



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 4 Section: 12

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 11955.9 in³
 Lateral Bending S = 864.0 in³

Bottom Flange S = 10205.4 in³
 Lateral Bending S = 864.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -16066 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -3063 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -5245 k-ft
 Lateral Live Load Moment = 42 k-ft
 Impact = 133%

Dead Load = DC = 18.9 ksi
 WS Load = DW = 3.6 ksi
 P = 0
 Live Load = LL + IM = 8.5 ksi
 Capacity = $\phi F_{nc} = C$ = 48.2 ksi

f_{bu} = 18.9 ksi
 f_l = 0.04 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 18.9 ksi

f_{bu} = 3.6 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.6 ksi

f_{bu} = 6.2 ksi
 f_l = 0.58 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.29 (Inv)
RF = 1.68 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -16066 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -3063 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -5245 k-ft
 Lateral Live Load Moment = 42 k-ft
 Impact = 133%

Dead Load = DC = 16.1 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 7.3 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 16.1 ksi
 f_l = 0.04 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 16.1 ksi

f_{bu} = 3.1 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.1 ksi

f_{bu} = 5.3 ksi
 f_l = 0.58 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.98 (Inv)
RF = 2.57 (Op)



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Girder: 7-2 Location: Pier 4 Section: 12

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	329	k
WS Load = DW =	64	k
P =	0	
Live Load = LL =	186	k
Impact =	133%	

Live Load = LL + IM = 247.4 k

Capacity = $\phi F_{nc} = C = 2052.7$ k

$\gamma_{DC} =$	1.25
$\gamma_{DW} =$	1.5
$\gamma_P =$	0
$\gamma_{LL} =$	1.75 (Inv)
$\gamma_{LL} =$	1.35 (Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF =	3.57	(Inv)
RF =	4.63	(Op)



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 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 4 Section: 12

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 11955.9 in³
 Lateral Bending S = 864.0 in³

Bottom Flange S = 10205.4 in³
 Lateral Bending S = 864.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -16066 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -3063 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -5245 k-ft
 Lateral Live Load Moment = 42 k-ft
 Impact = 133%

Dead Load = DC = 18.9 ksi
 WS Load = DW = 3.6 ksi
 P = 0
 Live Load = LL + IM = 8.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 18.9 ksi
 f_l = 0.04 ksi
 $DC = f_f + f_l/2 = 18.9$ ksi

f_f = 3.6 ksi
 f_l = 0.01 ksi
 $DW = f_f + f_l/2 = 3.6$ ksi

f_f = 6.2 ksi
 f_l = 0.58 ksi
 $LL + IM = f_f + f_l/2 = 8.5$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.27 (Inv)
 RF = 2.95 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -16066 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -3063 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -5245 k-ft
 Lateral Live Load Moment = 42 k-ft
 Impact = 133%

Dead Load = DC = 16.1 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 7.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 16.1 ksi
 f_l = 0.04 ksi
 $DC = f_f + f_l/2 = 16.1$ ksi

f_f = 3.1 ksi
 f_l = 0.01 ksi
 $DW = f_f + f_l/2 = 3.1$ ksi

f_f = 5.3 ksi
 f_l = 0.58 ksi
 $LL + IM = f_f + f_l/2 = 7.4$ ksi (Impact Added Here)

RF = 2.94 (Inv)
 RF = 3.83 (Op)



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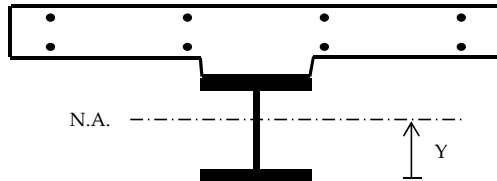
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Girder: 7-2

Location: Pier 4

Section: 12

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.0000 in
Top Flange Width =	36.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.0000 in
Bot. Flange Width =	36.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	72.00 in ²	114.0000 in	8208.00 in ³	56.500 in	229842.0 in ³	229866.0 in ³
Web	97.13 in ²	57.5000 in	5584.69 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	72.00 in ²	1.0000 in	72.00 in ³	56.500 in	229842.0 in ³	229866.0 in ³
Σ =	241.13 in ²		13864.69 in ³			

$$\text{Neutral Axis} = Y = 57.500 \text{ in}$$

$$\text{Total MOI} = 559455 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
9901.9 in ³	9729.7 in ³	9901.9 in ³	9729.7 in ³	864.0 in ³	864.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	241.13 in ²	57.50 in	13864.69 in ³	4.54 in	4973.89 in ³	564428.98 in ⁴
Top Bars	12.57 in ²	127.00 in	1595.93 in ³	64.96 in	53024.67 in ³	53024.72 in ⁴
Bot. Bars	4.95 in ²	118.38 in	585.96 in ³	56.33 in	15708.48 in ³	15708.50 in ⁴
Σ =	258.64 in ²		16046.57 in ³			

$$\text{Neutral Axis} = 62.04 \text{ in}$$

$$\text{Total MOI} = 633162.2 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	12186.0 in ³	11955.9 in ³	10372.6 in ³	10205.4 in ³	12425.1 in ³	10545.4 in ³	9747.2 in ³	11239.6 in ³



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Girder: 7-2 Location: Pier 4 Section: 13

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	1.5	in

$\lambda_f =$	9.333
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 49.4 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.875	in
Lb =	240.0	in
Cb =	1.0	(Conservative)

Dc =	57.00	in (Non-Comp)
rt =	6.841	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 47.51 ksi

Lp =	164.8	in
Lr =	619	in

Controlling Resistance:

Fnc = 47.51 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$\phi_f \phi_c \phi_s F_{nc} = 47.5$ ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.875	in
D =	111	in
do =	120	in

D/tw =	126.9
$1.12 \sqrt{Ek}/f_{yw} =$	82.2
$1.4 \sqrt{Ek}/f_{yw} =$	102.7
C =	0.52

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$\phi_v \phi_c \phi_s V_n = 2269.1$ k



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Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 4 Section: 13

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8537.9 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6943.7 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -8804 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1690 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3741 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 15.2 ksi
 WS Load = DW = 2.9 ksi
 P = 0
 Live Load = LL + IM = 8.9 ksi
 Capacity = $\phi F_{nc} = C$ = 47.5 ksi

f_{bu} = 15.2 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 15.2 ksi

f_{bu} = 2.9 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 2.9 ksi

f_{bu} = 6.5 ksi
 f_l = 0.73 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 8.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.54 (Inv)
RF = 2.00 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -8804 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1690 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3741 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 12.4 ksi
 WS Load = DW = 2.4 ksi
 P = 0
 Live Load = LL + IM = 7.3 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 12.4 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 12.4 ksi

f_{bu} = 2.4 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 2.4 ksi

f_{bu} = 5.3 ksi
 f_l = 0.73 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 7.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.41 (Inv)
RF = 3.13 (Op)



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Girder: 7-2

Location: Pier 4

Section: 13

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	265	k
WS Load = DW =	52	k
P =	0	
Live Load = LL =	163	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 216.8 k

Capacity = $\phi F_{nc} = C$ = 2269.1 k

RF = 4.90 (Inv)

RF = 6.35 (Op)



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Girder: 7-2 Location: Pier 4 Section: 13

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8537.9 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6943.7 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -8804 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1690 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3741 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 15.3 ksi
 WS Load = DW = 2.9 ksi
 P = 0
 Live Load = LL + IM = 8.9 ksi
 Capacity = $0.95R_h F_y$ = C = 47.5 ksi

f_f = 15.2 ksi
 f_l = 0.09 ksi
 $DC = f_f + f_l/2 = 15.3$ ksi

f_f = 2.9 ksi
 f_l = 0.06 ksi
 $DW = f_f + f_l/2 = 2.9$ ksi

f_f = 6.5 ksi
 f_l = 0.73 ksi
 $LL + IM = f_f + f_l/2 = 8.9$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.53 (Inv)
 RF = 3.28 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -8804 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1690 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3741 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 12.4 ksi
 WS Load = DW = 2.4 ksi
 P = 0
 Live Load = LL + IM = 7.5 ksi
 Capacity = $0.95R_h F_y$ = C = 47.5 ksi

f_f = 12.4 ksi
 f_l = 0.09 ksi
 $DC = f_f + f_l/2 = 12.4$ ksi

f_f = 2.4 ksi
 f_l = 0.06 ksi
 $DW = f_f + f_l/2 = 2.4$ ksi

f_f = 5.3 ksi
 f_l = 0.73 ksi
 $LL + IM = f_f + f_l/2 = 7.5$ ksi (Impact Added Here)

RF = 3.36 (Inv)
 RF = 4.37 (Op)



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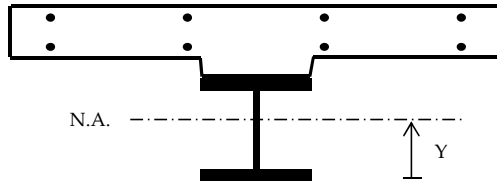
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Girder: 7-2

Location: Pier 4

Section: 13

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.5000 in
Top Flange Width =	28.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	42.00 in ²	113.2500 in	4756.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Web	97.13 in ²	57.0000 in	5536.13 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Σ =	181.13 in ²		10324.13 in ³			

$$\text{Neutral Axis} = Y = 57.000 \text{ in}$$

$$\text{Total MOI} = 365520 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6498.1 in ³	6412.6 in ³	6498.1 in ³	6412.6 in ³	392.0 in ³	392.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	181.13 in ²	57.00 in	10324.13 in ³	5.87 in	6240.05 in ³	371760.15 in ⁴
Top Bars	12.57 in ²	126.00 in	1583.36 in ³	63.13 in	50082.69 in ³	50082.73 in ⁴
Bot. Bars	4.95 in ²	117.38 in	581.01 in ³	54.51 in	14705.68 in ³	14705.69 in ⁴
Σ =	198.64 in ²		12488.49 in ³			

$$\text{Neutral Axis} = 62.87 \text{ in}$$

$$\text{Total MOI} = 436548.6 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	8665.0 in ³	8537.9 in ³	7027.6 in ³	6943.7 in ³	8796.0 in ³	7113.4 in ³	6915.0 in ³	8009.3 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 5 Section: 14

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/fyw =	76.2
do =	144	in	1.4√Ek/fyw =	95.2

Vp =	2213.1	k	k =	8.0	in
Vn =	1464.4	k	C =	0.28	

$$\phi_v \phi_c \phi_s V_n = 1464.4 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 5 Section: 14

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S =	12830.4	in ³
Short-term S =	35800.9	in ³
Lateral Bending S =	385.7	in ³

Bottom Flange:

Long-term S =	7110.6	in ³
Short-term S =	7784.0	in ³
Lateral Bending S =	220.4	in ³

Load Factors:

γ_{DC} =	1.25
γ_{DW} =	1.5
γ_P =	0
γ_{LL} =	1.75 (Inv)
γ_{LL} =	1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 6069 k-ft

Wearing Surface Moment = 1220 k-ft

Live Load Moment = 4906 k-ft

Impact = 133%

Dead Load = DC = 5.7 ksi

WS Load = DW = 1.1 ksi

P = 0

Live Load = LL + IM = 2.2 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 5.7 ksi

f_{bu} = 1.1 ksi

f_{bu} = 2.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 10.76 (Inv)

RF = 13.95 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 6069 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 1220 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 4906 k-ft

Lateral Live Load Moment = 13 k-ft

Impact = 133%

Dead Load = DC = 10.3 ksi

WS Load = DW = 2.1 ksi

P = 0

Live Load = LL + IM = 10.4 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.2 ksi

f_l = 0.05 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.3 ksi

f_{bu} = 2.1 ksi

f_l = 0.05 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 7.6 ksi

f_l = 0.71 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.88 (Inv)

RF = 2.43 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Span 5

Section: 14

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	177	k
WS Load = DW =	37	k
P =	0	
Live Load = LL =	190	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 252.7 k

Capacity = ϕF_{nc} = C = 1464.4 k

RF = 2.69 (Inv)

RF = 3.48 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 5 Section: 14

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 12830.4 in³
 Short-term S = 35800.9 in³

Bottom Flange:

Long-term S = 7110.6 in³
 Short-term S = 7784.0 in³
 Lateral Bending S = 220.4 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 6069 k-ft

Wearing Surface Moment = 1220 k-ft

Live Load Moment = 4906 k-ft
 Impact = 133%

Dead Load = DC = 5.7 ksi

WS Load = DW = 1.1 ksi

P = 0

Live Load = LL + IM = 2.2 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 5.7 ksi

ff = 1.1 ksi

ff = 2.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 14.31 (Inv)
 RF = 18.60 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 6069 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 1220 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 4906 k-ft

Lateral Live Load Moment = 13 k-ft

Impact = 133%

Dead Load = DC = 10.3 ksi

WS Load = DW = 2.1 ksi

P = 0

Live Load = LL + IM = 10.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 10.2 ksi

fl = 0.05 ksi

DC = ff + fl/2 = 10.3 ksi

fbu = 2.1 ksi

fl = 0.05 ksi

DW = ff + f/2l = 2.1 ksi

fbu = 7.6 ksi

fl = 0.71 ksi

LL + IM = ff + fl/2 = 10.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.57 (Inv)
 RF = 3.34 (Op)



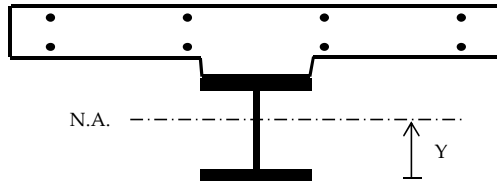
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 5 Section: 14

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.0000 in
Top Flange Width =	16.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	16.00 in ²	113.0000 in	1808.00 in ³	66.919 in	71649.5 in ³	71650.8 in ³
Web	76.31 in ²	57.0000 in	4349.81 in ³	10.919 in	9097.6 in ³	87451.5 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	45.331 in	86307.4 in ³	86315.3 in ³
Σ =	134.31 in ²		6189.31 in ³			

Neutral Axis = Y = 46.081 in
 Total MOI = 245418 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
3667.4 in ³	3640.2 in ³	5413.9 in ³	5325.7 in ³	385.7 in ³	220.4 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	134.31 in ²	46.08 in	6189.31 in ³	47.15 in	298569.3 in ⁴	543986.9 in ⁴
Slab	224.00 in ²	121.50 in	27216.00 in ³	28.27 in	179024.9 in ⁴	181712.93 in ⁴
Σ =	358.31 in ²		33405.31 in ³			

Neutral Axis = 93.23 in
 Total MOI = 725700 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
36706.3 in ³	35800.9 in ³	7847.1 in ³	7784.0 in ³	37658.7 in ³	7911.3 in ³	25669.9 in ³	21175.7 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	134.31 in ²	46.08 in	6189.31 in ³	26.95 in	97526.0 in ⁴	342943.64 in ⁴
Slab	74.67 in ²	121.50 in	9072.00 in ³	48.47 in	175432.6 in ⁴	176328.56 in ⁴
Σ =	208.98 in ²		15261.31 in ³			

Neutral Axis = 73.03 in
 Total MOI = 519272 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
12990.9 in ³	12830.4 in ³	7184.4 in ³	7110.6 in ³	13155.4 in ³	7259.7 in ³	10712.8 in ³	9532.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 15

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	1.5	in

λ_f =	9.333
λ_{pf} =	9.152
λ_{rf} =	13.487

Fnc = 49.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.75	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	57.00	in (Non-Comp)
rt =	6.984	in
Fyr = 0.7Fy =	35	ksi

Fnc = 45.73 ksi

Lp =	168.2	in
Lr =	632	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 45.73 ksi

$\phi_f \phi_c \phi_s F_{nc} = 45.7$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.75	in
D =	111	in
do =	150	in

D/tw =	148.0
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.32

k =	7.7	in
Vp =	2414.3	k
Vn =	1624.1	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 1624.1$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 15

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -6419 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1306 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3509 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 11.6 ksi
 WS Load = DW = 2.4 ksi
 P = 0
 Live Load = LL + IM = 8.7 ksi
 Capacity = $\phi F_{nc} = C$ = 45.7 ksi

f_{bu} = 11.6 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 11.6 ksi

f_{bu} = 2.4 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.4 ksi

f_{bu} = 6.3 ksi
 f_l = 0.58 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.83 (Inv)
RF = 2.37 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -6419 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1306 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3509 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 9.3 ksi
 WS Load = DW = 1.9 ksi
 P = 0
 Live Load = LL + IM = 7.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.3 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 9.3 ksi

f_{bu} = 1.9 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.9 ksi

f_{bu} = 5.1 ksi
 f_l = 0.58 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.91 (Inv)
RF = 3.77 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Pier 5

Section: 15

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	247	k
WS Load = DW =	51	k
P =	0	
Live Load = LL =	215	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 286.0 k

Capacity = $\phi F_{nc} = C$ = 1624.1 k

RF = 2.48 (Inv)

RF = 3.21 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 15

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6419 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1306 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3509 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 11.6 ksi
 WS Load = DW = 2.4 ksi
 P = 0
 Live Load = LL + IM = 8.7 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 11.6 ksi
 fl = 0.09 ksi

DC = ff + fl/2 = 11.6 ksi

ff = 2.4 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 2.4 ksi

ff = 6.3 ksi
 fl = 0.58 ksi

LL + IM = ff + fl/2 = 8.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.98 (Inv)
 RF = 3.87 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6419 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1306 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3509 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 9.3 ksi
 WS Load = DW = 1.9 ksi
 P = 0
 Live Load = LL + IM = 7.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 9.3 ksi
 fl = 0.09 ksi

DC = ff + fl/2 = 9.3 ksi

ff = 1.9 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 1.9 ksi

ff = 5.1 ksi
 fl = 0.58 ksi

LL + IM = ff + fl/2 = 7.1 ksi (Impact Added Here)

RF = 3.92 (Inv)
 RF = 5.10 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

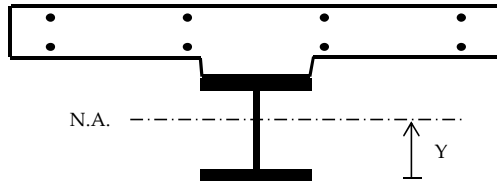
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

Location: Pier 5

Section: 15

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.5000 in
Top Flange Width =	28.0000 in
Web Thickness =	0.7500 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	42.00 in ²	113.2500 in	4756.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Web	83.25 in ²	57.0000 in	4745.25 in ³	0.000 in	0.0 in ³	85476.9 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Σ =	167.25 in ²		9533.25 in ³			

$$\text{Neutral Axis} = Y = 57.000 \text{ in}$$

$$\text{Total MOI} = 351274 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6244.9 in ³	6162.7 in ³	6244.9 in ³	6162.7 in ³	392.0 in ³	392.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	167.25 in ²	57.00 in	9533.25 in ³	6.31 in	6659.93 in ³	357933.87 in ⁴
Top Bars	12.57 in ²	126.00 in	1583.36 in ³	62.69 in	49385.78 in ³	49385.83 in ⁴
Bot. Bars	4.95 in ²	117.38 in	581.01 in ³	54.06 in	14468.80 in ³	14468.81 in ⁴
Σ =	184.77 in ²		11697.62 in ³			

$$\text{Neutral Axis} = 63.31 \text{ in}$$

$$\text{Total MOI} = 421788.5 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	8446.0 in ³	8321.0 in ³	6742.1 in ³	6662.2 in ³	8574.7 in ³	6823.9 in ³	6728.2 in ³	7801.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 16

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	2.25	in

$\lambda_f =$	6.222
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 50.0 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.75	in
Lb =	285.0	in
Cb =	1.0	(Conservative)

Dc =	57.75	in (Non-Comp)
rt =	7.291	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 46.61 ksi

Lp =	175.6	in
Lr =	659	in

Controlling Resistance:

Fnc = 46.61 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$\phi_f \phi_c \phi_s F_{nc} = 46.6$ ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.75	in
D =	111	in
do =	150	in

D/tw =	148.0
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.32

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$\phi_v \phi_c \phi_s V_n = 1624.1$ k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 16

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 10714.2 in³
 Lateral Bending S = 588.0 in³

Bottom Flange S = 8944.2 in³
 Lateral Bending S = 588.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -11696 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -2349 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -5509 k-ft
 Lateral Live Load Moment = 35 k-ft
 Impact = 133%

Dead Load = DC = 15.7 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 10.1 ksi
 Capacity = $\phi F_{nc} = C$ = 46.6 ksi

f_{bu} = 15.7 ksi
 f_l = 0.10 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 15.7 ksi

f_{bu} = 3.2 ksi
 f_l = 0.04 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.2 ksi

f_{bu} = 7.4 ksi
 f_l = 0.71 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.25 (Inv)
RF = 1.62 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -11696 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -2349 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -5509 k-ft
 Lateral Live Load Moment = 35 k-ft
 Impact = 133%

Dead Load = DC = 13.1 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 13.1 ksi
 f_l = 0.10 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 13.1 ksi

f_{bu} = 2.6 ksi
 f_l = 0.04 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 6.2 ksi
 f_l = 0.71 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.99 (Inv)
RF = 2.57 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Pier 5

Section: 16

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	318	k
WS Load = DW =	64	k
P =	0	
Live Load = LL =	255	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 339.2 k

Capacity = $\phi F_{nc} = C$ = 1624.1 k

RF = 1.90 (Inv)

RF = 2.47 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 16

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 10714.2 in³
 Lateral Bending S = 588.0 in³

Bottom Flange S = 8944.2 in³
 Lateral Bending S = 588.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -11696 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -2349 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -5509 k-ft
 Lateral Live Load Moment = 35 k-ft
 Impact = 133%

Dead Load = DC = 15.7 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 10.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 15.7 ksi
 fl = 0.10 ksi

DC = ff + fl/2 = 15.7 ksi

ff = 3.2 ksi
 fl = 0.04 ksi

DW = ff + fl/2 = 3.2 ksi

ff = 7.4 ksi
 fl = 0.71 ksi

LL + IM = ff + fl/2 = 10.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.17 (Inv)
 RF = 2.82 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -11696 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -2349 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -5509 k-ft
 Lateral Live Load Moment = 35 k-ft
 Impact = 133%

Dead Load = DC = 13.2 ksi
 WS Load = DW = 2.7 ksi
 P = 0
 Live Load = LL + IM = 8.7 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 13.1 ksi
 fl = 0.10 ksi

DC = ff + fl/2 = 13.2 ksi

ff = 2.6 ksi
 fl = 0.04 ksi

DW = ff + fl/2 = 2.7 ksi

ff = 6.2 ksi
 fl = 0.71 ksi

LL + IM = ff + fl/2 = 8.7 ksi (Impact Added Here)

RF = 2.81 (Inv)
 RF = 3.65 (Op)



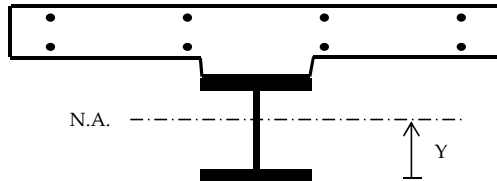
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 16

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.2500 in
Top Flange Width =	28.0000 in
Web Thickness =	0.7500 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.2500 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	63.00 in ²	114.3750 in	7205.63 in ³	56.625 in	202002.6 in ³	202029.2 in ³
Web	83.25 in ²	57.7500 in	4807.69 in ³	0.000 in	0.0 in ³	85476.9 in ³
Bot. Flange	63.00 in ²	1.1250 in	70.88 in ³	56.625 in	202002.6 in ³	202029.2 in ³
Σ =	209.25 in ²		12084.19 in ³			

$$\text{Neutral Axis} = Y = 57.750 \text{ in}$$

$$\text{Total MOI} = 489535 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
8645.2 in ³	8476.8 in ³	8645.2 in ³	8476.8 in ³	588.0 in ³	588.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	209.25 in ²	57.75 in	12084.19 in ³	5.20 in	5657.04 in ³	495192.36 in ⁴
Top Bars	12.57 in ²	127.50 in	1602.21 in ³	64.55 in	52361.13 in ³	52361.18 in ⁴
Bot. Bars	4.95 in ²	118.88 in	588.43 in ³	55.93 in	15481.92 in ³	15481.94 in ⁴
Σ =	226.77 in ²		14274.83 in ³			

$$\text{Neutral Axis} = 62.95 \text{ in}$$

$$\text{Total MOI} = 563035.5 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	10948.6 in ³	10714.2 in ³	9107.0 in ³	8944.2 in ³	11193.4 in ³	9275.8 in ³	8722.4 in ³	10067.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 17

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	1.5	in

λ_f =	9.333
λ_{pf} =	9.152
λ_{rf} =	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}}$$

$$\lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}}$$

$$\text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

$$F_{nc} = 49.4 \text{ ksi}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.75	in
Lb =	255.0	in
Cb =	1.0	(Conservative)

Dc =	57.00	in (Non-Comp)
rt =	6.984	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}}$$

$$\text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}}$$

$$r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}} \right)}}$$

$$F_{nc} = 47.19 \text{ ksi}$$

Lp =	168.2	in
Lr =	632	in

Controlling Resistance:

$$F_{nc} = 47.19 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 47.2 \text{ ksi}$$

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

$$F_{nt} = 50.00 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.75	in
D =	111	in
do =	135	in

D/tw =	148.0
$1.12 \sqrt{Ek}/f_{yw}$ =	78.1
$1.4 \sqrt{Ek}/f_{yw}$ =	97.6
C =	0.35

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$$\phi_v \phi_c \phi_s V_n = 1710.3 \text{ k}$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 17

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -7004 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1417 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3713 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 12.6 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 9.2 ksi
 Capacity = $\phi F_{nc} = C$ = 47.2 ksi

f_{bu} = 12.6 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 12.6 ksi

f_{bu} = 2.6 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 6.7 ksi
 f_l = 0.58 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.72 (Inv)
RF = 2.23 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -7004 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1417 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3713 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 10.1 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 7.4 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.1 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 10.1 ksi

f_{bu} = 2.0 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 5.4 ksi
 f_l = 0.58 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.65 (Inv)
RF = 3.44 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 17

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	220	k
WS Load = DW =	45	k
P =	0	
Live Load = LL =	159	k
Impact =	133%	

Live Load = LL + IM = 211.5 k

Capacity = $\phi F_{nc} = C = 1710.3$ k

$\gamma_{DC} =$	1.25
$\gamma_{DW} =$	1.5
$\gamma_P =$	0
$\gamma_{LL} =$	1.75 (Inv)
$\gamma_{LL} =$	1.35 (Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.70 (Inv)

RF = 4.79 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 5 Section: 17

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -7004 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1417 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3713 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 12.7 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 9.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 12.6 ksi
 fl = 0.09 ksi

DC = ff + fl/2 = 12.7 ksi

ff = 2.6 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 2.6 ksi

ff = 6.7 ksi
 fl = 0.58 ksi

LL + IM = ff + fl/2 = 9.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.71 (Inv)
 RF = 3.53 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -7004 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1417 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3713 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 10.1 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 7.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 10.1 ksi
 fl = 0.09 ksi

DC = ff + fl/2 = 10.1 ksi

ff = 2.0 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 2.1 ksi

ff = 5.4 ksi
 fl = 0.58 ksi

LL + IM = ff + fl/2 = 7.5 ksi (Impact Added Here)

RF = 3.62 (Inv)
 RF = 4.70 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

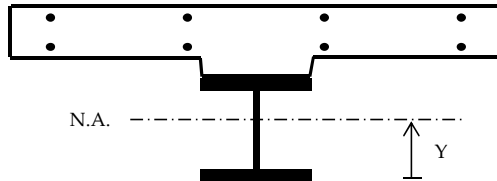
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

Location: Pier 5

Section: 17

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.5000 in
Top Flange Width =	28.0000 in
Web Thickness =	0.7500 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	42.00 in ²	113.2500 in	4756.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Web	83.25 in ²	57.0000 in	4745.25 in ³	0.000 in	0.0 in ³	85476.9 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Σ =	167.25 in ²		9533.25 in ³			

$$\text{Neutral Axis} = Y = 57.000 \text{ in}$$

$$\text{Total MOI} = 351274 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6244.9 in ³	6162.7 in ³	6244.9 in ³	6162.7 in ³	392.0 in ³	392.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	167.25 in ²	57.00 in	9533.25 in ³	6.31 in	6659.93 in ³	357933.87 in ⁴
Top Bars	12.57 in ²	126.00 in	1583.36 in ³	62.69 in	49385.78 in ³	49385.83 in ⁴
Bot. Bars	4.95 in ²	117.38 in	581.01 in ³	54.06 in	14468.80 in ³	14468.81 in ⁴
Σ =	184.77 in ²		11697.62 in ³			

$$\text{Neutral Axis} = 63.31 \text{ in}$$

$$\text{Total MOI} = 421788.5 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	8446.0 in ³	8321.0 in ³	6742.1 in ³	6662.2 in ³	8574.7 in ³	6823.9 in ³	6728.2 in ³	7801.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 6 Section: 18

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	$1.12 \sqrt{Ek}/f_{yw} =$	66.5
do =	240	in	$1.4 \sqrt{Ek}/f_{yw} =$	83.1

Vp =	2213.1	k	k =	6.1	in
Vn =	1106.1	k	C =	0.21	

$$\phi_v \phi_c \phi_s V_n = 1106.1 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 6 Section: 18

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 11902.3 in³
 Short-term S = 35850.7 in³
 Lateral Bending S = 149.5 in³

Bottom Flange:

Long-term S = 5430.3 in³
 Short-term S = 5989.2 in³
 Lateral Bending S = 104.7 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 3954 k-ft

Wearing Surface Moment = 799 k-ft

Live Load Moment = 3807 k-ft

Impact = 133%

Dead Load = DC = 4.0 ksi

WS Load = DW = 0.8 ksi

P = 0

Live Load = LL + IM = 1.7 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 4.0 ksi

f_{bu} = 0.8 ksi

f_{bu} = 1.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 14.77 (Inv)
 RF = 19.15 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3954 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 799 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3807 k-ft

Lateral Live Load Moment = 4 k-ft

Impact = 133%

Dead Load = DC = 8.7 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 10.3 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 8.7 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 8.7 ksi

f_{bu} = 1.8 ksi

f_l = 0.00 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.8 ksi

f_{bu} = 7.6 ksi

f_l = 0.46 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.01 (Inv)
 RF = 2.61 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Span 6

Section: 18

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	140	k
WS Load = DW =	30	k
P =	0	
Live Load = LL =	172	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 228.8 k

Capacity = ϕF_{nc} = C = 1106.1 k

RF = 2.21 (Inv)

RF = 2.87 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 6 Section: 18

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 11902.3 in³
 Short-term S = 35850.7 in³

Bottom Flange:

Long-term S = 5430.3 in³
 Short-term S = 5989.2 in³
 Lateral Bending S = 104.7 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3954 k-ft

Wearing Surface Moment = 799 k-ft

Live Load Moment = 3807 k-ft
 Impact = 133%

Dead Load = DC = 4.0 ksi

WS Load = DW = 0.8 ksi

P = 0

Live Load = LL + IM = 1.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 4.0 ksi

ff = 0.8 ksi

ff = 1.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 19.38 (Inv)

RF = 25.20 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3954 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 799 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3807 k-ft

Lateral Live Load Moment = 4 k-ft

Impact = 133%

Dead Load = DC = 8.7 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 10.4 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 8.7 ksi

f_l = 0.00 ksi

DC = ff + f_l/2 = 8.7 ksi

f_{bu} = 1.8 ksi

f_l = 0.00 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 7.6 ksi

f_l = 0.46 ksi

LL + IM = ff + f_l/2 = 10.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.72 (Inv)

RF = 3.54 (Op)



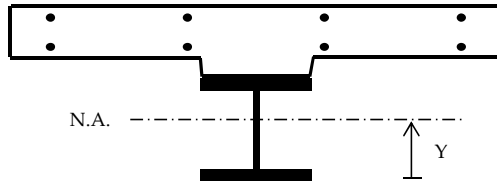
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 6 Section: 18

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	14.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.3125 in
Bot. Flange Width =	20.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	10.50 in ²	112.6875 in	1183.22 in ³	63.724 in	42637.7 in ³	42638.2 in ³
Web	76.31 in ²	56.8125 in	4335.50 in ³	7.849 in	4701.2 in ³	83055.1 in ³
Bot. Flange	26.25 in ²	0.6563 in	17.23 in ³	48.307 in	61257.1 in ³	61260.8 in ³
Σ =	113.06 in ²		5535.95 in ³			

Neutral Axis = Y = 48.964 in
 Total MOI = 186954 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
2933.8 in ³	2916.7 in ³	3870.1 in ³	3818.2 in ³	149.5 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	113.06 in ²	48.96 in	5535.95 in ³	47.91 in	259567.8 in ³	446521.9 in ⁴
Slab	224.00 in ²	121.06 in	27118.00 in ³	24.18 in	131015.1 in ³	133703.10 in ⁴
Σ =	337.06 in ²		32653.95 in ³			

Neutral Axis = 96.88 in
 Total MOI = 580225 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
36701.1 in ³	35850.7 in ³	6030.1 in ³	5989.2 in ³	37592.8 in ³	6071.5 in ³	23991.6 in ³	19222.6 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	113.06 in ²	48.96 in	5535.95 in ³	28.68 in	92974.9 in ³	279928.98 in ⁴
Slab	74.67 in ²	121.06 in	9039.33 in ³	43.42 in	140785.4 in ³	141681.35 in ⁴
Σ =	187.73 in ²		14575.28 in ³			

Neutral Axis = 77.64 in
 Total MOI = 421610 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
12029.7 in ³	11902.3 in ³	5476.6 in ³	5430.3 in ³	12159.8 in ³	5523.7 in ³	9709.5 in ³	8530.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 19

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

λ_f =	9.600
λ_{pf} =	9.152
λ_{rf} =	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 48.4 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 43.72 ksi

Lp =	139.4	in
Lr =	523	in

Controlling Resistance:

Fnc = 43.72 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$\phi_f \phi_c \phi_s F_{nc} = 43.7$ ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.27

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

k =	7.7	in
Vp =	2213.1	k
Vn =	1433.9	k

$\phi_v \phi_c \phi_s V_n = 1433.9$ k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 19

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -4859 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1004 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2772 k-ft
 Lateral Live Load Moment = 21 k-ft
 Impact = 133%

Dead Load = DC = 11.2 ksi
 WS Load = DW = 2.3 ksi
 P = 0
 Live Load = LL + IM = 8.9 ksi
 Capacity = $\phi F_{nc} = C$ = 43.7 ksi

f_{bu} = 11.2 ksi
 f_l = 0.15 ksi
 $DC = f_{bu} + \frac{1}{2}f_l = 11.2$ ksi

f_{bu} = 2.3 ksi
 f_l = 0.05 ksi
 $DW = f_{bu} + \frac{1}{2}f_l = 2.3$ ksi

f_{bu} = 6.4 ksi
 f_l = 1.05 ksi
 $LL + IM = f_{bu} + \frac{1}{2}f_l = 8.9$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.68 (Inv)
 RF = 2.17 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -4859 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1004 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2772 k-ft
 Lateral Live Load Moment = 21 k-ft
 Impact = 133%

Dead Load = DC = 8.6 ksi
 WS Load = DW = 1.8 ksi
 P = 0
 Live Load = LL + IM = 6.9 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 8.5 ksi
 f_l = 0.15 ksi
 $DC = f_{bu} + \frac{1}{2}f_l = 8.6$ ksi

f_{bu} = 1.8 ksi
 f_l = 0.05 ksi
 $DW = f_{bu} + \frac{1}{2}f_l = 1.8$ ksi

f_{bu} = 4.9 ksi
 f_l = 1.05 ksi
 $LL + IM = f_{bu} + \frac{1}{2}f_l = 6.9$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.01 (Inv)
 RF = 3.90 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Pier 6

Section: 19

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	206	k
WS Load = DW =	44	k
P =	0	
Live Load = LL =	196	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 260.7 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF =	2.43	(Inv)
RF =	3.16	(Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 19

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4859 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1004 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2772 k-ft
 Lateral Live Load Moment = 21 k-ft
 Impact = 133%

Dead Load = DC = 11.2 ksi
 WS Load = DW = 2.3 ksi
 P = 0
 Live Load = LL + IM = 8.9 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 11.2 ksi
 fl = 0.15 ksi
 $DC = ff + fl/2 = 11.2$ ksi

ff = 2.3 ksi
 fl = 0.05 ksi
 $DW = ff + fl/2 = 2.3$ ksi

ff = 6.4 ksi
 fl = 1.05 ksi
 $LL + IM = ff + fl/2 = 8.9$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.92 (Inv)
 RF = 3.80 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4859 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1004 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2772 k-ft
 Lateral Live Load Moment = 21 k-ft
 Impact = 133%

Dead Load = DC = 8.6 ksi
 WS Load = DW = 1.8 ksi
 P = 0
 Live Load = LL + IM = 7.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 8.5 ksi
 fl = 0.15 ksi
 $DC = ff + fl/2 = 8.6$ ksi

ff = 1.8 ksi
 fl = 0.05 ksi
 $DW = ff + fl/2 = 1.8$ ksi

ff = 4.9 ksi
 fl = 1.05 ksi
 $LL + IM = ff + fl/2 = 7.2$ ksi (Impact Added Here)

RF = 3.97 (Inv)
 RF = 5.17 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

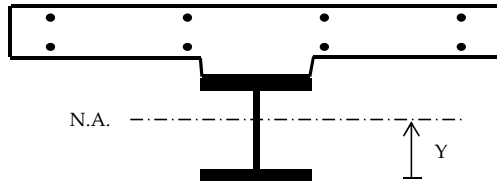
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

Location: Pier 6

Section: 19

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 20

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

φf =	1.00	LRFD 6.5.4.2
φv =	1.00	LRFD 6.5.4.3
φc =	1.00	MBE 6A.4.2.3-1
φs =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	2	in

λf =	6.000
λpf =	9.152
λrf =	13.487

Fnc = 50.0 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	57.50	in (Non-Comp)
rt =	6.137	in
Fyr = 0.7Fy =	35	ksi

Fnc = 44.39 ksi

Lp =	147.8	in
Lr =	555	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 44.39 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

φfφcφsFnc = 44.4 ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

φfφcφsFnt = 50.0 ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

0.95RhFyf = 47.5 ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
1.12√Ek/fyw =	75.0
1.4√Ek/fyw =	93.8
C =	0.27

k =	7.7	in
Vp =	2213.1	k
Vn =	1433.9	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

φvφcφsVn = 1433.9 k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 20

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8898.8 in³
 Lateral Bending S = 384.0 in³

Bottom Flange S = 7169.5 in³
 Lateral Bending S = 384.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -9335 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -1909 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4400 k-ft
 Lateral Live Load Moment = 30 k-ft
 Impact = 133%

Dead Load = DC = 15.7 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 10.2 ksi
 Capacity = $\phi F_{nc} = C$ = 44.4 ksi

f_{bu} = 15.6 ksi
 f_l = 0.13 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 15.7 ksi

f_{bu} = 3.2 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.2 ksi

f_{bu} = 7.4 ksi
 f_l = 0.94 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.12 (Inv)
RF = 1.45 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -9335 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -1909 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4400 k-ft
 Lateral Live Load Moment = 30 k-ft
 Impact = 133%

Dead Load = DC = 12.6 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.3 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 12.6 ksi
 f_l = 0.13 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 12.6 ksi

f_{bu} = 2.6 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 5.9 ksi
 f_l = 0.94 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.09 (Inv)
RF = 2.70 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Location: Bangor/Brewer, ME

Calculated by: JGM

Checked by: CTA

Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:

Date: 6/24/2015

Date: 6/24/2015

Girder: 7-2

Location: Pier 6

Section: 20

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	274	k
WS Load = DW =	57	k
P =	0	
Live Load = LL =	234	k
Impact =	133%	

Live Load = LL + IM = 311.2 k

Capacity = $\phi F_{nc} = C = 1433.9$ k

$\gamma_{DC} =$	1.25
$\gamma_{DW} =$	1.5
$\gamma_P =$	0
$\gamma_{LL} =$	1.75 (Inv)
$\gamma_{LL} =$	1.35 (Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.85 (Inv)

RF = 2.39 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 20

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8898.8 in³
 Lateral Bending S = 384.0 in³

Bottom Flange S = 7169.5 in³
 Lateral Bending S = 384.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -9335 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -1909 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4400 k-ft
 Lateral Live Load Moment = 30 k-ft
 Impact = 133%

Dead Load = DC = 15.7 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 10.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 15.6 ksi
 fl = 0.13 ksi
 $DC = ff + fl/2 = 15.7$ ksi

ff = 3.2 ksi
 fl = 0.06 ksi
 $DW = ff + fl/2 = 3.2$ ksi

ff = 7.4 ksi
 fl = 0.94 ksi
 $LL + IM = ff + fl/2 = 10.2$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.15 (Inv)
 RF = 2.80 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -9335 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -1909 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4400 k-ft
 Lateral Live Load Moment = 30 k-ft
 Impact = 133%

Dead Load = DC = 12.7 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 12.6 ksi
 fl = 0.13 ksi
 $DC = ff + fl/2 = 12.7$ ksi

ff = 2.6 ksi
 fl = 0.06 ksi
 $DW = ff + fl/2 = 2.6$ ksi

ff = 5.9 ksi
 fl = 0.94 ksi
 $LL + IM = ff + fl/2 = 8.5$ ksi (Impact Added Here)

RF = 2.91 (Inv)
 RF = 3.79 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

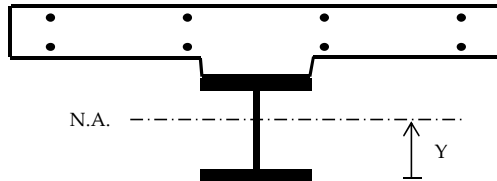
Project #: 55060.00
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Girder: 7-2

Location: Pier 6

Section: 20

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.0000 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.0000 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	48.00 in ²	114.0000 in	5472.00 in ³	56.500 in	153228.0 in ³	153244.0 in ³
Web	76.31 in ²	57.5000 in	4387.97 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	48.00 in ²	1.0000 in	48.00 in ³	56.500 in	153228.0 in ³	153244.0 in ³
Σ =	172.31 in ²		9907.97 in ³			

$$\text{Neutral Axis} = Y = 57.500 \text{ in}$$

$$\text{Total MOI} = 384842 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6811.4 in ³	6692.9 in ³	6811.4 in ³	6692.9 in ³	384.0 in ³	384.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	172.31 in ²	57.50 in	9907.97 in ³	6.19 in	6598.45 in ³	391440.31 in ⁴
Top Bars	12.57 in ²	127.00 in	1595.93 in ³	63.31 in	50370.88 in ³	50370.93 in ⁴
Bot. Bars	4.95 in ²	118.38 in	585.96 in ³	54.69 in	14803.71 in ³	14803.73 in ⁴
Σ =	189.83 in ²		12089.85 in ³			

$$\text{Neutral Axis} = 63.69 \text{ in}$$

$$\text{Total MOI} = 456615.0 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	9075.7 in ³	8898.8 in ³	7283.9 in ³	7169.5 in ³	9259.7 in ³	7402.0 in ³	7212.2 in ³	8349.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 21

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

φf =	1.00	LRFD 6.5.4.2
φv =	1.00	LRFD 6.5.4.3
φc =	1.00	MBE 6A.4.2.3-1
φs =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

λf =	9.600
λpf =	9.152
λrf =	13.487

Fnc = 48.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

Fnc = 43.72 ksi

Lp =	139.4	in
Lr =	523	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 43.72 ksi

φfφcφsFnc = 43.7 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

φfφcφsFnt = 50.0 ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

0.95RhFyf = 47.5 ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
1.12√Ek/fyw =	75.0
1.4√Ek/fyw =	93.8
C =	0.27

k =	7.7	in
Vp =	2213.1	k
Vn =	1433.9	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

φvφcφsVn = 1433.9 k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 21

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -4461 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -918 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2660 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 10.3 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 8.5 ksi
 Capacity = $\phi F_{nc} = C$ = 43.7 ksi

f_{bu} = 10.2 ksi
 f_l = 0.15 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 10.3 ksi

f_{bu} = 2.1 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 6.1 ksi
 f_l = 0.80 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.86 (Inv)
RF = 2.42 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -4461 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -918 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2660 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 7.9 ksi
 WS Load = DW = 1.6 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 7.8 ksi
 f_l = 0.15 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 7.9 ksi

f_{bu} = 1.6 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.6 ksi

f_{bu} = 4.7 ksi
 f_l = 0.80 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.28 (Inv)
RF = 4.25 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 21

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	197	k
WS Load = DW =	42	k
P =	0	
Live Load = LL =	161	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 214.1 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF = 3.00 (Inv)

RF = 3.89 (Op)



Computations

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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 6 Section: 21

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4461 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -918 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2660 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 10.3 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 8.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 10.2 ksi
 fl = 0.15 ksi
 $DC = ff + fl/2 = 10.3$ ksi

ff = 2.1 ksi
 fl = 0.05 ksi
 $DW = ff + fl/2 = 2.1$ ksi

ff = 6.1 ksi
 fl = 0.80 ksi
 $LL + IM = ff + fl/2 = 8.5$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.18 (Inv)
 RF = 4.13 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4461 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -918 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2660 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 7.9 ksi
 WS Load = DW = 1.6 ksi
 P = 0
 Live Load = LL + IM = 6.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 7.8 ksi
 fl = 0.15 ksi
 $DC = ff + fl/2 = 7.9$ ksi

ff = 1.6 ksi
 fl = 0.05 ksi
 $DW = ff + fl/2 = 1.6$ ksi

ff = 4.7 ksi
 fl = 0.80 ksi
 $LL + IM = ff + fl/2 = 6.8$ ksi (Impact Added Here)

RF = 4.32 (Inv)
 RF = 5.62 (Op)



Computations

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 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

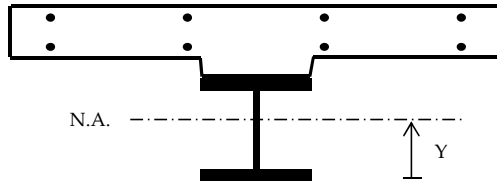
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 Date: 6/24/2015

Girder: 7-2

Location: Pier 6

Section: 21

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 7 Section: 22

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/fyw =	75.0
do =	150	in	1.4√Ek/fyw =	93.8

Vp =	2213.1	k	k =	7.7	in
Vn =	1433.9	k	C =	0.27	

$$\phi_v \phi_c \phi_s V_n = 1433.9 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 7 Section: 22

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S =	11528.4	in ³
Short-term S =	36617.6	in ³
Lateral Bending S =	73.3	in ³

Bottom Flange:

Long-term S =	4364.3	in ³
Short-term S =	4838.3	in ³
Lateral Bending S =	64.1	in ³

Load Factors:

γ_{DC} =	1.25
γ_{DW} =	1.5
γ_P =	0
γ_{LL} =	1.75 (Inv)
γ_{LL} =	1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 3815 k-ft

Wearing Surface Moment = 786 k-ft

Live Load Moment = 3406 k-ft

Impact = 133%

Dead Load = DC = 4.0 ksi

WS Load = DW = 0.8 ksi

P = 0

Live Load = LL + IM = 1.5 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 4.0 ksi

f_{bu} = 0.8 ksi

f_{bu} = 1.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 16.86 (Inv)
 RF = 21.86 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3815 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 786 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3406 k-ft

Lateral Live Load Moment = 2 k-ft

Impact = 133%

Dead Load = DC = 10.5 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 11.4 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.5 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.5 ksi

f_{bu} = 2.2 ksi

f_l = 0.00 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.2 ksi

f_{bu} = 8.4 ksi

f_l = 0.37 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.69 (Inv)
 RF = 2.19 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Span 7

Section: 22

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	132	k
WS Load = DW =	29	k
P =	0	
Live Load = LL =	137	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 182.2 k

Capacity = ϕF_{nc} = C = 1433.9 k

RF = 3.84 (Inv)

RF = 4.98 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 7 Section: 22

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 11528.4 in³
 Short-term S = 36617.6 in³

Bottom Flange:

Long-term S = 4364.3 in³
 Short-term S = 4838.3 in³
 Lateral Bending S = 64.1 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3815 k-ft

Wearing Surface Moment = 786 k-ft

Live Load Moment = 3406 k-ft
 Impact = 133%

Dead Load = DC = 4.0 ksi

WS Load = DW = 0.8 ksi

P = 0

Live Load = LL + IM = 1.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 4.0 ksi

ff = 0.8 ksi

ff = 1.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 22.13 (Inv)
 RF = 28.77 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3815 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 786 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3406 k-ft

Lateral Live Load Moment = 2 k-ft

Impact = 133%

Dead Load = DC = 10.5 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 11.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 10.5 ksi

fl = 0.00 ksi

DC = ff + fl/2 = 10.5 ksi

fbu = 2.2 ksi

fl = 0.00 ksi

DW = ff + f/2l = 2.2 ksi

fbu = 8.4 ksi

fl = 0.37 ksi

LL + IM = ff + fl/2 = 11.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.33 (Inv)
 RF = 3.03 (Op)



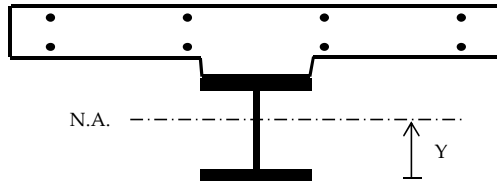
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 7 Section: 22

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	14.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.0000 in
Bot. Flange Width =	16.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	10.50 in ²	112.3750 in	1179.94 in ³	58.884 in	36406.3 in ³	36406.8 in ³
Web	76.31 in ²	56.5000 in	4311.66 in ³	3.009 in	690.7 in ³	79044.6 in ³
Bot. Flange	16.00 in ²	0.5000 in	8.00 in ³	52.991 in	44929.6 in ³	44930.9 in ³
Σ =	102.81 in ²		5499.59 in ³			

Neutral Axis = Y = 53.491 in
 Total MOI = 160382 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
2723.7 in ³	2706.5 in ³	3026.6 in ³	2998.3 in ³	73.3 in ³	64.1 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	102.81 in ²	53.49 in	5499.59 in ³	46.10 in	218493.8 in ⁴	378876.1 in ⁴
Slab	224.00 in ²	120.75 in	27048.00 in ³	21.16 in	100285.2 in ⁴	102973.24 in ⁴
Σ =	326.81 in ²		32547.59 in ³			

Neutral Axis = 99.59 in
 Total MOI = 481849 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
37691.7 in ³	36617.6 in ³	4862.7 in ³	4838.3 in ³	38830.7 in ³	4887.4 in ³	22772.8 in ³	17741.8 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	102.81 in ²	53.49 in	5499.59 in ³	28.30 in	82318.8 in ⁴	242701.11 in ⁴
Slab	74.67 in ²	120.75 in	9016.00 in ³	38.96 in	113349.2 in ⁴	114245.17 in ⁴
Σ =	177.48 in ²		14515.59 in ³			

Neutral Axis = 81.79 in
 Total MOI = 356946 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
11669.7 in ³	11528.4 in ³	4391.2 in ³	4364.3 in ³	11814.6 in ³	4418.3 in ³	9161.3 in ³	7938.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 23

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

φf =	1.00	LRFD 6.5.4.2
φv =	1.00	LRFD 6.5.4.3
φc =	1.00	MBE 6A.4.2.3-1
φs =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

λf =	9.600
λpf =	9.152
λrf =	13.487

Fnc = 48.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	228.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

Fnc = 46.54 ksi

Lp =	139.4	in
Lr =	523	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 46.54 ksi

φfφcφsFnc = 46.5 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

φfφcφsFnt = 50.0 ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

0.95RhFyf = 47.5 ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	114	in

D/tw =	161.5
1.12√Ek/fyw =	84.2
1.4√Ek/fyw =	105.2
C =	0.34

k =	9.7	in
Vp =	2213.1	k
Vn =	1639.1	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

φvφcφsVn = 1639.1 k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 23

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -7261 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1489 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3060 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 16.8 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 9.8 ksi
 Capacity = $\phi F_{nc} = C$ = 46.5 ksi

f_{bu} = 16.7 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 16.8 ksi

f_{bu} = 3.4 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.4 ksi

f_{bu} = 7.0 ksi
 f_l = 0.95 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.19 (Inv)
RF = 1.55 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -7261 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1489 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3060 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 12.8 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 7.6 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 12.8 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 12.8 ksi

f_{bu} = 2.6 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 5.4 ksi
 f_l = 0.95 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.26 (Inv)
RF = 2.93 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Pier 7

Section: 23

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	224	k
WS Load = DW =	47	k
P =	0	
Live Load = LL =	177	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 235.4 k

Capacity = $\phi F_{nc} = C$ = 1639.1 k

RF = 3.13 (Inv)

RF = 4.05 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 23

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -7261 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1489 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3060 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 16.8 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 9.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 16.7 ksi
 fl = 0.25 ksi

DC = ff + fl/2 = 16.8 ksi

ff = 3.4 ksi
 fl = 0.05 ksi

DW = ff + fl/2 = 3.4 ksi

ff = 7.0 ksi
 fl = 0.95 ksi

LL + IM = ff + fl/2 = 9.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.15 (Inv)
 RF = 2.79 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -7261 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1489 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3060 k-ft
 Lateral Live Load Moment = 19 k-ft
 Impact = 133%

Dead Load = DC = 12.9 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 7.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 12.8 ksi
 fl = 0.25 ksi

DC = ff + fl/2 = 12.9 ksi

ff = 2.6 ksi
 fl = 0.05 ksi

DW = ff + fl/2 = 2.6 ksi

ff = 5.4 ksi
 fl = 0.95 ksi

LL + IM = ff + fl/2 = 7.8 ksi (Impact Added Here)

RF = 3.16 (Inv)
 RF = 4.11 (Op)



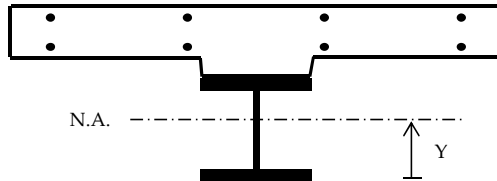
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 23

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Location: Bangor/Brewer, ME

Calculated by: JGM

Checked by: CTA

Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:

Date: 6/24/2015

Date: 6/24/2015

Girder: 7-2

Location: Pier 7

Section: 24

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	2.25	in

$\lambda_f =$	5.333
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

Fnc = 50.0 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	57.75	in (Non-Comp)
rt =	6.209	in
Fyr = 0.7Fy =	35	ksi

Fnc = 44.52 ksi

Lp =	149.5	in
Lr =	561	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 44.52 ksi

$\phi_f \phi_c \phi_s F_{nc} = 44.5$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.27

k =	7.7	in
Vp =	2213.1	k
Vn =	1433.9	k

$\phi_v \phi_c \phi_s V_n = 1433.9$ k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 24

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 9582.9 in³
 Lateral Bending S = 432.0 in³

Bottom Flange S = 7822.3 in³
 Lateral Bending S = 432.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -10909 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2229 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4357 k-ft
 Lateral Live Load Moment = 28 k-ft
 Impact = 133%

Dead Load = DC = 16.8 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 9.2 ksi
 Capacity = $\phi F_{nc} = C$ = 44.5 ksi

f_{bu} = 16.7 ksi
 f_l = 0.11 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 16.8 ksi

f_{bu} = 3.4 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.4 ksi

f_{bu} = 6.7 ksi
 f_l = 0.78 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.14 (Inv)
RF = 1.48 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -10909 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2229 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4357 k-ft
 Lateral Live Load Moment = 28 k-ft
 Impact = 133%

Dead Load = DC = 13.7 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 7.6 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 13.7 ksi
 f_l = 0.11 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 13.7 ksi

f_{bu} = 2.8 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 5.5 ksi
 f_l = 0.78 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.15 (Inv)
RF = 2.79 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/24/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 7-2

Location: Pier 7

Section: 24

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	280	k
WS Load = DW =	58	k
P =	0	
Live Load = LL =	218	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 289.9 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF = 1.96 (Inv)

RF = 2.55 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 24

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 9582.9 in³
 Lateral Bending S = 432.0 in³

Bottom Flange S = 7822.3 in³
 Lateral Bending S = 432.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -10909 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2229 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4357 k-ft
 Lateral Live Load Moment = 28 k-ft
 Impact = 133%

Dead Load = DC = 16.8 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 9.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 16.7 ksi
 fl = 0.11 ksi

DC = ff + fl/2 = 16.8 ksi

ff = 3.4 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 3.4 ksi

ff = 6.7 ksi
 fl = 0.78 ksi

LL + IM = ff + fl/2 = 9.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.27 (Inv)
 RF = 2.95 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -10909 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2229 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4357 k-ft
 Lateral Live Load Moment = 28 k-ft
 Impact = 133%

Dead Load = DC = 13.7 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 7.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 13.7 ksi
 fl = 0.11 ksi

DC = ff + fl/2 = 13.7 ksi

ff = 2.8 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 2.8 ksi

ff = 5.5 ksi
 fl = 0.78 ksi

LL + IM = ff + fl/2 = 7.8 ksi (Impact Added Here)

RF = 3.06 (Inv)
 RF = 3.98 (Op)



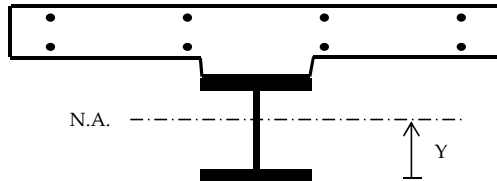
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 24

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	54.00 in ²	114.3750 in	6176.25 in ³	56.625 in	173145.1 in ³	173167.9 in ³
Web	76.31 in ²	57.7500 in	4407.05 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	54.00 in ²	1.1250 in	60.75 in ³	56.625 in	173145.1 in ³	173167.9 in ³
Σ =	184.31 in ²		10644.05 in ³			

$$\text{Neutral Axis} = Y = 57.750 \text{ in}$$

$$\text{Total MOI} = 424690 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
7500.0 in ³	7353.9 in ³	7500.0 in ³	7353.9 in ³	432.0 in ³	432.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	184.31 in ²	57.75 in	10644.05 in ³	5.84 in	6290.28 in ³	430979.88 in ⁴
Top Bars	12.57 in ²	127.50 in	1602.21 in ³	63.91 in	51324.07 in ³	51324.12 in ⁴
Bot. Bars	4.95 in ²	118.88 in	588.43 in ³	55.28 in	15128.27 in ³	15128.29 in ⁴
Σ =	201.83 in ²		12834.69 in ³			

$$\text{Neutral Axis} = 63.59 \text{ in}$$

$$\text{Total MOI} = 497432.3 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	9795.2 in ³	9582.9 in ³	7963.1 in ³	7822.3 in ³	10017.2 in ³	8109.2 in ³	7783.6 in ³	8997.9 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 25

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

$$\lambda_f = 9.600$$

$$\lambda_{pf} = 9.152$$

$$\lambda_{rf} = 13.487$$

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

$$F_{nc} = 48.4 \text{ ksi}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

$$D_c = 56.75 \text{ in (Non-Comp)}$$

$$r_t = 5.787 \text{ in}$$

$$F_{yr} = 0.7 F_y = 35 \text{ ksi}$$

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

$$F_{nc} = 43.72 \text{ ksi}$$

$$L_p = 139.4 \text{ in}$$

$$L_r = 523 \text{ in}$$

Controlling Resistance:

$$F_{nc} = 43.72 \text{ ksi}$$

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$$\phi_f \phi_c \phi_s F_{nc} = 43.7 \text{ ksi}$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

$$F_{nt} = 50.00 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

$$D/tw = 161.5$$

$$1.12 \sqrt{Ek}/f_{yw} = 75.0$$

$$1.4 \sqrt{Ek}/f_{yw} = 93.8$$

$$C = 0.27$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$$\phi_v \phi_c \phi_s V_n = 1433.9 \text{ k}$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 25

