TRANSMITTAL

Cives Steel Company — New England Division
Lipman Road
Augusta, ME 04330
Tel. (207)622-6141 Fax. (207)622-2151

Transmittal No. 182407
Cust. Transmittal No. 2
Page 1

TO : **Turner Construction Co.**

Boston, MA

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

Gentlemen, We are sending you :

DATE : **03/09/18**

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

REMARKS : **Post to Turner site**
Filename is: 182407-P17_FOR_APPROVAL.ZIP

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

Job # 7250P (1)

P17+

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 09, 2018

Submittal No. 051200-0009-0

COPY : Turner

Cives Steel Company — New England Division

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

NEW ENGLAND DIVISION

Maine Medical Center
22 Bramhall St.
Portland, ME

Beam to Column Web
Shear and Axial Extended Tab Connection
LRFD 14th Edition

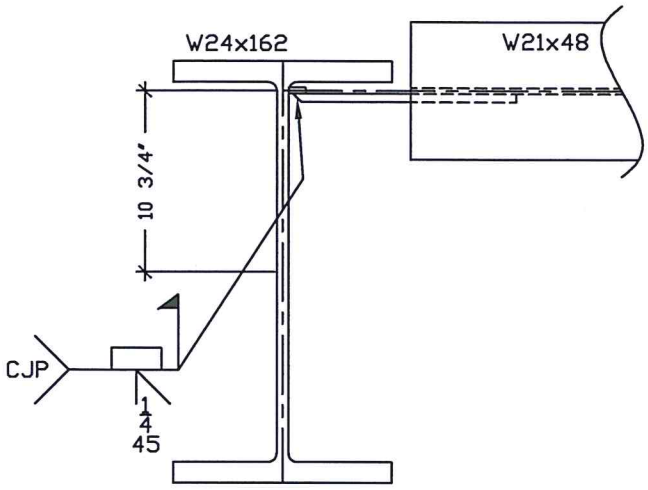
Prepared By:
Cives Steel Company
New England Division
103 Lipman Rd
Augusta, ME 04330

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

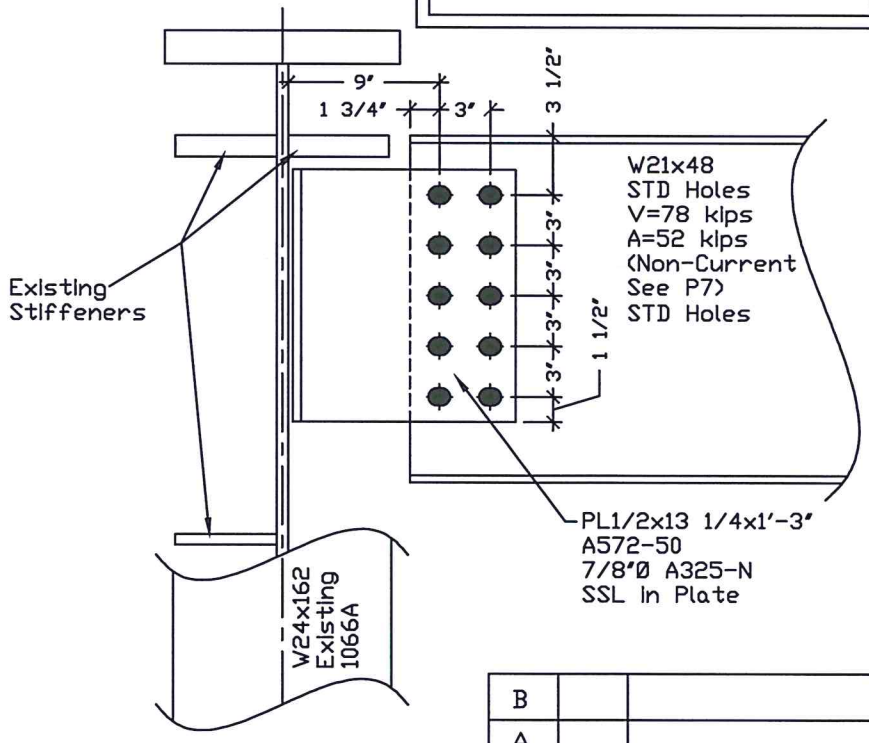
S.O. 7250
Calculation Number: P17
Revision: 0

By: S.Moreau
Date: March 5, 2018

Approved By: WAT
Date: 3/7/18



Location: S10-60
Level 6
Grid Ref: C/5



Rev.	Date	Remarks	Dwn	Chk
B				
A				
0		Original Issue		

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

14TH. EDITION LRFD

INPUT VALUES

Connection ID: P17 Calcs
Material Grade: Main 50, Connection 50 (ksi)
Bolts: 0.875 in. Diameter, A325 - N in SSL Holes (ϕr_n = 24.4 kips)
Transverse Short Slots in Plate only

Column: W24X162, Beam frames to Column Web

Beam: W21X48
Single Plate Connection - Extended
Beam Length = 35'-0"
Shear Reaction = 78 kips
Axial Reaction = 52 kips - per P7 t_w = 0.350 in. > 0.125 in. OKAY
Connection Material = PL1/2X13-1/4
Connection Length = 15 in.
Number of Rows of Bolts = 5
Row Spacing = 3 in.
Number of Columns of Bolts = 2
Column 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 = 9 in.
Weld Size = CJP

