

Bridge Load Rating

Prepared for

Maine Department of Transportation

Bridge No. 1558

BANGOR/BREWER

I-395

OVER

PENOBSCOT RIVER AND SOUTH MAIN STREET

Date of Inspection: 11/14/2013

Date of Rating: 7/20/2015

Prepared By: James G. Macpherson

Checked By: Carl T. Ayers, P.E.

Q.C. Review By: Robert S. Blunt, P.E.



VHB - Vanasse Hangen Brustlin, Inc.

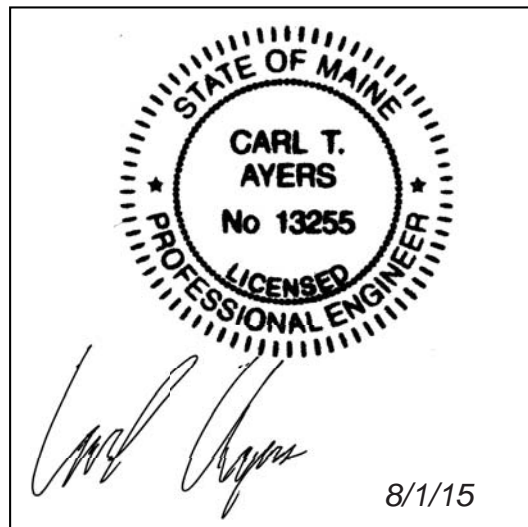


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Bridge No: 1558
 Town/City: Bangor/Brewer, ME
 Route Carried: I-395
 Crosses: Penobscot River

Owner: MaineDOT
 Maintainer: MaineDOT
 Year Built 1986
 Year(s) Rebuilt/Rehab: 2010

SUMMARY OF BRIDGE RATING

VEHICLE TYPE		RF	RT (TONS)	POSTING LOAD (TONS)
HL-93	INVENTORY	1.01		
	OPERATING	1.31		
HL-93 modified	INVENTORY			
	OPERATING			
CONFIGURATION 1				
CONFIGURATION 2				
CONFIGURATION 3				
CONFIGURATION 4				
CONFIGURATION 5				
CONFIGURATION 6				
CONFIGURATION 7				
CONFIGURATION 8				

Group 1 Posting Analysis (Configuration 1)

Governing Posting: _____
 Governing Load Model: _____

Group 2 Posting Analysis (Configurations 2 - 5)

Governing Posting: _____
 Governing Load Model: _____

Group 3 Posting Analysis (Configurations 6 - 8)

Governing Posting: _____
 Governing Load Model: _____

LRFR Evaluation Factors:

Live Load Factor: 1.75
 Live Load Routine Commercial: 1.30
 Live Load Special Hauling: 1.30
 Impact Factor: 33%
 Governing Condition Factor, ϕ_c : 1.00
 System Factor, ϕ_s : 1.00
 ADTT (one-way): 1912

Please check all the boxes that apply:

- ☐ Bridge load rating is governed by substructure rating
- ☐ Connections control the load rating
- ☐ Exterior girder controls load rating
- ☒ As-built load rating
- ☐ As-inspected load rating
- ☐ One Lane Loaded
- ☒ Advanced Analysis Used
- ☐ Actual Measurements Taken
- ☐ Finite Fatigue Life N/A years

BREAKDOWN OF BRIDGE RATING

Town/City: Bangor/Brewer, ME
 Bridge No: 1558

Route Carried: I-395
 Crosses: Penobscot River

LOAD RATING POINTS OF INTEREST

<u>Bridge Component</u>	HL-93		HL-93 Modified		MaineDOT Truck Configurations							
	Inv 72.0 kip	Oper 72.0 kip	Inv 90.0 kip	Oper 90.0 kip	1 100.0 kip	2 94.0 kip	3 88.0 kip	4 88.0 kip	5 88.0 kip	6 75.9 kip	7 59.0 kip	8 37.4 kip
Exterior Girder Strength I Positive Moment Span 1	1.66	2.15										
Exterior Girder Strength I Negative Moment Pier 1	1.63	2.11										
Exterior Girder Strength I Shear Abutment 1	1.51	1.95										
Interior Girder Strength I Postive Moment Span 1	2.02	2.61										
Interior Girder Strength I Negative Moment Pier 1	1.84	2.39										
Interior Girder Strength I Shear Abutment 1	1.43	1.86										
Exterior Girder Strength I Positive Moment Span 4	1.16	1.50										
Exterior Girder Strength I Negative Moment Pier 4	1.44	1.87										
Exterior Girder Strength I Shear Pier 2	1.43	1.86										
Interior Girder Strength I Postive Moment Span 4	1.07	1.39										
Interior Girder Strength I Negative Moment Pier 4	1.01	1.31										
Interior Girder Strength I Shear Pier 2	1.36	1.77										
CONTROLLING RATING FACTORS (STRENGTH I)	1.01	1.31										

DESCRIPTION OF BRIDGE

Bridge Number:	1558
Owner:	MaineDOT
Maintained By:	MaineDOT
Location:	Bangor/Brewer
Route Carried:	I-395
Feature Intersected:	Penobscot River
Latest NBI Inspection Date:	11/14/2013
Field Verification Date (if applicable):	N/A
Date of Construction:	1986
Bridge Type:	Steel plate girder with curved composite concrete deck
Material Properties:	Fy = 50 ksi (beams), 60 ksi (rebar), f'c = 3.0 ksi
Original Design Loading:	HS-25
Date(s) of Rebuild/Rehab :	2010
Description of Rebuild/Rehab :	Abutment backwalls, approach slabs, and wingwalls replaced. Three joints and portions of the transitions and median barriers replaced.
Posting:	N/A
Superstructure:	Kinked continuous steel plate girders (Spans 1&2 and Spans 3-8)
Substructure:	Reinforced concrete abutments and piers
Bearings:	Pot Bearings
Bridge Spans:	Spans = 117'-0", 120'-0", 200'-0", 300'-0", 246'-7¾", 201'-0¾", 200'-0", 170'-0" Total = 1555'-0" (along CL construction)
Bridge Skew:	Varies: 05°23'41.8" to 00°00'00"
Bridge Width:	Varies: 174'-11⅝" to 123'-9⅝"
Roadway Width:	Varies: 171'-3⅝" to 120'-1⅝"
Roadway Surface:	Bituminous - Asphalt
Curbs:	Concrete/Granite
Sidewalk/Walkway/Median:	N/A
Utilities:	N/A
Bridge Railing:	Aluminum 3 Bar Modified Rail
Approach Railing:	Steel Guardrail
Wearing Surface Condition:	7 - Good
Bridge Railing Condition:	1 – Meets Standards
Deck Condition:	7 - Good
Beam Condition:	7 - Good
Bearing Condition:	
Abutment Condition:	6 - Satisfactory
Pier Condition:	6 - Satisfactory

Structure Inventory and Appraisal Sheet (English Units)

Bridge Key: 1558	Agency ID: 1558	SR: 93.6	SD/FO: ND
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IDENTIFICATION

State 1: 23 Maine Struc Num 8: 1558
Facility Carried 7: INTERSTATE 395 Location 9: 0.1 MI E OF JCT RTE 1A
Rte.(On/Under)5A: Route On Structure Rte. Signing Prefix 5B: 3 State Hwy
Level of Service 5C: 1 Mainline Rte. Number 5D: 00395
Directional Suffix 5E: 0 N/A (NBI) % Responsibility : 0
SHD District 2: 04 Eastern County Code 3: 019 Penobscot
Place Code 4: 19020 Bangor Mile Post 11: 1.900 mi
Feature Intersected 6: PENOBSHOT RV & S MAIN ST
Latitude 16: 44d 47' 06" Longitude 17: 068d 46' 30"
Border Bridge Code 98: Not Applicable (P)
Border Bridge Number 99: n/a

INSPECTION

Frequency 91: 24 months Inspection Date 90: 11/14/2013 Next Inspection: 11/14/2015
FC Frequency 92A: NA FC Inspection Date 93A: NA Next FC Inspection: NA
UW Frequency 92B: 60 months UW Inspection Date 93B: 9/21/2010 Next UW Inspection: 9/21/2015
SI Frequency 92C: NA SI Date 93C: NA Next SI: NA
Element Frequency: 24 months Element Inspection Date: 11/14/2013 Next Elem. Insp. Due: 11/14/2015

