FOR: Ramp A5	JOB NO: 49633	SHEET NO:
MADE BY: LER	CHECKED BY: Jon	BACKCHECKED BY:
DATE: 8/1/12	DATE: 8/2/2012	DATE:

HNTB

RFI 3666 - End Diaphragm @ Girder 2

There is a 3/4" gap between the end of girder 2 and the end diaphragm located in span 3. The contractor would like to use a 3/4" shim plate to compensate for the gap.

Use AASHTO 6.13.6.1.5 to modify the bolt shear capacity for inclusion of the shimplate. Check that the modified capacity still exceeds the factor loading. There will be no impact to the slip resistance of the connection due to the shim plate.

Data from Design Calcs

See attached excerpts.

$V_u = 282$ K ✓

$\phi V_n = 859$ K ✓

$t_{web} = 11/16"$

$t_{angle} = 3/8"$ (L 6 x 6 x 3/8) ✓

Calculate adjustment factor for shear capacity of bolt.

$$R = \left[\frac{(1+\gamma)}{(1+2\gamma}\right]$$ ✓

$$\gamma = \frac{A_f}{A_p}$$ ✓

A_f = area of shim plate

A_p = area of angle leg.

Assuming the width of the shim plate and combined angle legs is equal,

$$\gamma = \frac{t_f}{t_{angle}} = \frac{0.75}{0.375} = 2$$ ✓

$$R = \left[\frac{(1+2)}{(1+2(2))}\right] = 0.60$$ ✓

$\therefore \phi R_n{}^* = 0.60 \times \phi R_n$

$= 0.60\ (859)$

$= 515$ K $> R_u$

OK ✓

The shim plate may be used.

ME:101:1204

RFI/FIELD DESIGN CHANGE/DESIGN DIRECTIVE

RFI Number (from Walsh): 00366 **Date:** 7/10/12

Part I: Identify Request

Requested by: Jason Fischer Phone: (440) 343-2116

Drawing Package Title: Ramp A5

RFC Date of Drawings:

Stationing: (show nearest 500')

Description of Change: G2E on Ramp A5 is short of the plate diaphragm PD1. We moved the PD1 to the other side of the stiffeners and it is still short by ¾".

Requested Change: We would like to install a ¾" shim plate between the 6x6 angles and the PD1. We would also need to up size bolt length from 2-3/4" to 3-1/2". Is this acceptable?

Attachments Sent to Design: No ☒ Yes ☐ List:

Owner approval needed for change to contract (including specs): No ☐ Yes ☐ Describe:

RFI/FIELD DESIGN CHANGE/DESIGN DIRECTIVE

RFI Number (from Walsh): 00366 **Date:** 7/10/12

Part II: Response

Response: HNTB takes no exception to the use of ~~#~~ a shim plate as described above. The shim plate shall be coated per note 3 on sheet 32/ce2 of the ~~des~~ RFC Plans.

Revised Plans needed before this change can be Implemented: ☐ No ☐ Yes List Sheets:

If plan changes: ☐ Quick Design Change ☐ Multi-Party Design Change; Third Party Reviews by: (list)

Owner approval needed for change to contract (including specs): ☐ No ☐ Yes Describe:

Plans to be as-built: ☐ No ☐ Yes List Sheets:

Responded by: _____ Date: _____

Checked by: _____

Attachments for Response: ☐ No ☐ Yes List:

HNTB Job String: ☐ DS 001 ☐ DS 004

FOR:	JOB NO:	SHEET NO:
MADE BY:	CHECKED BY:	BACKCHECKED BY:
DATE:	DATE:	DATE:

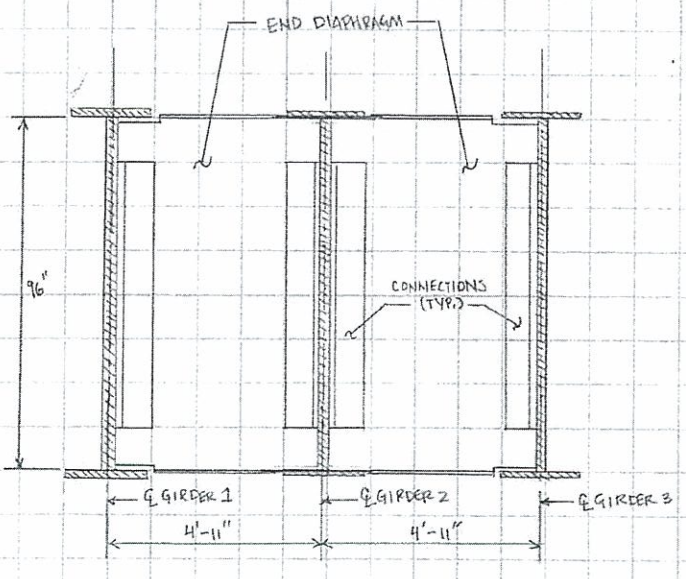
HNTB

Excerpts from Design

For CLEVELAND INNERBELT (RAMP A5)	Job no. 49633	Sheet no.
Made by DHE	Checked by LER	Backchecked by DHE
Date 02/08/2011	Date 3/7/11	Date 03/09/2011

