAIN AVE_SECTION P
Column: P3 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	238.35	17.15	10.41	21.34	11.62
	Live	127.19	40.16	19.18	37.54	17.88
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	238.35	17.15	10.41	21.34	11.62
	Live	57.48	18.72	8.95	17.21	8.11
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	238.35	17.15	10.41	21.34	11.62
	Live	87.10	28.02	13.40	25.58	12.07
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	238.35	17.15	10.41	21.34	11.62
	Live	100.87	32.17	15.38	28.84	13.63
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	238.35	17.15	10.41	21.34	11.62
	Live	97.30	30.26	14.31	22.68	12.03
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	34.67	30	30	67500	3	3122.02
	Y	34.67	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	57.65
Y	0.000	0.000	1.000	1.200	57.65

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	475.20	2605.03	0.652	0.400	1.000	475.20	1809.05	1809.05	0.652	1.539
2 U1	384.58	2383.37	0.806	0.400	1.000	384.58	1655.12	1655.12	0.806	1.449
3 U1	423.08	2484.25	0.732	0.400	1.000	423.08	1725.17	1725.17	0.732	1.486
4 U1	440.99	2527.63	0.703	0.400	1.000	440.99	1755.30	1755.30	0.703	1.504
5 U1	436.35	2516.58	0.710	0.400	1.000	436.35	1747.63	1747.63	0.710	1.499

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	475.20	2605.03	0.652	0.400	1.000	475.20	1809.05	1809.05	0.652	1.539
2 U1	384.58	2383.37	0.806	0.400	1.000	384.58	1655.12	1655.12	0.806	1.449
3 U1	423.08	2484.25	0.732	0.400	1.000	423.08	1725.17	1725.17	0.732	1.486
4 U1	440.99	2527.63	0.703	0.400	1.000	440.99	1755.30	1755.30	0.703	1.504

5 U1	436.35	2516.58	0.710	0.400	1.000	436.35	1747.63	1747.63	0.710	1.499

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	74.50	0.00	74.50	(N/A)	74.50	(N/A)
	-38.47	0.00	-38.47	(N/A)	-38.47	(N/A)
2 U1	46.63	0.00	46.63	(N/A)	46.63	(N/A)
	-25.17	0.00	-25.17	(N/A)	-25.17	(N/A)
3 U1	58.72	0.00	58.72	(N/A)	58.72	(N/A)
	-30.95	0.00	-30.95	(N/A)	-30.95	(N/A)
4 U1	64.12	0.00	64.12	(N/A)	64.12	(N/A)
	-33.53	0.00	-33.53	(N/A)	-33.53	(N/A)
5 U1	61.63	0.00	61.63	(N/A)	61.63	(N/A)
	-32.14	0.00	-32.14	(N/A)	-32.14	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	76.54	0.00	76.54	(N/A)	76.54	(N/A)
	-38.35	0.00	-38.35	(N/A)	-38.35	(N/A)
2 U1	50.11	0.00	50.11	(N/A)	50.11	(N/A)
	-25.65	0.00	-25.65	(N/A)	-25.65	(N/A)
3 U1	61.00	0.00	61.00	(N/A)	61.00	(N/A)
	-30.80	0.00	-30.80	(N/A)	-30.80	(N/A)
4 U1	65.23	0.00	65.23	(N/A)	65.23	(N/A)
	-32.82	0.00	-32.82	(N/A)	-32.82	(N/A)
5 U1	57.23	0.00	57.23	(N/A)	57.23	(N/A)
	-30.74	0.00	-30.74	(N/A)	-30.74	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	475.20	74.50	76.54	452.25	464.64	6.070	19.26	37.33	0.00281	0.755
2		475.20	-38.47	-38.35	-459.14	-457.74	11.936	19.26	37.33	0.00281	0.755
3	2 U1	384.58	46.63	50.11	434.31	466.76	9.314	17.79	37.33	0.00329	0.787
4		384.58	-25.17	-25.65	-446.27	-454.80	17.732	17.79	37.33	0.00329	0.787
5	3 U1	423.08	58.72	61.00	446.13	463.41	7.597	18.42	37.33	0.00308	0.772
6		423.08	-30.95	-30.80	-455.92	-453.62	14.729	18.42	37.33	0.00308	0.772
7	4 U1	440.99	64.12	65.23	452.41	460.30	7.056	18.70	37.33	0.00299	0.766
8		440.99	-33.53	-32.82	-461.19	-451.53	13.756	18.70	37.33	0.00299	0.766
9	5 U1	436.35	61.63	57.23	472.91	439.10	7.673	18.63	37.33	0.00301	0.768
10		436.35	-32.14	-30.74	-466.09	-445.92	14.504	18.63	37.33	0.00301	0.768

*** End of output ***

```
General Information:
====================
  File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P4-Inv.col
  Project:  MAIN AVE_SECTION P
  Column:   P4                              Engineer: GHD
  Code:     ACI 318-02                      Units: English

  Run Option: Investigation                 Slenderness: Considered
  Run Axis:   Biaxial                       Column Type: Structural

Material Properties:
====================
  f'c   = 3 ksi                             fy   = 36 ksi
  Ec    = 3122.02 ksi                       Es   = 29000 ksi
  Ultimate strain = 0.003 in/in
  Beta1 = 0.85

Section:
========
  Rectangular: Width = 30 in                Depth = 30 in

  Gross section area, Ag =  900 in^2
  Ix =  67500 in^4                          Iy =  67500 in^4
  rx =  8.66025 in                          ry =  8.66025 in
  Xo =  0 in                                Yo =  0 in

Reinforcement:
==============
  Bar Set: ASTM A615
  Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)   Size Diam (in) Area (in^2)
  ---- --------- -----------   ---- --------- -----------   ---- --------- -----------
  #  3      0.38        0.11   #  4      0.50        0.20   #  5      0.63        0.31
  #  6      0.75        0.44   #  7      0.88        0.60   #  8      1.00        0.79
  #  9      1.13        1.00   # 10      1.27        1.27   # 11      1.41        1.56
  # 14      1.69        2.25   # 18      2.26        4.00

  Confinement: Tied; #4 ties with #10 bars,  #4 with larger bars.
  phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

  Layout: Rectangular
  Pattern: All Sides Equal  (Cover to longitudinal reinforcement)
  Total steel area: As = 12.64 in^2 at rho = 1.40%
  Minimum clear spacing = 4.75 in

  16 #8   Cover = 3 in

Service Loads:
==============
      Load   Axial Load     Mx @ Top     Mx @ Bot     My @ Top     My @ Bot
  No. Case          kip         k-ft         k-ft         k-ft         k-ft
  --- ---- ------------ ------------ ------------ ------------ ------------
    1 Dead       239.99         2.04         0.30         2.78         0.50
      Live       143.39         4.13         2.46        52.08        26.28
      Wind         0.00         0.00         0.00         0.00         0.00
      EQ           0.00         0.00         0.00         0.00         0.00
      Snow         0.00         0.00         0.00         0.00         0.00

Sustained Load Factors:
=======================
   Load        Factor
   Case           (%)
   ---- ------------
   Dead           100
   Live             0
   Wind             0
   EQ               0
   Snow             0

Load Combinations:
==================
  U1  =  1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============
  Sway Criteria:
  --------------
  X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
  Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
```

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	38.83	30	30	67500	3	3122.02
	Y	38.83	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	64.57
Y	0.000	0.000	1.000	1.200	64.57

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	623.14	2286.26	0.501	0.403	1.000	623.14	1587.68	1587.68	0.501	2.098

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	623.14	2286.26	0.501	0.402	1.000	623.14	1587.68	1587.68	0.501	2.098

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	11.61	0.00	11.61	(N/A)	11.61	(N/A)
	-5.73	0.00	-5.73	(N/A)	-5.73	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	116.63	0.00	116.63	(N/A)	116.63	(N/A)
	-57.68	0.00	-57.68	(N/A)	-57.68	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	623.14	11.61	116.63	72.64	729.43	6.254	15.59	29.79	0.00274	0.750
2		623.14	-5.73	-57.68	-72.45	-729.49	12.648	15.59	29.78	0.00274	0.750

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P4-Opr.col
Project: MAIN AVE_SECTION P
Column: P4 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	239.99	2.04	0.30	2.78	0.50
	Live	143.39	4.13	2.46	52.08	26.28
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	239.99	2.04	0.30	2.78	0.50
	Live	64.28	14.23	1.56	23.11	13.30
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	239.99	2.04	0.30	2.78	0.50
	Live	97.63	20.95	2.20	34.22	19.93
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	239.99	2.04	0.30	2.78	0.50
	Live	113.14	23.86	2.16	38.39	22.63
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	239.99	2.04	0.30	2.78	0.50
	Live	111.99	22.31	10.61	28.33	13.52
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	38.83	30	30	67500	3	3122.02
	Y	38.83	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	64.57
Y	0.000	0.000	1.000	1.200	64.57

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	498.39	2110.05	0.626	0.421	1.000	498.39	1465.31	1465.31	0.626	1.830
2 U1	395.55	1918.06	0.789	0.554	1.000	395.55	1331.98	1331.98	0.789	1.655
3 U1	438.91	2005.41	0.711	0.557	1.000	438.91	1392.64	1392.64	0.711	1.725
4 U1	459.07	2042.68	0.680	0.562	1.000	459.07	1418.53	1418.53	0.680	1.759
5 U1	457.57	2039.99	0.682	0.421	1.000	457.57	1416.66	1416.66	0.682	1.756

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	498.39	2110.05	0.626	0.405	1.000	498.39	1465.31	1465.31	0.626	1.830
2 U1	395.55	1918.06	0.789	0.400	1.000	395.55	1331.98	1331.98	0.789	1.655
3 U1	438.91	2005.41	0.711	0.400	1.000	438.91	1392.64	1392.64	0.711	1.725
4 U1	459.07	2042.68	0.680	0.400	1.000	459.07	1418.53	1418.53	0.680	1.759

5 U1	457.57	2039.99	0.682	0.420	1.000	457.57	1416.66	1416.66	0.682	1.756

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	8.02	0.00	8.02	(N/A)	8.02	(N/A)
	-3.59	0.00	-3.59	(N/A)	-3.59	(N/A)
2 U1	21.15	0.00	21.15	(N/A)	21.15	(N/A)
	-2.42	0.00	-2.42	(N/A)	-2.42	(N/A)
3 U1	29.89	0.00	29.89	(N/A)	29.89	(N/A)
	-3.25	0.00	-3.25	(N/A)	-3.25	(N/A)
4 U1	33.67	0.00	33.67	(N/A)	33.67	(N/A)
	-3.20	0.00	-3.20	(N/A)	-3.20	(N/A)
5 U1	31.65	0.00	31.65	(N/A)	31.65	(N/A)
	-14.18	0.00	-14.18	(N/A)	-14.18	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	71.32	0.00	71.32	(N/A)	71.32	(N/A)
	-34.81	0.00	-34.81	(N/A)	-34.81	(N/A)
2 U1	33.66	0.00	33.66	(N/A)	33.66	(N/A)
	-17.94	0.00	-17.94	(N/A)	-17.94	(N/A)
3 U1	48.10	0.00	48.10	(N/A)	48.10	(N/A)
	-26.56	0.00	-26.56	(N/A)	-26.56	(N/A)
4 U1	53.52	0.00	53.52	(N/A)	53.52	(N/A)
	-30.07	0.00	-30.07	(N/A)	-30.07	(N/A)
5 U1	40.44	0.00	40.44	(N/A)	40.44	(N/A)
	-18.23	0.00	-18.23	(N/A)	-18.23	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	498.39	8.02	71.32	83.38	741.33	10.395	13.12	30.05	0.00390	0.827
2		498.39	-3.59	-34.81	-76.74	-744.64	21.389	12.91	29.76	0.00395	0.830
3	2 U1	395.55	21.15	33.66	346.05	550.65	16.361	17.15	36.55	0.00340	0.793
4		395.55	-2.42	-17.94	-97.48	-723.27	40.316	11.48	30.37	0.00496	0.897
5	3 U1	438.91	29.89	48.10	346.69	557.96	11.600	17.94	36.62	0.00313	0.775
6		438.91	-3.25	-26.56	-89.71	-733.14	27.604	12.07	30.17	0.00453	0.869
7	4 U1	459.07	33.67	53.52	350.56	557.24	10.412	18.31	36.67	0.00301	0.768
8		459.07	-3.20	-30.07	-78.80	-740.90	24.640	12.13	29.77	0.00441	0.861
9	5 U1	457.57	31.65	40.44	401.01	512.33	12.668	18.86	37.22	0.00292	0.762
10		457.57	-14.18	-18.23	-399.63	-513.55	28.177	18.85	37.20	0.00292	0.762

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P5-Inv.col
Project: MAIN AVE_SECTION P
Column: P5 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	191.62	4.18	1.83	22.28	11.73
	Live	166.07	3.63	3.78	80.34	37.91
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	609.48	1774.55	0.409	0.400	1.000	609.48	1232.32	1232.32	0.409	2.936 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	609.48	1774.55	0.409	0.408	1.000	609.48	1232.32	1232.32	0.409	2.936 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	13.31	0.00	13.31	(N/A)	13.31	(N/A)
	-10.58	0.00	-10.58	(N/A)	-10.58	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	203.30	0.00	203.30	(N/A)	203.30	(N/A)
	-97.51	0.00	-97.51	(N/A)	-97.51	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	609.48	13.31	203.30	48.47	740.31	3.641	14.49	28.73	0.00297	0.765
2		609.48	-10.58	-97.51	-79.23	-730.16	7.488	15.51	30.14	0.00284	0.756

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P5-Opr.col
Project: MAIN AVE_SECTION P
Column: P5 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	191.62	4.18	1.83	22.28	11.73
	Live	166.07	3.63	3.78	80.34	37.91
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	191.62	4.18	1.83	22.28	11.73
	Live	78.95	1.76	1.83	50.88	24.01
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	191.62	4.18	1.83	22.28	11.73
	Live	114.22	2.37	2.47	72.94	34.42
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	191.62	4.18	1.83	22.28	11.73
	Live	126.64	2.38	2.48	73.26	34.56
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	191.62	4.18	1.83	22.28	11.73
	Live	121.39	2.28	2.38	74.37	35.09
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	465.00	1627.80	0.536	0.400	1.000	465.00	1130.42	1130.42	0.536	2.215
2 U1	351.74	1463.43	0.708	0.400	1.000	351.74	1016.27	1016.27	0.708	1.857
3 U1	397.59	1536.91	0.627	0.400	1.000	397.59	1067.30	1067.30	0.627	1.987
4 U1	413.74	1560.36	0.602	0.400	1.000	413.74	1083.59	1083.59	0.602	2.037
5 U1	406.91	1550.59	0.612	0.400	1.000	406.91	1076.80	1076.80	0.612	2.016

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	465.00	1627.80	0.536	0.407	1.000	465.00	1130.42	1130.42	0.536	2.215
2 U1	351.74	1463.43	0.708	0.405	1.000	351.74	1016.27	1016.27	0.708	1.857
3 U1	397.59	1536.91	0.627	0.406	1.000	397.59	1067.30	1067.30	0.627	1.987
4 U1	413.74	1560.36	0.602	0.406	1.000	413.74	1083.59	1083.59	0.602	2.037

5	U1	406.91	1550.59	0.612	0.406	1.000	406.91	1076.80	1076.80	0.612	2.016

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	10.15	0.00	10.15	(N/A)	10.15	(N/A)
	-7.29	0.00	-7.29	(N/A)	-7.29	(N/A)
2 U1	7.72	0.00	7.72	(N/A)	7.72	(N/A)
	-4.76	0.00	-4.76	(N/A)	-4.76	(N/A)
3 U1	8.51	0.00	8.51	(N/A)	8.51	(N/A)
	-5.59	0.00	-5.59	(N/A)	-5.59	(N/A)
4 U1	8.53	0.00	8.53	(N/A)	8.53	(N/A)
	-5.60	0.00	-5.60	(N/A)	-5.60	(N/A)
5 U1	8.40	0.00	8.40	(N/A)	8.40	(N/A)
	-5.47	0.00	-5.47	(N/A)	-5.47	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	133.41	0.00	133.41	(N/A)	133.41	(N/A)
	-64.53	0.00	-64.53	(N/A)	-64.53	(N/A)
2 U1	95.11	0.00	95.11	(N/A)	95.11	(N/A)
	-46.46	0.00	-46.46	(N/A)	-46.46	(N/A)
3 U1	123.79	0.00	123.79	(N/A)	123.79	(N/A)
	-59.99	0.00	-59.99	(N/A)	-59.99	(N/A)
4 U1	124.20	0.00	124.20	(N/A)	124.20	(N/A)
	-60.18	0.00	-60.18	(N/A)	-60.18	(N/A)
5 U1	125.64	0.00	125.64	(N/A)	125.64	(N/A)
	-60.87	0.00	-60.87	(N/A)	-60.87	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	465.00	10.15	133.41	57.26	752.36	5.640	11.56	28.88	0.00457	0.871
2		465.00	-7.29	-64.53	-83.58	-739.60	11.461	12.40	29.98	0.00429	0.853
3	2 U1	351.74	7.72	95.11	57.37	706.58	7.429	9.74	28.72	0.00595	0.900
4		351.74	-4.76	-46.46	-72.18	-704.80	15.169	10.14	29.29	0.00576	0.900
5	3 U1	397.59	8.51	123.79	50.38	732.34	5.916	10.21	28.50	0.00546	0.900
6		397.59	-5.59	-59.99	-67.94	-729.12	12.153	10.70	29.20	0.00526	0.900
7	4 U1	413.74	8.53	124.20	50.71	738.51	5.946	10.48	28.54	0.00525	0.900
8		413.74	-5.60	-60.18	-68.35	-734.13	12.199	10.98	29.26	0.00506	0.900
9	5 U1	406.91	8.40	125.64	49.21	736.24	5.860	10.32	28.47	0.00536	0.900
10		406.91	-5.47	-60.87	-65.87	-732.56	12.036	10.80	29.14	0.00517	0.900

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P6-Inv.col
Project: MAIN AVE_SECTION P
Column: P6 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:
====================

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	255.93	12.12	11.98	33.20	15.44
	Live	176.98	48.66	23.56	65.94	29.21
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc — SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc — SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	30	67500	3	3122.02
	Y	28.86	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	47.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	716.76	4241.84	0.464	0.400	1.000	716.76	2945.72	2945.72	0.464	1.480

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	716.76	4241.84	0.464	0.421	1.000	716.76	2945.72	2945.72	0.464	1.480

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	121.35	0.00	121.35	(N/A)	121.35	(N/A)
	-66.70	0.00	-66.70	(N/A)	-66.70	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	186.25	0.00	186.25	(N/A)	186.25	(N/A)
	-83.46	0.00	-83.46	(N/A)	-83.46	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	716.76	121.35	186.25	353.06	541.89	2.909	22.79	36.95	0.00187	0.692
2		716.76	-66.70	-83.46	-400.85	-501.57	6.010	23.09	37.33	0.00185	0.690

*** End of output ***

General Information:
====================
File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P6-Opr.col
Project: MAIN AVE_SECTION P
Column: P6 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================
f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========
Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	255.93	12.12	11.98	33.20	15.44
	Live	176.98	48.66	23.56	65.94	29.21
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	255.93	12.12	11.98	33.20	15.44
	Live	81.98	25.20	12.22	33.80	13.68
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	255.93	12.12	11.98	33.20	15.44
	Live	120.29	36.15	20.79	41.01	16.14
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	255.93	12.12	11.98	33.20	15.44
	Live	134.13	43.10	23.10	42.36	18.33
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	255.93	12.12	11.98	33.20	15.44
	Live	118.67	35.73	20.66	38.77	15.71
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	30	67500	3	3122.02
	Y	28.86	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	47.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	562.78	3903.29	0.591	0.400	1.000	562.78	2710.62	2710.62	0.591	1.383
2 U1	439.28	3534.13	0.757	0.400	1.000	439.28	2454.26	2454.26	0.757	1.313
3 U1	489.09	3696.35	0.680	0.400	1.000	489.09	2566.91	2566.91	0.680	1.341
4 U1	507.08	3750.22	0.656	0.400	1.000	507.08	2604.32	2604.32	0.656	1.351
5 U1	486.98	3689.89	0.683	0.400	1.000	486.98	2562.42	2562.42	0.683	1.339

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	562.78	3903.29	0.591	0.420	1.000	562.78	2710.62	2710.62	0.591	1.383
2 U1	439.28	3534.13	0.757	0.426	1.000	439.28	2454.26	2454.26	0.757	1.313
3 U1	489.09	3696.35	0.680	0.430	1.000	489.09	2566.91	2566.91	0.680	1.341
4 U1	507.08	3750.22	0.656	0.421	1.000	507.08	2604.32	2604.32	0.656	1.351