STRUCTURE TYPE AND MATERIALS

Number of Approach Spans 46: 0 Number of Spans Main Unit 45: 8
Main Span Material/Design 43A/B:
4 Steel Continuous 02 Stringer/Girder
Deck Type 107: 1 Concrete-Cast-in-Place
Wearing Surface 108A: 6 Bituminous
Membrane 108B: 9 Other
Deck Protection 108C: None

CLASSIFICATION

Defense Highway 100: 1 On Interstate STRAHNE¹ Parallel Structure 101: No || bridge exists
Direction of Traffic 102: 1 1-way traffic Temporary Structure 103: Not Applicable (P)
Highway System 104: 1 On the NHS NBIS Length 112: Long Enough
Toll Facility 20: 3 On free road Functional Class 26: 11 Urban Interstate
Defense Hwy 110: 1 On Interstate STRAHNE¹ Historical Significance 37: 4 Hist sign not determin
Owner 22: 01 State Highway Agency
Custodian 21: 01 State Highway Agency

AGE AND SERVICE

Year Built 27: 1986 Year Reconstructed 106: -4
Type of Service on 42A: 1 Highway
Type of Service under 42B: 8 Hwy-waterway-RR
Lanes on 28A: 6 Lanes Under 28B: 4 Detour Length 19: 1.9 mi
ADT 29: 34,770 Truck ADT 109: 10 % Year of ADT 30: 2013

CONDITION

Deck 58: 7 Good Super 59: 7 Good Sub 60: 6 Satisfactory
Culvert 62: N N/A (NBI) Channel/Channel Protection 61: 7 Minor Damage

GEOMETRIC DATA

Length Max Span 48: 370.0 ft Structure Length 49: 1,563.0 ft
Curb/Sdwk Width L 50A: 0.6 ft Curb/Sidewalk Width R 50B: 0.6 ft
Width Curb to Curb 51: 100.6 ft Width Out to Out 52: 108.1 ft
Approach Roadway Width 32: 50.0 ft Median 33: 3 Closed Med w/Barriers
Deck Area: 168,960.8 sq. ft
Skew 34: 0.00 ° Structure Flared 35: 1 Yes, flared
Vertical Clearance 10: 99.99 ft Horiz. Clearance 47: 50.00 ft
Minimum Vertical Clearance Over Bridge 53: 327.8 ft
Minimum Vertical Underclearance Reference 54A: H Hwy beneath struct
Minimum Vertical Underclearance 54B: 25.0 ft
Minimum Lateral Underclearance Reference R 55A: H Hwy beneath struct
Minimum Lateral Underclearance R 55: 27.9 ft
Minimum Lateral Underclearance L 56: 26.6 ft

LOAD RATING AND POSTING

Inventory Rating Method 65: 1 LF Load Factor Operating Rating Method 63: 1 LF Load Factor
Inventory Rating 66: HS25.0 Operating Rating 64: HS41.6
Design Load 31: MS 22.5 or greater Posting 70: 5 At/Above Legal Loads
Posting status 41: A Open, no restriction

APPRAISAL

Bridge Rail 36A: 1 Meets Standards Approach Rail 36C: 1 Meets Standards
Transition 36B: 1 Meets Standards Approach Rail Ends 36D: 1 Meets Standards
Str. Evaluation 67: 6 Deck Geometry 68: 9 Above Desirable Crit
Underclearance, Vertical and Horizontal 69: 7 Above Minimum
Waterway Adequacy 71: 9 Above Desirable Approach Alignment 72: 7 Above Min Criteria
Scour Critical 113: 8 Stable Above Footing

PROPOSED IMPROVEMENTS

Bridge Cost 94: NA Type of Work 75: Unknown (P)
Roadway Cost 95: Unknown Length of Improvement 76:
Total Cost 96: Unknown Future ADT 114: 48,678
Year of Cost Estimate 97: Unknown Year of Future ADT 115: 2033

NAVIGATION DATA

Navigation Control 38: 1 Permit Required
Vertical Clearance 39: 70.0 ft Horizontal Clearance 40: 270.0 ft
Pier Protection 111: 2 In-Place, Functioning Lift Bridge Vertical Clearance 116: 0.0 ft

ELEMENT CONDITION STATE DATA

Str Unit	Elm/Env	Description	Units	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4	% in 5	Qty. St. 5
1	14/2	P Conc Deck/AC Ovly	(SF)	168,960	0 %	0	100 %	168,960	0 %	0	0 %	0	0 %	0
1	106/2	Unpnt Stl Opn Girder	(LF)	12,504	93 %	11,629	7 %	875	0 %	0	0 %	0	0 %	0
1	205/2	R/Conc Column	(EA)	15	70 %	11	25 %	4	5 %	1	0 %	0	0 %	0
1	215/2	R/Conc Abutment	(LF)	216	59 %	127	30 %	65	10 %	22	1 %	2	0 %	0
1	218/2	Undefined Wall Elem.	(LF)	50	60 %	30	30 %	15	10 %	5	0 %	0	0 %	0
1	234/2	R/Conc Cap	(LF)	757	95 %	719	4 %	30	1 %	8	0 %	0	0 %	0

Structure Inventory and Appraisal Sheet (English Units)

Str Unit	Elm/Env	Description	Units	Total Qty	% in 1	Qty. St. 1	% in 2	Qty. St. 2	% in 3	Qty. St. 3	% in 4	Qty. St. 4	% in 5	Qty. St. 5
1	302/2	Compressn Joint Seal	(LF)	108	100 %	108	0 %	0	0 %	0	0 %	0	0 %	0
1	303/2	Assembly Joint/Seal	(LF)	216	100 %	216	0 %	0	0 %	0	0 %	0	0 %	0
1	311/2	Moveable Bearing	(EA)	76	75 %	57	20 %	15	5 %	4	0 %	0	0 %	0
1	330/2	Metal Rail Uncoated	(LF)	3,126	85 %	2,657	5 %	156	5 %	156	5 %	156	0 %	0
1	331/2	Conc Bridge Railing	(LF)	3,126	0 %	0	98 %	3,063	2 %	63	0 %	0	0 %	0
1	383/2	Wear.Surf- AC+Membr.	(SF)	157,238	90 %	141,514	10 %	15,724	0 %	0	0 %	0	0 %	0
Str Unit	Elm/Env	Description	Element Notes											
1	14/2	Concrete Deck - Protected w/ AC	Rospalt wearing surface is in good condition with only minor longitudinal cracking. Bottom of the deck is in good condition with less than 1% cracking with efflo. The scattered transverse cracking is primarily on the spans located on the Brewer side. Recent finger joints and end posts rehab are in good condition. The concrete just behind the granite curb is scaling for the full length of the bridge and should be rehabbed.											
1	106/2	Unpainted Steel Open Girder/Bear	< none >											
1	205/2	Reinforced Conc Column or Pile Ex	Large crack in westerly channel pier (currently being monitored). Remaining piers have minor cracking only.											
1	215/2	Reinforced Conc Abutment	Concrete abutments have pervasive fine map cracking. Three of the four abutment corners of the bridge have moderate/heavy cracking and scaling.											
1	218/2	Undefined Wall Elem (Incl. Wing-, H	Moderate cracking & staining of wing walls.											
1	234/2	Reinforced Conc Cap	Cracking pier cap ends, see notes.											
1	302/2	Compression Joint Seal	< none >											
1	303/2	Assembly Joint/Seal (modular)	< none >											
1	311/2	Moveable Bearing (roller, sliding, et	Heavy corrosion of top bearing plates westerly pier. Sliding surfaces have freq'ly broken free from masonry plates.											
1	330/2	Metal Bridge Railing - Uncoated (Al	Minor collision scraping of aluminum rail, local bent rail bars.(see photos)											
1	331/2	Reinforced Conc Bridge Railing	Moderate discolored cracking typ for concrete barrier. Some of headlight baffles missing.											
1	383/2	Wearing Surface - AC & Membrane	< none >											

BRIDGE NOTES

Eight span, weathering steel, welded girders (both continuous and noncontinuous) w composite concrete deck. ROSPHALT WEARING SURFACE

PAST INSPECTION

Inspection Date: 11/14/2013

Type: 1 Regular NBI

Inspector: DTPDERO

Pontis User Key: DTPDERO - PETE

Scope:

NBI: ☒Other: ☐Element: ☒Underwater: ☐Fracture Critical: ☐

INSPECTION NOTES

Structure is in Satisfactory to Good condition.