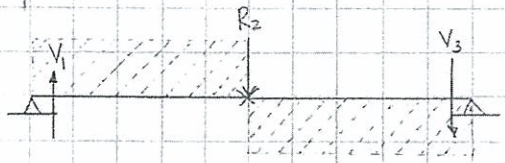
HNTB

END DIAPHRAGM DESIGN AT GIRDER 2



· PER AASHTO C6.7.4.2 DIAPHRAGMS WITH A SPAN-TO-DEPTH RATIOS LESS THAN 4.0 SHALL BE DESIGNED AS "DEEP BEAMS" SINCE "DEEP BEAMS" ARE NOT BENDING MEMBERS, RATHER THEY DISTORT INSTEAD OF DEFLECT, TRADITIONAL BEAM THEORY IS NOT APPLICABLE. BDGS DIAPHRAGM FORCE OUTPUT DOES NOT CONSIDER "DEEP BEAMS". THUS, DIAPHRAGM FORCE OUTPUT FROM BDGS CANNOT BE USED.

STRUCTURAL MODEL:
(SHOWING SHEAR DIAGRAM)



· SINCE THE END DIAPHRAGM IS NOT A BENDING MEMBER, FLANGES WILL SIZED BASED ONLY ON PROPORTIONALITY LIMITS. C6.7.4.2. STATES THAT A "DEEP BEAM" SHOULD BE EVALUATED BY USING PRINCIPAL STRESSES. SINCE THERE IS NO BENDING, THERE WILL BE NO MOMENT. IT CAN BE SHOWN THAT IN THE ABSENCE OF MOMENT, PRINCIPAL STRESSES WILL BE SHEAR STRESS. THUS, IF THE END DIAPHRAGM WEB IS DESIGNED FOR SHEAR ONLY, THEN C6.7.4.2 WILL BE SATISFIED. ADDITIONALLY, CONNECTIONS WILL BE DESIGNED FOR SHEAR ONLY.

· REACTIONS AT THE END OF GIRDER 2 (FROM BDGS OUTPUT @ SPAN LOC. 4.0)

$V_{u2} = 281.87$ k (STR I: LC 5)

$V_{s2} = 202.71$ k (SER II: LC 13)

$V_{F2} = 125.04$ k (MAX) (FAT: LC 19) (69.32 k MIN)

$V_{1u} = V_{3u} = \frac{V_{u2}}{2} = \frac{281.87}{2} = 140.94$ k

$V_{1s} = V_{3s} = \frac{V_{s2}}{2} = \frac{202.71}{2} = 101.36$ k

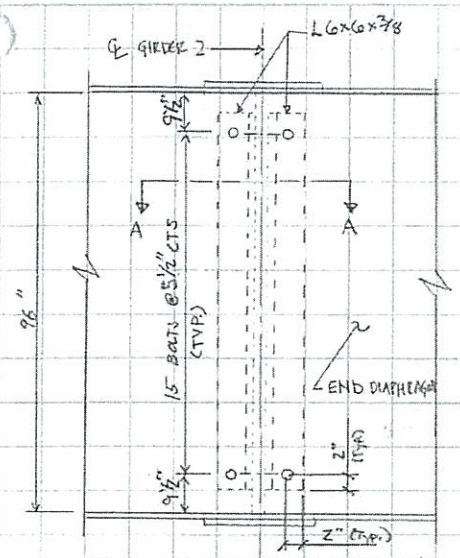
$V_{1F} = V_{3F} = \frac{V_{F2}}{2} = \frac{125.04}{2} = 62.52$ k (MAX)

34.66 k (MIN)

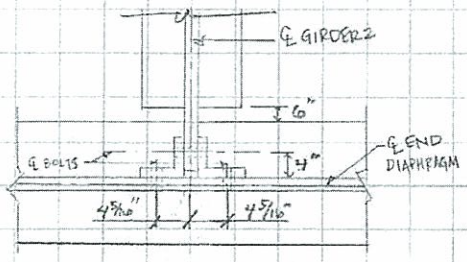
ME101-1204

For CLEVELAND INNERBELT (RAMP A5)	Job no. 49633	Sheet no.
Made by DHE	Checked by LER	Backchecked by
Date 02/10/2011	Date 6/8/11	Date

