TRANSMITTAL

Cives Steel Company — New England Division
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Transmittal No. 182322
Cust. Transmittal No. 2
Page 1

TO : **Turner Construction Co.**

Boston, MA

ATTN : **Richard Martineau (rmartineau@tcco.com)**

Gentlemen, We are sending you :

DATE : **03/07/18**

PROJECT : **MMCEASTTOWER**
CUST. NO. : **310**

REMARKS : **Post to Turner site**
Filename is: 182322-
P4_AND_P5_FOR_APPROVAL.ZIP

VIA : **CUSTOMER WEB SITE**
FOR : **APPROVAL**

Job # 7250P (2)

P4+ rev B, P5+ rev B

TURNER CONSTRUCTION COMPANY
Reviewed for General Acceptance only. This review does not relieve the Subcontractor of the responsibility for making the work conform to the requirements of the contract. The Subcontractor is responsible for all dimensions, correct fabrication and accurate fit with the work of other trades.
SUBJECT TO ARCHITECTS APPROVAL
Signed rmartineau Date Mar 08, 2018
Submittal No. 051200-0007-0

COPY : Turner

Cives Steel Company — New England Division

BY : **Cary Grant -CT-**
TITLE : **Chief Draftsman**

Cives Steel Company

NEW ENGLAND DIVISION

Maine Medical Center
22 Bramhall St.
Portland, ME

Beam to Beam Shear Tab Connection
Shear and Axial Top Cope Only
<u>LRFD 14th Edition</u>

Prepared By:
Cives Steel Company
New England Division
103 Lipman Rd
Augusta, ME 04330

Prepared For:
Cives Engineering Corporation
Cives Steel Company
3700 Mansell Road, Suite 500
Alpharetta, GA 30022

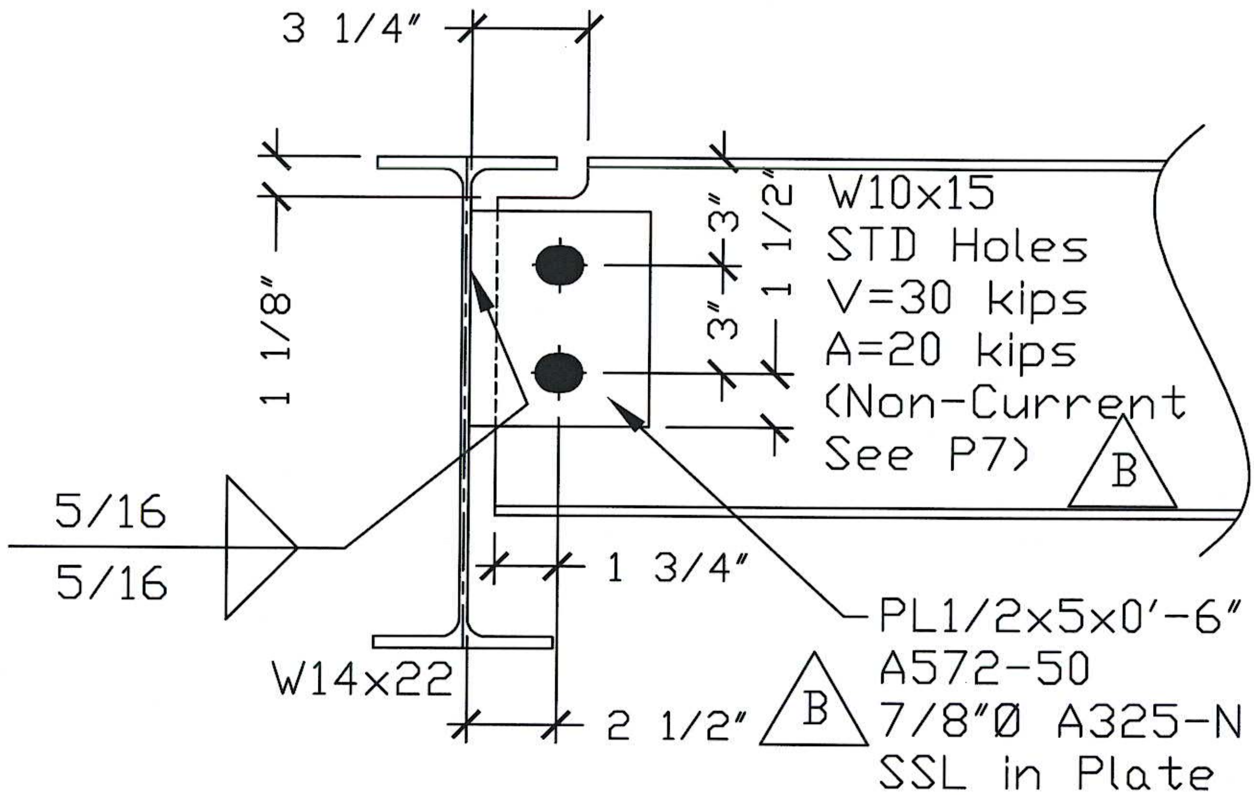
S.O. 7250
Calculation Number: P4
Revision: B