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -5297 k-ft
 Lateral Dead Load Moment = 7 k-ft

Wearing Surface Moment = -1098 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 12.3 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.4 ksi
 Capacity = $\phi F_{nc} = C$ = 43.7 ksi

f_{bu} = 12.2 ksi
 f_l = 0.35 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 12.3 ksi

f_{bu} = 2.5 ksi
 f_l = 0.10 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 2.6 ksi

f_{bu} = 6.0 ksi
 f_l = 0.85 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 8.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.67 (Inv)
RF = 2.17 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -5297 k-ft
 Lateral Dead Load Moment = 7 k-ft

Wearing Surface Moment = -1098 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 9.4 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.3 ksi
 f_l = 0.35 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 9.4 ksi

f_{bu} = 1.9 ksi
 f_l = 0.10 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 2.0 ksi

f_{bu} = 4.6 ksi
 f_l = 0.85 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 6.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.10 (Inv)
RF = 4.02 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Location: Bangor/Brewer, ME

Calculated by: JGM

Checked by: CTA

Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:

Date: 6/24/2015

Date: 6/24/2015

Girder: 7-2

Location: Pier 7

Section: 25

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	228	k
WS Load = DW =	48	k
P =	0	
Live Load = LL =	156	k
Impact =	133%	

Live Load = LL + IM = 207.5 k

Capacity = $\phi F_{nc} = C = 1433.9$ k

$\gamma_{DC} =$	1.25
$\gamma_{DW} =$	1.5
$\gamma_P =$	0
$\gamma_{LL} =$	1.75 (Inv)
$\gamma_{LL} =$	1.35 (Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.97 (Inv)

RF = 3.84 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 25

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5297 k-ft
 Lateral Dead Load Moment = 7 k-ft

Wearing Surface Moment = -1098 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 12.3 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 12.2 ksi
 fl = 0.35 ksi
 $DC = ff + fl/2 = 12.3$ ksi

ff = 2.5 ksi
 fl = 0.10 ksi
 $DW = ff + fl/2 = 2.6$ ksi

ff = 6.0 ksi
 fl = 0.85 ksi
 $LL + IM = ff + fl/2 = 8.4$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.99 (Inv)
 RF = 3.89 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5297 k-ft
 Lateral Dead Load Moment = 7 k-ft

Wearing Surface Moment = -1098 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 9.5 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 6.7 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 9.3 ksi
 fl = 0.35 ksi
 $DC = ff + fl/2 = 9.5$ ksi

ff = 1.9 ksi
 fl = 0.10 ksi
 $DW = ff + fl/2 = 2.0$ ksi

ff = 4.6 ksi
 fl = 0.85 ksi
 $LL + IM = ff + fl/2 = 6.7$ ksi (Impact Added Here)

RF = 4.14 (Inv)
 RF = 5.39 (Op)



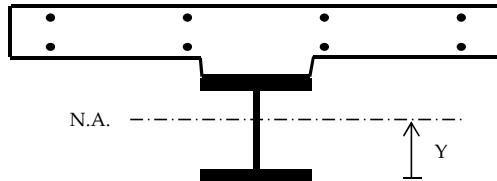
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Pier 7 Section: 25

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 8 Section: 26

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (End Panels) (6.10.9.3.3):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	137.9
d _o =	54	in	1.4√Ek/f _{yw} =	172.3

V _p =	2213.1	k	k =	26.1	in
V _n =	1889.8	k	C =	0.85	

$$\phi_v \phi_c \phi_s V_n = 1889.8 \text{ k}$$

$$V_n = C V_p$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	64.6
d _o =	288	in	1.4√Ek/f _{yw} =	80.8

V _p =	2213.1	k	k =	5.7	in
V _n =	997.5	k	C =	0.20	

$$\phi_v \phi_c \phi_s V_n = 997.5 \text{ k}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 8 Section: 26

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 12394.5 in³
 Short-term S = 36566.7 in³
 Lateral Bending S = 146.8 in³

Bottom Flange:

Long-term S = 5329.9 in³
 Short-term S = 5865.6 in³
 Lateral Bending S = 117.5 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 5734 k-ft

Wearing Surface Moment = 1167 k-ft

Live Load Moment = 3786 k-ft

Impact = 133%

Dead Load = DC = 5.6 ksi

WS Load = DW = 1.1 ksi

P = 0

Live Load = LL + IM = 1.7 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 5.6 ksi

f_{bu} = 1.1 ksi

f_{bu} = 1.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 14.30 (Inv)
 RF = 18.54 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 5734 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 1167 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3786 k-ft

Lateral Live Load Moment = 4 k-ft

Impact = 133%

Dead Load = DC = 12.9 ksi

WS Load = DW = 2.6 ksi

P = 0

Live Load = LL + IM = 10.5 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 12.9 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 12.9 ksi

f_{bu} = 2.6 ksi

f_l = 0.00 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 7.7 ksi

f_l = 0.41 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.63 (Inv)
 RF = 2.11 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 8 Section: 26

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	193	k
WS Load = DW =	43	k
P =	0	
Live Load = LL =	212	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 282.0 k

Capacity = $\phi F_{nc} = C$ = 997.5 k

RF = 1.40 (Inv)
 RF = 1.82 (Op)

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	197	k
WS Load = DW =	43	k
P =	0	
Live Load = LL =	220	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 292.6 k

Capacity = $\phi F_{nc} = C$ = 1889.8 k

RF = 3.08 (Inv)
 RF = 4.00 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 8 Section: 26

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 12394.5 in³
 Short-term S = 36566.7 in³

Bottom Flange:

Long-term S = 5329.9 in³
 Short-term S = 5865.6 in³
 Lateral Bending S = 117.5 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 5734 k-ft

Wearing Surface Moment = 1167 k-ft

Live Load Moment = 3786 k-ft
 Impact = 133%

Dead Load = DC = 5.6 ksi

WS Load = DW = 1.1 ksi

P = 0

Live Load = LL + IM = 1.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 5.6 ksi

ff = 1.1 ksi

ff = 1.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 19.00 (Inv)
 RF = 24.70 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 5734 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 1167 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3786 k-ft

Lateral Live Load Moment = 4 k-ft

Impact = 133%

Dead Load = DC = 12.9 ksi

WS Load = DW = 2.6 ksi

P = 0

Live Load = LL + IM = 10.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 12.9 ksi

fl = 0.00 ksi

DC = ff + fl/2 = 12.9 ksi

fbu = 2.6 ksi

fl = 0.00 ksi

DW = ff + f/2l = 2.6 ksi

fbu = 7.7 ksi

fl = 0.41 ksi

LL + IM = ff + fl/2 = 10.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.33 (Inv)
 RF = 3.02 (Op)



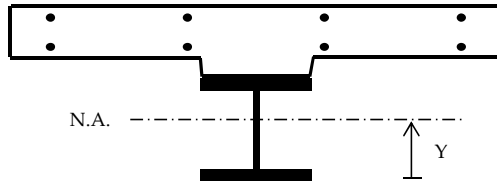
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 8 Section: 26

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.0000 in
Top Flange Width =	16.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	20.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	16.00 in ²	112.7500 in	1804.00 in ³	60.323 in	58221.6 in ³	58222.9 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	4.323 in	1426.1 in ³	79779.9 in ³
Bot. Flange	25.00 in ²	0.6250 in	15.63 in ³	51.802 in	67086.6 in ³	67089.8 in ³
Σ =	117.31 in ²		6150.36 in ³			

Neutral Axis = Y = 52.427 in
 Total MOI = 205093 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
3399.9 in ³	3372.0 in ³	3959.2 in ³	3912.0 in ³	146.8 in ³	117.5 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	117.31 in ²	52.43 in	6150.36 in ³	45.17 in	239332.3 in ⁴	444424.9 in ⁴
Slab	224.00 in ²	121.25 in	27160.00 in ³	23.66 in	125342.3 in ⁴	128030.28 in ⁴
Σ =	341.31 in ²		33310.36 in ³			

Neutral Axis = 97.59 in
 Total MOI = 572455 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
37773.1 in ³	36566.7 in ³	5903.4 in ³	5865.6 in ³	39061.8 in ³	5941.7 in ³	24200.1 in ³	19303.8 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	117.31 in ²	52.43 in	6150.36 in ³	26.77 in	84053.3 in ⁴	289145.95 in ⁴
Slab	74.67 in ²	121.25 in	9053.33 in ³	42.06 in	132060.4 in ⁴	132956.37 in ⁴
Σ =	191.98 in ²		15203.69 in ³			

Neutral Axis = 79.19 in
 Total MOI = 422102 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
12579.2 in ³	12394.5 in ³	5372.3 in ³	5329.9 in ³	12769.5 in ³	5415.4 in ³	10036.8 in ³	8783.6 in ³

-3.5-

Spans 3-8

Exterior Girder Rating





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder 8-2 Rating Summary

Girder Section	Location/Type		Flexure - Strength		Shear - Strength		Controlling Strength	Flexure - Service		Controlling Service
			Top Flange	Bott. Flange	End Panels	Int. Panels		Top Flange	Bott. Flange	
1	Span 3	Inventory	13.15	1.40	1.43	2.63	1.40	17.48	2.00	2.00
		Operating	17.04	1.81	1.86	3.41	1.81	22.72	2.60	2.60
2	Span 3	Inventory	10.79	2.35	---	3.35	2.35	14.28	3.15	3.15
		Operating	13.99	3.04	---	4.34	3.04	18.57	4.09	4.09
3	Pier 3	Inventory	1.49	2.37	---	3.55	1.49	2.51	3.56	2.51
		Operating	2.77	3.68	---	4.61	2.77	3.27	4.63	3.27
4	Pier 3	Inventory	2.14	2.84	---	4.09	2.14	3.41	4.23	3.41
		Operating	2.77	3.68	---	5.30	2.77	4.43	5.49	4.43
5	Span 4	Inventory	1.39	2.47	---	2.71	1.39	2.66	3.63	2.66
		Operating	1.80	3.20	---	3.52	1.80	3.46	4.72	3.46
6	Span 4	Inventory	7.53	1.16	---	2.92	1.16	10.34	1.74	1.74
		Operating	9.76	1.50	---	3.79	1.50	13.44	2.27	2.27
7	Span 4	Inventory	6.30	1.44	---	3.39	1.44	8.78	2.13	2.13
		Operating	8.16	1.87	---	4.40	1.87	11.41	2.77	2.77
8	Span 4	Inventory	7.79	1.34	---	2.71	1.34	10.64	1.95	1.95
		Operating	10.10	1.73	---	3.52	1.73	13.84	2.53	2.53
9	Span 4	Inventory	2.28	3.74	---	2.39	2.28	3.86	5.17	3.86
		Operating	2.95	4.85	---	3.10	2.95	5.01	6.73	5.01
10	Pier 4	Inventory	1.44	2.29	---	3.36	1.44	2.60	3.48	2.60
		Operating	1.87	2.97	---	4.35	1.87	3.38	4.52	3.38
11	Pier 4	Inventory	1.93	2.67	---	2.92	1.93	3.24	3.93	3.24
		Operating	2.50	3.46	---	3.78	2.50	4.22	5.10	4.22
12	Pier 4	Inventory	2.21	3.22	---	4.01	2.21	3.65	4.63	3.65
		Operating	2.87	4.17	---	5.20	2.87	4.74	6.02	4.74
13	Pier 4	Inventory	2.58	3.91	---	5.46	2.58	4.09	5.35	4.09
		Operating	3.34	5.06	---	7.08	3.34	5.31	6.96	5.31
14	Span 5	Inventory	10.31	1.87	---	3.20	1.87	13.64	2.54	2.54
		Operating	13.36	2.42	---	4.15	2.42	17.74	3.31	3.31
15	Pier 5	Inventory	2.69	4.15	---	2.91	2.69	4.25	5.54	4.25
		Operating	3.48	5.38	---	3.77	3.48	5.52	7.21	5.52
16	Pier 5	Inventory	1.78	2.73	---	2.38	1.78	2.96	3.80	2.96
		Operating	2.31	3.54	---	3.08	2.31	3.85	4.94	3.85
17	Pier 5	Inventory	2.66	3.98	---	4.02	2.66	4.07	5.35	4.07
		Operating	3.45	5.16	---	5.21	3.45	5.29	6.95	5.29
18	Span 6	Inventory	13.84	1.93	---	2.68	1.93	18.11	2.60	2.60
		Operating	17.94	2.50	---	3.47	2.50	23.54	3.38	3.38



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder 8-2 Rating Summary

Girder Section	Location/Type		Flexure - Strength		Shear - Strength		Controlling Strength	Flexure - Service		Controlling Service
			Top Flange	Bott. Flange	End Panels	Int. Panels		Top Flange	Bott. Flange	
19	Pier 6	Inventory	2.45	4.25	---	2.95	2.45	4.13	5.57	4.13
		Operating	3.18	5.51	---	3.83	3.18	5.38	7.24	5.38
20	Pier 6	Inventory	1.56	2.78	---	2.39	1.56	2.86	3.82	2.86
		Operating	2.02	3.60	---	3.10	2.02	3.72	4.96	3.72
21	Pier 6	Inventory	2.70	4.60	---	3.42	2.70	4.47	6.02	4.47
		Operating	3.50	5.96	---	4.43	3.50	5.81	7.83	5.81
22	Span 7	Inventory	15.24	1.57	---	4.33	1.57	19.95	2.15	2.15
		Operating	19.75	2.03	---	5.61	2.03	25.93	2.79	2.79
23	Pier 7	Inventory	1.76	3.14	---	3.64	1.76	2.99	4.31	2.99
		Operating	2.28	4.07	---	4.72	2.28	3.89	5.60	3.89
24	Pier 7	Inventory	1.57	2.82	---	2.55	1.57	2.96	3.93	2.96
		Operating	2.04	3.65	---	3.30	2.04	3.85	5.11	3.85
25	Pier 7	Inventory	2.49	4.39	---	3.27	2.49	4.27	5.75	4.27
		Operating	3.23	5.70	---	4.24	3.23	5.55	7.47	5.55
26	Span 8	Inventory	13.11	1.55	4.07	1.88	1.55	17.35	2.18	2.18
		Operating	17.00	2.01	5.27	2.44	2.01	22.55	2.84	2.84

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	
Inventory:	1.16	1.43	1.74
Operating:	1.50	1.86	2.27

-3.6-

Spans 3-8

Exterior Girder Loads

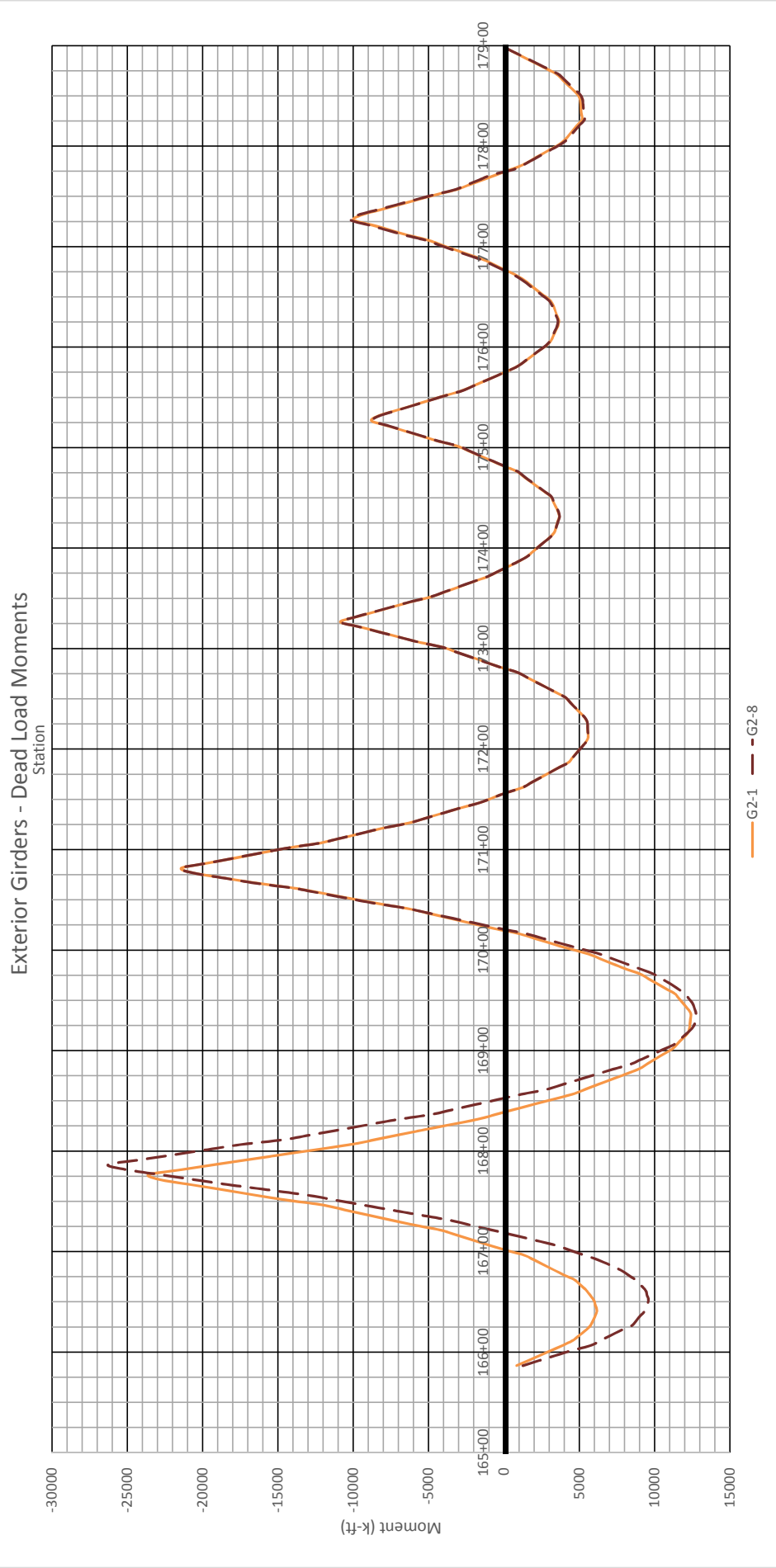




Computation

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/24/2015
Checked by: CTA	Date: 6/25/2015
Title: Dead and Wearing Surface Loads	

Spans 3-8



NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section	Sta.	My (k-ft)	Max/Min	Fz (k)		Sta	Max/Min
PIER 2	165+86	1253	9595	246	<u>1</u>	165+86	246
Section 1	165+91	2328	1253	222		165+91	-149
	165+96	3403		197		165+96	
	166+01	4477		172		166+01	
	166+06	5744		179		166+06	
	166+11	6413		154		166+11	
	166+16	7081		129		166+16	
	166+21	7750		104		166+21	
	166+26	8505		106		166+26	
	166+31	8793		81		166+31	
	166+36	9081		56		166+36	
	166+41	9370		30		166+41	
	166+51	9595	<u>1</u>	7		166+51	
	166+56	9494		-18		166+56	
	166+61	9393		-43		166+61	
	166+71	8760		-68		166+71	
	166+76	8262		-93		166+76	
	166+81	7765	<u>2</u>	-118		166+81	
Section 2	166+91	6290	7765	-149		166+91	-118
	166+96	5319	619	-174		166+96	-243
	167+01	4349		-199		167+01	
	167+06	3378		-224		167+06	
Section 3	167+16	619	3378	-243	<u>2</u>	167+16	-224
	167+21	-818	-18231	-269		167+21	-411
	167+26	-2256		-294		167+26	
	167+31	-3694		-319		167+31	
	167+41	-7527		-334		167+41	
	167+46	-9411		-359		167+46	
	167+51	-11295		-384		167+51	
	167+56	-13179		-409		167+56	
Section 4	167+66	-18231	<u>3</u>	-13179	<u>3</u>	167+66	488
	167+71	-20505	-26268	-438		167+71	-490
	167+76	-22780		-464		167+76	
PIER 3	167+81	-25055		-490	<u>4</u>	167+81	
Section 4	167+86	-26268	<u>4</u>	488		167+86	
	167+91	-24064		462		167+91	
	167+96	-21861		437		167+96	
	168+01	-19657		411		168+01	
	168+06	-17454	<u>5</u>	386		168+06	

G8-2 DEAD LOADS

LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 5	168+11	-14562	2849	415	5	168+11	415
	168+16	-12682	-17454	393		168+16	249
	168+21	-10803		371		168+21	
	168+26	-8924		348		168+26	
	168+31	-7046		326		168+31	
	168+36	-4815		337		168+36	
	168+41	-3323		315		168+41	
	168+46	-1830		293		168+46	
	168+51	-338		271		168+51	
	168+56	1154		249		168+56	
Section 6	168+61	2849	11345	255	6	168+61	255
	168+66	3950	1154	235		168+66	99
	168+71	5051		214		168+71	
	168+76	6152		194		168+76	
	168+81	7253		173		168+81	
	168+86	8406		172		168+86	
	168+91	9147		152		168+91	
	168+96	9889		132		168+96	
	169+01	10630		112		169+01	
Section 7	169+06	11345	6	12760		169+06	112
	169+11	11717		9000		169+11	-141
	169+16	12089		58		169+16	
	169+21	12460		37		169+21	
	169+26	12659		33		169+26	
	169+31	12709		13		169+31	
	169+36	12760	7	-8		169+36	
	169+46	12539		-30		169+46	
	169+51	12280		-51		169+51	
	169+56	12020		-71		169+56	
	169+66	11042		-94		169+66	
	169+71	10465		-114		169+71	
	169+76	9889	8	-134		169+76	
	169+81	9000	9889	-141	7	169+81	-134
Section 8	169+86	8095	-284	-160		169+86	-260
	169+91	7189		-180		169+91	
	169+96	6284		-200		169+96	
	170+01	5029		-201		170+01	
	170+06	3824		-221		170+06	
	170+11	2619		-240		170+11	
	170+16	1413		-260	8	170+16	
Section 9	170+21	-284	1413	-257		170+21	-257
	170+26	-1821	-8548	-277		170+26	-336
	170+31	-3359		-297		170+31	
	170+36	-4896		-317		170+36	
	170+41	-6434		-336	9	170+41	

G8-2 DEAD LOADS
LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 10	<u>170+46</u>	<u>-8548</u>	<u>9</u>	-6434	-328	170+46	-328
	170+51	-10357		-16454	-348	170+51	-388
	170+56	-12146			-368	170+56	
	170+61	-13935			<u>-388</u>	<u>10</u>	<u>170+61</u>
Section 11	<u>170+66</u>	<u>-16454</u>	<u>10</u>	-12216	-388	170+66	395
	170+71	-18500		-21460	-409	170+71	-431
	170+76	-20546			<u>-431</u>	<u>11</u>	<u>170+76</u>
PIER 4	<u>170+81</u>	<u>-21460</u>	<u>11</u>		395	170+81	
	170+86	-19701			375	170+86	
Section 11	170+91	-17941			354	170+91	
	170+96	-16182			333	170+96	
	<u>171+01</u>	<u>-14423</u>	<u>12</u>		313	171+01	
Section 12	171+06	-12216		-6288	<u>317</u>	<u>12</u>	<u>171+06</u>
	171+11	-10807		-14423	297	171+11	256
	171+16	-9399			278	171+16	
	<u>171+21</u>	<u>-7991</u>	<u>13</u>		<u>259</u>	<u>13</u>	<u>171+21</u>
Section 13	171+26	-6288		1195	256	171+26	259
	171+31	-5149		-7991	238	171+31	161
	171+36	-4010			219	171+36	
	171+41	-2871			201	171+41	
	171+46	-1638			198	171+46	
	171+51	-750			180	171+51	
	171+56	138			161	171+56	

G8-2 DEAD LOADS

LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 14	171+61	1195	5600	162	171+61	162
	171+66	1803	-243	144	171+66	-165
	171+71	2412		127	171+71	
	171+76	3020		110	171+76	
	171+81	3628		92	171+81	
	171+86	4279		94	171+86	
	171+91	4565		77	171+91	
	171+96	4851		59	171+96	
	172+01	5136		42	172+01	
	172+06	5422		24	172+06	
	172+11	5600	14	24	172+11	
	172+16	5581		7	172+16	
	172+21	5563		-11	172+21	
	172+26	5544		-28	172+26	
	172+31	5371		-28	172+31	
	172+36	5048		-45	172+36	
	172+41	4725		-63	172+41	
	172+46	4402		-80	172+46	
	172+51	4079		-97	172+51	
	172+56	3445		-95	172+56	
	172+61	2802		-113	172+61	
	172+66	2160		-130	172+66	
	172+71	1517		-147	172+71	
	172+76	874		-165	14	172+76
Section 15	172+81	-243	874	-161	172+81	-161
	172+86	-1209	-5683	-179	172+86	-232
	172+91	-2174		-197	172+91	
	172+96	-3140		-214	172+96	
	173+01	-4106		-232	15	173+01
Section 16	173+06	-5683	15	-4106	173+06	264
	173+11	-6974	-10848	-245	173+11	-301
	173+16	-8265		-264	173+16	
	173+21	-9557		-283	173+21	
PIER 5	173+26	-10848	16	-301	16	173+26
Section 16	173+31	-9856		264	173+31	
	173+36	-8647		245	173+36	
	173+41	-7439		227	173+41	
	173+46	-6231	17	208	173+46	
Section 17	173+51	-4872	-1117	210	17	173+51
	173+56	-3939	-6231	192	173+56	156
	173+61	-3006		174	173+61	
	173+66	-2072		156	173+66	

G8-2 DEAD LOADS

LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 18	173+71	-1117	3695	158	18	173+71	158
	173+76	-437	-1117	141		173+76	-128
	173+81	243		124		173+81	
	173+86	924		107		173+86	
	173+91	1527		110		173+91	
	173+96	1925		93		173+96	
	174+01	2322		76		174+01	
	174+06	2720		59		174+06	
	174+11	3117		42		174+11	
	174+16	3386		43		174+16	
	174+21	3489		26		174+21	
	174+26	3592		9		174+26	
	174+31	3695	18	-8		174+31	
	174+36	3613		-9		174+36	
	174+41	3455		-26		174+41	
	174+46	3298		-43		174+46	
	174+51	3140		-60		174+51	
	174+56	2692		-60		174+56	
	174+61	2239		-77		174+61	
	174+66	1786		-94		174+66	
	174+71	1333		-111		174+71	
	174+76	880		-128		174+76	
Section 19	174+81	52	880	-123		174+81	-123
	174+86	-720	-4327	-140		174+86	-193
	174+91	-1493		-158		174+91	
	174+96	-2265		-175		174+96	
	175+01	-3037		-193	19	175+01	
Section 20	175+06	-4327	19	-2780		175+06	251
	175+11	-5422	-8708	-204		175+11	-259
	175+16	-6518		-222		175+16	
	175+21	-7613		-240		175+21	
PIER 6	175+26	-8708	20	-259	20	175+26	
Section 20	175+31	-8301		251		175+31	
	175+36	-7211		233		175+36	
	175+41	-6121		215		175+41	
	175+46	-5032		196		175+46	
	175+51	-3942	21	178		175+51	
Section 21	175+56	-2780	977	185	21	175+56	185
	175+61	-2014	-3942	168		175+61	115
	175+66	-1247		150		175+66	
	175+71	-480		133		175+71	
	175+76	287		115		175+76	

G8-2 DEAD LOADS

LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 22	175+81	977	3584	<u>121</u>	<u>22</u>	<u>175+81</u>	121
	175+86	1427	977	104		175+86	-113
	175+91	1878		87		175+91	
	175+96	2329		70		175+96	
	176+01	2780		53		176+01	
	176+06	3094		54		176+06	
	176+11	3243		38		176+11	
	176+16	3392		21		176+16	
	176+21	3541		4		176+21	
	<u>176+26</u>	<u>3584</u>	<u>22</u>	4		176+26	
	176+31	3455		-13		176+31	
	176+36	3325		-30		176+36	
	176+41	3196		-47		176+41	
	176+46	2975		-45		176+46	
	176+51	2544		-62		176+51	
	176+56	2113		-79		176+56	
	176+61	1682		-96		176+61	
	176+66	1251		-113		176+66	
Section 23	176+71	692	1251	-109		176+71	-109
	176+76	-13	-6598	-127		176+76	-214
	176+81	-718		-144		176+81	
	176+86	-1423		-162		176+86	
	176+91	-2385		-162		176+91	
	176+96	-3334		-179		176+96	
	177+01	-4283		-197		177+01	
	177+06	-5232		<u>-214</u>	<u>23</u>	<u>177+06</u>	
Section 24	<u>177+11</u>	<u>-6598</u>	<u>23</u>	-3299		177+11	283
	177+16	-7790	-10174	-231		177+16	-267
	177+21	-8982		-249		177+21	
PIER 7	<u>177+26</u>	<u>-10174</u>	<u>24</u>	-267		177+26	
Section 24	177+31	-9674		<u>283</u>	<u>24</u>	<u>177+31</u>	
	177+36	-8423		265		177+36	
	177+41	-7172		247		177+41	
	177+46	-5921		229		177+46	
	<u>177+51</u>	<u>-4670</u>	<u>25</u>	210		177+51	
Section 25	177+56	-3299	579	<u>218</u>	<u>25</u>	<u>177+56</u>	218
	177+61	-2462	-4670	200		177+61	151
	177+66	-1625		182		177+66	
	177+71	-788		165		177+71	

G8-2 DEAD LOADS**LARSA COMPOUND LOADS OUTPUT**

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 26	177+76	579	5355	151	177+76	165
	177+81	1309	-788	151	177+81	-179
	177+86	1917		134	177+86	
	177+91	2525		117	177+91	
	177+96	3134		99	177+96	
	178+01	3742		82	178+01	
	178+06	4191		84	178+06	
	178+11	4480		67	178+11	
	178+16	4769		49	178+16	
	178+21	5058		32	178+21	
	<u>178+26</u>	<u>5355</u>	<u>26</u>	34	178+26	
	178+31	5322		17	178+31	
	178+36	5289		-1	178+36	
	178+41	5255		-19	178+41	
	178+46	5222		-36	178+46	
	178+51	5054		-33	178+51	
	178+56	4698		-51	178+56	
	178+61	4343		-69	178+61	
	178+66	3987		-87	178+66	
	178+71	3631		-105	178+71	
	178+76	2977		-101	178+76	
	178+81	2301		-119	178+81	
	178+86	1625		-137	178+86	
	178+91	949		-155	178+91	
	178+96	273		-173	178+96	
	ABUT 2	178+98	62	<u>-179</u>	<u>26</u>	<u>178+98</u>

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section	Sta.	My (k-ft)	Max/Min	Fz (k)		Sta	Max/Min
PIER 2	165+86	204	1564	40	<u>1</u>	165+86	40
Section 1	165+91	375	204	36		165+91	-25
	165+96	547		31		165+96	
	166+01	718		26		166+01	
	166+06	938		30		166+06	
	166+11	1046		25		166+11	
	166+16	1153		21		166+16	
	166+21	1260		16		166+21	
	166+26	1394		18		166+26	
	166+31	1439		13		166+31	
	166+36	1483		9		166+36	
	166+41	1528		4		166+41	
	166+51	1564	<u>1</u>	1		166+51	
	166+56	1544		-4		166+56	
	166+61	1523		-8		166+61	
	166+71	1407		-12		166+71	
	166+76	1319		-16		166+76	
	166+81	1232	<u>2</u>	-21		166+81	
Section 2	166+91	966	1232	-25		166+91	-21
	166+96	800	-23	-30		166+96	-40
	167+01	634		-34		167+01	
	167+06	468		-38		167+06	
Section 3	167+16	-23	468	-40	<u>2</u>	167+16	-38
	167+21	-260	-3118	-44		167+21	-65
	167+26	-497		-48		167+26	
	167+31	-734		-53		167+31	
	167+41	-1389		-53		167+41	
	167+46	-1688		-57		167+46	
	167+51	-1987		-61		167+51	
	167+56	-2287		-65		167+56	
Section 4	167+66	-3118	<u>3</u>	-2287	<u>3</u>	167+66	76
	167+71	-3461	-4334	-66		167+71	-74
	167+76	-3804		-70		167+76	
PIER 3	167+81	-4148		-74	<u>4</u>	167+81	
Section 4	167+86	-4334	<u>4</u>	76		167+86	
	167+91	-3993		72		167+91	
	167+96	-3652		68		167+96	
	168+01	-3311		64		168+01	
	168+06	-2970	<u>5</u>	60		168+06	

G8-2 WEARING LOADS

LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 5	168+11	-2464	527	<u>69</u>	<u>5</u>	<u>168+11</u>	69
	168+16	-2155	-2970	65		168+16	42
	168+21	-1847		61		168+21	
	168+26	-1538		57		168+26	
	168+31	-1229		53		168+31	
	168+36	-819		58		168+36	
	168+41	-565		54		168+41	
	168+46	-310		50		168+46	
	168+51	-56		46		168+51	
	168+56	199		42		168+56	
Section 6	168+61	527	2064	<u>45</u>	<u>6</u>	<u>168+61</u>	45
	168+66	720	199	41		168+66	17
	168+71	914		38		168+71	
	168+76	1107		34		168+76	
	168+81	1300		30		168+81	
	168+86	1528		31		168+86	
	168+91	1659		27		168+91	
	168+96	1790		23		168+96	
	169+01	1921		20		169+01	
Section 7	<u>169+06</u>	<u>2064</u>	<u>6</u>	2309		169+06	20
	169+11	2128		14		169+11	-25
	169+16	2192		10		169+16	
	169+21	2256		6		169+21	
	169+26	2295		5		169+26	
	169+31	2302		2		169+31	
	<u>169+36</u>	<u>2309</u>	<u>7</u>	-2		169+36	
	169+46	2262		-6		169+46	
	169+51	2214		-9		169+51	
	169+56	2165		-13		169+56	
	169+66	1977		-17		169+66	
	169+71	1872		-21		169+71	
	<u>169+76</u>	<u>1768</u>	<u>8</u>	-24		169+76	
	169+81	1587	1768	<u>-25</u>	<u>7</u>	<u>169+81</u>	-24
	169+86	1425	-116	-29		169+86	-46
Section 8	169+91	1263		-32		169+91	
	169+96	1100		-36		169+96	
	170+01	853		-36		170+01	
	170+06	640		-39		170+06	
	170+11	426		-43		170+11	
	170+16	213		<u>-46</u>	<u>8</u>	<u>170+16</u>	
Section 9	170+21	-116	213	-44		170+21	-44
	170+26	-381	-1573	-48		170+26	-58
	170+31	-646		-51		170+31	
	170+36	-911		-55		170+36	
	170+41	-1176		<u>-58</u>	<u>9</u>	<u>170+41</u>	

G8-2 WEARING LOADS
LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 10	<u>170+46</u>	<u>-1573</u>	<u>9</u>	-1176	-54	170+46	-54
	170+51	-1873		-2903	-58	170+51	-64
	170+56	-2170			-61	170+56	
	170+61	-2466			<u>-64</u>	<u>10</u>	<u>170+61</u>
Section 11	<u>170+66</u>	<u>-2903</u>	<u>10</u>	-2185	-62	170+66	63
	170+71	-3229		-3700	-65	170+71	-68
	170+76	-3555			<u>-68</u>	<u>11</u>	<u>170+76</u>
PIER 4	<u>170+81</u>	<u>-3700</u>	<u>11</u>		63	170+81	
	170+86	-3420			59	170+86	
Section 11	170+91	-3141			56	170+91	
	170+96	-2861			53	170+96	
	<u>171+01</u>	<u>-2582</u>	<u>12</u>		50	171+01	
Section 12	171+06	-2185		-1152	<u>53</u>	<u>12</u>	<u>171+06</u>
	171+11	-1949		-2582	50	171+11	43
	171+16	-1713			47	171+16	
	<u>171+21</u>	<u>-1476</u>	<u>13</u>		<u>43</u>	<u>13</u>	<u>171+21</u>
Section 13	171+26	-1152		212	45	171+26	45
	171+31	-953		-1476	41	171+31	29
	171+36	-755			38	171+36	
	171+41	-557			35	171+41	
	171+46	-315			35	171+46	
	171+51	-156			32	171+51	
	171+56	3			29	171+56	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 14	171+61	212	1037	30	171+61	30
	171+66	323	-68	26	171+66	-30
	171+71	435		23	171+71	
	171+76	546		20	171+76	
	171+81	657		17	171+81	
	171+86	790		17	171+86	
	171+91	843		14	171+91	
	171+96	896		11	171+96	
	172+01	949		8	172+01	
	172+06	1002		4	172+06	
	172+11	1037	14	5	172+11	
	172+16	1034		1	172+16	
	172+21	1030		-2	172+21	
	172+26	1027		-5	172+26	
	172+31	984		-5	172+31	
	172+36	925		-8	172+36	
	172+41	867		-11	172+41	
	172+46	808		-15	172+46	
	172+51	750		-18	172+51	
	172+56	613		-17	172+56	
	172+61	499		-20	172+61	
	172+66	384		-23	172+66	
	172+71	270		-26	172+71	
	172+76	155		-30	14	172+76
Section 15	172+81	-68	155	-27	172+81	-27
	172+86	-235	-1028	-31	172+86	-40
	172+91	-401		-34	172+91	
	172+96	-567		-37	172+96	
	173+01	-733		-40	15	173+01
Section 16	173+06	-1028	15	-733	-37	173+06
	173+11	-1239	-1874	-40	173+11	-50
	173+16	-1451		-43	173+16	
	173+21	-1662		-47	173+21	
PIER 5	173+26	-1874	16	-50	16	173+26
Section 16	173+31	-1737		44	173+31	
	173+36	-1538		40	173+36	
	173+41	-1340		37	173+41	
	173+46	-1141	17	34	173+46	
Section 17	173+51	-890	-220	36	17	173+51
	173+56	-729	-1141	33	173+56	27
	173+61	-568		30	173+61	
	173+66	-407		27	173+66	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 18	173+71	-220	671	<u>28</u>	<u>18</u>	<u>173+71</u>	28
	173+76	-99	-220	25		173+76	-23
	173+81	22		22		173+81	
	173+86	143		19		173+86	
	173+91	267		20		173+91	
	173+96	339		17		173+96	
	174+01	411		14		174+01	
	174+06	483		11		174+06	
	174+11	555		7		174+11	
	174+16	614		8		174+16	
	174+21	633		5		174+21	
	174+26	652		2		174+26	
	<u>174+31</u>	<u>671</u>	<u>18</u>	-2		174+31	
	174+36	654		-2		174+36	
	174+41	625		-5		174+41	
	174+46	596		-8		174+46	
	174+51	567		-11		174+51	
	174+56	473		-10		174+56	
	174+61	391		-14		174+61	
	174+66	309		-17		174+66	
	174+71	228		-20		174+71	
	174+76	146		-23		174+76	
Section 19	174+81	-20	146	-21		174+81	-21
	174+86	-155	-800	-24		174+86	-34
	174+91	-289		-28		174+91	
	174+96	-424		-31		174+96	
	175+01	-558		<u>-34</u>	<u>19</u>	<u>175+01</u>	
Section 20	<u>175+06</u>	<u>-800</u>	<u>19</u>	-504		175+06	42
	175+11	-982	-1527	-34		175+11	-43
	175+16	-1164		-37		175+16	
	175+21	-1346		-40		175+21	
PIER 6	<u>175+26</u>	<u>-1527</u>	<u>20</u>	<u>-43</u>	<u>20</u>	<u>175+26</u>	
Section 20	175+31	-1459		42		175+31	
	175+36	-1276		39		175+36	
	175+41	-1094		36		175+41	
	175+46	-911		33		175+46	
Section 21	<u>175+51</u>	<u>-728</u>	<u>21</u>	29		175+51	
	175+56	-504	180	<u>33</u>	<u>21</u>	<u>175+56</u>	33
	175+61	-369	-728	30		175+61	20
	175+66	-234		26		175+66	
	175+71	-99		23		175+71	
	175+76	37		20		175+76	

G8-2 WEARING LOADS

LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 22	175+81	180	667	<u>22</u>	<u>22</u>	<u>175+81</u>	22
	175+86	262	180	19		175+86	-21
	175+91	344		16		175+91	
	175+96	427		13		175+96	
	176+01	509		9		176+01	
	176+06	577		10		176+06	
	176+11	605		7		176+11	
	176+16	632		4		176+16	
	176+21	659		0		176+21	
	<u>176+26</u>	<u>667</u>	<u>22</u>	1		176+26	
	176+31	643		-2		176+31	
	176+36	618		-6		176+36	
	176+41	593		-9		176+41	
	176+46	542		-8		176+46	
	176+51	462		-11		176+51	
	176+56	382		-15		176+56	
	176+61	302		-18		176+61	
	176+66	222		-21		176+66	
	176+71	104	222	-19		176+71	-19
	176+76	-23	-1215	-23		176+76	-38
Section 23	176+81	-150		-26		176+81	
	176+86	-277		-29		176+86	
	176+91	-465		-28		176+91	
	176+96	-630		-31		176+96	
	177+01	-796		-34		177+01	
	177+06	-961		<u>-38</u>	<u>23</u>	<u>177+06</u>	
	<u>177+11</u>	<u>-1215</u>	<u>23</u>	-35		177+11	48
Section 24	177+16	-1415	-1814	-39		177+16	-45
	177+21	-1614		-42		177+21	
	<u>177+26</u>	<u>-1814</u>	<u>24</u>	-45		177+26	
PIER 7	177+31	-1726		<u>48</u>	<u>24</u>	<u>177+31</u>	
Section 24	177+36	-1514		45		177+36	
	177+41	-1302		42		177+41	
	177+46	-1090		39		177+46	
	<u>177+51</u>	<u>-877</u>	<u>25</u>	35		177+51	
Section 25	177+56	-609	81	<u>39</u>	<u>25</u>	<u>177+56</u>	39
	177+61	-462	-877	35		177+61	27
	177+66	-314		32		177+66	
	177+71	-167		29		177+71	

G8-2 WEARING LOADS
LARSA COMPOUND LOADS OUTPUT

PRINTED: 7/18/2015

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 26	177+76	81	988	27	177+76	29
	177+81	235	-167	28	177+81	-32
	177+86	345		24	177+86	
	177+91	456		21	177+91	
	177+96	566		18	177+96	
	178+01	676		15	178+01	
	178+06	773		16	178+06	
	178+11	825		12	178+11	
	178+16	878		9	178+16	
	178+21	931		6	178+21	
	<u>178+26</u>	<u>988</u>	<u>26</u>	7	178+26	
	178+31	981		3	178+31	
	178+36	974		0	178+36	
	178+41	968		-4	178+41	
	178+46	961		-7	178+46	
	178+51	921		-6	178+51	
	178+56	856		-9	178+56	
	178+61	791		-13	178+61	
	178+66	726		-16	178+66	
	178+71	661		-19	178+71	
	178+76	529		-17	178+76	
	178+81	410		-21	178+81	
	178+86	290		-24	178+86	
	178+91	171		-28	178+91	
	178+96	51		-31	178+96	
	ABUT 2	178+98	14	<u>-32</u>	<u>26</u>	<u>178+98</u>

NOTE: Member refers to the LARSA member ID.

Section	Member	Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
PIER 2	415	1	2
Section 1	415	1	2
	415	0	1
	415	0	1
	416	2	1
	416	2	1
	416	1	1
	416	1	1
	417	2	0
	417	2	0
	417	4	0
	417	4	0
	418	2	0
	418	2	0
	418	11	2
	418	11	2
	419	<u>20</u>	<u>3</u>
	419	20	3
	419	34	5
	419	34	5
Section 2	420	<u>37</u>	<u>5</u>
	420	37	5
	420	28	4
	420	28	4
Section 3	421	20	4
	421	20	4
	421	31	6
	421	31	6
	422	42	6
	422	42	6
	422	71	11
Section 4	422	<u>71</u>	<u>11</u>
	423	69	12
	423	69	12
	423	152	30
PIER 3	423	152	30
	424	<u>171</u>	<u>33</u>
Section 4	424	171	33
	424	134	23
	424	<u>134</u>	<u>23</u>

NOTE: Member refers to the LARSA member ID.

Section	Member	Mz (k-ft) Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
Section 5	425	116	19
	425	116	19
	425	48	8
	425	48	8
	426	37	7
	426	37	7
	426	2	1
	426	2	1
Section 6	427	0	1
	427	0	1
	427	12	3
	427	12	3
	428	24	4
	428	24	4
	428	35	6
	428	<u>35</u>	<u>6</u>
Section 7	429	32	6
	429	32	6
	429	21	4
	429	21	4
	430	15	3
	430	15	3
	430	1	0
	430	1	0
	431	<u>3</u>	<u>1</u>
	431	3	1
	431	1	0
	431	1	0
	432	7	2
	432	7	2
	432	10	2
	432	<u>10</u>	<u>2</u>
Section 8	433	7	1
	433	7	1
	433	4	0
	433	4	0
	434	2	1
	434	2	1
	434	2	1
	434	2	1
Section 9	435	3	0
	435	3	0
	435	5	0
	435	5	0

NOTE: Member refers to the LARSA member ID.

Mz (k-ft)		Lateral Bending		
Section	Member	DC		DW
		ABS(MAX)		ABS(Max)
Section 10	436	<u>6</u>	<u>9</u>	<u>2</u>
	436	6		2
	436	1		2
	436	<u>1</u>	<u>10</u>	<u>2</u>
Section 11	437	1		1
	437	1		1
	437	17		5
PIER 4	437	17		5
	438	<u>18</u>	<u>11</u>	<u>5</u>
Section 11	438	18		5
	438	4		1
	438	<u>4</u>	<u>12</u>	<u>1</u>
Section 12	439	4		1
	439	4		1
	439	0		1
	439	0		1
Section 13	440	<u>1</u>	<u>13</u>	<u>1</u>
	440	1		1
	440	1		1
	440	1		1
	441	0		1
	441	0		1
	441	0		1
	441	0		1

NOTE: Member refers to the LARSA member ID.

Section	Member	Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
Section 14	442	1	1
	442	1	1
	442	1	1
	442	1	1
	443	1	0
	443	1	0
	443	0	0
	443	0	0
	444	0	0
	444	0	0
	444	0	0
	445	<u>1</u>	<u>1</u>
	445	1	1
	445	0	0
	445	0	0
	446	1	1
	446	1	1
	446	1	1
	446	1	1
Section 15	447	1	1
	447	1	1
	447	1	1
	447	1	1
Section 16	448	<u>3</u>	<u>1</u>
	448	3	1
	448	8	3
PIER 5	448	8	3
	449	<u>9</u>	<u>2</u>
Section 16	449	9	2
	449	5	1
	449	<u>5</u>	<u>1</u>
Section 17	450	2	1
	450	2	1
	450	0	1
	450	0	1

NOTE: Member refers to the LARSA member ID.

Section	Member	Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
Section 18	451	1	1
	451	1	1
	451	1	1
	451	1	1
	452	0	0
	452	0	0
	452	0	0
	452	0	0
	453	0	0
	453	<u>0</u>	<u>18</u>
	453	0	0
	453	0	0
	454	0	0
	454	0	0
	454	0	0
	454	0	0
	455	0	0
	455	0	0
	455	0	0
	455	0	0
Section 19	456	0	1
	456	0	1
	456	1	1
	456	1	1
Section 20	457	<u>3</u>	<u>19</u>
	457	3	1
	457	6	2
PIER 6	457	<u>6</u>	<u>20</u>
	458	6	2
Section 20	458	6	2
	458	4	1
Section 21	458	<u>4</u>	<u>21</u>
	459	1	1
	459	1	1
	459	1	1

NOTE: Member refers to the LARSA member ID.

Mz (k-ft)		Lateral Bending	
Section	Member	DC	DW
		ABS(MAX)	ABS(Max)
Section 22	460	0	0
	460	0	0
	460	0	0
	460	0	0
	461	0	0
	461	0	0
	461	0	0
	461	0	0
	462	<u>0</u>	<u>22</u>
	462	0	0
	462	0	0
	462	0	0
	463	0	0
	463	0	0
	463	0	0
	463	0	0
Section 23	464	1	1
	464	1	1
	464	1	1
	464	1	1
	465	1	1
	465	1	1
	465	1	1
Section 24	466	<u>5</u>	<u>23</u>
	466	5	1
	466	9	2
PIER 7	466	<u>9</u>	<u>24</u>
	467	5	2
Section 24	467	5	2
	467	7	2
	467	7	2
Section 25	468	<u>10</u>	<u>25</u>
	468	10	1
	468	9	1
	468	9	1

NOTE: Member refers to the LARSA member ID.

Section	Member	Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
Section 26	469	9	1
	469	9	1
	469	0	1
	469	0	1
	470	1	0
	470	1	0
	470	0	0
	470	0	0
	471	0	0
	471	0	0
	471	<u>0</u>	<u>0</u>
	471	0	0
	472	0	0
	472	0	0
	472	0	0
	472	0	0
	473	1	1
	473	1	1
	473	1	1
	473	1	1
	474	1	1
	474	1	1
	474	1	1
	474	1	1
ABUT 2	474	1	1

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

+My (k-ft) (HL-93 Truck + Lane)							
1 Lane	2 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L2+L3					
m= 1.20	m= 1.00	m= 0.85	m= 0.65				
495	708	771	690	PIER 2	165+86	771	6611
962	1344	1426	1255		165+91	1426	771
1430	1981	2083	1821		165+96	2083	
1897	2617	2740	2389		166+01	2740	
2328	3237	3432	3027		166+06	3432	
2515	3531	3776	3345		166+11	3776	
2777	3920	4203	3726		166+16	4203	
3094	4370	4681	4148		166+21	4681	
3393	4814	5188	4634		166+26	5188	
3477	4956	5372	4815	Section 1	166+31	5372	
3587	5140	5592	5026		166+36	5592	
3767	5404	5881	5288		166+41	5881	
3974	5736	6281	5690		<u>166+51</u>	<u>6281</u>	<u>1</u>
3996	5784	6353	5769		166+56	6353	
4096	5925	6505	5910		166+61	6505	
4144	6006	6611	6034		166+71	6611	
4084	5931	6541	5986		166+76	6541	
4094	5937	6542	5993		<u>166+81</u>	<u>6542</u>	<u>2</u>
3989	5789	6389	5893		166+91	6389	6542
3806	5529	6112	5661	Section 2	166+96	6112	5102
3669	5320	5882	5466		167+01	5882	
3600	5196	5726	5327		167+06	5726	
3263	4669	5102	4734		167+16	5102	5726
2979	4271	4681	4380		167+21	4681	1480
2744	3926	4307	4063		167+26	4307	
2583	3679	4019	3812	Section 3	167+31	4019	
2088	2917	3145	3009		167+41	3145	
1752	2451	2652	2597		167+46	2652	
1504	2090	2258	2263		167+51	2263	
1346	1860	1995	2034		167+56	2034	
828	1175	1327	1480		167+66	1480	2034
659	1013	1186	1383	Section 4	167+71	1383	1137
644	996	1173	1386		167+76	1386	
658	1017	1196	1417		167+81	1417	
656	1014	1192	1389	PIER 3	167+86	1389	
617	954	1120	1296		167+91	1296	
578	893	1048	1203	Section 4	167+96	1203	
580	875	1012	1137		168+01	1137	
811	1063	1153	1208		168+06	1208	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

1047	1351	1389	1336	Section 5	168+11	1389	4213
1112	1443	1457	1359		168+16	1457	1208
1232	1603	1613	1454		168+21	1613	
1458	1893	1899	1658		168+26	1899	
1745	2260	2263	1941		168+31	2263	
1919	2548	2620	2283		168+36	2620	
1988	2680	2793	2456		168+41	2793	
2114	2883	3038	2692		168+46	3038	
2342	3210	3398	3025		168+51	3398	
2618	3594	3819	3410		168+56	3819	
2795	3900	4213	3855	Section 6	168+61	4213	6615
2878	4075	4449	4102		168+66	4449	3819
3015	4309	4737	4390		168+71	4737	
3239	4636	5106	4740		168+76	5106	
3491	4994	5505	5114		168+81	5505	
3618	5220	5795	5444		168+86	5795	
3680	5344	5961	5621		168+91	5961	
3810	5541	6190	5847		168+96	6190	
3980	5780	6457	6103		169+01	6457	
4032	5892	6615	6307		<u>169+06</u>	<u>6615</u>	<u>6</u> 6941
4039	5924	6668	6373	Section 7	169+11	6668	5791
4108	6021	6778	6483		169+16	6778	
4219	6165	6931	6627		169+21	6931	
4204	6162	6941	6656		169+26	6941	
4165	6118	6903	6634		169+31	6903	
4190	6140	6924	6658		<u>169+36</u>	<u>6924</u>	<u>7</u>
4153	6078	6846	6587		169+46	6846	
4064	5957	6720	6479		169+51	6720	
4044	5909	6656	6419		169+56	6656	
3884	5657	6355	6120		169+66	6355	
3743	5459	6139	5925	Section 8	169+71	6139	
3672	5333	5985	5777		<u>169+76</u>	<u>5985</u>	<u>8</u>
3616	5199	5791	5536		169+81	5791	5985
3392	4884	5445	5220		169+86	5445	3183
3198	4604	5131	4929		169+91	5131	
3076	4398	4883	4689		169+96	4883	
2953	4169	4586	4352		170+01	4586	
2691	3787	4163	3963		170+06	4163	
2482	3476	3802	3623		170+11	3802	
2358	3258	3537	3359		170+16	3537	
2219	2991	3183	2950	Section 9	170+21	3183	3537
1934	2596	2758	2565		170+26	2758	1732
1685	2257	2393	2235		170+31	2393	
1525	2017	2127	1995		170+36	2127	
1436	1870	1954	1841		170+41	1954	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

1331	1689	1732	1640	Section 10	170+46	1732	1954
1095	1412	1479	1458		170+51	1479	1271
918	1207	1312	1350		170+56	1350	
816	1114	1246	1325		170+61	1325	
643	977	1144	1271	Section 11	170+66	1271	1598
640	995	1179	1327		170+71	1327	1271
675	1051	1246	1407		170+76	1407	
684	1065	1263	1431	PIER 4	170+81	1431	
656	1021	1212	1366		170+86	1366	
630	981	1163	1307	Section 11	170+91	1307	
655	993	1163	1287		170+96	1287	
932	1225	1353	1414		171+01	1414	
1158	1505	1598	1598	Section 12	171+06	1598	2634
1248	1637	1731	1692		171+11	1731	1414
1401	1846	1951	1862		171+16	1951	
1635	2143	2256	2116		171+21	2256	
1836	2464	2634	2489	Section 13	171+26	2634	4549
1936	2634	2834	2671		171+31	2834	2256
2095	2871	3099	2908		171+36	3099	
2315	3181	3434	3205		171+41	3434	
2464	3440	3752	3528		171+46	3752	
2579	3622	3960	3719		171+51	3960	
2748	3857	4213	3946		171+56	4213	
2950	4150	4549	4271	Section 14	171+61	4549	5235
2958	4194	4615	4341		171+66	4615	2165
2992	4263	4704	4429		171+71	4704	
3087	4398	4852	4562		171+76	4852	
3228	4579	5038	4725		171+81	5038	
3336	4737	5218	4895		171+86	5218	
3270	4673	5164	4858		171+91	5164	
3230	4633	5132	4838		171+96	5132	
3264	4671	5169	4871		172+01	5169	
3331	4743	5235	4926		172+06	5235	
3324	4734	5222	4902		172+11	5222	14
3205	4581	5065	4773		172+16	5065	
3129	4472	4946	4673		172+21	4946	
3108	4421	4879	4614		172+26	4879	
3077	4346	4771	4476		172+31	4771	
2873	4072	4481	4232		172+36	4481	
2689	3819	4213	4006		172+41	4213	
2574	3637	4006	3827		172+46	4006	
2498	3500	3839	3680		172+51	3839	
2373	3284	3563	3366		172+56	3563	
2085	2897	3157	3031		172+61	3157	
1847	2559	2795	2732		172+66	2795	
1745	2391	2594	2562		172+71	2594	
1697	2293	2471	2462		172+76	2471	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

1556	2050	2165	2121	Section 15	172+81	2165	2471
1305	1752	1873	1904		172+86	1904	1599
1120	1530	1659	1753		172+91	1753	
1041	1428	1557	1692		172+96	1692	
1015	1388	1531	1700		173+01	1700	
894	1293	1466	1599	Section 16	173+06	1599	2110
849	1293	1500	1671		173+11	1671	1599
908	1390	1617	1808		173+16	1808	
982	1505	1751	1958		173+21	1958	
1057	1620	1887	2110	PIER 5	173+26	2110	
887	1363	1594	1851		173+31	1851	
843	1296	1517	1755	Section 16	173+36	1755	
822	1256	1465	1678		173+41	1678	
925	1326	1509	1676		173+46	1676	
970	1360	1532	1744	Section 17	173+51	1744	2317
1047	1460	1617	1781		173+56	1781	1676
1210	1657	1808	1911		173+61	1911	
1444	1933	2078	2105		173+66	2105	
1492	2049	2246	2317	Section 18	173+71	2317	4112
1576	2183	2398	2427		173+76	2427	2317
1750	2431	2661	2625		173+81	2661	
2004	2761	2996	2879		173+86	2996	
2065	2884	3161	3065		173+91	3161	
2124	2987	3282	3154		173+96	3282	
2225	3138	3444	3277		174+01	3444	
2390	3353	3663	3444		174+06	3663	
2574	3591	3904	3629		174+11	3904	
2576	3615	3948	3692		174+16	3948	
2568	3620	3958	3691		174+21	3958	
2614	3681	4018	3728		174+26	4018	
2701	3782	4112	3793		174+31	4112	18
2638	3696	4018	3709		174+36	4018	
2563	3595	3912	3607		174+41	3912	
2539	3550	3852	3540		174+46	3852	
2559	3547	3831	3504		174+51	3831	
2410	3324	3574	3258		174+56	3574	
2231	3083	3317	3028		174+61	3317	
2080	2870	3085	2816		174+66	3085	
2005	2733	2920	2657		174+71	2920	
1953	2627	2783	2519		174+76	2783	
1715	2264	2364	2114	Section 19	174+81	2364	2783
1472	1940	2029	1823		174+86	2029	1232
1273	1679	1758	1599		174+91	1758	
1176	1527	1591	1461		174+96	1591	
1121	1436	1486	1390		175+01	1486	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

906	1150	1232	1208	Section 20	175+06	1232	1486
633	928	1055	1100		175+11	1100	1100
599	914	1061	1135		175+16	1135	
637	975	1132	1221		175+21	1221	
680	1040	1208	1314	PIER 6	175+26	1314	
668	1021	1189	1298		175+31	1298	
618	949	1110	1213	Section 20	175+36	1213	
592	904	1054	1145		175+41	1145	
710	991	1113	1166		175+46	1166	
989	1229	1305	1293		175+51	1305	
1106	1424	1479	1424	Section 21	175+56	1479	2647
1168	1522	1591	1504		175+61	1591	1305
1288	1699	1782	1660		175+66	1782	
1495	1972	2068	1900		175+71	2068	
1738	2295	2407	2185	Section 22	175+76	2407	
1834	2482	2647	2428		175+81	2647	3811
1889	2591	2784	2554		175+86	2784	2647
1986	2749	2965	2713		175+91	2965	
2149	2974	3204	2918		175+96	3204	
2336	3225	3468	3141		176+01	3468	
2373	3303	3574	3254		176+06	3574	
2361	3310	3594	3274		176+11	3594	
2400	3371	3662	3332		176+16	3662	
2489	3483	3775	3424		176+21	3775	
2516	3517	3811	3454		176+26	3811	22
2426	3407	3701	3360		176+31	3701	
2379	3340	3628	3294		176+36	3628	
2391	3335	3611	3271		176+41	3611	
2410	3330	3580	3218		176+46	3580	
2228	3085	3322	2996		176+51	3322	
2065	2863	3085	2790		176+56	3085	
1957	2695	2896	2622		176+61	2896	
1897	2585	2758	2492		176+66	2758	
1850	2466	2592	2306	Section 23	176+71	2592	2758
1599	2130	2237	1999		176+76	2237	702
1418	1867	1947	1744		176+81	1947	
1323	1710	1767	1581		176+86	1767	
1212	1512	1519	1331		176+91	1519	
984	1222	1225	1089		176+96	1225	
807	1001	1003	911		177+01	1003	
706	866	867	814		177+06	867	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