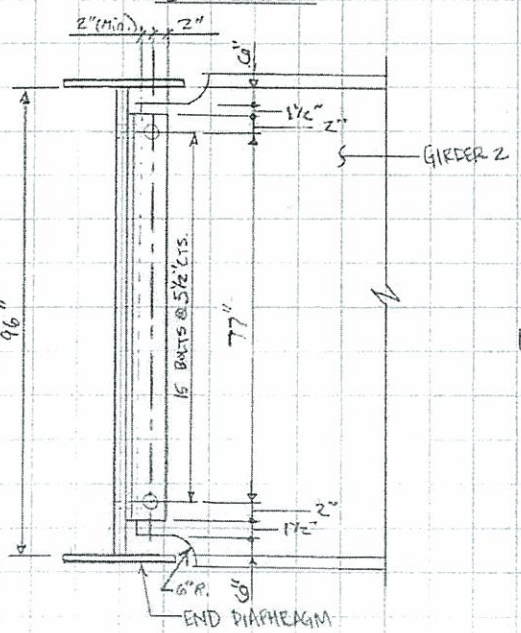
HNTB



END DIAPHRAGM CONNECTION AT GIRDER 2



SECTION A-A



GIRDER 2 TO DOUBLE ANGLE CONNECTION:

CHECK BOLT SHEAR: $V_u = 281.87$ k (ASSUME 1" ϕ A325 BOLTS w/ 1¼" ϕ holes)

$R_n N_b = \phi_s (0.38) A_b F_{uL} N_s N_b = (0.8)(0.38)(0.785)(120)(2)(15) = 859.1$ k

$R_n N_b \geq V_u$ ∴ OK

CHECK BOLT SLIP: $V_s = 202.71$ k

$R_n N_b = K_h K_s N_s P_t N_b = (0.85)(0.50)(2)(51)(15) = 650.25$ k

$R_n N_b \geq V_s$ ∴ OK

CHECK BOLT BEARING ON GIRDER 2 WEB

- SINCE DIMENSIONS OF GIRDER 2 WEB ARE IDENTICAL TO THE END DIAPHRAGM WEB, BOLT BEARING ON GIRDER 2 WEB OK BY INSPECTION

CHECK BOLT BEARING ON ANGLE ($V_u = \frac{281.87}{2} = 140.94$ k)

- CLEAR HOLE DISTANCE = $5\frac{1}{2}" - 1.25 = 4.25" > 2d_b = 2"$
- CLEAR END DISTANCE = $2 - \frac{1.25}{2} = 1.375" < 2d_b = 2"$

$R_r = \phi_{bl} 1.2 L_{ct} F_u = (0.8)(1.2)(1.375)(0.375)(65) = 32.18$ k

$R_r > V_u/N_b = 9.4^k$ ∴ OK

BLOCK SHEAR ON GIRDER 2 WEB

- DUE TO SIMILAR GEOMETRY ON END DIAPHRAGM WEB → OK BY INSPECTION

BLOCK SHEAR ON ANGLE ($V_u = \frac{281.87}{2} = 140.94$ k)

$A_{VG} = (0.375)[2+14.5.5] = 29.625$ in²

$A_{VN} = (0.375)[(2+14.5.5) - (14.5)(1.25)] = 22.83$ in²

$A_{LN} = (0.375)(2 - 0.5 \cdot 1.25) = 0.52$ in²

$R_p = 0.9$ (CONSERVATIVE)

$U_{bs} = 0.5$ (CONSERVATIVE)

$F_{yw} = 50$ ksi ; $F_{uw} = 65$ ksi

$\phi_{bs} = 0.80$

YIELD: $R_r = (0.8)(0.9)[(0.58)(50)(29.63) + (0.5)(65)(0.52)] = 630.8$ k ← CONTROLS

FRACTURE: $R_r = (0.8)(0.9)[(0.58)(65)(22.83) + (0.5)(65)(0.52)] = 631.9$ k

$R_r = 630.8 > V_u$ ∴ OK

CHECK BOLT BEARING ON END DIAPH. WEB AT GIRDER 2

$V_u = \frac{281.87}{2} = 140.94$ k

- CLEAR HOLE DISTANCE = $4.25" > 2d_b$
- CLEAR END DISTANCE $> 2d_b$ (BY INSPECTION)