STATE OF MAINE
BRIAN MATTHEW VOLPE
No. PE15347
LICENSED
PROFESSIONAL ENGINEER
MARCH 5, 2018

By: S.Moreau
Date: February 28, 2018

Approved By: WAT
Date: 3/2/18

Location: S10-70
Level 7
Grid Ref: C.6-D/2.4-3



Rev.	Date	Remarks	Dwn	Chk
B	2/28	Added P7 Ref. for Axial Calcs	SRM	NED
A	2/8	Revised Per CEC Comments	SRM	NED
0		Original Issue		

CUSTOMER: Turner Construction	JOB: Maine Medical Center 22 Bramhall St Portland, ME	Drawn by	Checked by
Cives Steel Company		SRM	NED
		Job No.	Rev.
NEW ENGLAND DIVISION		7250	B

14TH. EDITION LRFD

INPUT VALUES

Material Grade: Main 50, Connection 50 (ksi)
Bolts: 0.875 in. Diameter, A325-N in SSL Holes (Shear Value = $\phi\, r_n$ = 24.4 kips)
Transverse Short Slots in Plate only

Supporting Beam: W14X22

Beam: W10X15
  Single Plate Connection - Conventional
  Beam Length = 4'-0"
  Shear Reaction = 30 kips
  Axial Reaction = 20 kips - per P7 t_w = 0.230 in. > 0.100 in. OKAY
  Connection Material = PL1/2X5
  Connection Length = 6 in.
  Number of Rows of Bolts = 2
  Bolt Spacing = 3 in.
  Punch Down = 3 in.
  Beam End Distance = 1.75 (± 0.25) in.
  Distance to First Column of Bolts from Face of Supporting Member = 2.5 in.
  Weld Size = 5 / 16
  Beam Copes:
    Top Depth = 1.125   Top Width = 3.25
    Btm Depth = 0   Btm Width = 0

SINGLE PLATE CONNECTION - CONVENTIONAL - SHEAR

INELASTIC BOLT DESIGN CAPACITY
e = a / 2 = 2.5 / 2 = 1.25 in.
C = 1.51
$\phi R_n = C \times \phi r_n$
  = 1.51 x 24.4
  = 36.8 ≥ 30 kips OKAY

BEARING / TEAROUT ON CONTROLLING ELEMENT (Assumes 1.5 in. Minimum Beam End Distance)
  Bearing at Critical Bolt
    $\phi R_n = \phi \times 1.5 \times l_c \times t \times F_u \le \phi \times 2.4 \times Ø_b \times t \times F_u$
      = 0.75 x 1.5 x 1.88 x 0.23 x 65 ≤ 0.75 x 2.4 x 0.875 x 0.23 x 65 = 23.5
    $\phi R_n / R$ = 23.5 / 0.982 = 23.9 < ϕr_n / 0.982 = 24.4 / 0.982 = 24.8, therefore:
  Prorate Capacity Based on Bearing / Tearout
    $\phi R_{n\text{-}pro} = ((\phi R_n / R) / (\phi r_n / 0.982)) \times C \times \phi r_n$
      = ((23.5 / 0.982) / (24.4 / 0.982)) x 1.51 x 24.4
      = 35.5 ≥ 30 kips OKAY