Wearing surface:

Rospalt wearing surface is in good condition with only minor longitudinal cracking.

Deck:

Bottom of the deck is in good condition with less than 5% cracking with efflo. The scattered transverse cracking is primarily on the spans located on the Brewer side. Recent joint and end posts rehab are in good condition. The concrete just behind the granite curb is scaling for the full length of the bridge and should be rehabbed. Aluminum bridge rail has collision damage to 4 pieces of rail and several posts. Impact damage from plows has caused isolated areas of bridge rail anchor posts to be sheared off, weakening these areas for future impacts.(See photos)

Structure Inventory and Appraisal Sheet (English Units)

PAST INSPECTION

Inspection Date: 08/15/2012

Type: 1 Regular NBI

Inspector: DTJHANN

Pontis User Key: DTJHANN - JAMIE

Scope:

NBI: ☒ Other: ☐ Element: ☒
Underwater: ☐ Fracture Critical: ☐

INSPECTION NOTES

Structure is in Satisfactory to Good condition.
Initial topside inspection on 8-6-12.
Inspected with the UBIT on the down stream side starting at the Bangor end on 8-15-12.
The pier cap ends have cracking that ranges from 1/16" to - 1/8" wide, see photos.

Wearing surface:

Rosphalt wearing surface is in good condition with only minor longitudinal cracking.

Deck:

Bottom of the deck is in good condition with less than 1% cracking with efflo.
The scattered transverse cracking is primarily on the spans located on the Brewer side.
Recent finger joints and end posts rehab are in good condition.

PAST INSPECTION

Inspection Date: 12/21/2010

Type: 1 Regular NBI

Inspector: DTPDERO

Pontis User Key: DTPDERO - PETE

Scope:

NBI: ☒ Other: ☐ Element: ☒
Underwater: ☐ Fracture Critical: ☐

INSPECTION NOTES

Structure is in Satisfactory to Good condition.
Joint seals and headers and armor in need of repair.
Bearings should be cleaned and rehabed at abutments.

Structure Inventory and Appraisal Sheet (English Units)

PAST INSPECTION

Inspection Date: 12/15/2008

Type: 1 Regular NBI

Inspector: DTPVERR

Pontis User Key: DTPVERR - PAUL

Scope:

NBI: ☒ Other: ☐ Element: ☒
Underwater: ☐ Fracture Critical: ☐

INSPECTION NOTES

CHANNEL: Erosion area in Bangor shore. Refer to prev reports, inc UNDERWATER, for detailed descrip.
Refer to ELEMENT LEVEL for addt'l comments.

PAST INSPECTION

Inspection Date: 01/03/2007

Type: 1 Regular NBI

Inspector: DT2HARR

Pontis User Key: DT2HARR - SCOT

Scope:

NBI: ☒ Other: ☐ Element: ☒
Underwater: ☐ Fracture Critical: ☐

INSPECTION NOTES

Walked entire catwalk from end to end and found minor deterioration of main elements only. Large crack in westerly channel pier footing is currently being monitored. Recommend filling of potholes at concrete joint headers and minor repair of rusty drains.

Structure Inventory and Appraisal Sheet (English Units)

PAST INSPECTION

Inspection Date: 05/20/2004

Type: 1 Regular NBI

Inspector: -1

Pontis User Key: PWV

Scope:

NBI: ☒ Other: ☐ Element: ☒
 Underwater: ☒ Fracture Critical: ☐

INSPECTION NOTES

INSPECTOR WORK CANDIDATES

Work Candidate ID	Action	Object	Agency Status	Agency Priority	Assigned to a Project	Rec. Date
A-DOT001-1127109A-00000000	Other	Bridge	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-00000019	Other	Bridge	Approved	Medium	No	12/15/2008
A-DOT001-10D93198-0000001B	Other	Bridge	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-00000017	Scour	Bridge	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-0000001F	Part Paint	Unpnt Stl Opn Girder	Approved	High	No	11/14/2013
A-DOT001-10D93198-0000001D	Min Repair	P Conc Deck/AC Ovly	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-00000021	Min Repair	R/Conc Abutment	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-00000025	Rehab Elem	Undefined Wall Elem.	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-00000023	Min Repair	R/Conc Cap	Approved	low	No	11/14/2013
A-DOT001-10D93198-00000027	Min Repair	R/Conc Cap	Approved	low	No	11/14/2013
A-DOT001-10D93198-0000002B	Rehab Elem	Compressn Joint Seal	Approved	High	No	12/15/2008
A-DOT001-0D2E4A34-0000001B	Rehab Elem	Assembly Joint/Seal	Approved	High	No	12/21/2010
A-DOT001-10D93198-0000002D	Rehab Elem	Assembly Joint/Seal	Approved	High	No	12/15/2008
A-DOT001-10D93198-0000002F	Rehab Elem	Moveable Bearing	Approved	Medium	No	11/14/2013
A-DOT001-10D93198-00000031	Min Repair	Metal Rail Uncoated	Approved	High	No	11/14/2013
A-DOT001-10D93198-00000033	Rehab Elem	Conc Bridge Railing	Approved	low	No	8/6/2012

-1.0-

Load Rating Model and Calculations



Load Rating Table of Contents

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-1.1-

Assumptions and Methods





Computations

Project:	Br # 1558 - 2015 Maine Load Ratings	Project #:	55060.00
Location:	Bangor/Brewer, ME	Sheet:	
Calculated by:	JGM	Date:	7/3/2015
Checked by:	CTA	Date:	7/4/2015
Title:	Modeling Assumptions and Methodology		

Model and Rating Layout:

The bridge is broken out into three segments, each segment is modeled and rated separately (see attached sketch). The girder sections for each bridge segment are identical. The three bridge segments are:

1. Spans 1 & 2 - LT (Westbound)
2. Spans 1 & 2 - RT (Eastbound)
3. Spans 3-8

General Model Assumptions:

1. All dimension are per the 1984 As-Built Plans.
2. LARSA 4D Structural and Earthquake Engineering Integrated Analysis and Design Software 7.08 is used to model this bridge.
3. The beams are modeled using line elements which are assigned the appropriate section properties. Beam section properties are generated using the LARSA Section Composer.
4. The deck is modeled using classic plate elements. Plate nodes are offset from the beam nodes and are connected via rigid links.
5. Crossframes are modeled using line elements. Crossframes are modeled separately and the Simplified Euler-Bernoulli Approximation method is used to determine the equivalent stiffness. The moment fixity was released at the end of each crossframe, at the beam connection. An equivalent area is assigned to each crossframe element to account for the dead load of each frame.
6. The effects of superelevation and vertical curve are assumed negligible and are not included in the model.
7. Bottom flange lateral bracing is not included in the model.