5	U1	486.98	3689.89	0.683	0.427	1.000	486.98	2562.42	2562.42	0.683	1.339

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	79.01	0.00	79.01	(N/A)	79.01	(N/A)
	-46.20	0.00	-46.20	(N/A)	-46.20	(N/A)
2 U1	48.52	0.00	48.52	(N/A)	48.52	(N/A)
	-31.46	0.00	-31.46	(N/A)	-31.46	(N/A)
3 U1	62.75	0.00	62.75	(N/A)	62.75	(N/A)
	-42.60	0.00	-42.60	(N/A)	-42.60	(N/A)
4 U1	71.79	0.00	71.79	(N/A)	71.79	(N/A)
	-45.60	0.00	-45.60	(N/A)	-45.60	(N/A)
5 U1	62.20	0.00	62.20	(N/A)	62.20	(N/A)
	-42.43	0.00	-42.43	(N/A)	-42.43	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	128.88	0.00	128.88	(N/A)	128.88	(N/A)
	-58.04	0.00	-58.04	(N/A)	-58.04	(N/A)
2 U1	87.10	0.00	87.10	(N/A)	87.10	(N/A)
	-37.86	0.00	-37.86	(N/A)	-37.86	(N/A)
3 U1	96.47	0.00	96.47	(N/A)	96.47	(N/A)
	-41.05	0.00	-41.05	(N/A)	-41.05	(N/A)
4 U1	98.23	0.00	98.23	(N/A)	98.23	(N/A)
	-43.90	0.00	-43.90	(N/A)	-43.90	(N/A)
5 U1	93.56	0.00	93.56	(N/A)	93.56	(N/A)
	-40.49	0.00	-40.49	(N/A)	-40.49	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	562.78	79.01	128.88	347.05	566.09	4.392	20.04	36.71	0.00250	0.734
2		562.78	-46.20	-58.04	-408.85	-513.65	8.849	20.64	37.32	0.00243	0.729
3	2 U1	439.28	48.52	87.10	322.61	579.17	6.649	17.66	36.34	0.00317	0.779
4		439.28	-31.46	-37.86	-414.13	-498.33	13.164	18.68	37.33	0.00300	0.767
5	3 U1	489.09	62.75	96.47	359.55	552.77	5.730	18.90	36.78	0.00284	0.756
6		489.09	-42.60	-41.05	-467.76	-450.77	10.980	19.48	37.33	0.00275	0.750
7	4 U1	507.08	71.79	98.23	387.32	529.99	5.396	19.50	37.07	0.00270	0.747
8		507.08	-45.60	-43.90	-468.97	-451.45	10.283	19.77	37.33	0.00266	0.745
9	5 U1	486.98	62.20	93.56	364.48	548.20	5.859	18.92	36.83	0.00284	0.756
10		486.98	-42.43	-40.49	-469.87	-448.42	11.073	19.45	37.33	0.00276	0.751

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P7-Inv.col
Project: MAIN AVE_SECTION P
Column: P7 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	326.73	15.04	10.63	4.24	2.60
	Live	134.82	34.35	16.82	32.59	17.89
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	32.02	30	30	67500	3	3122.02
	Y	32.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	53.24
Y	0.000	0.000	1.000	1.200	53.24

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	717.31	3168.98	0.592	0.400	1.000	717.31	2200.68	2200.68	0.592	1.769

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	717.31	3168.98	0.592	0.400	1.000	717.31	2200.68	2200.68	0.592	1.769

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	94.09	0.00	94.09	(N/A)	94.09	(N/A)
	-50.32	0.00	-50.32	(N/A)	-50.32	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	76.23	0.00	76.23	(N/A)	76.23	(N/A)
	-42.20	0.00	-42.20	(N/A)	-42.20	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	717.31	94.09	76.23	498.46	403.85	5.298	23.10	37.33	0.00185	0.690
2		717.31	-50.32	-42.20	-490.73	-411.57	9.753	23.10	37.33	0.00185	0.690

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P7-Opr.col
Project: MAIN AVE_SECTION P
Column: P7 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:
====================

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	326.73	15.04	10.63	4.24	2.60
	Live	134.82	34.35	16.82	32.59	17.89
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	326.73	15.04	10.63	4.24	2.60
	Live	60.20	15.36	7.52	17.07	9.24
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	326.73	15.04	10.63	4.24	2.60
	Live	91.44	23.33	11.42	25.45	13.80
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	326.73	15.04	10.63	4.24	2.60
	Live	106.02	27.04	13.24	28.76	15.63
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	326.73	15.04	10.63	4.24	2.60
	Live	106.06	27.01	13.22	24.57	13.37
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	32.02	30	30	67500	3	3122.02
	Y	32.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	53.24
Y	0.000	0.000	1.000	1.200	53.24

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	600.02	2954.20	0.708	0.400	1.000	600.02	2051.53	2051.53	0.708	1.639
2 U1	503.01	2735.53	0.844	0.400	1.000	503.01	1899.68	1899.68	0.844	1.546
3 U1	543.62	2832.41	0.781	0.400	1.000	543.62	1966.95	1966.95	0.781	1.584
4 U1	562.58	2874.89	0.755	0.400	1.000	562.58	1996.45	1996.45	0.755	1.602
5 U1	562.63	2875.01	0.755	0.400	1.000	562.63	1996.53	1996.53	0.755	1.602

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	600.02	2954.20	0.708	0.400	1.000	600.02	2051.53	2051.53	0.708	1.639
2 U1	503.01	2735.53	0.844	0.400	1.000	503.01	1899.68	1899.68	0.844	1.546
3 U1	543.62	2832.41	0.781	0.400	1.000	543.62	1966.95	1966.95	0.781	1.584
4 U1	562.58	2874.89	0.755	0.400	1.000	562.58	1996.45	1996.45	0.755	1.602

5 U1	562.63	2875.01	0.755	0.400	1.000	562.63	1996.53	1996.53	0.755	1.602

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	64.21	0.00	64.21	(N/A)	64.21	(N/A)
	-35.68	0.00	-35.68	(N/A)	-35.68	(N/A)
2 U1	39.52	0.00	39.52	(N/A)	39.52	(N/A)
	-23.59	0.00	-23.59	(N/A)	-23.59	(N/A)
3 U1	49.88	0.00	49.88	(N/A)	49.88	(N/A)
	-28.66	0.00	-28.66	(N/A)	-28.66	(N/A)
4 U1	54.70	0.00	54.70	(N/A)	54.70	(N/A)
	-31.03	0.00	-31.03	(N/A)	-31.03	(N/A)
5 U1	54.66	0.00	54.66	(N/A)	54.66	(N/A)
	-31.00	0.00	-31.00	(N/A)	-31.00	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	47.88	0.00	47.88	(N/A)	47.88	(N/A)
	-26.64	0.00	-26.64	(N/A)	-26.64	(N/A)
2 U1	27.70	0.00	27.70	(N/A)	27.70	(N/A)
	-15.39	0.00	-15.39	(N/A)	-15.39	(N/A)
3 U1	38.60	0.00	38.60	(N/A)	38.60	(N/A)
	-21.32	0.00	-21.32	(N/A)	-21.32	(N/A)
4 U1	42.90	0.00	42.90	(N/A)	42.90	(N/A)
	-23.70	0.00	-23.70	(N/A)	-23.70	(N/A)
5 U1	37.45	0.00	37.45	(N/A)	37.45	(N/A)
	-20.76	0.00	-20.76	(N/A)	-20.76	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	600.02	64.21	47.88	526.42	392.55	8.199	21.10	37.19	0.00229	0.720
2		600.02	-35.68	-26.64	-526.22	-392.79	14.746	21.10	37.19	0.00229	0.720
3	2 U1	503.01	39.52	27.70	538.38	377.40	13.623	19.33	36.97	0.00274	0.750
4		503.01	-23.59	-15.39	-553.02	-360.76	23.438	19.15	36.80	0.00277	0.751
5	3 U1	543.62	49.88	38.60	519.38	401.89	10.412	20.25	37.23	0.00252	0.735
6		543.62	-28.66	-21.32	-527.53	-392.36	18.403	20.16	37.14	0.00253	0.736
7	4 U1	562.58	54.70	42.90	516.73	405.23	9.446	20.60	37.28	0.00243	0.729
8		562.58	-31.03	-23.70	-522.18	-398.80	16.828	20.54	37.22	0.00244	0.730
9	5 U1	562.63	54.66	37.45	544.20	372.85	9.955	20.28	36.96	0.00247	0.732
10		562.63	-31.00	-20.76	-548.77	-367.46	17.700	20.23	36.91	0.00247	0.732

*** End of output ***

General Information:
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File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P8-Inv.col
Project: MAIN AVE_SECTION P
Column: P8 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	313.35	21.84	12.74	0.76	0.86
	Live	134.74	33.13	16.25	26.22	12.67
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	36.17	30	30	67500	3	3122.02
	Y	36.17	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	60.14
Y	0.000	0.000	1.000	1.200	60.14

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	699.74	2499.19	0.582	0.400	1.000	699.74	1735.55	1735.55	0.582	2.163

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	699.74	2499.19	0.582	0.402	1.000	699.74	1735.55	1735.55	0.582	2.163

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	100.28	0.00	100.28	(N/A)	100.28	(N/A)
	-51.82	0.00	-51.82	(N/A)	-51.82	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	57.89	0.00	57.89	(N/A)	57.89	(N/A)
	-28.61	0.00	-28.61	(N/A)	-28.61	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	699.74	100.28	57.89	566.58	327.04	5.650	22.27	36.67	0.00194	0.697
2		699.74	-51.82	-28.61	-574.59	-317.22	11.087	22.19	36.57	0.00195	0.697

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P8-Opr.col
Project: MAIN AVE_SECTION P
Column: P8 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	313.35	21.84	12.74	0.76	0.86
	Live	134.74	33.13	16.25	26.22	12.67
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	313.35	21.84	12.74	0.76	0.86
	Live	60.60	15.47	7.09	13.31	6.82
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	313.35	21.84	12.74	0.76	0.86
	Live	92.38	23.23	10.55	19.75	10.24
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	313.35	21.84	12.74	0.76	0.86
	Live	106.75	26.67	12.09	22.21	11.65
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	313.35	21.84	12.74	0.76	0.86
	Live	104.01	25.70	12.60	18.17	9.65
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	36.17	30	30	67500	3	3122.02
	Y	36.17	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	60.14
Y	0.000	0.000	1.000	1.200	60.14

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	582.52	2326.89	0.699	0.400	1.000	582.52	1615.90	1615.90	0.699	1.926
2 U1	486.13	2151.36	0.838	0.400	1.000	486.13	1494.00	1494.00	0.838	1.766
3 U1	527.45	2231.04	0.772	0.400	1.000	527.45	1549.33	1549.33	0.772	1.831
4 U1	546.13	2264.80	0.746	0.400	1.000	546.13	1572.77	1572.77	0.746	1.862
5 U1	542.57	2258.46	0.751	0.400	1.000	542.57	1568.38	1568.38	0.751	1.856

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	582.52	2326.89	0.699	0.400	1.000	582.52	1615.90	1615.90	0.699	1.926
2 U1	486.13	2151.36	0.838	0.400	1.000	486.13	1494.00	1494.00	0.838	1.766
3 U1	527.45	2231.04	0.772	0.400	1.000	527.45	1549.33	1549.33	0.772	1.831
4 U1	546.13	2264.80	0.746	0.[illegible]	[illegible]	546.13	1572.77	1572.77	0.746	1.862

5	U1	542.57	2258.46	0.751	0.400	1.000	542.57	1568.38	1568.38	0.751	1.856

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	71.46	0.00	71.46	(N/A)	71.46	(N/A)
	-37.69	0.00	-37.69	(N/A)	-37.69	(N/A)
2 U1	48.50	0.00	48.50	(N/A)	48.50	(N/A)
	-25.78	0.00	-25.78	(N/A)	-25.78	(N/A)
3 U1	58.59	0.00	58.59	(N/A)	58.59	(N/A)
	-30.28	0.00	-30.28	(N/A)	-30.28	(N/A)
4 U1	63.06	0.00	63.06	(N/A)	63.06	(N/A)
	-32.28	0.00	-32.28	(N/A)	-32.28	(N/A)
5 U1	61.80	0.00	61.80	(N/A)	61.80	(N/A)
	-32.94	0.00	-32.94	(N/A)	-32.94	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	35.07	0.00	35.07	(N/A)	35.07	(N/A)
	-17.59	0.00	-17.59	(N/A)	-17.59	(N/A)
2 U1	18.29	0.00	18.29	(N/A)	18.29	(N/A)
	-9.98	0.00	-9.98	(N/A)	-9.98	(N/A)
3 U1	26.66	0.00	26.66	(N/A)	26.66	(N/A)
	-14.43	0.00	-14.43	(N/A)	-14.43	(N/A)
4 U1	29.86	0.00	29.86	(N/A)	29.86	(N/A)
	-16.26	0.00	-16.26	(N/A)	-16.26	(N/A)
5 U1	24.61	0.00	24.61	(N/A)	24.61	(N/A)
	-13.66	0.00	-13.66	(N/A)	-13.66	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	582.52	71.46	35.07	606.61	297.73	8.489	19.90	36.25	0.00247	0.731
2		582.52	-37.69	-17.59	-614.78	-286.92	16.313	19.74	36.07	0.00248	0.733
3	2 U1	486.13	48.50	18.29	644.64	243.10	13.291	16.97	34.85	0.00317	0.778
4		486.13	-25.78	-9.98	-640.98	-248.25	24.864	17.07	34.96	0.00315	0.777
5	3 U1	527.45	58.59	26.66	619.62	281.97	10.575	18.57	35.82	0.00279	0.753
6		527.45	-30.28	-14.43	-612.57	-291.95	20.232	18.77	36.04	0.00276	0.751
7	4 U1	546.13	63.06	29.86	613.47	290.48	9.728	19.11	36.04	0.00266	0.744
8		546.13	-32.28	-16.26	-603.13	-303.87	18.685	19.32	36.26	0.00263	0.743
9	5 U1	542.57	61.80	24.61	638.85	254.38	10.337	18.31	35.25	0.00278	0.753
10		542.57	-32.94	-13.66	-633.08	-262.58	19.218	18.48	35.43	0.00276	0.751

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P9-Inv.col
Project: MAIN AVE_SECTION P
Column: P9 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	313.18	27.65	14.34	3.83	1.51
	Live	132.42	31.09	15.32	24.84	12.41
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	41.33	30	30	67500	3	3122.02
	Y	41.33	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	68.72
Y	0.000	0.000	1.000	1.200	68.72

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	694.49	1909.17	0.586	0.400	1.000	694.49	1325.81	1325.81	0.586	3.316	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Y-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	694.49	1909.17	0.586	0.404	1.000	694.49	1325.81	1325.81	0.586	3.316	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	103.41	0.00	103.41	(N/A)	103.41	(N/A)
	-51.89	0.00	-51.89	(N/A)	-51.89	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	58.88	0.00	58.88	(N/A)	58.88	(N/A)
	-28.89	0.00	-28.89	(N/A)	-28.89	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	694.49	103.41	58.88	569.78	324.44	5.510	22.15	36.64	0.00196	0.698
2		694.49	-51.89	-28.89	-573.81	-319.52	11.059	22.11	36.59	0.00196	0.698

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P9-Opr.col
Project: MAIN AVE_SECTION P
Column: P9 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	313.18	27.65	14.34	3.83	1.51
	Live	132.42	24.83	15.32	24.84	12.41
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	313.18	27.65	14.34	3.83	1.51
	Live	59.61	14.53	7.16	13.21	6.54
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	313.18	27.65	14.34	3.83	1.51
	Live	90.43	21.71	10.70	19.63	9.73
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	313.18	27.65	14.34	3.83	1.51
	Live	104.51	24.90	12.27	22.10	10.97
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	313.18	27.65	14.34	3.83	1.51
	Live	104.60	24.56	12.10	16.54	8.06
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	41.33	30	30	67500	3	3122.02
	Y	41.33	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	68.72
Y	0.000	0.000	1.000	1.200	68.72

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	579.28	1778.45	0.703	0.400	1.000	579.28	1235.04	1235.04	0.703	2.669	x
2 U1	484.63	1645.78	0.840	0.400	1.000	484.63	1142.90	1142.90	0.840	2.301	
3 U1	524.69	1705.23	0.776	0.400	1.000	524.69	1184.19	1184.19	0.776	2.444	
4 U1	543.00	1730.72	0.750	0.400	1.000	543.00	1201.89	1201.89	0.750	2.515	x
5 U1	543.11	1730.88	0.750	0.400	1.000	543.11	1202.00	1202.00	0.750	2.515	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Y-axis Ld/Comb	Nonsway Pu(kip)	Nonsway Pc(kip)	Nonsway Betad	Nonsway Cm	Nonsway Delta	Sway SumPu(kip)	Sway Pc(kip)	Sway SumPc(kip)	Sway Betad	Sway Delta
1 U1	579.28	1778.45	0.703	0.406	1.000	579.28	1235.04	1235.04	0.703	2.669 x
2 U1	484.63	1645.78	0.840	0.411	1.000	484.63	1142.90	1142.90	0.840	2.301
3 U1	524.69	1705.23	0.776	0.408	1.000	524.69	1184.19	1184.19	0.776	2.444
4 U1	543.00	1730.72	0.750	0.407	1.000	543.00	1201.89	1201.89	0.750	2.515 x
5 U1	543.11	1730.88	0.750	0.412	1.000	543.11	1202.00	1202.00	0.750	2.515 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	68.23	0.00	68.23	(N/A)	68.23	(N/A)
	-38.56	0.00	-38.56	(N/A)	-38.56	(N/A)
2 U1	54.83	0.00	54.83	(N/A)	54.83	(N/A)
	-27.95	0.00	-27.95	(N/A)	-27.95	(N/A)
3 U1	64.17	0.00	64.17	(N/A)	64.17	(N/A)
	-32.55	0.00	-32.55	(N/A)	-32.55	(N/A)
4 U1	68.31	0.00	68.31	(N/A)	68.31	(N/A)
	-34.59	0.00	-34.59	(N/A)	-34.59	(N/A)
5 U1	67.87	0.00	67.87	(N/A)	67.87	(N/A)
	-34.37	0.00	-34.37	(N/A)	-34.37	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	37.27	0.00	37.27	(N/A)	37.27	(N/A)
	-18.10	0.00	-18.10	(N/A)	-18.10	(N/A)
2 U1	22.15	0.00	22.15	(N/A)	22.15	(N/A)
	-10.46	0.00	-10.46	(N/A)	-10.46	(N/A)
3 U1	30.50	0.00	30.50	(N/A)	30.50	(N/A)
	-14.61	0.00	-14.61	(N/A)	-14.61	(N/A)
4 U1	33.71	0.00	33.71	(N/A)	33.71	(N/A)
	-16.22	0.00	-16.22	(N/A)	-16.22	(N/A)
5 U1	26.48	0.00	26.48	(N/A)	26.48	(N/A)
	-12.44	0.00	-12.44	(N/A)	-12.44	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	579.28	68.23	37.27	587.41	320.90	8.610	20.06	36.47	0.00245	0.731
2		579.28	-38.56	-18.10	-614.09	-288.20	15.926	19.70	36.09	0.00250	0.734
3	2 U1	484.63	54.83	22.15	634.95	256.51	11.579	17.22	35.14	0.00313	0.776
4		484.63	-27.95	-10.46	-645.48	-241.68	23.094	16.91	34.81	0.00319	0.779
5	3 U1	524.69	64.17	30.50	612.94	291.32	9.552	18.71	36.01	0.00278	0.752
6		524.69	-32.55	-14.61	-621.62	-279.03	19.096	18.45	35.74	0.00282	0.755
7	4 U1	543.00	68.31	33.71	606.93	299.48	8.884	19.22	36.21	0.00265	0.744
8		543.00	-34.59	-16.22	-614.92	-288.40	17.776	19.01	35.99	0.00268	0.746
9	5 U1	543.11	67.87	26.48	641.67	250.35	9.454	18.25	35.17	0.00279	0.753
10		543.11	-34.37	-12.44	-651.82	-235.93	18.964	17.96	34.85	0.00283	0.756

*** End of output ***

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spColumn v4.50 (TM)
Computer program for the Strength Design of Reinforced Concrete Sections

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P10-Inv.col
Project: MAIN AVE_SECTION P
Column: P10 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	262.34	19.18	9.25	20.49	10.43
	Live	155.28	25.48	13.46	50.61	23.74
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	678.00	1663.22	0.503	0.400	1.000	678.00	1155.01	1155.01	0.503	4.601	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Y-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	678.00	1663.22	0.503	0.409	1.000	678.00	1155.01	1155.01	0.503	4.601	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	80.23	0.00	80.23	(N/A)	80.23	(N/A)
	-41.23	0.00	-41.23	(N/A)	-41.23	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	136.46	0.00	136.46	(N/A)	136.46	(N/A)
	-65.07	0.00	-65.07	(N/A)	-65.07	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	678.00	80.23	136.46	332.78	566.05	4.148	21.93	36.70	0.00202	0.702
2		678.00	-41.23	-65.07	-349.76	-552.00	8.483	22.08	36.87	0.00201	0.701