WELD SIZE REQUIRED
D Required
  $D_{req} = 0.625 \times t_p \times 16$
    = 0.625 x 0.5 x 16
    = 5, **Use 5 Minimum**
Shear Rupture on Supporting Member
  $\phi R_n = \phi \times 0.6 \times F_u \times L \times t \times 2$
    = 0.75 x 0.6 x 65 x 6 x 0.23 x 2
    = 80.7 ≥ 30 kips OKAY

GROSS SHEAR ON PLATE

$\phi R_n = \phi \times 0.6 \times F_y \times L \times t$

$= 1.00 \times 0.6 \times 50 \times 6 \times 0.5$

$= 90 \geq 30$ kips OKAY

NET SHEAR ON PLATE

$\phi R_n = \phi \times 0.6 \times F_u \times (L - n \times (Ø_h + 0.0625)) \times t$

$= 0.75 \times 0.6 \times 65 \times (6 - 2 \times (0.9375 + 0.0625)) \times 0.5$

$= 58.5 \geq 30$ kips OKAY

LATERAL TORSIONAL BUCKLING ON PLATE

$\phi R_n = \phi \times 1{,}500 \times \pi \times L \times t^3 / a^2$

$= 0.90 \times 1{,}500 \times \pi \times 6 \times 0.5^3 / 2.5^2$

$= 509 \geq 30$ kips OKAY

TORSION ON PLATE DUE TO LAP ECCENTRICITY

$M_t = V \times (t_w + t_c) / 2$

$= 30 \times (0.23 + 0.5) / 2$

$= 11$ kip - in.

$\phi M_n = (\phi_v \times 0.6 \times F_{yc} - V / (L \times t_c)) \times L \times t_c^2 / 2 + 2 \times V^2 \times (t_w + t_c) \times b_f / (\phi_b \times F_{yb} \times L_s \times t_w^2)$

$= (1.00 \times 0.6 \times 50 - 30 / (6 \times 0.5)) \times 6 \times 0.5^2 / 2 + 2 \times 30^2 \times (0.23 + 0.5) \times 4 / (0.90 \times 50 \times 48 \times 0.23^2)$

$= 61 \geq 11$ kip - in. OKAY

GROSS BENDING ON PLATE

$e = a / 2 = 2.5 / 2 = 1.25$ in.

$Z = t \times L^2 / 4$

$= 0.5 \times 6^2 / 4$

$= 4.5$ in.^{3}

$\phi R_n = \phi \times F_y \times Z / e$

$= 0.90 \times 50 \times 4.5 / 1.25$

$= 162 \geq 30$ kips OKAY

NET BENDING ON PLATE

$e = a / 2 = 2.5 / 2 = 1.25$ in.

$Z_{net} = t \times L^2 / 4 - (t \times (Ø_h + 0.0625) \times b \times n^2 / 4)$

$= 0.5 \times 6^2 / 4 - (0.5 \times (0.9375 + 0.0625) \times 3 \times 2^2 / 4)$

$= 3$ in.^{3}

$\phi R_n = \phi \times F_u \times Z_{net} / e$

$= 0.75 \times 65 \times 3 / 1.25$

$= 117 \geq 30$ kips OKAY

BLOCK SHEAR ON PLATE

$A_{nt} = t \times (L_e - 0.5 \times (Ø_h + 0.0625))$

$= 0.5 \times (2.5 - 0.5 \times (1.125 + 0.0625))$

$= 0.953$ in.^{2}

$A_{gv} = t \times (L_e + (n - 1) \times b)$

$= 0.5 \times (1.5 + (2 - 1) \times 3)$

$= 2.25$ in.^{2}

$A_{nv} = t \times (L_e + (n - 1) \times b - (n - 0.5) \times (Ø_h + 0.0625))$

$= 0.5 \times (1.5 + (2 - 1) \times 3 - (2 - 0.5) \times (0.9375 + 0.0625))$

$= 1.5$ in.^{2}

$\phi R_n = \phi \times (0.6 \times F_u \times A_{nv} + U_{bs} \times F_u \times A_{nt}) \leq \phi \times (0.6 \times F_y \times A_{gv} + U_{bs} \times F_u \times A_{nt})$