522	656	696	702		177+11	702	1369
368	547	623	672	Section 24	177+16	672	672
393	596	687	749		177+21	749	
437	665	768	842	PIER 7	177+26	842	
435	663	766	848		177+31	848	
419	639	739	814		177+36	814	
416	628	724	790	Section 24	177+41	790	
544	739	817	850		177+46	850	
839	1015	1054	1024		177+51	1054	
1006	1305	1369	1309		177+56	1369	2649
1098	1460	1556	1473	Section 25	177+61	1556	1054
1234	1685	1811	1692		177+66	1811	
1466	2006	2148	1975		177+71	2148	
1844	2499	2649	2381		177+76	2649	4202
1903	2607	2796	2538		177+81	2796	75
1993	2754	2965	2684		177+86	2965	
2143	2971	3197	2877		177+91	3197	
2340	3232	3466	3099		177+96	3466	
2574	3532	3770	3348		178+01	3770	
2586	3585	3853	3438		178+06	3853	
2593	3608	3884	3462		178+11	3884	
2652	3689	3966	3525		178+16	3966	
2758	3817	4088	3619		178+21	4088	
2862	3939	4202	3699		<u>178+26</u>	<u>4202</u>	<u>26</u>
2758	3804	4062	3577		178+31	4062	
2665	3681	3933	3462	Section 26	178+36	3933	
2629	3614	3850	3384		178+41	3850	
2630	3594	3810	3337		178+46	3810	
2602	3512	3686	3191		178+51	3686	
2360	3194	3359	2912		178+56	3359	
2156	2910	3060	2654		178+61	3060	
1972	2647	2779	2410		178+66	2779	
1868	2460	2562	2215		178+71	2562	
1643	2117	2157	1829		178+76	2157	
1262	1634	1670	1419		178+81	1670	
881	1152	1183	1010		178+86	1183	
501	670	697	602		178+91	697	
120	188	213	198		178+96	213	
4	39	65	75	ABUT 2	178+98	75	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

- My (k-ft) (HL-93 Double Truck + Lane)

1 Lane	2 Lanes	3 Lanes	7 Lanes				
L1	L1+L2	L1+L2+L3		Section	Sta.	Max	My Max/Min
m= 1.20	m= 1.00	m= 0.85	m= 0.65				
-86	-135	-160	-171	PIER 2	165+86	-86	-86
-159	-247	-292	-310		165+91	-159	-1776
-231	-359	-424	-450		165+96	-231	
-303	-472	-557	-589		166+01	-303	
-380	-593	-701	-746		166+06	-380	
-454	-706	-835	-884		166+11	-454	
-527	-820	-968	-1022		166+16	-527	
-601	-934	-1102	-1160		166+21	-601	
-679	-1058	-1250	-1319		166+26	-679	
-757	-1177	-1388	-1456	Section 1	166+31	-757	
-834	-1295	-1526	-1594		166+36	-834	
-912	-1414	-1664	-1732		166+41	-912	
-1076	-1667	-1961	-2033		166+51	-1076	
-1159	-1793	-2104	-2172		166+56	-1159	
-1243	-1918	-2248	-2311		166+61	-1243	
-1412	-2176	-2547	-2608		166+71	-1412	
-1501	-2307	-2694	-2745		166+76	-1501	
-1590	-2438	-2841	-2882		166+81	-1590	
-1776	-2724	-3176	-3218		166+91	-1776	-1590
-1863	-2847	-3310	-3335	Section 2	166+96	-1863	-2202
-1950	-2970	-3443	-3451		167+01	-1950	
-2037	-3093	-3577	-3567		167+06	-2037	
-2202	-3335	-3846	-3806		167+16	-2202	-2037
-2298	-3466	-3983	-3921		167+21	-2298	-4261
-2395	-3597	-4121	-4036		167+26	-2395	
-2491	-3728	-4258	-4151	Section 3	167+31	-2491	
-2765	-4081	-4628	-4467		167+41	-2765	
-2986	-4338	-4869	-4657		167+46	-2986	
-3247	-4685	-5192	-4912		167+51	-3247	
-3551	-5096	-5604	-5237		167+56	-3551	
-4261	-6122	-6718	-6198		167+66	-4261	3 -3551
-4679	-6693	-7314	-6700	Section 4	167+71	-4679	-5914
-5156	-7332	-7976	-7254		167+76	-5156	
-5675	-8023	-8685	-7846	PIER 3	167+81	-5675	
-5914	-8339	-9010	-8100		167+86	-5914	4
-5389	-7639	-8292	-7477		167+91	-5389	
-4875	-6954	-7586	-6866	Section 4	167+96	-4875	
-4407	-6317	-6922	-6285		168+01	-4407	
-3985	-5734	-6308	-5745		168+06	-3985	5

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

-3571	-5095	-5559	-5008	Section 5	168+11	-3571	-1229
-3201	-4579	-5009	-4518		168+16	-3201	-3985
-2864	-4106	-4501	-4068		168+21	-2864	
-2558	-3676	-4040	-3659		168+26	-2558	
-2282	-3289	-3625	-3293		168+31	-2282	
-2024	-2909	-3197	-2899		168+36	-2024	
-1808	-2611	-2883	-2640		168+41	-1808	
-1621	-2354	-2616	-2427		168+46	-1621	
-1457	-2135	-2394	-2258		168+51	-1457	
-1315	-1948	-2212	-2132		168+56	-1315	
-1229	-1831	-2095	-2054	Section 6	168+61	-1229	-1052
-1164	-1770	-2050	-2044		168+66	-1164	-1315
-1138	-1744	-2035	-2058		168+71	-1138	
-1114	-1719	-2021	-2074		168+76	-1114	
-1089	-1695	-2007	-2090		168+81	-1089	
-1092	-1699	-2010	-2102		168+86	-1092	
-1079	-1685	-2003	-2116		168+91	-1079	
-1065	-1672	-1997	-2130		168+96	-1065	
-1052	-1659	-1990	-2145		169+01	-1052	
-1058	-1667	-1999	-2164		169+06	-1058	-1035
-1050	-1659	-1993	-2171	Section 7	169+11	-1050	-1135
-1043	-1651	-1988	-2178		169+16	-1043	
-1035	-1643	-1982	-2185		169+21	-1035	
-1046	-1658	-1997	-2201		169+26	-1046	
-1046	-1658	-1998	-2206		169+31	-1046	
-1046	-1659	-1999	-2211		169+36	-1046	
-1059	-1678	-2019	-2233		169+46	-1059	
-1067	-1688	-2028	-2238		169+51	-1067	
-1075	-1698	-2036	-2242		169+56	-1075	
-1096	-1727	-2065	-2262		169+66	-1096	
-1111	-1745	-2080	-2265	Section 8	169+71	-1111	
-1127	-1763	-2094	-2268		169+76	-1127	
-1135	-1776	-2110	-2277		169+81	-1135	-1127
-1157	-1800	-2127	-2274		169+86	-1157	-1624
-1179	-1825	-2145	-2271		169+91	-1179	
-1205	-1851	-2164	-2271		169+96	-1205	
-1234	-1894	-2207	-2300		170+01	-1234	
-1292	-1958	-2264	-2324		170+06	-1292	
-1373	-2055	-2351	-2374		170+11	-1373	
-1489	-2190	-2480	-2461		170+16	-1489	
-1624	-2378	-2667	-2600	Section 9	170+21	-1624	-1489
-1792	-2601	-2894	-2765		170+26	-1792	-2731
-1982	-2861	-3168	-2982		170+31	-1982	
-2200	-3161	-3490	-3250		170+36	-2200	
-2448	-3506	-3862	-3568		170+41	-2448	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

-2731	-3935	-4357	-4038	Section 10	<u>170+46</u>	<u>-2731</u>	<u>9</u>	-2448
-3038	-4360	-4817	-4445		170+51	-3038		-4160
-3374	-4823	-5316	-4886		170+56	-3374		
-3743	-5326	-5855	-5363		170+61	-3743		
-4160	-5935	-6535	-6002	Section 11	<u>170+66</u>	<u>-4160</u>	<u>10</u>	-3247
-4604	-6526	-7157	-6546		170+71	-4604		-5298
-5096	-7166	-7824	-7124		170+76	-5096		
-5298	-7412	-8069	-7339		<u>170+81</u>	<u>-5298</u>	<u>11</u>	
-4819	-6793	-7429	-6792	PIER 4	170+86	-4819		
-4358	-6193	-6808	-6261		170+91	-4358		
-3957	-5655	-6243	-5775		170+96	-3957		
-3597	-5165	-5724	-5328		<u>171+01</u>	<u>-3597</u>	<u>12</u>	
-3247	-4647	-5140	-4791	Section 12	171+06	-3247		-2249
-2952	-4247	-4718	-4432		171+11	-2952		-3597
-2688	-3891	-4342	-4116		171+16	-2688		
-2453	-3575	-4014	-3845		<u>171+21</u>	<u>-2453</u>	<u>13</u>	
-2249	-3282	-3692	-3564	Section 13	171+26	-2249		-1577
-2070	-3049	-3458	-3380		171+31	-2070		-2453
-1917	-2854	-3264	-3235		171+36	-1917		
-1789	-2703	-3120	-3137		171+41	-1789		
-1729	-2625	-3036	-3067		171+46	-1729		
-1668	-2544	-2954	-3011		171+51	-1668		
-1607	-2463	-2872	-2955		171+56	-1607		

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

-1577	-2418	-2819	-2905	Section 14	171+61	-1577	-810
-1524	-2343	-2739	-2844		171+66	-1524	-1577
-1470	-2268	-2660	-2784		171+71	-1470	
-1417	-2193	-2580	-2723		171+76	-1417	
-1363	-2119	-2501	-2663		171+81	-1363	
-1342	-2083	-2455	-2609		171+86	-1342	
-1295	-2014	-2379	-2544		171+91	-1295	
-1248	-1945	-2303	-2480		171+96	-1248	
-1201	-1877	-2228	-2416		172+01	-1201	
-1154	-1808	-2152	-2351		172+06	-1154	
-1135	-1776	-2110	-2296		172+11	-1135	
-1093	-1712	-2038	-2229		172+16	-1093	
-1051	-1649	-1965	-2161		172+21	-1051	
-1009	-1586	-1893	-2094		172+26	-1009	
-990	-1555	-1854	-2038		172+31	-990	
-952	-1495	-1784	-1967		172+36	-952	
-914	-1436	-1714	-1896		172+41	-914	
-876	-1376	-1644	-1826		172+46	-876	
-838	-1317	-1573	-1757		172+51	-838	
-834	-1304	-1550	-1700		172+56	-834	
-810	-1258	-1491	-1640		172+61	-810	
-830	-1265	-1485	-1625		172+66	-830	
-935	-1380	-1587	-1702		172+71	-935	
-1071	-1552	-1752	-1836		172+76	-1071	
-1260	-1812	-2012	-2015	Section 15	172+81	-1260	-1071
-1452	-2076	-2290	-2248		172+86	-1452	-2604
-1679	-2390	-2623	-2537		172+91	-1679	
-1942	-2750	-3005	-2869		172+96	-1942	
-2244	-3158	-3434	-3241	Section 16	173+01	-2244	
-2604	-3676	-3997	-3677		<u>173+06</u>	<u>-2604</u>	<u>15</u> -2244
-2963	-4161	-4508	-4120		173+11	-2963	-4289
-3381	-4706	-5071	-4605		173+16	-3381	
-3831	-5286	-5667	-5116	PIER 5	173+21	-3831	
-4289	-5874	-6271	-5633		<u>173+26</u>	<u>-4289</u>	<u>16</u>
-3809	-5229	-5595	-5134	Section 16	173+31	-3809	
-3367	-4671	-5031	-4655		173+36	-3367	
-2964	-4155	-4505	-4205		173+41	-2964	
-2619	-3696	-4030	-3796	Section 17	<u>173+46</u>	<u>-2619</u>	<u>17</u>
-2255	-3184	-3482	-3384		173+51	-2255	-1310
-1972	-2808	-3094	-3057		173+56	-1972	-2619
-1728	-2481	-2757	-2772		173+61	-1728	
-1521	-2204	-2487	-2542		173+66	-1521	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

-1310	-1915	-2197	-2341	Section 18	173+71	-1310	-976
-1159	-1746	-2033	-2196		173+76	-1159	-1310
-1064	-1645	-1938	-2107		173+81	-1064	
-1032	-1608	-1906	-2071		173+86	-1032	
-986	-1546	-1843	-2033		173+91	-986	
-991	-1552	-1848	-2024		173+96	-991	
-995	-1559	-1853	-2019		174+01	-995	
-1000	-1565	-1858	-2016		174+06	-1000	
-1005	-1571	-1863	-2013		174+11	-1005	
-976	-1529	-1816	-1981		174+16	-976	
-986	-1540	-1824	-1974		174+21	-986	
-996	-1550	-1831	-1967		174+26	-996	
-1006	-1561	-1838	-1960		174+31	-1006	
-986	-1530	-1802	-1926		174+36	-986	
-1002	-1547	-1811	-1913		174+41	-1002	
-1018	-1563	-1821	-1901		174+46	-1018	
-1035	-1579	-1831	-1889		174+51	-1035	
-1017	-1551	-1797	-1849		174+56	-1017	
-1042	-1574	-1809	-1831		174+61	-1042	
-1066	-1596	-1821	-1814		174+66	-1066	
-1091	-1619	-1833	-1798		174+71	-1091	
-1116	-1642	-1845	-1782		174+76	-1116	
-1119	-1629	-1820	-1735	Section 19	174+81	-1119	-1116
-1240	-1763	-1941	-1804		174+86	-1240	-2068
-1391	-1949	-2119	-1940		174+91	-1391	
-1574	-2184	-2353	-2125		174+96	-1574	
-1792	-2468	-2642	-2363	Section 20	175+01	-1792	
-2068	-2865	-3077	-2746		<u>175+06</u>	<u>-2068</u>	<u>19</u> -1730
-2360	-3256	-3484	-3094		175+11	-2360	-3518
-2698	-3698	-3941	-3485		175+16	-2698	
-3095	-4208	-4460	-3925	PIER 6	175+21	-3095	
-3518	-4744	-5003	-4384		<u>175+26</u>	<u>-3518</u>	<u>20</u>
-3374	-4565	-4823	-4237	Section 20	175+31	-3374	
-2970	-4048	-4298	-3798		175+36	-2970	
-2592	-3558	-3796	-3378		175+41	-2592	
-2268	-3130	-3351	-3002		175+46	-2268	
-1984	-2748	-2951	-2663	Section 21	<u>175+51</u>	<u>-1984</u>	<u>21</u>
-1730	-2378	-2542	-2307		175+56	-1730	-997
-1509	-2088	-2245	-2073		175+61	-1509	-1984
-1323	-1846	-2019	-1899		175+66	-1323	
-1165	-1671	-1855	-1777		175+71	-1165	
-1049	-1541	-1737	-1697		175+76	-1049	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

-997	-1474	-1667	-1640	Section 22	175+81	-997	-844
-953	-1421	-1620	-1615		175+86	-953	-997
-925	-1395	-1602	-1613		175+91	-925	
-903	-1375	-1589	-1614		175+96	-903	
-882	-1355	-1575	-1616		176+01	-882	
-877	-1346	-1566	-1612		176+06	-877	
-867	-1336	-1557	-1608		176+11	-867	
-857	-1325	-1548	-1604		176+16	-857	
-847	-1314	-1540	-1600		176+21	-847	
-844	-1310	-1535	-1595		176+26	-844	
-845	-1309	-1531	-1584		176+31	-845	
-846	-1307	-1527	-1574		176+36	-846	
-847	-1306	-1522	-1564		176+41	-847	
-845	-1306	-1524	-1560		176+46	-845	
-858	-1315	-1524	-1543		176+51	-858	
-871	-1324	-1525	-1527		176+56	-871	
-884	-1332	-1525	-1512		176+61	-884	
-896	-1341	-1526	-1496		176+66	-896	
-901	-1349	-1534	-1491	Section 23	176+71	-901	-896
-935	-1374	-1545	-1476		176+76	-935	-2383
-1039	-1469	-1616	-1508		176+81	-1039	
-1184	-1642	-1776	-1618		176+86	-1184	
-1360	-1879	-2013	-1797		176+91	-1360	
-1565	-2143	-2278	-2002		176+96	-1565	
-1799	-2452	-2595	-2260		177+01	-1799	
-2067	-2807	-2961	-2564		177+06	-2067	
-2383	-3256	-3453	-2996	Section 24	<u>177+11</u>	<u>-2383</u>	<u>23</u> -1694
-2724	-3706	-3916	-3385		177+16	-2724	-3546
-3116	-4211	-4431	-3816		177+21	-3116	
-3546	-4752	-4977	-4274	PIER 7	<u>177+26</u>	<u>-3546</u>	<u>24</u>
-3390	-4546	-4762	-4101	Section 24	177+31	-3390	
-2961	-4004	-4216	-3654		177+36	-2961	
-2565	-3494	-3698	-3229		177+41	-2565	
-2222	-3043	-3236	-2849		177+46	-2222	
-1917	-2642	-2822	-2513	Section 25	<u>177+51</u>	<u>-1917</u>	<u>25</u>
-1694	-2323	-2494	-2267		177+56	-1694	-1129
-1505	-2103	-2297	-2123		177+61	-1505	-1917
-1364	-1958	-2168	-2031		177+66	-1364	
-1292	-1878	-2093	-1982		177+71	-1292	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

-1129	-1666	-1875	-1806	Section 26	177+76	-1129	-6
-1058	-1556	-1748	-1690		177+81	-1058	-1292
-1001	-1481	-1672	-1633		177+86	-1001	
-943	-1406	-1595	-1576		177+91	-943	
-886	-1331	-1519	-1520		177+96	-886	
-829	-1256	-1444	-1464		178+01	-829	
-795	-1200	-1374	-1392		178+06	-795	
-745	-1130	-1299	-1328		178+11	-745	
-696	-1060	-1223	-1265		178+16	-696	
-646	-990	-1148	-1201		178+21	-646	
-604	-924	-1070	-1121		178+26	-604	
-559	-858	-995	-1050		178+31	-559	
-515	-792	-921	-979		178+36	-515	
-470	-725	-846	-908		178+41	-470	
-425	-659	-772	-837		178+46	-425	
-385	-596	-696	-753		178+51	-385	
-344	-532	-622	-676		178+56	-344	
-302	-468	-549	-600		178+61	-302	
-261	-405	-475	-523		178+66	-261	
-219	-341	-402	-447		178+71	-219	
-176	-273	-320	-353		178+76	-176	
-136	-211	-247	-273		178+81	-136	
-95	-148	-174	-193		178+86	-95	
-55	-85	-101	-113		178+91	-55	
-14	-23	-27	-34		178+96	-14	
-6	-7	-8	-12		178+98	-6	
				ABUT 2			

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-15	-17	-13	-16	-15	-14	PIER 2	415	17
4	6	7	8	8	13	Section 1	415	13
-10	-12	-9	-11	-10	-10		415	12
3	4	5	5	5	8		415	8
-4	-4	-4	-4	-4	-4		416	4
2	2	2	3	3	4		416	4
-7	-9	-7	-8	-8	-7		416	9
2	3	3	4	4	6		416	6
-5	-6	-5	-6	-6	-6		417	6
2	3	3	3	3	4		417	4
-8	-10	-8	-10	-9	-9		417	10
3	4	3	4	4	6		417	6
-2	-1	-2	-2	-2	-2		418	2
3	3	3	3	3	4		418	4
-1	-2	-2	-2	-2	-4		418	4
2	4	4	6	5	8		418	8
-9	-13	-12	-15	-14	-16		419	16
5	8	7	9	8	9		419	9
-19	-28	-25	-31	-29	-29		419	31
9	14	13	16	15	16		419	16
-9	-14	-13	-16	-15	-17	Section 2	420	17
24	34	29	36	34	32		420	36
-4	-7	-6	-8	-8	-11		420	11
15	21	19	23	22	23		420	23
-2	-5	-7	-9	-8	-13	Section 3	421	13
2	3	3	3	4	7		421	7
-4	-5	-6	-7	-7	-9		421	9
3	3	4	4	4	5		421	5
-1	-1	-2	-2	-2	-6		422	6
12	16	13	16	15	18		422	18
-5	-7	-7	-9	-8	-12		422	12
24	33	29	36	33	32		422	36

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-30	-42	-36	-45	-42	-41	Section 4	423	45
13	16	14	17	16	19		423	19
-16	-25	-26	-32	-30	-40		423	40
12	13	13	13	13	13		423	13
-13	-13	-12	-12	-12	-13		424	13
16	24	24	30	29	45	PIER 3	424	45
-10	-12	-10	-11	-11	-13	Section 4	424	13
30	43	37	47	43	45		424	47
-31	-43	-37	-47	-43	-42	Section 5	425	47
6	8	7	9	9	13		425	13
-16	-22	-19	-23	-21	-23		425	23
3	4	4	5	5	9		425	9
-6	-7	-7	-8	-7	-8		426	8
5	8	7	9	9	13		426	13
-13	-16	-13	-16	-15	-15		426	16
5	7	6	8	7	12		426	12
-8	-10	-9	-10	-9	-10		427	10
2	3	3	3	3	6		427	6
-7	-9	-8	-9	-8	-9	Section 6	427	9
2	3	3	3	3	9		427	9
-10	-14	-13	-16	-15	-16		428	16
3	4	4	5	4	6		428	6
-16	-24	-21	-26	-24	-25		428	26
4	6	6	7	7	9		428	9

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NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)	
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65				
-5	-6	-5	-7	-6	-7	Section 7	429	7	<u>7</u>
11	15	14	16	16	18		429	18	
-6	-7	-6	-6	-6	-7		429	7	
5	6	6	6	6	11		429	11	
-5	-6	-6	-7	-6	-9		430	9	
4	4	4	4	4	5		430	5	
-7	-9	-8	-10	-9	-9		<u>430</u>	<u>10</u>	
4	4	4	4	4	7		430	7	<u>8</u>
-3	-4	-3	-4	-4	-7		431	7	
8	10	9	10	9	9		431	10	
-6	-6	-6	-6	-6	-7		431	7	
5	6	6	6	6	7		431	7	
-3	-3	-3	-4	-4	-8		432	8	
9	12	10	12	11	11		432	12	
-5	-6	-6	-6	-6	-9		432	9	
8	9	7	8	8	7	Section 8	432	9	
-3	-4	-4	-5	-4	-8		433	8	<u>8</u>
11	14	12	15	13	13		<u>433</u>	<u>15</u>	
-2	-3	-3	-4	-3	-6		433	6	
9	11	10	11	11	10		433	11	
-3	-4	-4	-5	-4	-9		434	9	
11	14	12	14	13	13		434	14	
-2	-4	-3	-4	-4	-8		434	8	
10	13	11	13	12	11	Section 9	434	13	
-4	-6	-5	-7	-6	-11		435	11	
12	16	13	16	15	16		435	16	
-2	-3	-3	-3	-3	-7	Section 10	435	7	
10	13	11	13	12	12		435	13	
-11	-15	-13	-16	-15	-20		436	20	
17	21	18	21	19	21		436	21	
-4	-6	-5	-7	-7	-15		436	15	
19	24	20	25	22	22		436	25	

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-12	-15	-13	-15	-14	-15	Section 11	437	15
7	8	7	8	8	13		437	13
-26	-32	-28	-33	-30	-46		437	46
42	53	46	54	50	54	PIER 4	437	54
-42	-52	-44	-52	-48	-57		438	57
31	42	36	44	41	58		438	58
-16	-19	-16	-19	-17	-25	Section 11	438	25
20	27	23	28	25	30		438	30
-12	-15	-13	-15	-14	-13	Section 12	439	15
2	2	2	3	3	7		439	7
-16	-19	-16	-19	-18	-21		439	21
11	15	13	16	15	20		439	20
-8	-9	-7	-8	-8	-7	Section 13	440	9
1	1	1	2	2	5		440	5
-11	-13	-11	-13	-12	-13		440	13
5	7	6	8	7	11		440	11
-8	-8	-7	-8	-7	-7		441	8
2	2	2	3	3	5		441	5
-10	-12	-10	-12	-11	-11		441	12
3	5	4	5	5	9		441	9

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-5	-6	-6	-6	-6	-5	Section 14	442	6
2	2	2	3	3	4		442	4
-7	-8	-7	-8	-7	-7		442	8
2	2	2	3	3	5		442	5
-4	-5	-4	-5	-5	-5		443	5
4	4	4	5	4	5		443	5
-5	-6	-5	-6	-6	-6		443	6
3	3	3	3	3	4		443	4
-3	-4	-4	-4	-4	-6		444	6
6	7	6	7	7	7		444	7
-4	-5	-4	-5	-5	-6		444	6
5	5	5	5	5	6		444	6
-3	-4	-4	-5	-4	-7		445	7
8	9	8	9	8	9		445	9
-3	-4	-3	-4	-4	-6		445	6
6	7	7	7	7	7		445	7
-3	-5	-4	-5	-5	-8		446	8
9	11	9	11	10	10		446	11
-3	-4	-4	-4	-4	-7		446	7
8	9	8	9	9	9		446	9
-3	-5	-5	-6	-5	-9	Section 15	447	9
10	12	10	12	11	11		447	12
-2	-3	-3	-4	-4	-7		447	7
9	10	9	10	9	9	Section 16	447	10
-8	-11	-10	-12	-11	-15		448	15
10	12	11	13	12	15		448	15
-11	-16	-14	-18	-17	-26	PIER 5	448	26
18	24	21	25	23	27		448	27
-16	-21	-17	-21	-19	-23	Section 16	449	23
11	17	14	19	17	24		449	24
-8	-10	-9	-10	-9	-13		449	13
9	12	10	13	12	15	Section 17	449	15
-8	-9	-8	-9	-8	-8		450	9
2	2	2	3	3	5		450	5
-11	-12	-10	-11	-11	-11		450	12
4	6	5	7	6	10		450	10

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NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-4	-4	-4	-4	-4	-4	Section 18	451	4
1	2	1	2	2	3		451	3
-5	-6	-5	-5	-5	-5		451	6
2	2	2	2	2	4		451	4
-3	-4	-3	-3	-3	-3		452	4
1	1	1	2	2	3		452	3
-4	-4	-4	-4	-4	-4		452	4
1	2	1	2	2	3		452	3
-3	-3	-3	-3	-3	-3		453	3
2	3	3	3	3	3		453	3
-3	-3	-3	-3	-3	-3		453	3
2	2	2	2	2	3		453	3
-2	-2	-2	-2	-2	-3		454	3
3	4	4	4	4	4		454	4
-2	-2	-2	-2	-2	-3		454	3
3	4	3	4	3	4		454	4
-1	-2	-2	-2	-2	-3		455	3
4	4	4	4	4	4		455	4
-1	-1	-1	-2	-2	-3		455	3
3	4	3	4	3	3		455	4
-3	-4	-4	-5	-5	-7	Section 19	456	7
9	10	8	9	8	9		456	10
-1	-2	-2	-2	-2	-4		456	4
6	7	6	6	6	6	Section 20	456	7
-11	-14	-12	-14	-13	-17		457	17
13	15	12	14	13	16		457	16
-16	-19	-17	-19	-18	-24	PIER 6	457	24
20	23	19	22	20	24		457	24
-19	-21	-18	-20	-18	-20	Section 20	458	21
14	16	14	16	15	21		458	21
-12	-13	-11	-12	-12	-13		458	13
9	11	10	11	11	14	Section 21	458	14
-8	-9	-7	-8	-8	-7		459	9
2	3	2	3	3	6		459	6
-10	-11	-9	-10	-10	-10		459	11
3	5	4	5	5	8		459	8

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NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-2	-2	-2	-2	-2	-2	Section 22	460	2
1	1	1	1	1	2		460	2
-3	-3	-2	-3	-3	-3		460	3
1	1	1	1	1	2		460	2
-2	-2	-2	-2	-2	-2		461	2
1	1	1	1	1	2		461	2
-2	-3	-2	-3	-2	-2		461	3
1	1	1	1	1	2		461	2
-1	-1	-2	-2	-1	-2		462	2
2	2	2	2	2	2		462	2
-1	-2	-2	-2	-2	-2		462	2
2	2	2	2	2	2		462	2
-1	-1	-1	-1	-1	-2		463	2
2	3	2	3	2	2		463	3
-1	-1	-1	-1	-1	-2		463	2
2	2	2	2	2	2		463	2
-3	-5	-4	-5	-5	-9	Section 23	464	9
11	12	10	11	10	10		464	12
-2	-3	-3	-4	-4	-7		464	7
9	10	8	9	8	8		464	10
-4	-5	-5	-6	-5	-8		465	8
9	10	8	9	9	9		465	10
-2	-3	-2	-3	-3	-6		465	6
8	9	7	8	8	8	Section 24	465	9
-11	-13	-11	-13	-12	-15		466	15
11	12	10	11	11	13		466	13
-18	-20	-18	-20	-19	-25	PIER 7	466	25
21	23	19	21	20	23		466	23
-21	-24	-20	-22	-21	-23	Section 24	467	24
16	19	16	19	18	23		467	23
-14	-16	-13	-15	-14	-16		467	16
13	16	14	16	15	18	Section 25	467	18
-9	-10	-9	-10	-9	-8		468	10
1	2	2	2	2	4		468	4
-15	-21	-18	-22	-21	-20		468	22
13	17	15	18	17	17		468	18

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NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Truck + Lane)						Section	Member	ABS(MAX)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-13	-17	-15	-18	-17	-17	Section 26	469	18
15	21	18	22	21	20		469	22
-26	-34	-29	-35	-32	-31		469	35
19	28	24	30	28	29		469	30
-6	-8	-7	-8	-8	-7		470	8
6	7	7	7	7	8		470	8
-4	-4	-4	-4	-4	-4		470	4
1	1	2	2	2	3		470	3
-2	-2	-2	-2	-2	-2		471	2
1	1	1	2	1	2		471	2
-2	-3	-2	-3	-2	-2		471	3
1	1	2	1	1	2		471	2
-1	-2	-2	-2	-2	-3		472	3
4	4	4	4	4	4		472	4
-1	-2	-2	-2	-2	-3		472	3
3	3	3	3	3	3		472	3
-1	-2	-2	-2	-2	-4		473	4
6	6	5	5	5	5		473	6
-1	-2	-2	-2	-2	-4		473	4
5	5	4	5	5	4		473	5
-2	-2	-2	-3	-3	-5		474	5
8	8	7	7	7	6		474	8
-2	-3	-3	-4	-3	-7		474	7
10	10	9	9	9	8	ABUT 2	474	10

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NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-13	-16	-12	-14	-14	-13	PIER 2	415	16
4	6	7	8	7	12		415	8
-9	-11	-8	-10	-9	-9		415	11
3	4	5	5	5	8		415	5
-4	-4	-4	-4	-4	-4		416	4
2	2	3	3	3	4		416	3
-7	-8	-6	-8	-7	-7		416	8
2	3	3	3	3	6		416	3
-5	-6	-5	-6	-5	-5		417	6
2	3	3	3	3	4		417	3
-7	-9	-7	-9	-8	-8		417	9
3	4	3	4	4	6		417	4
-2	-1	-2	-2	-2	-2		418	2
3	3	3	3	3	3		418	3
-1	-2	-2	-2	-2	-4		418	2
2	4	4	5	5	7		418	5
-8	-12	-11	-14	-13	-15		419	14
5	7	6	8	8	8		419	8
-18	-26	-23	-29	-27	-27	Section 2	419	29
8	13	12	15	14	15		419	15
-8	-12	-11	-15	-14	-16		420	15
22	31	27	34	32	30	Section 2	420	34
-4	-6	-6	-8	-7	-10		420	8
13	19	17	21	20	21		420	21
-2	-5	-6	-8	-8	-13	Section 3	421	8
2	3	3	3	4	6		421	4
-4	-6	-7	-8	-7	-10		421	8
3	3	4	4	4	5		421	4
-1	-1	-2	-2	-2	-6		422	2
11	14	12	15	14	17		422	15
-6	-8	-8	-10	-10	-13		422	10
26	36	31	38	35	34		422	38
-27	-38	-33	-41	-38	-38	Section 4	<u>423</u>	<u>41</u>
13	18	15	18	17	19		423	18
-15	-23	-26	-31	-30	-41		423	31
12	13	13	13	13	13		423	13
-12	-12	-11	-11	-11	-13	PIER 3	424	12
14	22	24	29	29	43		<u>424</u>	<u>29</u>
-10	-12	-10	-12	-11	-13	Section 4	424	12
30	43	38	48	44	46		424	48

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NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)	
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65				
-33	-47	-41	-51	-47	-46	Section 5	425	51	5
7	10	8	10	10	13		425	10	
-15	-20	-18	-22	-20	-21		425	22	
2	4	4	5	5	8		425	5	
-6	-7	-6	-7	-7	-7		426	7	
5	8	7	9	9	13		426	9	
-12	-15	-12	-15	-13	-14		426	15	
5	7	6	8	7	12		426	8	
-7	-9	-8	-10	-9	-9	Section 6	427	10	
3	3	3	4	3	6		427	4	
-7	-8	-7	-9	-8	-9		427	9	
2	3	3	3	3	8		427	3	
-9	-13	-12	-14	-13	-15		428	14	
3	4	4	5	5	6		428	5	
-15	-21	-19	-24	-22	-22		428	24	
4	7	6	8	8	10		428	8	
-5	-7	-6	-7	-7	-7	Section 7	429	7	
10	14	13	15	15	17		429	15	
-6	-7	-6	-7	-6	-7		429	7	
5	6	6	6	6	10		429	6	
-5	-6	-6	-6	-6	-9		430	6	
4	5	4	5	4	5		430	5	
-7	-9	-8	-9	-8	-9		430	9	
4	5	4	5	5	7		430	5	
-4	-4	-4	-4	-4	-7	Section 8	431	4	
8	9	8	10	9	9		431	10	
-6	-6	-6	-7	-6	-8		431	7	
6	6	6	6	6	7		431	6	
-3	-4	-4	-4	-4	-8		432	4	
9	11	9	11	10	10		432	11	
-5	-6	-6	-6	-6	-9		432	6	
8	9	7	8	8	7		432	9	
-3	-4	-4	-5	-5	-8	Section 8	433	5	
10	13	11	13	12	12		433	13	
-2	-3	-3	-4	-4	-6		433	4	
8	10	9	10	10	10		433	10	
-3	-5	-4	-5	-5	-10		434	5	
10	13	11	13	12	12		434	13	
-2	-4	-3	-4	-4	-8		434	4	
9	11	10	12	11	10		434	12	

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)	
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65				
-5	-7	-6	-7	-7	-11	Section 9	435	7	<u>9</u>
11	15	12	15	14	15		435	15	
-2	-3	-3	-3	-3	-7		435	3	
9	12	10	12	11	12		435	12	
-11	-15	-13	-16	-14	-19	Section 10	436	16	<u>10</u>
15	19	16	19	18	20		436	19	
-5	-7	-6	-8	-8	-15		436	8	
17	22	18	22	20	20		436	22	
-11	-14	-12	-15	-13	-15	Section 11	437	15	<u>11</u>
7	8	7	8	8	12		437	8	
-25	-32	-28	-33	-31	-45		437	33	
38	49	41	49	45	50		437	49	
-39	-50	-42	-50	-45	-55	Section 11	438	50	<u>12</u>
31	42	36	44	41	57		438	44	
-15	-19	-16	-19	-17	-24		438	19	
19	25	22	27	24	29		438	27	
-13	-15	-13	-15	-14	-13	Section 12	439	15	<u>13</u>
2	2	3	3	3	8		439	3	
-15	-18	-16	-18	-17	-20		439	18	
10	15	13	16	15	20		439	16	
-7	-8	-7	-8	-7	-7	Section 13	440	8	
1	2	2	2	2	4		440	2	
-10	-13	-11	-12	-11	-12		440	13	
5	7	6	8	7	11		440	8	
-7	-8	-7	-7	-7	-7		441	8	
2	2	2	3	3	5		441	3	
-9	-11	-10	-11	-10	-11		441	11	
3	5	4	6	5	9		441	6	

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)	
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65				
-5	-6	-5	-6	-5	-5	Section 14	442	6	
2	2	3	3	3	4		442	3	
-6	-7	-7	-7	-7	-7		442	7	
2	2	2	3	3	5		442	3	
-4	-5	-5	-5	-5	-6		443	5	
4	4	4	4	4	5		443	4	
-5	-6	-5	-6	-5	-6		443	6	
3	3	3	3	3	4		443	3	
-4	-4	-4	-5	-4	-6		444	5	
6	7	6	7	6	7		444	7	
-4	-5	-5	-5	-5	-6		444	5	
5	5	5	5	5	6		444	5	
-3	-4	-4	-5	-4	-7		445	5	
7	9	7	9	8	8		445	9	
-3	-4	-4	-4	-4	-6		445	4	
6	7	6	7	6	7		445	7	
-3	-5	-4	-5	-5	-8		446	5	
8	10	9	10	9	10		446	10	
-3	-4	-3	-4	-4	-7		446	4	
7	9	7	9	8	8		446	9	
-4	-6	-5	-7	-6	-10	Section 15	447	7	
9	11	9	11	10	11		447	11	
-2	-3	-3	-4	-4	-7		447	4	
8	10	8	10	9	9	Section 16	447	10	
-8	-11	-10	-12	-11	-15		448	12	
10	12	11	13	12	15		448	13	
-12	-17	-15	-19	-18	-26	PIER 5	448	19	
17	23	20	24	22	26		448	24	
-15	-20	-17	-21	-19	-23		449	21	
11	17	15	19	17	24	Section 16	449	19	
-8	-10	-9	-11	-10	-13		449	11	
8	12	10	13	11	15		449	13	
-8	-9	-7	-8	-8	-7	Section 17	450	9	
2	2	2	3	3	5		450	3	
-10	-11	-10	-11	-10	-11		450	11	
5	7	6	7	7	10		450	7	

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)	
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65				
-4	-4	-3	-4	-4	-4	Section 18	451	4	
1	2	1	2	2	3		451	2	
-5	-5	-4	-5	-5	-5		451	5	
2	2	2	3	3	4		451	3	
-3	-3	-3	-3	-3	-3		452	3	
1	2	2	2	2	3		452	2	
-3	-4	-3	-4	-3	-4		452	4	
1	2	2	2	2	3		452	2	
-3	-3	-3	-3	-3	-3		453	3	
2	3	3	3	3	3		453	<u>3</u>	
-3	-3	-3	-3	-3	-3		453	3	
2	2	2	3	2	3		453	3	
-2	-2	-2	-2	-2	-3		454	2	
3	4	3	4	4	4		454	4	
-2	-2	-2	-3	-2	-3		454	3	
3	3	3	4	3	4		454	4	
-1	-2	-2	-2	-2	-3		455	2	
4	4	4	4	4	4		455	4	
-1	-1	-1	-2	-2	-3		455	2	
3	3	3	3	3	3		455	3	
-3	-5	-4	-5	-5	-8	Section 19	456	5	
8	9	8	8	8	8		456	9	
-1	-2	-2	-2	-2	-4		456	2	
6	6	5	6	6	5		456	6	
-11	-14	-12	-14	-13	-17	Section 20	<u>457</u>	<u>14</u>	<u>19</u>
12	14	12	14	13	16		457	14	
-16	-20	-17	-20	-19	-25		457	20	
19	22	19	21	20	24	PIER 6	<u>457</u>	<u>22</u>	<u>20</u>
-17	-19	-17	-18	-17	-20		458	19	
14	16	14	16	15	21	Section 20	458	16	
-11	-12	-10	-11	-11	-13		458	12	
9	11	10	11	11	14		<u>458</u>	<u>11</u>	<u>21</u>
-7	-8	-7	-7	-7	-7	Section 21	459	8	
2	3	2	3	3	6		459	3	
-9	-11	-9	-10	-9	-10		459	11	
4	5	4	6	5	9		459	6	

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)	
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65				
-2	-2	-2	-2	-2	-2	Section 22	460	2	
1	1	1	1	1	2		460	1	
-2	-3	-2	-3	-2	-2		460	3	
1	1	1	1	1	2		460	1	
-2	-2	-2	-2	-2	-2		461	2	
1	2	2	2	2	2		461	2	
-2	-2	-2	-2	-2	-2		461	2	
1	1	2	2	1	2		461	2	
-2	-2	-2	-2	-2	-2		462	<u>2</u>	
2	2	2	2	2	2		462	2	
-1	-2	-2	-2	-2	-2		462	2	
2	2	2	2	2	2		462	2	
-1	-1	-1	-1	-1	-2		463	1	
2	2	2	2	2	2		463	2	
-1	-1	-1	-1	-1	-2		463	1	
2	2	2	2	2	2		463	2	
-4	-5	-4	-6	-5	-9	Section 23	464	6	
10	11	9	10	10	10		464	11	
-3	-4	-3	-4	-4	-7		464	4	
8	9	7	8	8	8		464	9	
-4	-6	-5	-6	-6	-8		465	6	
8	9	8	9	8	9		465	9	
-2	-3	-3	-4	-3	-6		465	4	
7	8	7	8	7	8	Section 24	465	8	
-11	-13	-11	-13	-12	-14		<u>466</u>	<u>13</u>	<u>23</u>
10	11	9	10	10	12		466	11	
-17	-20	-18	-20	-19	-24	PIER 7	466	20	
19	21	18	20	18	22		466	21	
-20	-23	-20	-22	-21	-23	Section 24	<u>467</u>	<u>23</u>	<u>24</u>
15	18	16	18	17	23		467	18	
-14	-16	-13	-15	-14	-16		467	16	
12	15	13	16	14	18	Section 25	<u>467</u>	<u>16</u>	<u>25</u>
-10	-11	-9	-11	-10	-8		468	11	
2	2	2	2	2	4		468	2	
-15	-20	-17	-21	-20	-19		468	21	
13	17	16	19	18	18		468	19	

NOTE: Member refers to the LARSA member ID.

Mz (k-ft) (HL-93 Double Truck + Lane)						Section	Member	ABS(Max)
1 Lane L1 m= 1.20	2 Lanes L1+L2 m= 1.00	2 Lanes L1+L3 m= 1.00	3 Lanes L1+L2+L3 m= 0.85	3 Lanes L1+L3+L4 m= 0.85	7 Lanes m= 0.65			
-13	-17	-16	-19	-18	-18	Section 26	469	19
15	20	17	21	20	19		469	21
-26	-33	-29	-35	-32	-31		469	35
18	26	23	28	26	27		469	28
-7	-8	-8	-9	-8	-7		470	9
5	7	7	7	7	8		470	7
-4	-5	-4	-5	-4	-4		470	5
1	1	2	2	2	3		470	2
-2	-2	-2	-2	-2	-2		471	2
1	1	1	1	1	2		471	1
-2	-3	-2	-3	-2	-2		471	3
1	1	1	1	1	2		471	1
-1	-2	-2	-2	-2	-3		472	2
3	4	3	4	3	4		472	4
-1	-2	-2	-2	-2	-3		472	2
3	3	3	3	3	3		472	3
-1	-2	-2	-2	-2	-4		473	2
5	5	5	5	5	5		473	5
-1	-2	-2	-2	-2	-4		473	2
5	5	4	4	4	4		473	5
-1	-2	-2	-3	-2	-5		474	3
7	8	6	7	7	6		474	8
-2	-3	-3	-4	-3	-6		474	4
9	9	8	8	8	7	ABUT 2	474	9

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Truck + Lane		Double Truck + Lane		Section	Station	Controlling	ABS(Max)
Station	+ Fz	- Fz	- Fz				
165+86	188	-39	-36	PIER 2	<u>165+86</u>	<u>188</u>	<u>1</u> 188
165+91	154	-41	-41	Section 1	165+91	154	
165+96	134	-51	-53		165+96	134	
166+01	123	-71	-71		166+01	123	
166+06	178	-43	-45		166+06	178	
166+11	138	-43	-45		166+11	138	
166+16	114	-52	-56		166+16	114	
166+21	100	-74	-76		166+21	100	
166+26	150	-56	-57		166+26	150	
166+31	118	-56	-57		166+31	118	
166+36	96	-60	-62		166+36	96	
166+41	83	-74	-76		166+41	83	
166+51	83	-68	-69		166+51	83	
166+56	68	-71	-73		166+56	73	
166+61	61	-83	-83		166+61	83	
166+71	73	-81	-85		166+71	85	
166+76	56	-84	-87		166+76	87	
166+81	49	-95	-98		166+81	98	
166+91	64	-104	-105	Section 2	166+91	105	<u>130</u>
166+96	43	-106	-107		166+96	107	
167+01	35	-115	-115		167+01	115	
167+06	31	-129	-126		167+06	129	
167+16	45	-130	-129	Section 3	<u>167+16</u>	<u>130</u>	<u>2</u> 188
167+21	28	-133	-131		167+21	133	
167+26	21	-143	-140		167+26	143	
167+31	19	-158	-154		167+31	158	
167+41	33	-156	-152		167+41	156	
167+46	18	-160	-156		167+46	160	
167+51	12	-171	-166		167+51	171	
167+56	11	-188	-181		167+56	188	
167+66	20	-178	-171	Section 4	<u>167+66</u>	<u>178</u>	<u>3</u> 220
167+71	14	-185	-178		167+71	185	
167+76	10	-196	-187		167+76	196	
167+81	10	-215	-205	PIER 3	<u>167+81</u>	<u>215</u>	<u>4</u>
167+86	220	-28	-29	Section 4	167+86	220	
167+91	192	-28	-29		167+91	192	
167+96	180	-29	-32		167+96	180	
168+01	171	-36	-38		168+01	171	
168+06	167	-47	-50		168+06	167	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Truck + Lane		Double Truck + Lane		Section	Station	Controlling	ABS(Max)
Station	+ Fz	- Fz	- Fz				
168+11	196	-28	-31	Section 5	168+11	196	5 196
168+16	172	-28	-31		168+16	172	
168+21	159	-30	-34		168+21	159	
168+26	149	-36	-40		168+26	149	
168+31	147	-54	-55		168+31	147	
168+36	171	-34	-35		168+36	171	
168+41	148	-34	-35		168+41	148	
168+46	136	-38	-40		168+46	136	
168+51	127	-46	-47		168+51	127	
168+56	125	-66	-65		168+56	125	
168+61	147	-39	-41	Section 6	168+61	147	6 147
168+66	124	-39	-41		168+66	124	
168+71	113	-45	-45		168+71	113	
168+76	105	-55	-54		168+76	105	
168+81	105	-76	-73		168+81	105	
168+86	120	-47	-48		168+86	120	
168+91	101	-49	-50		168+91	101	
168+96	90	-59	-58		168+96	90	
169+01	88	-78	-76		169+01	88	
169+06	103	-55	-56		169+06	103	116
169+11	83	-58	-59	Section 7	169+11	83	
169+16	73	-69	-69		169+16	73	
169+21	71	-91	-89		169+21	91	
169+26	88	-66	-67		169+26	88	
169+31	71	-71	-72		169+31	72	
169+36	60	-83	-82		169+36	83	
169+46	75	-79	-79		169+46	79	
169+51	59	-86	-85		169+51	86	
169+56	49	-99	-97		169+56	99	
169+66	63	-95	-93		169+66	95	
169+71	49	-102	-100	Section 8	169+71	102	
169+76	40	-116	-113		169+76	116	
169+81	83	-113	-109		169+81	113	7 157
169+86	52	-113	-109		169+86	113	
169+91	39	-122	-117		169+91	122	
169+96	31	-137	-131		169+96	137	
170+01	71	-131	-125		170+01	131	
170+06	43	-132	-126		170+06	132	
170+11	31	-141	-135		170+11	141	
170+16	26	-157	-148		170+16	157	8

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Station	Truck + Lane		Double Truck	Section	Station	Controlling	ABS(Max)
	+ Fz	- Fz	+ Lane - Fz				
170+21	68	-150	-143	Section 9	170+21	150	190
170+26	40	-151	-144		170+26	151	
170+31	27	-159	-151		170+31	159	
170+36	23	-169	-161		170+36	169	
170+41	22	-190	-180		170+41	190	9
170+46	42	-169	-161	Section 10	170+46	169	204
170+51	26	-171	-163		170+51	171	
170+56	20	-183	-174		170+56	183	
170+61	20	-204	-192		170+61	204	10
170+66	32	-185	-176	Section 11	170+66	185	208
170+71	25	-191	-182		170+71	191	
170+76	20	-208	-197		170+76	208	11
170+81	202	-22	-24	PIER 4	170+81	202	
170+86	174	-22	-25		170+86	174	
170+91	157	-28	-30	Section 11	170+91	157	
170+96	147	-34	-36		170+96	147	
171+01	143	-48	-50		171+01	143	
171+06	169	-25	-27	Section 12	171+06	169	12 169
171+11	145	-26	-28		171+11	145	
171+16	133	-33	-35		171+16	133	
171+21	126	-47	-47		171+21	126	13
171+26	148	-30	-31	Section 13	171+26	148	148
171+31	126	-32	-33		171+31	126	
171+36	114	-41	-41		171+36	114	
171+41	110	-59	-58		171+41	110	
171+46	123	-34	-34		171+46	123	
171+51	105	-40	-41		171+51	105	
171+56	95	-53	-52		171+56	95	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Truck + Lane		Double Truck + Lane		Section	Station	Controlling	ABS(Max)
Station	+ Fz	- Fz	- Fz				
171+61	138	-40	-41	Section 14	171+61	138	163
171+66	109	-41	-41		171+66	109	
171+71	90	-47	-47		171+71	90	
171+76	81	-55	-55		171+76	81	
171+81	77	-77	-73		171+81	77	
171+86	115	-53	-54		171+86	115	
171+91	87	-55	-55		171+91	87	
171+96	72	-62	-61		171+96	72	
172+01	63	-73	-70		172+01	73	
172+06	61	-96	-91		172+06	96	
172+11	88	-71	-69		172+11	88	
172+16	64	-74	-73		172+16	74	
172+21	53	-84	-81		172+21	84	
172+26	49	-101	-95		172+26	101	
172+31	90	-91	-87		172+31	91	
172+36	62	-92	-88		172+36	92	
172+41	48	-100	-95		172+41	100	
172+46	41	-112	-106		172+46	112	
172+51	40	-134	-125		172+51	134	
172+56	70	-113	-108		172+56	113	
172+61	46	-116	-110		172+61	116	
172+66	38	-125	-118		172+66	125	
172+71	35	-139	-131		172+71	139	
172+76	35	-163	-152		172+76	163	14
172+81	55	-136	-128	Section 15	172+81	136	188
172+86	39	-140	-132		172+86	140	
172+91	34	-150	-141		172+91	150	
172+96	31	-164	-154		172+96	164	
173+01	31	-188	-175	Section 16	173+01	188	15
173+06	47	-157	-147		173+06	157	212
173+11	38	-160	-150		173+11	160	
173+16	32	-171	-159		173+16	171	
173+21	31	-187	-174	PIER 5	173+21	187	
173+26	31	-212	-197		173+26	212	16
173+31	163	-33	-33	Section 16	173+31	163	
173+36	146	-36	-38		173+36	146	
173+41	134	-44	-45	Section 17	173+41	134	
173+46	131	-58	-59		173+46	131	
173+51	149	-34	-35		173+51	149	17
173+56	129	-35	-38		173+56	129	149
173+61	117	-43	-45		173+61	117	
173+66	113	-61	-61		173+66	113	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Truck + Lane		Double Truck + Lane		Section	Station	Controlling	ABS(Max)
Station	+ Fz	- Fz	- Fz				
173+71	131	-38	-40	Section 18	173+71	131	18 139
173+76	110	-40	-43		173+76	110	
173+81	99	-48	-51		173+81	99	
173+86	95	-68	-69		173+86	95	
173+91	122	-43	-46		173+91	122	
173+96	98	-46	-49		173+96	98	
174+01	84	-52	-55		174+01	84	
174+06	76	-66	-67		174+06	76	
174+11	74	-89	-88		174+11	89	
174+16	92	-53	-56		174+16	92	
174+21	72	-59	-62		174+21	72	
174+26	61	-70	-72		174+26	72	
174+31	57	-92	-92		174+31	92	
174+36	78	-67	-70		174+36	78	
174+41	58	-74	-76		174+41	76	
174+46	47	-85	-87		174+46	87	
174+51	44	-108	-107		174+51	108	
174+56	72	-87	-88		174+56	88	
174+61	49	-90	-91		174+61	91	
174+66	37	-99	-99		174+66	99	
174+71	31	-114	-113		174+71	114	
174+76	31	-139	-135		174+76	139	
174+81	58	-112	-111	Section 19	174+81	112	166
174+86	36	-116	-115		174+86	116	
174+91	29	-126	-124		174+91	126	
174+96	26	-142	-139		174+96	142	
175+01	26	-166	-160	Section 20	175+01	166	19 188
175+06	45	-135	-133		175+06	135	
175+11	31	-138	-136		175+11	138	
175+16	26	-148	-145		175+16	148	
175+21	24	-162	-159	PIER 6	175+21	162	
175+26	24	-188	-181		175+26	188	20
175+31	170	-28	-28		175+31	170	
175+36	146	-28	-30		175+36	146	
175+41	132	-34	-36	Section 20	175+41	132	
175+46	123	-42	-43		175+46	123	
175+51	121	-61	-62		175+51	121	
175+56	145	-29	-31		175+56	145	21 145
175+61	121	-29	-32	Section 21	175+61	121	
175+66	107	-35	-38		175+66	107	
175+71	99	-46	-48		175+71	99	
175+76	97	-69	-68		175+76	97	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Truck + Lane		Double Truck + Lane		Section	Station	Controlling	ABS(Max)
Station	+ Fz	- Fz	- Fz				
175+81	124	-37	-38	Section 22	<u>175+81</u>	<u>124</u>	<u>22</u> 124
175+86	99	-38	-41		175+86	99	
175+91	86	-44	-47		175+91	86	
175+96	78	-59	-59		175+96	78	
176+01	76	-82	-80		176+01	82	
176+06	96	-45	-47		176+06	96	
176+11	74	-49	-50		176+11	74	
176+16	63	-58	-59		176+16	63	
176+21	57	-78	-75		176+21	78	
176+26	94	-58	-61		176+26	94	
176+31	66	-61	-64		176+31	66	
176+36	53	-69	-71		176+36	71	
176+41	44	-82	-83		176+41	83	
176+46	93	-80	-81		176+46	93	
176+51	64	-80	-81		176+51	81	
176+56	44	-87	-87		176+56	87	
176+61	35	-97	-96		176+61	97	
176+66	30	-117	-113		176+66	117	
176+71	67	-102	-100		176+71	102	155
176+76	39	-103	-102		176+76	103	
176+81	26	-114	-112		176+81	114	
176+86	24	-132	-128	Section 23	176+86	132	
176+91	51	-122	-119		176+91	122	
176+96	28	-126	-124		176+96	126	
177+01	22	-138	-134		177+01	138	
177+06	20	-155	-152	Section 24	<u>177+06</u>	<u>155</u>	<u>23</u>
177+11	35	-140	-136		177+11	140	176
177+16	26	-144	-141		177+16	144	
177+21	20	-158	-153		177+21	158	
177+26	20	-176	-171	PIER 7	177+26	176	
177+31	170	-12	-13		<u>177+31</u>	<u>170</u>	<u>24</u>
177+36	146	-15	-15		177+36	146	
177+41	131	-21	-21		177+41	131	
177+46	122	-29	-29	Section 24	177+46	122	
177+51	120	-50	-48		177+51	120	
177+56	145	-14	-15		<u>177+56</u>	<u>145</u>	<u>25</u> 145
177+61	120	-15	-16		177+61	120	
177+66	106	-22	-22	Section 25	177+66	106	
177+71	98	-35	-34		177+71	98	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Truck + Lane		Double Truck + Lane		Section	Station	Controlling	ABS(Max)
Station	+ Fz	- Fz	- Fz				
177+76	98	-50	-47	Section 26	177+76	98	171
177+81	124	-19	-19		177+81	124	
177+86	99	-21	-21		177+86	99	
177+91	85	-28	-27		177+91	85	
177+96	77	-44	-41		177+96	77	
178+01	75	-74	-68		178+01	75	
178+06	97	-29	-28		178+06	97	
178+11	74	-34	-32		178+11	74	
178+16	63	-44	-41		178+16	63	
178+21	56	-65	-60		178+21	65	
178+26	102	-48	-46		178+26	102	
178+31	72	-48	-46		178+31	72	
178+36	52	-55	-51		178+36	55	
178+41	43	-65	-61		178+41	65	
178+46	37	-87	-81		178+46	87	
178+51	76	-74	-69		178+51	76	
178+56	47	-75	-69		178+56	75	
178+61	29	-83	-77		178+61	83	
178+66	22	-97	-89		178+66	97	
178+71	22	-118	-109		178+71	118	
178+76	49	-102	-94		178+76	102	
178+81	27	-106	-97		178+81	106	
178+86	20	-117	-108		178+86	117	
178+91	17	-135	-124		178+91	135	
178+96	17	-162	-148		178+96	162	
178+98	17	-171	-156	ABUT 2	178+98	171	26

-3.7-

Spans 3-8

Exterior Girder

Capacities and Rating Factors





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Loads - Spans: 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder 8-2

Spans: 3-8

Section	Station	Moments (k-ft)						Shears (k)			
		DC	DC _{LAT}	DW	DW _{LAT}	LL	LL _{LAT}	Station	DC	DW	LL
1 (End)								165+86	246	40	188
1	166+51	9595	20	1564	3	6281	16	165+89	232	38	168
2	166+81	7765	37	1232	5	6542	17	167+16	243	40	130
3	167+66	-18231	71	-3118	11	-4261	41	167+66	409	65	188
4	167+86	-26268	171	-4334	33	-5914	29	167+81	488	76	220
5	168+06	-17454	134	-2970	23	-3985	51	168+11	415	69	196
6	169+06	11345	35	2064	6	6615	9	168+61	255	45	147
7	169+36	12760	3	2309	1	6924	10	169+81	141	25	113
8	169+76	9889	10	1768	2	5985	15	170+16	260	46	157
9	170+46	-8548	6	-1573	2	-2731	12	170+41	336	58	190
10	170+66	-16454	1	-2903	2	-4160	22	170+61	388	64	204
11	170+81	-21460	18	-3700	5	-5298	50	170+76	431	68	208
12	171+01	-14423	4	-2582	1	-3597	27	171+06	317	53	169
13	171+21	-7991	1	-1476	1	-2453	16	171+21	256	45	148
14	172+11	5600	1	1037	1	5222	7	172+76	165	30	163
15	173+06	-5683	3	-1028	1	-2604	12	173+01	232	40	188
16	173+26	-10848	9	-1874	2	-4289	24	173+26	301	50	212
17	173+46	-6231	5	-1141	1	-2619	13	173+51	210	36	149
18	174+31	3695	0	671	0	4112	3	173+71	158	28	139
19	175+06	-4327	3	-800	1	-2068	14	175+01	193	34	166
20	175+26	-8708	6	-1527	2	-3518	22	175+26	259	43	188
21	175+51	-3942	4	-728	1	-1984	11	175+56	185	33	145
22	176+26	3584	0	667	0	3811	2	175+81	121	22	124
23	177+11	-6598	5	-1215	1	-2383	13	177+06	214	38	155
24	177+26	-10174	9	-1814	2	-3546	23	177+31	283	48	170
25	177+51	-4670	10	-877	1	-1917	16	177+56	218	39	145
26	178+26	5355	0	988	0	4202	4	178+95	173	31	168
26 (End)								178+98	179	32	171