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P10-Opr.col
Project: MAIN AVE_SECTION P
Column: P10 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	262.34	19.18	9.25	20.49	10.43
	Live	155.28	25.48	13.46	50.61	23.74
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	262.34	19.18	9.25	20.49	10.43
	Live	73.81	12.41	6.51	32.05	15.03
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	262.34	19.18	9.25	20.49	10.43
	Live	106.94	17.56	9.21	46.11	21.61
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	262.34	19.18	9.25	20.49	10.43
	Live	118.72	19.52	10.17	46.61	21.83
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	262.34	19.18	9.25	20.49	10.43
	Live	114.28	19.05	10.22	46.99	22.03
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	542.91	1535.36	0.628	0.400	1.000	542.91	1066.22	1066.22	0.628	3.114	x
2 U1	436.99	1404.07	0.780	0.400	1.000	436.99	975.05	975.05	0.780	2.485	
3 U1	480.06	1461.54	0.710	0.400	1.000	480.06	1014.96	1014.96	0.710	2.707	x
4 U1	495.38	1480.55	0.688	0.400	1.000	495.38	1028.16	1028.16	0.688	2.797	x
5 U1	489.61	1473.47	0.697	0.400	1.000	489.61	1023.24	1023.24	0.697	2.762	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Y-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	542.91	1535.36	0.628	0.408	1.000	542.91	1066.22	1066.22	0.628	3.114	x
2 U1	436.99	1404.07	0.780	0.406	1.000	436.99	975.05	975.05	0.780	2.485	
3 U1	480.06	1461.54	0.710	0.408	1.000	480.06	1014.96	1014.96	0.710	2.707	x
4 U1	495.38	1480.55	0.688	0.408	1.000	495.38	1028.16	1028.16	0.688	2.797	x
5 U1	489.61	1473.47	0.697	0.408	1.000	489.61	1023.24	1023.24	0.697	2.762	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	58.06	0.00	58.06	(N/A)	58.06	(N/A)
	-29.52	0.00	-29.52	(N/A)	-29.52	(N/A)
2 U1	41.07	0.00	41.07	(N/A)	41.07	(N/A)
	-20.49	0.00	-20.49	(N/A)	-20.49	(N/A)
3 U1	47.76	0.00	47.76	(N/A)	47.76	(N/A)
	-24.00	0.00	-24.00	(N/A)	-24.00	(N/A)
4 U1	50.31	0.00	50.31	(N/A)	50.31	(N/A)
	-25.25	0.00	-25.25	(N/A)	-25.25	(N/A)
5 U1	49.70	0.00	49.70	(N/A)	49.70	(N/A)
	-25.31	0.00	-25.31	(N/A)	-25.31	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	92.43	0.00	92.43	(N/A)	92.43	(N/A)
	-44.42	0.00	-44.42	(N/A)	-44.42	(N/A)
2 U1	68.30	0.00	68.30	(N/A)	68.30	(N/A)
	-33.10	0.00	-33.10	(N/A)	-33.10	(N/A)
3 U1	86.58	0.00	86.58	(N/A)	86.58	(N/A)
	-41.65	0.00	-41.65	(N/A)	-41.65	(N/A)
4 U1	87.23	0.00	87.23	(N/A)	87.23	(N/A)
	-41.94	0.00	-41.94	(N/A)	-41.94	(N/A)
5 U1	87.72	0.00	87.72	(N/A)	87.72	(N/A)
	-42.20	0.00	-42.20	(N/A)	-42.20	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	542.91	58.06	92.43	352.66	561.45	6.074	19.75	36.74	0.00258	0.739
2		542.91	-29.52	-44.42	-365.73	-550.28	12.388	19.88	36.87	0.00257	0.738
3	2 U1	436.99	41.07	68.30	339.23	564.21	8.261	17.82	36.53	0.00315	0.777
4		436.99	-20.49	-33.10	-345.72	-558.51	16.874	17.89	36.60	0.00314	0.776
5	3 U1	480.06	47.76	86.58	322.50	584.61	6.752	18.34	36.38	0.00295	0.764
6		480.06	-24.00	-41.65	-331.99	-576.21	13.834	18.45	36.48	0.00294	0.763
7	4 U1	495.38	50.31	87.23	332.78	576.99	6.615	18.72	36.50	0.00285	0.757
8		495.38	-25.25	-41.94	-342.29	-568.60	13.558	18.82	36.60	0.00284	0.756
9	5 U1	489.61	49.70	87.72	328.65	580.10	6.613	18.57	36.45	0.00289	0.760
10		489.61	-25.31	-42.20	-341.27	-568.96	13.483	18.71	36.59	0.00287	0.758

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P11-Inv.col
Project: MAIN AVE_SECTION P
Column: P11 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	331.17	52.13	31.68	27.83	14.19
	Live	191.54	100.96	54.89	90.45	40.11
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	30	67500	3	3122.02
	Y	28.86	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	47.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	846.16	4116.44	0.509	0.400	1.000	846.16	2858.64	2858.64	0.509	1.652

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	846.16	4116.44	0.509	0.418	1.000	846.16	2858.64	2858.64	0.509	1.652

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	286.85	0.00	286.85	(N/A)	286.85	(N/A)
	-160.30	0.00	-160.30	(N/A)	-160.30	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	232.46	0.00	232.46	(N/A)	232.46	(N/A)
	-105.49	0.00	-105.49	(N/A)	-105.49	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	846.16	286.85	232.46	470.83	381.54	1.641	25.21	37.33	0.00144	0.663
2		846.16	-160.30	-105.49	-509.05	-334.99	3.176	25.02	37.00	0.00144	0.663

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P11-Opr.col
Project: MAIN AVE_SECTION P
Column: P11 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	331.17	52.13	31.68	27.83	14.19
	Live	191.54	100.96	54.89	90.45	40.11
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	331.17	52.13	31.68	27.83	14.19
	Live	90.50	51.64	28.21	32.43	13.63
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	331.17	52.13	31.68	27.83	14.19
	Live	132.32	74.42	40.62	40.51	16.87
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	331.17	52.13	31.68	27.83	14.19
	Live	147.88	82.45	44.89	37.15	15.31
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	331.17	52.13	31.68	27.83	14.19
	Live	130.59	73.79	40.25	38.49	16.00
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	30	67500	3	3122.02
	Y	28.86	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	47.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	679.52	3802.03	0.634	0.400	1.000	679.52	2640.30	2640.30	0.634	1.522
2 U1	548.17	3478.73	0.785	0.400	1.000	548.17	2415.79	2415.79	0.785	1.434
3 U1	602.54	3622.51	0.715	0.400	1.000	602.54	2515.64	2515.64	0.715	1.469
4 U1	622.77	3672.22	0.691	0.400	1.000	622.77	2550.15	2550.15	0.691	1.483
5 U1	600.29	3616.87	0.717	0.400	1.000	600.29	2511.71	2511.71	0.717	1.468

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	679.52	3802.03	0.634	0.416	1.000	679.52	2640.30	2640.30	0.634	1.522
2 U1	548.17	3478.73	0.785	0.415	1.000	548.17	2415.79	2415.79	0.785	1.434
3 U1	602.54	3622.51	0.715	0.418	1.000	602.54	2515.64	2515.64	0.715	1.469
4 U1	622.77	3672.22	0.691	0.418	1.000	622.77	2550.15	2550.15	0.691	1.483

5 U1	600.29	3616.87	0.717	0.418	1.000	600.29	2511.71	2511.71	0.717	1.468

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	199.02	0.00	199.02	(N/A)	199.02	(N/A)
	-112.54	0.00	-112.54	(N/A)	-112.54	(N/A)
2 U1	134.90	0.00	134.90	(N/A)	134.90	(N/A)
	-77.86	0.00	-77.86	(N/A)	-77.86	(N/A)
3 U1	164.51	0.00	164.51	(N/A)	164.51	(N/A)
	-93.99	0.00	-93.99	(N/A)	-93.99	(N/A)
4 U1	174.95	0.00	174.95	(N/A)	174.95	(N/A)
	-99.54	0.00	-99.54	(N/A)	-99.54	(N/A)
5 U1	163.70	0.00	163.70	(N/A)	163.70	(N/A)
	-93.51	0.00	-93.51	(N/A)	-93.51	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	153.76	0.00	153.76	(N/A)	153.76	(N/A)
	-70.59	0.00	-70.59	(N/A)	-70.59	(N/A)
2 U1	78.34	0.00	78.34	(N/A)	78.34	(N/A)
	-36.17	0.00	-36.17	(N/A)	-36.17	(N/A)
3 U1	88.84	0.00	88.84	(N/A)	88.84	(N/A)
	-40.38	0.00	-40.38	(N/A)	-40.38	(N/A)
4 U1	84.47	0.00	84.47	(N/A)	84.47	(N/A)
	-38.35	0.00	-38.35	(N/A)	-38.35	(N/A)
5 U1	86.22	0.00	86.22	(N/A)	86.22	(N/A)
	-39.25	0.00	-39.25	(N/A)	-39.25	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	679.52	199.02	153.76	513.14	396.46	2.578	22.50	37.33	0.00198	0.699
2		679.52	-112.54	-70.59	-553.76	-347.34	4.921	22.08	36.85	0.00201	0.701
3	2 U1	548.17	134.90	78.34	576.65	334.86	4.275	19.66	36.57	0.00258	0.739
4		548.17	-77.86	-36.17	-616.39	-286.32	7.917	19.07	35.96	0.00266	0.744
5	3 U1	602.54	164.51	88.84	588.33	317.71	3.576	20.44	36.46	0.00235	0.724
6		602.54	-93.99	-40.38	-625.56	-268.74	6.656	19.80	35.74	0.00242	0.728
7	4 U1	622.77	174.95	84.47	606.77	292.97	3.468	20.57	36.25	0.00229	0.720
8		622.77	-99.54	-38.35	-638.68	-246.06	6.416	19.82	35.32	0.00235	0.724
9	5 U1	600.29	163.70	86.22	593.01	312.33	3.623	20.35	36.41	0.00237	0.725
10		600.29	-93.51	-39.25	-628.96	-263.98	6.726	19.68	35.64	0.00244	0.730

*** End of output ***

General Information:
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File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P12-Inv.col
Project: MAIN AVE_SECTION P
Column: P12 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	367.19	16.92	11.63	2.89	0.94
	Live	136.05	44.95	23.06	23.92	12.66
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	30.02	30	30	67500	3	3122.02
	Y	30.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	49.92
Y	0.000	0.000	1.000	1.200	49.92

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	772.58	3547.97	0.618	0.400	1.000	772.58	2463.87	2463.87	0.618	1.718

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	772.58	3547.97	0.618	0.400	1.000	772.58	2463.87	2463.87	0.618	1.718

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				--2nd Order--	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	119.54	0.00	119.54	(N/A)	119.54	(N/A)
	-65.16	0.00	-65.16	(N/A)	-65.16	(N/A)

Y-axis	1st Order				--2nd Order--	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	55.66	0.00	55.66	(N/A)	55.66	(N/A)
	-28.69	0.00	-28.69	(N/A)	-28.69	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	772.58	119.54	55.66	587.28	273.47	4.913	23.19	36.23	0.00169	0.680
2		772.58	-65.16	-28.69	-594.49	-261.80	9.124	23.04	36.01	0.00169	0.680

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P12-Opr.col
Project: MAIN AVE_SECTION P
Column: P12 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	367.19	16.92	11.63	2.89	0.94
	Live	136.05	44.95	23.06	23.92	12.66
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	367.19	16.92	11.63	2.89	0.94
	Live	60.70	20.04	10.26	12.33	6.51
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	367.19	16.92	11.63	2.89	0.94
	Live	92.22	30.45	15.59	18.43	9.73
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	367.19	16.92	11.63	2.89	0.94
	Live	106.94	35.31	18.08	20.87	11.03
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	367.19	16.92	11.63	2.89	0.94
	Live	107.39	36.12	18.85	17.93	9.44
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	30.02	30	30	67500	3	3122.02
	Y	30.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	49.92
Y	0.000	0.000	1.000	1.200	49.92

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	654.21	3318.67	0.730	0.400	1.000	654.21	2304.63	2304.63	0.730	1.609
2 U1	556.26	3089.18	0.858	0.400	1.000	556.26	2145.27	2145.27	0.858	1.528
3 U1	597.23	3190.27	0.799	0.400	1.000	597.23	2215.47	2215.47	0.799	1.561
4 U1	616.37	3234.88	0.774	0.400	1.000	616.37	2246.45	2246.45	0.774	1.577
5 U1	616.95	3236.22	0.774	0.400	1.000	616.95	2247.38	2247.38	0.774	1.577

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	654.21	3318.67	0.730	0.400	1.000	654.21	2304.63	2304.63	0.730	1.609
2 U1	556.26	3089.18	0.858	0.404	1.000	556.26	2145.27	2145.27	0.858	1.528
3 U1	597.23	3190.27	0.799	0.400	1.000	597.23	2215.47	2215.47	0.799	1.561
4 U1	616.37	3234.88	0.774	0.400	1.000	616.37	2246.45	2246.45	0.774	1.577

5 U1	616.95	3236.22	0.774	0.401	1.000	616.95	2247.38	2247.38	0.774	1.577

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	80.43	0.00	80.43	(N/A)	80.43	(N/A)
	-45.10	0.00	-45.10	(N/A)	-45.10	(N/A)
2 U1	48.05	0.00	48.05	(N/A)	48.05	(N/A)
	-28.46	0.00	-28.46	(N/A)	-28.46	(N/A)
3 U1	61.58	0.00	61.58	(N/A)	61.58	(N/A)
	-35.39	0.00	-35.39	(N/A)	-35.39	(N/A)
4 U1	67.90	0.00	67.90	(N/A)	67.90	(N/A)
	-38.62	0.00	-38.62	(N/A)	-38.62	(N/A)
5 U1	68.95	0.00	68.95	(N/A)	68.95	(N/A)
	-39.62	0.00	-39.62	(N/A)	-39.62	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	34.85	0.00	34.85	(N/A)	34.85	(N/A)
	-17.68	0.00	-17.68	(N/A)	-17.68	(N/A)
2 U1	19.79	0.00	19.79	(N/A)	19.79	(N/A)
	-9.68	0.00	-9.68	(N/A)	-9.68	(N/A)
3 U1	27.72	0.00	27.72	(N/A)	27.72	(N/A)
	-13.87	0.00	-13.87	(N/A)	-13.87	(N/A)
4 U1	30.89	0.00	30.89	(N/A)	30.89	(N/A)
	-15.56	0.00	-15.56	(N/A)	-15.56	(N/A)
5 U1	27.07	0.00	27.07	(N/A)	27.07	(N/A)
	-13.49	0.00	-13.49	(N/A)	-13.49	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	654.21	80.43	34.85	619.94	268.64	7.708	20.81	35.86	0.00217	0.712
2		654.21	-45.10	-17.68	-633.13	-248.21	14.039	20.48	35.43	0.00219	0.713
3	2 U1	556.26	48.05	19.79	633.98	261.07	13.195	18.73	35.44	0.00268	0.746
4		556.26	-28.46	-9.68	-659.52	-224.46	23.176	18.01	34.66	0.00278	0.752
5	3 U1	597.23	61.58	27.72	619.26	278.71	10.056	19.87	35.94	0.00243	0.729
6		597.23	-35.39	-13.87	-638.47	-250.27	18.043	19.38	35.35	0.00248	0.732
7	4 U1	616.37	67.90	30.89	616.48	280.44	9.079	20.27	36.02	0.00233	0.723
8		616.37	-38.62	-15.56	-633.34	-255.17	16.398	19.84	35.50	0.00237	0.725
9	5 U1	616.95	68.95	27.07	636.75	249.95	9.235	19.77	35.39	0.00237	0.725
10		616.95	-39.62	-13.49	-654.74	-222.97	16.524	19.31	34.83	0.00241	0.728

*** End of output ***

General Information:

```
File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P13-Inv.col
Project:  MAIN AVE_SECTION P
Column:   P13                         Engineer: GHD
Code:     ACI 318-02                  Units: English

Run Option: Investigation             Slenderness: Considered
Run Axis:   Biaxial                   Column Type: Structural
```

Material Properties:

```
f'c   = 3 ksi                         fy   = 36 ksi
Ec    = 3122.02 ksi                   Es   = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85
```

Section:

```
Rectangular: Width = 30 in            Depth = 30 in

Gross section area, Ag =  900 in^2
Ix =  67500 in^4                      Iy =  67500 in^4
rx =  8.66025 in                      ry =  8.66025 in
Xo =  0 in                            Yo =  0 in
```

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

```
Confinement: Tied; #4 ties with #10 bars,  #4 with larger bars.
phi(a) = 0.8,  phi(b) = 0.9,  phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal  (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8   Cover = 3 in
```

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	328.66	8.24	1.99	0.31	0.36
	Live	137.07	33.40	16.42	28.53	13.85
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

```
U1  =  1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow
```

Slenderness:

Sway Criteria:

```
X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
```

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	36.17	30	30	67500	3	3122.02
	Y	36.17	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	60.14
Y	0.000	0.000	1.000	1.200	60.14

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	724.70	2487.53	0.590	0.416	1.000	724.70	1727.45	1727.45	0.590	2.269

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	724.70	2487.53	0.590	0.404	1.000	724.70	1727.45	1727.45	0.590	2.269

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	83.19	0.00	83.19	(N/A)	83.19	(N/A)
	-38.22	0.00	-38.22	(N/A)	-38.22	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	62.31	0.00	62.31	(N/A)	62.31	(N/A)
	-30.52	0.00	-30.52	(N/A)	-30.52	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	724.70	83.19	62.31	514.11	385.09	6.180	23.20	37.28	0.00182	0.689
2		724.70	-38.22	-30.52	-500.59	-399.79	13.098	23.25	37.33	0.00182	0.688

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P13-Opr.col
Project: MAIN AVE_SECTION P
Column: P13 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	328.66	8.24	1.99	0.31	0.36
	Live	137.07	33.40	16.42	28.53	13.85
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	328.66	8.24	1.99	0.31	0.36
	Live	61.64	15.59	7.66	14.24	6.88
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	328.66	8.24	1.99	0.31	0.36
	Live	93.93	23.41	11.51	21.33	10.33
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	328.66	8.24	1.99	0.31	0.36
	Live	108.59	26.88	13.21	24.26	11.75
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	328.66	8.24	1.99	0.31	0.36
	Live	105.97	25.96	13.58	14.80	6.76
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	36.17	30	30	67500	3	3122.02
	Y	36.17	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	60.14
Y	0.000	0.000	1.000	1.200	60.14

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	605.45	2318.18	0.706	0.423	1.000	605.45	1609.85	1609.85	0.706	2.006
2 U1	507.39	2146.55	0.842	0.438	1.000	507.39	1490.66	1490.66	0.842	1.831
3 U1	549.37	2224.24	0.778	0.429	1.000	549.37	1544.61	1544.61	0.778	1.902
4 U1	568.42	2257.35	0.752	0.427	1.000	568.42	1567.60	1567.60	0.752	1.936
5 U1	565.02	2251.53	0.756	0.418	1.000	565.02	1563.56	1563.56	0.756	1.930

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	605.45	2318.18	0.706	0.403	1.000	605.45	1609.85	1609.85	0.706	2.006
2 U1	507.39	2146.55	0.842	0.401	1.000	507.39	1490.66	1490.66	0.842	1.831
3 U1	549.37	2224.24	0.778	0.402	1.000	549.37	1544.61	1544.61	0.778	1.902
4 U1	568.42	2257.35	0.752	[illegible]	[illegible]	568.42	1567.60	1567.60	0.752	1.936

5	U1	565.02	2251.53	0.756	0.412	1.000	565.02	1563.56	1563.56	0.756	1.930

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	54.13	0.00	54.13	(N/A)	54.13	(N/A)
	-23.93	0.00	-23.93	(N/A)	-23.93	(N/A)
2 U1	30.98	0.00	30.98	(N/A)	30.98	(N/A)
	-12.54	0.00	-12.54	(N/A)	-12.54	(N/A)
3 U1	41.14	0.00	41.14	(N/A)	41.14	(N/A)
	-17.55	0.00	-17.55	(N/A)	-17.55	(N/A)
4 U1	45.66	0.00	45.66	(N/A)	45.66	(N/A)
	-19.76	0.00	-19.76	(N/A)	-19.76	(N/A)
5 U1	44.46	0.00	44.46	(N/A)	44.46	(N/A)
	-20.24	0.00	-20.24	(N/A)	-20.24	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	37.49	0.00	37.49	(N/A)	37.49	(N/A)
	-18.47	0.00	-18.47	(N/A)	-18.47	(N/A)
2 U1	18.91	0.00	18.91	(N/A)	18.91	(N/A)
	-9.41	0.00	-9.41	(N/A)	-9.41	(N/A)
3 U1	28.13	0.00	28.13	(N/A)	28.13	(N/A)
	-13.90	0.00	-13.90	(N/A)	-13.90	(N/A)
4 U1	31.94	0.00	31.94	(N/A)	31.94	(N/A)
	-15.74	0.00	-15.74	(N/A)	-15.74	(N/A)
5 U1	19.64	0.00	19.64	(N/A)	19.64	(N/A)
	-9.26	0.00	-9.26	(N/A)	-9.26	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	605.45	54.13	37.49	540.84	374.58	9.991	21.02	37.02	0.00228	0.719
2		605.45	-23.93	-18.47	-519.14	-400.71	21.692	21.27	37.28	0.00226	0.718
3	2 U1	507.39	30.98	18.91	566.42	345.84	18.284	19.06	36.65	0.00277	0.752
4		507.39	-12.54	-9.41	-524.55	-393.55	41.813	19.57	37.14	0.00269	0.747
5	3 U1	549.37	41.14	28.13	544.63	372.38	13.237	20.06	36.95	0.00253	0.736
6		549.37	-17.55	-13.90	-514.65	-407.53	29.325	20.40	37.29	0.00248	0.733
7	4 U1	568.42	45.66	31.94	539.95	377.75	11.827	20.43	37.02	0.00244	0.730
8		568.42	-19.76	-15.74	-513.47	-409.09	25.985	20.73	37.32	0.00240	0.727
9	5 U1	565.02	44.46	19.64	623.65	275.53	14.027	19.19	35.78	0.00260	0.740
10		565.02	-20.24	-9.26	-618.56	-282.86	30.560	19.33	35.94	0.00258	0.739

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P14-Inv.col
Project: MAIN AVE_SECTION P
Column: P14 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	318.49	23.44	10.83	5.16	2.98
	Live	132.50	31.09	15.32	30.92	15.57
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	41.33	30	30	67500	3	3122.02
	Y	41.33	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	68.72
Y	0.000	0.000	1.000	1.200	68.72