$= 0.75 \times (0.6 \times 65 \times 1.5 + 1 \times 65 \times 0.953) = 90.3 \leq 0.75 \times (0.6 \times 50 \times 2.25 + 1 \times 65 \times 0.953) = 97.1$

$= 90.3 \geq 30$ kips OKAY

GROSS SHEAR ON BEAM WEB

$\phi R_n = \phi \times 0.6 \times F_y \times L \times t$

$= 1.00 \times 0.6 \times 50 \times 10 \times 0.23$

$= 69 \geq 30$ kips OKAY

BLOCK SHEAR ON BEAM WEB (Assumes 1.5 in. Minimum Beam End Distance)

$A_{nt} = t \times (L_e - 0.5 \times (Ø_h + 0.0625))$

$= 0.23 \times (1.5 - 0.5 \times (0.9375 + 0.0625))$

$= 0.23$ in.^{2}

$A_{gv} = t \times (L_e + (n - 1) \times b)$

$= 0.23 \times (1.875 + (2 - 1) \times 3)$

$= 1.12$ in.^{2}

$A_{nv} = t \times (L_e + (n - 1) \times b - (n - 0.5) \times (Ø_h + 0.0625))$

$= 0.23 \times (1.875 + (2 - 1) \times 3 - (2 - 0.5) \times (0.9375 + 0.0625))$

$= 0.776$ in.^{2}

$\phi R_n = \phi \times (0.6 \times F_u \times A_{nv} + U_{bs} \times F_u \times A_{nt}) \leq \phi \times (0.6 \times F_y \times A_{gv} + U_{bs} \times F_u \times A_{nt})$

$= 0.75 \times (0.6 \times 65 \times 0.776 + 1 \times 65 \times 0.23) = 33.9 \leq 0.75 \times (0.6 \times 50 \times 1.12 + 1 \times 65 \times 0.23) = 36.4$

$= 33.9 \geq 30$ kips OKAY

SHEAR ON REMAINING BEAM WEB

$\phi R_n = \phi \times 0.6 \times F_y \times L \times t$

$= 1.00 \times 0.6 \times 50 \times 8.875 \times 0.23$

$= 61.2 \geq 30$ kips OKAY

SINGLE TOP FLANGE COPE CAPACITY (Assumes 0.5 in. Minimum Proud Dimension)

Capacity Based on Elastic Section Modulus

Cope Length Does Not Exceed 2 x Beam Depth And Cope Depth Does Not Exceed Beam Depth / 2

$c / d = 2.75 / 10 = 0.275 \leq 1$, therefore $f = 2 \times c / d = 2 \times 2.75 / 10 = 0.55$

$c / h_o = 2.75 / 8.875 = 0.31 \leq 1$, therefore $k = 2.2 \times (h_o / c)^{1.65} = 2.2 \times (8.875 / 2.75)^{1.65} = 15.2$

$F_{cr} = 26{,}210 \times (t_w / h_o)^2 \times f \times k \leq F_y$

$= 26{,}210 \times (0.23 / 8.875)^2 \times 0.55 \times 15.2 = 147 > 50$

$= 50$ ksi

Area of Remaining T

$A_f = b_f \times t_f$

$= 4 \times 0.27$

$= 1.08$ in.^{2}

$A_w = (d - d_c - t_f) \times t_w$

$= (10 - 1.125 - 0.27) \times 0.23$

$= 1.98$ in.^{2}

Elastic Neutral Axis of Remaining T

$CG_f = 0.5 \times t_f$

$= 0.5 \times 0.27$

$= 0.135$ in.

$CG_w = 0.5 \times (d - d_c + t_f)$

$= 0.5 \times (10 - 1.125 + 0.27)$

$= 4.57$ in.

$ENA_{bot} = (A_f \times CG_f + A_w \times CG_w) / (A_f + A_w)$

$= (1.08 \times 0.135 + 1.98 \times 4.57) / (1.08 + 1.98)$

$= 3$ in.

$ENA_{top} = d - d_c - ENA_{bot}$

$= 10 - 1.125 - 3$

$= 5.88$ in.