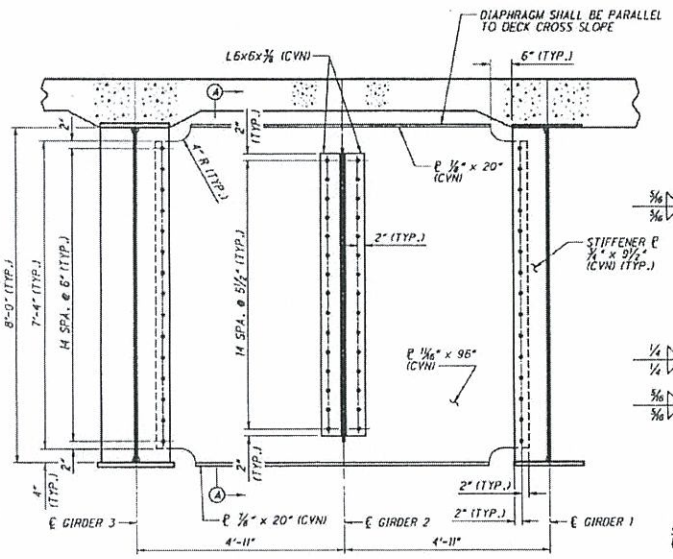
$R_r = \phi_{bl} 2.4 d_b t F_u = (0.8)(2.4)(1.00)(0.6875)(65) = 85.8$ k/bolt

$R_r N_b = 1287$ k $> V_u$ ∴ OK

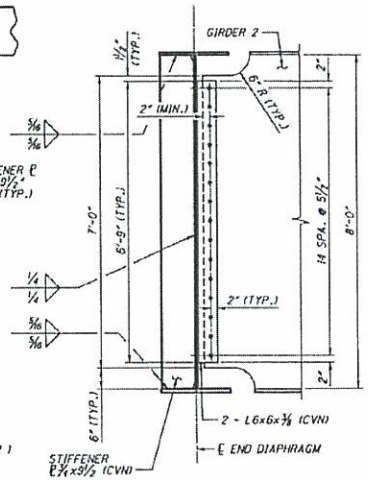
∴ USE 2 × L6 × 6 × ⅜ WITH 15 1" ϕ BOLTS w/ 1¼" ϕ Holes & Class B Slip Surface

↳ Contractor request 1 7/16" hole → ok

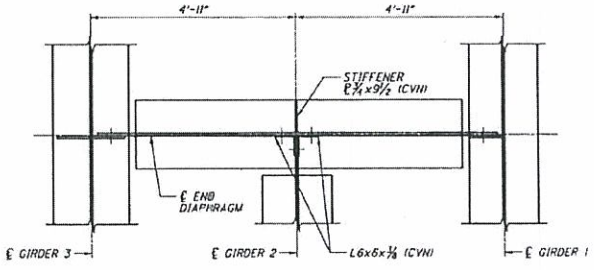
MEI01-1204



ELEVATION OF END DIAPHRAGM



SECTION A-A



PLAN OF END DIAPHRAGM

Independent Design Quality Manager

Released For Construction

AUG 18 2011

Name

Date

NOTES:

1. ALL HIGH STRENGTH BOLTS SHALL BE 1" ϕ A325, TYPE 1. ALL HOLES SHALL BE 1⅛" ϕ.
2. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A709, GRADE 50.
3. ALL STEEL SHALL BE PAINTED WITH AN IZEU COATING SYSTEM. SURFACES OF BOLTED CONNECTIONS SHALL BE PAINTED WITH A COATING THAT WILL PROVIDE CLASS B SLIP RESISTANCE AS DEFINED IN SECTION 6.13.2.8 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.
4. FOR END DIAPHRAGM LOCATION , SEE FRAMING PLAN.
5. FOR ADDITIONAL NOTES, SEE SHEET 30/62.
6. BEARING OF THE SLAB ON THE TOP FLANGE OF THE END DIAPHRAGM IS NOT PERMITTED.
7. FORM COPES PER CLAUSE 3.2 OF AWS D1.5 (2008), EXCEPT THERMAL CUTTING OF RADIUS WILL NOT BE PERMITTED.
8. REFER TO SHEET 28/62 FOR ADDITIONAL INTERMEDIATE STIFFENER DETAILS.

8-12-11

NO.	REVISIONS	DATE
1	INTERIM SUBMITTAL	01/20/11
2	FINAL SUBMITTAL	06/08/11
3	APPROVED FOR CONSTRUCTION	08/18/11

DESIGN AGENCY: WALSH HNTB

DESIGNED LER | DETAILED HEU | CHECKED LER | REVIEWED HPH | DATE 08/12/11 | STRUCTURE FILE NUMBER 1809431

BRIDGE RAMP A5

SUPERSTRUCTURE DETAILS

BRIDGE NO. CUY-90-1532

I-90 RAMP A5

CUY-90-14.90

PID No. 77332/85531

32/62

Date:8/12/2011
Model:Sheet1
File:43613-S-BR-SSD03-RampA5.dgn