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis Ld/Comb	Nonsway Pu(kip)	Nonsway Pc(kip)	Nonsway Betad	Nonsway Cm	Nonsway Delta	Sway SumPu(kip)	Sway Pc(kip)	Sway SumPc(kip)	Sway Betad	Sway Delta
1 U1	701.56	1904.46	0.590	0.407	1.000	701.56	1322.54	1322.54	0.590	3.416 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Y-axis Ld/Comb	Nonsway Pu(kip)	Nonsway Pc(kip)	Nonsway Betad	Nonsway Cm	Nonsway Delta	Sway SumPu(kip)	Sway Pc(kip)	Sway SumPc(kip)	Sway Betad	Sway Delta
1 U1	701.56	1904.46	0.590	0.400	1.000	701.56	1322.54	1322.54	0.590	3.416 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	97.94	0.00	97.94	(N/A)	97.94	(N/A)
	-47.32	0.00	-47.32	(N/A)	-47.32	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	73.80	0.00	73.80	(N/A)	73.80	(N/A)
	-37.66	0.00	-37.66	(N/A)	-37.66	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	701.56	97.94	73.80	515.92	388.79	5.268	22.81	37.29	0.00190	0.694
2		701.56	-47.32	-37.66	-504.24	-401.29	10.655	22.85	37.33	0.00190	0.694

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P14-Opr.col
Project: MAIN AVE_SECTION P
Column: P14 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	318.49	23.44	10.83	5.16	2.98
	Live	132.50	31.09	15.32	30.92	15.57
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	318.49	23.44	10.83	5.16	2.98
	Live	59.65	14.53	7.16	15.56	7.87
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	318.49	23.44	10.83	5.16	2.98
	Live	90.49	21.71	10.70	23.33	11.78
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	318.49	23.44	10.83	5.16	2.98
	Live	104.57	24.90	12.27	26.50	13.39
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	318.49	23.44	10.83	5.16	2.98
	Live	104.71	24.58	12.11	18.38	9.33
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	41.33	30	30	67500	3	3122.02
	Y	41.33	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	68.72
Y	0.000	0.000	1.000	1.200	68.72

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	586.29	1774.94	0.706	0.408	1.000	586.29	1232.59	1232.59	0.706	2.734	x
2 U1	491.58	1643.85	0.842	0.410	1.000	491.58	1141.57	1141.57	0.842	2.348	
3 U1	531.67	1702.55	0.779	0.409	1.000	531.67	1182.33	1182.33	0.779	2.497	
4 U1	549.98	1727.72	0.753	0.409	1.000	549.98	1199.81	1199.81	0.753	2.572	x
5 U1	550.16	1727.97	0.753	0.409	1.000	550.16	1199.98	1199.98	0.753	2.573	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Y-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	586.29	1774.94	0.706	0.400	1.000	586.29	1232.59	1232.59	0.706	2.734	x
2 U1	491.58	1643.85	0.842	0.400	1.000	491.58	1141.57	1141.57	0.842	2.348	
3 U1	531.67	1702.55	0.779	0.400	1.000	531.67	1182.33	1182.33	0.779	2.497	
4 U1	549.98	1727.72	0.753	0.400	1.000	549.98	1199.81	1199.81	0.753	2.572	x
5 U1	550.16	1727.97	0.753	0.400	1.000	550.16	1199.98	1199.98	0.753	2.573	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	70.89	0.00	70.89	(N/A)	70.89	(N/A)
	-33.99	0.00	-33.99	(N/A)	-33.99	(N/A)
2 U1	49.36	0.00	49.36	(N/A)	49.36	(N/A)
	-23.39	0.00	-23.39	(N/A)	-23.39	(N/A)
3 U1	58.69	0.00	58.69	(N/A)	58.69	(N/A)
	-27.99	0.00	-27.99	(N/A)	-27.99	(N/A)
4 U1	62.84	0.00	62.84	(N/A)	62.84	(N/A)
	-30.03	0.00	-30.03	(N/A)	-30.03	(N/A)
5 U1	62.43	0.00	62.43	(N/A)	62.43	(N/A)
	-29.82	0.00	-29.82	(N/A)	-29.82	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	46.90	0.00	46.90	(N/A)	46.90	(N/A)
	-24.11	0.00	-24.11	(N/A)	-24.11	(N/A)
2 U1	26.94	0.00	26.94	(N/A)	26.94	(N/A)
	-14.10	0.00	-14.10	(N/A)	-14.10	(N/A)
3 U1	37.04	0.00	37.04	(N/A)	37.04	(N/A)
	-19.19	0.00	-19.19	(N/A)	-19.19	(N/A)
4 U1	41.16	0.00	41.16	(N/A)	41.16	(N/A)
	-21.28	0.00	-21.28	(N/A)	-21.28	(N/A)
5 U1	30.60	0.00	30.60	(N/A)	30.60	(N/A)
	-16.00	0.00	-16.00	(N/A)	-16.00	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	586.29	70.89	46.90	550.70	364.37	7.768	20.60	36.90	0.00238	0.725
2		586.29	-33.99	-24.11	-536.93	-380.88	15.794	20.76	37.06	0.00236	0.724
3	2 U1	491.58	49.36	26.94	587.43	320.56	11.901	18.52	36.37	0.00289	0.760
4		491.58	-23.39	-14.10	-568.00	-342.57	24.287	18.76	36.60	0.00286	0.757
5	3 U1	531.67	58.69	37.04	560.57	353.73	9.551	19.56	36.75	0.00264	0.743
6		531.67	-27.99	-19.19	-544.03	-372.96	19.437	19.76	36.94	0.00261	0.741
7	4 U1	549.98	62.84	41.16	553.21	362.32	8.803	19.97	36.85	0.00254	0.736
8		549.98	-30.03	-21.28	-537.42	-380.84	17.896	20.15	37.03	0.00251	0.735
9	5 U1	550.16	62.43	30.60	608.02	298.06	9.740	19.33	36.21	0.00262	0.742
10		550.16	-29.82	-16.00	-591.51	-317.42	19.835	19.52	36.40	0.00259	0.740

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P15-Inv.col
Project: MAIN AVE_SECTION P
Column: P15 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	263.87	19.66	9.93	19.43	9.21
	Live	155.37	34.82	17.20	50.64	23.75
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway				Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	680.18	1661.77	0.504	0.401	1.000	680.18	1154.01	1154.01	0.504	4.670 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Y-axis	Nonsway				Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	680.18	1661.77	0.504	0.412	1.000	680.18	1154.01	1154.01	0.504	4.670 x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	101.12	0.00	101.12	(N/A)	101.12	(N/A)
	-50.23	0.00	-50.23	(N/A)	-50.23	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	135.15	0.00	135.15	(N/A)	135.15	(N/A)
	-63.51	0.00	-63.51	(N/A)	-63.51	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	680.18	101.12	135.15	388.67	519.48	3.844	22.45	37.26	0.00198	0.699
2		680.18	-50.23	-63.51	-401.66	-507.82	7.996	22.51	37.33	0.00198	0.699

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P15-Opr.col
Project: MAIN AVE_SECTION P
Column: P15 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	263.87	19.66	9.93	19.43	9.21
	Live	155.37	34.82	17.20	50.64	23.75
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	263.87	19.66	9.93	19.43	9.21
	Live	73.85	16.54	8.17	32.07	15.04
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	263.87	19.66	9.93	19.43	9.21
	Live	106.98	24.06	11.89	46.13	21.63
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	263.87	19.66	9.93	19.43	9.21
	Live	118.76	26.81	13.24	46.64	21.85
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	263.87	19.66	9.93	19.43	9.21
	Live	114.32	25.77	12.73	47.01	22.04
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	545.01	1534.21	0.629	0.401	1.000	545.01	1065.42	1065.42	0.629	3.145	x
2 U1	439.04	1403.36	0.781	0.400	1.000	439.04	974.55	974.55	0.781	2.504	x
3 U1	482.10	1460.59	0.712	0.400	1.000	482.10	1014.30	1014.30	0.712	2.730	x
4 U1	497.42	1479.53	0.690	0.401	1.000	497.42	1027.45	1027.45	0.690	2.821	x
5 U1	491.65	1472.47	0.698	0.400	1.000	491.65	1022.55	1022.55	0.698	2.786	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Y-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	545.01	1534.21	0.629	0.412	1.000	545.01	1065.42	1065.42	0.629	3.145	x
2 U1	439.04	1403.36	0.781	0.412	1.000	439.04	974.55	974.55	0.781	2.504	x
3 U1	482.10	1460.59	0.712	0.412	1.000	482.10	1014.30	1014.30	0.712	2.730	x
4 U1	497.42	1479.53	0.690	0.412	1.000	497.42	1027.45	1027.45	0.690	2.821	x
5 U1	491.65	1472.47	0.698	0.412	1.000	491.65	1022.55	1022.55	0.698	2.786	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5).
Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	70.82	0.00	70.82	(N/A)	70.82	(N/A)
	-35.27	0.00	-35.27	(N/A)	-35.27	(N/A)
2 U1	47.06	0.00	47.06	(N/A)	47.06	(N/A)
	-23.53	0.00	-23.53	(N/A)	-23.53	(N/A)
3 U1	56.84	0.00	56.84	(N/A)	56.84	(N/A)
	-28.37	0.00	-28.37	(N/A)	-28.37	(N/A)
4 U1	60.41	0.00	60.41	(N/A)	60.41	(N/A)
	-30.12	0.00	-30.12	(N/A)	-30.12	(N/A)
5 U1	59.06	0.00	59.06	(N/A)	59.06	(N/A)
	-29.46	0.00	-29.46	(N/A)	-29.46	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	91.09	0.00	91.09	(N/A)	91.09	(N/A)
	-42.85	0.00	-42.85	(N/A)	-42.85	(N/A)
2 U1	66.95	0.00	66.95	(N/A)	66.95	(N/A)
	-31.52	0.00	-31.52	(N/A)	-31.52	(N/A)
3 U1	85.23	0.00	85.23	(N/A)	85.23	(N/A)
	-40.09	0.00	-40.09	(N/A)	-40.09	(N/A)
4 U1	85.89	0.00	85.89	(N/A)	85.89	(N/A)
	-40.38	0.00	-40.38	(N/A)	-40.38	(N/A)
5 U1	86.37	0.00	86.37	(N/A)	86.37	(N/A)
	-40.63	0.00	-40.63	(N/A)	-40.63	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	545.01	70.82	91.09	403.06	518.40	5.691	20.29	37.25	0.00251	0.734
2		545.01	-35.27	-42.85	-416.60	-506.13	11.812	20.38	37.33	0.00250	0.733
3	2 U1	439.04	47.06	66.95	374.83	533.26	7.965	18.26	36.93	0.00307	0.772
4		439.04	-23.53	-31.52	-388.84	-520.96	16.525	18.42	37.09	0.00304	0.770
5	3 U1	482.10	56.84	85.23	364.96	547.27	6.421	18.85	36.83	0.00287	0.758
6		482.10	-28.37	-40.09	-378.64	-535.16	13.348	19.00	36.98	0.00284	0.756
7	4 U1	497.42	60.41	85.89	377.95	537.36	6.256	19.24	36.97	0.00277	0.751
8		497.42	-30.12	-40.38	-391.77	-525.18	13.007	19.39	37.12	0.00274	0.750
9	5 U1	491.65	59.06	86.37	371.15	542.79	6.284	19.07	36.90	0.00281	0.754
10		491.65	-29.46	-40.63	-384.83	-530.71	13.064	19.22	37.04	0.00278	0.753

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P16-Inv.col
Project: MAIN AVE_SECTION P
Column: P16 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	231.39	109.71	47.09	11.91	8.32
	Live	135.13	131.68	58.40	46.61	21.33
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	30	67500	3	3122.02
	Y	28.86	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	47.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	594.04	4123.04	0.506	0.425	1.000	594.04	2863.22	2863.22	0.506	1.382

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	594.04	4123.04	0.506	0.404	1.000	594.04	2863.22	2863.22	0.506	1.382

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	428.37	0.00	428.37	(N/A)	428.37	(N/A)
	-187.95	0.00	-187.95	(N/A)	-187.95	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	116.63	0.00	116.63	(N/A)	116.63	(N/A)
	-57.10	0.00	-57.10	(N/A)	-57.10	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	594.04	428.37	116.63	682.37	185.78	1.593	18.17	33.99	0.00261	0.741
2		594.04	-187.95	-57.10	-670.29	-203.65	3.566	18.49	34.37	0.00258	0.739

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P16-Opr.col
Project: MAIN AVE_SECTION P
Column: P16 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	231.39	109.71	47.09	11.91	8.32
	Live	135.13	131.68	58.40	46.61	21.33
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	231.39	109.71	47.09	11.91	8.32
	Live	68.70	65.52	28.84	24.47	11.10
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	231.39	109.71	47.09	11.91	8.32
	Live	99.38	95.39	42.08	36.85	16.72
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	231.39	109.71	47.09	11.91	8.32
	Live	110.57	106.36	47.07	41.36	18.80
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	231.39	109.71	47.09	11.91	8.32
	Live	98.95	94.25	41.62	35.78	16.25
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	30	67500	3	3122.02
	Y	28.86	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	47.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	476.48	3807.26	0.631	0.425	1.000	476.48	2643.93	2643.93	0.631	1.316
2 U1	390.12	3506.84	0.771	0.427	1.000	390.12	2435.30	2435.30	0.771	1.272
3 U1	430.00	3654.41	0.700	0.426	1.000	430.00	2537.79	2537.79	0.700	1.292
4 U1	444.55	3704.30	0.677	0.426	1.000	444.55	2572.43	2572.43	0.677	1.299
5 U1	429.44	3652.45	0.700	0.426	1.000	429.44	2536.43	2536.43	0.700	1.292

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	476.48	3807.26	0.631	0.400	1.000	476.48	2643.93	2643.93	0.631	1.316
2 U1	390.12	3506.84	0.771	0.400	1.000	390.12	2435.30	2435.30	0.771	1.272
3 U1	430.00	3654.41	0.700	0.400	1.000	430.00	2537.79	2537.79	0.700	1.292
4 U1	444.55	3704.30	0.677	0.400	1.000	444.55	2572.43	2572.43	0.677	1.299

5 U1	429.44	3652.45	0.700	0.400	1.000	429.44	2536.43	2536.43	0.700	1.292

Factored First-Order and Factored Magnified (Second-Order) Moments:
==

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	313.81	0.00	313.81	(N/A)	313.81	(N/A)
	-137.14	0.00	-137.14	(N/A)	-137.14	(N/A)
2 U1	227.80	0.00	227.80	(N/A)	227.80	(N/A)
	-98.71	0.00	-98.71	(N/A)	-98.71	(N/A)
3 U1	266.63	0.00	266.63	(N/A)	266.63	(N/A)
	-115.92	0.00	-115.92	(N/A)	-115.92	(N/A)
4 U1	280.89	0.00	280.89	(N/A)	280.89	(N/A)
	-122.41	0.00	-122.41	(N/A)	-122.41	(N/A)
5 U1	265.15	0.00	265.15	(N/A)	265.15	(N/A)
	-115.32	0.00	-115.32	(N/A)	-115.32	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	76.08	0.00	76.08	(N/A)	76.08	(N/A)
	-38.54	0.00	-38.54	(N/A)	-38.54	(N/A)
2 U1	47.29	0.00	47.29	(N/A)	47.29	(N/A)
	-25.25	0.00	-25.25	(N/A)	-25.25	(N/A)
3 U1	63.39	0.00	63.39	(N/A)	63.39	(N/A)
	-32.55	0.00	-32.55	(N/A)	-32.55	(N/A)
4 U1	69.25	0.00	69.25	(N/A)	69.25	(N/A)
	-35.26	0.00	-35.26	(N/A)	-35.26	(N/A)
5 U1	62.00	0.00	62.00	(N/A)	62.00	(N/A)
	-31.94	0.00	-31.94	(N/A)	-31.94	(N/A)

Factored Loads and Moments with Corresponding Capacities:
===

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	476.48	313.81	76.08	692.49	167.88	2.207	15.00	32.84	0.00359	0.806
2		476.48	-137.14	-38.54	-679.03	-190.85	4.951	15.62	33.57	0.00346	0.798
3	2 U1	390.12	227.80	47.29	695.77	144.45	3.054	12.69	31.89	0.00459	0.873
4		390.12	-98.71	-25.25	-677.03	-173.16	6.859	13.49	32.79	0.00434	0.856
5	3 U1	430.00	266.63	63.39	689.37	163.89	2.585	13.98	32.61	0.00404	0.836
6		430.00	-115.92	-32.55	-673.56	-189.14	5.810	14.68	33.40	0.00385	0.823
7	4 U1	444.55	280.89	69.25	687.78	169.57	2.449	14.41	32.82	0.00386	0.824
8		444.55	-122.41	-35.26	-672.90	-193.81	5.497	15.08	33.58	0.00370	0.813
9	5 U1	429.44	265.15	62.00	690.78	161.52	2.605	13.90	32.53	0.00406	0.838
10		429.44	-115.32	-31.94	-674.86	-186.92	5.852	14.60	33.33	0.00387	0.825

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P17-Inv.col
Project: MAIN AVE_SECTION P
Column: P17 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	262.74	68.44	30.24	19.73	8.02
	Live	126.58	62.31	29.60	31.07	16.01
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.02	30	30	67500	3	3122.02
	Y	28.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	46.59
Y	0.000	0.000	1.000	1.200	46.59

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	616.24	4239.18	0.554	0.415	1.000	616.24	2943.87	2943.87	0.554	1.387

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	616.24	4239.18	0.554	0.406	1.000	616.24	2943.87	2943.87	0.554	1.387

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	224.18	0.00	224.18	(N/A)	224.18	(N/A)
	-103.54	0.00	-103.54	(N/A)	-103.54	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	93.07	0.00	93.07	(N/A)	93.07	(N/A)
	-45.17	0.00	-45.17	(N/A)	-45.17	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	616.24	224.18	93.07	629.29	261.25	2.807	19.94	35.62	0.00236	0.724
2		616.24	-103.54	-45.17	-622.44	-271.52	6.011	20.12	35.83	0.00235	0.723

*** End of output ***

General Information:
====================
File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P17-Opr.col
Project: MAIN AVE_SECTION P
Column: P17 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================
f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========
Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	262.74	68.44	30.24	19.73	8.02
	Live	126.58	62.31	29.60	31.07	16.01
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	262.74	68.44	30.24	19.73	8.02
	Live	56.57	27.88	13.27	15.71	9.33
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	262.74	68.44	30.24	19.73	8.02
	Live	85.90	42.34	20.15	23.52	12.14
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	262.74	68.44	30.24	19.73	8.02
	Live	99.57	49.07	23.34	26.71	13.78
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	262.74	68.44	30.24	19.73	8.02
	Live	100.42	48.78	22.85	15.04	10.92
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.02	30	30	67500	3	3122.02
	Y	28.02	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	46.59
Y	0.000	0.000	1.000	1.200	46.59

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	506.12	3933.93	0.675	0.417	1.000	506.12	2731.90	2731.90	0.675	1.328
2 U1	415.10	3614.60	0.823	0.419	1.000	415.10	2510.14	2510.14	0.823	1.283
3 U1	453.23	3757.28	0.754	0.418	1.000	453.23	2609.22	2609.22	0.754	1.301
4 U1	471.00	3819.21	0.725	0.418	1.000	471.00	2652.23	2652.23	0.725	1.310
5 U1	472.11	3822.97	0.723	0.419	1.000	472.11	2654.84	2654.84	0.723	1.311

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	506.12	3933.93	0.675	0.411	1.000	506.12	2731.90	2731.90	0.675	1.328
2 U1	415.10	3614.60	0.823	0.404	1.000	415.10	2510.14	2510.14	0.823	1.283
3 U1	453.23	3757.28	0.754	0.414	1.000	453.23	2609.22	2609.22	0.754	1.301
4 U1	471.00	3819.21	0.725	[illegible]	1.000	471.00	2652.23	2652.23	0.725	1.310

5 U1	472.11	3822.97	0.723	0.400	1.000	472.11	2654.84	2654.84	0.723	1.311

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	169.98	0.00	169.98	(N/A)	169.98	(N/A)
	-77.79	0.00	-77.79	(N/A)	-77.79	(N/A)
2 U1	125.22	0.00	125.22	(N/A)	125.22	(N/A)
	-56.56	0.00	-56.56	(N/A)	-56.56	(N/A)
3 U1	144.01	0.00	144.01	(N/A)	144.01	(N/A)
	-65.51	0.00	-65.51	(N/A)	-65.51	(N/A)
4 U1	152.76	0.00	152.76	(N/A)	152.76	(N/A)
	-69.65	0.00	-69.65	(N/A)	-69.65	(N/A)
5 U1	152.39	0.00	152.39	(N/A)	152.39	(N/A)
	-69.02	0.00	-69.02	(N/A)	-69.02	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	66.04	0.00	66.04	(N/A)	66.04	(N/A)
	-31.24	0.00	-31.24	(N/A)	-31.24	(N/A)
2 U1	46.07	0.00	46.07	(N/A)	46.07	(N/A)
	-22.56	0.00	-22.56	(N/A)	-22.56	(N/A)
3 U1	56.22	0.00	56.22	(N/A)	56.22	(N/A)
	-26.21	0.00	-26.21	(N/A)	-26.21	(N/A)
4 U1	60.37	0.00	60.37	(N/A)	60.37	(N/A)
	-28.34	0.00	-28.34	(N/A)	-28.34	(N/A)
5 U1	45.20	0.00	45.20	(N/A)	45.20	(N/A)
	-24.62	0.00	-24.62	(N/A)	-24.62	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	506.12	169.98	66.04	641.96	249.42	3.777	17.48	35.03	0.00302	0.768
2		506.12	-77.79	-31.24	-637.35	-255.94	8.193	17.62	35.18	0.00300	0.767
3	2 U1	415.10	125.22	46.07	639.54	235.31	5.107	15.48	34.53	0.00370	0.814
4		415.10	-56.56	-22.56	-628.54	-250.64	11.112	15.79	34.85	0.00363	0.809
5	3 U1	453.23	144.01	56.22	636.46	248.48	4.419	16.47	34.90	0.00337	0.792
6		453.23	-65.51	-26.21	-633.05	-253.27	9.664	16.57	35.00	0.00335	0.790
7	4 U1	471.00	152.76	60.37	636.76	251.65	4.168	16.86	35.00	0.00324	0.783
8		471.00	-69.65	-28.34	-632.67	-257.41	9.083	16.98	35.13	0.00322	0.782
9	5 U1	472.11	152.39	45.20	673.26	199.70	4.418	15.77	33.83	0.00344	0.796
10		472.11	-69.02	-24.62	-650.74	-232.15	9.429	16.47	34.58	0.00331	0.787