Moment of Inertia of Remaining T

$i_f = A_f \times (ENA_{bot} - CG_f)^2 + b_f \times t_f^3 / 12$

$= 1.08 \times (3 - 0.135)^2 + 4 \times 0.27^3 / 12$

$= 8.87$ in.^{4}

$i_w = A_w \times (ENA_{bot} - CG_w)^2 + t_w \times (d - d_c - t_f)^3 / 12$

$= 1.98 \times (3 - 4.57)^2 + 0.23 \times (10 - 1.125 - 0.27)^3 / 12$

$= 17.1 \text{ in.}^4$

$I_T = i_f + i_w$

$= 8.87 + 17.1$

$= 26 \text{ in.}^4$

Elastic Section Modulus of Remaining T

Since $ENA_{bot} = 3 < ENA_{top} = 5.88$

$S = I_T / ENA_{top}$

$= 26 / 5.88$

$= 4.42 \text{ in.}^3$

$\phi R_n = \phi \times F_{cr} \times S / e$

$= 0.90 \times 50 \times 4.42 / 3.25$

$= 61.2 \geq 30$ kips OKAY

NEW ENGLAND DIVISION

Maine Medical Center
22 Bramhall St.
Portland, ME

Beam to Beam Shear Tab Connection
Shear and Axial Top and Bottom Copes
LRFD 14th Edition

Prepared By:
Cives Steel Company
New England Division
103 Lipman Rd
Augusta, ME 04330

Prepared For:
Cives Engineering Corporation
Cives Steel Company
3700 Mansell Road, Suite 500
Alpharetta, GA 30022