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 1

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (End Panels) (6.10.9.3.3):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	96.7
d _o =	88.5	in	1.4√Ek/f _{yw} =	120.9

V _p =	2213.1	k	k =	12.9	in
V _n =	994.6	k	C =	0.45	

$$\phi_v \phi_c \phi_s V_n = 994.6 \text{ k}$$

$$V_n = C V_p$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	73.1
d _o =	162	in	1.4√Ek/f _{yw} =	91.4

V _p =	2213.1	k	k =	7.3	in
V _n =	1377.0	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 1377.0 \text{ k}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 1

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 19074.5 in³

Short-term S = 56274.3 in³

Lateral Bending S = 398.8 in³

Bottom Flange:

Long-term S = 8157.6 in³

Short-term S = 8759.2 in³

Lateral Bending S = 341.8 in³

Load Factors:

γ_{DC}	1.25
γ_{DW}	1.5
γ_P	0
γ_{LL}	1.75 (Inv)
γ_{LL}	1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 9595 k-ft

Wearing Surface Moment = 1564 k-ft

Live Load Moment = 6281 k-ft

Impact = 133%

Dead Load = DC = 6.0 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 1.8 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

$f_{bu} = 6.0$ ksi

$f_{bu} = 1.0$ ksi

$f_{bu} = 1.8$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 13.15 (Inv)
 RF = 17.04 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 9595 k-ft

Lateral Dead Load Moment = 20 k-ft

Wearing Surface Moment = 1564 k-ft

Lat. Wearing Surface Moment = 3 k-ft

Live Load Moment = 6281 k-ft

Lateral Live Load Moment = 16 k-ft

Impact = 133%

Dead Load = DC = 14.3 ksi

WS Load = DW = 2.3 ksi

P = 0

Live Load = LL + IM = 11.7 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

$f_{bu} = 14.1$ ksi

$f_l = 0.70$ ksi

DC = $f_{bu} + \frac{1}{2}f_l = 14.3$ ksi

$f_{bu} = 2.3$ ksi

$f_l = 0.11$ ksi

DW = $f_{bu} + \frac{1}{2}f_l = 2.3$ ksi

$f_{bu} = 8.6$ ksi

$f_l = 0.56$ ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l = 11.7$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.40 (Inv)
 RF = 1.81 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	246	k
WS Load = DW =	40	k
P =	0	
Live Load = LL =	188	k
Impact =	1.33	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 250.0 k

Capacity = ϕF_{nc} = C = 995 k

RF = 1.43 (Inv)
 RF = 1.86 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	232	k
WS Load = DW =	38	k
P =	0	
Live Load = LL =	168	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 223.4 k

Capacity = ϕF_{nc} = C = 1377 k

RF = 2.63 (Inv)
 RF = 3.41 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 1

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 19074.5 in³
 Short-term S = 56274.3 in³

Bottom Flange:

Long-term S = 8157.6 in³
 Short-term S = 8759.2 in³
 Lateral Bending S = 341.8 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 9595 k-ft

Wearing Surface Moment = 1564 k-ft

Live Load Moment = 6281 k-ft
 Impact = 133%

Dead Load = DC = 6.0 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 1.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 6.0 ksi

ff = 1.0 ksi

ff = 1.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 17.48 (Inv)
 RF = 22.72 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 9595 k-ft

Lateral Dead Load Moment = 20 k-ft

Wearing Surface Moment = 1564 k-ft

Lat. Wearing Surface Moment = 3 k-ft

Live Load Moment = 6281 k-ft

Lateral Live Load Moment = 16 k-ft

Impact = 133%

Dead Load = DC = 14.5 ksi

WS Load = DW = 2.4 ksi

P = 0

Live Load = LL + IM = 11.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 14.1 ksi

fl = 0.70 ksi

DC = ff + fl/2 = 14.5 ksi

fbu = 2.3 ksi

fl = 0.11 ksi

DW = ff + f/2l = 2.4 ksi

fbu = 8.6 ksi

fl = 0.56 ksi

LL + IM = ff + fl/2 = 11.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.00 (Inv)
 RF = 2.60 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

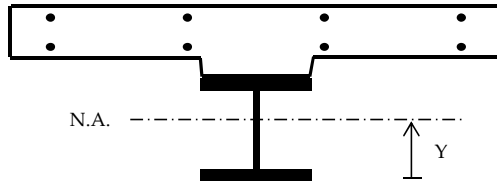
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Span 3

Section: 1

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.3750 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.7500 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	240.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	33.00 in ²	113.4375 in	3743.44 in ³	61.924 in	126541.9 in ³	126547.1 in ³
Web	76.31 in ²	57.2500 in	4368.89 in ³	5.737 in	2511.4 in ³	80865.3 in ³
Bot. Flange	49.00 in ²	0.8750 in	42.88 in ³	50.638 in	125647.8 in ³	125660.3 in ³
Σ =	158.31 in ²		8155.20 in ³			

Neutral Axis = Y = 51.513 in
 Total MOI = 333073 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
5378.7 in ³	5319.7 in ³	6577.5 in ³	6465.8 in ³	398.8 in ³	341.8 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	158.31 in ²	51.51 in	8155.20 in ³	47.24 in	353300.9 in ⁴	686373.5 in ⁴
Slab	320.00 in ²	122.13 in	39080.00 in ³	23.37 in	174787.3 in ⁴	178627.34 in ⁴
Σ =	478.31 in ²		47235.20 in ³			

Neutral Axis = 98.75 in
 Total MOI = 865001 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
58909.1 in ³	56274.3 in ³	8837.5 in ³	8759.2 in ³	61802.8 in ³	8917.2 in ³	37011.5 in ³	29450.7 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	158.31 in ²	51.51 in	8155.20 in ³	28.42 in	127909.3 in ⁴	460981.97 in ⁴
Slab	106.67 in ²	122.13 in	13026.67 in ³	42.19 in	189840.4 in ⁴	191120.43 in ⁴
Σ =	264.98 in ²		21181.87 in ³			

Neutral Axis = 79.94 in
 Total MOI = 652102 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
19466.0 in ³	19074.5 in ³	8247.9 in ³	8157.6 in ³	19873.8 in ³	8340.2 in ³	15457.4 in ³	13532.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 2

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/fyw =	73.1
do =	162	in	1.4√Ek/fyw =	91.4

Vp =	2213.1	k	k =	7.3	in
Vn =	1377.0	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 1377.0 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 2

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S =	17124.9	in ³
Short-term S =	47056.8	in ³
Lateral Bending S =	909.5	in ³

Bottom Flange:

Long-term S =	10997.3	in ³
Short-term S =	11840.6	in ³
Lateral Bending S =	505.3	in ³

Load Factors:

γ_{DC} =	1.25
γ_{DW} =	1.5
γ_P =	0
γ_{LL} =	1.75 (Inv)
γ_{LL} =	1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 7765 k-ft

Wearing Surface Moment = 1232 k-ft

Live Load Moment = 6542 k-ft

Impact = 133%

Dead Load = DC = 5.4 ksi

WS Load = DW = 0.9 ksi

P = 0

Live Load = LL + IM = 2.2 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 5.4 ksi

f_{bu} = 0.9 ksi

f_{bu} = 2.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 10.79 (Inv)
 RF = 13.99 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 7765 k-ft

Lateral Dead Load Moment = 37 k-ft

Wearing Surface Moment = 1232 k-ft

Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = 6542 k-ft

Lateral Live Load Moment = 17 k-ft

Impact = 133%

Dead Load = DC = 8.8 ksi

WS Load = DW = 1.4 ksi

P = 0

Live Load = LL + IM = 9.0 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 8.5 ksi

f_l = 0.88 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 8.8 ksi

f_{bu} = 1.3 ksi

f_l = 0.12 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.4 ksi

f_{bu} = 6.6 ksi

f_l = 0.40 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.35 (Inv)
 RF = 3.04 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 3

Section: 2

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	243	k
WS Load = DW =	40	k
P =	0	
Live Load = LL =	130	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 172.9 k

Capacity = $\phi F_{nc} = C$ = 1377.0 k

RF = 3.35 (Inv)

RF = 4.34 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 3 Section: 2

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 17124.9 in³
 Short-term S = 47056.8 in³

Bottom Flange:

Long-term S = 10997.3 in³
 Short-term S = 11840.6 in³
 Lateral Bending S = 505.3 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 7765 k-ft

Wearing Surface Moment = 1232 k-ft

Live Load Moment = 6542 k-ft
 Impact = 133%

Dead Load = DC = 5.4 ksi

WS Load = DW = 0.9 ksi

P = 0

Live Load = LL + IM = 2.2 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 5.4 ksi

ff = 0.9 ksi

ff = 2.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 14.28 (Inv)
 RF = 18.57 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 7765 k-ft

Lateral Dead Load Moment = 37 k-ft

Wearing Surface Moment = 1232 k-ft

Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = 6542 k-ft

Lateral Live Load Moment = 17 k-ft

Impact = 133%

Dead Load = DC = 8.9 ksi

WS Load = DW = 1.4 ksi

P = 0

Live Load = LL + IM = 9.1 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 8.5 ksi

fl = 0.88 ksi

DC = ff + fl/2 = 8.9 ksi

fbu = 1.3 ksi

fl = 0.12 ksi

DW = ff + f/2l = 1.4 ksi

fbu = 6.6 ksi

fl = 0.40 ksi

LL + IM = ff + fl/2 = 9.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.15 (Inv)
 RF = 4.09 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

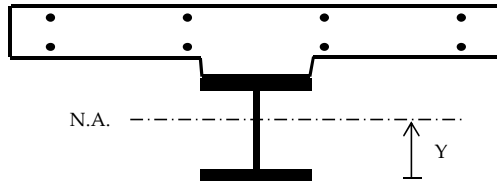
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Span 3

Section: 2

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	20.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.1250 in
Bot. Flange Width =	36.0000 in

Deck Inputs:

Tributary Deck Width =	216.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	25.00 in ²	113.7500 in	2843.75 in ³	72.569 in	131655.6 in ³	131658.9 in ³
Web	76.31 in ²	57.6250 in	4397.51 in ³	16.444 in	20634.7 in ³	98988.6 in ³
Bot. Flange	76.50 in ²	1.0625 in	81.28 in ³	40.119 in	123127.8 in ³	123156.5 in ³
Σ =	177.81 in ²		7322.54 in ³			

Neutral Axis = Y = 41.181 in
 Total MOI = 353804 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4875.4 in ³	4833.8 in ³	8818.9 in ³	8591.4 in ³	909.5 in ³	505.3 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	177.81 in ²	41.18 in	7322.54 in ³	50.20 in	448095.2 in ⁴	801899.2 in ⁴
Slab	288.00 in ²	122.38 in	35244.00 in ³	30.99 in	276656.0 in ⁴	280112.01 in ⁴
Σ =	465.81 in ²		42566.54 in ³			

Neutral Axis = 91.38 in
 Total MOI = 1082011 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
48371.6 in ³	47056.8 in ³	11979.9 in ³	11840.6 in ³	49762.0 in ³	12122.5 in ³	34910.7 in ³	29248.5 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	177.81 in ²	41.18 in	7322.54 in ³	28.47 in	144093.2 in ⁴	497897.20 in ⁴
Slab	96.00 in ²	122.38 in	11748.00 in ³	52.73 in	266891.4 in ⁴	268043.40 in ⁴
Σ =	273.81 in ²		19070.54 in ³			

Neutral Axis = 69.65 in
 Total MOI = 765941 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
17367.5 in ³	17124.9 in ³	11167.6 in ³	10997.3 in ³	17617.2 in ³	11343.4 in ³	14526.6 in ³	13042.4 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 3

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	36	in	λ_f =	8.471
tfc =	2.125	in	λ_{pf} =	9.152

Fnc = 50 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in	Dc =	57.63	in (Non-Comp)
Lb =	168.0	in	rt =	9.597	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 ksi

Lp = 231.1 in
 Lr = 868 in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 50.00 ksi

$\phi_f \phi_c \phi_s F_{nc} = 50.0$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	$1.12 \sqrt{Ek}/f_{yw} =$	144.5
do =	51	in	$1.4 \sqrt{Ek}/f_{yw} =$	180.6
			C =	0.89

k = 28.7 in
 Vp = 2213.1 k
 Vn = 2164.3 k

$\phi_v \phi_c \phi_s V_n = 2164.3$ k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 3

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 12596.5 in³
 Lateral Bending S = 918.0 in³

Bottom Flange S = 10353.9 in³
 Lateral Bending S = 918.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -18231 k-ft
 Lateral Dead Load Moment = 71 k-ft

Wearing Surface Moment = -3118 k-ft
 Lat. Wearing Surface Moment = 11 k-ft

Live Load Moment = -4261 k-ft
 Lateral Live Load Moment = 41 k-ft
 Impact = 133%

Dead Load = DC = 21.4 ksi
 WS Load = DW = 3.7 ksi
 P = 0
 Live Load = LL + IM = 6.8 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 21.1 ksi
 f_l = 0.93 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 21.4 ksi

f_{bu} = 3.6 ksi
 f_l = 0.14 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.7 ksi

f_{bu} = 4.9 ksi
 f_l = 0.54 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.49 (Inv)
RF = 1.93 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -18231 k-ft
 Lateral Dead Load Moment = 71 k-ft

Wearing Surface Moment = -3118 k-ft
 Lat. Wearing Surface Moment = 11 k-ft

Live Load Moment = -4261 k-ft
 Lateral Live Load Moment = 41 k-ft
 Impact = 133%

Dead Load = DC = 17.7 ksi
 WS Load = DW = 3.0 ksi
 P = 0
 Live Load = LL + IM = 5.6 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 17.4 ksi
 f_l = 0.93 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 17.7 ksi

f_{bu} = 3.0 ksi
 f_l = 0.14 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.0 ksi

f_{bu} = 4.1 ksi
 f_l = 0.54 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.37 (Inv)
RF = 3.07 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 3

Section: 3

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	409	k
WS Load = DW =	65	k
P =	0	
Live Load = LL =	188	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 250.0 k

Capacity = $\phi F_{nc} = C$ = 2164.3 k

RF = 3.55 (Inv)

RF = 4.61 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 3

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 12596.5 in³
 Lateral Bending S = 918.0 in³

Bottom Flange S = 10353.9 in³
 Lateral Bending S = 918.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -18231 k-ft
 Lateral Dead Load Moment = 71 k-ft

Wearing Surface Moment = -3118 k-ft
 Lat. Wearing Surface Moment = 11 k-ft

Live Load Moment = -4261 k-ft
 Lateral Live Load Moment = 41 k-ft
 Impact = 133%

Dead Load = DC = 21.6 ksi
 WS Load = DW = 3.7 ksi
 P = 0
 Live Load = LL + IM = 6.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 21.1 ksi
 fl = 0.93 ksi

DC = ff + fl/2 = 21.6 ksi

ff = 3.6 ksi
 fl = 0.14 ksi

DW = ff + fl/2 = 3.7 ksi

ff = 4.9 ksi
 fl = 0.54 ksi

LL + IM = ff + fl/2 = 6.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_{DC})(DC)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.51 (Inv)
 RF = 3.27 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -18231 k-ft
 Lateral Dead Load Moment = 71 k-ft

Wearing Surface Moment = -3118 k-ft
 Lat. Wearing Surface Moment = 11 k-ft

Live Load Moment = -4261 k-ft
 Lateral Live Load Moment = 41 k-ft
 Impact = 133%

Dead Load = DC = 17.8 ksi
 WS Load = DW = 3.0 ksi
 P = 0
 Live Load = LL + IM = 5.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.4 ksi
 fl = 0.93 ksi

DC = ff + fl/2 = 17.8 ksi

ff = 3.0 ksi
 fl = 0.14 ksi

DW = ff + fl/2 = 3.0 ksi

ff = 4.1 ksi
 fl = 0.54 ksi

LL + IM = ff + fl/2 = 5.8 ksi (Impact Added Here)

RF = 3.56 (Inv)
 RF = 4.63 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

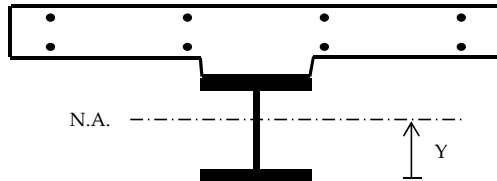
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 3

Section: 3

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.1250 in
Top Flange Width =	36.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.1250 in
Bot. Flange Width =	36.0000 in

Deck Inputs:

Tributary Deck Width =	210.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	11.00 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.50 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	76.50 in ²	114.1875 in	8735.34 in ³	56.563 in	244747.7 in ³	244776.5 in ³
Web	76.31 in ²	57.6250 in	4397.51 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	76.50 in ²	1.0625 in	81.28 in ³	56.563 in	244747.7 in ³	244776.5 in ³
Σ =	229.31 in ²		13214.13 in ³			

$$\text{Neutral Axis} = Y = 57.625 \text{ in}$$

$$\text{Total MOI} = 567907 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
10040.3 in ³	9855.2 in ³	10040.3 in ³	9855.2 in ³	918.0 in ³	918.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	229.31 in ²	57.63 in	13214.13 in ³	5.63 in	7270.31 in ³	575177.15 in ⁴
Top Bars	14.99 in ²	127.25 in	1907.98 in ³	63.99 in	61404.34 in ³	61404.39 in ⁴
Bot. Bars	5.99 in ²	118.63 in	710.56 in ³	55.37 in	18363.90 in ³	18363.91 in ⁴
Σ =	250.30 in ²		15832.68 in ³			

$$\text{Neutral Axis} = 63.26 \text{ in}$$

$$\text{Total MOI} = 654945.5 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	12859.3 in ³	12596.5 in ³	10530.8 in ³	10353.9 in ³	13133.2 in ³	10713.9 in ³	10234.4 in ³	11828.7 in ³



Computations

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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 4

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	44	in	λ_f =	7.333
tfc =	3	in	λ_{pf} =	9.152

Fnc = 50 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.875	in	Dc =	58.50	in (Non-Comp)
Lb =	300.0	in	rt =	11.953	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 49.77 ksi

Lp = 287.9 in
 Lr = 1081 in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 49.77 ksi

$\phi_f \phi_c \phi_s F_{nc} = 49.8$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.875	in	D/tw =	126.9
D =	111	in	$1.12 \sqrt{Ek}/f_{yw} =$	144.5
do =	51	in	$1.4 \sqrt{Ek}/f_{yw} =$	180.6
			C =	1.00

k = 28.7 in
 Vp = 2816.6 k
 Vn = 2816.6 k

$\phi_v \phi_c \phi_s V_n = 2816.6$ k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 4

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 19169.3 in³
 Lateral Bending S = 1936.0 in³

Bottom Flange S = 16867.6 in³
 Lateral Bending S = 1936.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -26268 k-ft
 Lateral Dead Load Moment = 171 k-ft

Wearing Surface Moment = -4334 k-ft
 Lat. Wearing Surface Moment = 33 k-ft

Live Load Moment = -5914 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 19.0 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 5.7 ksi
 Capacity = $\phi F_{nc} = C$ = 49.8 ksi

f_{bu} = 18.7 ksi
 f_l = 1.06 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 19.0 ksi

f_{bu} = 3.1 ksi
 f_l = 0.20 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.2 ksi

f_{bu} = 4.2 ksi
 f_l = 0.18 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.14 (Inv)
RF = 2.77 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -26268 k-ft
 Lateral Dead Load Moment = 171 k-ft

Wearing Surface Moment = -4334 k-ft
 Lat. Wearing Surface Moment = 33 k-ft

Live Load Moment = -5914 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 16.8 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 16.4 ksi
 f_l = 1.06 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 16.8 ksi

f_{bu} = 2.7 ksi
 f_l = 0.20 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 3.7 ksi
 f_l = 0.18 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.84 (Inv)
RF = 3.68 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 3

Section: 4

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	488	k
WS Load = DW =	76	k
P =	0	
Live Load = LL =	220	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 292.6 k

Capacity = $\phi F_{nc} = C$ = 2816.6 k

RF = 4.09 (Inv)

RF = 5.30 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 4

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 19169.3 in³
 Lateral Bending S = 1936.0 in³

Bottom Flange S = 16867.6 in³
 Lateral Bending S = 1936.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -26268 k-ft
 Lateral Dead Load Moment = 171 k-ft

Wearing Surface Moment = -4334 k-ft
 Lat. Wearing Surface Moment = 33 k-ft

Live Load Moment = -5914 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 19.2 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 5.7 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 18.7 ksi
 fl = 1.06 ksi

DC = ff + fl/2 = 19.2 ksi

ff = 3.1 ksi
 fl = 0.20 ksi

DW = ff + fl/2 = 3.2 ksi

ff = 4.2 ksi
 fl = 0.18 ksi

LL + IM = ff + fl/2 = 5.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.41 (Inv)
 RF = 4.43 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -26268 k-ft
 Lateral Dead Load Moment = 171 k-ft

Wearing Surface Moment = -4334 k-ft
 Lat. Wearing Surface Moment = 33 k-ft

Live Load Moment = -5914 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 17.0 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 16.4 ksi
 fl = 1.06 ksi

DC = ff + fl/2 = 17.0 ksi

ff = 2.7 ksi
 fl = 0.20 ksi

DW = ff + fl/2 = 2.8 ksi

ff = 3.7 ksi
 fl = 0.18 ksi

LL + IM = ff + fl/2 = 5.0 ksi (Impact Added Here)

RF = 4.23 (Inv)
 RF = 5.49 (Op)



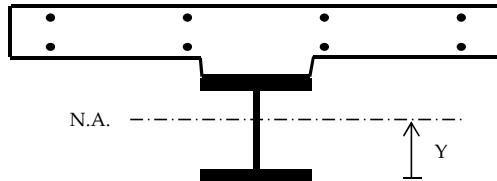
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 3 Section: 4

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	3.0000 in
Top Flange Width =	44.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	3.0000 in
Bot. Flange Width =	44.0000 in

Deck Inputs:

Tributary Deck Width =	210.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	11.00 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.50 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	132.00 in ²	115.5000 in	15246.00 in ³	57.000 in	428868.0 in ³	428967.0 in ³
Web	97.13 in ²	58.5000 in	5681.81 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	132.00 in ²	1.5000 in	198.00 in ³	57.000 in	428868.0 in ³	428967.0 in ³
Σ =	361.13 in ²		21125.81 in ³			

$$\text{Neutral Axis} = Y = 58.500 \text{ in}$$

$$\text{Total MOI} = 957657 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
16801.0 in ³	16370.2 in ³	16801.0 in ³	16370.2 in ³	1936.0 in ³	1936.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	361.13 in ²	58.50 in	21125.81 in ³	3.74 in	5041.51 in ³	962698.60 in ⁴
Top Bars	14.99 in ²	129.00 in	1934.22 in ³	66.76 in	66833.81 in ³	66833.86 in ⁴
Bot. Bars	5.99 in ²	120.38 in	721.05 in ³	58.14 in	20246.79 in ³	20246.81 in ⁴
Σ =	382.11 in ²		23781.08 in ³			

$$\text{Neutral Axis} = 62.24 \text{ in}$$

$$\text{Total MOI} = 1049779.3 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	19709.1 in ³	19169.3 in ³	17284.2 in ³	16867.6 in ³	20280.3 in ³	17721.9 in ³	15723.8 in ³	18056.5 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 5

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	32	in	λ_f =	6.737
tfc =	2.375	in	λ_{pf} =	9.152

Fnc = 50 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in	Dc =	57.88	in (Non-Comp)
Lb =	300.0	in	rt =	8.524	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 47.49 ksi

Lp = 205.3 in
 Lr = 771 in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 47.49 ksi

$\phi_f \phi_c \phi_s F_{nc} = 47.5$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

0.95RhFyf = 47.5 ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/fyw =	99.9
do =	84	in	1.4√Ek/fyw =	124.9
			C =	0.48

k = 13.7 in
 Vp = 2213.1 k
 Vn = 1860.4 k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 1860.4$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 5

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 12405.5 in³
 Lateral Bending S = 810.7 in³

Bottom Flange S = 10279.2 in³
 Lateral Bending S = 810.7 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -17454 k-ft
 Lateral Dead Load Moment = 134 k-ft

Wearing Surface Moment = -2970 k-ft
 Lat. Wearing Surface Moment = 23 k-ft

Live Load Moment = -3985 k-ft
 Lateral Live Load Moment = 51 k-ft
 Impact = 133%

Dead Load = DC = 21.0 ksi
 WS Load = DW = 3.6 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = $\phi F_{nc} = C$ = 47.5 ksi

f_{bu} = 20.4 ksi
 f_l = 1.98 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 21.0 ksi

f_{bu} = 3.5 ksi
 f_l = 0.34 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.6 ksi

f_{bu} = 4.7 ksi
 f_l = 0.75 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.39 (Inv)
RF = 1.80 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -17454 k-ft
 Lateral Dead Load Moment = 134 k-ft

Wearing Surface Moment = -2970 k-ft
 Lat. Wearing Surface Moment = 23 k-ft

Live Load Moment = -3985 k-ft
 Lateral Live Load Moment = 51 k-ft
 Impact = 133%

Dead Load = DC = 17.5 ksi
 WS Load = DW = 3.0 ksi
 P = 0
 Live Load = LL + IM = 5.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 16.9 ksi
 f_l = 1.98 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 17.5 ksi

f_{bu} = 2.9 ksi
 f_l = 0.34 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.0 ksi

f_{bu} = 3.9 ksi
 f_l = 0.75 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.47 (Inv)
RF = 3.20 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 4

Section: 5

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	415	k
WS Load = DW =	69	k
P =	0	
Live Load = LL =	196	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 260.7 k

Capacity = $\phi F_{nc} = C$ = 1860.4 k

RF = 2.71 (Inv)

RF = 3.52 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 5

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 12405.5 in³
 Lateral Bending S = 810.7 in³

Bottom Flange S = 10279.2 in³
 Lateral Bending S = 810.7 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -17454 k-ft
 Lateral Dead Load Moment = 134 k-ft

Wearing Surface Moment = -2970 k-ft
 Lat. Wearing Surface Moment = 23 k-ft

Live Load Moment = -3985 k-ft
 Lateral Live Load Moment = 51 k-ft
 Impact = 133%

Dead Load = DC = 21.4 ksi
 WS Load = DW = 3.6 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 20.4 ksi
 fl = 1.98 ksi

DC = ff + fl/2 = 21.4 ksi

ff = 3.5 ksi
 fl = 0.34 ksi

DW = ff + fl/2 = 3.6 ksi

ff = 4.7 ksi
 fl = 0.75 ksi

LL + IM = ff + fl/2 = 6.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.66 (Inv)
 RF = 3.46 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -17454 k-ft
 Lateral Dead Load Moment = 134 k-ft

Wearing Surface Moment = -2970 k-ft
 Lat. Wearing Surface Moment = 23 k-ft

Live Load Moment = -3985 k-ft
 Lateral Live Load Moment = 51 k-ft
 Impact = 133%

Dead Load = DC = 17.9 ksi
 WS Load = DW = 3.0 ksi
 P = 0
 Live Load = LL + IM = 5.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 16.9 ksi
 fl = 1.98 ksi

DC = ff + fl/2 = 17.9 ksi

ff = 2.9 ksi
 fl = 0.34 ksi

DW = ff + fl/2 = 3.0 ksi

ff = 3.9 ksi
 fl = 0.75 ksi

LL + IM = ff + fl/2 = 5.6 ksi (Impact Added Here)

RF = 3.63 (Inv)
 RF = 4.72 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

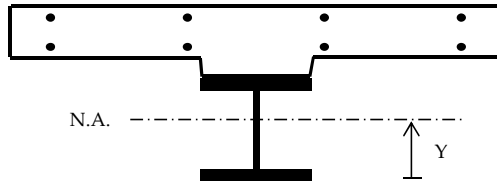
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Span 4

Section: 5

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.3750 in
Top Flange Width =	32.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.3750 in
Bot. Flange Width =	32.0000 in

Deck Inputs:

Tributary Deck Width =	200.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	11.00 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.50 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	76.00 in ²	114.5625 in	8706.75 in ³	56.688 in	244223.9 in ³	244259.6 in ³
Web	76.31 in ²	57.8750 in	4416.59 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	76.00 in ²	1.1875 in	90.25 in ³	56.688 in	244223.9 in ³	244259.6 in ³
Σ =	228.31 in ²		13213.59 in ³			

$$\text{Neutral Axis} = Y = 57.875 \text{ in}$$

$$\text{Total MOI} = 566873 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
10000.0 in ³	9794.8 in ³	10000.0 in ³	9794.8 in ³	810.7 in ³	810.7 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	228.31 in ²	57.88 in	13213.59 in ³	5.42 in	6718.89 in ³	573592.04 in ⁴
Top Bars	14.28 in ²	127.75 in	1824.27 in ³	64.45 in	59316.52 in ³	59316.57 in ⁴
Bot. Bars	5.70 in ²	119.13 in	679.01 in ³	55.83 in	17763.78 in ³	17763.80 in ⁴
Σ =	248.29 in ²		15716.86 in ³			

$$\text{Neutral Axis} = 63.30 \text{ in}$$

$$\text{Total MOI} = 650672.4 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	12692.9 in ³	12405.5 in ³	10475.7 in ³	10279.2 in ³	12993.9 in ³	10679.9 in ³	10095.7 in ³	11655.5 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 6

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	73.4
d _o =	160	in	1.4√Ek/f _{yw} =	91.8

V _p =	2213.1	k	k =	7.4	in
V _n =	1386.1	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 1386.1 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 6

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 14376.8 in³
 Short-term S = 39090.3 in³
 Lateral Bending S = 518.7 in³

Bottom Flange:

Long-term S = 8241.5 in³
 Short-term S = 8956.1 in³
 Lateral Bending S = 324.2 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 11345 k-ft

Wearing Surface Moment = 2064 k-ft

Live Load Moment = 6615 k-ft

Impact = 133%

Dead Load = DC = 9.5 ksi

WS Load = DW = 1.7 ksi

P = 0

Live Load = LL + IM = 2.7 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.5 ksi

f_{bu} = 1.7 ksi

f_{bu} = 2.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 7.53 (Inv)
 RF = 9.76 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 11345 k-ft

Lateral Dead Load Moment = 35 k-ft

Wearing Surface Moment = 2064 k-ft

Lat. Wearing Surface Moment = 6 k-ft

Live Load Moment = 6615 k-ft

Lateral Live Load Moment = 9 k-ft

Impact = 133%

Dead Load = DC = 17.0 ksi

WS Load = DW = 3.1 ksi

P = 0

Live Load = LL + IM = 11.9 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 16.5 ksi

f_l = 1.30 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 17.0 ksi

f_{bu} = 3.0 ksi

f_l = 0.22 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 3.1 ksi

f_{bu} = 8.9 ksi

f_l = 0.33 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.16 (Inv)
 RF = 1.50 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 4

Section: 6

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	255	k
WS Load = DW =	45	k
P =	0	
Live Load = LL =	147	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 195.5 k

Capacity = $\phi F_{nc} = C$ = 1386.1 k

RF = 2.92 (Inv)

RF = 3.79 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 6

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 14376.8 in³
 Short-term S = 39090.3 in³

Bottom Flange:

Long-term S = 8241.5 in³
 Short-term S = 8956.1 in³
 Lateral Bending S = 324.2 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 11345 k-ft

Wearing Surface Moment = 2064 k-ft

Live Load Moment = 6615 k-ft
 Impact = 133%

Dead Load = DC = 9.5 ksi

WS Load = DW = 1.7 ksi

P = 0

Live Load = LL + IM = 2.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 9.5 ksi

ff = 1.7 ksi

ff = 2.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 10.34 (Inv)
 RF = 13.44 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 11345 k-ft

Lateral Dead Load Moment = 35 k-ft

Wearing Surface Moment = 2064 k-ft

Lat. Wearing Surface Moment = 6 k-ft

Live Load Moment = 6615 k-ft

Lateral Live Load Moment = 9 k-ft

Impact = 133%

Dead Load = DC = 17.2 ksi

WS Load = DW = 3.1 ksi

P = 0

Live Load = LL + IM = 12.0 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 16.5 ksi

f_l = 1.30 ksi

DC = ff + f_l/2 = 17.2 ksi

f_{bu} = 3.0 ksi

f_l = 0.22 ksi

DW = ff + f_l/2 = 3.1 ksi

f_{bu} = 8.9 ksi

f_l = 0.33 ksi

LL + IM = ff + f_l/2 = 12.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.74 (Inv)
 RF = 2.27 (Op)



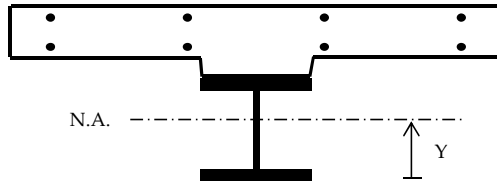
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 6

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.1250 in
Top Flange Width =	20.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.6250 in
Bot. Flange Width =	32.0000 in

Deck Inputs:

Tributary Deck Width =	180.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	22.50 in ²	113.1875 in	2546.72 in ³	67.115 in	101349.3 in ³	101351.7 in ³
Web	76.31 in ²	57.1250 in	4359.35 in ³	11.052 in	9322.0 in ³	87675.9 in ³
Bot. Flange	52.00 in ²	0.8125 in	42.25 in ³	45.260 in	106520.7 in ³	106532.1 in ³
Σ =	150.81 in ²		6948.32 in ³			

Neutral Axis = Y = 46.073 in
 Total MOI = 295560 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4403.8 in ³	4367.2 in ³	6530.3 in ³	6415.1 in ³	518.7 in ³	324.2 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	150.81 in ²	46.07 in	6948.32 in ³	46.47 in	325728.4 in ⁴	621288.1 in ⁴
Slab	240.00 in ²	121.75 in	29220.00 in ³	29.20 in	204683.0 in ⁴	207562.97 in ⁴
Σ =	390.81 in ²		36168.32 in ³			

Neutral Axis = 92.55 in
 Total MOI = 828851 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
40155.5 in ³	39090.3 in ³	9035.4 in ³	8956.1 in ³	41280.5 in ³	9116.1 in ³	28381.9 in ³	23544.5 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	150.81 in ²	46.07 in	6948.32 in ³	26.23 in	103760.3 in ⁴	399320.01 in ⁴
Slab	80.00 in ²	121.75 in	9740.00 in ³	49.45 in	195604.4 in ⁴	196564.44 in ⁴
Σ =	230.81 in ²		16688.32 in ³			

Neutral Axis = 72.30 in
 Total MOI = 595884 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
14574.6 in ³	14376.8 in ³	8335.2 in ³	8241.5 in ³	14778.0 in ³	8431.0 in ³	12050.9 in ³	10746.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 7

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	66.5
d _o =	240	in	1.4√Ek/f _{yw} =	83.1

V _p =	2213.1	k	k =	6.1	in
V _n =	1106.1	k	C =	0.21	

$$\phi_v \phi_c \phi_s V_n = 1106.1 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 7

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 14168.6 in³
 Short-term S = 36291.3 in³
 Lateral Bending S = 663.6 in³

Bottom Flange:

Long-term S = 9865.2 in³
 Short-term S = 10722.2 in³
 Lateral Bending S = 414.8 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 12760 k-ft

Wearing Surface Moment = 2309 k-ft

Live Load Moment = 6924 k-ft

Impact = 133%

Dead Load = DC = 10.8 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 3.0 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 10.8 ksi

f_{bu} = 2.0 ksi

f_{bu} = 3.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 6.30 (Inv)
 RF = 8.16 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 12760 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 2309 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 6924 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 15.6 ksi

WS Load = DW = 2.8 ksi

P = 0

Live Load = LL + IM = 10.4 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 15.5 ksi

f_l = 0.09 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 15.6 ksi

f_{bu} = 2.8 ksi

f_l = 0.03 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 7.7 ksi

f_l = 0.29 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.44 (Inv)
 RF = 1.87 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 7

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	141	k
WS Load = DW =	25	k
P =	0	
Live Load = LL =	113	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 150.3 k

Capacity = $\phi F_{nc} = C$ = 1106.1 k

RF = 3.39 (Inv)

RF = 4.40 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 7

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 14168.6 in³
 Short-term S = 36291.3 in³

Bottom Flange:

Long-term S = 9865.2 in³
 Short-term S = 10722.2 in³
 Lateral Bending S = 414.8 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 12760 k-ft

Wearing Surface Moment = 2309 k-ft

Live Load Moment = 6924 k-ft
 Impact = 133%

Dead Load = DC = 10.8 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 3.0 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 10.8 ksi

ff = 2.0 ksi

ff = 3.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 8.78 (Inv)
 RF = 11.41 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 12760 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 2309 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 6924 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 15.6 ksi

WS Load = DW = 2.8 ksi

P = 0

Live Load = LL + IM = 10.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 15.5 ksi

fl = 0.09 ksi

DC = ff + fl/2 = 15.6 ksi

fbu = 2.8 ksi

fl = 0.03 ksi

DW = ff + f/2l = 2.8 ksi

fbu = 7.7 ksi

fl = 0.29 ksi

LL + IM = ff + fl/2 = 10.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.13 (Inv)
 RF = 2.77 (Op)



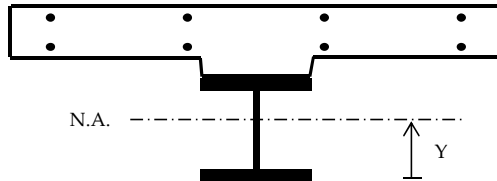
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 7

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	20.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.1250 in
Bot. Flange Width =	32.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	25.00 in ²	113.7500 in	2843.75 in ³	70.555 in	124449.1 in ³	124452.3 in ³
Web	76.31 in ²	57.6250 in	4397.51 in ³	14.430 in	15889.5 in ³	94243.3 in ³
Bot. Flange	68.00 in ²	1.0625 in	72.25 in ³	42.133 in	120711.9 in ³	120737.5 in ³
Σ =	169.31 in ²		7313.51 in ³			

Neutral Axis = Y = 43.195 in
 Total MOI = 339433 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4810.9 in ³	4768.7 in ³	8056.3 in ³	7858.1 in ³	663.6 in ³	414.8 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	169.31 in ²	43.20 in	7313.51 in ³	45.09 in	344300.0 in ⁴	683733.1 in ⁴
Slab	224.00 in ²	122.38 in	27412.00 in ³	34.09 in	260242.4 in ⁴	262930.39 in ⁴
Σ =	393.31 in ²		34725.51 in ³			

Neutral Axis = 88.29 in
 Total MOI = 946663 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
37182.2 in ³	36291.3 in ³	10852.8 in ³	10722.2 in ³	38117.9 in ³	10986.7 in ³	27773.5 in ³	23616.3 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	169.31 in ²	43.20 in	7313.51 in ³	24.23 in	99417.9 in ⁴	438850.99 in ⁴
Slab	74.67 in ²	122.38 in	9137.33 in ³	54.95 in	225437.8 in ⁴	226333.83 in ⁴
Σ =	243.98 in ²		16450.84 in ³			

Neutral Axis = 67.43 in
 Total MOI = 665185 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
14359.8 in ³	14168.6 in ³	10023.2 in ³	9865.2 in ³	14556.2 in ³	10186.2 in ³	12105.8 in ³	10914.0 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 8

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	73.4
d _o =	160	in	1.4√Ek/f _{yw} =	91.8

V _p =	2213.1	k	k =	7.4	in
V _n =	1386.1	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 1386.1 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 8

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 13168.7 in³
 Short-term S = 35842.9 in³
 Lateral Bending S = 409.7 in³

Bottom Flange:

Long-term S = 7841.6 in³
 Short-term S = 8566.4 in³
 Lateral Bending S = 263.4 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 9889 k-ft

Wearing Surface Moment = 1768 k-ft

Live Load Moment = 5985 k-ft

Impact = 133%

Dead Load = DC = 9.0 ksi

WS Load = DW = 1.6 ksi

P = 0

Live Load = LL + IM = 2.7 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.0 ksi

f_{bu} = 1.6 ksi

f_{bu} = 2.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 7.79 (Inv)
 RF = 10.10 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 9889 k-ft

Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = 1768 k-ft

Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = 5985 k-ft

Lateral Live Load Moment = 15 k-ft

Impact = 133%

Dead Load = DC = 15.3 ksi

WS Load = DW = 2.7 ksi

P = 0

Live Load = LL + IM = 11.5 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 15.1 ksi

f_l = 0.46 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 15.3 ksi

f_{bu} = 2.7 ksi

f_l = 0.09 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.7 ksi

f_{bu} = 8.4 ksi

f_l = 0.68 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.34 (Inv)
 RF = 1.73 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 4

Section: 8

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	260	k
WS Load = DW =	46	k
P =	0	
Live Load = LL =	157	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 208.8 k

Capacity = $\phi F_{nc} = C$ = 1386.1 k

RF = 2.71 (Inv)

RF = 3.52 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 8

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 13168.7 in³
 Short-term S = 35842.9 in³

Bottom Flange:

Long-term S = 7841.6 in³
 Short-term S = 8566.4 in³
 Lateral Bending S = 263.4 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 9889 k-ft

Wearing Surface Moment = 1768 k-ft

Live Load Moment = 5985 k-ft
 Impact = 133%

Dead Load = DC = 9.0 ksi

WS Load = DW = 1.6 ksi

P = 0

Live Load = LL + IM = 2.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 9.0 ksi

ff = 1.6 ksi

ff = 2.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 10.64 (Inv)
 RF = 13.84 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 9889 k-ft

Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = 1768 k-ft

Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = 5985 k-ft

Lateral Live Load Moment = 15 k-ft

Impact = 133%

Dead Load = DC = 15.4 ksi

WS Load = DW = 2.8 ksi

P = 0

Live Load = LL + IM = 11.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 15.1 ksi

fl = 0.46 ksi

DC = ff + fl/2 = 15.4 ksi

fbu = 2.7 ksi

fl = 0.09 ksi

DW = ff + f/2l = 2.8 ksi

fbu = 8.4 ksi

fl = 0.68 ksi

LL + IM = ff + fl/2 = 11.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.95 (Inv)
 RF = 2.53 (Op)



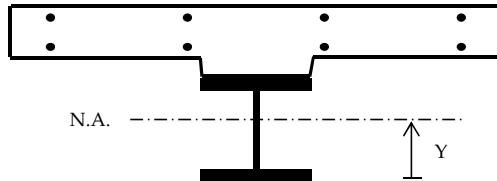
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
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 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 8

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.0000 in
Top Flange Width =	18.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.7500 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	18.00 in ²	113.2500 in	2038.50 in ³	68.242 in	83824.5 in ³	83826.0 in ³
Web	76.31 in ²	57.2500 in	4368.89 in ³	12.242 in	11436.0 in ³	89789.8 in ³
Bot. Flange	49.00 in ²	0.8750 in	42.88 in ³	44.133 in	95440.1 in ³	95452.6 in ³
Σ =	143.31 in ²		6450.27 in ³			

Neutral Axis = Y = 45.008 in
 Total MOI = 269068 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
3942.9 in ³	3914.2 in ³	6096.7 in ³	5978.2 in ³	409.7 in ³	263.4 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	143.31 in ²	45.01 in	6450.27 in ³	46.80 in	313884.9 in ⁴	582953.3 in ⁴
Slab	224.00 in ²	121.75 in	27272.00 in ³	29.94 in	200819.8 in ⁴	203507.79 in ⁴
Σ =	367.31 in ²		33722.27 in ³			

Neutral Axis = 91.81 in
 Total MOI = 786461 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
36678.7 in ³	35842.9 in ³	8648.8 in ³	8566.4 in ³	37554.4 in ³	8732.8 in ³	26266.2 in ³	21881.5 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	143.31 in ²	45.01 in	6450.27 in ³	26.29 in	99030.6 in ⁴	368098.98 in ⁴
Slab	74.67 in ²	121.75 in	9090.67 in ³	50.45 in	190075.7 in ⁴	190971.74 in ⁴
Σ =	217.98 in ²		15540.93 in ³			

Neutral Axis = 71.30 in
 Total MOI = 559071 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
13325.6 in ³	13168.7 in ³	7939.0 in ³	7841.6 in ³	13486.4 in ³	8038.9 in ³	11080.7 in ³	9903.0 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
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Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 9

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in	λ_f =	8.000
tfc =	1.75	in	λ_{pf} =	9.152

Fnc = 50 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in	Dc =	57.25	in (Non-Comp)
Lb =	300.0	in	rt =	7.179	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 46.00 ksi

Lp = 172.9 in
 Lr = 649 in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 46.00 ksi

$\phi_f \phi_c \phi_s F_{nc} = 46.0$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	$1.12 \sqrt{Ek}/f_{yw} =$	80.4
do =	126	in	$1.4 \sqrt{Ek}/f_{yw} =$	100.5
			C =	0.31
k =	8.9	in	$V_p = 0.58 F_{yw} D t_w$	
Vp =	2213.1	k	$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$	
Vn =	1564.4	k		

$\phi_v \phi_c \phi_s V_n = 1564.4$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 9

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 9015.8 in³
 Lateral Bending S = 457.3 in³

Bottom Flange S = 7279.3 in³
 Lateral Bending S = 457.3 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -8548 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1573 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2731 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 14.1 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 6.1 ksi
 Capacity = $\phi F_{nc} = C$ = 46.0 ksi

f_{bu} = 14.1 ksi
 f_l = 0.16 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 14.1 ksi

f_{bu} = 2.6 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 4.5 ksi
 f_l = 0.31 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.28 (Inv)
RF = 2.95 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -8548 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1573 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2731 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 11.4 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 11.4 ksi
 f_l = 0.16 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 11.4 ksi

f_{bu} = 2.1 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 3.6 ksi
 f_l = 0.31 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.74 (Inv)
RF = 4.85 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 4

Section: 9

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	336	k
WS Load = DW =	58	k
P =	0	
Live Load = LL =	190	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 252.7 k

Capacity = $\phi F_{nc} = C$ = 1564.4 k

RF = 2.39 (Inv)

RF = 3.10 (Op)



Computations

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Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 4 Section: 9

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 9015.8 in³
 Lateral Bending S = 457.3 in³

Bottom Flange S = 7279.3 in³
 Lateral Bending S = 457.3 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -8548 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1573 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2731 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 14.2 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 6.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 14.1 ksi
 f_l = 0.16 ksi
 $DC = f_f + f_l/2 = 14.2$ ksi

f_f = 2.6 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 2.6$ ksi

f_f = 4.5 ksi
 f_l = 0.31 ksi
 $LL + IM = f_f + f_l/2 = 6.1$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.86 (Inv)
 RF = 5.01 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -8548 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1573 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -2731 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 11.5 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 11.4 ksi
 f_l = 0.16 ksi
 $DC = f_f + f_l/2 = 11.5$ ksi

f_f = 2.1 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 2.1$ ksi

f_f = 3.6 ksi
 f_l = 0.31 ksi
 $LL + IM = f_f + f_l/2 = 5.0$ ksi (Impact Added Here)

RF = 5.17 (Inv)
 RF = 6.73 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

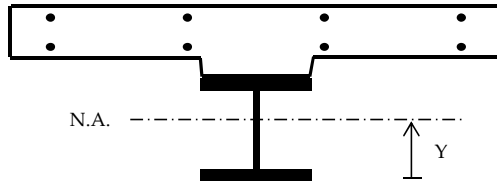
Project #: 55060.00
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Girder: 8-2

Location: Span 4

Section: 9

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.7500 in
Top Flange Width =	28.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.7500 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	49.00 in ²	113.6250 in	5567.63 in ³	56.375 in	155728.9 in ³	155741.4 in ³
Web	76.31 in ²	57.2500 in	4368.89 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	49.00 in ²	0.8750 in	42.88 in ³	56.375 in	155728.9 in ³	155741.4 in ³
Σ =	174.31 in ²		9979.39 in ³			

$$\text{Neutral Axis} = Y = 57.250 \text{ in}$$

$$\text{Total MOI} = 389837 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6915.1 in ³	6809.4 in ³	6915.1 in ³	6809.4 in ³	457.3 in ³	457.3 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	174.31 in ²	57.25 in	9979.39 in ³	6.10 in	6487.93 in ³	396324.58 in ⁴
Top Bars	12.57 in ²	126.50 in	1589.65 in ³	63.15 in	50112.40 in ³	50112.45 in ⁴
Bot. Bars	4.95 in ²	117.88 in	583.48 in ³	54.52 in	14715.78 in ³	14715.80 in ⁴
Σ =	191.83 in ²		12152.52 in ³			

$$\text{Neutral Axis} = 63.35 \text{ in}$$

$$\text{Total MOI} = 461152.8 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	9172.8 in ³	9015.8 in ³	7381.3 in ³	7279.3 in ³	9335.2 in ³	7486.1 in ³	7302.6 in ³	8457.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:

Date: 7/18/2015

Date: 7/20/2015

Girder: 8-2

Location: Pier 4

Section: 10

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	36	in
tfc =	1.875	in

λ_f =	9.600
λ_{pf} =	9.152
λ_{rf} =	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 48.4 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.875	in
Lb =	210.0	in
Cb =	1.0	(Conservative)

Dc =	57.38	in (Non-Comp)
rt =	9.303	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Fnc = 50.00 ksi

Lp =	224.0	in
Lr =	841	in

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}} \right)}}$$

Controlling Resistance:

Fnc = 48.45 ksi

$\phi_f \phi_c \phi_s F_{nc} = 48.4$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.875	in
D =	111	in
do =	132	in

D/tw =	126.9
$1.12 \sqrt{Ek}/f_{yw} =$	78.8
$1.4 \sqrt{Ek}/f_{yw} =$	98.5
C =	0.48

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$\phi_v \phi_c \phi_s V_n = 2175.8$ k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 10

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 11447.0 in³
 Lateral Bending S = 810.0 in³

Bottom Flange S = 9714.7 in³
 Lateral Bending S = 810.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -16454 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -2903 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4160 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 20.3 ksi
 WS Load = DW = 3.6 ksi
 P = 0
 Live Load = LL + IM = 7.0 ksi
 Capacity = $\phi F_{nc} = C$ = 48.4 ksi

f_{bu} = 20.3 ksi
 f_l = 0.01 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 20.3 ksi

f_{bu} = 3.6 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.6 ksi

f_{bu} = 5.1 ksi
 f_l = 0.33 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.44 (Inv)
RF = 1.87 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -16454 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -2903 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4160 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 17.3 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 5.9 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 17.2 ksi
 f_l = 0.01 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 17.3 ksi

f_{bu} = 3.0 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.1 ksi

f_{bu} = 4.4 ksi
 f_l = 0.33 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.29 (Inv)
RF = 2.97 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 4

Section: 10

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	388	k
WS Load = DW =	64	k
P =	0	
Live Load = LL =	204	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 271.3 k

Capacity = $\phi F_{nc} = C$ = 2175.8 k

RF = 3.36 (Inv)

RF = 4.35 (Op)



Computations

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 Location: Bangor/Brewer, ME
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 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 10

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 11447.0 in³
 Lateral Bending S = 810.0 in³

Bottom Flange S = 9714.7 in³
 Lateral Bending S = 810.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -16454 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -2903 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4160 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 20.3 ksi
 WS Load = DW = 3.6 ksi
 P = 0
 Live Load = LL + IM = 7.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 20.3 ksi
 fl = 0.01 ksi

DC = ff + fl/2 = 20.3 ksi

ff = 3.6 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 3.6 ksi

ff = 5.1 ksi
 fl = 0.33 ksi

LL + IM = ff + fl/2 = 7.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.60 (Inv)
 RF = 3.38 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -16454 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -2903 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4160 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 17.3 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 6.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.2 ksi
 fl = 0.01 ksi

DC = ff + fl/2 = 17.3 ksi

ff = 3.0 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 3.1 ksi

ff = 4.4 ksi
 fl = 0.33 ksi

LL + IM = ff + fl/2 = 6.0 ksi (Impact Added Here)

RF = 3.48 (Inv)
 RF = 4.52 (Op)



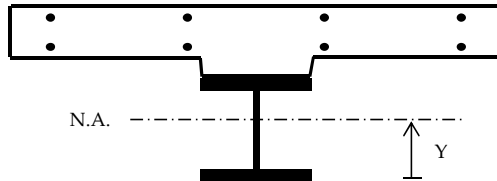
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 10

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.8750 in
Top Flange Width =	36.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.8750 in
Bot. Flange Width =	36.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	67.50 in ²	113.8125 in	7682.34 in ³	56.438 in	215000.4 in ³	215020.2 in ³
Web	97.13 in ²	57.3750 in	5572.55 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	67.50 in ²	0.9375 in	63.28 in ³	56.438 in	215000.4 in ³	215020.2 in ³
Σ =	232.13 in ²		13318.17 in ³			

$$\text{Neutral Axis} = Y = 57.375 \text{ in}$$

$$\text{Total MOI} = 529763 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
9386.7 in ³	9233.4 in ³	9386.7 in ³	9233.4 in ³	810.0 in ³	810.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	232.13 in ²	57.38 in	13318.17 in ³	4.70 in	5120.56 in ³	534884.05 in ⁴
Top Bars	12.57 in ²	126.75 in	1592.79 in ³	64.68 in	52568.59 in ³	52568.64 in ⁴
Bot. Bars	4.95 in ²	118.13 in	584.72 in ³	56.05 in	15552.73 in ³	15552.75 in ⁴
Σ =	249.64 in ²		15495.68 in ³			

$$\text{Neutral Axis} = 62.07 \text{ in}$$

$$\text{Total MOI} = 603005.4 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	11654.4 in ³	11447.0 in ³	9863.6 in ³	9714.7 in ³	11869.4 in ³	10017.2 in ³	9323.2 in ³	10757.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
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Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 11

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	36	in	$\lambda_f =$	6.000
tfc =	3	in	$\lambda_{pf} =$	9.152

Fnc = 50 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.875	in	Dc =	58.50	in (Non-Comp)
Lb =	300.0	in	rt =	9.657	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 48.42 ksi

Lp = 232.6 in
 Lr = 873 in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 48.42 ksi

$\phi_f \phi_c \phi_s F_{nc} = 48.4$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.875	in	D/tw =	126.9
D =	111	in	$1.12 \sqrt{Ek}/f_{yw} =$	75.0
do =	150	in	$1.4 \sqrt{Ek}/f_{yw} =$	93.8
			C =	0.44

k = 7.7 in
 Vp = 2816.6 k
 Vn = 2052.7 k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 2052.7$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 11

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 16008.6 in³
 Lateral Bending S = 1296.0 in³

Bottom Flange S = 14149.7 in³
 Lateral Bending S = 1296.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -21460 k-ft
 Lateral Dead Load Moment = 18 k-ft

Wearing Surface Moment = -3700 k-ft
 Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = -5298 k-ft
 Lateral Live Load Moment = 50 k-ft
 Impact = 133%

Dead Load = DC = 18.3 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 6.2 ksi
 Capacity = $\phi F_{nc} = C$ = 48.4 ksi

f_{bu} = 18.2 ksi
 f_l = 0.17 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 18.3 ksi

f_{bu} = 3.1 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.2 ksi

f_{bu} = 4.5 ksi
 f_l = 0.46 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.93 (Inv)
RF = 2.50 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -21460 k-ft
 Lateral Dead Load Moment = 18 k-ft

Wearing Surface Moment = -3700 k-ft
 Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = -5298 k-ft
 Lateral Live Load Moment = 50 k-ft
 Impact = 133%

Dead Load = DC = 16.1 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 5.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 16.1 ksi
 f_l = 0.17 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 16.1 ksi

f_{bu} = 2.8 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 4.0 ksi
 f_l = 0.46 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.67 (Inv)
RF = 3.46 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 4

Section: 11

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	431	k
WS Load = DW =	68	k
P =	0	
Live Load = LL =	208	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 276.6 k

Capacity = $\phi F_{nc} = C$ = 2052.7 k

RF = 2.92 (Inv)

RF = 3.78 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 11

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 16008.6 in³
 Lateral Bending S = 1296.0 in³

Bottom Flange S = 14149.7 in³
 Lateral Bending S = 1296.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -21460 k-ft
 Lateral Dead Load Moment = 18 k-ft

Wearing Surface Moment = -3700 k-ft
 Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = -5298 k-ft
 Lateral Live Load Moment = 50 k-ft
 Impact = 133%

Dead Load = DC = 18.3 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 6.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 18.2 ksi
 fl = 0.17 ksi

DC = ff + fl/2 = 18.3 ksi

ff = 3.1 ksi
 fl = 0.05 ksi

DW = ff + fl/2 = 3.2 ksi

ff = 4.5 ksi
 fl = 0.46 ksi

LL + IM = ff + fl/2 = 6.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.24 (Inv)
 RF = 4.22 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -21460 k-ft
 Lateral Dead Load Moment = 18 k-ft

Wearing Surface Moment = -3700 k-ft
 Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = -5298 k-ft
 Lateral Live Load Moment = 50 k-ft
 Impact = 133%

Dead Load = DC = 16.2 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 5.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 16.1 ksi
 fl = 0.17 ksi

DC = ff + fl/2 = 16.2 ksi

ff = 2.8 ksi
 fl = 0.05 ksi

DW = ff + fl/2 = 2.8 ksi

ff = 4.0 ksi
 fl = 0.46 ksi

LL + IM = ff + fl/2 = 5.6 ksi (Impact Added Here)

RF = 3.93 (Inv)
 RF = 5.10 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

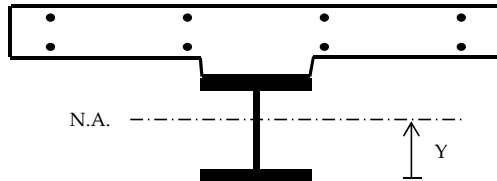
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 4

Section: 11

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	3.0000 in
Top Flange Width =	36.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	3.0000 in
Bot. Flange Width =	36.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	108.00 in ²	115.5000 in	12474.00 in ³	57.000 in	350892.0 in ³	350973.0 in ³
Web	97.13 in ²	58.5000 in	5681.81 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	108.00 in ²	1.5000 in	162.00 in ³	57.000 in	350892.0 in ³	350973.0 in ³
Σ =	313.13 in ²		18317.81 in ³			

$$\text{Neutral Axis} = Y = 58.500 \text{ in}$$

$$\text{Total MOI} = 801669 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
14064.4 in ³	13703.7 in ³	14064.4 in ³	13703.7 in ³	1296.0 in ³	1296.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	313.13 in ²	58.50 in	18317.81 in ³	3.61 in	4071.08 in ³	805740.17 in ⁴
Top Bars	12.57 in ²	129.00 in	1621.06 in ³	66.89 in	56232.51 in ³	56232.55 in ⁴
Bot. Bars	4.95 in ²	120.38 in	595.86 in ³	58.27 in	16806.76 in ³	16806.78 in ⁴
Σ =	330.64 in ²		20534.73 in ³			

$$\text{Neutral Axis} = 62.11 \text{ in}$$

$$\text{Total MOI} = 878779.5 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	16458.3 in ³	16008.6 in ³	14499.9 in ³	14149.7 in ³	16934.0 in ³	14867.9 in ³	13136.8 in ³	15081.4 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 12