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P18-Inv.col
Project: MAIN AVE_SECTION P
Column: P18 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	222.34	32.35	13.80	19.71	8.15
	Live	145.81	43.67	20.84	27.77	13.65
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	29.67	30	30	67500	3	3122.02
	Y	29.67	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	49.33
Y	0.000	0.000	1.000	1.200	49.33

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	605.45	3977.50	0.477	0.415	1.000	605.45	2762.15	2762.15	0.477	1.413

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	605.45	3977.50	0.477	0.413	1.000	605.45	2762.15	2762.15	0.477	1.413

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	136.82	0.00	136.82	(N/A)	136.82	(N/A)
	-63.16	0.00	-63.16	(N/A)	-63.16	(N/A)

Y-axis	1st Order				2nd Order	Ratio
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	85.88	0.00	85.88	(N/A)	85.88	(N/A)
	-40.22	0.00	-40.22	(N/A)	-40.22	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	605.45	136.82	85.88	559.99	351.52	4.093	20.80	36.80	0.00231	0.721
2		605.45	-63.16	-40.22	-557.26	-354.80	8.823	20.84	36.83	0.00230	0.721

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P18-Opr.col
Project: MAIN AVE_SECTION P
Column: P18 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	222.34	32.35	13.80	19.71	8.15
	Live	145.81	43.67	20.84	27.77	13.65
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	222.34	32.35	13.80	19.71	8.15
	Live	65.99	20.38	9.74	13.97	6.82
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	222.34	32.35	13.80	19.71	8.15
	Live	100.05	30.69	14.67	20.93	10.24
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	222.34	32.35	13.80	19.71	8.15
	Live	115.75	35.35	16.89	23.76	11.64
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	222.34	32.35	13.80	19.71	8.15
	Live	106.09	33.54	15.85	13.90	7.38
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	29.67	30	30	67500	3	3122.02
	Y	29.67	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	49.33
Y	0.000	0.000	1.000	1.200	49.33

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	478.59	3663.71	0.604	0.418	1.000	478.59	2544.24	2544.24	0.604	1.335
2 U1	374.83	3317.86	0.771	0.421	1.000	374.83	2304.07	2304.07	0.771	1.277
3 U1	419.11	3477.84	0.690	0.419	1.000	419.11	2415.16	2415.16	0.690	1.301
4 U1	439.52	3545.03	0.658	0.419	1.000	439.52	2461.82	2461.82	0.658	1.312
5 U1	426.96	3504.14	0.677	0.420	1.000	426.96	2433.43	2433.43	0.677	1.305

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	478.59	3663.71	0.604	0.416	1.000	478.59	2544.24	2544.24	0.604	1.335
2 U1	374.83	3317.86	0.771	0.422	1.000	374.83	2304.07	2304.07	0.771	1.277
3 U1	419.11	3477.84	0.690	0.419	1.000	419.11	2415.16	2415.16	0.690	1.301
4 U1	439.52	3545.03	0.658	0.4[illegible]	[illegible]	439.52	2461.82	2461.82	0.658	1.312

5	U1	426.96	3504.14	0.677	0.415	1.000	426.96	2433.43	2433.43	0.677	1.305

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	98.83	0.00	98.83	(N/A)	98.83	(N/A)
	-45.03	0.00	-45.03	(N/A)	-45.03	(N/A)
2 U1	68.55	0.00	68.55	(N/A)	68.55	(N/A)
	-30.60	0.00	-30.60	(N/A)	-30.60	(N/A)
3 U1	81.95	0.00	81.95	(N/A)	81.95	(N/A)
	-37.01	0.00	-37.01	(N/A)	-37.01	(N/A)
4 U1	88.01	0.00	88.01	(N/A)	88.01	(N/A)
	-39.90	0.00	-39.90	(N/A)	-39.90	(N/A)
5 U1	85.66	0.00	85.66	(N/A)	85.66	(N/A)
	-38.54	0.00	-38.54	(N/A)	-38.54	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	61.72	0.00	61.72	(N/A)	61.72	(N/A)
	-28.34	0.00	-28.34	(N/A)	-28.34	(N/A)
2 U1	43.78	0.00	43.78	(N/A)	43.78	(N/A)
	-19.46	0.00	-19.46	(N/A)	-19.46	(N/A)
3 U1	52.83	0.00	52.83	(N/A)	52.83	(N/A)
	-23.91	0.00	-23.91	(N/A)	-23.91	(N/A)
4 U1	56.51	0.00	56.51	(N/A)	56.51	(N/A)
	-25.73	0.00	-25.73	(N/A)	-25.73	(N/A)
5 U1	43.69	0.00	43.69	(N/A)	43.69	(N/A)
	-20.19	0.00	-20.19	(N/A)	-20.19	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	478.59	98.83	61.72	560.21	349.89	5.669	18.62	36.67	0.00291	0.761
2		478.59	-45.03	-28.34	-558.70	-351.61	12.407	18.64	36.69	0.00291	0.761
3	2 U1	374.83	68.55	43.78	544.27	347.64	7.940	16.83	36.55	0.00352	0.801
4		374.83	-30.60	-19.46	-545.13	-346.67	17.813	16.82	36.54	0.00352	0.802
5	3 U1	419.11	81.95	52.83	548.73	353.75	6.696	17.66	36.67	0.00323	0.783
6		419.11	-37.01	-23.91	-548.34	-354.19	14.816	17.66	36.67	0.00323	0.782
7	4 U1	439.52	88.01	56.51	551.52	354.13	6.267	18.03	36.70	0.00311	0.774
8		439.52	-39.90	-25.73	-550.67	-355.09	13.802	18.04	36.71	0.00311	0.774
9	5 U1	426.96	85.66	43.69	593.65	302.82	6.931	17.08	35.98	0.00332	0.789
10		426.96	-38.54	-20.19	-589.43	-308.73	15.292	17.20	36.10	0.00330	0.787

*** End of output ***

General Information:
====================

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P19-Inv.col
Project: MAIN AVE_SECTION P
Column: P19 — Engineer: GHD
Code: ACI 318-02 — Units: English

Run Option: Investigation — Slenderness: Considered
Run Axis: Biaxial — Column Type: Structural

Material Properties:
====================

f'c = 3 ksi — fy = 36 ksi
Ec = 3122.02 ksi — Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========

Rectangular: Width = 30 in — Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 — Iy = 67500 in^4
rx = 8.66025 in — ry = 8.66025 in
Xo = 0 in — Yo = 0 in

Reinforcement:
==============

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	227.56	6.59	2.51	6.34	4.29
	Live	143.55	29.28	14.11	51.44	25.97
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:
=======================

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:
==================

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:
============

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc — SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc — SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	35.33	30	30	67500	3	3122.02
	Y	35.33	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	58.75
Y	0.000	0.000	1.000	1.200	58.75

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	607.33	2786.88	0.487	0.412	1.000	607.33	1935.33	1935.33	0.487	1.719

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	607.33	2786.88	0.487	0.400	1.000	607.33	1935.33	1935.33	0.487	1.719

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				--2nd Order-	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	72.10	0.00	72.10	(N/A)	72.10	(N/A)
	-33.88	0.00	-33.88	(N/A)	-33.88	(N/A)

Y-axis	1st Order				--2nd Order-	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	119.87	0.00	119.87	(N/A)	119.87	(N/A)
	-61.93	0.00	-61.93	(N/A)	-61.93	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	607.33	72.10	119.87	341.56	567.81	4.737	20.76	36.71	0.00231	0.721
2		607.33	-33.88	-61.93	-320.34	-585.54	9.455	20.55	36.50	0.00233	0.722

*** End of output ***

General Information:
====================
File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P19-Opr.col
Project: MAIN AVE_SECTION P
Column: P19 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:
====================
f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:
========
Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:
==============
Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:
==============

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	227.56	6.59	2.51	6.34	4.29
	Live	143.55	29.28	14.11	51.44	25.97
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	227.56	6.59	2.51	6.34	4.29
	Live	64.36	14.33	6.90	26.04	13.15
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	227.56	6.59	2.51	6.34	4.29
	Live	97.76	21.10	10.17	39.00	19.70
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	227.56	6.59	2.51	6.34	4.29
	Live	113.28	24.01	11.58	44.28	22.36
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	227.56	6.59	2.51	6.34	4.29
	Live	112.06	22.50	10.70	30.62	15.55
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	35.33	30	30	67500	3	3122.02
	Y	35.33	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	58.75
Y	0.000	0.000	1.000	1.200	58.75

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	482.44	2569.04	0.613	0.415	1.000	482.44	1784.06	1784.06	0.613	1.564
2 U1	379.50	2328.90	0.780	0.420	1.000	379.50	1617.29	1617.29	0.780	1.455
3 U1	422.92	2438.58	0.699	0.417	1.000	422.92	1693.46	1693.46	0.699	1.499
4 U1	443.09	2485.15	0.668	0.416	1.000	443.09	1725.80	1725.80	0.668	1.521
5 U1	441.51	2481.58	0.670	0.418	1.000	441.51	1723.32	1723.32	0.670	1.519

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	482.44	2569.04	0.613	0.400	1.000	482.44	1784.06	1784.06	0.613	1.564
2 U1	379.50	2328.90	0.780	0.400	1.000	379.50	1617.29	1617.29	0.780	1.455
3 U1	422.92	2438.58	0.699	0.400	1.000	422.92	1693.46	1693.46	0.699	1.499
4 U1	443.09	2485.15	0.668	0.400	1.000	443.09	1725.80	1725.80	0.668	1.521

5 U1	441.51	2481.58	0.670	0.400	1.000	441.51	1723.32	1723.32	0.670	1.519

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	46.63	0.00	46.63	(N/A)	46.63	(N/A)
	-21.61	0.00	-21.61	(N/A)	-21.61	(N/A)
2 U1	27.20	0.00	27.20	(N/A)	27.20	(N/A)
	-12.23	0.00	-12.23	(N/A)	-12.23	(N/A)
3 U1	36.00	0.00	36.00	(N/A)	36.00	(N/A)
	-16.48	0.00	-16.48	(N/A)	-16.48	(N/A)
4 U1	39.78	0.00	39.78	(N/A)	39.78	(N/A)
	-18.32	0.00	-18.32	(N/A)	-18.32	(N/A)
5 U1	37.82	0.00	37.82	(N/A)	37.82	(N/A)
	-17.17	0.00	-17.17	(N/A)	-17.17	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	75.11	0.00	75.11	(N/A)	75.11	(N/A)
	-39.34	0.00	-39.34	(N/A)	-39.34	(N/A)
2 U1	42.09	0.00	42.09	(N/A)	42.09	(N/A)
	-22.67	0.00	-22.67	(N/A)	-22.67	(N/A)
3 U1	58.94	0.00	58.94	(N/A)	58.94	(N/A)
	-31.19	0.00	-31.19	(N/A)	-31.19	(N/A)
4 U1	65.81	0.00	65.81	(N/A)	65.81	(N/A)
	-34.65	0.00	-34.65	(N/A)	-34.65	(N/A)
5 U1	48.05	0.00	48.05	(N/A)	48.05	(N/A)
	-25.79	0.00	-25.79	(N/A)	-25.79	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	482.44	46.63	75.11	348.69	561.68	7.478	18.67	36.66	0.00289	0.760
2		482.44	-21.61	-39.34	-321.64	-585.61	14.887	18.37	36.37	0.00294	0.763
3	2 U1	379.50	27.20	42.09	350.67	542.77	12.894	16.95	36.59	0.00348	0.799
4		379.50	-12.23	-22.67	-311.11	-576.60	25.432	16.36	36.02	0.00361	0.807
5	3 U1	422.92	36.00	58.94	341.97	559.95	9.500	17.58	36.53	0.00324	0.783
6		422.92	-16.48	-31.19	-310.44	-587.35	18.833	17.16	36.13	0.00332	0.788
7	4 U1	443.09	39.78	65.81	340.80	563.77	8.567	17.93	36.55	0.00312	0.775
8		443.09	-18.32	-34.65	-311.62	-589.41	17.013	17.60	36.22	0.00318	0.779
9	5 U1	441.51	37.82	48.05	401.54	510.17	10.618	18.61	37.23	0.00300	0.767
10		441.51	-17.17	-25.79	-362.51	-544.45	21.109	18.16	36.79	0.00308	0.772

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P20-Inv.col
Project: MAIN AVE_SECTION P
Column: P20 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	187.15	8.27	4.30	17.85	7.82
	Live	165.76	30.87	14.39	81.88	38.67
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	602.99	1781.17	0.403	0.411	1.000	602.99	1236.93	1236.93	0.403	2.857	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Y-axis	Nonsway					Sway					
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta	
1 U1	602.99	1781.17	0.403	0.413	1.000	602.99	1236.93	1236.93	0.403	2.857	x

x Strength and stability of structure as a whole under factored gravity loads is exceeded (Delta_sway > 2.5). Revise column!

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	77.74	0.00	77.74	(N/A)	77.74	(N/A)
	-36.82	0.00	-36.82	(N/A)	-36.82	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	200.88	0.00	200.88	(N/A)	200.88	(N/A)
	-94.08	0.00	-94.08	(N/A)	-94.08	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	602.99	77.74	200.88	247.58	639.77	3.185	19.45	35.31	0.00245	0.730
2		602.99	-36.82	-94.08	-249.78	-638.29	6.785	19.49	35.35	0.00245	0.730

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P20-Opr.col
Project: MAIN AVE_SECTION P
Column: P20 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Structural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 30 in

Gross section area, Ag = 900 in^2
Ix = 67500 in^4 Iy = 67500 in^4
rx = 8.66025 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 12.64 in^2 at rho = 1.40%
Minimum clear spacing = 4.75 in

16 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	187.15	8.27	4.30	17.85	7.82
	Live	165.76	30.87	14.39	81.88	38.67
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	187.15	8.27	4.30	17.85	7.82
	Live	78.81	15.43	7.24	51.87	24.50
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	187.15	8.27	4.30	17.85	7.82
	Live	114.09	21.92	10.36	74.23	35.05
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	187.15	8.27	4.30	17.85	7.82
	Live	126.56	24.38	11.52	74.46	35.16
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	187.15	8.27	4.30	17.85	7.82
	Live	121.17	22.53	10.34	75.70	35.75
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	45.49	30	30	67500	3	3122.02
	Y	45.49	30	30	67500	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	75.64
Y	0.000	0.000	1.000	1.200	75.64

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 7.55e+007 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.55e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	458.78	1633.56	0.530	0.409	1.000	458.78	1134.41	1134.41	0.530	2.170
2 U1	345.75	1467.32	0.704	0.405	1.000	345.75	1018.97	1018.97	0.704	1.826
3 U1	391.61	1541.91	0.621	0.406	1.000	391.61	1070.77	1070.77	0.621	1.952
4 U1	407.82	1565.76	0.597	0.406	1.000	407.82	1087.33	1087.33	0.597	2.000
5 U1	400.82	1555.59	0.607	0.410	1.000	400.82	1080.27	1080.27	0.607	1.979

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	458.78	1633.56	0.530	0.414	1.000	458.78	1134.41	1134.41	0.530	2.170
2 U1	345.75	1467.32	0.704	0.415	1.000	345.75	1018.97	1018.97	0.704	1.826
3 U1	391.61	1541.91	0.621	0.414	1.000	391.61	1070.77	1070.77	0.621	1.952
4 U1	407.82	1565.76	0.597	0.414	1.000	407.82	1087.33	1087.33	0.597	2.000

5 U1	400.82	1555.59	0.607	0.414	1.000	400.82	1080.27	1080.27	0.607	1.979

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.5 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	50.88	0.00	50.88	(N/A)	50.88	(N/A)
	-24.30	0.00	-24.30	(N/A)	-24.30	(N/A)
2 U1	30.81	0.00	30.81	(N/A)	30.81	(N/A)
	-15.00	0.00	-15.00	(N/A)	-15.00	(N/A)
3 U1	39.25	0.00	39.25	(N/A)	39.25	(N/A)
	-19.06	0.00	-19.06	(N/A)	-19.06	(N/A)
4 U1	42.44	0.00	42.44	(N/A)	42.44	(N/A)
	-20.57	0.00	-20.57	(N/A)	-20.57	(N/A)
5 U1	40.04	0.00	40.04	(N/A)	40.04	(N/A)
	-19.03	0.00	-19.03	(N/A)	-19.03	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	129.65	0.00	129.65	(N/A)	129.65	(N/A)
	-60.44	0.00	-60.44	(N/A)	-60.44	(N/A)
2 U1	90.64	0.00	90.64	(N/A)	90.64	(N/A)
	-42.02	0.00	-42.02	(N/A)	-42.02	(N/A)
3 U1	119.70	0.00	119.70	(N/A)	119.70	(N/A)
	-55.73	0.00	-55.73	(N/A)	-55.73	(N/A)
4 U1	120.00	0.00	120.00	(N/A)	120.00	(N/A)
	-55.87	0.00	-55.87	(N/A)	-55.87	(N/A)
5 U1	121.61	0.00	121.61	(N/A)	121.61	(N/A)
	-56.64	0.00	-56.64	(N/A)	-56.64	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	458.78	50.88	129.65	249.76	636.39	4.909	16.60	34.94	0.00333	0.789
2		458.78	-24.30	-60.44	-254.49	-633.02	10.474	16.69	35.04	0.00331	0.788
3	2 U1	345.75	30.81	90.64	216.76	637.66	7.035	13.81	33.94	0.00437	0.858
4		345.75	-15.00	-42.02	-225.41	-631.32	15.026	14.00	34.13	0.00432	0.855
5	3 U1	391.61	39.25	119.70	213.40	650.87	5.437	14.62	34.02	0.00398	0.832
6		391.61	-19.06	-55.73	-220.74	-645.52	11.583	14.77	34.17	0.00395	0.830
7	4 U1	407.82	42.44	120.00	227.66	643.66	5.364	15.20	34.35	0.00379	0.820
8		407.82	-20.57	-55.87	-234.98	-638.39	11.425	15.35	34.51	0.00376	0.817
9	5 U1	400.82	40.04	121.61	214.59	651.77	5.359	14.82	34.07	0.00390	0.827
10		400.82	-19.03	-56.64	-218.14	-649.20	11.462	14.89	34.14	0.00389	0.826

*** End of output ***

WEST APPROACH – SECTION P

AS INSPECTED RATING

TranSystems

Made By: GHD Date: 2/23/2012 Job No.:

Checked By: DMP Date: 2/25/2012 Sheet No.:

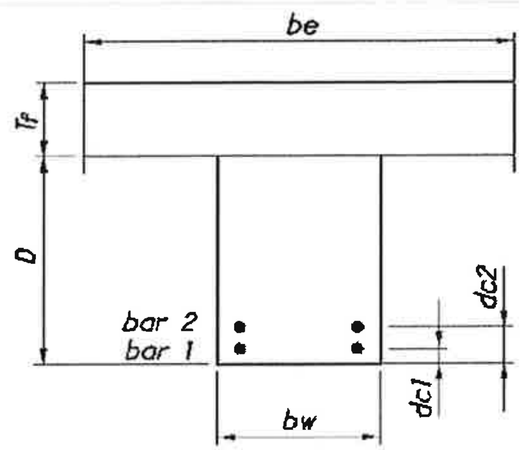
Stringers Rating Summary - As Inspected

STRINGERS	RATING FACTORS - WEST APPROACH - SECTION P											
	HS20				OHIO LEGAL LOADS							
	MOMENT		SHEAR		2F1		3F1		4F1		5C1	
	Inv.	Opr.	Inv.	Opr.	M	V	M	V	M	V	M	V
S1,S2	2.92	4.88	2.26	3.77	8.42	7.62	5.88	5.27	5.38	4.81	6.06	5.37
S3,S13	1.76	2.95	1.46	2.44	4.53	5.01	3.46	3.47	3.16	3.17	3.24	3.37
S4	1.70	2.84	1.46	2.44	4.53	5.01	3.34	3.47	3.04	3.17	3.24	3.37
S5,S6	2.29	3.83	3.13	5.22	6.04	5.57	4.26	4.91	4.31	3.98	4.18	4.91
S7	2.46	4.11	3.83	6.40	7.19	11.30	5.04	8.15	4.60	7.79	5.16	8.39
S8,S12	3.08	5.14	2.80	4.68	8.78	9.60	6.18	6.52	5.79	5.69	7.68	6.32
S9,S14	2.71	4.52	1.15	1.91	7.36	3.86	5.21	2.64	4.83	2.40	6.33	2.59
S10,S11	1.25	2.09	1.26	2.11	3.50	4.27	2.46	2.90	2.27	2.61	2.84	2.84
S15	1.39	2.32	1.26	2.11	3.87	4.27	2.72	2.90	2.51	2.61	3.14	2.84
S16,S17,S18	1.91	3.19	2.19	3.66	5.03	3.95	3.53	3.48	3.56	2.83	3.46	3.47
Fascia	1.36	2.27	3.65	6.10	3.50	12.10	3.61	8.22	4.15	7.75	3.68	8.22