S.O. 7250
Calculation Number: P5
Revision: B

By: S.Moreau
Date: February 28, 2018

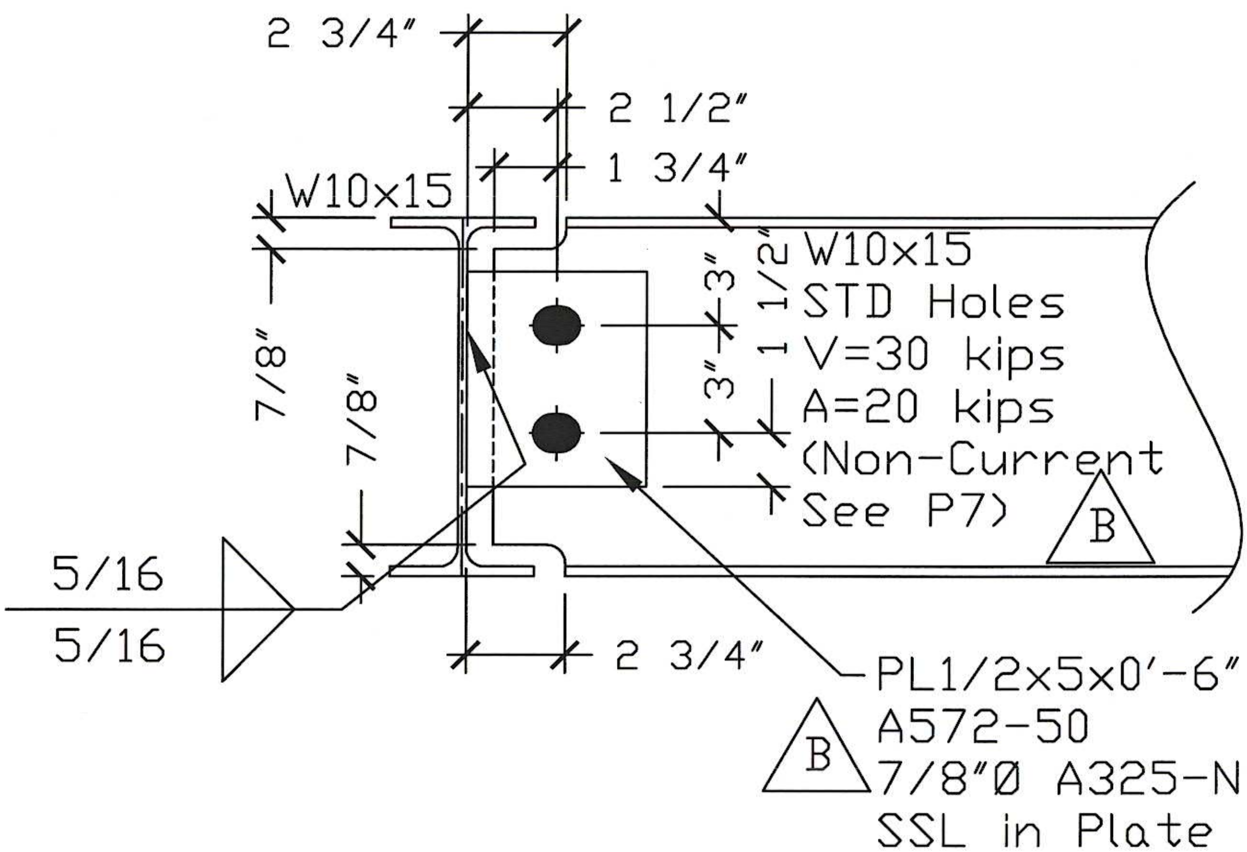
Approved By: WAT
Date: 3/2/18

STATE OF MAINE
BRIAN MATTHEW VOLPE
No. PE15347
LICENSED
PROFESSIONAL ENGINEER
MARCH 5, 2018

Location: S10-70

Level 7

Grid Ref: C.3-C.6/2.4-3



B	2/28	Added P7 Ref. for Axial Calcs	SRM	NED
A	2/8	Revised Per CEC Comments	SRM	NED
0		Original Issue		
Rev.	Date	Remarks	Dwn	Chk

CUSTOMER: Turner Construction	JOB: Maine Medical Center 22 Bramhall St Portland, ME	Drawn by	Checked by
Cives Steel Company		SRM	NED
		Job No.	Rev.
NEW ENGLAND DIVISION		7250	B

14TH. EDITION LRFD

INPUT VALUES

Material Grade: Main 50, Connection 50 (ksi)
Bolts: 0.875 in. Diameter, A325-N in SSL Holes (Shear Value = $\phi\ r_n$ = 24.4 kips)
Transverse Short Slots in Plate only

Supporting Beam: W10X15

Beam: W10X15
Single Plate Connection - Conventional
Beam Length = 5'-2"
Shear Reaction = 30 kips
Axial Reaction = 20 kips - per P7 t_w = 0.230 in. > 0.100 in. OKAY
Connection Material = PL1/2X5
Connection Length = 6 in.
Number of Rows of Bolts = 2
Bolt Spacing = 3 in.
Punch Down = 3 in.
Beam End Distance = 1.75 (± 0.25) in.
Distance to First Column of Bolts from Face of Supporting Member = 2.5 in.
Weld Size = 5 / 16
Beam Copes:
Top Depth = 0.875 Top Width = 2.75
Btm Depth = 0.875 Btm Width = 2.75

SINGLE PLATE CONNECTION - CONVENTIONAL - SHEAR

INELASTIC BOLT DESIGN CAPACITY
e = a / 2 = 2.5 / 2 = 1.25 in.
C = 1.51
$\phi R_n = C \times \phi r_n$
= 1.51 x 24.4
= 36.8 $\geq$ 30 kips OKAY

BEARING / TEAROUT ON CONTROLLING ELEMENT (Assumes 1.5 in. Minimum Beam End Distance)
Bearing at Critical Bolt
$\phi R_n = \phi \times 1.5 \times l_c \times t \times F_u \leq \phi \times 2.4 \times Ø_b \times t \times F_u$
= 0.75 x 1.5 x 1.88 x 0.23 x 65 $\leq$ 0.75 x 2.4 x 0.875 x 0.23 x 65 = 23.5
$\phi R_n / R$ = 23.5 / 0.982 = 23.9 < ϕr_n / 0.982 = 24.4 / 0.982 = 24.8, therefore:
Prorate Capacity Based on Bearing / Tearout
$\phi R_{n\text{-}pro} = ((\phi R_n / R) / (\phi r_n / 0.982)) \times C \times \phi r_n$
= ((23.5 / 0.982) / (24.4 / 0.982)) x 1.51 x 24.4
= 35.5 $\geq$ 30 kips OKAY