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	36	in	$\lambda_f =$	9.000
tfc =	2	in	$\lambda_{pf} =$	9.152

Fnc = 50 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.875	in	Dc =	57.50	in (Non-Comp)
Lb =	300.0	in	rt =	9.359	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 48.20 ksi

Lp = 225.4 in
 Lr = 846 in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 48.20 ksi

$\phi_f \phi_c \phi_s F_{nc} = 48.2$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.875	in	D/tw =	126.9
D =	111	in	$1.12 \sqrt{Ek}/f_{yw} =$	75.0
do =	150	in	$1.4 \sqrt{Ek}/f_{yw} =$	93.8
			C =	0.44

k = 7.7 in
 Vp = 2816.6 k
 Vn = 2052.7 k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 2052.7$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 12

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 11955.9 in³
 Lateral Bending S = 864.0 in³

Bottom Flange S = 10205.4 in³
 Lateral Bending S = 864.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -14423 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2582 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3597 k-ft
 Lateral Live Load Moment = 27 k-ft
 Impact = 133%

Dead Load = DC = 17.0 ksi
 WS Load = DW = 3.0 ksi
 P = 0
 Live Load = LL + IM = 5.8 ksi
 Capacity = $\phi F_{nc} = C$ = 48.2 ksi

f_{bu} = 17.0 ksi
 f_l = 0.06 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 17.0 ksi

f_{bu} = 3.0 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.0 ksi

f_{bu} = 4.2 ksi
 f_l = 0.38 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.21 (Inv)
RF = 2.87 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -14423 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2582 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3597 k-ft
 Lateral Live Load Moment = 27 k-ft
 Impact = 133%

Dead Load = DC = 14.5 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 14.5 ksi
 f_l = 0.06 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 14.5 ksi

f_{bu} = 2.6 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 3.6 ksi
 f_l = 0.38 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.22 (Inv)
RF = 4.17 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 4

Section: 12

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	317	k
WS Load = DW =	53	k
P =	0	
Live Load = LL =	169	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 224.8 k

Capacity = $\phi F_{nc} = C$ = 2052.7 k

RF = 4.01 (Inv)

RF = 5.20 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 12

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 11955.9 in³
 Lateral Bending S = 864.0 in³

Bottom Flange S = 10205.4 in³
 Lateral Bending S = 864.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -14423 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2582 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3597 k-ft
 Lateral Live Load Moment = 27 k-ft
 Impact = 133%

Dead Load = DC = 17.0 ksi
 WS Load = DW = 3.0 ksi
 P = 0
 Live Load = LL + IM = 5.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.0 ksi
 fl = 0.06 ksi

DC = ff + fl/2 = 17.0 ksi

ff = 3.0 ksi
 fl = 0.01 ksi

DW = ff + fl/2 = 3.0 ksi

ff = 4.2 ksi
 fl = 0.38 ksi

LL + IM = ff + fl/2 = 5.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.65 (Inv)
 RF = 4.74 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -14423 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -2582 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -3597 k-ft
 Lateral Live Load Moment = 27 k-ft
 Impact = 133%

Dead Load = DC = 14.5 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 5.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 14.5 ksi
 fl = 0.06 ksi

DC = ff + fl/2 = 14.5 ksi

ff = 2.6 ksi
 fl = 0.01 ksi

DW = ff + fl/2 = 2.6 ksi

ff = 3.6 ksi
 fl = 0.38 ksi

LL + IM = ff + fl/2 = 5.1 ksi (Impact Added Here)

RF = 4.63 (Inv)
 RF = 6.02 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

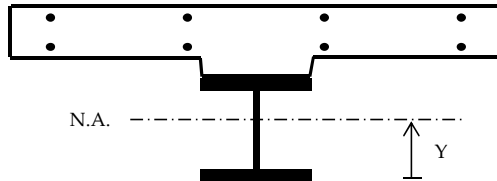
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 4

Section: 12

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.0000 in
Top Flange Width =	36.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.0000 in
Bot. Flange Width =	36.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	72.00 in ²	114.0000 in	8208.00 in ³	56.500 in	229842.0 in ³	229866.0 in ³
Web	97.13 in ²	57.5000 in	5584.69 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	72.00 in ²	1.0000 in	72.00 in ³	56.500 in	229842.0 in ³	229866.0 in ³
Σ =	241.13 in ²		13864.69 in ³			

$$\text{Neutral Axis} = Y = 57.500 \text{ in}$$

$$\text{Total MOI} = 559455 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
9901.9 in ³	9729.7 in ³	9901.9 in ³	9729.7 in ³	864.0 in ³	864.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	241.13 in ²	57.50 in	13864.69 in ³	4.54 in	4973.89 in ³	564428.98 in ⁴
Top Bars	12.57 in ²	127.00 in	1595.93 in ³	64.96 in	53024.67 in ³	53024.72 in ⁴
Bot. Bars	4.95 in ²	118.38 in	585.96 in ³	56.33 in	15708.48 in ³	15708.50 in ⁴
Σ =	258.64 in ²		16046.57 in ³			

$$\text{Neutral Axis} = 62.04 \text{ in}$$

$$\text{Total MOI} = 633162.2 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	12186.0 in ³	11955.9 in ³	10372.6 in ³	10205.4 in ³	12425.1 in ³	10545.4 in ³	9747.2 in ³	11239.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 13

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

φf =	1.00	LRFD 6.5.4.2
φv =	1.00	LRFD 6.5.4.3
φc =	1.00	MBE 6A.4.2.3-1
φs =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	1.5	in

λf =	9.333
λpf =	9.152
λrf =	13.487

Fnc = 49.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.875	in
Lb =	240.0	in
Cb =	1.0	(Conservative)

Dc =	57.00	in (Non-Comp)
rt =	6.841	in
Fyr = 0.7Fy =	35	ksi

Fnc = 47.51 ksi

Lp =	164.8	in
Lr =	619	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 47.51 ksi

φfφcφsFnc = 47.5 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

φfφcφsFnt = 50.0 ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

0.95RhFyf = 47.5 ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.875	in
D =	111	in
do =	120	in

D/tw =	126.9
1.12√Ek/fyw =	82.2
1.4√Ek/fyw =	102.7
C =	0.52

k =	9.3	in
Vp =	2816.6	k
Vn =	2269.1	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

φvφcφsVn = 2269.1 k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 13

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8537.9 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6943.7 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -7991 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -1476 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2453 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 13.8 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 5.9 ksi
 Capacity = $\phi F_{nc} = C$ = 47.5 ksi

f_{bu} = 13.8 ksi
 f_l = 0.03 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 13.8 ksi

f_{bu} = 2.6 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 4.2 ksi
 f_l = 0.49 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.58 (Inv)
RF = 3.34 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -7991 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -1476 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2453 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 11.2 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 4.8 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 11.2 ksi
 f_l = 0.03 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 11.2 ksi

f_{bu} = 2.1 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 3.4 ksi
 f_l = 0.49 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 4.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.91 (Inv)
RF = 5.06 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 4

Section: 13

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	256	k
WS Load = DW =	45	k
P =	0	
Live Load = LL =	148	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 196.8 k

Capacity = $\phi F_{nc} = C$ = 2269.1 k

RF = 5.46 (Inv)

RF = 7.08 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 4 Section: 13

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8537.9 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6943.7 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -7991 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -1476 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2453 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 13.8 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 5.9 ksi
 Capacity = $0.95R_h F_y$ = C = 47.5 ksi

f_f = 13.8 ksi
 f_l = 0.03 ksi
 $DC = f_f + f_l/2 = 13.8$ ksi

f_f = 2.6 ksi
 f_l = 0.03 ksi
 $DW = f_f + f_l/2 = 2.6$ ksi

f_f = 4.2 ksi
 f_l = 0.49 ksi
 $LL + IM = f_f + f_l/2 = 5.9$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.09 (Inv)
 RF = 5.31 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -7991 k-ft
 Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = -1476 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2453 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 11.2 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 4.9 ksi
 Capacity = $0.95R_h F_y$ = C = 47.5 ksi

f_f = 11.2 ksi
 f_l = 0.03 ksi
 $DC = f_f + f_l/2 = 11.2$ ksi

f_f = 2.1 ksi
 f_l = 0.03 ksi
 $DW = f_f + f_l/2 = 2.1$ ksi

f_f = 3.4 ksi
 f_l = 0.49 ksi
 $LL + IM = f_f + f_l/2 = 4.9$ ksi (Impact Added Here)

RF = 5.35 (Inv)
 RF = 6.96 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

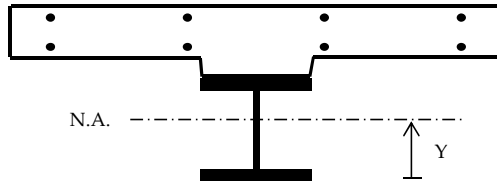
Project #: 55060.00
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 Date: 7/20/2015

Girder: 8-2

Location: Pier 4

Section: 13

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.5000 in
Top Flange Width =	28.0000 in
Web Thickness =	0.8750 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	42.00 in ²	113.2500 in	4756.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Web	97.13 in ²	57.0000 in	5536.13 in ³	0.000 in	0.0 in ³	99723.1 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Σ =	181.13 in ²		10324.13 in ³			

$$\text{Neutral Axis} = Y = 57.000 \text{ in}$$

$$\text{Total MOI} = 365520 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6498.1 in ³	6412.6 in ³	6498.1 in ³	6412.6 in ³	392.0 in ³	392.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	181.13 in ²	57.00 in	10324.13 in ³	5.87 in	6240.05 in ³	371760.15 in ⁴
Top Bars	12.57 in ²	126.00 in	1583.36 in ³	63.13 in	50082.69 in ³	50082.73 in ⁴
Bot. Bars	4.95 in ²	117.38 in	581.01 in ³	54.51 in	14705.68 in ³	14705.69 in ⁴
Σ =	198.64 in ²		12488.49 in ³			

$$\text{Neutral Axis} = 62.87 \text{ in}$$

$$\text{Total MOI} = 436548.6 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	8665.0 in ³	8537.9 in ³	7027.6 in ³	6943.7 in ³	8796.0 in ³	7113.4 in ³	6915.0 in ³	8009.3 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 5 Section: 14

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/f _{yw} =	76.2
do =	144	in	1.4√Ek/f _{yw} =	95.2

V _p =	2213.1	k	k =	8.0	in
V _n =	1464.4	k	C =	0.28	

$$\phi_v \phi_c \phi_s V_n = 1464.4 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 5 Section: 14

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S =	12830.4	in ³
Short-term S =	35800.9	in ³
Lateral Bending S =	385.7	in ³

Bottom Flange:

Long-term S =	7110.6	in ³
Short-term S =	7784.0	in ³
Lateral Bending S =	220.4	in ³

Load Factors:

γ_{DC} =	1.25
γ_{DW} =	1.5
γ_P =	0
γ_{LL} =	1.75 (Inv)
γ_{LL} =	1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 5600 k-ft

Wearing Surface Moment = 1037 k-ft

Live Load Moment = 5222 k-ft

Impact = 133%

Dead Load = DC = 5.2 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 2.3 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 5.2 ksi

f_{bu} = 1.0 ksi

f_{bu} = 2.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 10.31 (Inv)
 RF = 13.36 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 5600 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 1037 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 5222 k-ft

Lateral Live Load Moment = 7 k-ft

Impact = 133%

Dead Load = DC = 9.5 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 10.9 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.5 ksi

f_l = 0.05 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 9.5 ksi

f_{bu} = 1.8 ksi

f_l = 0.05 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.8 ksi

f_{bu} = 8.1 ksi

f_l = 0.38 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.87 (Inv)
 RF = 2.42 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 5

Section: 14

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	165	k
WS Load = DW =	30	k
P =	0	
Live Load = LL =	163	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 216.8 k

Capacity = $\phi F_{nc} = C$ = 1464.4 k

RF = 3.20 (Inv)

RF = 4.15 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 5 Section: 14

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 12830.4 in³
 Short-term S = 35800.9 in³

Bottom Flange:

Long-term S = 7110.6 in³
 Short-term S = 7784.0 in³
 Lateral Bending S = 220.4 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 5600 k-ft

Wearing Surface Moment = 1037 k-ft

Live Load Moment = 5222 k-ft
 Impact = 133%

Dead Load = DC = 5.2 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 2.3 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 5.2 ksi

ff = 1.0 ksi

ff = 2.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 13.64 (Inv)
 RF = 17.74 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 5600 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 1037 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 5222 k-ft

Lateral Live Load Moment = 7 k-ft

Impact = 133%

Dead Load = DC = 9.5 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 11.0 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 9.5 ksi

f_l = 0.05 ksi

DC = ff + f_l/2 = 9.5 ksi

f_{bu} = 1.8 ksi

f_l = 0.05 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 8.1 ksi

f_l = 0.38 ksi

LL + IM = ff + f_l/2 = 11.0 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.54 (Inv)
 RF = 3.31 (Op)



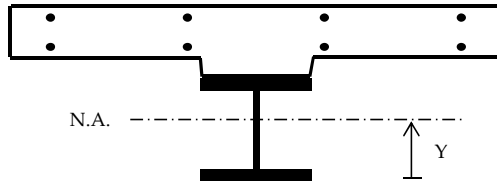
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 5 Section: 14

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.0000 in
Top Flange Width =	16.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	16.00 in ²	113.0000 in	1808.00 in ³	66.919 in	71649.5 in ³	71650.8 in ³
Web	76.31 in ²	57.0000 in	4349.81 in ³	10.919 in	9097.6 in ³	87451.5 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	45.331 in	86307.4 in ³	86315.3 in ³
Σ =	134.31 in ²		6189.31 in ³			

Neutral Axis = Y = 46.081 in
 Total MOI = 245418 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
3667.4 in ³	3640.2 in ³	5413.9 in ³	5325.7 in ³	385.7 in ³	220.4 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	134.31 in ²	46.08 in	6189.31 in ³	47.15 in	298569.3 in ⁴	543986.9 in ⁴
Slab	224.00 in ²	121.50 in	27216.00 in ³	28.27 in	179024.9 in ⁴	181712.93 in ⁴
Σ =	358.31 in ²		33405.31 in ³			

Neutral Axis = 93.23 in
 Total MOI = 725700 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
36706.3 in ³	35800.9 in ³	7847.1 in ³	7784.0 in ³	37658.7 in ³	7911.3 in ³	25669.9 in ³	21175.7 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	134.31 in ²	46.08 in	6189.31 in ³	26.95 in	97526.0 in ⁴	342943.64 in ⁴
Slab	74.67 in ²	121.50 in	9072.00 in ³	48.47 in	175432.6 in ⁴	176328.56 in ⁴
Σ =	208.98 in ²		15261.31 in ³			

Neutral Axis = 73.03 in
 Total MOI = 519272 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
12990.9 in ³	12830.4 in ³	7184.4 in ³	7110.6 in ³	13155.4 in ³	7259.7 in ³	10712.8 in ³	9532.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 15

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	1.5	in

λ_f =	9.333
λ_{pf} =	9.152
λ_{rf} =	13.487

Fnc = 49.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.75	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	57.00	in (Non-Comp)
rt =	6.984	in
Fyr = 0.7Fy =	35	ksi

Fnc = 45.73 ksi

Lp =	168.2	in
Lr =	632	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 45.73 ksi

$\phi_f \phi_c \phi_s F_{nc} = 45.7$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.75	in
D =	111	in
do =	150	in

D/tw =	148.0
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.32

k =	7.7	in
Vp =	2414.3	k
Vn =	1624.1	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 1624.1$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 15

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -5683 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1028 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2604 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 10.3 ksi
 WS Load = DW = 1.9 ksi
 P = 0
 Live Load = LL + IM = 6.4 ksi
 Capacity = $\phi F_{nc} = C$ = 45.7 ksi

f_{bu} = 10.2 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 10.3 ksi

f_{bu} = 1.9 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.9 ksi

f_{bu} = 4.7 ksi
 f_l = 0.37 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.69 (Inv)
RF = 3.48 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -5683 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1028 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2604 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 8.2 ksi
 WS Load = DW = 1.5 ksi
 P = 0
 Live Load = LL + IM = 5.2 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 8.2 ksi
 f_l = 0.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 8.2 ksi

f_{bu} = 1.5 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.5 ksi

f_{bu} = 3.8 ksi
 f_l = 0.37 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.15 (Inv)
RF = 5.38 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 5

Section: 15

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	232	k
WS Load = DW =	40	k
P =	0	
Live Load = LL =	188	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 250.0 k

Capacity = $\phi F_{nc} = C$ = 1624.1 k

RF = 2.91 (Inv)

RF = 3.77 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 15

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5683 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1028 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2604 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 10.3 ksi
 WS Load = DW = 1.9 ksi
 P = 0
 Live Load = LL + IM = 6.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 10.2 ksi
 fl = 0.09 ksi

DC = ff + fl/2 = 10.3 ksi

ff = 1.9 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 1.9 ksi

ff = 4.7 ksi
 fl = 0.37 ksi

LL + IM = ff + fl/2 = 6.4 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.25 (Inv)
 RF = 5.52 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5683 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -1028 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2604 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 8.2 ksi
 WS Load = DW = 1.5 ksi
 P = 0
 Live Load = LL + IM = 5.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 8.2 ksi
 fl = 0.09 ksi

DC = ff + fl/2 = 8.2 ksi

ff = 1.5 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 1.5 ksi

ff = 3.8 ksi
 fl = 0.37 ksi

LL + IM = ff + fl/2 = 5.2 ksi (Impact Added Here)

RF = 5.54 (Inv)
 RF = 7.21 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

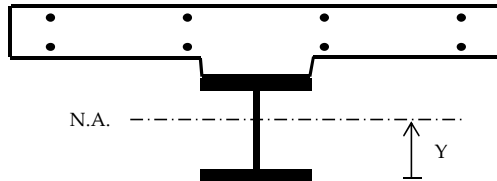
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 5

Section: 15

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.5000 in
Top Flange Width =	28.0000 in
Web Thickness =	0.7500 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	42.00 in ²	113.2500 in	4756.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Web	83.25 in ²	57.0000 in	4745.25 in ³	0.000 in	0.0 in ³	85476.9 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Σ =	167.25 in ²		9533.25 in ³			

$$\text{Neutral Axis} = Y = 57.000 \text{ in}$$

$$\text{Total MOI} = 351274 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6244.9 in ³	6162.7 in ³	6244.9 in ³	6162.7 in ³	392.0 in ³	392.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	167.25 in ²	57.00 in	9533.25 in ³	6.31 in	6659.93 in ³	357933.87 in ⁴
Top Bars	12.57 in ²	126.00 in	1583.36 in ³	62.69 in	49385.78 in ³	49385.83 in ⁴
Bot. Bars	4.95 in ²	117.38 in	581.01 in ³	54.06 in	14468.80 in ³	14468.81 in ⁴
Σ =	184.77 in ²		11697.62 in ³			

$$\text{Neutral Axis} = 63.31 \text{ in}$$

$$\text{Total MOI} = 421788.5 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	8446.0 in ³	8321.0 in ³	6742.1 in ³	6662.2 in ³	8574.7 in ³	6823.9 in ³	6728.2 in ³	7801.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 16

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	2.25	in

$\lambda_f =$	6.222
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

Fnc = 50.0 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.75	in
Lb =	285.0	in
Cb =	1.0	(Conservative)

Dc =	57.75	in (Non-Comp)
rt =	7.291	in
Fyr = 0.7Fy =	35	ksi

Fnc = 46.61 ksi

Lp =	175.6	in
Lr =	659	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}} \right)}}$$

Controlling Resistance:

Fnc = 46.61 ksi

$\phi_f \phi_c \phi_s F_{nc} = 46.6$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.75	in
D =	111	in
do =	150	in

D/tw =	148.0
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.32

k =	7.7	in
Vp =	2414.3	k
Vn =	1624.1	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 1624.1$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 16

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 10714.2 in³
 Lateral Bending S = 588.0 in³

Bottom Flange S = 8944.2 in³
 Lateral Bending S = 588.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -10848 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1874 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4289 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 14.6 ksi
 WS Load = DW = 2.5 ksi
 P = 0
 Live Load = LL + IM = 7.9 ksi
 Capacity = $\phi F_{nc} = C$ = 46.6 ksi

f_{bu} = 14.6 ksi
 f_l = 0.18 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 14.6 ksi

f_{bu} = 2.5 ksi
 f_l = 0.04 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.5 ksi

f_{bu} = 5.8 ksi
 f_l = 0.49 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.78 (Inv)
RF = 2.31 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -10848 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1874 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4289 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 12.2 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 12.1 ksi
 f_l = 0.18 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 12.2 ksi

f_{bu} = 2.1 ksi
 f_l = 0.04 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 4.8 ksi
 f_l = 0.49 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.73 (Inv)
RF = 3.54 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 5

Section: 16

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	301	k
WS Load = DW =	50	k
P =	0	
Live Load = LL =	212	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 282.0 k

Capacity = $\phi F_{nc} = C$ = 1624.1 k

RF = 2.38 (Inv)

RF = 3.08 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 16

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 10714.2 in³
 Lateral Bending S = 588.0 in³

Bottom Flange S = 8944.2 in³
 Lateral Bending S = 588.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -10848 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1874 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4289 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 14.6 ksi
 WS Load = DW = 2.5 ksi
 P = 0
 Live Load = LL + IM = 7.9 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 14.6 ksi
 f_l = 0.18 ksi
 $DC = f_f + f_l/2 = 14.6$ ksi

f_f = 2.5 ksi
 f_l = 0.04 ksi
 $DW = f_f + f_l/2 = 2.5$ ksi

f_f = 5.8 ksi
 f_l = 0.49 ksi
 $LL + IM = f_f + f_l/2 = 7.9$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.96 (Inv)
 RF = 3.85 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -10848 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1874 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -4289 k-ft
 Lateral Live Load Moment = 24 k-ft
 Impact = 133%

Dead Load = DC = 12.2 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 6.7 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 12.1 ksi
 f_l = 0.18 ksi
 $DC = f_f + f_l/2 = 12.2$ ksi

f_f = 2.1 ksi
 f_l = 0.04 ksi
 $DW = f_f + f_l/2 = 2.1$ ksi

f_f = 4.8 ksi
 f_l = 0.49 ksi
 $LL + IM = f_f + f_l/2 = 6.7$ ksi (Impact Added Here)

RF = 3.80 (Inv)
 RF = 4.94 (Op)



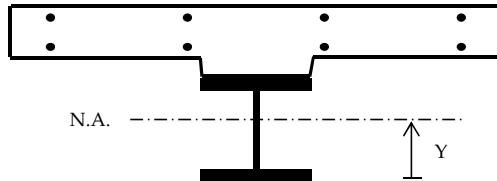
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 16

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.2500 in
Top Flange Width =	28.0000 in
Web Thickness =	0.7500 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.2500 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	63.00 in ²	114.3750 in	7205.63 in ³	56.625 in	202002.6 in ³	202029.2 in ³
Web	83.25 in ²	57.7500 in	4807.69 in ³	0.000 in	0.0 in ³	85476.9 in ³
Bot. Flange	63.00 in ²	1.1250 in	70.88 in ³	56.625 in	202002.6 in ³	202029.2 in ³
Σ =	209.25 in ²		12084.19 in ³			

$$\text{Neutral Axis} = Y = 57.750 \text{ in}$$

$$\text{Total MOI} = 489535 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
8645.2 in ³	8476.8 in ³	8645.2 in ³	8476.8 in ³	588.0 in ³	588.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	209.25 in ²	57.75 in	12084.19 in ³	5.20 in	5657.04 in ³	495192.36 in ⁴
Top Bars	12.57 in ²	127.50 in	1602.21 in ³	64.55 in	52361.13 in ³	52361.18 in ⁴
Bot. Bars	4.95 in ²	118.88 in	588.43 in ³	55.93 in	15481.92 in ³	15481.94 in ⁴
Σ =	226.77 in ²		14274.83 in ³			

$$\text{Neutral Axis} = 62.95 \text{ in}$$

$$\text{Total MOI} = 563035.5 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	10948.6 in ³	10714.2 in ³	9107.0 in ³	8944.2 in ³	11193.4 in ³	9275.8 in ³	8722.4 in ³	10067.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 17

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	28	in
tfc =	1.5	in

λ_f =	9.333
λ_{pf} =	9.152
λ_{rf} =	13.487

Fnc = 49.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.75	in
Lb =	255.0	in
Cb =	1.0	(Conservative)

Dc =	57.00	in (Non-Comp)
rt =	6.984	in
Fyr = 0.7Fy =	35	ksi

Fnc = 47.19 ksi

Lp =	168.2	in
Lr =	632	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 47.19 ksi

$\phi_f \phi_c \phi_s F_{nc} = 47.2$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.75	in
D =	111	in
do =	135	in

D/tw =	148.0
$1.12 \sqrt{Ek}/f_{yw} =$	78.1
$1.4 \sqrt{Ek}/f_{yw} =$	97.6
C =	0.35

k =	8.4	in
Vp =	2414.3	k
Vn =	1710.3	k

$\phi_v \phi_c \phi_s V_n = 1710.3$ k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 17

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -6231 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1141 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 11.3 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = $\phi F_{nc} = C$ = 47.2 ksi

f_{bu} = 11.2 ksi
 f_l = 0.15 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 11.3 ksi

f_{bu} = 2.1 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 4.7 ksi
 f_l = 0.40 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.66 (Inv)
RF = 3.45 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -6231 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1141 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 9.0 ksi
 WS Load = DW = 1.7 ksi
 P = 0
 Live Load = LL + IM = 5.2 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.0 ksi
 f_l = 0.15 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 9.0 ksi

f_{bu} = 1.6 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.7 ksi

f_{bu} = 3.8 ksi
 f_l = 0.40 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.98 (Inv)
RF = 5.16 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 5

Section: 17

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	210	k
WS Load = DW =	36	k
P =	0	
Live Load = LL =	149	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 198.2 k

Capacity = $\phi F_{nc} = C$ = 1710.3 k

RF =	4.02	(Inv)
RF =	5.21	(Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 5 Section: 17

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8321.0 in³
 Lateral Bending S = 392.0 in³

Bottom Flange S = 6662.2 in³
 Lateral Bending S = 392.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6231 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1141 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 11.3 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 11.2 ksi
 fl = 0.15 ksi

DC = ff + fl/2 = 11.3 ksi

ff = 2.1 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 2.1 ksi

ff = 4.7 ksi
 fl = 0.40 ksi

LL + IM = ff + fl/2 = 6.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.07 (Inv)
 RF = 5.29 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6231 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1141 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2619 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 9.1 ksi
 WS Load = DW = 1.7 ksi
 P = 0
 Live Load = LL + IM = 5.3 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 9.0 ksi
 fl = 0.15 ksi

DC = ff + fl/2 = 9.1 ksi

ff = 1.6 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 1.7 ksi

ff = 3.8 ksi
 fl = 0.40 ksi

LL + IM = ff + fl/2 = 5.3 ksi (Impact Added Here)

RF = 5.35 (Inv)
 RF = 6.95 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

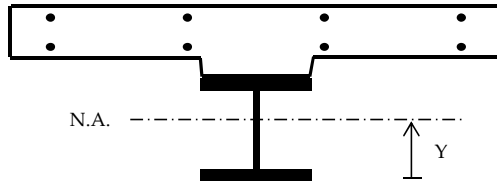
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 5

Section: 17

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.5000 in
Top Flange Width =	28.0000 in
Web Thickness =	0.7500 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	28.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	42.00 in ²	113.2500 in	4756.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Web	83.25 in ²	57.0000 in	4745.25 in ³	0.000 in	0.0 in ³	85476.9 in ³
Bot. Flange	42.00 in ²	0.7500 in	31.50 in ³	56.250 in	132890.6 in ³	132898.5 in ³
Σ =	167.25 in ²		9533.25 in ³			

$$\text{Neutral Axis} = Y = 57.000 \text{ in}$$

$$\text{Total MOI} = 351274 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6244.9 in ³	6162.7 in ³	6244.9 in ³	6162.7 in ³	392.0 in ³	392.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	167.25 in ²	57.00 in	9533.25 in ³	6.31 in	6659.93 in ³	357933.87 in ⁴
Top Bars	12.57 in ²	126.00 in	1583.36 in ³	62.69 in	49385.78 in ³	49385.83 in ⁴
Bot. Bars	4.95 in ²	117.38 in	581.01 in ³	54.06 in	14468.80 in ³	14468.81 in ⁴
Σ =	184.77 in ²		11697.62 in ³			

$$\text{Neutral Axis} = 63.31 \text{ in}$$

$$\text{Total MOI} = 421788.5 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	8446.0 in ³	8321.0 in ³	6742.1 in ³	6662.2 in ³	8574.7 in ³	6823.9 in ³	6728.2 in ³	7801.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 6 Section: 18

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/fyw =	66.5
do =	240	in	1.4√Ek/fyw =	83.1

Vp =	2213.1	k	k =	6.1	in
Vn =	1106.1	k	C =	0.21	

$$\phi_v \phi_c \phi_s V_n = 1106.1 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 6 Section: 18

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S =	11902.3	in ³
Short-term S =	35850.7	in ³
Lateral Bending S =	149.5	in ³

Bottom Flange:

Long-term S =	5430.3	in ³
Short-term S =	5989.2	in ³
Lateral Bending S =	104.7	in ³

Load Factors:

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 3695 k-ft

Wearing Surface Moment = 671 k-ft

Live Load Moment = 4112 k-ft

Impact = 133%

Dead Load = DC = 3.7 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 1.8 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 3.7 ksi

f_{bu} = 0.7 ksi

f_{bu} = 1.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 13.84 (Inv)
 RF = 17.94 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3695 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 671 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 4112 k-ft

Lateral Live Load Moment = 3 k-ft

Impact = 133%

Dead Load = DC = 8.2 ksi

WS Load = DW = 1.5 ksi

P = 0

Live Load = LL + IM = 11.1 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 8.2 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 8.2 ksi

f_{bu} = 1.5 ksi

f_l = 0.00 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.5 ksi

f_{bu} = 8.2 ksi

f_l = 0.34 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.93 (Inv)
 RF = 2.50 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Span 6

Section: 18

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	158	k
WS Load = DW =	28	k
P =	0	
Live Load = LL =	139	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 184.9 k

Capacity = ϕF_{nc} = C = 1106.1 k

RF =	2.68	(Inv)
RF =	3.47	(Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 6 Section: 18

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 11902.3 in³
 Short-term S = 35850.7 in³

Bottom Flange:

Long-term S = 5430.3 in³
 Short-term S = 5989.2 in³
 Lateral Bending S = 104.7 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3695 k-ft

Wearing Surface Moment = 671 k-ft

Live Load Moment = 4112 k-ft
 Impact = 133%

Dead Load = DC = 3.7 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 1.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.7 ksi

ff = 0.7 ksi

ff = 1.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 18.11 (Inv)

RF = 23.54 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3695 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 671 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 4112 k-ft

Lateral Live Load Moment = 3 k-ft

Impact = 133%

Dead Load = DC = 8.2 ksi

WS Load = DW = 1.5 ksi

P = 0

Live Load = LL + IM = 11.2 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 8.2 ksi

fl = 0.00 ksi

DC = ff + fl/2 = 8.2 ksi

fbu = 1.5 ksi

fl = 0.00 ksi

DW = ff + f/2l = 1.5 ksi

fbu = 8.2 ksi

fl = 0.34 ksi

LL + IM = ff + fl/2 = 11.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.60 (Inv)

RF = 3.38 (Op)



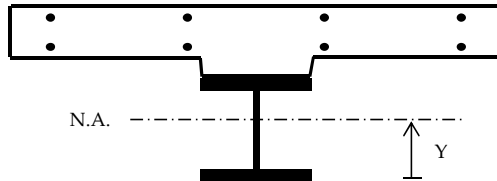
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 6 Section: 18

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	14.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.3125 in
Bot. Flange Width =	20.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	10.50 in ²	112.6875 in	1183.22 in ³	63.724 in	42637.7 in ³	42638.2 in ³
Web	76.31 in ²	56.8125 in	4335.50 in ³	7.849 in	4701.2 in ³	83055.1 in ³
Bot. Flange	26.25 in ²	0.6563 in	17.23 in ³	48.307 in	61257.1 in ³	61260.8 in ³
Σ =	113.06 in ²		5535.95 in ³			

Neutral Axis = Y = 48.964 in
 Total MOI = 186954 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
2933.8 in ³	2916.7 in ³	3870.1 in ³	3818.2 in ³	149.5 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	113.06 in ²	48.96 in	5535.95 in ³	47.91 in	259567.8 in ⁴	446521.9 in ⁴
Slab	224.00 in ²	121.06 in	27118.00 in ³	24.18 in	131015.1 in ⁴	133703.10 in ⁴
Σ =	337.06 in ²		32653.95 in ³			

Neutral Axis = 96.88 in
 Total MOI = 580225 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
36701.1 in ³	35850.7 in ³	6030.1 in ³	5989.2 in ³	37592.8 in ³	6071.5 in ³	23991.6 in ³	19222.6 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	113.06 in ²	48.96 in	5535.95 in ³	28.68 in	92974.9 in ⁴	279928.98 in ⁴
Slab	74.67 in ²	121.06 in	9039.33 in ³	43.42 in	140785.4 in ⁴	141681.35 in ⁴
Σ =	187.73 in ²		14575.28 in ³			

Neutral Axis = 77.64 in
 Total MOI = 421610 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
12029.7 in ³	11902.3 in ³	5476.6 in ³	5430.3 in ³	12159.8 in ³	5523.7 in ³	9709.5 in ³	8530.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 19

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

$\lambda_f =$	9.600
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

Fnc = 48.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

Fnc = 43.72 ksi

Lp =	139.4	in
Lr =	523	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Controlling Resistance:

Fnc = 43.72 ksi

$\phi_f \phi_c \phi_s F_{nc} = 43.7$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.27

k =	7.7	in
Vp =	2213.1	k
Vn =	1433.9	k

$\phi_v \phi_c \phi_s V_n = 1433.9$ k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 19

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -4327 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -800 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2068 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 10.0 ksi
 WS Load = DW = 1.9 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 Capacity = $\phi F_{nc} = C$ = 43.7 ksi

f_{bu} = 9.9 ksi
 f_l = 0.15 ksi
 $DC = f_{bu} + \frac{1}{2}f_l = 10.0$ ksi

f_{bu} = 1.8 ksi
 f_l = 0.05 ksi
 $DW = f_{bu} + \frac{1}{2}f_l = 1.9$ ksi

f_{bu} = 4.8 ksi
 f_l = 0.70 ksi
 $LL + IM = f_{bu} + \frac{1}{2}f_l = 6.6$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.45 (Inv)
 RF = 3.18 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -4327 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -800 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2068 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 7.7 ksi
 WS Load = DW = 1.4 ksi
 P = 0
 Live Load = LL + IM = 5.1 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 7.6 ksi
 f_l = 0.15 ksi
 $DC = f_{bu} + \frac{1}{2}f_l = 7.7$ ksi

f_{bu} = 1.4 ksi
 f_l = 0.05 ksi
 $DW = f_{bu} + \frac{1}{2}f_l = 1.4$ ksi

f_{bu} = 3.6 ksi
 f_l = 0.70 ksi
 $LL + IM = f_{bu} + \frac{1}{2}f_l = 5.1$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.25 (Inv)
 RF = 5.51 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 6

Section: 19

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	193	k
WS Load = DW =	34	k
P =	0	
Live Load = LL =	166	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 220.8 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF = 2.95 (Inv)

RF = 3.83 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 19

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4327 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -800 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2068 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 10.0 ksi
 WS Load = DW = 1.9 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 9.9 ksi
 f_l = 0.15 ksi
 $DC = f_f + f_l/2 = 10.0$ ksi

f_f = 1.8 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 1.9$ ksi

f_f = 4.8 ksi
 f_l = 0.70 ksi
 $LL + IM = f_f + f_l/2 = 6.6$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.13 (Inv)
 RF = 5.38 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4327 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -800 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2068 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 7.7 ksi
 WS Load = DW = 1.4 ksi
 P = 0
 Live Load = LL + IM = 5.3 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 7.6 ksi
 f_l = 0.15 ksi
 $DC = f_f + f_l/2 = 7.7$ ksi

f_f = 1.4 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 1.4$ ksi

f_f = 3.6 ksi
 f_l = 0.70 ksi
 $LL + IM = f_f + f_l/2 = 5.3$ ksi (Impact Added Here)

RF = 5.57 (Inv)
 RF = 7.24 (Op)



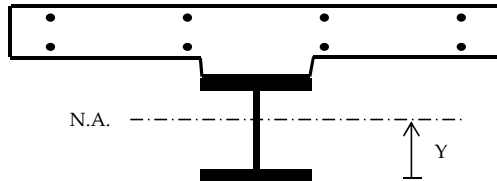
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 19

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 20

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	2	in

$\lambda_f =$	6.000
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 50.0 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	57.50	in (Non-Comp)
rt =	6.137	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 44.39 ksi

Lp =	147.8	in
Lr =	555	in

Controlling Resistance:

Fnc = 44.39 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$\phi_f \phi_c \phi_s F_{nc} = 44.4$ ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.27

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$\phi_v \phi_c \phi_s V_n = 1433.9$ k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 20

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8898.8 in³
 Lateral Bending S = 384.0 in³

Bottom Flange S = 7169.5 in³
 Lateral Bending S = 384.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -8708 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1527 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3518 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 14.6 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.1 ksi
 Capacity = $\phi F_{nc} = C$ = 44.4 ksi

f_{bu} = 14.6 ksi
 f_l = 0.19 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 14.6 ksi

f_{bu} = 2.6 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 5.9 ksi
 f_l = 0.69 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.56 (Inv)
RF = 2.02 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -8708 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1527 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3518 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 11.8 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 11.7 ksi
 f_l = 0.19 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 11.8 ksi

f_{bu} = 2.1 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.1 ksi

f_{bu} = 4.7 ksi
 f_l = 0.69 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.78 (Inv)
RF = 3.60 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 6

Section: 20

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	259	k
WS Load = DW =	43	k
P =	0	
Live Load = LL =	188	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 250.0 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF = 2.39 (Inv)

RF = 3.10 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 20

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 8898.8 in³
 Lateral Bending S = 384.0 in³

Bottom Flange S = 7169.5 in³
 Lateral Bending S = 384.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -8708 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1527 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3518 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 14.7 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 8.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 14.6 ksi
 fl = 0.19 ksi

DC = ff + fl/2 = 14.7 ksi

ff = 2.6 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 2.6 ksi

ff = 5.9 ksi
 fl = 0.69 ksi

LL + IM = ff + fl/2 = 8.1 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.86 (Inv)
 RF = 3.72 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -8708 k-ft
 Lateral Dead Load Moment = 6 k-ft

Wearing Surface Moment = -1527 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3518 k-ft
 Lateral Live Load Moment = 22 k-ft
 Impact = 133%

Dead Load = DC = 11.8 ksi
 WS Load = DW = 2.1 ksi
 P = 0
 Live Load = LL + IM = 6.8 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 11.7 ksi
 fl = 0.19 ksi

DC = ff + fl/2 = 11.8 ksi

ff = 2.1 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 2.1 ksi

ff = 4.7 ksi
 fl = 0.69 ksi

LL + IM = ff + fl/2 = 6.8 ksi (Impact Added Here)

RF = 3.82 (Inv)
 RF = 4.96 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

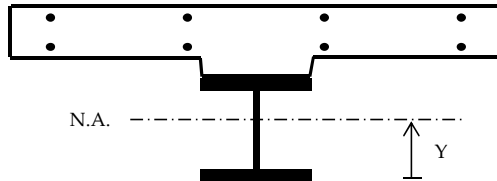
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 6

Section: 20

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.0000 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.0000 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	48.00 in ²	114.0000 in	5472.00 in ³	56.500 in	153228.0 in ³	153244.0 in ³
Web	76.31 in ²	57.5000 in	4387.97 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	48.00 in ²	1.0000 in	48.00 in ³	56.500 in	153228.0 in ³	153244.0 in ³
Σ =	172.31 in ²		9907.97 in ³			

$$\text{Neutral Axis} = Y = 57.500 \text{ in}$$

$$\text{Total MOI} = 384842 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
6811.4 in ³	6692.9 in ³	6811.4 in ³	6692.9 in ³	384.0 in ³	384.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	172.31 in ²	57.50 in	9907.97 in ³	6.19 in	6598.45 in ³	391440.31 in ⁴
Top Bars	12.57 in ²	127.00 in	1595.93 in ³	63.31 in	50370.88 in ³	50370.93 in ⁴
Bot. Bars	4.95 in ²	118.38 in	585.96 in ³	54.69 in	14803.71 in ³	14803.73 in ⁴
Σ =	189.83 in ²		12089.85 in ³			

$$\text{Neutral Axis} = 63.69 \text{ in}$$

$$\text{Total MOI} = 456615.0 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	9075.7 in ³	8898.8 in ³	7283.9 in ³	7169.5 in ³	9259.7 in ³	7402.0 in ³	7212.2 in ³	8349.6 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 21

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

ϕ_f =	1.00	LRFD 6.5.4.2
ϕ_v =	1.00	LRFD 6.5.4.3
ϕ_c =	1.00	MBE 6A.4.2.3-1
ϕ_s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

λ_f =	9.600
λ_{pf} =	9.152
λ_{rf} =	13.487

Fnc = 48.4 ksi

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

Fnc = 43.72 ksi

Lp =	139.4	in
Lr =	523	in

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}} \right)}}$$

Controlling Resistance:

Fnc = 43.72 ksi

$\phi_f \phi_c \phi_s F_{nc} = 43.7$ ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.27

k =	7.7	in
Vp =	2213.1	k
Vn =	1433.9	k

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D} \right)^2}} \right]$$

$\phi_v \phi_c \phi_s V_n = 1433.9$ k

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w} \right)^2} \left(\frac{Ek}{F_{yw}} \right)$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 21

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -3942 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -728 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1984 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 9.1 ksi
 WS Load = DW = 1.7 ksi
 P = 0
 Live Load = LL + IM = 6.3 ksi
 Capacity = $\phi F_{nc} = C$ = 43.7 ksi

f_{bu} = 9.1 ksi
 f_l = 0.20 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 9.1 ksi

f_{bu} = 1.7 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.7 ksi

f_{bu} = 4.6 ksi
 f_l = 0.55 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.3 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.70 (Inv)
RF = 3.50 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -3942 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -728 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1984 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 7.0 ksi
 WS Load = DW = 1.3 ksi
 P = 0
 Live Load = LL + IM = 4.9 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 6.9 ksi
 f_l = 0.20 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 7.0 ksi

f_{bu} = 1.3 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.3 ksi

f_{bu} = 3.5 ksi
 f_l = 0.55 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 4.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.60 (Inv)
RF = 5.96 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 6

Section: 21

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	185	k
WS Load = DW =	33	k
P =	0	
Live Load = LL =	145	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 192.9 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF = 3.42 (Inv)

RF = 4.43 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 21

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -3942 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -728 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1984 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 9.2 ksi
 WS Load = DW = 1.7 ksi
 P = 0
 Live Load = LL + IM = 6.3 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 9.1 ksi
 f_l = 0.20 ksi
 $DC = f_f + f_l/2 = 9.2$ ksi

f_f = 1.7 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 1.7$ ksi

f_f = 4.6 ksi
 f_l = 0.55 ksi
 $LL + IM = f_f + f_l/2 = 6.3$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.47 (Inv)
 RF = 5.81 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -3942 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -728 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1984 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 7.0 ksi
 WS Load = DW = 1.3 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 6.9 ksi
 f_l = 0.20 ksi
 $DC = f_f + f_l/2 = 7.0$ ksi

f_f = 1.3 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 1.3$ ksi

f_f = 3.5 ksi
 f_l = 0.55 ksi
 $LL + IM = f_f + f_l/2 = 5.0$ ksi (Impact Added Here)

RF = 6.02 (Inv)
 RF = 7.83 (Op)



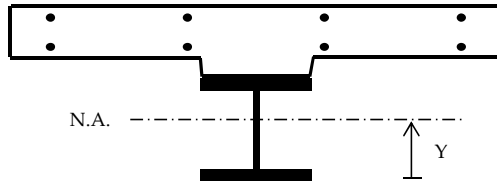
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 6 Section: 21

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 7 Section: 22

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

tw =	0.6875	in	D/tw =	161.5
D =	111	in	1.12√Ek/fyw =	75.0
do =	150	in	1.4√Ek/fyw =	93.8

Vp =	2213.1	k	k =	7.7	in
Vn =	1433.9	k	C =	0.27	

$$\phi_v \phi_c \phi_s V_n = 1433.9 \text{ k}$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 7 Section: 22

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S =	11528.4	in ³
Short-term S =	36617.6	in ³
Lateral Bending S =	73.3	in ³

Bottom Flange:

Long-term S =	4364.3	in ³
Short-term S =	4838.3	in ³
Lateral Bending S =	64.1	in ³

Load Factors:

γ_{DC} =	1.25
γ_{DW} =	1.5
γ_P =	0
γ_{LL} =	1.75 (Inv)
γ_{LL} =	1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 3584 k-ft

Wearing Surface Moment = 667 k-ft

Live Load Moment = 3811 k-ft

Impact = 133%

Dead Load = DC = 3.7 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 1.7 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 3.7 ksi

f_{bu} = 0.7 ksi

f_{bu} = 1.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 15.24 (Inv)
 RF = 19.75 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3584 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 667 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3811 k-ft

Lateral Live Load Moment = 2 k-ft

Impact = 133%

Dead Load = DC = 9.9 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 12.7 ksi

Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.9 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 9.9 ksi

f_{bu} = 1.8 ksi

f_l = 0.00 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.8 ksi

f_{bu} = 9.5 ksi

f_l = 0.37 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 12.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.57 (Inv)
 RF = 2.03 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 7 Section: 22

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	121	k
WS Load = DW =	22	k
P =	0	
Live Load = LL =	124	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 164.9 k

Capacity = ϕF_{nc} = C = 1433.9 k

RF =	4.33	(Inv)
RF =	5.61	(Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 7 Section: 22

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 11528.4 in³
 Short-term S = 36617.6 in³

Bottom Flange:

Long-term S = 4364.3 in³
 Short-term S = 4838.3 in³
 Lateral Bending S = 64.1 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3584 k-ft

Wearing Surface Moment = 667 k-ft

Live Load Moment = 3811 k-ft
 Impact = 133%

Dead Load = DC = 3.7 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 1.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.7 ksi

ff = 0.7 ksi

ff = 1.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 19.95 (Inv)
 RF = 25.93 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3584 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 667 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 3811 k-ft

Lateral Live Load Moment = 2 k-ft

Impact = 133%

Dead Load = DC = 9.9 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 12.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 9.9 ksi

f_l = 0.00 ksi

DC = ff + f_l/2 = 9.9 ksi

f_{bu} = 1.8 ksi

f_l = 0.00 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 9.5 ksi

f_l = 0.37 ksi

LL + IM = ff + f_l/2 = 12.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.15 (Inv)
 RF = 2.79 (Op)



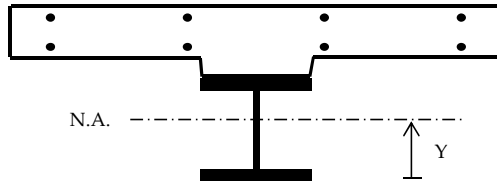
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 7 Section: 22

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	14.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.0000 in
Bot. Flange Width =	16.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	10.50 in ²	112.3750 in	1179.94 in ³	58.884 in	36406.3 in ³	36406.8 in ³
Web	76.31 in ²	56.5000 in	4311.66 in ³	3.009 in	690.7 in ³	79044.6 in ³
Bot. Flange	16.00 in ²	0.5000 in	8.00 in ³	52.991 in	44929.6 in ³	44930.9 in ³
Σ =	102.81 in ²		5499.59 in ³			

Neutral Axis = Y = 53.491 in
 Total MOI = 160382 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
2723.7 in ³	2706.5 in ³	3026.6 in ³	2998.3 in ³	73.3 in ³	64.1 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	102.81 in ²	53.49 in	5499.59 in ³	46.10 in	218493.8 in ⁴	378876.1 in ⁴
Slab	224.00 in ²	120.75 in	27048.00 in ³	21.16 in	100285.2 in ⁴	102973.24 in ⁴
Σ =	326.81 in ²		32547.59 in ³			

Neutral Axis = 99.59 in
 Total MOI = 481849 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
37691.7 in ³	36617.6 in ³	4862.7 in ³	4838.3 in ³	38830.7 in ³	4887.4 in ³	22772.8 in ³	17741.8 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	102.81 in ²	53.49 in	5499.59 in ³	28.30 in	82318.8 in ⁴	242701.11 in ⁴
Slab	74.67 in ²	120.75 in	9016.00 in ³	38.96 in	113349.2 in ⁴	114245.17 in ⁴
Σ =	177.48 in ²		14515.59 in ³			

Neutral Axis = 81.79 in
 Total MOI = 356946 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
11669.7 in ³	11528.4 in ³	4391.2 in ³	4364.3 in ³	11814.6 in ³	4418.3 in ³	9161.3 in ³	7938.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 23

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

$\lambda_f =$	9.600
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 48.4 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	228.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 46.54 ksi

Lp =	139.4	in
Lr =	523	in

Controlling Resistance:

Fnc = 46.54 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$\phi_f \phi_c \phi_s F_{nc} = 46.5$ ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	114	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	84.2
$1.4 \sqrt{Ek}/f_{yw} =$	105.2
C =	0.34

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$\phi_v \phi_c \phi_s V_n = 1639.1$ k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 23

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -6598 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1215 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2383 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 15.2 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 7.6 ksi
 Capacity = $\phi F_{nc} = C$ = 46.5 ksi

f_{bu} = 15.2 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 15.2 ksi

f_{bu} = 2.8 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 5.5 ksi
 f_l = 0.65 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.76 (Inv)
RF = 2.28 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -6598 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1215 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2383 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 11.7 ksi
 WS Load = DW = 2.2 ksi
 P = 0
 Live Load = LL + IM = 5.9 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 11.6 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 11.7 ksi

f_{bu} = 2.1 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.2 ksi

f_{bu} = 4.2 ksi
 f_l = 0.65 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 5.9 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 3.14 (Inv)
RF = 4.07 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 7

Section: 23

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	214	k
WS Load = DW =	38	k
P =	0	
Live Load = LL =	155	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 206.2 k

Capacity = $\phi F_{nc} = C$ = 1639.1 k

RF = 3.64 (Inv)

RF = 4.72 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 23

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6598 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1215 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2383 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 15.3 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 7.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 15.2 ksi
 fl = 0.25 ksi

DC = ff + fl/2 = 15.3 ksi

ff = 2.8 ksi
 fl = 0.05 ksi
 DW = ff + fl/2 = 2.8 ksi

ff = 5.5 ksi
 fl = 0.65 ksi
 LL + IM = ff + fl/2 = 7.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.99 (Inv)
 RF = 3.89 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6598 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1215 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2383 k-ft
 Lateral Live Load Moment = 13 k-ft
 Impact = 133%

Dead Load = DC = 11.7 ksi
 WS Load = DW = 2.2 ksi
 P = 0
 Live Load = LL + IM = 6.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 11.6 ksi
 fl = 0.25 ksi

DC = ff + fl/2 = 11.7 ksi

ff = 2.1 ksi
 fl = 0.05 ksi
 DW = ff + fl/2 = 2.2 ksi

ff = 4.2 ksi
 fl = 0.65 ksi
 LL + IM = ff + fl/2 = 6.0 ksi (Impact Added Here)

RF = 4.31 (Inv)
 RF = 5.60 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

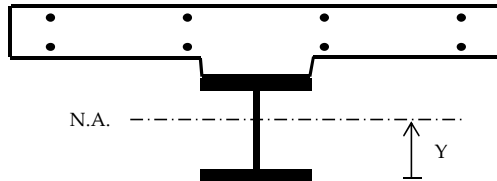
Project #: 55060.00
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 Date: 7/18/2015
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Girder: 8-2

Location: Pier 7

Section: 23

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 24

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

$\phi_f =$	1.00	LRFD 6.5.4.2
$\phi_v =$	1.00	LRFD 6.5.4.3
$\phi_c =$	1.00	MBE 6A.4.2.3-1
$\phi_s =$	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	2.25	in

$\lambda_f =$	5.333
$\lambda_{pf} =$	9.152
$\lambda_{rf} =$	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 50.0 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	57.75	in (Non-Comp)
rt =	6.209	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 44.52 ksi

Lp =	149.5	in
Lr =	561	in

Controlling Resistance:

Fnc = 44.52 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

$\phi_f \phi_c \phi_s F_{nc} = 44.5$ ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

$\phi_f \phi_c \phi_s F_{nt} = 50.0$ ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

$0.95 R_h F_{yf} = 47.5$ ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
$1.12 \sqrt{Ek}/f_{yw} =$	75.0
$1.4 \sqrt{Ek}/f_{yw} =$	93.8
C =	0.27

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}} \right)$$

$\phi_v \phi_c \phi_s V_n = 1433.9$ k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 24

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 9582.9 in³
 Lateral Bending S = 432.0 in³

Bottom Flange S = 7822.3 in³
 Lateral Bending S = 432.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -10174 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1814 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3546 k-ft
 Lateral Live Load Moment = 23 k-ft
 Impact = 133%

Dead Load = DC = 15.7 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 7.5 ksi
 Capacity = $\phi F_{nc} = C$ = 44.5 ksi

f_{bu} = 15.6 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 15.7 ksi

f_{bu} = 2.8 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 5.4 ksi
 f_l = 0.64 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.57 (Inv)
RF = 2.04 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -10174 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1814 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3546 k-ft
 Lateral Live Load Moment = 23 k-ft
 Impact = 133%

Dead Load = DC = 12.8 ksi
 WS Load = DW = 2.3 ksi
 P = 0
 Live Load = LL + IM = 6.2 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 12.7 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 12.8 ksi

f_{bu} = 2.3 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.3 ksi

f_{bu} = 4.4 ksi
 f_l = 0.64 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.82 (Inv)
RF = 3.65 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Location: Bangor/Brewer, ME

Calculated by: JGM

Checked by: CTA

Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:

Date: 7/18/2015

Date: 7/20/2015

Girder: 8-2

Location: Pier 7

Section: 24

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	283	k
WS Load = DW =	48	k
P =	0	
Live Load = LL =	170	k
Impact =	133%	

Live Load = LL + IM = 226.1 k

Capacity = $\phi F_{nc} = C = 1433.9$ k

$\gamma_{DC} =$	1.25
$\gamma_{DW} =$	1.5
$\gamma_P =$	0
$\gamma_{LL} =$	1.75 (Inv)
$\gamma_{LL} =$	1.35 (Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.55 (Inv)

RF = 3.30 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 24

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 9582.9 in³
 Lateral Bending S = 432.0 in³

Bottom Flange S = 7822.3 in³
 Lateral Bending S = 432.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -10174 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1814 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3546 k-ft
 Lateral Live Load Moment = 23 k-ft
 Impact = 133%

Dead Load = DC = 15.7 ksi
 WS Load = DW = 2.8 ksi
 P = 0
 Live Load = LL + IM = 7.5 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 15.6 ksi
 fl = 0.25 ksi

DC = ff + fl/2 = 15.7 ksi

ff = 2.8 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 2.8 ksi

ff = 5.4 ksi
 fl = 0.64 ksi

LL + IM = ff + fl/2 = 7.5 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.96 (Inv)
 RF = 3.85 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -10174 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1814 k-ft
 Lat. Wearing Surface Moment = 2 k-ft

Live Load Moment = -3546 k-ft
 Lateral Live Load Moment = 23 k-ft
 Impact = 133%

Dead Load = DC = 12.9 ksi
 WS Load = DW = 2.3 ksi
 P = 0
 Live Load = LL + IM = 6.3 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 12.7 ksi
 fl = 0.25 ksi

DC = ff + fl/2 = 12.9 ksi

ff = 2.3 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 2.3 ksi

ff = 4.4 ksi
 fl = 0.64 ksi

LL + IM = ff + fl/2 = 6.3 ksi (Impact Added Here)

RF = 3.93 (Inv)
 RF = 5.11 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

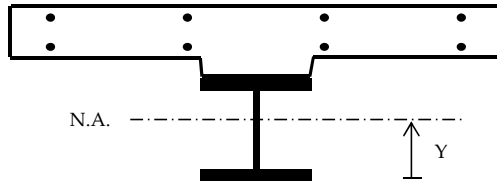
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 7

Section: 24

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	2.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	2.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	54.00 in ²	114.3750 in	6176.25 in ³	56.625 in	173145.1 in ³	173167.9 in ³
Web	76.31 in ²	57.7500 in	4407.05 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	54.00 in ²	1.1250 in	60.75 in ³	56.625 in	173145.1 in ³	173167.9 in ³
Σ =	184.31 in ²		10644.05 in ³			

$$\text{Neutral Axis} = Y = 57.750 \text{ in}$$

$$\text{Total MOI} = 424690 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
7500.0 in ³	7353.9 in ³	7500.0 in ³	7353.9 in ³	432.0 in ³	432.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	184.31 in ²	57.75 in	10644.05 in ³	5.84 in	6290.28 in ³	430979.88 in ⁴
Top Bars	12.57 in ²	127.50 in	1602.21 in ³	63.91 in	51324.07 in ³	51324.12 in ⁴
Bot. Bars	4.95 in ²	118.88 in	588.43 in ³	55.28 in	15128.27 in ³	15128.29 in ⁴
Σ =	201.83 in ²		12834.69 in ³			

$$\text{Neutral Axis} = 63.59 \text{ in}$$

$$\text{Total MOI} = 497432.3 \text{ in}^4$$

	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
Section Mod. = S =	9795.2 in ³	9582.9 in ³	7963.1 in ³	7822.3 in ³	10017.2 in ³	8109.2 in ³	7783.6 in ³	8997.9 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 25

Negative Moment

Noncomposite Section w/ Rebar

Section Capacities:

E =	29000	ksi
Fy =	50	ksi
Rh =	1	LRFD 6.10.1.10.1
Rb =	1	LRFD 6.10.1.10.2

φf =	1.00	LRFD 6.5.4.2
φv =	1.00	LRFD 6.5.4.3
φc =	1.00	MBE 6A.4.2.3-1
φs =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Discretely Braced Flanges):

Local Buckling Resistance (LRFD 6.10.8.2.2):

bfc =	24	in
tfc =	1.25	in

λf =	9.600
λpf =	9.152
λrf =	13.487

$$\lambda_f = \frac{b_{fc}}{2t_{fc}} \quad \lambda_{pf} = 0.38 \sqrt{\frac{E}{f_{yc}}} \quad \text{if } \lambda_f \leq \lambda_{pf} \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$\lambda_{rf} = 0.56 \sqrt{\frac{E}{f_{yc}}}$$

Fnc = 48.4 ksi

Lateral Torsional Buckling Resistance (LRFD 6.10.8.2.3):

tw =	0.6875	in
Lb =	300.0	in
Cb =	1.0	(Conservative)

Dc =	56.75	in (Non-Comp)
rt =	5.787	in
Fyr = 0.7Fy =	35	ksi

$$L_r = \pi r_t \sqrt{\frac{E}{F_{yr}}} \quad \text{if } L_b \leq L_p \text{ then, } F_{nc} = R_b R_h F_{yc}$$

$$L_p = 1.0 r_t \sqrt{\frac{E}{F_{yb}}} \quad r_t = \frac{b_{fc}}{\sqrt{12 \left(1 + \frac{1}{3} \frac{D_c t_w}{b_{fc} t_{fc}}\right)}}$$

Fnc = 43.72 ksi

Lp =	139.4	in
Lr =	523	in

Controlling Resistance:

Fnc = 43.72 ksi

if $L_p < L_b < L_r$ then:

$$F_{nc} = C_b \left[1 - \left(1 - \frac{F_{yr}}{R_h F_{yc}} \right) \left(\frac{L_b - L_p}{L_r - L_p} \right) \right]$$

φfφcφsFnc = 43.7 ksi

Tension Flange Resistance (Discretely and Continuously Braced Flanges):

Tension-Flange Flexural Resistance (LRFD 6.10.8.3):

Fnt = 50.00 ksi

$$F_{nt} = R_h F_{yt}$$

φfφcφsFnt = 50.0 ksi

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2 - See Section C6.10.4.2.2)

0.95RhFyf = 47.5 ksi

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3):

tw =	0.6875	in
D =	111	in
do =	150	in

D/tw =	161.5
1.12√Ek/fyw =	75.0
1.4√Ek/fyw =	93.8
C =	0.27

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

φvφcφsVn = 1433.9 k



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 25

Flexure Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Bottom Flange (Compression):

Discretely Braced Flanges in Compression (LRFD 6.10.8.1.1):

Dead Load Moment = -4670 k-ft
 Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = -877 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1917 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 10.9 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 6.2 ksi
 Capacity = $\phi F_{nc} = C$ = 43.7 ksi

f_{bu} = 10.7 ksi
 f_l = 0.50 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 10.9 ksi

f_{bu} = 2.0 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.0 ksi

f_{bu} = 4.4 ksi
 f_l = 0.80 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 6.2 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.49 (Inv)
RF = 3.23 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -4670 k-ft
 Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = -877 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1917 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 8.4 ksi
 WS Load = DW = 1.6 ksi
 P = 0
 Live Load = LL + IM = 4.8 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 8.2 ksi
 f_l = 0.50 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 8.4 ksi

f_{bu} = 1.5 ksi
 f_l = 0.05 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.6 ksi

f_{bu} = 3.4 ksi
 f_l = 0.80 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 4.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.39 (Inv)
RF = 5.70 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 7/18/2015

Checked by: CTA

Date: 7/20/2015

Title: Capacities and Rating Factors - Spans 3-8

Girder: 8-2

Location: Pier 7

Section: 25

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	218	k
WS Load = DW =	39	k
P =	0	
Live Load = LL =	145	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 192.9 k

Capacity = $\phi F_{nc} = C$ = 1433.9 k

RF = 3.27 (Inv)

RF = 4.24 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Pier 7 Section: 25

Service Rating Factors:

Negative Moment

Section Properties:

Top Flange S = 6827.0 in³
 Lateral Bending S = 240.0 in³

Bottom Flange S = 5223.6 in³
 Lateral Bending S = 240.0 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Bottom Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4670 k-ft
 Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = -877 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1917 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 11.0 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 6.2 ksi
 Capacity = $0.95R_h F_y$ = C = 47.5 ksi

f_f = 10.7 ksi
 f_l = 0.50 ksi
 $DC = f_f + f_l/2 = 11.0$ ksi

f_f = 2.0 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 2.0$ ksi

f_f = 4.4 ksi
 f_l = 0.80 ksi
 $LL + IM = f_f + f_l/2 = 6.2$ ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 4.27 (Inv)
 RF = 5.55 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -4670 k-ft
 Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = -877 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -1917 k-ft
 Lateral Live Load Moment = 16 k-ft
 Impact = 133%

Dead Load = DC = 8.5 ksi
 WS Load = DW = 1.6 ksi
 P = 0
 Live Load = LL + IM = 5.0 ksi
 Capacity = $0.95R_h F_y$ = C = 47.5 ksi

f_f = 8.2 ksi
 f_l = 0.50 ksi
 $DC = f_f + f_l/2 = 8.5$ ksi

f_f = 1.5 ksi
 f_l = 0.05 ksi
 $DW = f_f + f_l/2 = 1.6$ ksi

f_f = 3.4 ksi
 f_l = 0.80 ksi
 $LL + IM = f_f + f_l/2 = 5.0$ ksi (Impact Added Here)

RF = 5.75 (Inv)
 RF = 7.47 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

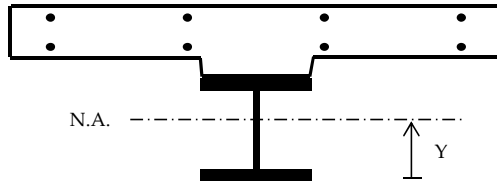
Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2

Location: Pier 7

Section: 25

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.2500 in
Top Flange Width =	24.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	24.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	10.50 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	15.00 in
Bot. C.C. =	1.000 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	30.00 in ²	112.8750 in	3386.25 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	0.000 in	0.0 in ³	78353.9 in ³
Bot. Flange	30.00 in ²	0.6250 in	18.75 in ³	56.125 in	94500.5 in ³	94504.4 in ³
Σ =	136.31 in ²		7735.73 in ³			

$$\text{Neutral Axis} = Y = 56.750 \text{ in}$$

$$\text{Total MOI} = 267363 \text{ in}^4$$

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4763.7 in ³	4711.2 in ³	4763.7 in ³	4711.2 in ³	240.0 in ³	240.0 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	136.31 in ²	56.75 in	7735.73 in ³	7.55 in	7772.14 in ³	275134.75 in ⁴
Top Bars	12.57 in ²	125.50 in	1577.08 in ³	61.20 in	47065.10 in ³	47065.15 in ⁴
Bot. Bars	4.95 in ²	116.88 in	578.53 in ³	52.57 in	13681.94 in ³	13681.96 in ⁴
Σ =	153.83 in ²		9891.35 in ³			

$$\text{Neutral Axis} = 64.30 \text{ in}$$

$$\text{Total MOI} = 335881.9 \text{ in}^4$$

Section Mod. = S =	Top Flange		Bot. Flange		Web		Reinforcing Steel	
	Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top Web	Bot. Web	Top Bar	Bot. Bar
	6914.8 in ³	6827.0 in ³	5274.9 in ³	5223.6 in ³	7005.0 in ³	5327.1 in ³	5488.4 in ³	6388.7 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 8 Section: 26

Positive Moment

Composite Section

Section Capacities:

Per AASHTO LRFD 6.10.6.2.2 "Composite sections of kinked (chorded continuous or horizontally curved steel girder bridges shall be considered as noncompact sections and shall satisfy the requirements of Article 6.10.7.2".