Made By:	GHD	Date:	2/27/2012	Job No.:	
Checked By:	DMP	Date:	2/28/2012	Sheet No.:	

Stringer S4 - Section P - As Inspected

Posivitve Moment Capacity:



Dimensions:

be =	84.00	in.
Tf =	6.75	in.
D =	52.25	in.
bw =	18.00	in.
dc1 =	3.31	in.
dc2 =	6.06	in.
bar1=	2.28	in^2 (2-#1.125")
bar2=	5.66	in^2 (2-#1.125" and 2-#1.25")

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

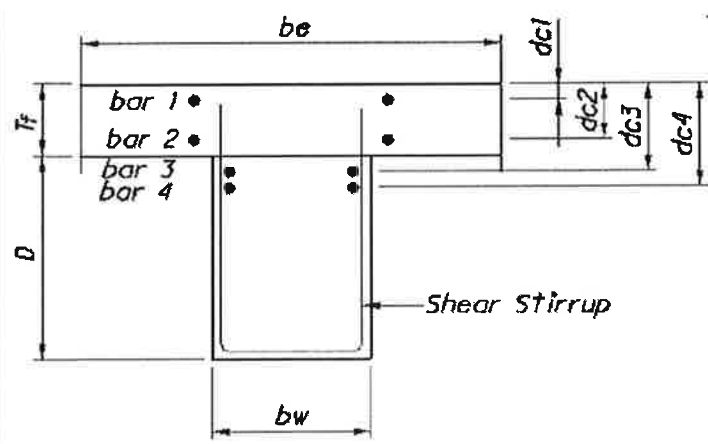
Check if can be analyzed as a rectangular section:

Beam total depth =	59.00	in.	(Tf+D)
Total rebar area As =	7.93	in^2	
Average dt =	53.73	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.89	in	0.89 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1141.42** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	84.00	in.	
Tf =	6.75	in.	
D =	52.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.53	in^2	2-#1.125" and 2-#1"
bar4=	2.53	in^2	2-#1.125"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	6.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	59.00	in.	(Tf+D)
ΣAs fy=	431.25	kips	
Average dt =	51.43	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	9.40	in	(a = Σ As fy / (0.85fc' bw))

Negative Moment Capacity:

ΦMn = **1511.54** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	101.42	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	123.44	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **191.13** k-ft   ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	127.51	k-ft	DL =	206.70	k-ft	DL =	33.53	k
HS 20 =	264.70	k-ft	HS 20 =	301.87	k-ft	HS 20 =	46.57	k
2F1 =	156.50	k-ft	2F1 =	210.92	k-ft	2F1 =	22.65	k
3F1 =	224.92	k-ft	3F1 =	271.96	k-ft	3F1 =	32.71	k
4F1 =	246.53	k-ft	4F1 =	275.12	k-ft	4F1 =	35.79	k
5C1 =	218.15	k-ft	5C1 =	295.08	k-ft	5C1 =	33.69	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.70	2.84	1.90	3.17	1.46	2.44

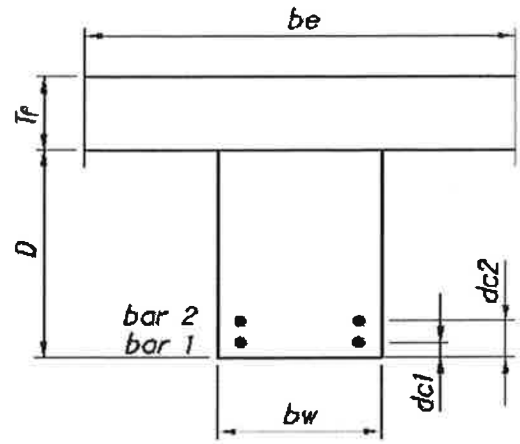
Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
4.80	4.53	5.01	3.34	3.52	3.47

4F1			5C1		
M+	M-	V	M+	M-	V
3.04	3.48	3.17	3.44	3.24	3.37

Stringer S9,S14 - Section P - As Inspected

Posivitve Moment Capacity:



Dimensions:			Material Properties:		
be =	73.98	in.	fy =	36.00	ksi
Tf =	6.75	in.	fc' =	4500.00	psi
D =	58.25	in.			
bw =	18.00	in.			
dc1 =	3.25	in.			
dc2 =	6.00	in.			
bar1=	6.01	in^2	4-#1.125" & 2-#1"		
bar2=	4.00	in^2	4-#1"		

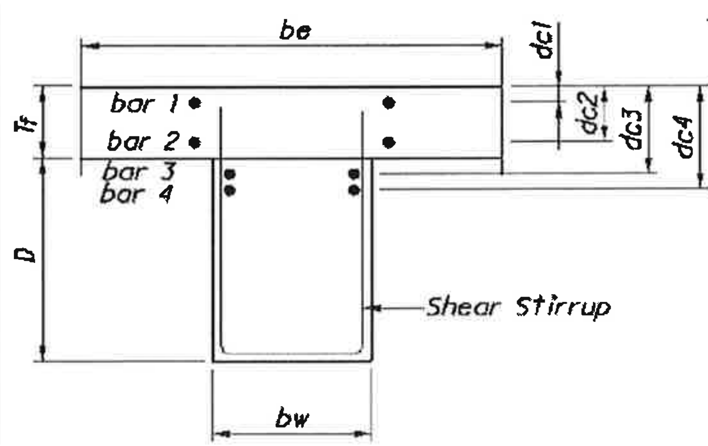
Check if can be analyzed as a rectangular section:

Beam total depth =	65.00	in.	(Tf+D)
Total rebar area As =	10.01	in^2	
Average dt =	60.65	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	1.27	in	1.27 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **1621.69** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:			Material Properties:		
be =	73.98	in.	fy1 =	60.00	ksi
Tf =	6.75	in.	fy2 =	36.00	ksi
D =	86.25	in.	fc' =	3000.00	psi
bw =	18.00	in.			
dc1 =	2.75	in.			
dc2 =	4.81	in.			
dc3 =	9.00	in.			
dc4 =	12.25	in.			
bar1=	1.40	in^2	7-#4		
bar2=	1.55	in^2	5-#5		
bar3=	4.53	in^2	2-#1" and 2-#1.125"		
bar4=	2.00	in^2	2-#1"		
Shear stirrup Av =	0.40	in^2	2 legs of #4		
Shear stirrup Spacing S =	24.00	in			

Beam total depth =	93.00	in.	(Tf+D)
ΣAs fy=	412.13	kips	
Average dt =	85.65	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	8.98	in	(a = Σ As fy / (0.85fc' bw))

Negative Moment Capacity:

ΦMn = **2508.64** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Shear Capacity:

Concrete shear strength Vc =	168.89	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	51.39	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **187.24** k-ft $\Phi Vn = \Phi (Vc+Vs)$

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	91.11	k-ft	DL =	221.50	k-ft	DL =	32.65	k
HS 20 =	256.00	k-ft	HS 20 =	201.24	k-ft	HS 20 =	58.25	k
2F1 =	157.11	k-ft	2F1 =	103.34	k-ft	2F1 =	28.84	k
3F1 =	221.96	k-ft	3F1 =	154.34	k-ft	3F1 =	42.12	k
4F1 =	239.23	k-ft	4F1 =	174.17	k-ft	4F1 =	46.50	k
5C1 =	182.78	k-ft	5C1 =	225.26	k-ft	5C1 =	42.94	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
2.71	4.52	5.09	8.49	1.15	1.91

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
7.36	16.53	3.86	5.21	11.07	2.64

4F1			5C1		
M+	M-	V	M+	M-	V
4.83	9.81	2.40	6.33	7.58	2.59

Made By: GHD	Date: 2/27/2012	Job No.:
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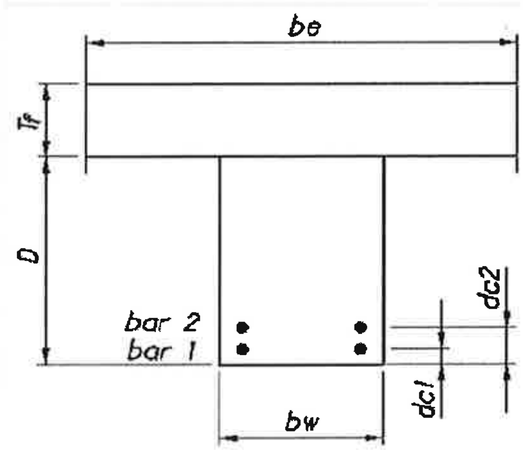
Stringer S10,S11 - Section P - As Inspected

Posivitve Moment Capacity:



Dimensions:

be =	73.98	in.
Tf =	6.75	in.
D =	58.25	in.
bw =	18.00	in.
dc1 =	3.25	in.
dc2 =	6.00	in.
bar1=	1.53	in^2	2-#1"
bar2=	4.00	in^2	4-#1"

Material Properties:

fy =	36.00	ksi
fc' =	4500.00	psi

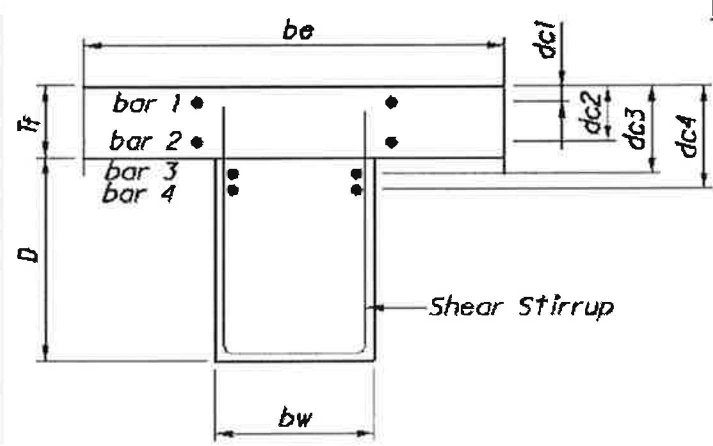
Check if can be analyzed as a rectangular section:

Beam total depth =	65.00	in.	(Tf+D)
Total rebar area As =	5.53	in^2	
Average dt =	59.76	in.	(dt = (As1xdt1+As2dt2)/(As1+As2))
a = As fy/(0.85fc' be) =	0.70	in	0.7 < 6.75, analyze as a rectangular section

Positive Moment Capacity:

ΦMn = **887.27** k-ft   ΦMn = Φ As fy (dt-a/2)

Negative Moment Capacity:



Dimensions:

be =	73.98	in.	
Tf =	6.75	in.	
D =	86.25	in.	
bw =	18.00	in.	
dc1 =	2.75	in.	
dc2 =	4.81	in.	
dc3 =	9.00	in.	
dc4 =	12.25	in.	
bar1=	1.40	in^2	7-#4
bar2=	1.55	in^2	5-#5
bar3=	4.00	in^2	4-#1"
bar4=	2.00	in^2	2-#1"
Shear stirrup Av =	0.40	in^2	2 legs of #4
Shear stirrup Spacing S =	24.00	in	

Material Properties:

fy1 =	60.00	ksi
fy2 =	36.00	ksi
fc' =	3000.00	psi

Beam total depth =	93.00	in.	(Tf+D)
ΣAs fy=	393.00	kips	
Average dt =	85.73	in.	(dt = Σ(Asi dti fyi)/Σ(Asi fyi))
a =	8.56	in	(a = Σ As fy / (0.85fc' bw)

Negative Moment Capacity:

ΦMn = **2400.78** k-ft   ΦMn = Φ Σ(As fy)(dt-a/2)

Stringer S10,S11 - Section P - As Inspected

Shear Capacity:

Concrete shear strength Vc =	169.05	kips	Vc = 2 (fc')^0.5 bw d
Rebar shear strength Vs =	51.44	kips	Vs = Av fy d / s

Shear Capacity:

ΦVn = **187.41** k-ft ΦVn = Φ (Vc+Vs)

STAAD Output (service loads):

Max Positive Moment			Max Negative Moment			Max Shear		
DL =	121.25	k-ft	DL =	208.02	k-ft	DL =	32.55	k
HS 20 =	268.19	k-ft	HS 20 =	287.30	k-ft	HS 20 =	53.02	k
2F1 =	160.40	k-ft	2F1 =	175.51	k-ft	2F1 =	26.16	k
3F1 =	227.98	k-ft	3F1 =	248.36	k-ft	3F1 =	38.47	k
4F1 =	246.85	k-ft	4F1 =	245.01	k-ft	4F1 =	42.83	k
5C1 =	197.59	k-ft	5C1 =	280.39	k-ft	5C1 =	39.28	k

Rating Factors:

HS 20:

HS 20					
Positive Moment		Negative Moment		Shear	
Inv.	Opr.	Inv.	Opr.	Inv.	Opr.
1.25	2.09	3.42	5.71	1.26	2.11

Ohio Legal Loads:

2F1			3F1		
M+	M-	V	M+	M-	V
3.50	9.34	4.27	2.46	6.60	2.90

4F1			5C1		
M+	M-	V	M+	M-	V
2.27	6.69	2.61	2.84	5.84	2.84

TranSystems

Made By: GHD Date: 2/23/2012 Job No.:

Checked By: ADP Date: 3/2/2012 Sheet No.:

Columns Rating Summary - As Inspected

COLUMNS	Column Length	SERVICE LOADS (From STAAD Output)																														RATING FACTORS					
		DEAD LOAD					HS20					2F1					3F1					4F1					5C1					HS20		OHIO LEGAL LOADS			
		Axial	Top		Bottom		Axial	Top		Bottom		Axial	Top		Bottom		Axial	Top		Bottom		Axial	Top		Bottom		Axial	Top		Bottom							
	L (ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	P (k)	My(k-ft)	Mz(k-ft)	My(k-ft)	Mz(k-ft)	Inv.	Opr.	2F1	3F1	4F1	5C1
P1	28.86	210.01	33.56	33.56	22.37	14.60	130.69	68.75	50.28	30.95	19.42	64.27	33.23	38.87	14.81	15.05	94.63	49.14	46.49	21.97	17.88	105.61	55.28	40.50	24.89	15.39	93.34	48.55	44.10	21.72	16.92	*2.87*	*4.01*	*5.07*	*4.45*	*4.52*	*4.54*
P2	33.02	275.72	24.83	6.53	15.40	4.42	118.39	46.55	36.78	22.19	20.28	52.88	20.88	19.11	9.97	10.42	80.32	31.69	28.52	15.13	15.59	93.12	36.71	32.27	17.52	17.67	92.97	36.08	27.59	16.99	15.11	4.12	6.12	9.71	7.63	6.98	7.35
P3	34.67	238.35	17.15	21.34	10.41	11.62	127.19	40.16	37.54	19.18	17.88	57.48	18.72	17.21	8.95	8.11	87.10	28.02	25.58	13.40	12.07	100.87	32.17	28.84	15.38	13.63	97.30	30.26	22.68	14.31	12.03	4.22	6.07	9.31	7.60	7.06	7.67
P4	38.83	239.99	2.04	2.78	0.30	0.50	143.39	4.13	52.08	2.46	26.28	64.28	14.23	23.11	1.56	13.30	97.63	20.95	34.22	2.20	19.93	113.14	23.86	38.39	2.16	22.63	111.99	22.31	28.33	10.61	13.52	6.25	10.40	16.36	11.60	10.41	12.67
P5	45.49	191.62	4.18	22.28	1.83	11.73	166.07	3.63	80.34	3.78	37.91	78.95	1.76	50.88	1.83	24.01	114.22	2.37	72.94	2.47	34.42	126.64	2.38	73.26	2.48	34.56	121.39	2.28	74.37	2.38	35.09	3.64	5.64	7.43	5.92	5.95	5.86
P6	28.86	255.93	12.12	33.20	11.98	15.44	176.98	48.66	65.94	23.56	29.21	81.98	25.20	33.80	12.22	13.68	120.29	36.15	41.01	20.79	16.14	134.13	43.10	42.36	23.10	18.33	118.67	35.73	38.77	20.66	15.71	2.91	4.39	6.65	5.73	5.40	5.86
P7	32.02	326.73	15.04	4.24	10.63	2.60	134.82	34.35	32.59	16.82	17.89	60.20	15.36	17.07	7.52	9.24	91.44	23.33	25.45	11.42	13.80	106.02	27.04	28.76	13.24	15.63	106.06	27.01	24.57	13.22	13.37	5.30	8.20	13.62	10.41	9.45	9.96
P8	36.17	313.35	21.84	0.76	12.74	0.86	134.74	33.13	26.22	16.25	12.67	60.60	15.47	13.31	7.09	6.82	92.38	23.23	19.75	10.55	10.24	106.75	26.67	22.21	12.09	11.65	104.01	25.70	18.17	12.60	9.65	5.65	8.49	13.29	10.58	9.73	10.34
P9	41.33	313.18	27.65	3.83	14.34	1.51	132.42	31.09	24.84	15.32	12.41	59.61	14.53	13.21	7.16	6.54	90.43	21.71	19.63	10.70	9.73	104.51	24.90	22.10	12.27	10.97	104.60	24.56	16.54	12.10	8.06	5.51	8.61	11.58	9.55	8.88	9.45
P10	45.49	262.34	19.18	20.49	9.25	10.43	155.28	25.48	50.61	13.46	23.74	73.81	12.41	32.05	6.51	15.03	106.94	17.56	46.11	9.21	21.61	118.72	19.52	46.61	10.17	21.83	114.28	19.05	46.99	10.22	22.03	4.15	6.07	8.26	6.75	6.62	6.61
P11	28.86	331.17	52.13	27.83	31.68	14.19	191.54	100.96	90.45	54.89	40.11	90.50	51.64	32.43	28.21	13.63	132.32	74.42	40.51	40.62	16.87	147.88	82.45	37.15	44.89	15.31	130.59	73.79	38.49	40.25	16.00	1.64	2.58	4.28	3.58	3.47	3.62
P12	30.02	367.19	16.92	2.89	11.63	0.94	136.05	44.95	23.92	23.06	12.66	60.70	20.04	12.33	10.26	6.51	92.22	30.45	18.43	15.59	9.73	106.94	35.31	20.87	18.08	11.03	107.39	36.12	17.93	18.85	9.44	4.91	7.71	13.20	10.06	9.08	9.23
P13	36.17	328.66	8.24	0.31	1.99	0.36	137.07	33.40	28.53	16.42	13.85	61.64	15.59	14.24	7.66	6.88	93.93	23.41	21.33	11.51	10.33	108.59	26.88	24.26	13.21	11.75	105.97	25.96	14.80	13.58	6.76	6.18	9.99	18.28	13.24	11.83	14.03
P14	41.33	318.49	23.44	5.16	10.83	2.98	132.50	31.09	30.92	15.32	15.57	59.65	14.53	15.56	7.16	7.87	90.49	21.71	23.33	10.70	11.78	104.57	24.90	26.50	12.27	13.39	104.71	24.58	18.38	12.11	9.33	5.27	7.77	11.90	9.55	8.80	9.74
P15	45.49	263.87	19.66	19.43	9.93	9.21	155.37	34.82	50.64	17.20	23.75	73.85	16.54	32.07	8.17	15.04	106.98	24.06	46.13	11.89	21.63	118.76	26.81	46.64	13.24	21.85	114.32	25.77	47.01	12.73	22.04	3.84	5.69	7.97	6.42	6.26	6.28
P16	28.86	231.39	109.71	11.91	47.09	8.32	135.13	131.68	46.61	58.40	21.33	68.70	65.52	24.47	28.84	11.10	99.38	95.39	36.85	42.08	16.72	110.57	106.36	41.36	47.07	18.80	98.95	94.25	35.78	41.62	16.25	1.59	2.21	3.05	2.59	2.45	2.61
P17	28.02	262.74	68.44	19.73	30.24	8.02	126.58	62.31	31.07	29.60	16.01	56.57	27.88	15.71	13.27	9.33	85.90	42.34	23.52	20.15	12.14	99.57	49.07	26.71	23.34	13.78	100.42	48.78	15.04	22.85	10.92	2.81	3.78	5.11	4.42	4.17	4.42
P18	29.67	222.34	32.35	19.71	13.80	8.15	145.81	43.67	27.77	20.84	13.65	65.99	20.38	13.97	9.74	6.82	100.05	30.69	20.93	14.67	10.24	115.75	35.35	23.76	16.89	11.64	106.09	33.54	13.90	15.85	7.38	4.09	5.67	7.94	6.70	6.27	6.93
P19	35.33	227.56	6.59	6.34	2.51	4.29	143.55	29.28	51.44	14.11	25.97	64.36	14.33	26.04	6.90	13.15	97.76	21.10	39.00	10.17	19.70	113.28	24.01	44.28	11.58	22.36	112.06	22.50	30.62	10.70	15.55	4.74	7.48	12.89	9.50	8.57	10.62
P20	45.49	187.15	8.27	17.85	4.30	7.82	165.76	30.87	81.88	14.39	38.67	78.81	15.43	51.87	7.24	24.50	114.09	21.92	74.23	10.36	35.05	126.56	24.38	74.46	11.52	35.16	121.17	22.53	75.70	10.34	35.75	3.19	4.91	7.04	5.44	5.36	5.36

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P1-Inv_AI.col
Project: MAIN AVE_SECTION P
Column: P1 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Architectural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 36 in