WELD SIZE REQUIRED
D Required
$D_{req} = 0.625 \times t_p \times 16$
= 0.625 x 0.5 x 16
= 5, **Use 5 Minimum**
Shear Rupture on Supporting Member
$\phi R_n = \phi \times 0.6 \times F_u \times L \times t \times 2$
= 0.75 x 0.6 x 65 x 6 x 0.23 x 2
= 80.7 $\geq$ 30 kips OKAY

GROSS SHEAR ON PLATE

$\phi R_n = \phi \times 0.6 \times F_y \times L \times t$

$= 1.00 \times 0.6 \times 50 \times 6 \times 0.5$

$= 90 \geq 30$ kips OKAY

NET SHEAR ON PLATE

$\phi R_n = \phi \times 0.6 \times F_u \times (L - n \times (Ø_h + 0.0625)) \times t$

$= 0.75 \times 0.6 \times 65 \times (6 - 2 \times (0.9375 + 0.0625)) \times 0.5$

$= 58.5 \geq 30$ kips OKAY

LATERAL TORSIONAL BUCKLING ON PLATE

$\phi R_n = \phi \times 1{,}500 \times \pi \times L \times t^3 / a^2$

$= 0.90 \times 1{,}500 \times \pi \times 6 \times 0.5^3 / 2.5^2$

$= 509 \geq 30$ kips OKAY

TORSION ON PLATE DUE TO LAP ECCENTRICITY

$M_t = V \times (t_w + t_c) / 2$

$= 30 \times (0.23 + 0.5) / 2$

$= 11$ kip - in.

$\phi M_n = (\phi_v \times 0.6 \times F_{yc} - V / (L \times t_c)) \times L \times t_c^2 / 2 + 2 \times V^2 \times (t_w + t_c) \times b_f / (\phi_b \times F_{yb} \times L_s \times t_w^2)$

$= (1.00 \times 0.6 \times 50 - 30 / (6 \times 0.5)) \times 6 \times 0.5^2 / 2 + 2 \times 30^2 \times (0.23 + 0.5) \times 4 / (0.90 \times 50 \times 62 \times 0.23^2)$

$= 50.6 \geq 11$ kip - in. OKAY

GROSS BENDING ON PLATE

$e = a / 2 = 2.5 / 2 = 1.25$ in.

$Z = t \times L^2 / 4$

$= 0.5 \times 6^2 / 4$

$= 4.5$ in.^{3}

$\phi R_n = \phi \times F_y \times Z / e$

$= 0.90 \times 50 \times 4.5 / 1.25$

$= 162 \geq 30$ kips OKAY

NET BENDING ON PLATE

$e = a / 2 = 2.5 / 2 = 1.25$ in.

$Z_{net} = t \times L^2 / 4 - (t \times (Ø_h + 0.0625) \times b \times n^2 / 4)$

$= 0.5 \times 6^2 / 4 - (0.5 \times (0.9375 + 0.0625) \times 3 \times 2^2 / 4)$

$= 3$ in.^{3}

$\phi R_n = \phi \times F_u \times Z_{net} / e$

$= 0.75 \times 65 \times 3 / 1.25$

$= 117 \geq 30$ kips OKAY

BLOCK SHEAR ON PLATE

$A_{nt} = t \times (L_e - 0.5 \times (Ø_h + 0.0625))$

$= 0.5 \times (2.5 - 0.5 \times (1.125 + 0.0625))$

$= 0.953$ in.^{2}

$A_{gv} = t \times (L_e + (n - 1) \times b)$

$= 0.5 \times (1.5 + (2 - 1) \times 3)$

$= 2.25$ in.^{2}

$A_{nv} = t \times (L_e + (n - 1) \times b - (n - 0.5) \times (Ø_h + 0.0625))$

$= 0.5 \times (1.5 + (2 - 1) \times 3 - (2 - 0.5) \times (0.9375 + 0.0625))$

$= 1.5$ in.^{2}

$\phi R_n = \phi \times (0.6 \times F_u \times A_{nv} + U_{bs} \times F_u \times A_{nt}) \leq \phi \times (0.6 \times F_y \times A_{gv} + U_{bs} \times F_u \times A_{nt})$