Material Properties:

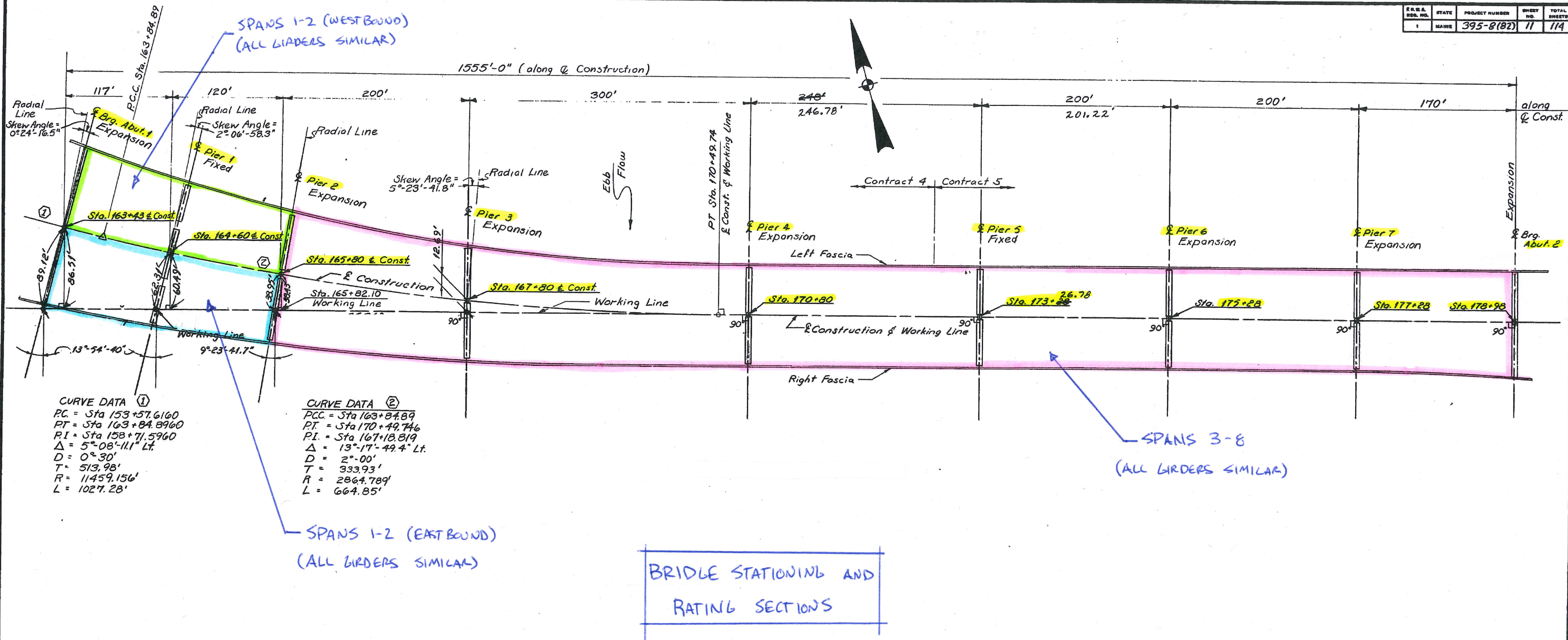
1. Structural Steel - ASTM A588, $F_y = 50\text{ksi}$
2. Reinforcing Steel - ASTM A615, $F_y = 60\text{ksi}$
3. Concrete - Class A, $f'_c = 3.0\text{ksi}$

Dead Loads:

1. Girder and deck self weights are generated by LARSA based on the assigned material properties and beam areas. Deck thickness varies from 12½" to 11", see model calculations.
2. The dead loads due to the median barrier and exterior curb/railing are applied as equivalent point loads to each fascia plate.
3. The dead loads due to deck haunch and detail factor are applied as line load across each girder. See model calculations.
A detail factor of 10% is assumed, this does not include the weight of crossframes.
4. The total wearing surface thickness is 3¾". Although the bridge has been resurfaced, the pavement thickness is assumed to be the same as the stated on the as-built plans. Wearing surface loads are applied as an uniform load to each plate. The uniform load is reduced for fascia plates that are partially covered by a curb or barrier.
5. The dead load of the overhead sign structure is applied as three point loads in span three. The loads are determined based shop drawings for a similar structure.

Rating Notes and Assumptions:

1. The load rating was performed in accordance with Maine Department of Transportation Load Rating Guidelines (April 2015).
2. The girders are rated for the HL-93 load case. All inventory rating factors are greater than 1.0, MaineDOT legal loads are not considered.
3. The bridge was evaluated at the strength and service limit states. The service limit state is only for serviceability considerations and is excluded from rating evaluations per MaineDOT Load Rating Guidelines (3.7.1)
4. Continuous lateral bracing of the top flange assumed per MBE 6A.6.9.3
5. Condition (ϕ_c) and System (ϕ_s) factors are both = 1.0.
6. Capacity was checked in accordance with AASHTO LRFD Design Specification, Section 6.10.
7. Composite action is assume throughout the bridge.
Flexural capacities in positive moment regions are calculated based on the girder steel and transformed concrete deck.
Flexural capacities in negative moment regions are calculated based on the girder steel and reinforcing deck steel.
Lateral Bending Capacities are calculated based on the girder steel properties only.
Shear capacities are calculated based on the girder web steel only.



107-144

Revision	Date	STATE OF MAINE DEPARTMENT OF TRANSPORTATION
Δ Station change	4-9-84	
		I-395 BRIDGE OVER PENOBSCOT RIVER BANGOR - BREWER PENOBSCOT COUNTY SUBSTRUCTURE LAYOUT
		AUGUSTA, MAINE Sept. 1983

As Built per Material 5/94



Computations

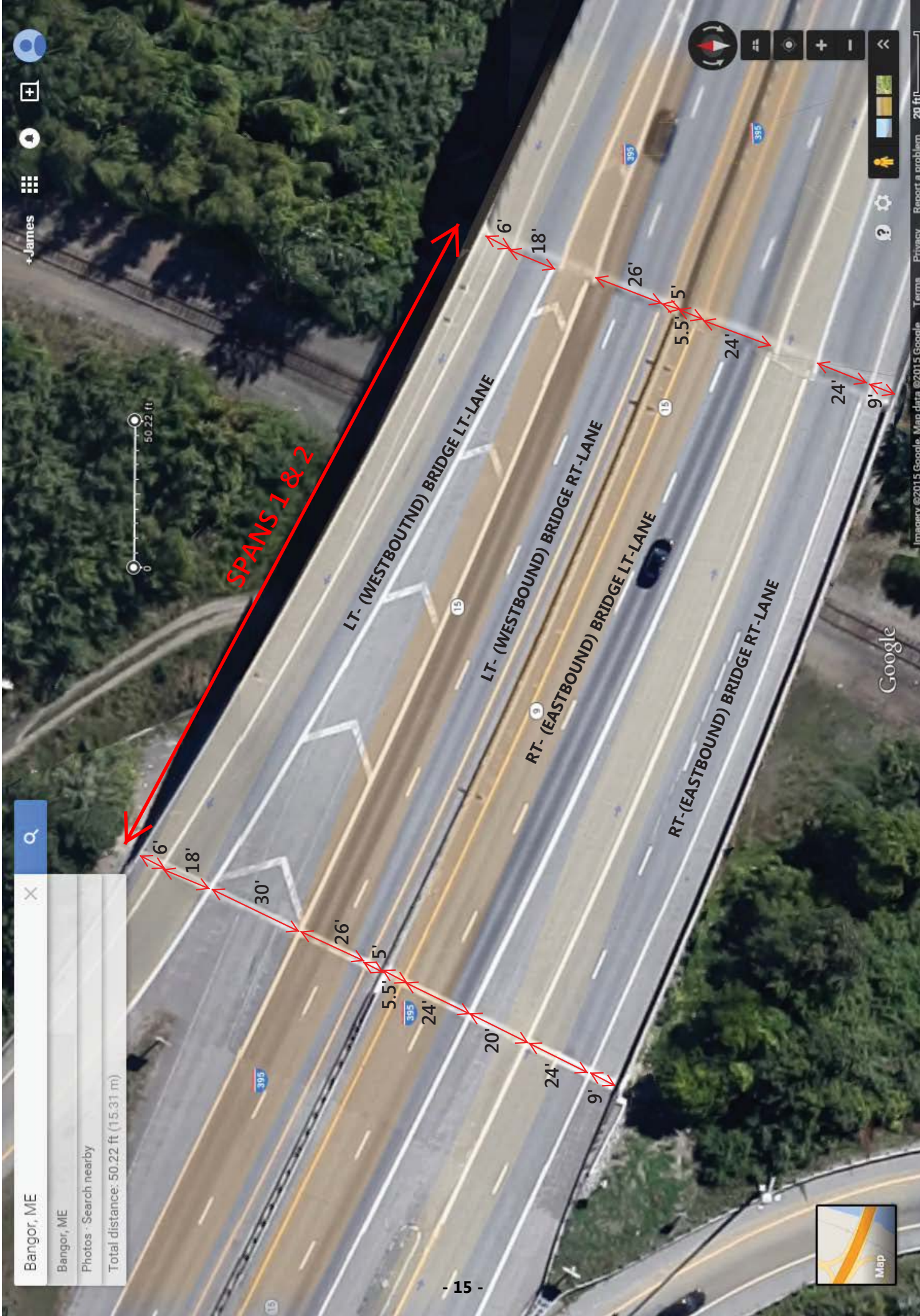
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 7/3/2015
Checked by: CTA	Date: 7/4/2015
Title: Modeling Assumptions and Methodology	

Live Loading Spans 1 & 2:

Live loading is developed using the striped lanes only. See attached sketch for assumed lane grouping and dimensions.