Gross section area, Ag = 1080 in^2
Ix = 116640 in^4 Iy = 81000 in^4
rx = 10.3923 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 9.48 in^2 at rho = 0.88% (Note: rho < 1.0%)
Minimum clear spacing = 6.67 in

12 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	210.01	33.56	22.37	33.56	14.60
	Live	130.69	68.75	30.95	50.28	19.42
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 2.170*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	36	116640	3	3122.02
	Y	28.86	30	36	81000	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	39.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 1.14e+008 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.62e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	556.61	6266.62	0.490	0.400	1.000	556.61	4351.82	4351.82	0.490	1.206

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	556.61	4204.88	0.490	0.440	1.000	556.61	2920.06	2920.06	0.490	1.341

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.68 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis	1st Order				--2nd Order--	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	192.82	0.00	192.82	(N/A)	192.82	(N/A)
	-96.24	0.00	-96.24	(N/A)	-96.24	(N/A)

Y-axis	1st Order				--2nd Order--	--Ratio--
Load Combo	Mns k-ft	Ms k-ft	Mu k-ft	Mmin k-ft	Mu k-ft	2nd/1st
1 U1	152.74	0.00	152.74	(N/A)	152.74	(N/A)
	-61.12	0.00	-61.12	(N/A)	-61.12	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	556.61	192.82	152.74	552.83	437.92	2.867	21.79	41.21	0.00267	0.745
2		556.61	-96.24	-61.12	-610.60	-387.78	6.344	21.75	41.60	0.00274	0.750

*** End of output ***

General Information:

File Name: G:\CL11\0046\Bridge\Analysis\West Approach\Section P\PCA-COLUMN\P1-Opr_AI.col
Project: MAIN AVE_SECTION P
Column: P1 Engineer: GHD
Code: ACI 318-02 Units: English

Run Option: Investigation Slenderness: Considered
Run Axis: Biaxial Column Type: Architectural

Material Properties:

f'c = 3 ksi fy = 36 ksi
Ec = 3122.02 ksi Es = 29000 ksi
Ultimate strain = 0.003 in/in
Beta1 = 0.85

Section:

Rectangular: Width = 30 in Depth = 36 in

Gross section area, Ag = 1080 in^2
Ix = 116640 in^4 Iy = 81000 in^4
rx = 10.3923 in ry = 8.66025 in
Xo = 0 in Yo = 0 in

Reinforcement:

Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #4 ties with #10 bars, #4 with larger bars.
phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Rectangular
Pattern: All Sides Equal (Cover to longitudinal reinforcement)
Total steel area: As = 9.48 in^2 at rho = 0.88% (Note: rho < 1.0%)
Minimum clear spacing = 6.67 in

12 #8 Cover = 3 in

Service Loads:

No.	Load Case	Axial Load kip	Mx @ Top k-ft	Mx @ Bot k-ft	My @ Top k-ft	My @ Bot k-ft
1	Dead	210.01	33.56	22.37	33.56	14.60
	Live	130.69	68.75	30.95	50.28	19.42
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
2	Dead	210.01	33.56	22.37	33.56	14.60
	Live	64.27	33.23	14.81	38.87	15.05
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
3	Dead	210.01	33.56	22.37	33.56	14.60
	Live	94.63	49.14	21.97	46.49	17.88
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
4	Dead	210.01	33.56	22.37	33.56	14.60
	Live	105.61	55.28	24.89	40.50	15.39
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00
5	Dead	210.01	33.56	22.37	33.56	14.60
	Live	93.34	48.55	21.72	44.10	16.92
	Wind	0.00	0.00	0.00	0.00	0.00
	EQ	0.00	0.00	0.00	0.00	0.00
	Snow	0.00	0.00	0.00	0.00	0.00

Sustained Load Factors:

Load Case	Factor (%)
Dead	100
Live	0
Wind	0
EQ	0
Snow	0

Load Combinations:

U1 = 1.300*Dead + 1.300*Live + 0.000*Wind + 0.000*EarthQuake + 0.000*Snow

Slenderness:

Sway Criteria:

X-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu
Y-axis: Sway column. SumPc = 1.00 * Pc   SumPu = 1.00 * Pu

Column	Axis	Height ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Design	X	28.86	30	36	116640	3	3122.02
	Y	28.86	30	36	81000	3	3122.02
Above	X	(no column specified...)					
	Y	(no column specified...)					
Below	X	(no column specified...)					
	Y	(no column specified...)					

X-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Y-Beams Location	Length ft	Width in	Depth in	I in^4	f'c ksi	Ec ksi
Above Left	(no beam specified...)					
Above Right	(no beam specified...)					
Below Left	(no beam specified...)					
Below Right	(no beam specified...)					

Effective Length Factors:

Axis	Psi(top)	Psi(bot)	k(Nonsway)	k(Sway)	klu/r
X	0.000	0.000	1.000	1.200	39.99
Y	0.000	0.000	1.000	1.200	47.99

Moment Magnification Factors:

Stiffness reduction factor, phi(K) = 0.75
Cracked-section coefficients: cI(beams) = 0.35; cI(columns) = 0.7

0.2*Ec*Ig + Es*Ise (X-axis) = 1.14e+008 kip-in^2
0.2*Ec*Ig + Es*Ise (Y-axis) = 7.62e+007 kip-in^2

X-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	442.91	5778.46	0.616	0.400	1.000	442.91	4012.82	4012.82	0.616	1.173
2 U1	356.56	5289.95	0.766	0.400	1.000	356.56	3673.58	3673.58	0.766	1.149
3 U1	396.03	5528.89	0.689	0.400	1.000	396.03	3839.51	3839.51	0.689	1.159
4 U1	410.31	5608.51	0.665	0.400	1.000	410.31	3894.80	3894.80	0.665	1.163
5 U1	394.35	5519.31	0.692	0.400	1.000	394.35	3832.86	3832.86	0.692	1.159

Y-axis	Nonsway					Sway				
Ld/Comb	Pu(kip)	Pc(kip)	Betad	Cm	Delta	SumPu(kip)	Pc(kip)	SumPc(kip)	Betad	Delta
1 U1	442.91	3877.33	0.616	0.438	1.000	442.91	2692.59	2692.59	0.616	1.281
2 U1	356.56	3549.54	0.766	0.436	1.000	356.56	2464.96	2464.96	0.766	1.239
3 U1	396.03	3709.87	0.689	0.438	1.000	396.03	2576.30	2576.30	0.689	1.258
4 U1	410.31	3763.29	0.665	0.[illegible]	[illegible]	410.31	2613.40	2613.40	0.665	1.265

5 U1	394.35	3703.44	0.692	0.438	1.000	394.35	2571.83	2571.83	0.692	1.257

Factored First-Order and Factored Magnified (Second-Order) Moments:

Minimum eccentricity, Ex,min = 1.68 in
Minimum eccentricity, Ey,min = 1.5 in

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

X-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	133.00	0.00	133.00	(N/A)	133.00	(N/A)
	-69.32	0.00	-69.32	(N/A)	-69.32	(N/A)
2 U1	86.83	0.00	86.83	(N/A)	86.83	(N/A)
	-48.33	0.00	-48.33	(N/A)	-48.33	(N/A)
3 U1	107.51	0.00	107.51	(N/A)	107.51	(N/A)
	-57.64	0.00	-57.64	(N/A)	-57.64	(N/A)
4 U1	115.49	0.00	115.49	(N/A)	115.49	(N/A)
	-61.44	0.00	-61.44	(N/A)	-61.44	(N/A)
5 U1	106.74	0.00	106.74	(N/A)	106.74	(N/A)
	-57.32	0.00	-57.32	(N/A)	-57.32	(N/A)

Y-axis Load Combo	1st Order Mns k-ft	1st Order Ms k-ft	1st Order Mu k-ft	1st Order Mmin k-ft	2nd Order Mu k-ft	Ratio 2nd/1st
1 U1	108.99	0.00	108.99	(N/A)	108.99	(N/A)
	-44.23	0.00	-44.23	(N/A)	-44.23	(N/A)
2 U1	94.16	0.00	94.16	(N/A)	94.16	(N/A)
	-38.54	0.00	-38.54	(N/A)	-38.54	(N/A)
3 U1	104.07	0.00	104.07	(N/A)	104.07	(N/A)
	-42.22	0.00	-42.22	(N/A)	-42.22	(N/A)
4 U1	96.28	0.00	96.28	(N/A)	96.28	(N/A)
	-38.99	0.00	-38.99	(N/A)	-38.99	(N/A)
5 U1	100.96	0.00	100.96	(N/A)	100.96	(N/A)
	-40.98	0.00	-40.98	(N/A)	-40.98	(N/A)

Factored Loads and Moments with Corresponding Capacities:

NOTE: Each loading combination includes the following cases:
First line - at column top
Second line - at column bottom

No.	Load Combo	Pu kip	Mux k-ft	Muy k-ft	fMnx k-ft	fMny k-ft	fMn/Mu	NA depth in	Dt depth in	eps_t	Phi
1	1 U1	442.91	133.00	108.99	532.77	436.59	4.006	19.58	41.11	0.00330	0.787
2		442.91	-69.32	-44.23	-596.49	-380.58	8.605	19.63	41.66	0.00337	0.791
3	2 U1	356.56	86.83	94.16	440.48	477.67	5.073	17.02	39.51	0.00396	0.831
4		356.56	-48.33	-38.54	-521.47	-415.86	10.789	17.95	41.20	0.00388	0.826
5	3 U1	396.03	107.51	104.07	478.76	463.42	4.453	18.14	40.18	0.00365	0.810
6		396.03	-57.64	-42.22	-552.51	-404.73	9.585	18.70	41.39	0.00364	0.810
7	4 U1	410.31	115.49	96.28	522.28	435.39	4.522	18.84	40.99	0.00353	0.802
8		410.31	-61.44	-38.99	-591.68	-375.46	9.630	19.00	41.69	0.00358	0.806
9	5 U1	394.35	106.74	100.96	484.65	458.39	4.540	18.18	40.30	0.00365	0.810
10		394.35	-57.32	-40.98	-558.19	-399.05	9.739	18.67	41.44	0.00366	0.811

*** End of output ***

TranSystems

Made By: ADK | Date: 3/1/12 | Job No: P402110046
Checked By: GHD | Date: 3/1/12 | Sheet No.

As-Inspected Adjustments

Section P

Stringers

S10 → Bottom Layer of □ Rebar → 7/8" × 7/8" Remaining
S11 → " " → 1/8" S.L.
S17 → 1 Bot. Layer □ Rebar w/ 1/8" S.L.
S4 → 10% loss to bot. Layer of □ Rebar
S9 → 1/16" S.L. bot. □ rebar
S14 → " "

Columns

Column 1 → 1/16" S.L. all rebar on one face of column.

TranSystems®

Field Notes

PROJECT NO P402-11-0046

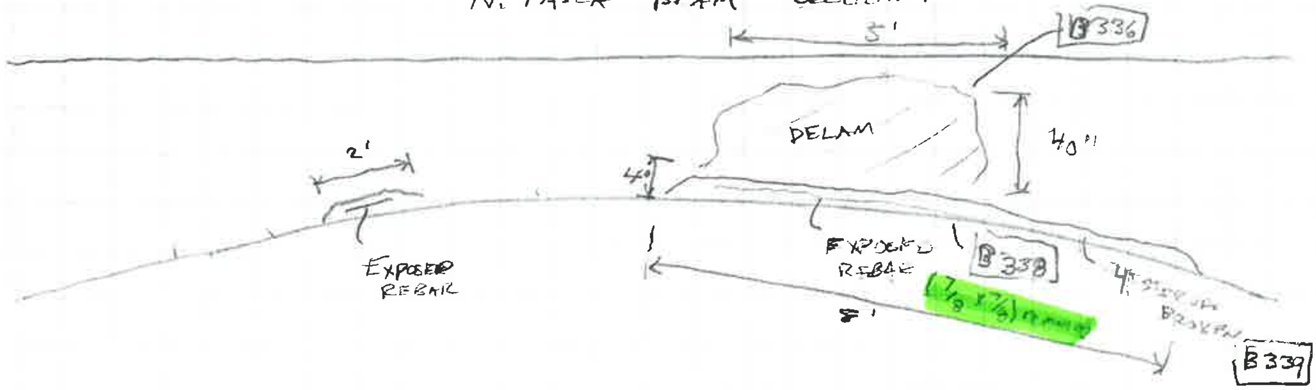
BRIDGE NO GUY-2-1441

DATE 11/18/11

SHEET

CREW ADK / SFH

N. FASCIA BEAM SECTION P



REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

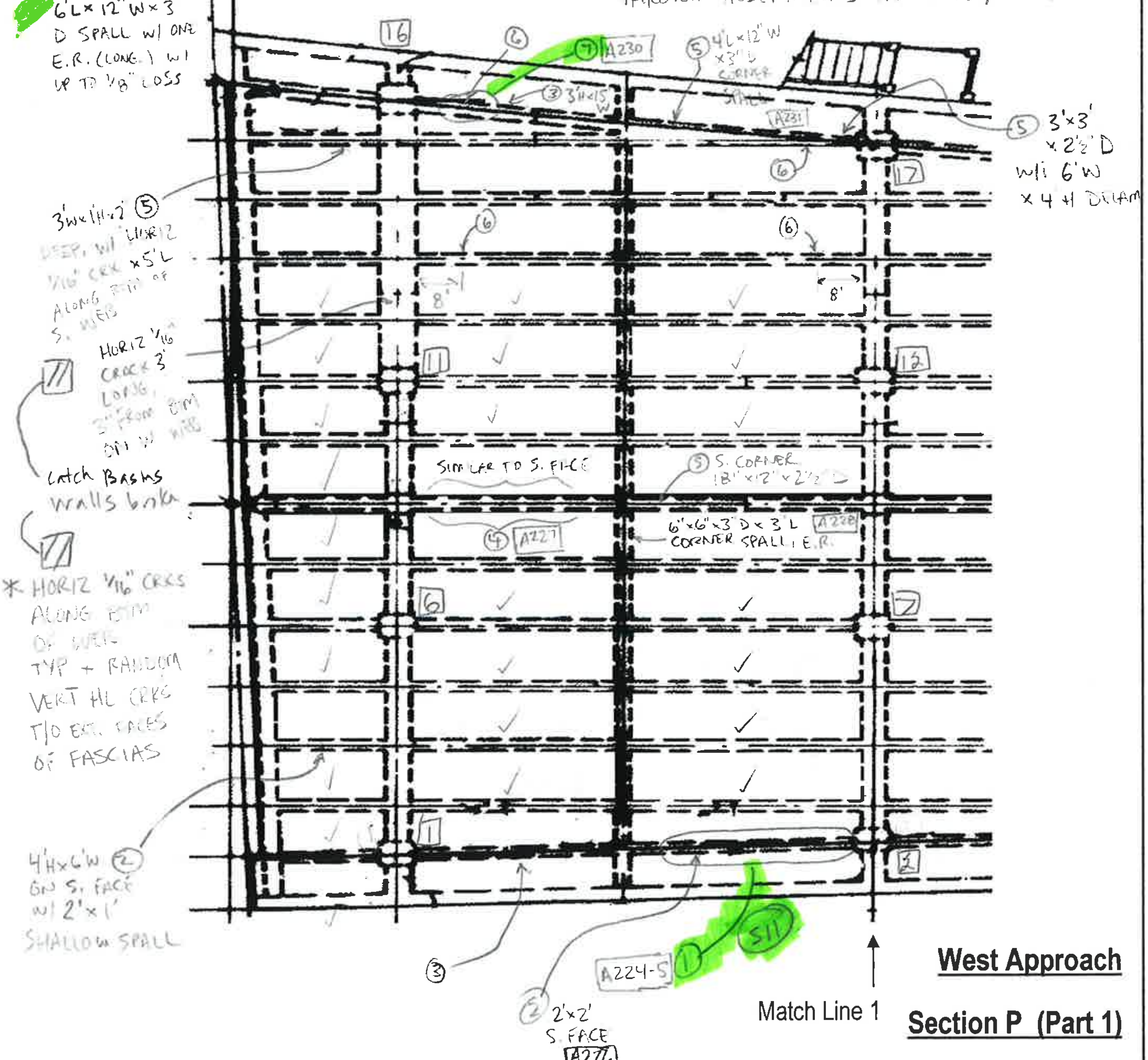
TranSystems®

Field Notes

PROJECT NO P402110046 BRIDGE NO CUY-2-1441
DATE 11/15/11 12/12/11 SHEET
CREW DWC, SFH ADK/KMW

N ↑

① FW BOTTOM OF FASCIA SPALLED AWAY (~3" DEEP) 12' LONG, EXP. REBAR (1" SQUARE PRIMARY BARS w/ UP TO 1/8" S.L.)
② DELAM
③ 6'L 1/8" HORIZ CRK ON S. FACE OF BEAM, 6" FROM BTM. ISO HORIZ + VERT HL CRACKS IN REST OF BEAM
④ 2'H × 12'W - PREV. FAILING PATCH w/ ISO SPALLS UP TO 1½" DEEP
⑤ SPALL w/ E.R.
⑥ B-B CHANNEL SECTIONS PROTRUDING THROUGH INDENTATIONS IN WEB, BOTH FACES



West Approach

Section P (Part 1)

REVISION △1	DATE	CREW	REVISION △2	DATE	CREW
REVISION △3	DATE	CREW	REVISION △4	DATE	CREW

TranSystems

Field Notes

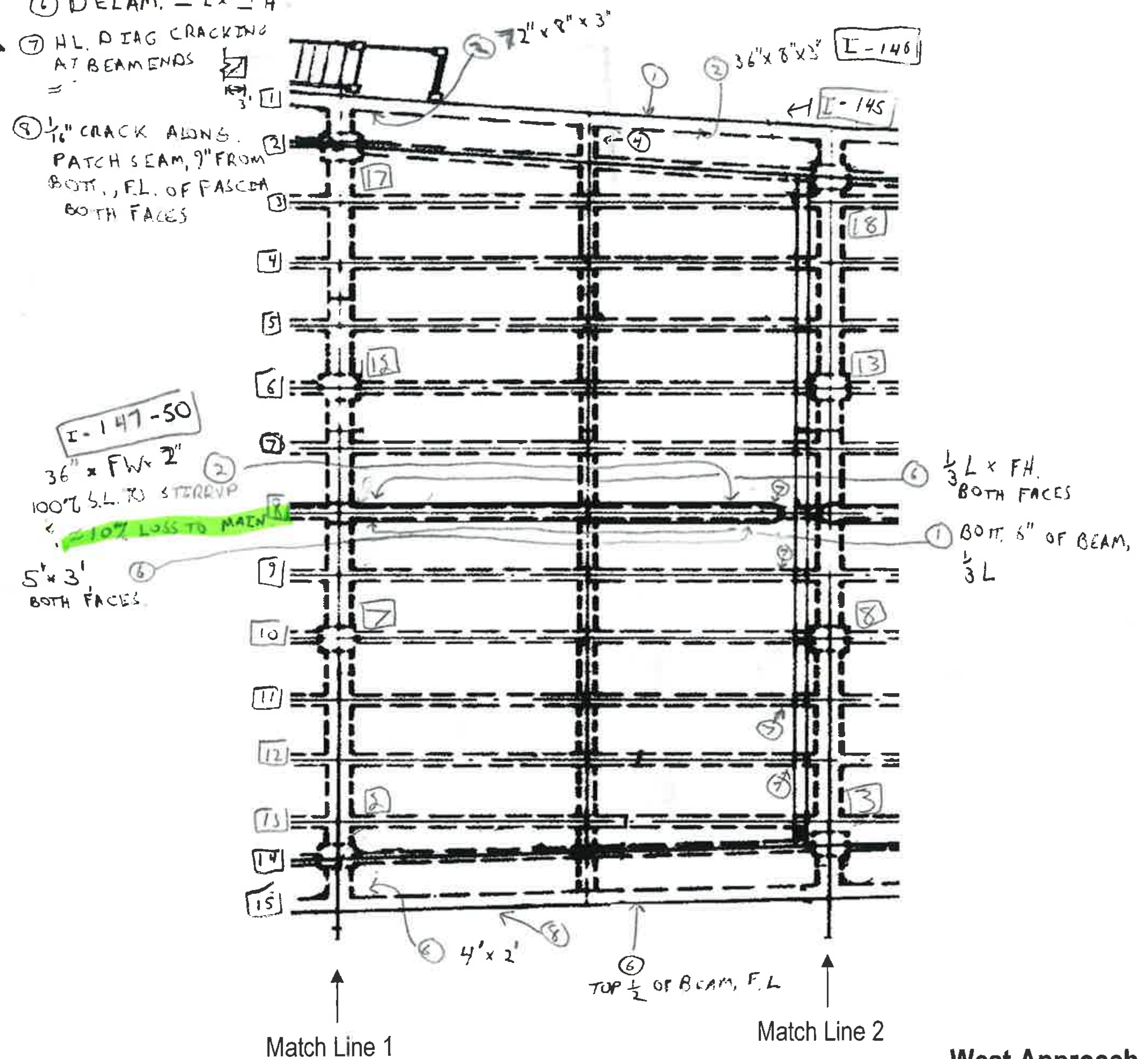
PROJECT NO P402110046
DATE 12/9/11 12/12/11
CREW NRF/KMW APK/KMW

BRIDGE NO CUY-2-1441
SHEET

Not in skew direction

① BOTT 3" OF GIRD. SPALLED/DELAM. F.L. OF GIRD. I-145
② SPALL _"L × _"H × _"D, EXP REBAR
③ H.L. CRACKS ON BOTT. FL, F.W. & EXTEND F.H. OF STR./GIRD. SPACED ≈1', F.L. TYP.
④ H.L. CRACKS AT MID-BAY ON BOTT. FL FW & EXTEND FH. OF DIA. TYP.
⑤ TYP. DIA. HAVE SPALLS ON TOP, FW, ≈1" D.
⑥ DELAM. _"L × _"H
⑦ H.L. DIAG CRACKING AT BEAM ENDS
⑧ 1/16" CRACK ALONG PATCH SEAM, 9" FROM BOTT., F.L. OF FASCIA BOTH FACES

N TYP.