$= 0.75 \times (0.6 \times 65 \times 1.5 + 1 \times 65 \times 0.953) = 90.3 \leq 0.75 \times (0.6 \times 50 \times 2.25 + 1 \times 65 \times 0.953) = 97.1$

$= 90.3 \geq 30$ kips OKAY

GROSS SHEAR ON BEAM WEB

$\phi R_n = \phi \times 0.6 \times F_y \times L \times t$

$= 1.00 \times 0.6 \times 50 \times 10 \times 0.23$

$= 69 \geq 30$ kips OKAY

NET SHEAR ON BEAM WEB

$\phi R_n = \phi \times 0.6 \times F_u \times (L - n \times (\varnothing_h + 0.0625)) \times t$

$= 0.75 \times 0.6 \times 65 \times (8.25 - 2 \times (0.9375 + 0.0625)) \times 0.23$

$= 42 \geq 30$ kips OKAY

BLOCK SHEAR ON BEAM WEB (Assumes 1.5 in. Minimum Beam End Distance)

$A_{nt} = t \times (L_e - 0.5 \times (\varnothing_h + 0.0625))$

$= 0.23 \times (1.5 - 0.5 \times (0.9375 + 0.0625))$

$= 0.23$ in.^{2}

$A_{gv} = t \times (L_e + (n - 1) \times b)$

$= 0.23 \times (2.125 + (2 - 1) \times 3)$

$= 1.18$ in.^{2}

$A_{nv} = t \times (L_e + (n - 1) \times b - (n - 0.5) \times (\varnothing_h + 0.0625))$

$= 0.23 \times (2.125 + (2 - 1) \times 3 - (2 - 0.5) \times (0.9375 + 0.0625))$

$= 0.834$ in.^{2}

$\phi R_n = \phi \times (0.6 \times F_u \times A_{nv} + U_{bs} \times F_u \times A_{nt}) \leq \phi \times (0.6 \times F_y \times A_{gv} + U_{bs} \times F_u \times A_{nt})$

$= 0.75 \times (0.6 \times 65 \times 0.834 + 1 \times 65 \times 0.23) = 35.6 \leq 0.75 \times (0.6 \times 50 \times 1.18 + 1 \times 65 \times 0.23) = 37.8$

$= 35.6 \geq 30$ kips OKAY

SHEAR ON REMAINING BEAM WEB

$\phi R_n = \phi \times 0.6 \times F_y \times L \times t$

$= 1.00 \times 0.6 \times 50 \times 8.25 \times 0.23$

$= 56.9 \geq 30$ kips OKAY

DOUBLE COPE CAPACITY (Assumes 0.5 in. Minimum Proud Dimension)

Capacity Based On Elastic Section Modulus

Cope Length Does Not Exceed 2 x Beam Depth And Top Cope Depth Does Not Exceed 0.2 x Beam Depth

$f_d = 3.5 - 7.5 \times (d_{ct} / d) = 3.5 - 7.5 \times (0.875 / 10) = 2.84$

$F_{cr} = 0.62 \times \pi \times E \times (t_w{}^2 / (c \times h_o)) \times f_d \leq F_y$

$= 0.62 \times \pi \times 29000 \times (0.23^2 / (2.25 \times 8.25)) \times 2.84 = 457 > 50$

$= 50$ ksi

$S = t_w \times h_o{}^2 / 6$

$= 0.23 \times 8.25^2 / 6$

$= 2.61$ in.^{3}

$\phi R_n = \phi \times F_{cr} \times S / e$

$= 0.90 \times 50 \times 2.61 / 2.75$

$= 42.7 \geq 30$ kips OKAY

LATERAL TORSIONAL BUCKLING ON REMAINING BEAM WEB (Assumes 0.5 in. Minimum Proud Dimension)

$\phi R_n = \phi \times 1{,}500 \times \pi \times L \times t^3 / c^2$

$= 0.90 \times 1{,}500 \times \pi \times 8.25 \times 0.23^3 / 2.25^2$

$= 84.1 \geq 30$ kips OKAY