The following steps are used to generate the worst case loading for each beam section:

1. A two-dimensional surface is created for each lane grouping.
Each surface has a forward increment of 3.0' and a transverse increment of 3.0'.
2. LARSA is used to generate an "Influence Surface Case", which determines the worst case live load configuration for each point along the surface. The following live load configurations are considered for each surface:
HL-93 Truck + Lane
HL-93 Tandem + Lane
90% HL-93 Double Truck + 90% Lane (Negative Region Moment Only)
Multiple lanes and multipresence factor are applied here.
Centrifugal forces are applied here.
Impact is not added here, it is applied in the actual rating calculations.
3. Each composite girder is defined by grouping each beam element with the adjacent plate elements.
4. Composite shears and moments are generated using the "Compound Element Forces" tool in LARSA.
Each composite beam is sliced at 5.0' intervals along the longitudinal axis of the bridge.
The maximum moments and shears for each girder section are determined based on results of the compound forces.



SPANS 1 & 2 - LANE GROUPING DIAGRAM



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: Modeling Assumptions and Methodology	

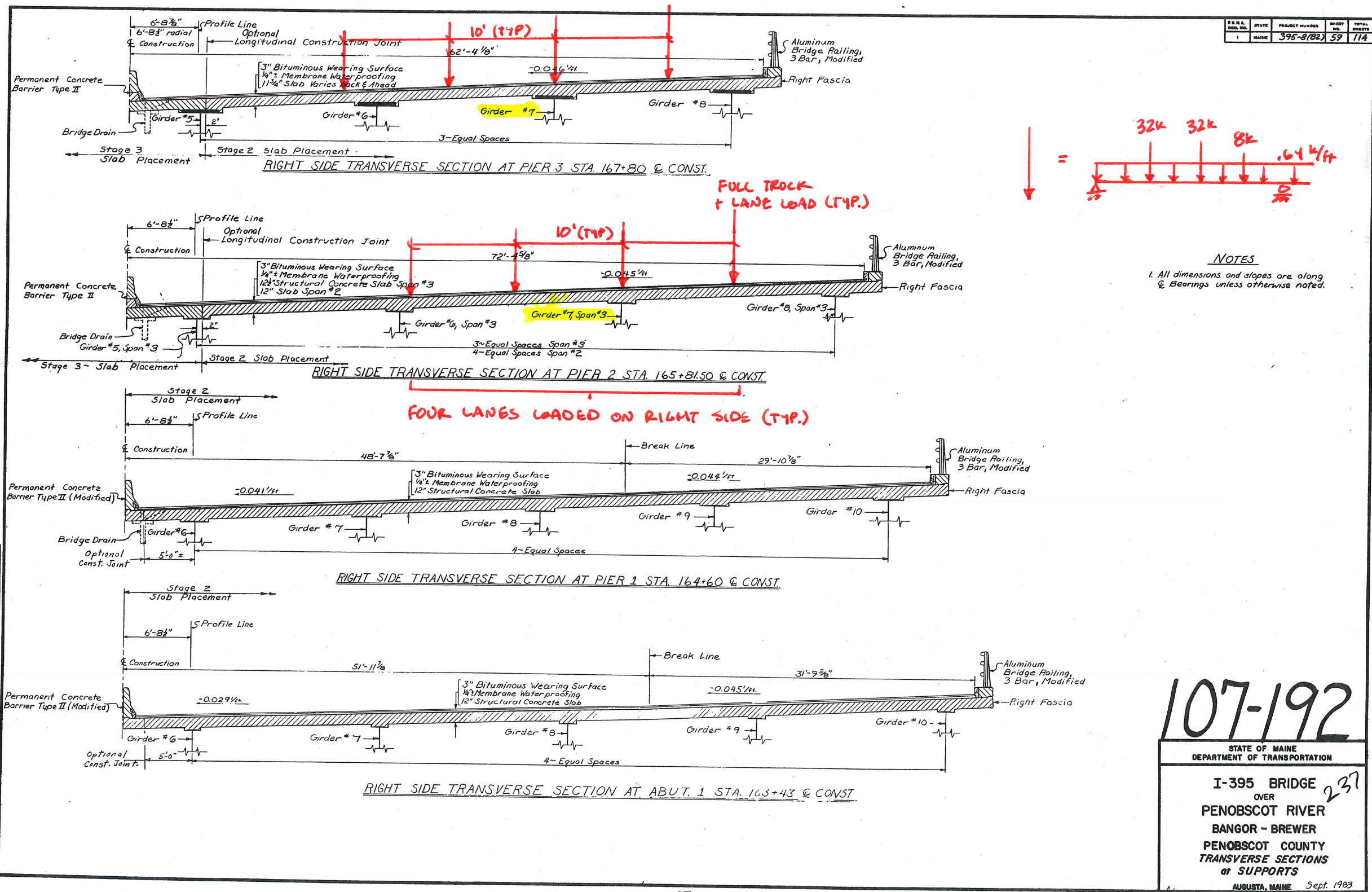
Live Loading Spans 3-8:

Note: Due to the size and complexity of the spans 3-8 model, live load surfaces can not be used efficiently. The method outlined below has been checked to ensure accuracy and proper distribution of live load to all girders across the bridge.

The following steps are used to generate the worst case loading for each beam section:

1. Each lane is represented using a single line/influence load. The first line (lane) load is placed to create the worst case loading to the girder in question. Each subsequent line (lane) load is placed 10.0' to the right or left as appropriate. See attached sketches for assumed lane spacing and grouping.
Each lane/influence load has a forward increment of 2.0'.
2. LARSA is used to generate an "Influence Line Case", which applies difference live load configuration for each point along influence line. The following live load configurations are considered for each influence line:
 - HL-93 Truck + Lane
 - HL-93 Tandem + Lane
 - 90% HL-93 Double Truck + 90% Lane (Negative Moment Region Only)Centrifugal forces are applied here.
Impact is not added here, it is applied in the actual rating calculations.
Only one lane is loaded at a time, multipresence factor are not applied here. They are applied in the actual rating calculations.
3. Each composite girder is defined by grouping each beam element with the adjacent plate elements.
4. Composite shears and moments are generated using the "Compound Element Forces" tool in LARSA.
Each composite beam is sliced at 5.0' intervals along the longitudinal axis of the bridge.
5. Spreadsheets are used to combine lanes and determine the maximum moments and shears for each girder section.
Multipresence factors are applied here.