West Approach

Section P (Part 2)

REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

Calculations for 1/4 US Grid

Tran Systems

Field Notes

PROJECT NO P402110046

BRIDGE NO CUY-2-1441

DATE 12/9/11 12/13/11

SHEET

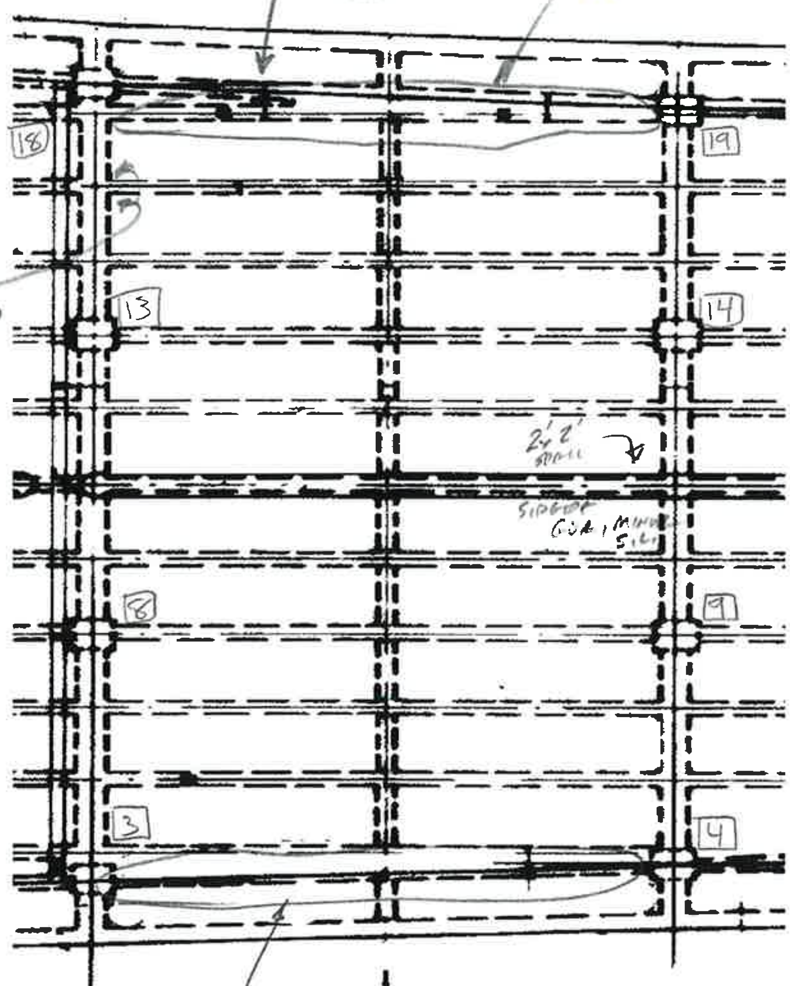
CREW KMW/NRF ADK/KMW

-HL CRKING TYP FOR GDRS @ MIDSPAN

N

Same as S. Gdr, 1/16" sl. openings

I 151 & I 152



~6 ft² Delam Below Gdr on Piercap

Match Line 2

Match Line 3

Entire Btm cover spalled or delam., Bars w/ Sec. Lo, 150 up to 1/16" Deco. However, not in Full Circumf. of section

West Approach

Section P (Part 3)

REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

Calculations for 1/4 US Grid

TranSystems®

Field Notes

PROJECT NO P402110046

DATE 12/9/11 12/12/11

CREW KMW / NRF ADK/KMW

BRIDGE NO CUY-2-1441

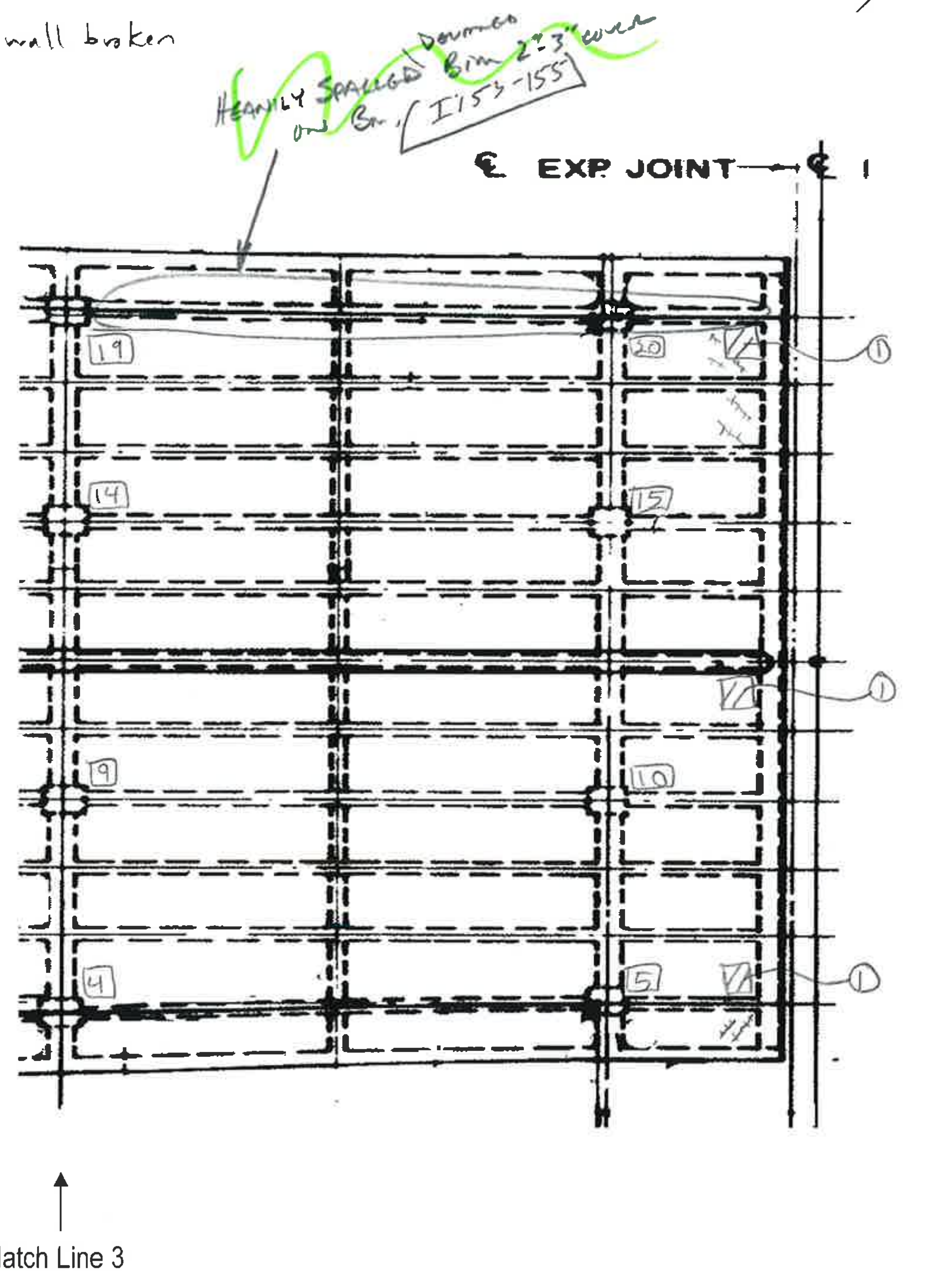
SHEET

-HL CRKING TYP T/O BTM FE's of LONG BMS.

-150 2'-6 sq. ft spalls / DELAMS ON BEAM WEBS + FL. THIS SPAN BETTER THAN SPANS TO THE WEST

N

(1) Catch Basin wall broken



West Approach

Section P (Part 4)

REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

TranSystems

Field Notes

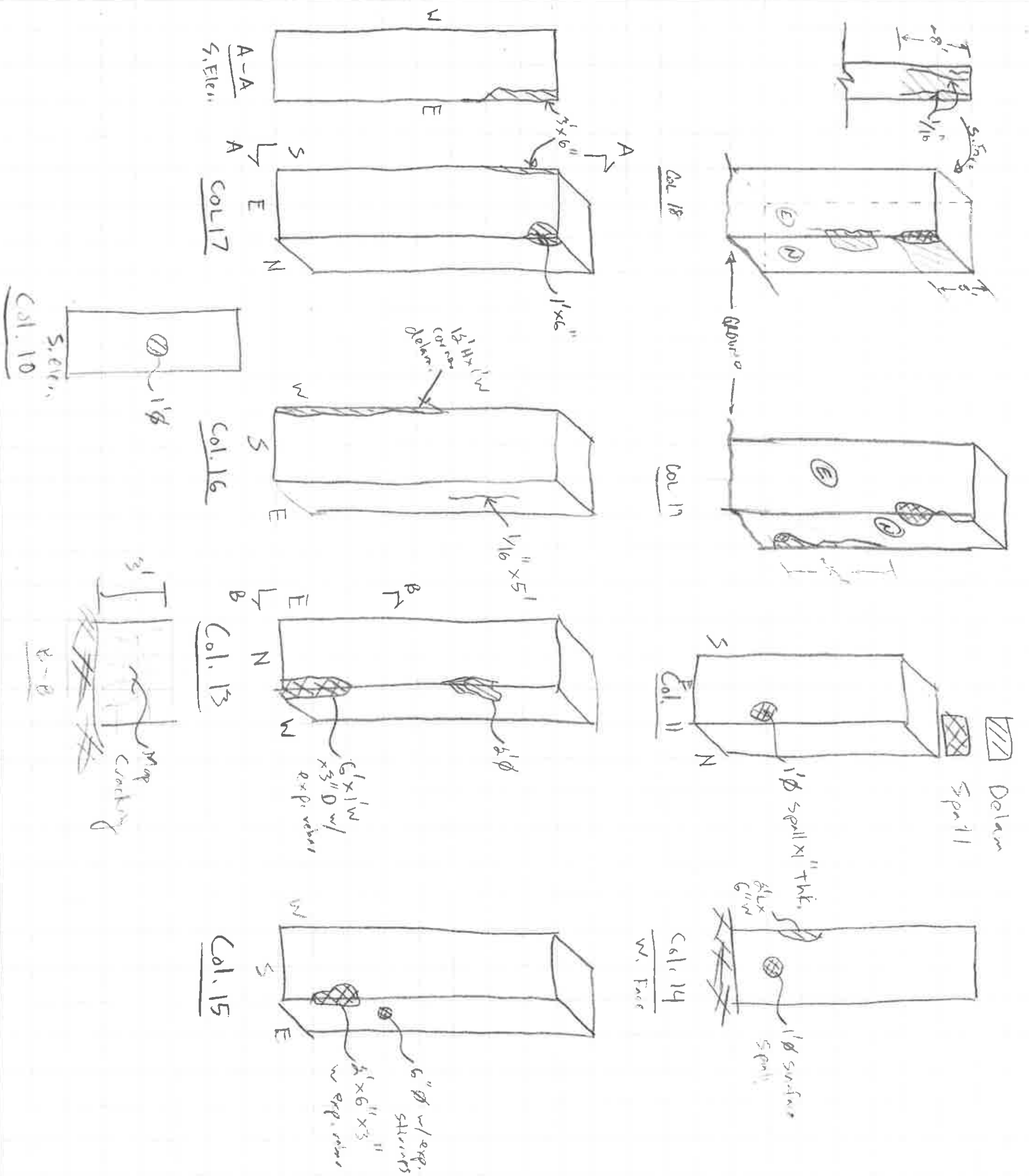
PROJECT NO

DATE 12/12/11

CREW ADK/KMW

BRIDGE NO 1800035

SHEET



Section P

REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

Calculations for 1/4 US Grid

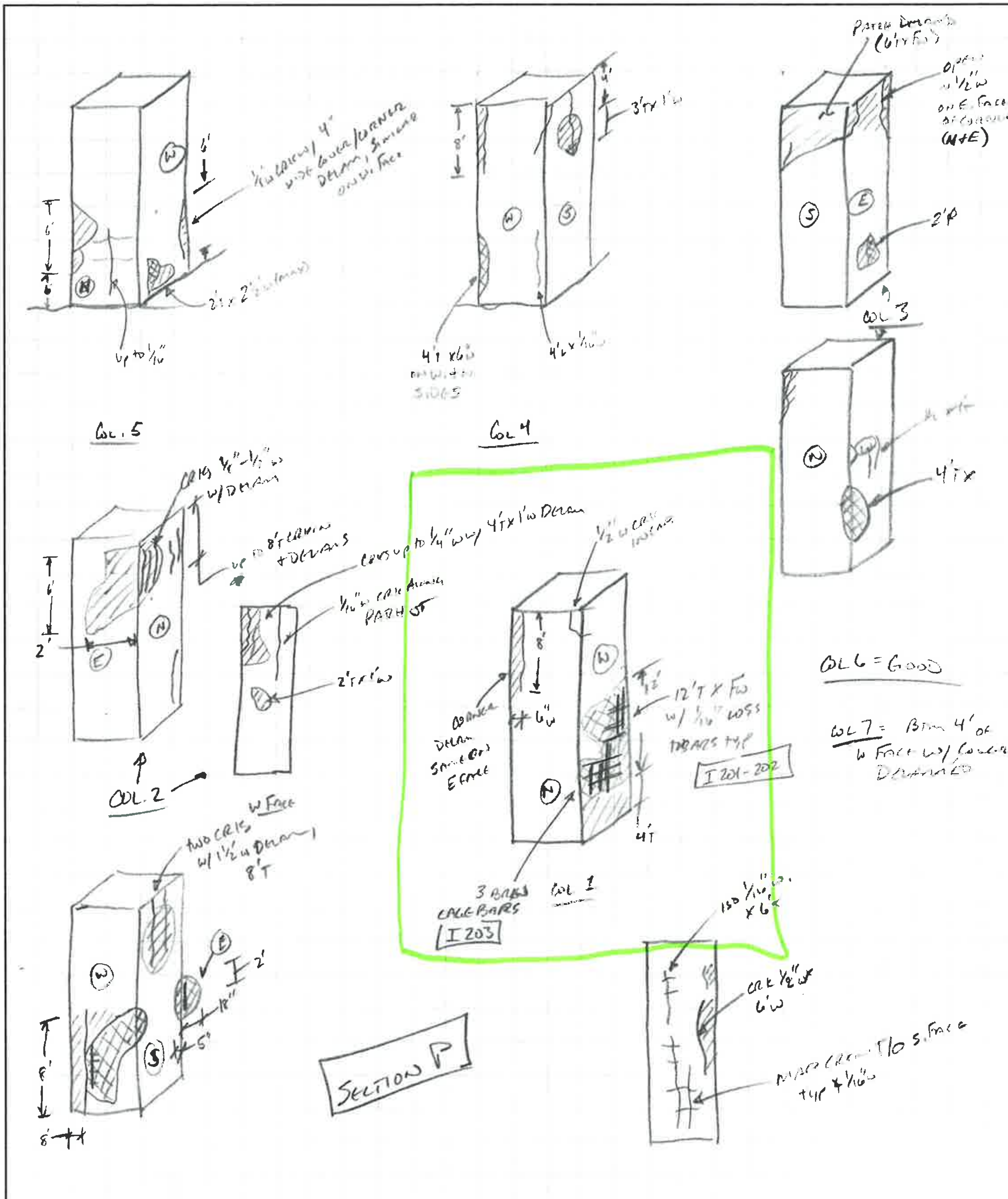
TranSystems®

Field Notes

PROJECT NO P402110046 BRIDGE NO MAIN AVE

DATE 12/12/1_ SHEET

CREW KMW / ADK



REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

Calculations for 1/4 US Grid

TranSystems®

Field Notes

PROJECT NO P402110046

DATE 12/9/11

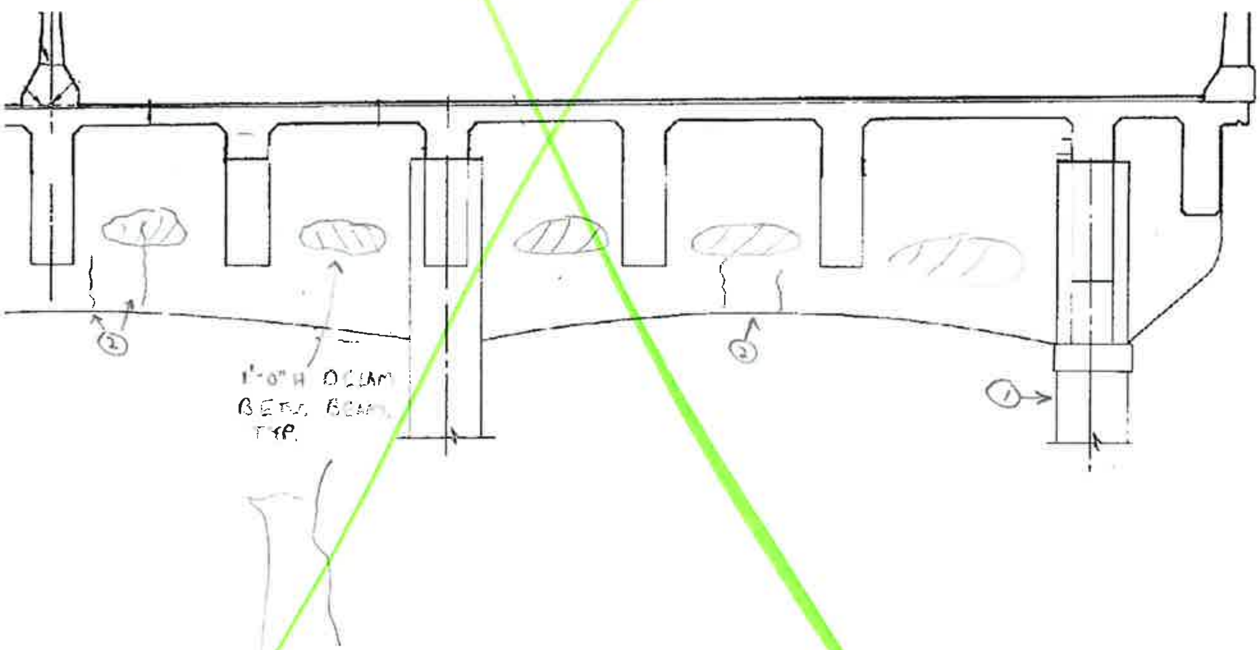
CREW KMW / NRF

BRIDGE NO CUY-2-1441

SHEET

① TOP 3' OF COL. DELAM. W/ CORNER SPALL ON NW CORNER, 1'H x 2'W x 3"D

② HL CRACKS, F.W. BOTT. FL, EXTEND UP



West Approach

Section P – Cross Section

E **Elevation**

South / North Half

FB 2

REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

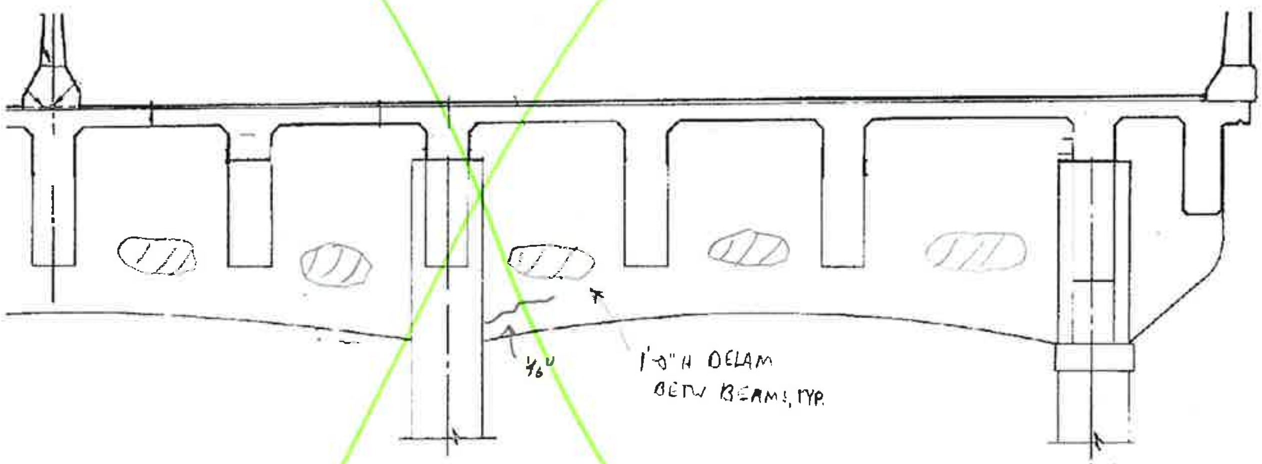
® TranSystems

Field Notes

PROJECT NO P402110046 BRIDGE NO CUY-2-1441

DATE 12/9/11 SHEET

CREW KMW / NRF



FB 2

West Approach

Section P – Cross Section

W **Elevation**

South / North Half

REVISION 1	DATE	CREW	REVISION 2	DATE	CREW
REVISION 3	DATE	CREW	REVISION 4	DATE	CREW

Calculations for 1/4 US Grid