SINGLE PLATE CONNECTION - EXTENDED

INELASTIC BOLT DESIGN CAPACITY
$e = a + (n - 1) \times (b / 2)$
$= 9 + (2 - 1) \times (3 / 2)$
$= 10.5$ in.
$C = 3.39$
$\phi R_n = C \times \phi r_n$
$= 3.39 \times 24.4$
$= 82.7 \geq 78$ kips OKAY

BEARING / TEAROUT ON CONTROLLING ELEMENT (Assumes 1.5 in. Minimum Beam End Distance)
Bearing at Critical Bolt
$\phi R_n = \phi \times 1.5 \times l_c \times t \times F_u \leq \phi \times 2.4 \times \varnothing_b \times t \times F_u$
$= 0.75 \times 1.5 \times 1.22 \times 0.35 \times 65 \leq 0.75 \times 2.4 \times 0.875 \times 0.35 \times 65 = 31.2$
$\phi R_n / R = 31.2 / 0.982 = 31.8 \geq \phi r_n / 0.982 = 24.4 / 0.982 = 24.8$, therefore:
(Bearing / Tearout Does Not Control)

MAXIMUM PLATE THICKNESS (Assumes 1.5 in. Minimum Beam End Distance)
$M_{max} = r_{n\text{-}bearing} \times C' / 0.90$
$= 32.5 \times 38.5 / 0.90$
$= 1390$ kip - in.
$t_{max} = 6 \times M_{max} / (F_y \times L^2)$
$= 6 \times 1390 / (50 \times 15^2)$
$= 0.741 \geq 0.5$ in. OKAY

LATERAL TORSIONAL BUCKLING ON PLATE

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

$= 0.90 \times 1{,}500 \times \pi \times 15 \times 0.5^3 / 9^2$

$= 98.2 \geq 78$ kips OKAY

TORSION ON PLATE DUE TO LAP ECCENTRICITY

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

$= 78 \times (0.35 + 0.5) / 2$

$= 33.2$ kip - in.

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

$= (1.00 \times 0.6 \times 50 - 78 / (15 \times 0.5)) \times 15 \times 0.5^2 / 2 + 2 \times 78^2 \times (0.35 + 0.5) \times 8.14 / (0.90 \times 50 \times 420 \times 0.35^2)$

$= 73.1 \geq 33.2$ kip - in. OKAY

GROSS SHEAR AND BENDING INTERACTION ON PLATE

$\lambda = L \times F_y^{0.5} / (10 \times t \times (475 + 280 \times (L / a)^2)^{0.5})$

$= 15 \times 50^{0.5} / (10 \times 0.5 \times (475 + 280 \times (15 / 9)^2)^{0.5})$

$= 0.599 \leq 0.7$, therefore $Q = 1$

$\phi R_n = \phi \times F_y \times t \times L / ((16 / Q^2) \times (a / L)^2 + 2.25)^{0.5}$

$= 0.90 \times 50 \times 0.5 \times 15 / ((16 / 1^2) \times (9 / 15)^2 + 2.25)^{0.5}$

$= 119 \geq 78$ kips OKAY

NET SHEAR AND BENDING INTERACTION ON PLATE

$Z_{net} = t \times L^2 / 4 - (t \times (\varnothing_h + 0.0625) \times b \times ((n^2 - 1) / 4) + (t \times (\varnothing_h + 0.0625)^2 / 4))$

$= 0.5 \times 15^2 / 4 - (0.5 \times (0.9375 + 0.0625) \times 3 \times ((5^2 - 1) / 4) + (0.5 \times (0.9375 + 0.0625)^2 / 4))$

$= 19$ in.^{3}

$\phi R_n = \phi \times F_u / ((a / Z_{net})^2 + (5 / (3 \times t \times (L - n \times (\varnothing_h + 0.0625))))^2)^{0.5}$

$= 0.75 \times 65 / ((9 / 19)^2 + (5 / (3 \times 0.5 \times (15 - 5 \times (0.9375 + 0.0625))))^2)^{0.5}$

$= 84.2 \geq 78$ kips OKAY

WELD SIZE REQUIRED

D Required

$D_{req} = 0.625 \times t_p \times 16$

$= 0.625 \times 0.5 \times 16$

$= 5$, **Due to Framing Situation Use CJP Weld - No Additional Checks Required**

BLOCK SHEAR ON PLATE

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

$= 0.5 \times (1.5 + (2 - 1) \times 3 - (2 - 0.5) \times (1.125 + 0.0625))$

$= 1.36$ in.^{2}

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

$= 0.5 \times (1.5 + (5 - 1) \times 3)$

$= 6.75$ in.^{2}

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

$= 0.5 \times (1.5 + (5 - 1) \times 3 - (5 - 0.5) \times (0.9375 + 0.0625))$

$= 4.5$ in.^{2}

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

$= 0.75 \times (0.6 \times 65 \times 4.5 + 0.5 \times 65 \times 1.36) = 165 \leq 0.75 \times (0.6 \times 50 \times 6.75 + 0.5 \times 65 \times 1.36) = 185$

$= 165 \geq 78$ kips OKAY

GROSS SHEAR ON BEAM WEB

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

$= 1.00 \times 0.6 \times 50 \times 20.6 \times 0.35$

$= 216 \geq 78$ kips OKAY