GIRDER #7-2 LIVE LOADING
(SPANS 3-8)



PROJECT DESIGN ENGINEER	DATE
DESIGN CHECKED	BY
REVISIONS	DATE
FIELD CHANGES	DATE

107-192

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

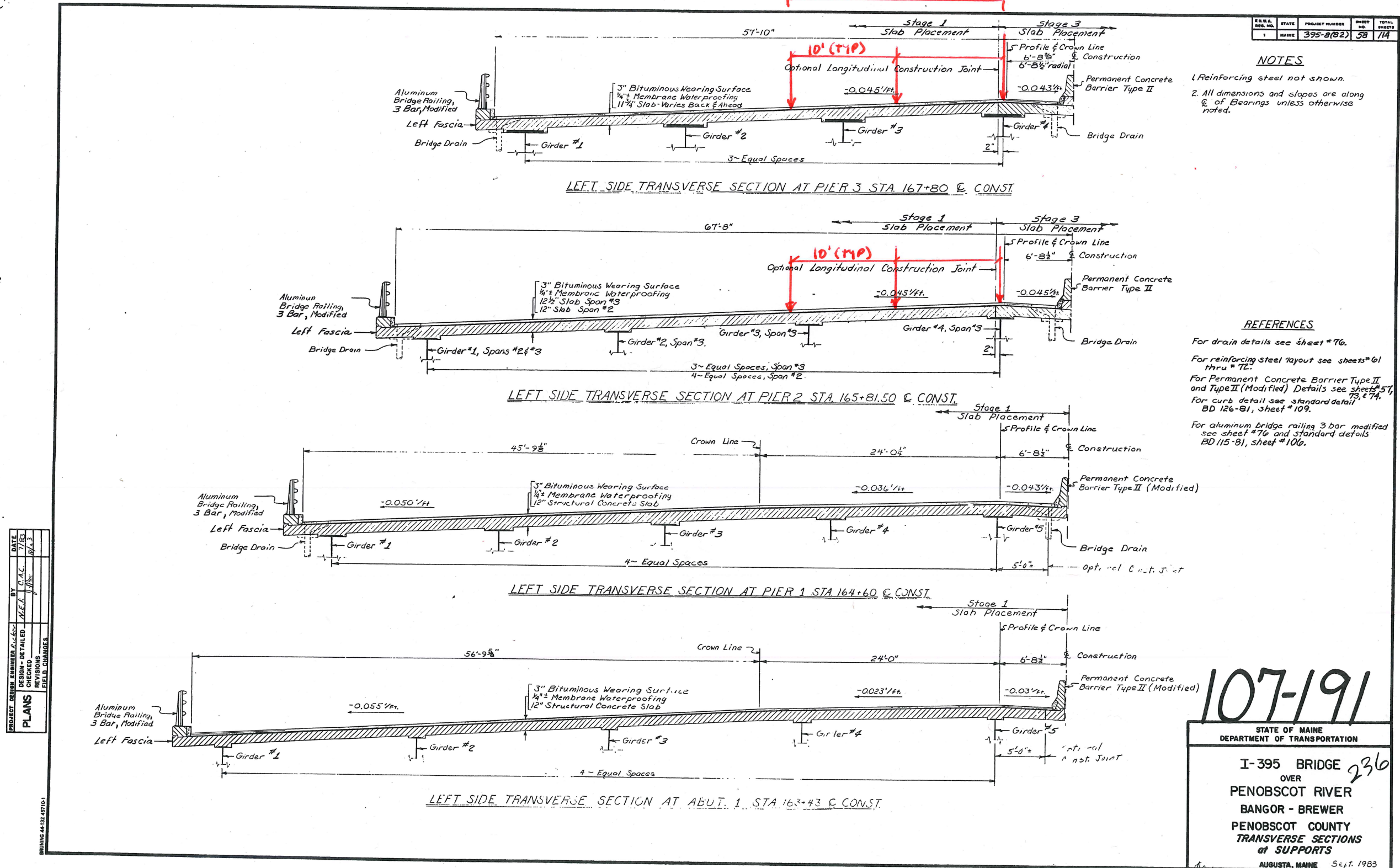
I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
at SUPPORTS

AUGUSTA, MAINE Sept. 1983

GIRDER # 7-2 LIVE LOADING

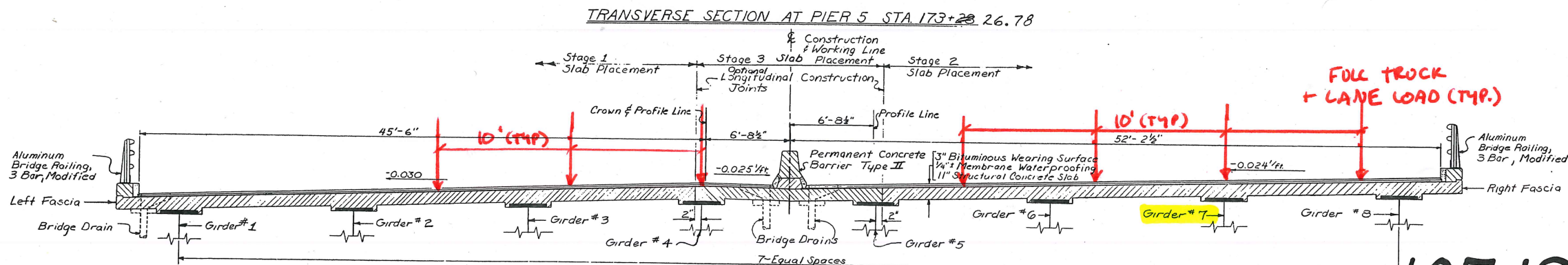
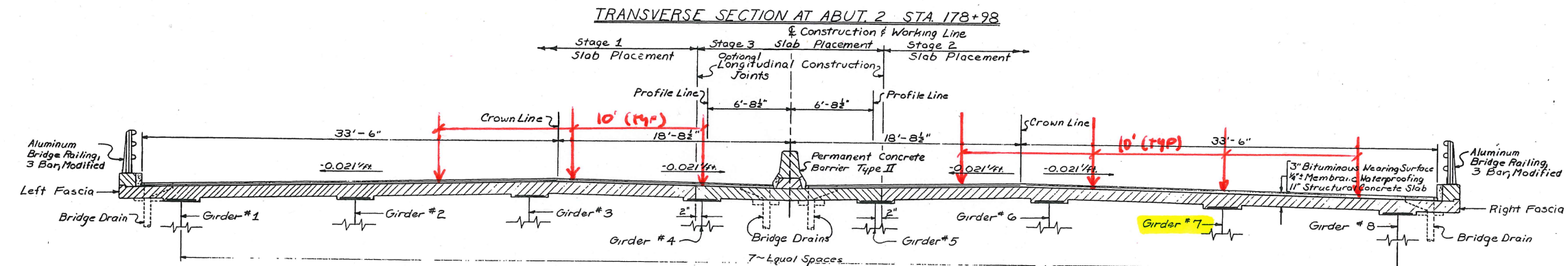
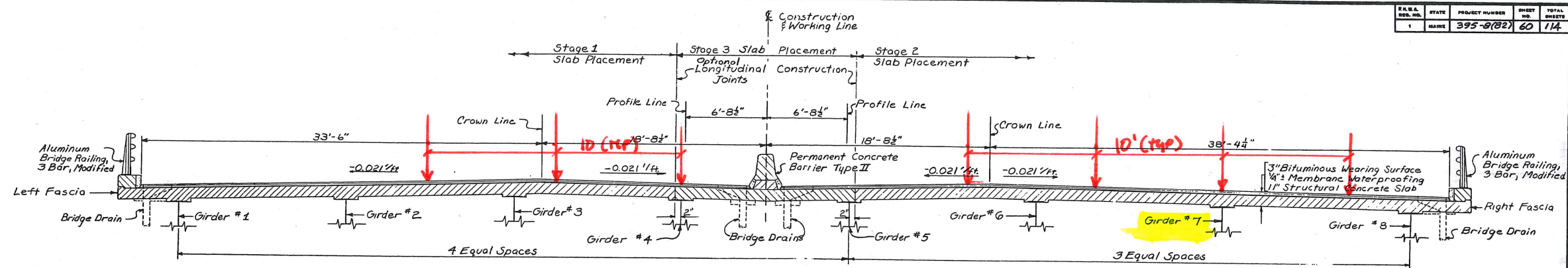
(SPANS 3-8)

THREE LANES LOADED ON LEFT SIDE (TYP.)



GIRDER # 7-2 LIVE LOADING

(SPANS 3-8)



THREE LANES LOADED ON
LEFT SIDE (TYP.)

FOUR LANES LOADED ON RIGHT SIDE
(TYP.)