E =	29000	ksi
F _y =	50	ksi
R _h =	1	LRFD 6.10.1.10.1
R _b =	1	LRFD 6.10.1.10.2

φ _f =	1.00	LRFD 6.5.4.2
φ _v =	1.00	LRFD 6.5.4.3
φ _c =	1.00	MBE 6A.4.2.3-1
φ _s =	1.00	MBE 6A.4.2.4-1

Compression Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-1)

$$F_{nc} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 50.0 \text{ ksi}$$

$$F_{nc} = R_b R_h F_{yc}$$

Tension Flange Resistance (Noncompact Sections):

Nominal Flexural Resistance (LRFD 6.10.7.2.2-2)

$$F_{nt} = 50 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nt} = 50.0 \text{ ksi}$$

$$F_{nt} = R_h F_{yt}$$

Service II Top and Bottom Flange Resistance:

Service Flexural Requirements (LRFD 6.10.4.2.2-1 and 6.10.4.2.2-2)

$$0.95 R_h F_{yf} = 47.5 \text{ ksi}$$

$$f_f \leq 0.95 R_h F_{yf} \text{ (Top)}$$

$$f_f + \frac{f_l}{2} \leq 0.95 R_h F_{yf} \text{ (Bottom)}$$

Nominal Shear Resistance of Stiffened Webs (End Panels) (6.10.9.3.3):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	137.9
d _o =	54	in	1.4√Ek/f _{yw} =	172.3

V _p =	2213.1	k	k =	26.1	in
V _n =	1889.8	k	C =	0.85	

$$\phi_v \phi_c \phi_s V_n = 1889.8 \text{ k}$$

$$V_n = C V_p$$

$$\frac{D}{t_w} \leq 1.12 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = 1.0$$

$$1.12 \sqrt{\frac{Ek}{F_{yw}}} < \frac{D}{t_w} < 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then: } C = \frac{1.12}{\frac{D}{t_w}} \sqrt{\frac{Ek}{F_{yw}}}$$

Nominal Shear Resistance of Stiffened Webs (Interior Panels) (6.10.9.3.2):

t _w =	0.6875	in	D/t _w =	161.5
D =	111	in	1.12√Ek/f _{yw} =	64.6
d _o =	288	in	1.4√Ek/f _{yw} =	80.8

V _p =	2213.1	k	k =	5.7	in
V _n =	997.5	k	C =	0.20	

$$\phi_v \phi_c \phi_s V_n = 997.5 \text{ k}$$

$$V_p = 0.58 F_{yw} D t_w$$

$$V_n = V_p \left[C + \frac{0.87(1-C)}{\sqrt{1 + \left(\frac{d_o}{D}\right)^2}} \right]$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 8 Section: 26

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 12394.5 in³
 Short-term S = 36566.7 in³
 Lateral Bending S = 146.8 in³

Bottom Flange:

Long-term S = 5329.9 in³
 Short-term S = 5865.6 in³
 Lateral Bending S = 117.5 in³

Load Factors:

γ_{DC} = 1.25
 γ_{DW} = 1.5
 γ_P = 0
 γ_{LL} = 1.75 (Inv)
 γ_{LL} = 1.35 (Op)

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 5355 k-ft

Wearing Surface Moment = 988 k-ft

Live Load Moment = 4202 k-ft

Impact = 133%

Dead Load = DC = 5.2 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 1.8 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 5.2 ksi

f_{bu} = 1.0 ksi

f_{bu} = 1.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 13.11 (Inv)
 RF = 17.00 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 5355 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 988 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 4202 k-ft

Lateral Live Load Moment = 4 k-ft

Impact = 133%

Dead Load = DC = 12.1 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 11.6 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 12.1 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 12.1 ksi

f_{bu} = 2.2 ksi

f_l = 0.00 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.2 ksi

f_{bu} = 8.6 ksi

f_l = 0.41 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.6 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 1.55 (Inv)
 RF = 2.01 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 8 Section: 26

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	173	k
WS Load = DW =	31	k
P =	0	
Live Load = LL =	168	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 223.4 k

Capacity = ϕF_{nc} = C = 997.5 k

RF = 1.88 (Inv)
 RF = 2.44 (Op)

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	179	k
WS Load = DW =	32	k
P =	0	
Live Load = LL =	171	k
Impact =	133%	

γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_P =	0	
γ_{LL} =	1.75	(Inv)
γ_{LL} =	1.35	(Op)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

Live Load = LL + IM = 227.4 k

Capacity = ϕF_{nc} = C = 1889.8 k

RF = 4.07 (Inv)
 RF = 5.27 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00

Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 8 Section: 26

Service Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 12394.5 in³
 Short-term S = 36566.7 in³

Bottom Flange:

Long-term S = 5329.9 in³
 Short-term S = 5865.6 in³
 Lateral Bending S = 117.5 in³

Load Factors:

γ_{DC} = 1
 γ_{DW} = 1
 γ_P = 0
 γ_{LL} = 1.3 (Inv)
 γ_{LL} = 1 (Op)

Top Flange:

Service Flexural Requirments (LRFD 6.10.4.2.2-1)

Dead Load Moment = 5355 k-ft

Wearing Surface Moment = 988 k-ft

Live Load Moment = 4202 k-ft
 Impact = 133%

Dead Load = DC = 5.2 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 1.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 5.2 ksi

ff = 1.0 ksi

ff = 1.8 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 17.35 (Inv)
 RF = 22.55 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 5355 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 988 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 4202 k-ft

Lateral Live Load Moment = 4 k-ft

Impact = 133%

Dead Load = DC = 12.1 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 11.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 12.1 ksi

fl = 0.00 ksi

DC = ff + fl/2 = 12.1 ksi

fbu = 2.2 ksi

fl = 0.00 ksi

DW = ff + f/2l = 2.2 ksi

fbu = 8.6 ksi

fl = 0.41 ksi

LL + IM = ff + fl/2 = 11.7 ksi (Impact Added Here)

$$RF = \frac{C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW) \pm (\gamma_P)(P)}{(\gamma_{LL})(LL + IM)}$$

RF = 2.18 (Inv)
 RF = 2.84 (Op)



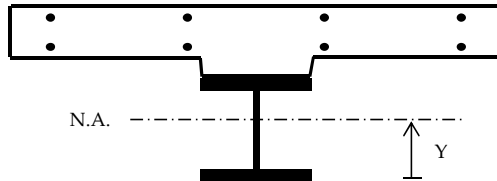
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 3-8

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Girder: 8-2 Location: Span 8 Section: 26

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	1.0000 in
Top Flange Width =	16.0000 in
Web Thickness =	0.6875 in
Web Depth =	111.0000 in
Bot. Flange Thickness =	1.2500 in
Bot. Flange Width =	20.0000 in

Deck Inputs:

Tributary Deck Width =	168.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 0
Top Bar Spacing =	0.00 in
Top C.C. =	0.00 in
Bot. Bar Number =	# 0
Bot. Bar Spacing =	0.00 in
Bot. C.C. =	0.00 in

Note: Concrete in haunch does not add to the structural capacity, only used for dimensioning purposes.

Non-Composite:

Component	Area	d	A*d	Y	A*Y ²	MOI
Top Flange	16.00 in ²	112.7500 in	1804.00 in ³	60.323 in	58221.6 in ³	58222.9 in ³
Web	76.31 in ²	56.7500 in	4330.73 in ³	4.323 in	1426.1 in ³	79779.9 in ³
Bot. Flange	25.00 in ²	0.6250 in	15.63 in ³	51.802 in	67086.6 in ³	67089.8 in ³
Σ =	117.31 in ²		6150.36 in ³			

Neutral Axis = Y = 52.427 in
 Total MOI = 205093 in⁴

$$I = \frac{bh^3}{12} + AY^2$$

$$S = \frac{I}{Y} \quad f = \frac{M}{S}$$

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
3399.9 in ³	3372.0 in ³	3959.2 in ³	3912.0 in ³	146.8 in ³	117.5 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	117.31 in ²	52.43 in	6150.36 in ³	45.17 in	239332.3 in ⁴	444424.9 in ⁴
Slab	224.00 in ²	121.25 in	27160.00 in ³	23.66 in	125342.3 in ⁴	128030.28 in ⁴
Σ =	341.31 in ²		33310.36 in ³			

Neutral Axis = 97.59 in
 Total MOI = 572455 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
37773.1 in ³	36566.7 in ³	5903.4 in ³	5865.6 in ³	39061.8 in ³	5941.7 in ³	24200.1 in ³	19303.8 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	MOI
Girder	117.31 in ²	52.43 in	6150.36 in ³	26.77 in	84053.3 in ⁴	289145.95 in ⁴
Slab	74.67 in ²	121.25 in	9053.33 in ³	42.06 in	132060.4 in ⁴	132956.37 in ⁴
Σ =	191.98 in ²		15203.69 in ³			

Neutral Axis = 79.19 in
 Total MOI = 422102 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
12579.2 in ³	12394.5 in ³	5372.3 in ³	5329.9 in ³	12769.5 in ³	5415.4 in ³	10036.8 in ³	8783.6 in ³

Bridge Photos





Looking E/SE'ly. Some of headlight baffles missing from barrier.

As adj.

1558

BANGOR

Veterans Remembrance

12/15/2008



Isol'd sev spalling of NW'ly joint.



NW'ly modular joint: dam'd bulkhead + one of seals failed.



Br Maint rehab'g and retrofitting SE'ly joint.



Light mast dam'd. Typ barrier cracking.

1558

BANGOR

Veterans Remembrance

12/15/2008



Sliding surface broken free from sole plate – freq problem of some area.



Typ dry construction in Bangor.

Exten deter of SE'ly abut inc cracks to 3/16" wide.

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BANGOR

Veterans Remembrance

12/15/2008



Looking toward Brewer along upstream side.

As adj.

1558

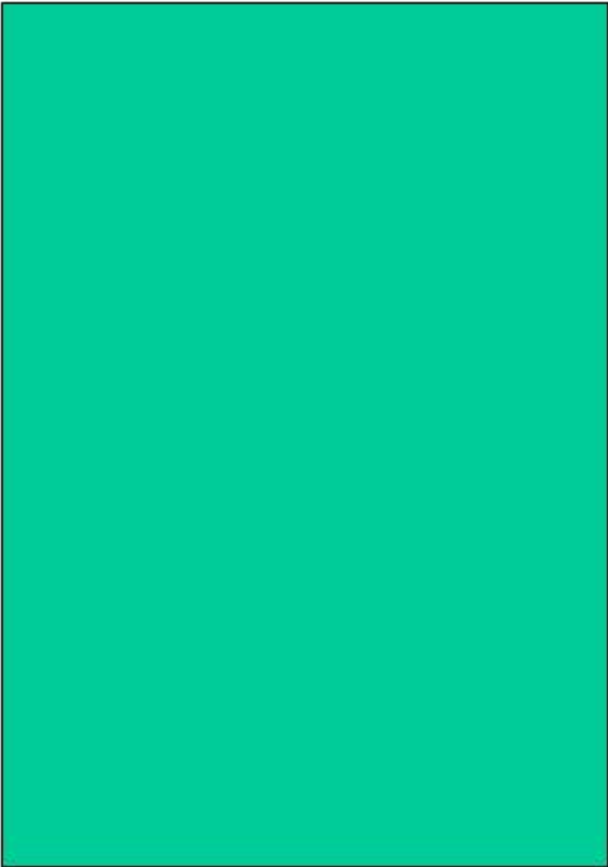
BANGOR

Veterans Remembrance

12/15/2008



Sliding surface broken free from sole plate – freq problem of some area.



NW'ly modular joint: dam'd bulkhead + one of seals failed.



Erg key to restrain lateral movement absent. Sliding surface broken free.
Weathering patina unstable.



Conc cracking $\leq 5/32''$ wide under shelter but exp'd to joint leakage.

1558

BANGOR

Veterans Remembrance

12/15/2008



Looking easterly along northern bridge fascia @ midspan



Looking easterly along northern bridge fascia at western abutment

#1558

BANGOR



Looking westerly along northern bridge fascia



Looking easterly along I-395 Westbound

VETERAN'S REMEMBRANCE

06/24/2009



Eastern Abutment



Typical river pier, note weathering steel rust washing down columns

#1558

BANGOR



Western abutment



Typical land pier, note weathering steel rust washing down columns

VETERAN'S REMEMBRANCE

06/24/2009



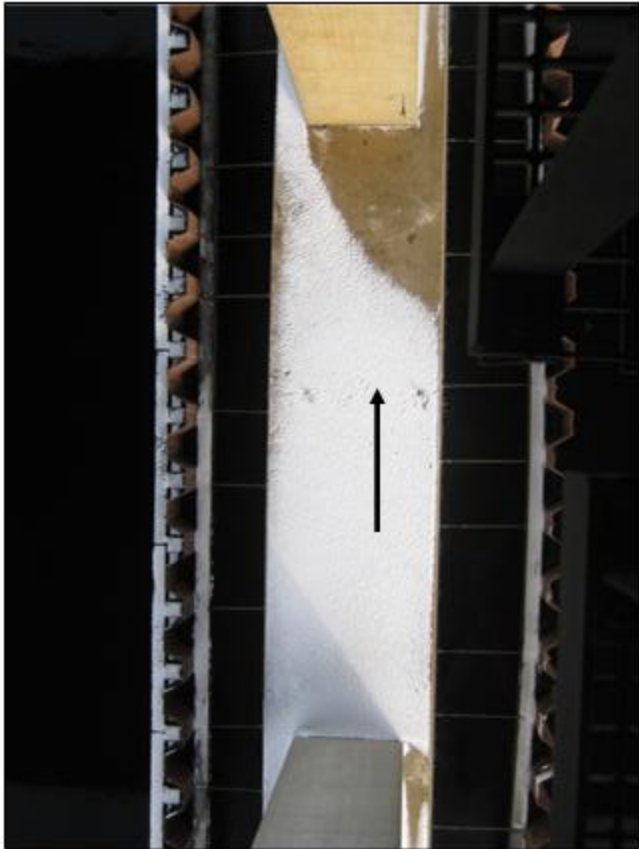
Westernmost water pier (#3) with footing post tension strengthening



External post tensioning bolts at footing



Pier #4 with large crack through crack at center of footing



Pier #4 looking down at top of footing at large through crack

#1558

BANGOR

VETERAN'S REMEMBRANCE

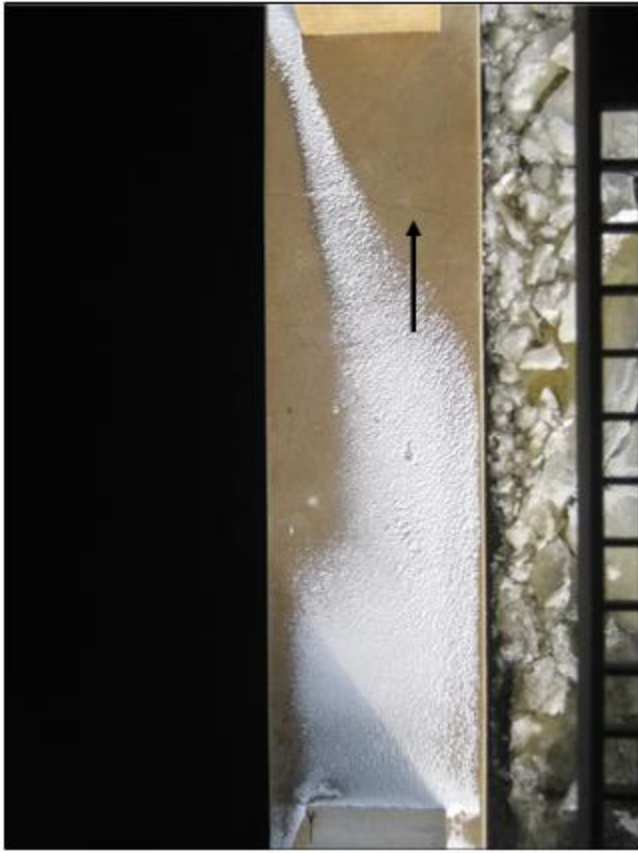
06/24/2009



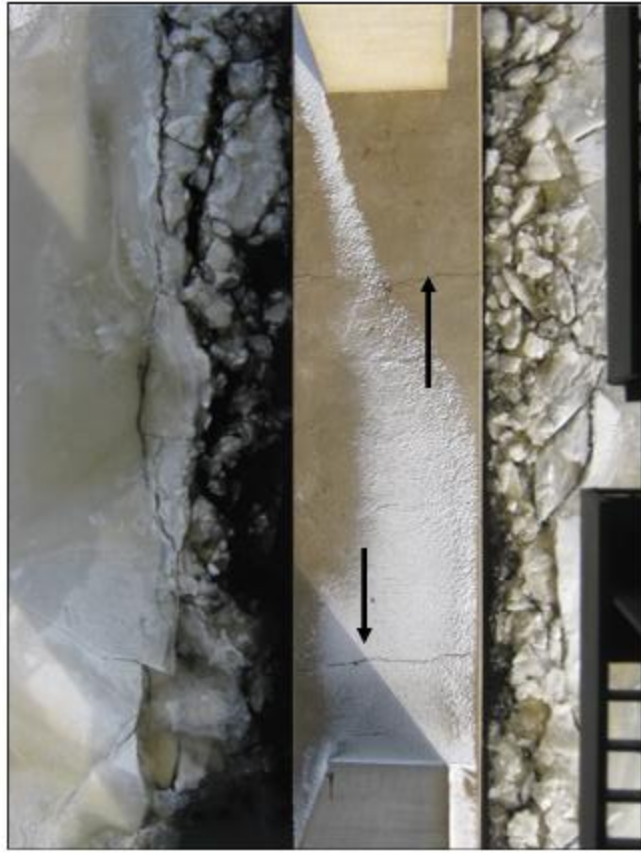
Pier #5 with visible large through crack at northern edge of footing



Easternmost water pier (#6) with multiple large footing cracks



Pier #5 looking down at top of footing at large through crack



Pier #6 looking down at top of footing at large through cracks



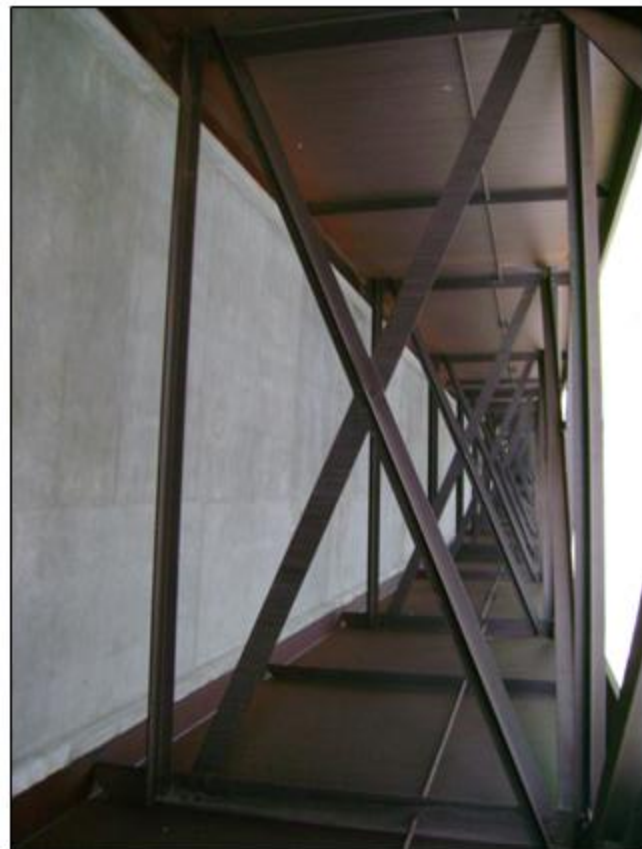
Typical beam splice



Typical bearing with some delamination of friction plate

VETERAN'S REMEMBRANCE

06/24/2009



General superstructure and deck



Corrosion of bridge drains - typical of approximately half

BANGOR

#1558



Typical wearing surface



Failed seal with heavy corrosion of weathering steel and det. of concrete

VETERAN'S REMEMBRANCE

06/24/2009



Westbound eastern joint

Westbound joint @ Pier #2



Failed bridge joint seal over Pier 2

#1558

BANGOR



Deterioration of concrete at Pier #2, northeastern corner



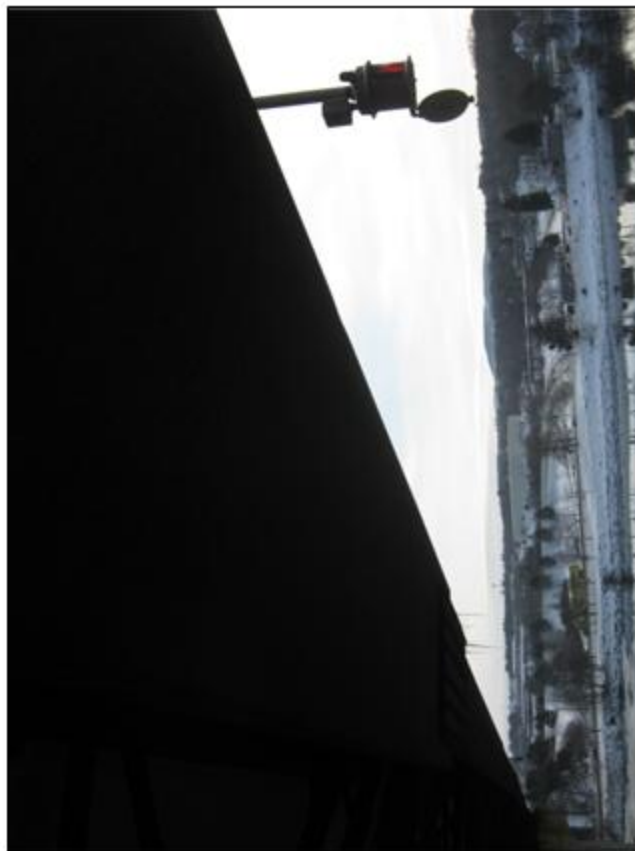
Bridge rail splice disconnected (approx. over Pier #2 westbound)

#1558

BANGOR



Abnormal weathering of steel at scattered locations



50% of navigation lights in need of repair or replacement

VETERAN'S REMEMBRANCE

06/24/2009



Roadway looking West



Wearing Surface



North face



South face

1558

Bangor

Veterans Remembrance

11-14-13



Bearings slid back approx. 6" with damaged slide plates



Three of four corners of abutments have moderate cracking/spalling and rust stains



East abutment



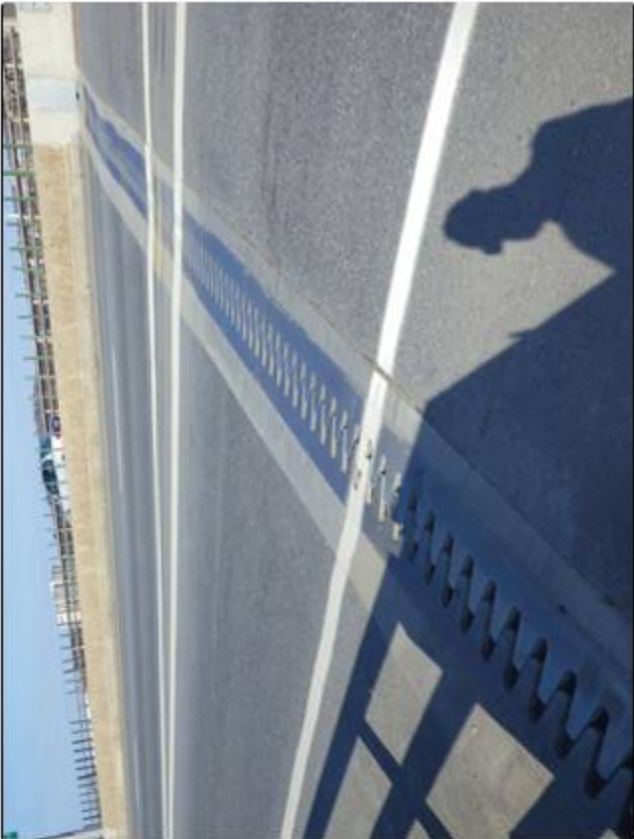
NE corner of east abutment has exposed footing

11-14-13

Veterans Remembrance

Bangor

1558



East joint



West joint

11-14-13

Veterans Remembrance



East span - Scattered minor transverse cracking with light efflorescences



Center joint west end

1558

Bangor



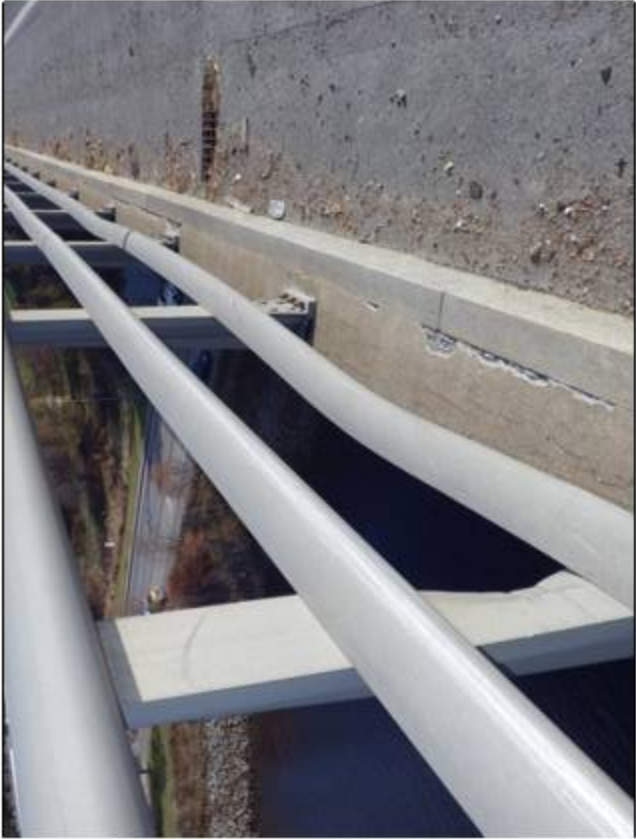
West span



Partially plugged drains with rusted thru downspouts - Typical



West abutment



Scattered damaged bridge rail but still solid

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Bangor

Veterans Remembrance

11-14-13



Bridge rail post with the three front anchor bolts sheared off and only two on the back – Eleven on the south side and five on the north side – Some of these areas span two to three posts, diminishing the strength of the rail if impacted

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Bangor

Veterans Remembrance

11-14-13



One post on the north side has four anchor bolts sheared off, leaving only one on the back side



First median light post from Bangor side has impact damage

1558

Bangor

Veterans Remembrance

11-14-13



Third median light post from Bangor side has impact damage			
1558	Bangor	Veterans Remembrance	11-14-13



First median light post from Brewer side has t slip joint

1558

Bangor

Veterans Remembrance

11-14-13



1/8" Cracks in concrete base propagating from the anchor bolts – Located at the Brewer sign truss – Both bases on the south side

1558

Bangor

Veterans Remembrance

11-14-13



Looking E'ly.,

As adj.

1558

BANGOR - BREWER

Veterans' Remembrance

05202004



Typical cracking in barrier rail.



Deterioration of pier below leaky deck joint.



Cracking in curb typical.



As above.



Bearing sliding surface delam'd...



As above except smaller bearing.



Pointing largely failed.



Crack in deck w/ leakage.

1558

BANGOR - BREWER

Veterans' Remembrance

05202004



Perforation in drain.



As above.



Multiple perforations in drain.



As adj.

Cracks in E'ly about turn and wing \leq or \approx 3/16 in wide.

1558

BANGOR - BREWER

Veterans' Remembrance

05202004



Section loss in joint bulkhead to 2 5/8 in penetration.



Typ cracking in E'ly modular joint.



≤ or = severe sect loss at drain inlet.



Deter of fascia.

1558

BANGOR - BREWER

Veterans' Remembrance

05202004



Bearing at E'ly pier **excessively** in expansion direction at 70 deg F. Approx
7 1/4 in from edge masonry plate to edge of sole pl one side & 1/4 in the other.

1558

BANGOR - BREWER

Ibid.

Veterans' Remembrance

05202004



Bearing sliding plate dalam'd .		Ibid.	
1558	BANGOR - BREWER	Veterans' Remembrance	05202004



Part of erosion area in Bangor embankment.

Ibid.

1558

BANGOR - BREWER

Veterans' Remembrance

05202004



Small potholes in joint header



Potholes

Veterans Remembrance

1-3-2007



Roadway looking east



General condition wearing surface

Bangor

1558



Roadway looking east (westbound)



Potholes in westbound west joint header

1558

Bangor



Plaque



Potholes

Veterans Remembrance

1-3-2007



Typical pier west end



Typical bearing

Veterans Remembrance

1-3-2007



South end view



Looking thru catwalk

Bangor

1558



North end view



Heavy rusting drain (one of several)



General view modular joint



Corroding at bearing top plate west pier



Documented crack in west channel pier footing



General condition superstructure

Veterans Remembrance

1-3-2007



Cracking concrete with rust staining Abutment



Typical condition patina at connection are as

Bangor

1558



General view



Documented crack in west channel pier footing



Crack in 2nd westerly channel pier footing



General condition pier



Typical condition superstructure & deck		General condition	
1558	Bangor	Veterans Remembrance	1-3-2007

Existing Photos



STATE OF MAINE DEPARTMENT OF TRANSPORTATION



CONTRACT 4, 5, & 6
PLANS FOR STEEL ALTERNATE

I-395 BRIDGE

OVER

PENOBSCOT RIVER

BANGOR ~ BREWER

PENOBSCOT COUNTY

PROJECT NO. I-IG-395-8(02)176

PROJECT LENGTH 0.322 MILES

CONVENTIONAL SIGNS

COUNTY LINES	TRAVELLED HWY - PROPOSED
PROPERTY LINES	UTILITIES - EXISTING
R/W LINES - EXISTING	UNDERGROUND UTILITIES - PROPOSED
R/W LINES - NEW - ACCESS CONTROL	RAILROAD - SINGLE TRACK
R/W LINES - NEW - NO ACCESS CONTROL	RAILROAD - DOUBLE TRACK
CLAY - EXISTING	UTILITY POLE - EXISTING
CLAY - PROPOSED	UTILITY POLE - TEMPORARY
CONCRETE - EXISTING	PROPOSED UTILITY POLE - PERMANENT
CONCRETE - PROPOSED	PROPOSED UTILITY POLE - PERMANENT
TRAVELLED HWY - EXISTING	WOODS

CONTRACT DESCRIPTIONS

CONCRETE ALTERNATE (refer to Plans for Concrete Alternate)

CONTRACT 1 - SUBSTRUCTURE

CONTRACT 2 - SUPERSTRUCTURE

CONTRACT 3 - COMBINED SUBSTRUCTURE AND SUPERSTRUCTURE

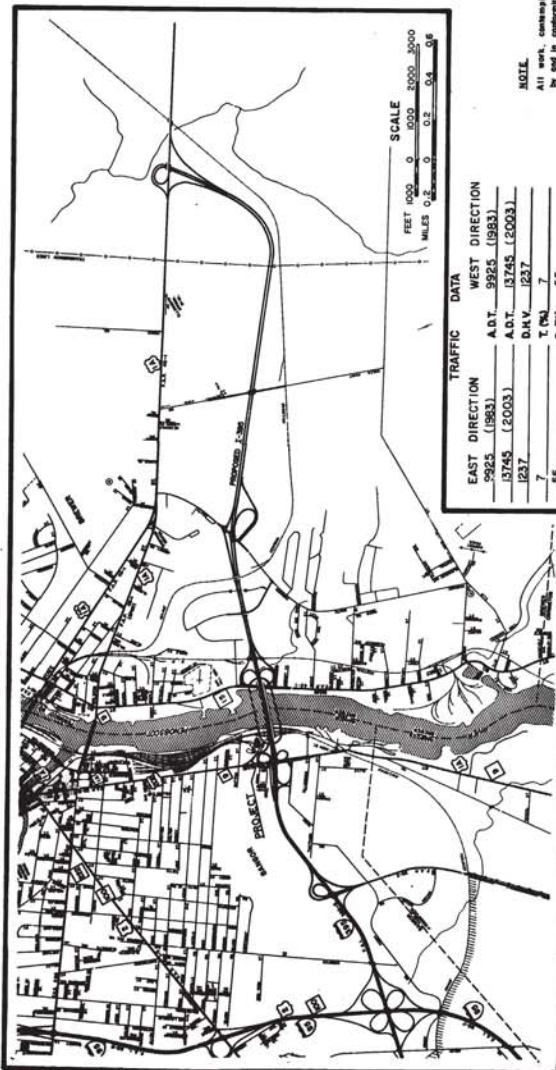
STEEL ALTERNATE

CONTRACT 4 - BANGOR SPANS (Substructure and Superstructure)

CONTRACT 5 - BREWER SPANS (Substructure and Superstructure)

CONTRACT 6 - COMBINED BANGOR AND BREWER SPANS

NOTE - It is the intent to award either Contracts 1 and 2 or Contract 3 for the Concrete Alternate; or Contracts 4 and 5 or Contract 6 for the Steel Alternate.



EAST DIRECTION	DATA	WEST DIRECTION
9225 (1983)	A.D.T.	9225 (1983)
13745 (2003)	A.D.T.	13745 (2003)
1227	D.V.	1227
7	T (N)	7
55	D (N)	55
60	V	60
N.A.	PS.D (N)	N.A.
527	18 RUP	527

A PORTION OF PENOBSCOT COUNTY

INDEX OF SHEETS

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SURVEY PLAN	PROFILE	2
BIN WALL DETAILS	SUBSTRUCTURE LAYOUT	3
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ABUTMENT 1 DETAILS	ABUTMENT 2 FOOTING PLAN	5
ABUTMENT 2 PLAN AND ELEVATION	PIER FOOTING - PIERS 1, 2, 3 & 7	6
PIER FOOTING - PIERS 1, 2, 3 & 7	PIER BARS - PIERS 3 & 4	7
PIER BARS - PIERS 3 & 4	PIER BARS - PIERS 5 & 6	8
PIER BARS - PIERS 5 & 6	POT BEARING DETAILS	9
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APPROVED: STATE OF MAINE

DEPARTMENT OF TRANSPORTATION

DATE 9-21-93

APPROVED: *Richard Coleman*

CHIEF ENGINEER

REVISOR - P. Blunt - 10/1/94

107-125

COAST GUARD PERMIT NO. 2-830-1

UNITED STATES

DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

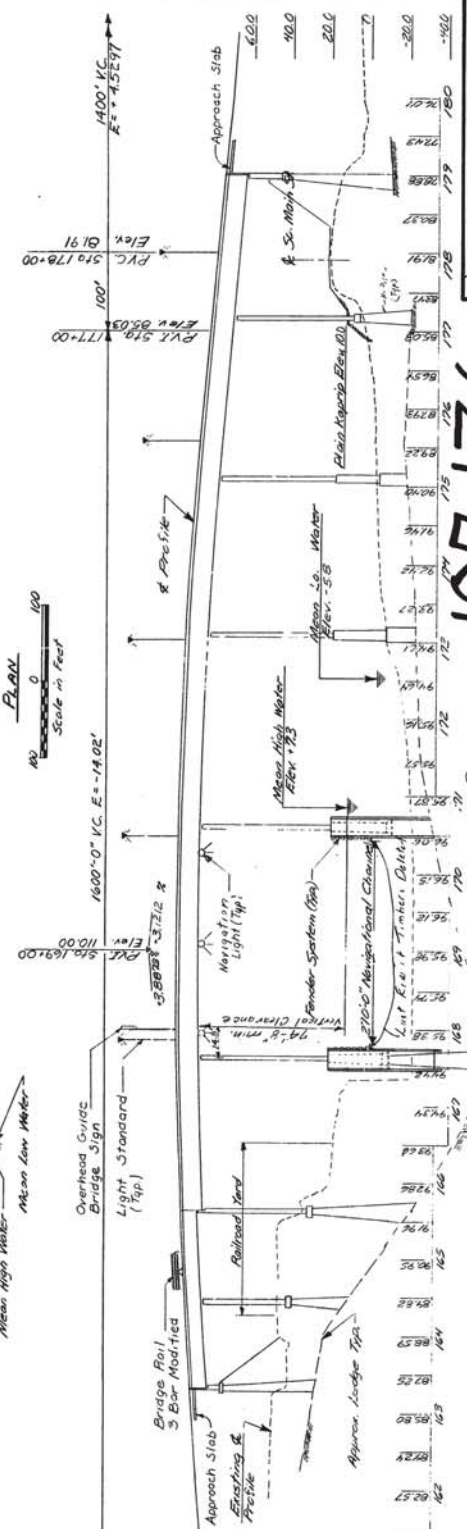
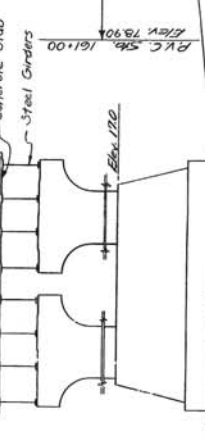
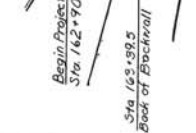
REASON 1

APPROVED:

DIVISION ADMINISTRATOR

DATE

PLANS	DESIGN - DETAILED	BY	DATE
	CHECKED		10/27
FIELD CHAIRMAN			

[illegible]

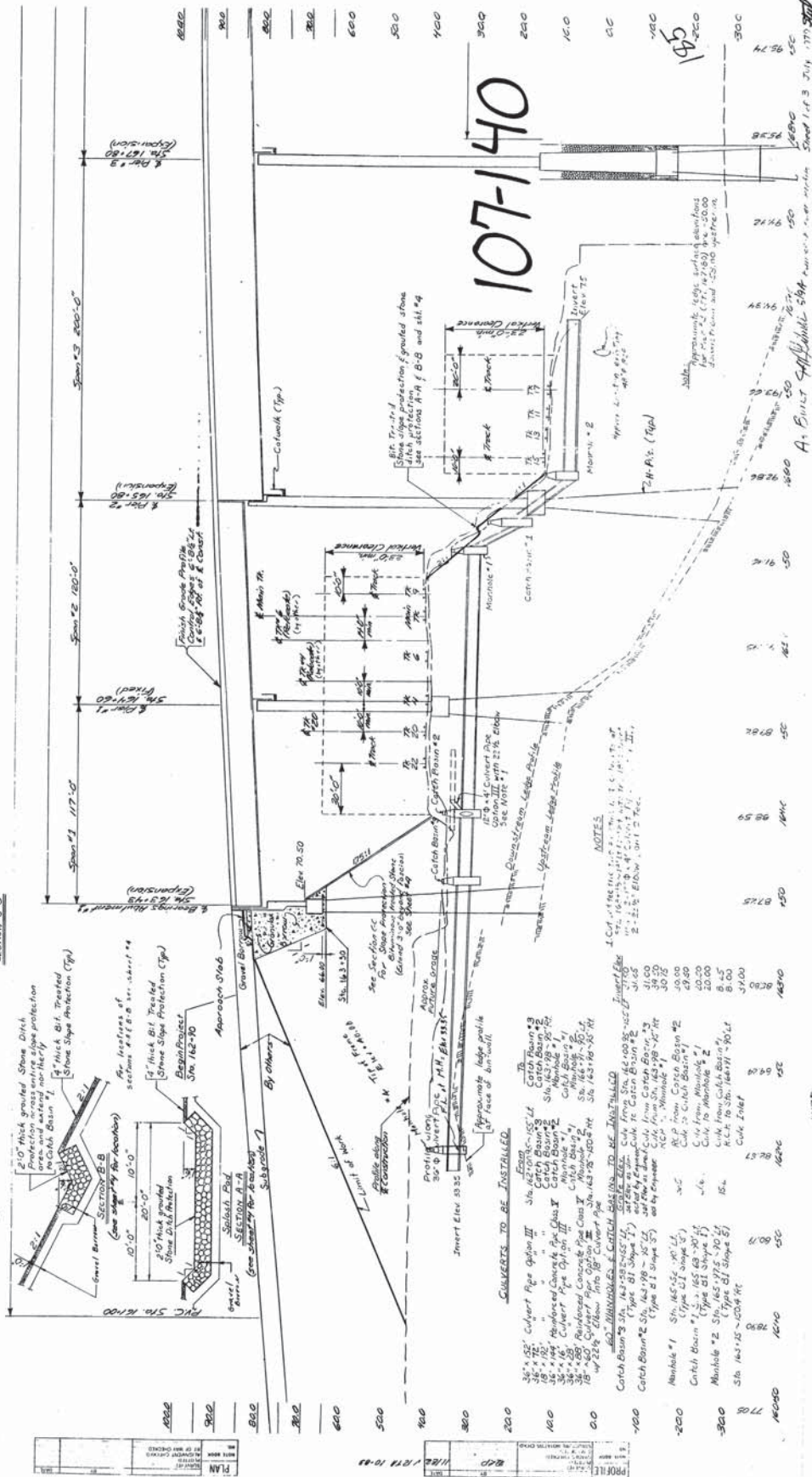
As BUILT Gulf of Maine Mfg. Co. Steel



1



Note: The grouted Stone Ditch Protection and splash pads shall be uniformly finished to within 2 inches above or 2 inches below the lines designated.



NOTES

I Cut at the end of the first day of the trip. I cut at the end of the first day of the trip.

CULVERTS TO BE INSTALLED

[illegible]

60" MANHOLES & CATCH BASINS TO BE INSTALLED
NO. 3 Sls 16.3-582-55" 1/2 GRADE Elev. 6.1-6.0-5.9

Catch Basin #2 Sta. 16+2.00 - 5'14"
(Type B1 Slope 1")
excavated by Engineer C. L. G. to Catch Basin #2
and Elongated as shown. Catch Basin #2 Sta. 16+2.00 - 5'14"

(Type of Shape S)
designed by Engineer
City from Sta. 163+98 - 157+40
NCHRP, Minneapolis

Mainhole #1 Stn. 1655c - 10' Lf.
(Type LI sample 5')

Catch blown #1 $\frac{1}{2}$ 165 63-20 41
(Type of Stone?)
w/o.
Cite from, Washade #1
Cite to Washade #2

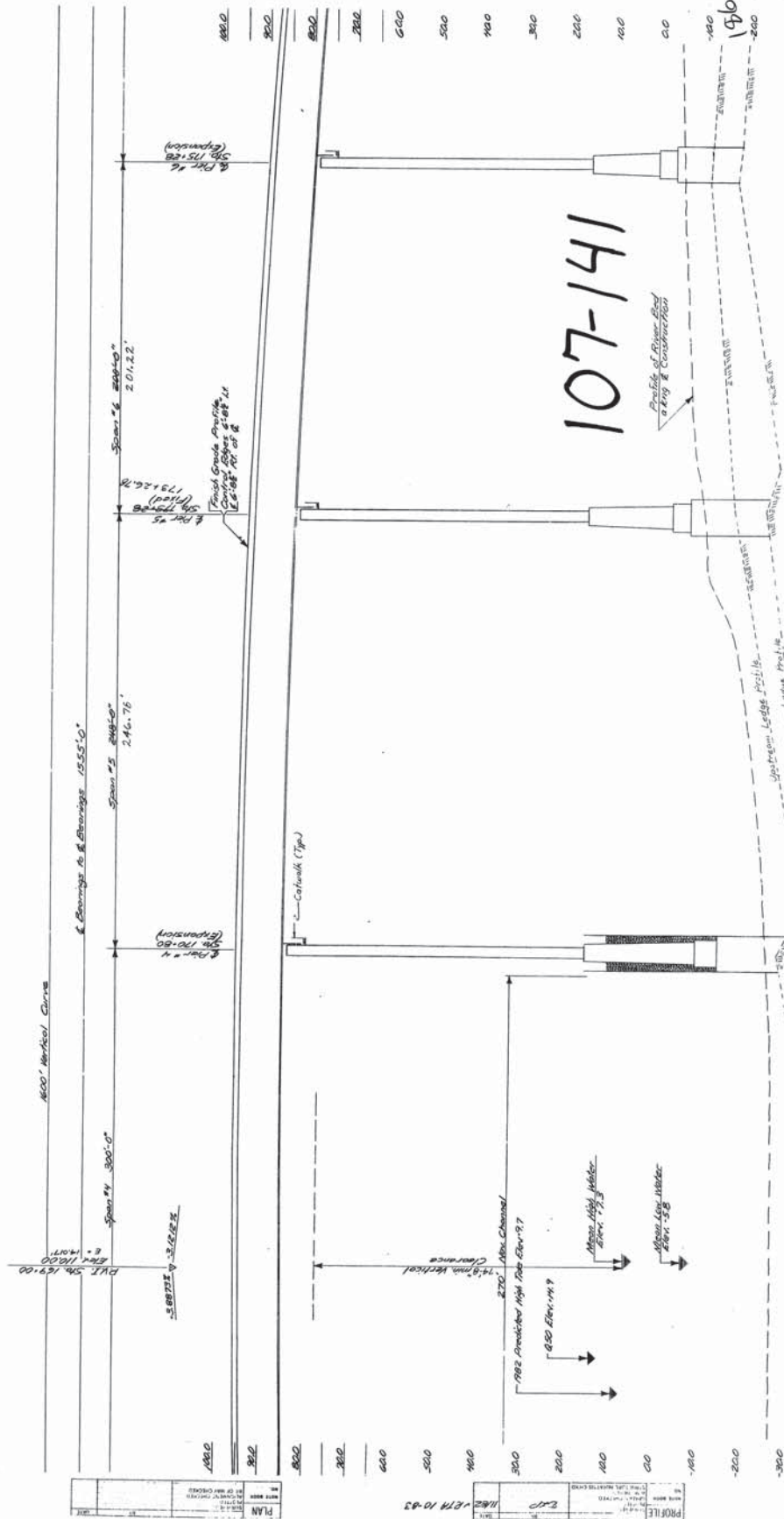
Manhole #2 Sta. 165+77.5 ~ 90' Lt.
(Type of Stone 5)

Sta 162.15 ~ 150.4' NR

78.90 60.17 52.28 54.69

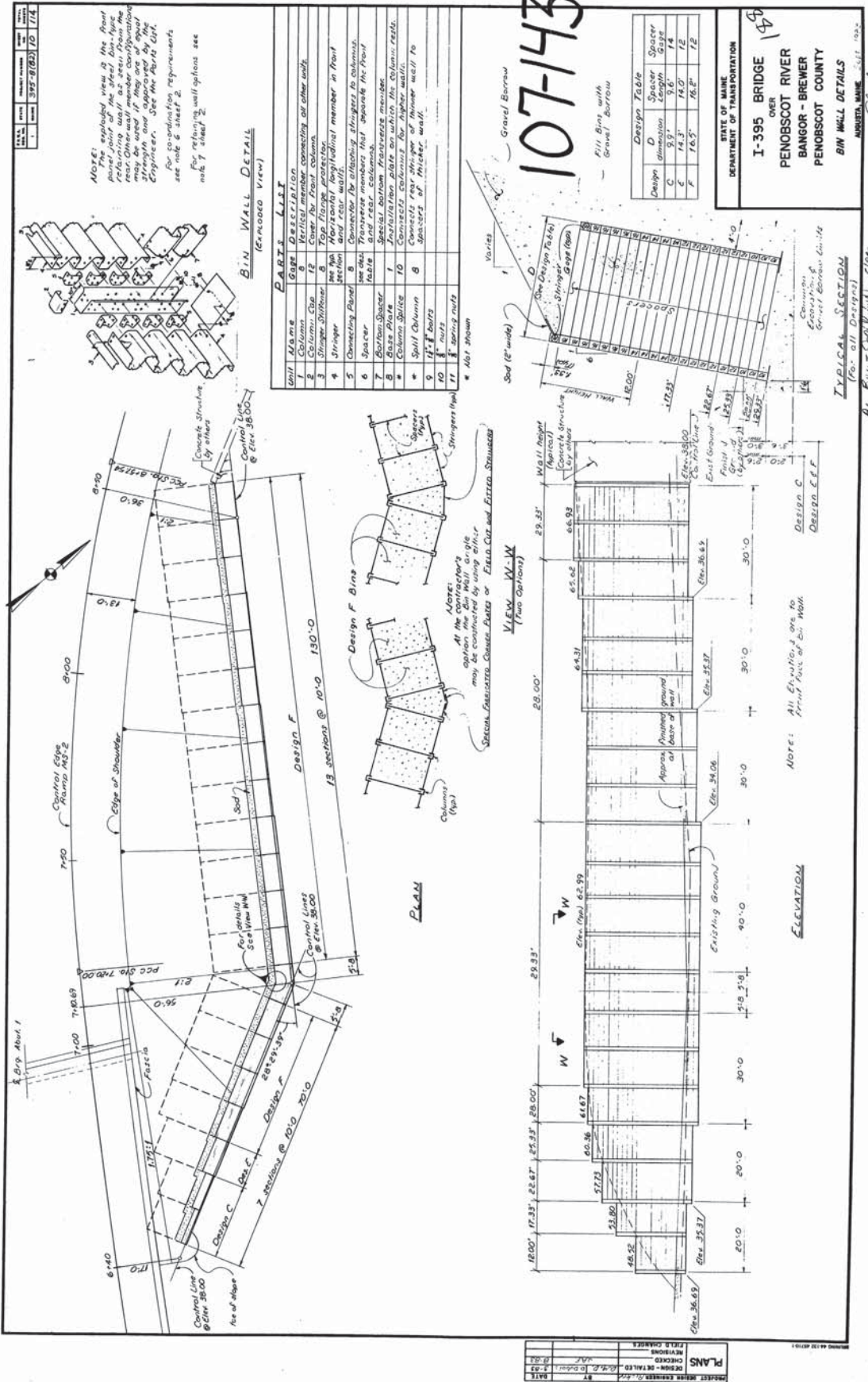
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395-8(8) 8 7/14

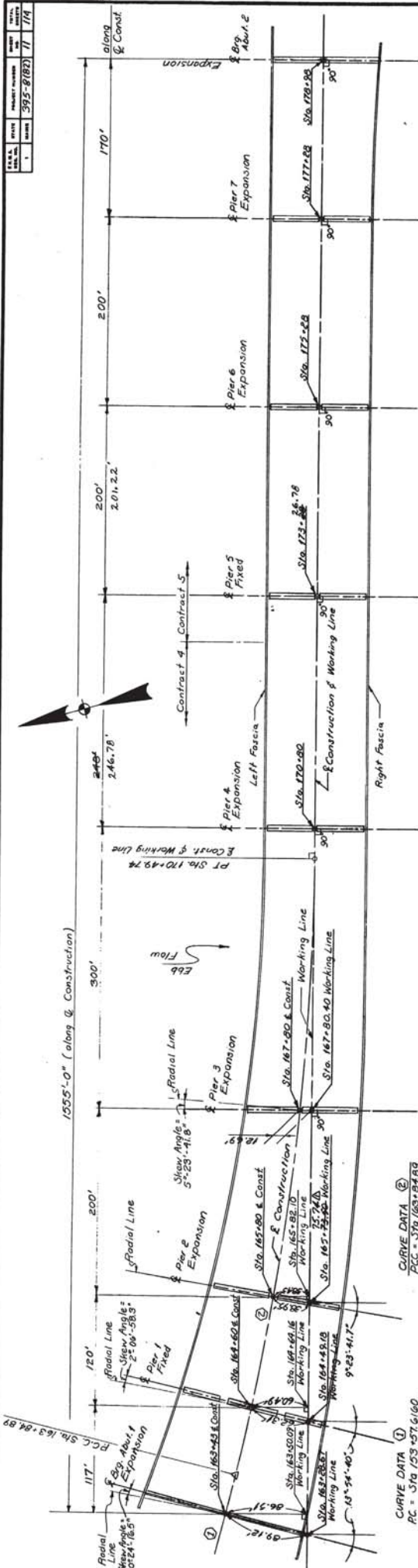


Station	Elevation
95.38	95.38
95.39	95.39
95.40	95.40
95.41	95.41
95.42	95.42
95.43	95.43
95.44	95.44
95.45	95.45
95.46	95.46
95.47	95.47
95.48	95.48
95.49	95.49
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95.52	95.52
95.53	95.53
95.54	95.54
95.55	95.55
95.56	95.56
95.57	95.57
95.58	95.58
95.59	95.59
95.60	95.60
95.61	95.61
95.62	95.62
95.63	95.63
95.64	95.64
95.65	95.65
95.66	95.66
95.67	95.67
95.68	95.68
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95.76	95.76
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96.08	96.08
96.09	96.09
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96.11	96.11
96.12	96.12

As Built Profile 5/1/94
Bayer-Bauer Profile Sheet 2 of 3 July 1979



DATE	BY	REVISION	PROJECT NUMBER	DATE	BY	REVISION
10/1/84	1	1	395-8(82)	11/1/84		



SUBSTRUCTURE LAYOUT

CURVE DATA ②
 PCC = Sta 163+84.89
 PT = Sta 170+49.74
 PI = Sta 167+10.819
 $\Delta = 13^\circ 17' 49''$
 $D = 240'$
 $R = 2864.789'$
 $L = 664.85'$

CURVE DATA ①
 PC = Sta 153+57.610
 PT = Sta 163+84.89
 PI = Sta 158+71.250
 $\Delta = 0^\circ 50'$
 $D = 240'$
 $R = 2864.789'$
 $L = 1027.28'$

107-144

Revision	Date	STATE OF MAINE DEPARTMENT OF TRANSPORTATION
1	4-7-84	
I-395 BRIDGE OVER PENOBSCOT RIVER BANGOR - BREWER PENOBSCOT COUNTY SUBSTRUCTURE LAYOUT		

As Built *Chas. Marshall* 5/94

DATE	BY	PROJECT NUMBER	DATE
10-28-83	WLB	395-882	12/14

ABUT. - PILE NOTES

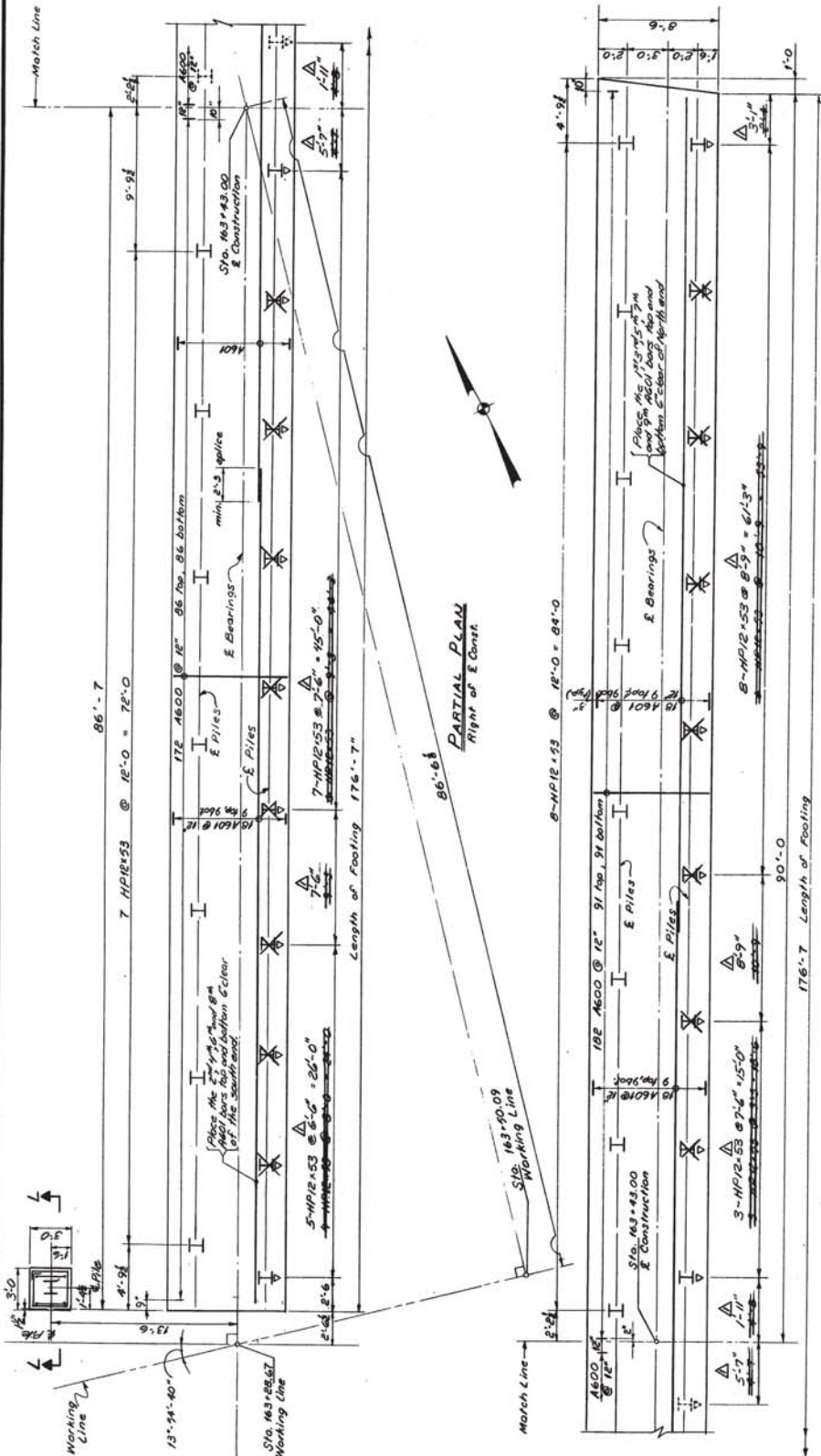
- The pile layout shown is for 45,000 psi. See note #7.
- Piles marked must be battered 3 inches per foot in the direction of the arrow.
- Pile Design Loads:
Abut 1 HP12-53 116 Tons 12,000 psi
Abut 2 HP14-73 161 Tons 129 Tons
- HP12-53 bearing piles may be substituted for HP14-73 bearing piles at the option of the engineer. The design load for the piles will be made under Item 501.216 for the piles and Item 501.236 for the load tests.
- Estimate of piles required: long = 1480 ft
Abut 1 24 HP14-73 64' long = 1,584 ft
Abut 2 24 HP14-73 64' long = 1,584 ft

PILE SIZE	REIN. #	SIZE
HP 12-53	11	1/2" x 1' x 1'-0"
HP 14-73	12	1/2" x 1' x 1'-0"

ROUTED REINFORCED PILE TIP (FOR BATTERED PILES) SHOWN IN DETAILS 8D (127-81) SHEET 110

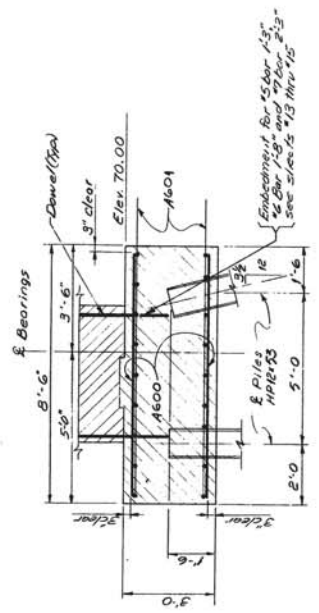
A new pile layout will be furnished by the engineer in the event a load test fails. In the event the size of the pile to be used will not change.