107-193

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

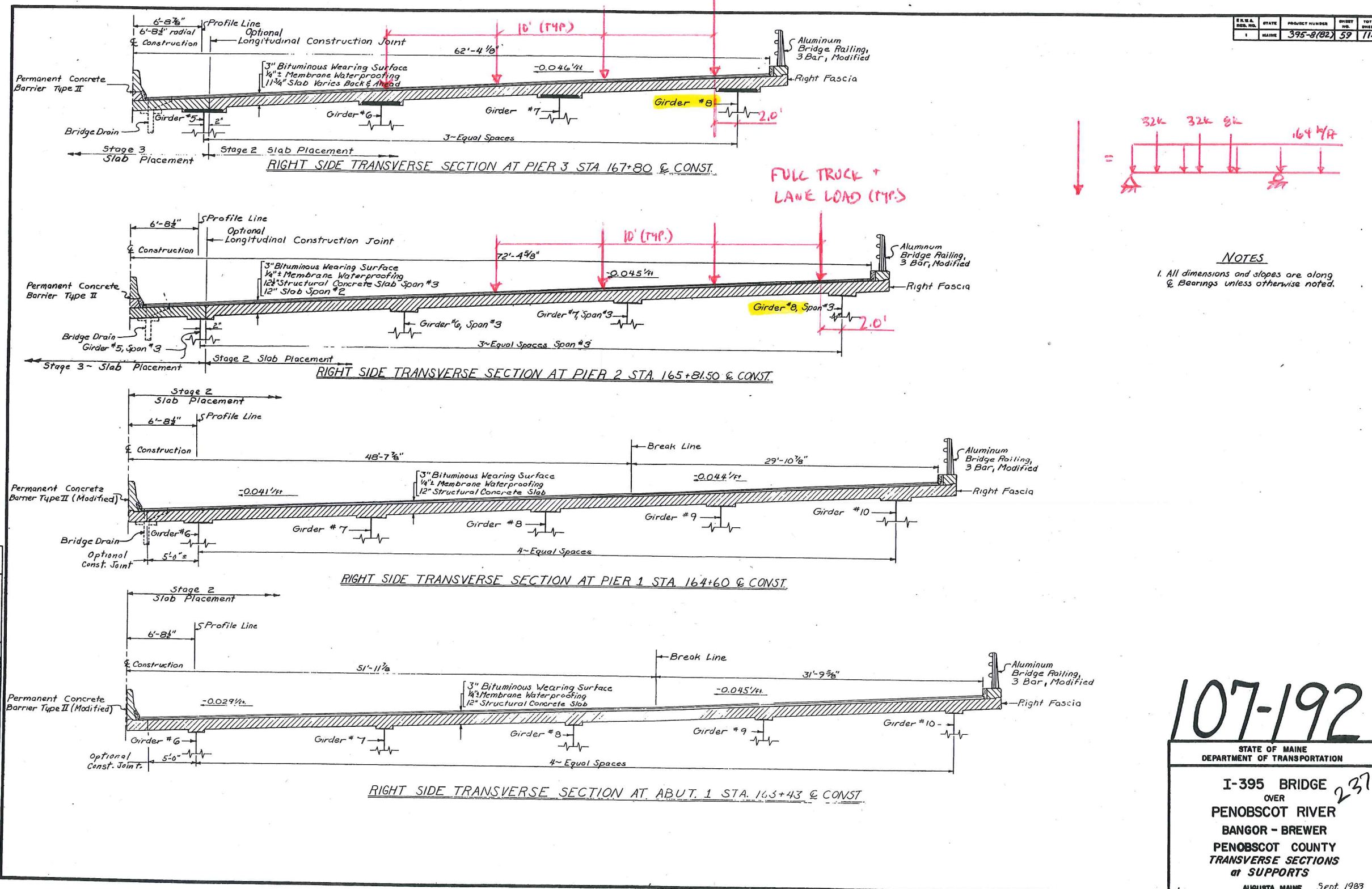
I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY

TRANSVERSE SECTIONS
at SUPPORTS
AUGUSTA, MAINE Sept. 1983

DATE	BY	REVISIONS
7/1/83	C.A.C.	1
7/1/83	J.M.	2
7/1/83	J.M.	3
7/1/83	J.M.	4
7/1/83	J.M.	5
7/1/83	J.M.	6
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7/1/83	J.M.	100

GIRDER 8-2 LIVE LOADING
(SPANS 3-8)

FOUR LANES LOADED ON THE RIGHT SIDE
(TYP.)



PROJECT DESIGN ENGINEER	DATE
DESIGN - DETAIL	7/83
CHECKED	7/83
FIELD CHANGES	10/12

107-192

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
at SUPPORTS

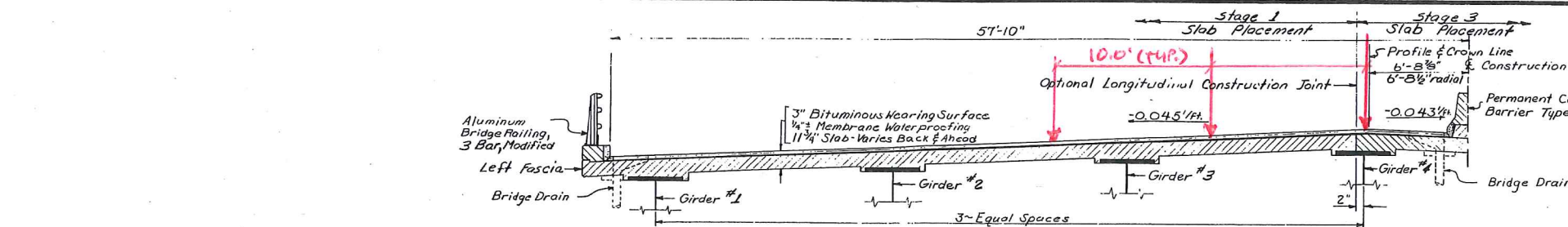
AUGUSTA, MAINE Sept. 1983

As Built for Maine Dept. of Transportation

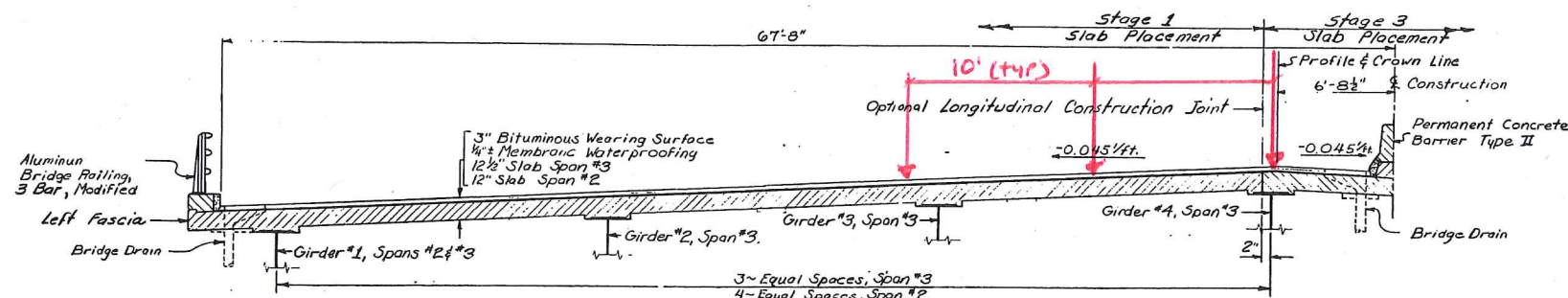
GIRDER #8-2 - LIVE LOADING
(SPANS 3-8)

THREE LANES LOADED ON LEFT SIDE
(TYP.)