H-Piles shall meet the requirements of ASTM A 36.



PARTIAL PLAN
Right of Const.

PARTIAL PLAN
Left of Const.



TYPICAL SECTION

SECTION L-L

107-145

Revision	State of Maine Department of Transportation
1	107-145
2	107-145
3	107-145
4	107-145
5	107-145
6	107-145
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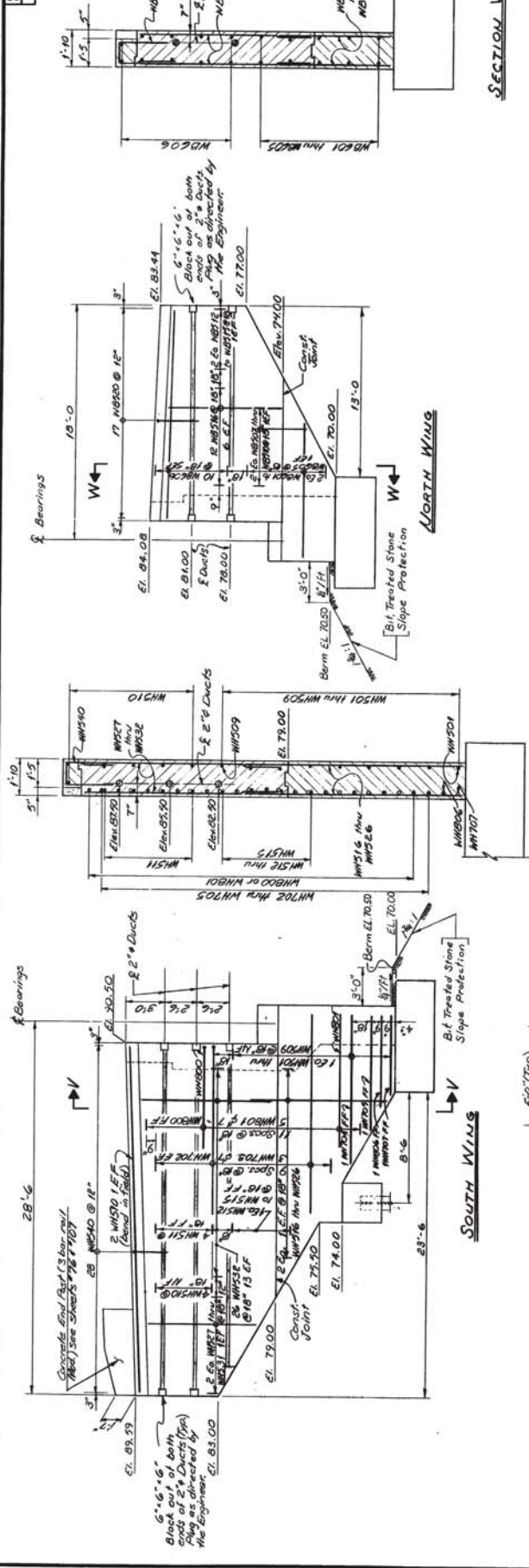
A. BUILT 1914

ABUTMENT / FOOTING

ANGUSTA, MAINE Sept 1983

I-395 BRIDGE OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY

DATE	BY	CHECKED	PROJECT NUMBER	SHEET NUMBER	TOTAL SHEETS
10/1/83	WAS	WAS	395-002	15	174



SECTION W-W

SECTION V-V

SECTION U-U

SECTION S-S

SECTION T-T

SECTION R-R

SECTION Q-Q

SECTION P-P

SECTION O-O

SECTION N-N

SECTION M-M

SECTION L-L

SECTION K-K

SECTION J-J

SECTION I-I

SECTION H-H

SECTION G-G

SECTION F-F

SECTION E-E

SECTION D-D

SECTION C-C

SECTION B-B

SECTION A-A

SECTION 1-1

SECTION 2-2

SECTION 3-3

SECTION 4-4

SECTION 5-5

SECTION 6-6

SECTION 7-7

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SECTION 9-9

SECTION 10-10

SECTION 11-11

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SECTION 14-14

SECTION 15-15

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SECTION 200-200

SECTION 201-201

SECTION 202-202

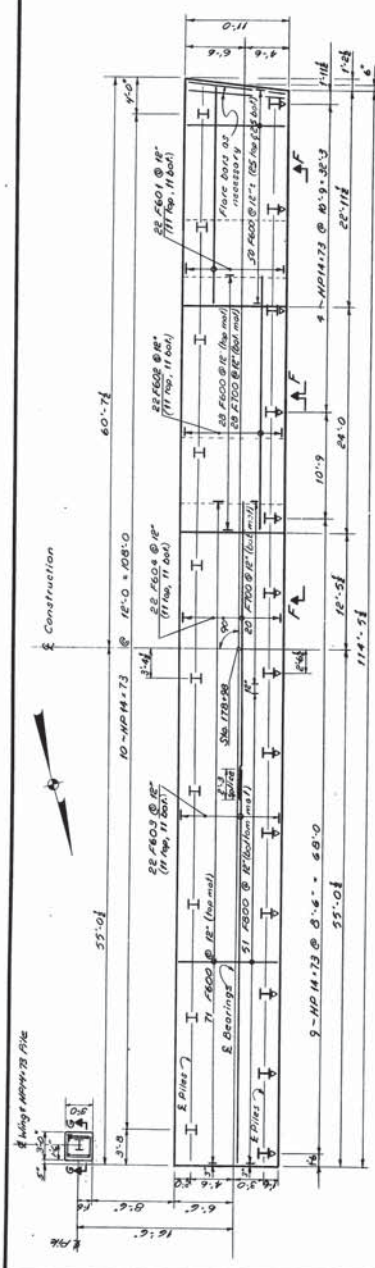
SECTION 203-203

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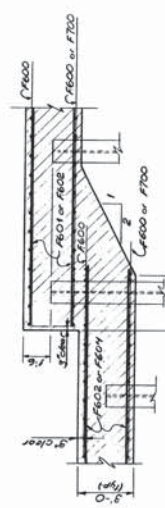
SECTION 205-205

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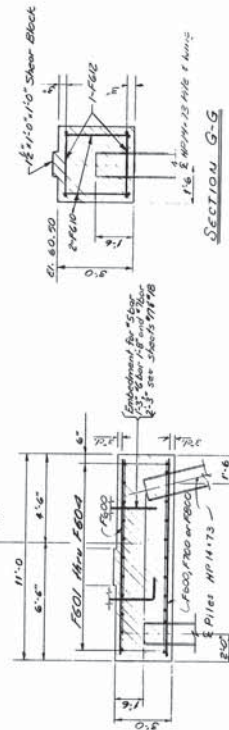
DATE	BY	CHKD	APP'D	NO.
10/1/58	W. H. B.	W. H. B.	W. H. B.	114



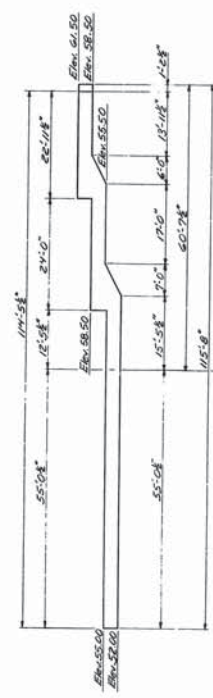
FOOTING PLAN



VIEW FF



TYPICAL FOOTING SECTION



ELEVATION

107-149

Plate Notes - see sheet 112

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
ABUTMENT 2 FOOTING

MAINTENANCE
Sept 1953
H. B. Bunt Highway 5/24

DATE	BY	CHKD	APP'D	NO.
10/1/58	W. H. B.	W. H. B.	W. H. B.	114



NEWTON LINE 3-12-85
107-150 REFERENCE:

Mounting Note: - see sheet #13

ASUTMENT 2 ELEVEN

MAKE-UP of KILN-FURNACE STEEL VETS

ABUTMENT 2 PLAN & ELEVATION

As Built S&W Viki - 5/9A

DATE	BY	CHECKED	APPROVED
10/1/83	WAS	WAS	WAS
10/1/83	WAS	WAS	WAS
10/1/83	WAS	WAS	WAS

PROJECT NUMBER
395-8(2) 18 1/4

DATE
10/1/83

BY
WAS

CHECKED
WAS

APPROVED
WAS

PROJECT NUMBER
395-8(2) 18 1/4

DATE
10/1/83

BY
WAS

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WAS

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PROJECT NUMBER
395-8(2) 18 1/4

DATE
10/1/83

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PROJECT NUMBER
395-8(2) 18 1/4

DATE
10/1/83

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PROJECT NUMBER
395-8(2) 18 1/4

DATE
10/1/83

BY
WAS

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WAS

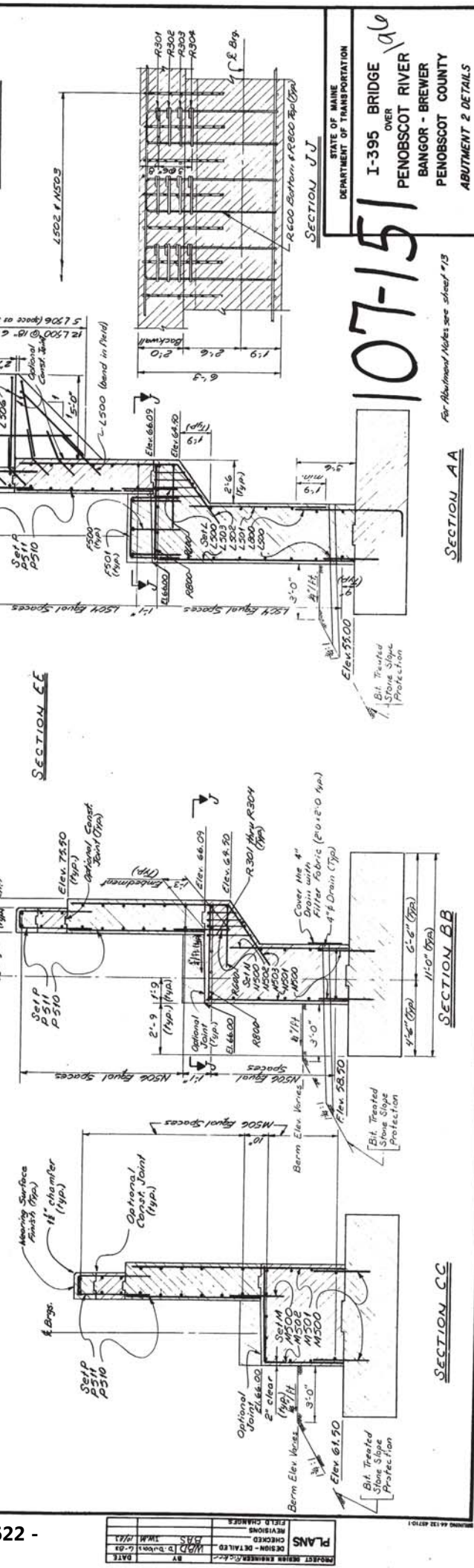
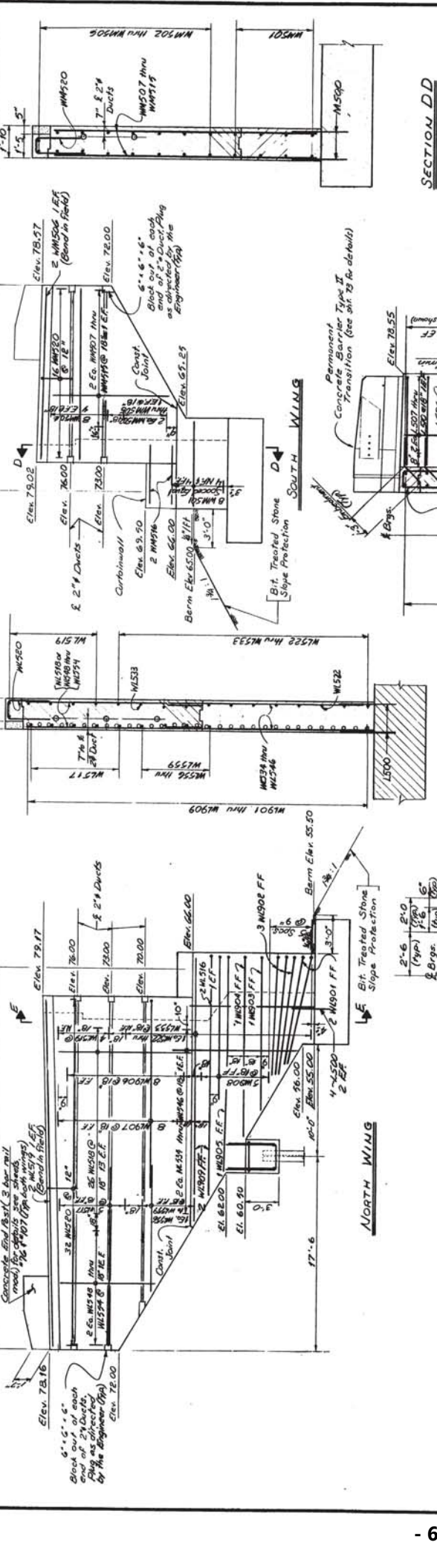
PROJECT NUMBER
395-8(2) 18 1/4

DATE
10/1/83

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APPROVED
WAS



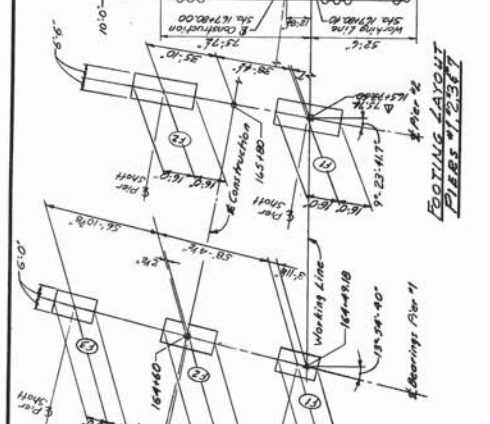
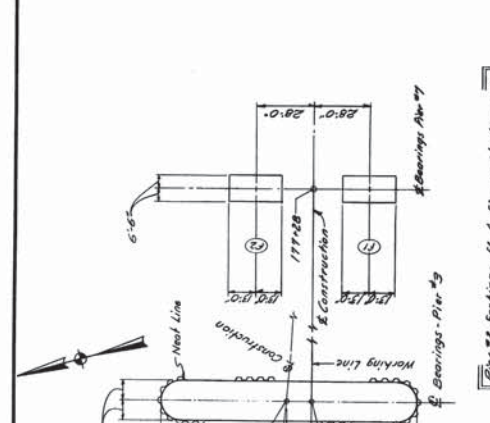
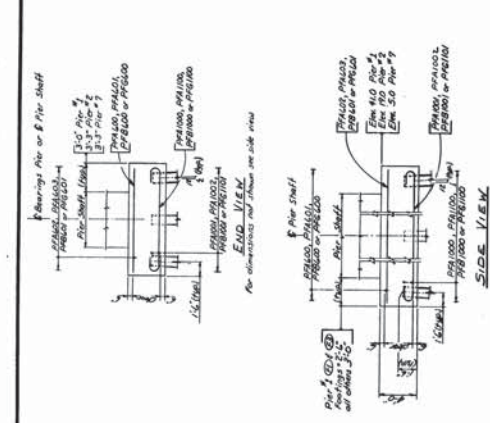
STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
I-395 BRIDGE OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
ABUTMENT 2 DETAILS
As Built
Sept. 1983
107-151

NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1
2	10-1-52	J. H. B.	2

PIER-PILE NOTES

- The pile layout shown is for 15,000 p.s.f. See note #8.
- Piles marked "Pier" shall be battered 3 inch per foot in the direction of the current, except 1 inch per foot for Pier #3.
- Pile Design loads: HP 14-89 15,000 lbs. 12,000 lbs. in 157 feet
- HP 14-89 bearing piles may be substituted for HP 14-89 bearing piles in the construction of the piers under stress 50,000 psi for the pier and 17,000 psi for the load pile.
- Estimate of piles required:
 Pier #1: 11-HP 14-89 @ 25' = 275 ft
 Pier #2: 11-HP 14-89 @ 50' = 550 ft
 Pier #3: 18-HP 14-89 @ 42' = 756 ft
 Pier #4: 130-HP 14-89 @ 42' = 5,460 ft
 Pier #5: 18-HP 14-89 @ 28' = 504 ft
 Pier #6: 18-HP 14-89 @ 22' = 396 ft

A new pile layout will be furnished by the engineer in the event a load test fails. In any case, the size of the pile to be used will not change.



PIER	NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1	1
2	10-1-52	J. H. B.	2	2

PIER	NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1	1
2	10-1-52	J. H. B.	2	2

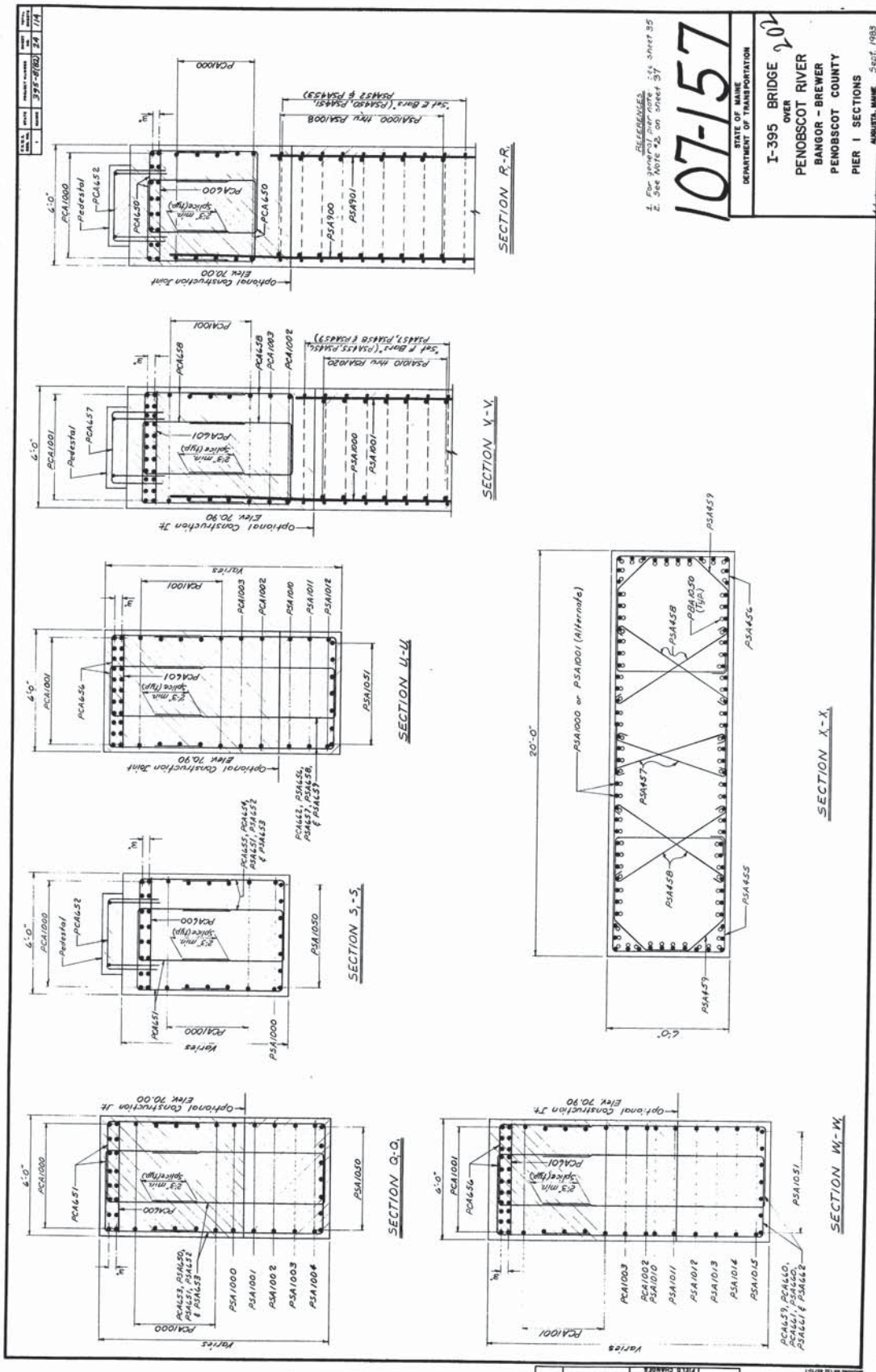
PIER	NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1	1
2	10-1-52	J. H. B.	2	2

PIER	NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1	1
2	10-1-52	J. H. B.	2	2

PIER	NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1	1
2	10-1-52	J. H. B.	2	2

PIER	NO.	DATE	BY	REVISION
1	10-1-52	J. H. B.	1	1
2	10-1-52	J. H. B.	2	2



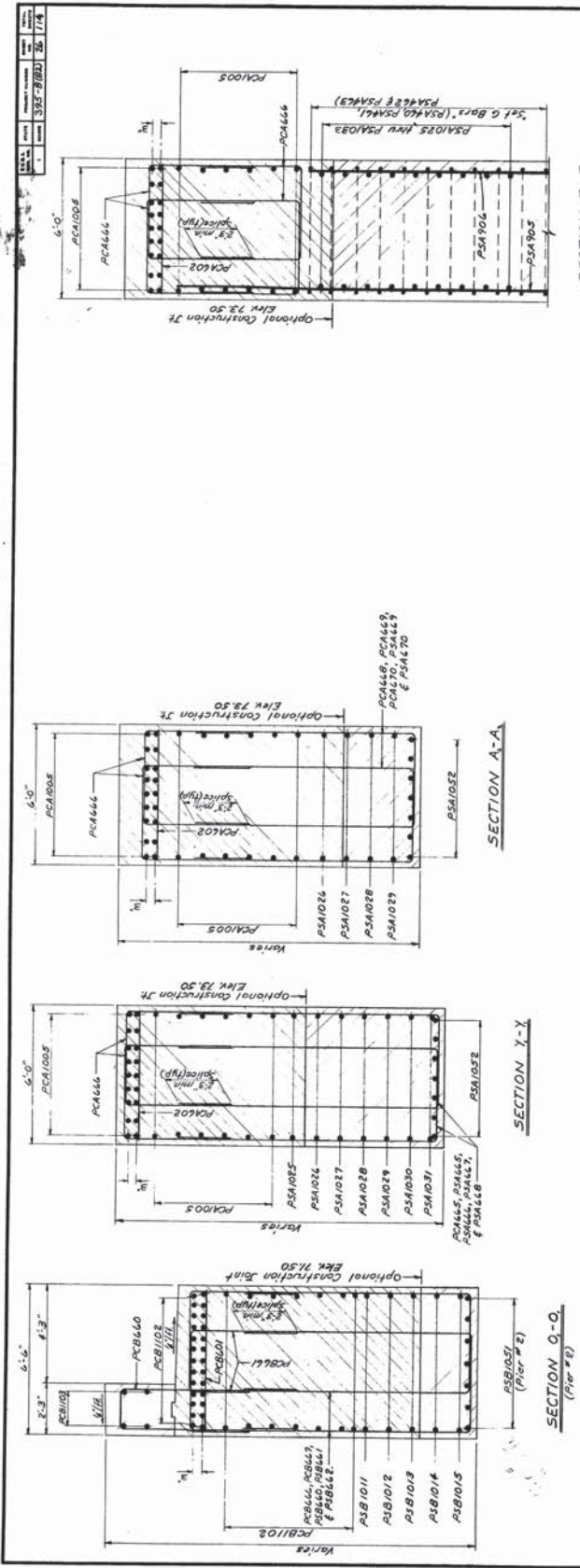


REVISIONS
 1. For general reference see sheet 35
 2. See note 42 on sheet 37

STATE OF MAINE
 DEPARTMENT OF TRANSPORTATION
 I-395 BRIDGE 202
 OVER
 PENOBSCOT RIVER
 BANGOR - BREWER
 PENOBSCOT COUNTY
 PIER 1 SECTIONS

As Built by [Signature] 5-2-11

PLANS	DATE	BY
DESIGNED - [Signature]	10/25/03	[Signature]
CHECKED - [Signature]	11/10/03	[Signature]
APPROVED - [Signature]	11/10/03	[Signature]



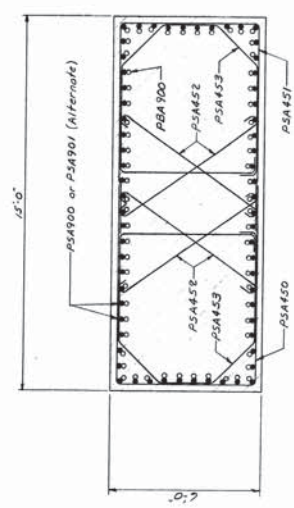
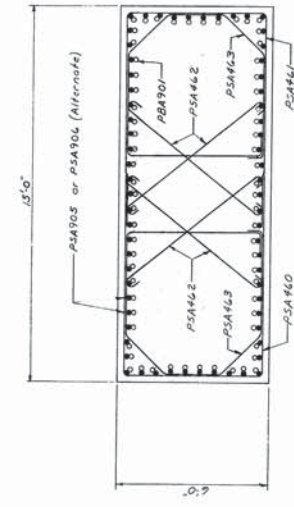
DATE	BY	CHKD	IN CHARGE
10/1/83	BT	BT	BT
10/1/83	BT	BT	BT
10/1/83	BT	BT	BT

REFERENCES:
1. For general notes, see sheet 35
2. See notes on sheet 37

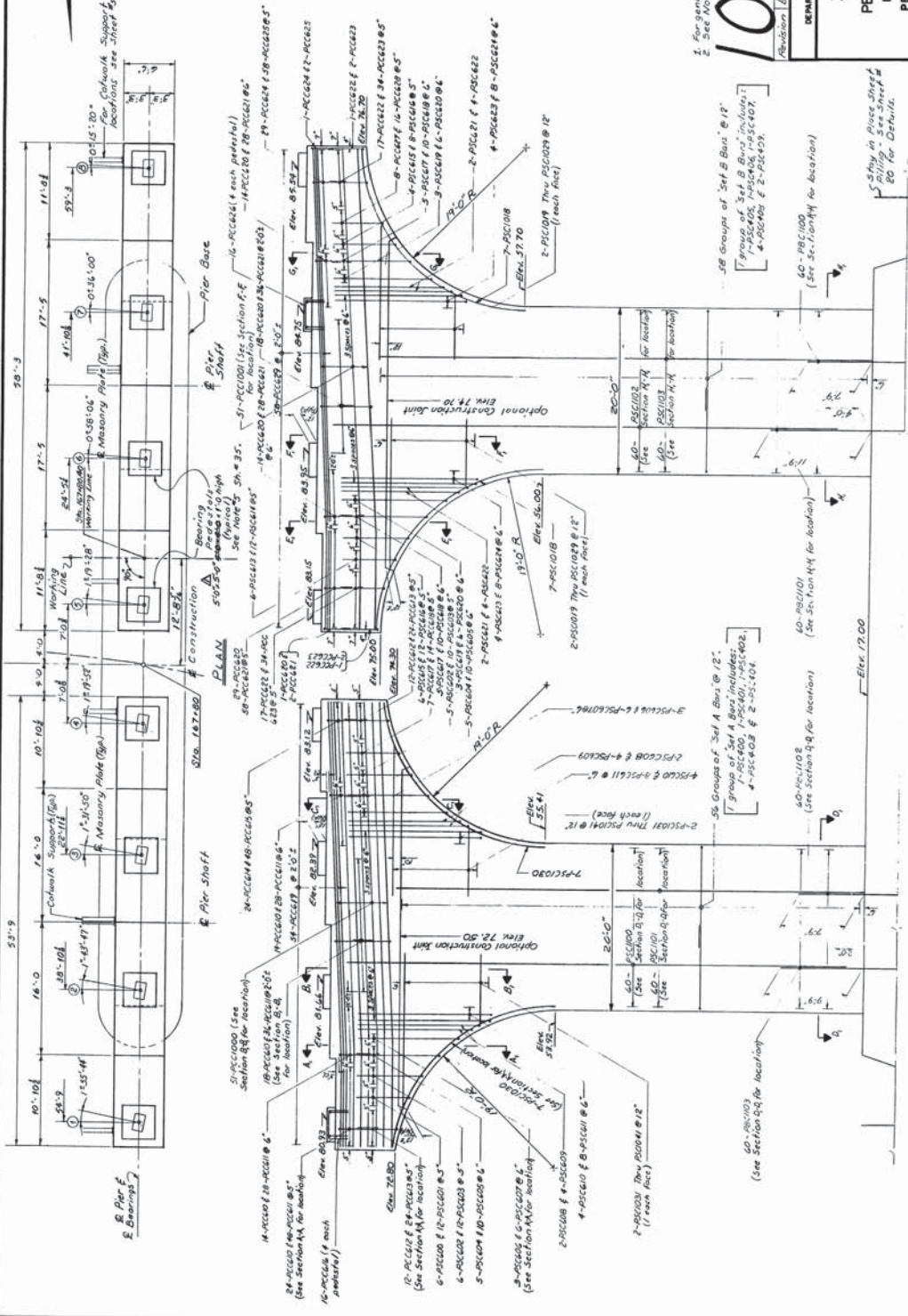
107-159

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
I-395 BRIDGE 10A
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
PIERS 1 & 2 SECTIONS
AUGUSTA, MAINE 306 1983

As Built with original sheet 37

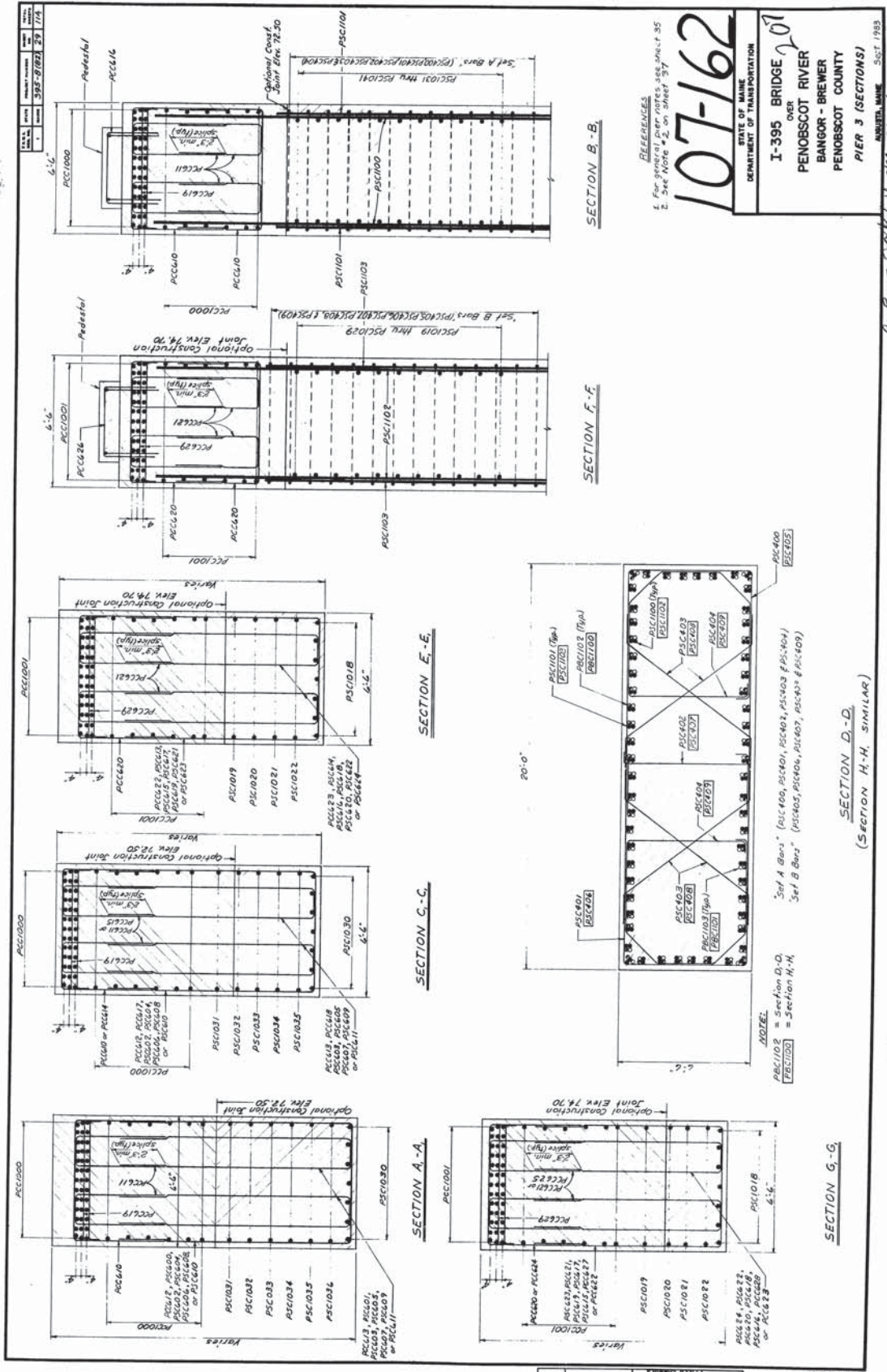


Revision <input type="checkbox"/>	Pinches/ Size	Date 11-5-94
STATE OF MAINE DEPARTMENT OF TRANSPORTATION		
I-395 BRIDGE 206 OVER PENOBSCOT RIVER BANGOR - BREWER PENOBSCOT COUNTY PIER 3 SHAFT AUGUSTA, MAINE Sept. 1983		



PIER'3

As Built S.M. Kahlke 5/94



DATE	STATE	PROPERTY NO. & DESCRIPTION	QUANTITY	REMARKS
1		395-9(82)	30	114

REFERENCES

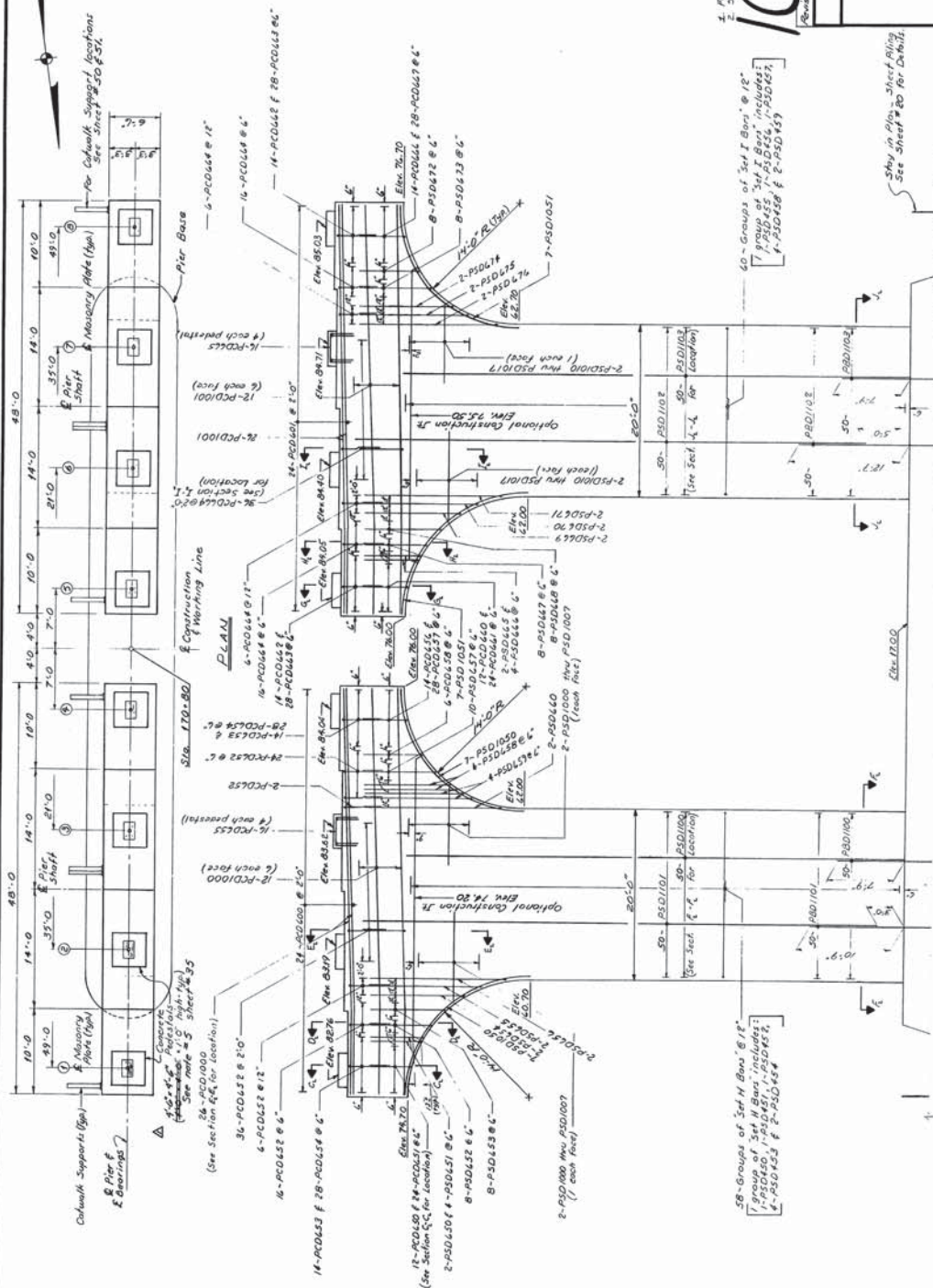
1. For general pier notes see sheet 35
2. See Note # 2 on sheet 37

107-163
2. See Note # 2 on sheet 97

10	△	Pedestol Size	Date 11-5-84
----	---	---------------	--------------

I-395 BRIDGE 2
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
PIER 4 SHAFT

A. BUNT G.M. LINDLE 5/10/41 Street



PIER 14





PLANS		DESIGN - DETAIL	REVISIONS	FIELD CHANGE
DATE	BY	DATE	BY	DATE
10-23	W.S.	10-23	W.S.	10-23
10-23	W.S.	10-23	W.S.	10-23

REFERENCES

1. For general pier notes see sheet 35
2. See Note # 2 on sheet 37

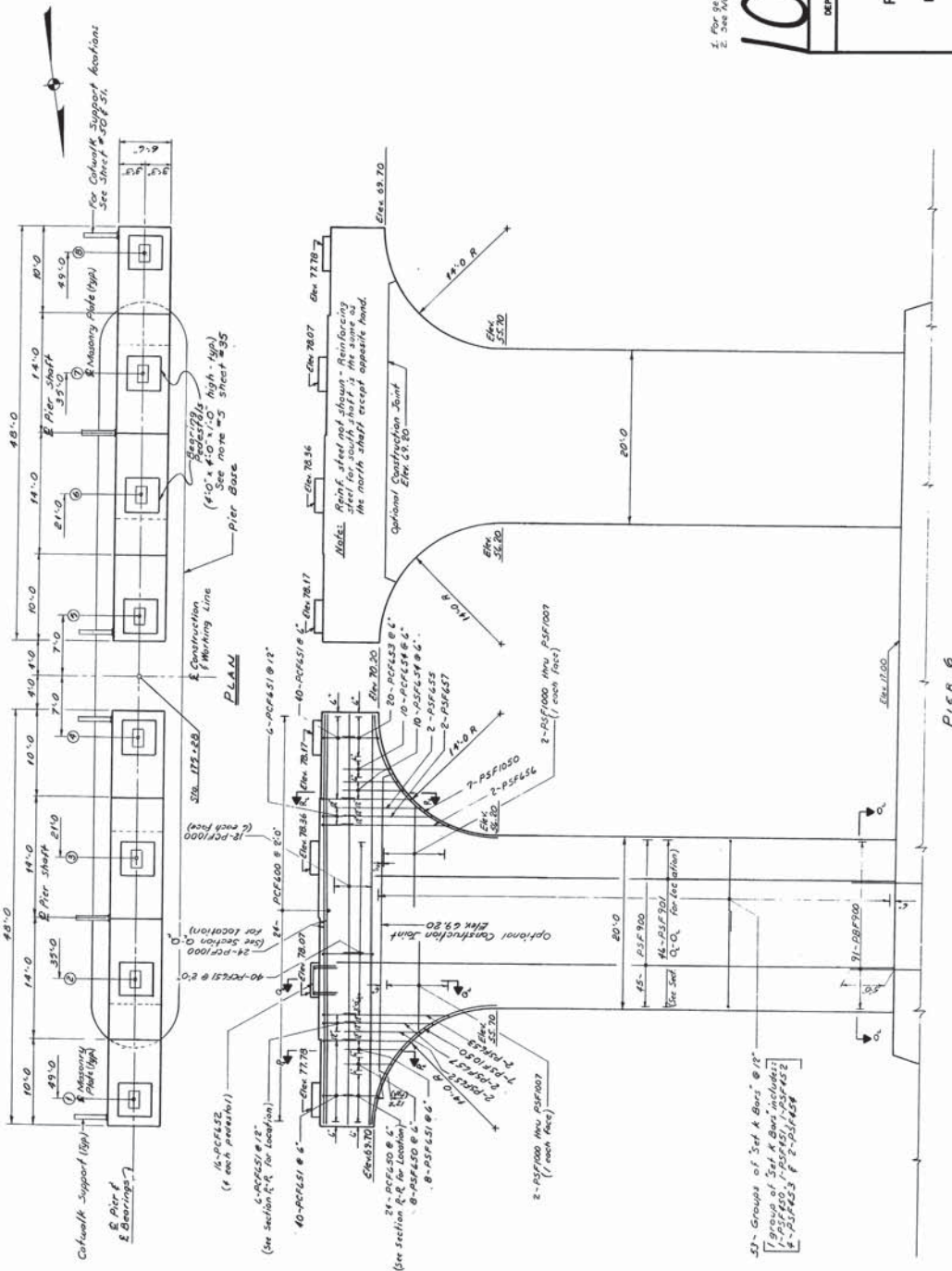
107-166

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE 211
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY

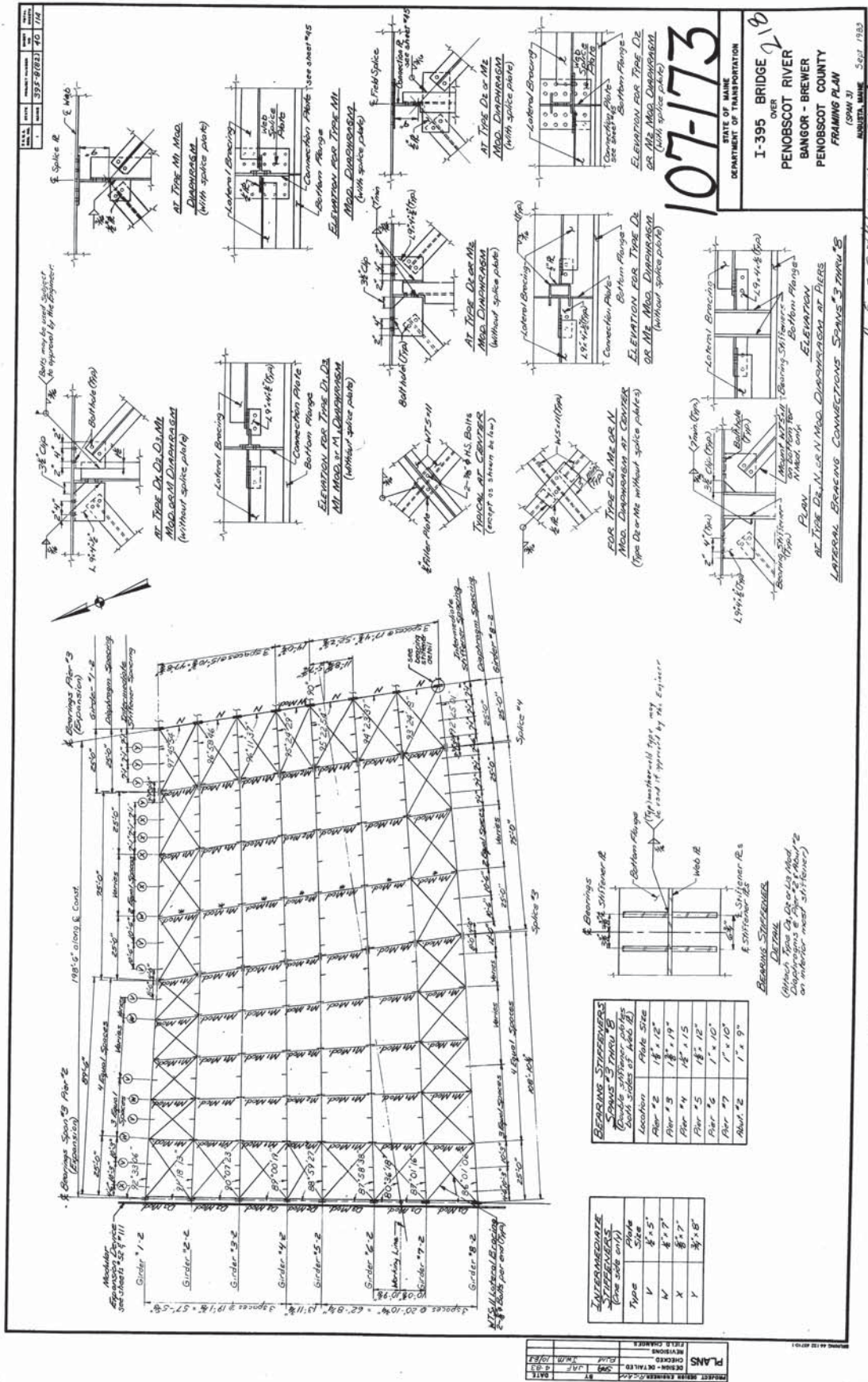
Augusta, Maine Sept. 1982
Steel

As Built Spill-Kit/Kit 5/94



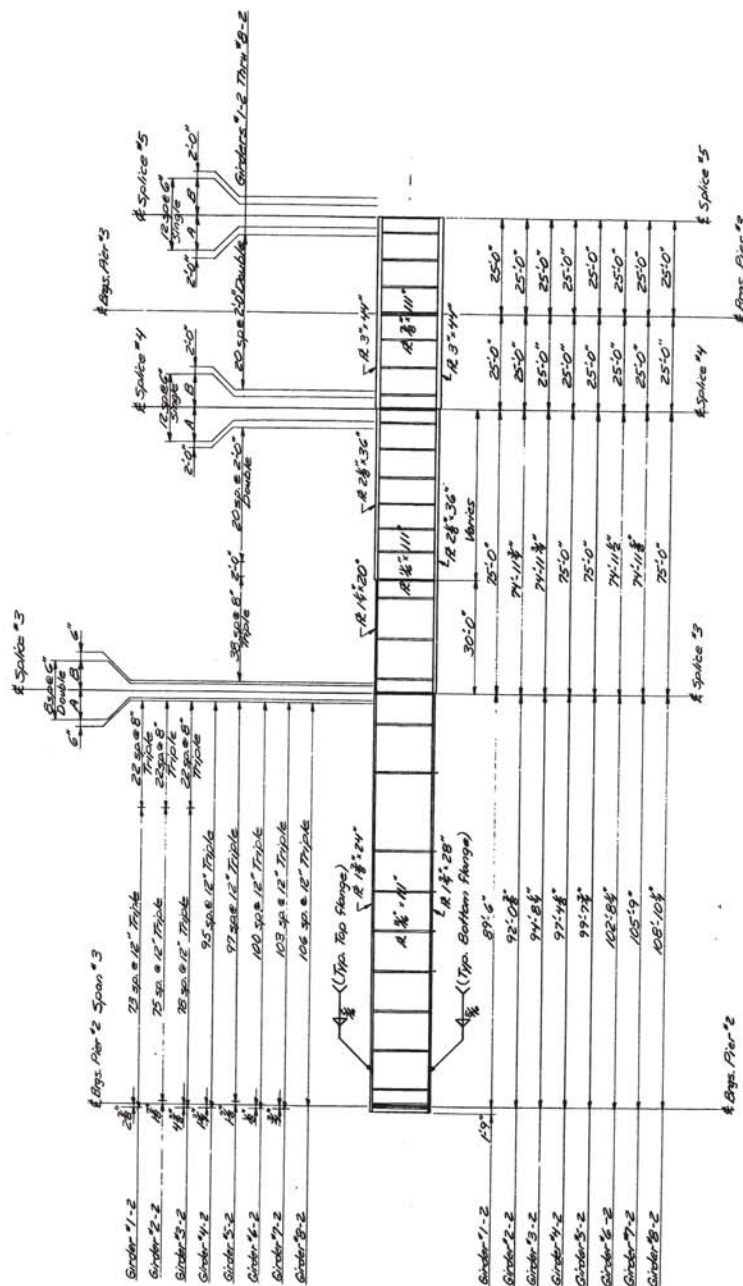
ORDER DELIVERED

- 638 -

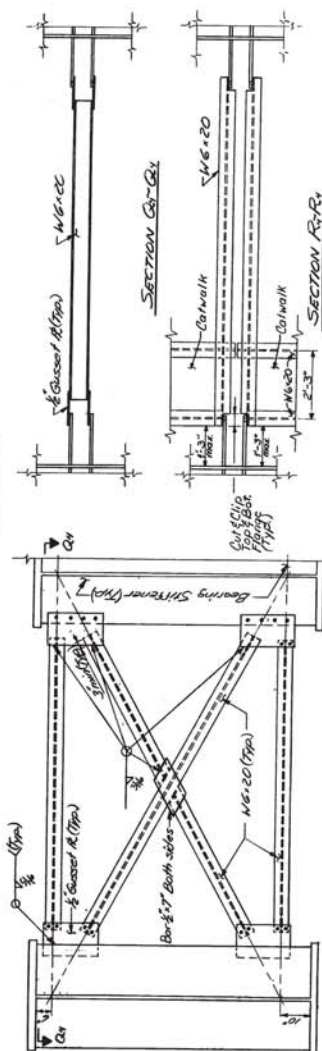


DATE	BY	PROJECT NUMBER	DATE
10/7/74	107-174	995-8(102)	11/1/74

SHEAR CONNECTOR LAYOUT - SPICES #3-8									
Location	Splice #3		Splice #4		Splice #5		Splice #6		Splice #7
	A	B	A	B	A	B	A	B	
Girder #1-2	14'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #2-2	1'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #3-2	1'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #4-2	1'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #5-2	1'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #6-2	2'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #7-2	2'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"
Girder #8-2	2'0"	2'5"	2'0"	2'0"	2'0"	2'0"	2'0"	2'0"	1'0"



ELEVATION



TYPE N DIAPHRAGM

TYPE N MOD. DIAPHRAGM
(Per details not shown on Page N
Diaphragm this sheet)

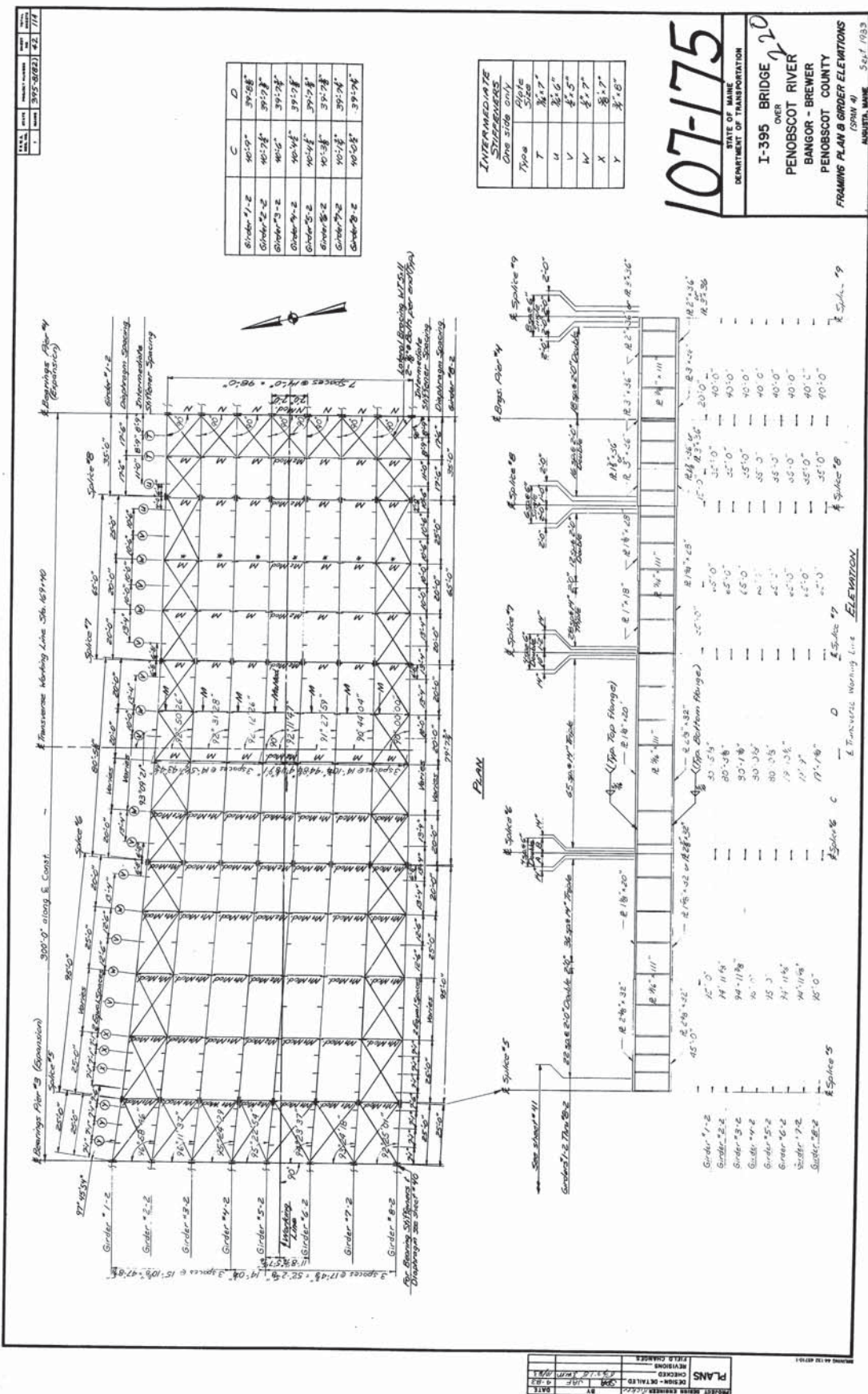
107-174

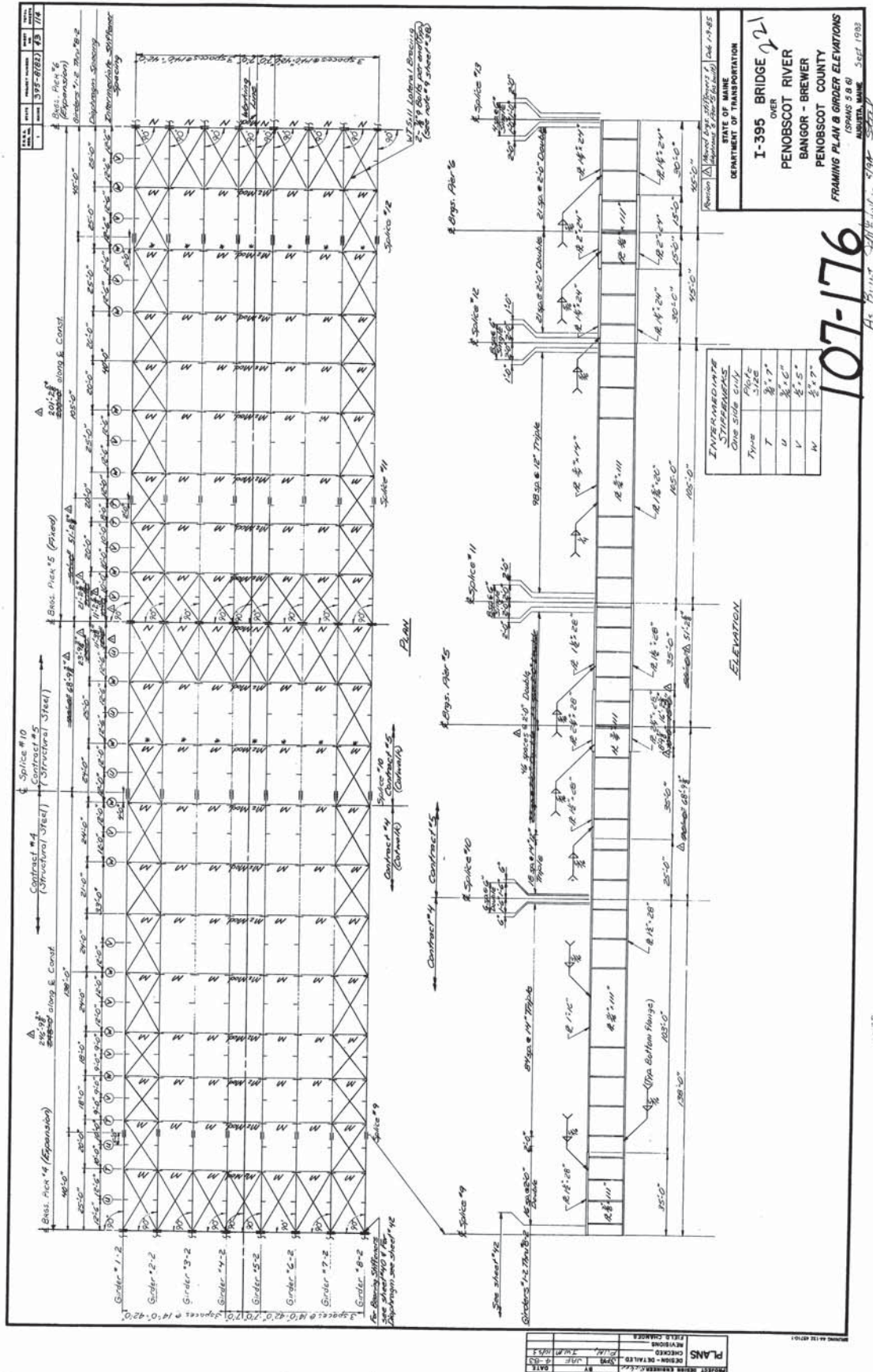
STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE 219
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
GRADE ELEVATIONS

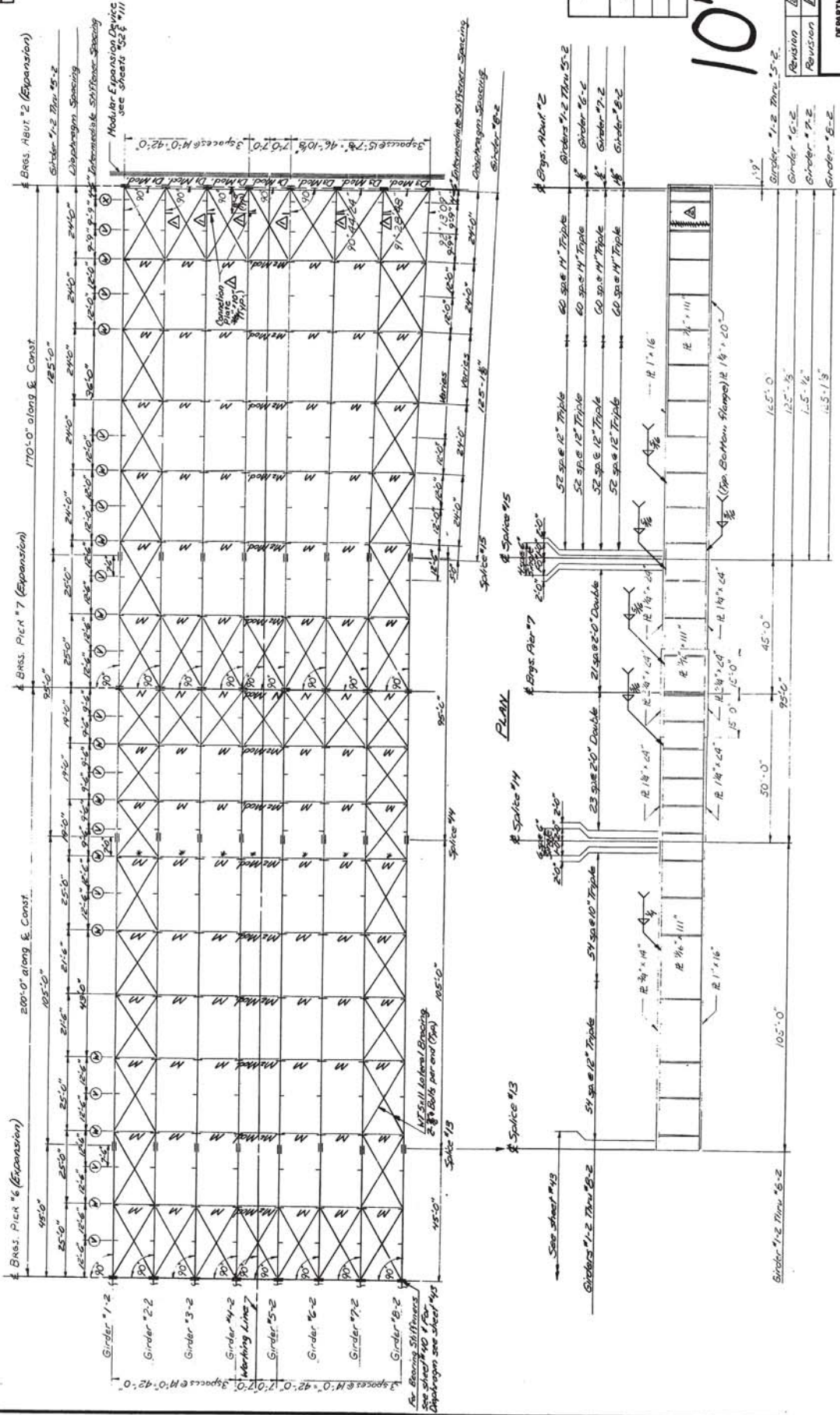
MAINE
SEP 1933
AS BUILT
11/1/74

DATE	BY	DESIGN - CHECKED	PROJECT NUMBER
10/7/74	107-174	995-8(102)	11/1/74





DATE	BY	CHECKED	PROJECT NUMBER	SHEET NO.
1			395-0821	44



INTERMEDIATE	SPACERS
One side only	
Type	Size
V	1/2" x 5/8"
W	1/2" x 7/8"
X	1/2" x 1"

107-177

REVISION	DATE	BY	REASON
1	10/1/80	JAF	DESIGN - DETAILED
2	10/1/80	JAF	CHECKED
3	10/1/80	JAF	FIELD CHANGES

I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
FRAMING PLAN & GIRDER ELEVATIONS
 (SPANS 7 & 8)
 AUGUSTA, MAINE Sept 1983

As Built J.M. Miller 9/8/83

- 649 -

DATE: 10/1/81
 DRAWN BY: J. L. BROWN
 CHECKED BY: J. L. BROWN
 PROJECT: MAINE BRIDGE 107-181

Station	Distance	1-2	2-2	3-2	4-2	5-2	6-2	7-2	8-2
1-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
2-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
3-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
4-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
6-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
7-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
8-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Station	Distance	1-2	2-2	3-2	4-2	5-2	6-2	7-2	8-2
1-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
2-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
3-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
4-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
6-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
7-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
8-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

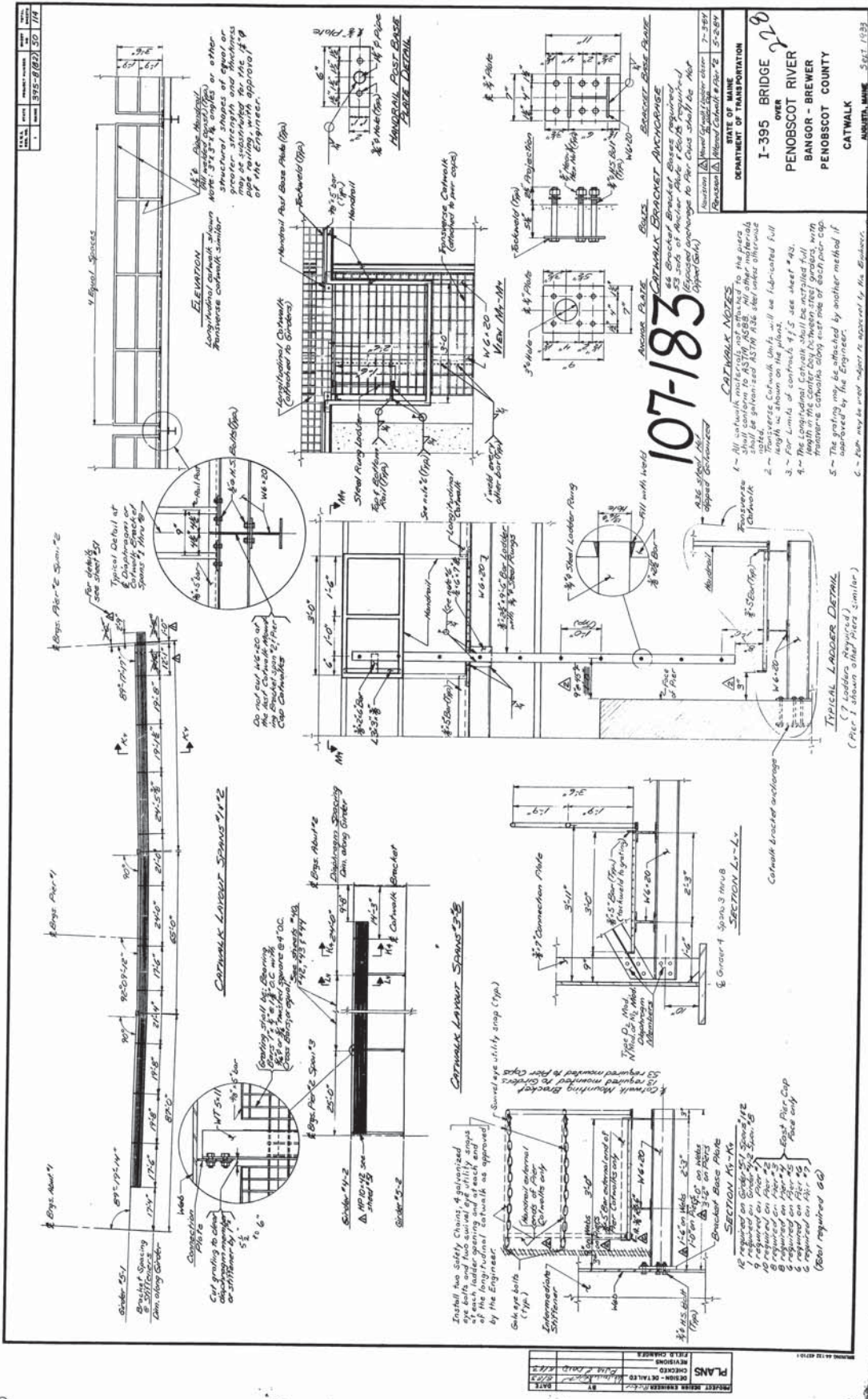
Station	Distance	1-2	2-2	3-2	4-2	5-2	6-2	7-2	8-2
1-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
2-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
3-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
4-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
6-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
7-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
8-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

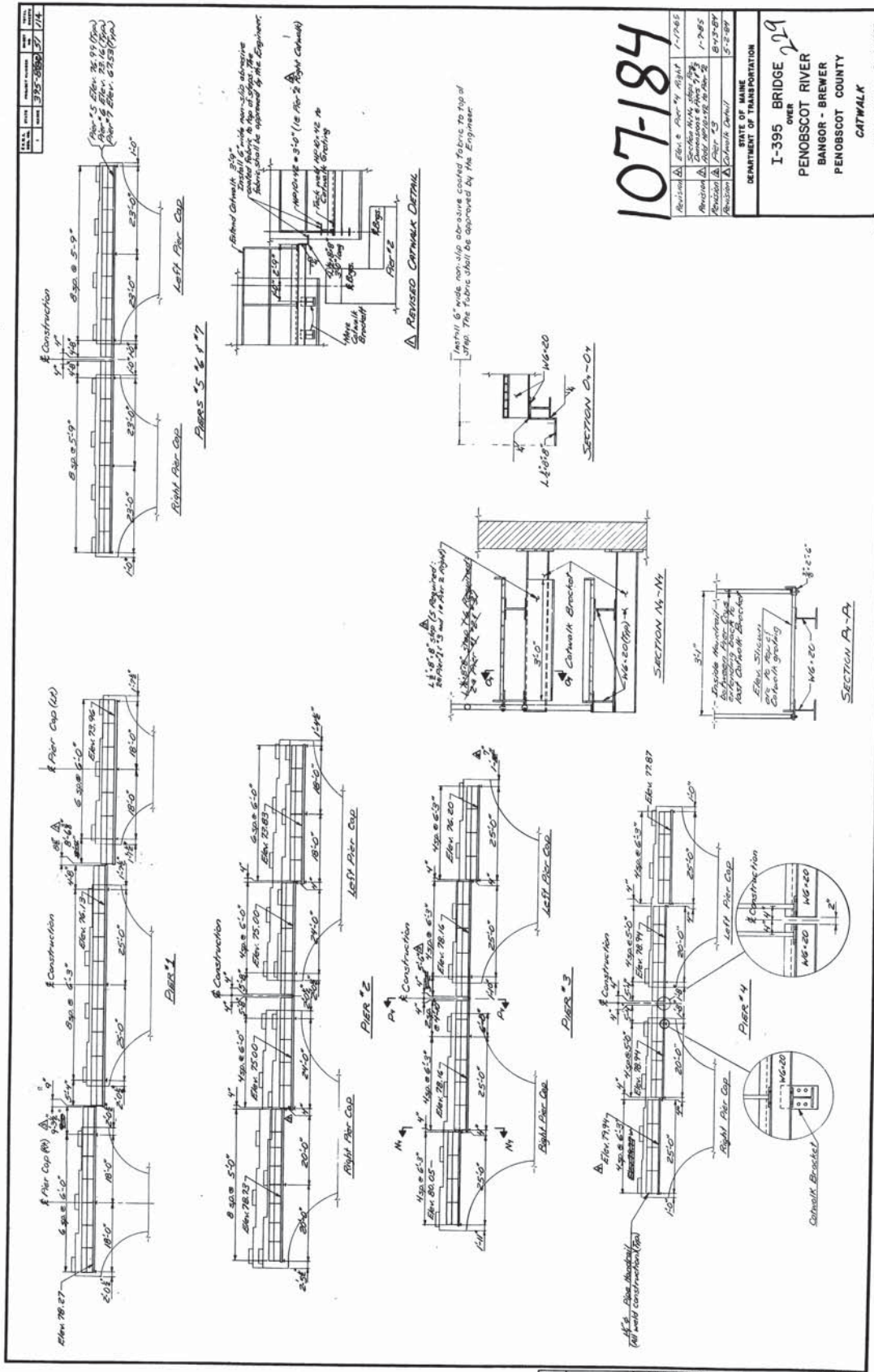
Station	Distance	1-2	2-2	3-2	4-2	5-2	6-2	7-2	8-2
1-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
2-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
3-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
4-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
6-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
7-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
8-2	Distance	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

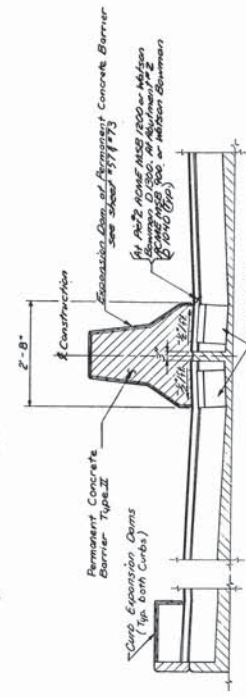
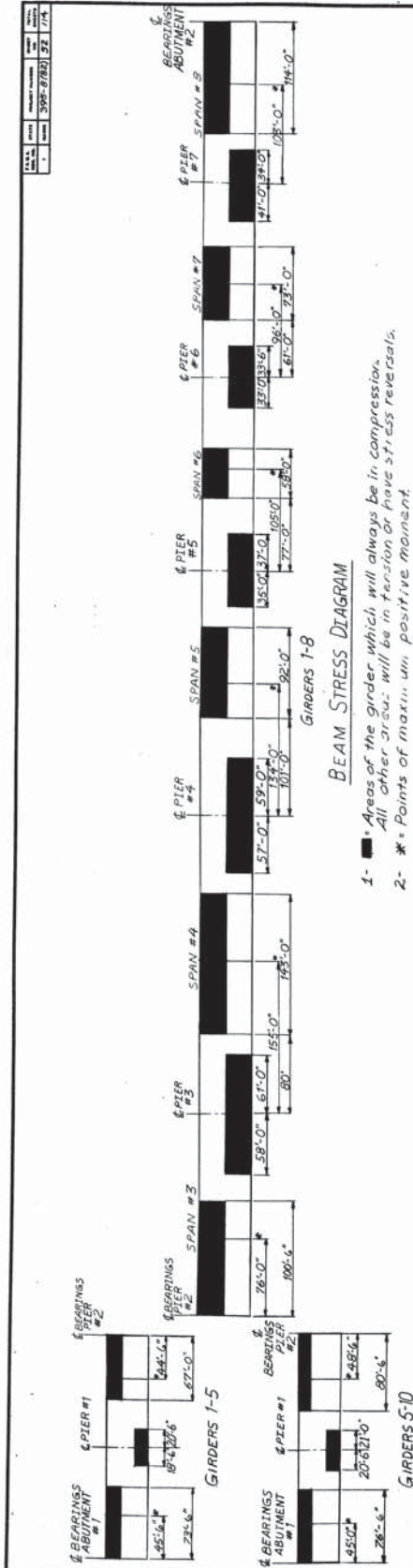
107-181

STATE OF MAINE
 DEPARTMENT OF TRANSPORTATION
 I-395 BRIDGE
 PENOBSCOT RIVER
 BANGOR - BREWER
 PENOBSCOT COUNTY
 CAMBER TABLE

As Built Sept. 1981



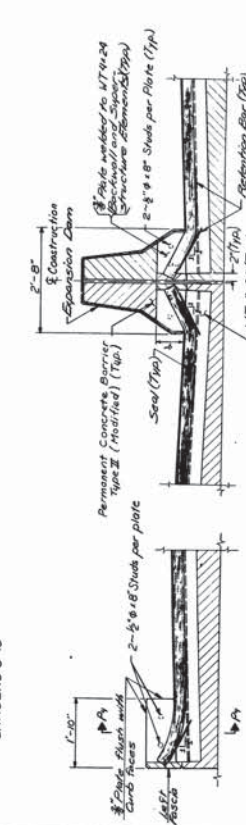




MODULAR EXPANSION DEVICE
 For details not shown see sheet #111

MODULAR EXPANSION DEVICE NOTES

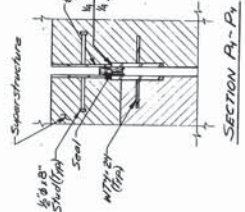
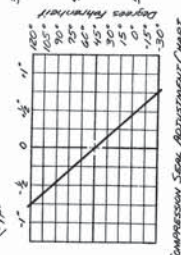
- 1- The entire Modular Expansion Device assembly from right fascia to left fascia of Pier 2 will be paid for under the lump sum Item 522.060.
- 2- The entire Modular Expansion Device assembly from right fascia to left fascia of Abutment 2 will be paid for under the lump sum Item 522.060.



COMPRESSION SEAL ELEVATION
 For details not shown see sheets 51, 131, 108

COMPRESSION SEAL NOTES

- 1- The seal will be furnished with a minimum movement rating of 1/4" at Abutment #1.
- 2- The seal will be approved by the Engineer prior to fabrication of the final armor.
- 3- The joint gaskets will vary depending on the Contractor's design and will be subject to the approved Shop detail drawings.
- 4- The seal is designed to provide a watertight seal and to provide a means for the seal to be adjusted to the joint to provide a watertight seal.
- 5- The seal is designed to provide a watertight seal and to provide a means for the seal to be adjusted to the joint to provide a watertight seal.
- 6- The entire compression seal assembly from right fascia to left fascia of Abutment 1 will be paid for under the lump sum Item 520.22.



STATE OF MAINE
 DEPARTMENT OF TRANSPORTATION
 1-395 BRIDGE OVER
 PENOBSCOT RIVER
 BANGOR - BREWER
 PENOBSCOT COUNTY
 BEAM STRESS DIAGRAM
 NORTH MAINE SHEET 108

107-185

As Built 9/11/1985

DATE	BY	CHKD	APP'D
3/25/82	SS		

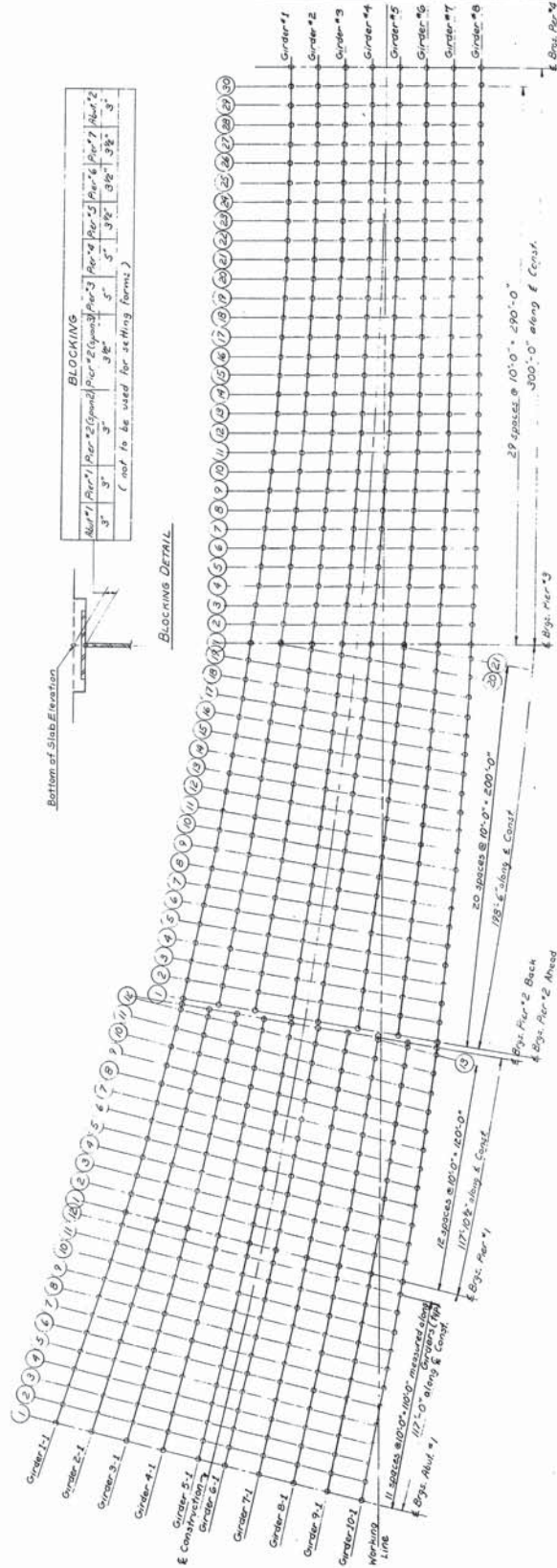
BLOCKING

(not to be used for setting forms)

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	32nd	33rd	34th	35th	36th	37th	38th	39th	40th	41st	42nd	43rd	44th	45th	46th	47th	48th	49th	50th	51st	52nd	53rd	54th	55th	56th	57th	58th	59th	60th	61st	62nd	63rd	64th	65th	66th	67th	68th	69th	70th	71st	72nd	73rd	74th	75th	76th	77th	78th	79th	80th	81st	82nd	83rd	84th	85th	86th	87th	88th	89th	90th	91st	92nd	93rd	94th	95th	96th	97th	98th	99th	100th
-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	-------

Bottom of Slab Elevation

BLOCKING DETAIL



SPACING OF SLAB ELEVATIONS

Span	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Span	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Span	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45

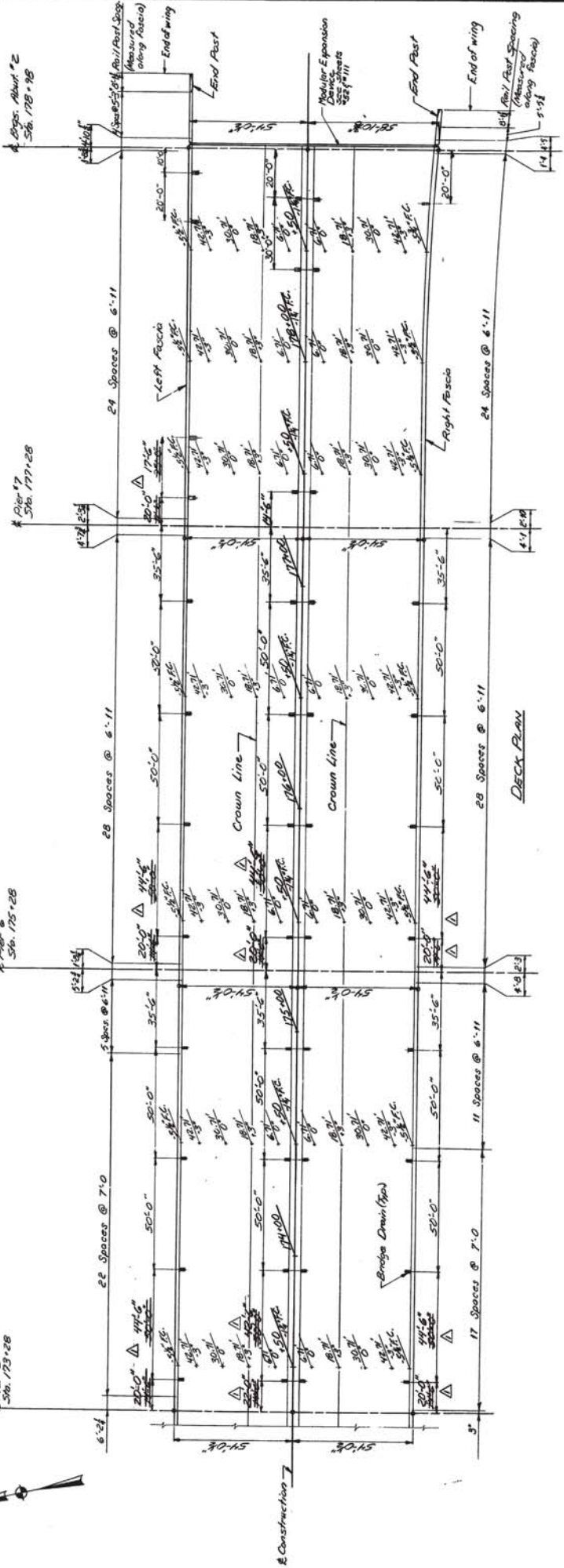
STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
BLOCKING TABLE

107-186

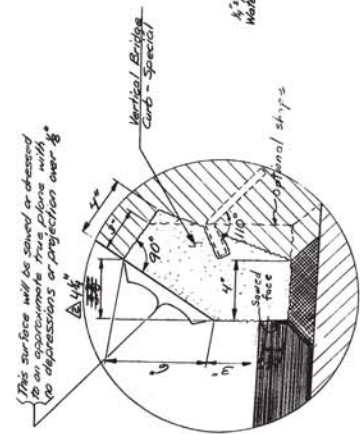
MAINE STATE HIGHWAY 194



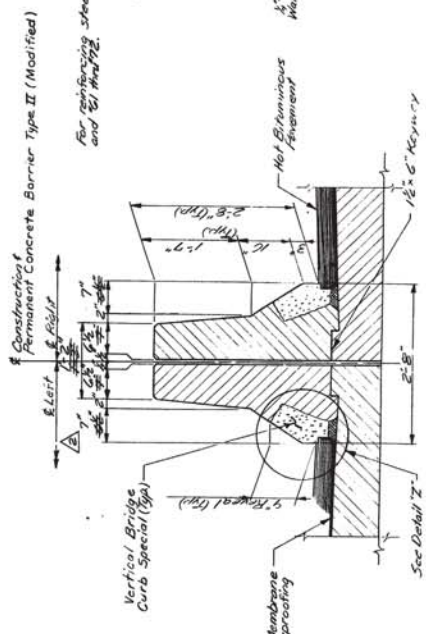
NO.	DATE	BY	CHKD.	APP'D.	REVISION
1	3/25/82	57	114		



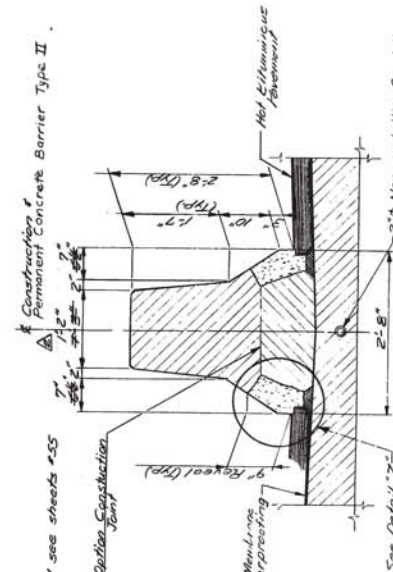
DECK PLAN



DETAIL "Z"
Vertical Bridge Curb Special



PERMANENT CONCRETE BARRIER TYPE II (MODIFIED) DETAIL
Form for Permanent Concrete Barrier Type II (Modified) shall be made under Item 556.31

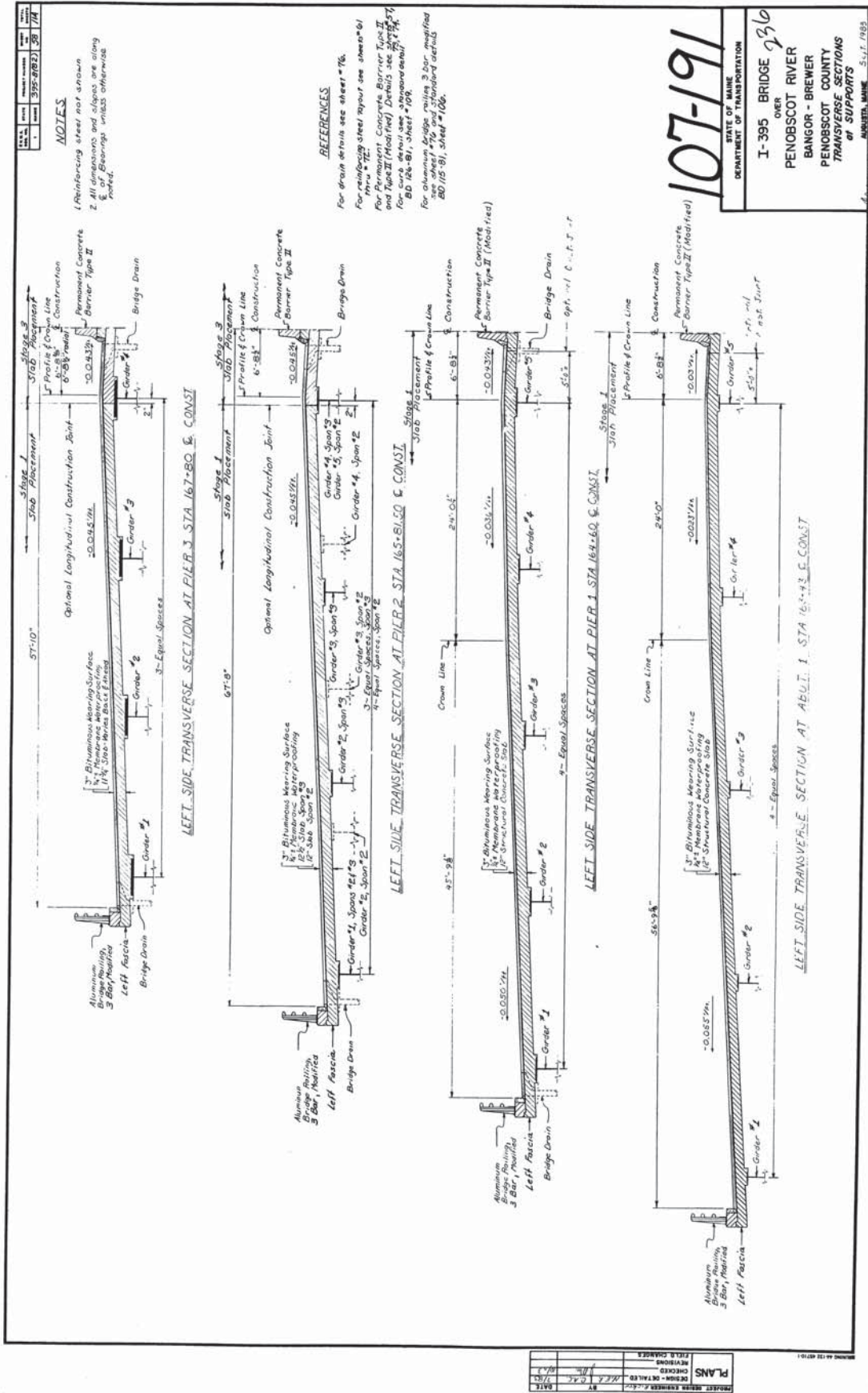


PERMANENT CONCRETE BARRIER TYPE II DETAIL
Spans 3 thru 8

107-190

Revision	Barrier Bar Spacing Date 7-30-84
Revision	Drain Spacing Date 7-30-84
STATE OF MAINE DEPARTMENT OF TRANSPORTATION	
I-395 BRIDGE 735 OVER PENOBSCOT RIVER BANGOR - BREWER PENOBSCOT COUNTY DECK PLANS SPANS 6, 7 & 8	
MAINE Sept. 1983	

As Built 107-190



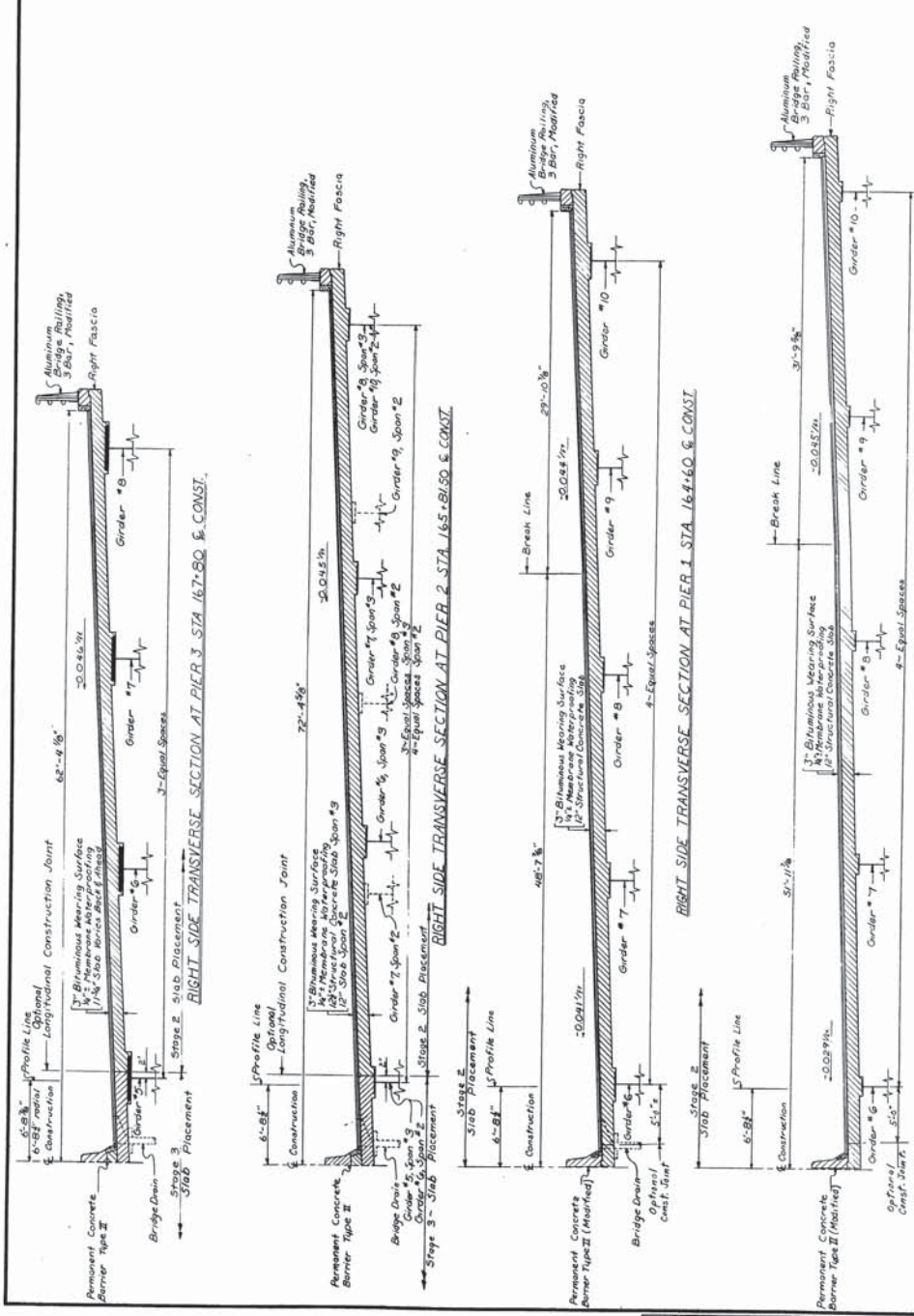
DATE	1	BY	1	REVISION	395-2783	59	714
------	---	----	---	----------	----------	----	-----

NOTES

1 All dimensions and slopes are along & bearings unless otherwise noted.

107-192

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
I-395 BRIDGE OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
AT SUPPORTS
APPROX. DATE 1948-52



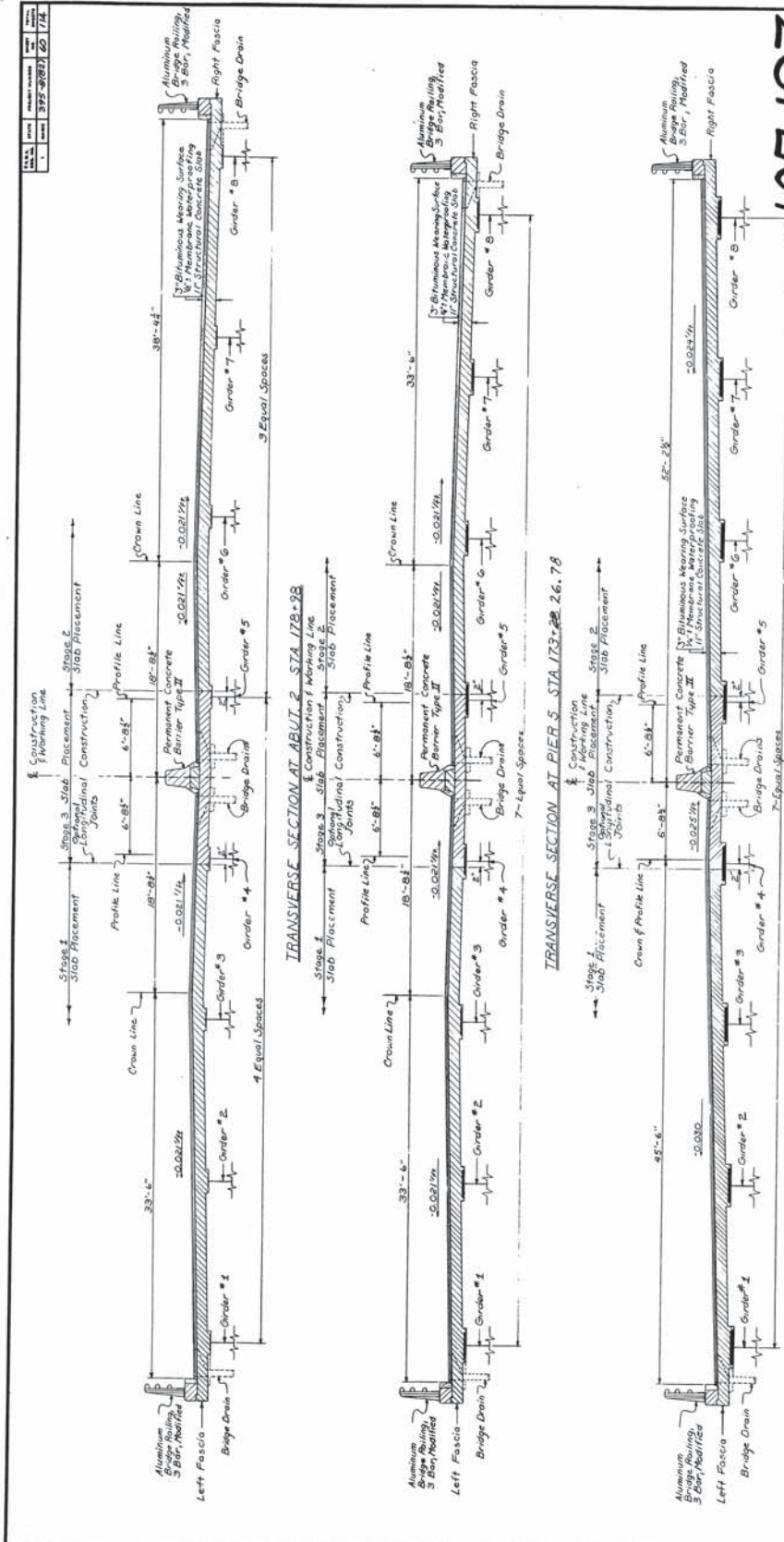
RIGHT SIDE TRANSVERSE SECTION AT PIER 3 STA 167+80 & CONST.

RIGHT SIDE TRANSVERSE SECTION AT PIER 2 STA 165+80.50 & CONST.

RIGHT SIDE TRANSVERSE SECTION AT PIER 1 STA 164+60 & CONST.

PROJECT NUMBER	395-2783
DESIGN - PRELIMINARY	7/83
CHECKED	7/83
APPROVED	7/83
DATE	7/83

NO.	DATE	BY	REVISION
1	3/27/82	GO	1/14



107-193

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
1-395 BRIDGE 130
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
OF SUPPORTS
MAINT. MAP SHEET 128

As Built 9/11/82 STA 178+98

DATE	BY	REVISION	DESCRIPTION
3/27/82	GO	1/14	107-193

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En/Ar 41

As Built per Normal 5/94 Steel

107-201



LONGITUDINAL REINFORCING STEEL
Bar # 8 @ 20" = 25%

Top Bar		Bottom Bar	
Location	Area Length	Location	Area Length
B ₁ # 4	3.552 36'-2 1/2"	B ₁ # 4	5.877 36'-2 1/2"
B ₂ # 4	3.552 36'-2 1/2"	B ₂ # 4	5.877 36'-2 1/2"
B ₃ # 3	5.517 42'-9 1/4"	B ₃ # 3	5.516 42'-9 1/4"
B ₄ # 3	5.556 60'-2 1/8"	B ₄ # 3	5.556 60'-2 1/8"
B ₅ # 3	5.556 60'-2 1/8"	B ₅ # 3	5.556 60'-2 1/8"
B ₆ # 3	5.556 60'-2 1/8"	B ₆ # 3	5.556 60'-2 1/8"
B ₇ # 3	5.556 60'-2 1/8"	B ₇ # 3	5.556 60'-2 1/8"
B ₈ # 3	5.556 60'-2 1/8"	B ₈ # 3	5.556 60'-2 1/8"

City and note this schedule to compare with SD-362
@ 508.33 quantities

I-395 BRIDGE 2A7
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE DECK SECTIONS
(SOA 3, 4, 5, 6, 7)

1997

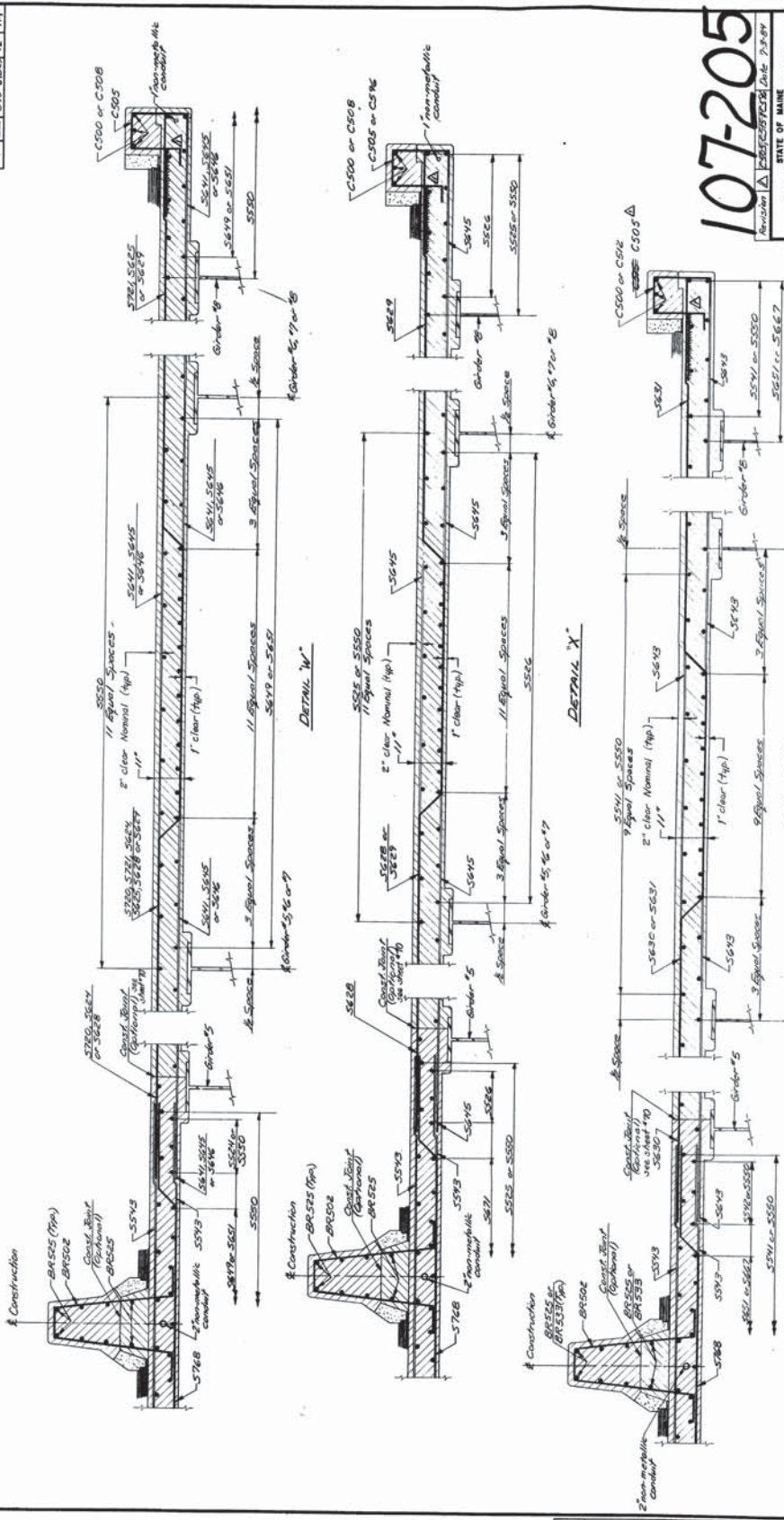


RIGHT SIDE TRANSVERSE SECTION SPAN #3

2500	60%	3%	50%	66%	66
Do not use this schedule to compute Items 503.12 or 503.13 quantities.					



NO.	DATE	BY	REVISION
1	3/95	WJ	1/1

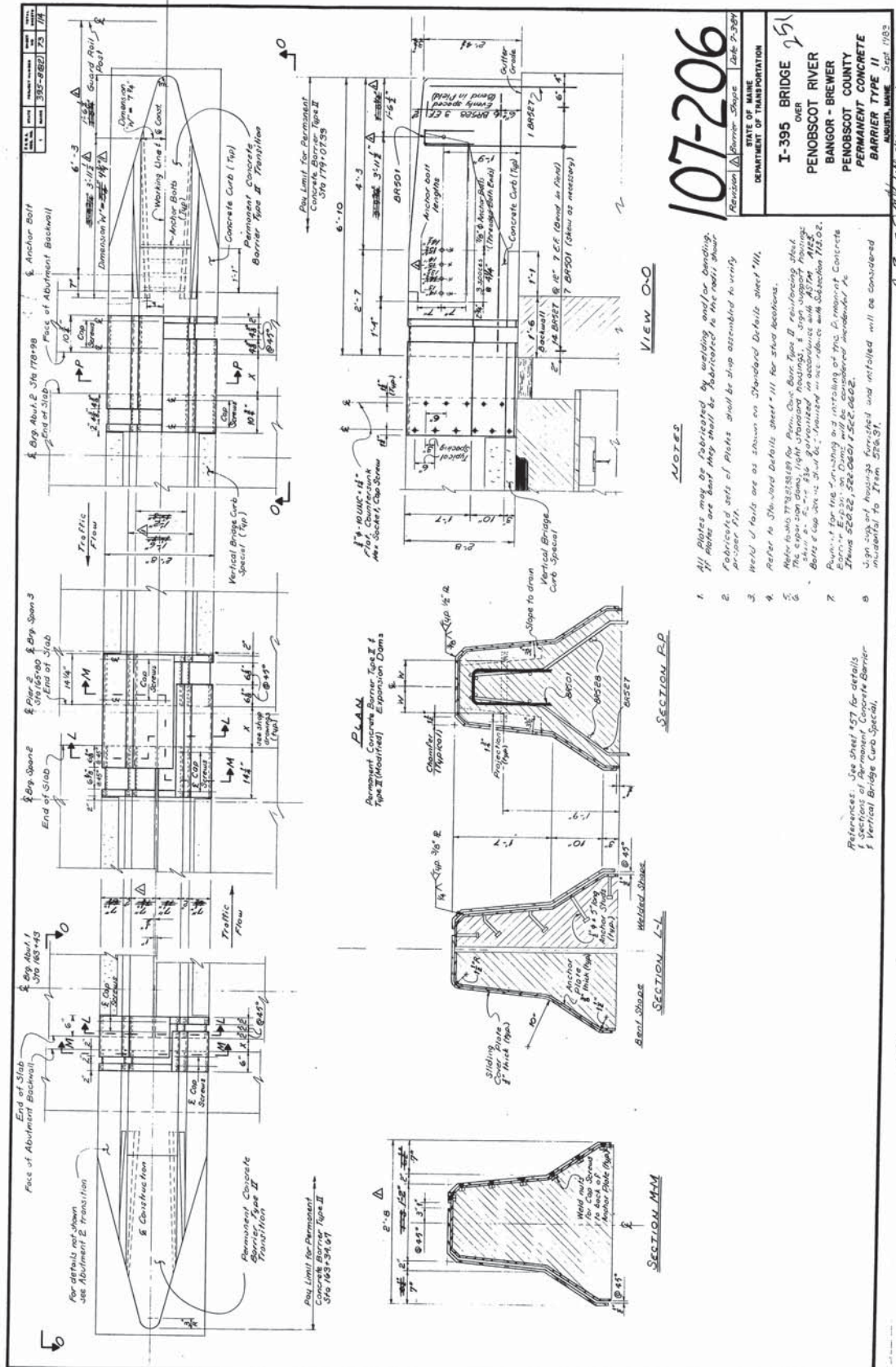


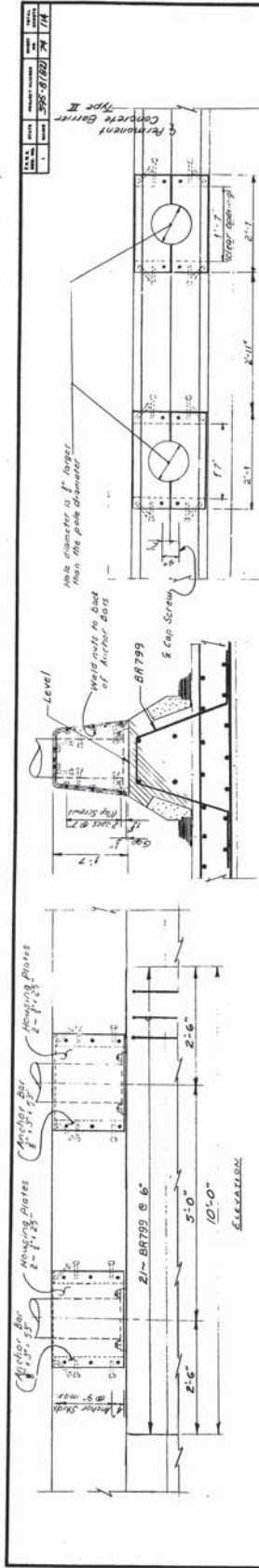
107-205

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
SPANS 4 THRU 8
AS BUILT 1984-85

DATE	BY	DESIGN - DETAIL	REVISION
3/95	WJ	1/1	1/1



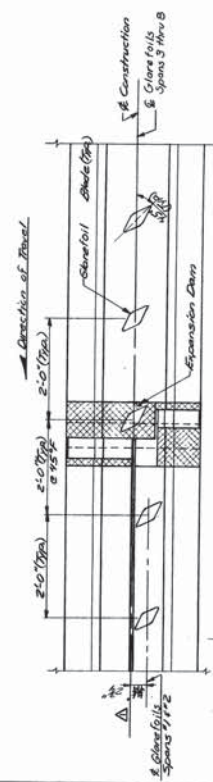


PLAN

SECTION

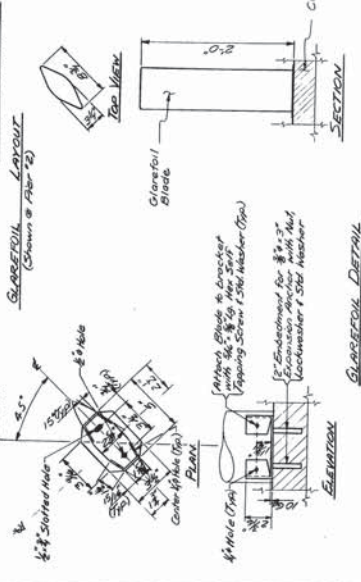
SIGN SUPPORT HOUSING

See Permanent Concrete Barrier Type II Notes Sheet # 79.



DATE	BY	CHECKED	DESIGN - DATE	PROJECT NUMBER
10/23	EN	EN	10/23	107-207

- GLAREFOIL NOTES:**
- 1- Attach Glarefoil to expansion dams and transitions by a method approved by the Engineer.
 - 2- Adjust the 2'-0" spacing to clear Light Standing Base Cover and sign supports as directed by the Engineer.
 - 3- Begin Glarefoils at Sta 119+38.5
 - 4- Install Anchor Dismountable Reflectized Pa-linators, mounted on the Glarefoil Blades. The pa-linators are to be attached to the Glarefoils by means of 1/2" x 6" bolts. The bolts are to be spaced at intervals of 100 ft. The bolts are to be attached to the Glarefoils and not to the expansion dams. Payment will be considered incidental to Item 602.50 Glarefoils.



GLAREFOIL DETAIL (186 - required)

107-207

STATE OF MAINE	DATE 7-2-94
DEPARTMENT OF TRANSPORTATION	
1-395 BRIDGE 252	
OVER	
PENOBSCOT RIVER	
BANGOR - BREWER	
PENOBSCOT COUNTY	
BARRIER RAIL DETAILS	

As BUILT 10/23/94

4. Buier Jeff-Michael 5/94

0-01-100 201-100 200-100

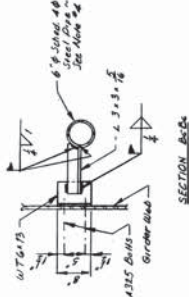
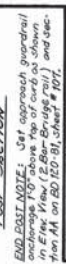
U.S. A. DEPT. OF COM.	STATE	PROPERTY NUMBER	NUMBER AND	INSTRUMENT NUMBER
1		395-9182	76	411



2. Payment will be made under Item 574.093, Aluminum Bridge Railing 3 Bars.
3. Maximum post spacing 7'-0" center to center.
4. For Rail Post Layout see sheet 055 mw-57.



3 BAR MODIFIED
(For Rail Fast Spacing see sheets # 55-56 & 57)

DRAIN NOTES

I-395 BRIDGE 05A

OVER
PENOBSCOT RIVER

DRAINS AND RAIL DETAILS

AUGUSTA, MAINE Sept 1993
 W. Gladstone

CONTRACT LIMITS
Rail Police Bar shall be furnished and installed under Contract #4)

BRIDGE DRAIN