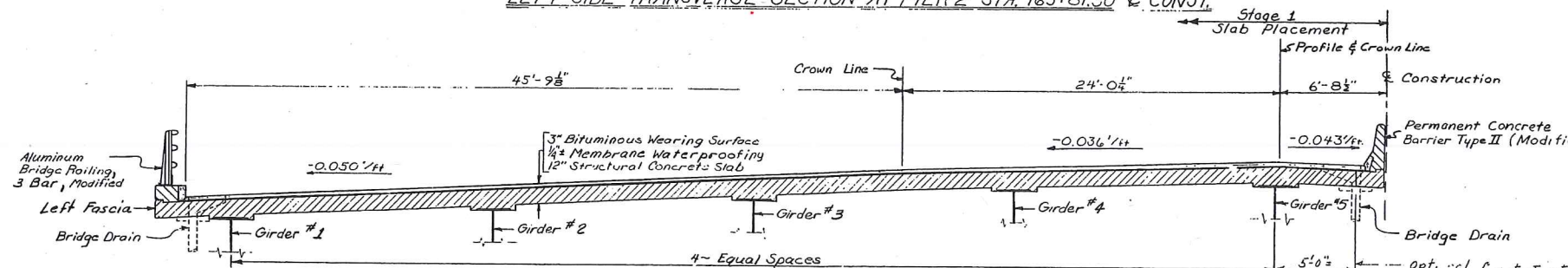
PROJECT	ENGINEER	DATE
BRIDGE 236	W.E.B.	1/83
REVISIONS	BY	DATE
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3	W.E.B.	1/83
4	W.E.B.	1/83
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100	W.E.B.	1/83



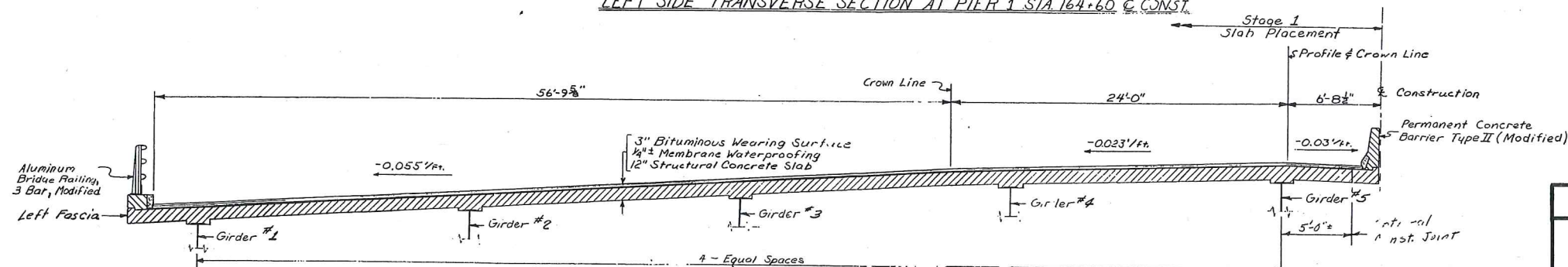
LEFT SIDE TRANSVERSE SECTION AT PIER 3 STA 167+80 & CONST.



LEFT SIDE TRANSVERSE SECTION AT PIER 2 STA 165+81.50 & CONST.



LEFT SIDE TRANSVERSE SECTION AT PIER 1 STA 164+60 & CONST.



LEFT SIDE TRANSVERSE SECTION AT ABUT. 1 STA 163+43 & CONST.

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
MAINE	395-8(2)	58	114

NOTES

1. Reinforcing steel not shown.
2. All dimensions and slopes are along & of Bearings unless otherwise noted.

REFERENCES

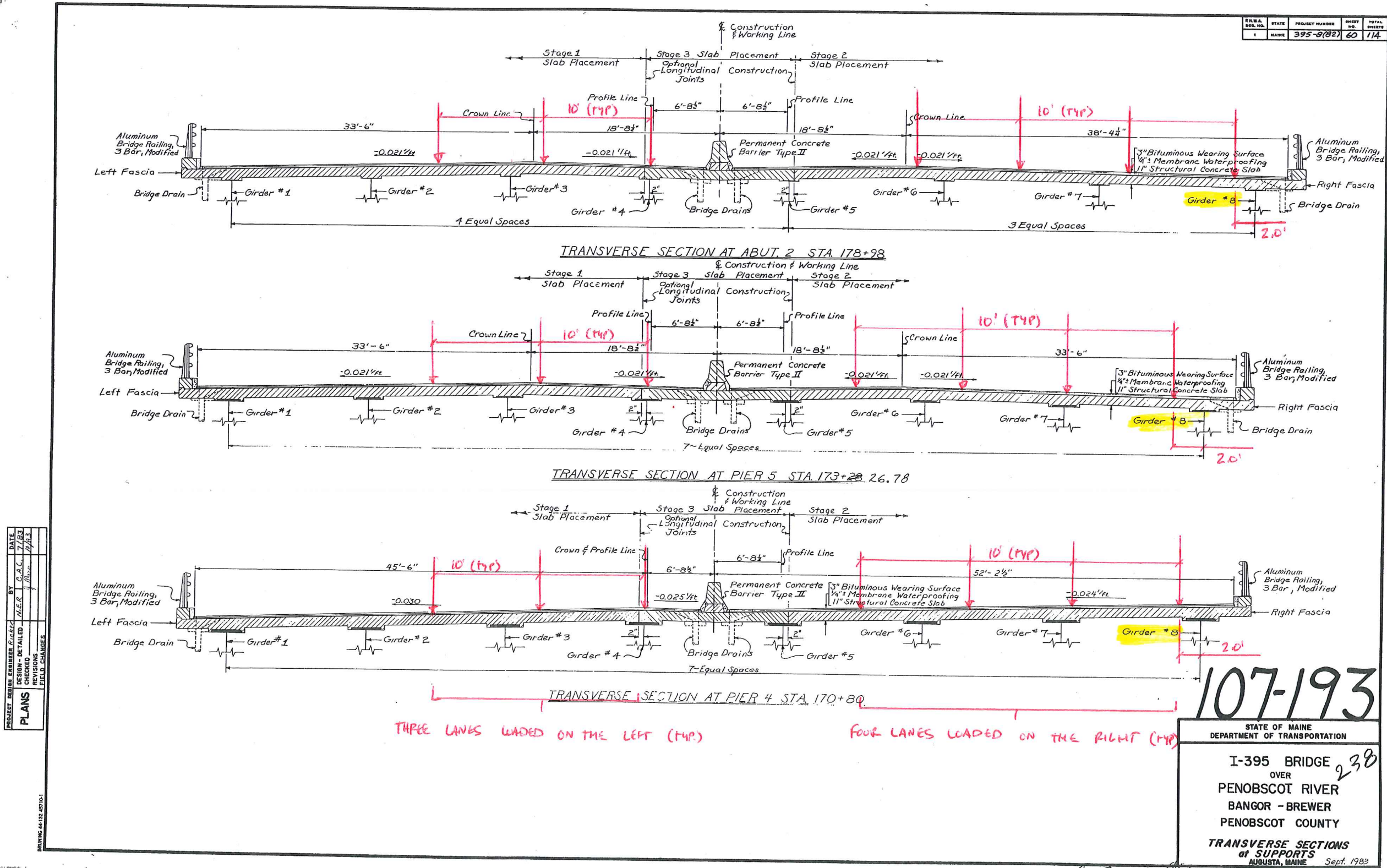
- For drain details see sheet #76.
- For reinforcing steel layout see sheets #61 thru #72.
- For Permanent Concrete Barrier Type II and Type II (Modified) Details see sheets #57, #73, #74.
- For curb detail see standard detail BD 126-B1, sheet #109.
- For aluminum bridge railing 3 bar modified see sheet #76 and standard details BD 115-B1, sheet #106.

107-191

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE 236
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
at SUPPORTS
AUGUSTA, MAINE Sept. 1983

GIRDER 8-2 LIVE LOADING
(SPANS 3-8)



-1.2-

LARSA Model Calculations





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
Location: Bangor/Brewer, ME
Calculated by: JGM
Checked by: CTA
Title: LARSA Model Calculations

Project #: 55060.00
Sheet:
Date: 4/9/2015
Date: 6/22/2015

Dead Loads (Spans 1 & 2)

Median Barrier:

Unit Weight Conc = 0.15 kcf

Median, Curb, and Rail loads will be applied as equivalent point loads along the deck fascia loads.

Barrier Cross-section Area = 2.5 ft² (Measured in CADD)

Fascia Length = 237 ft

Nodes = 13

Unit Weight = 0.375 klf

Equivalent Point Load = 6.84 k

Curb and Rail:

Curb Weight = 250 plf (Maine BDG T3-1)

Fascia Length = 243.5 ft

3-Bar Aluminum Rail Weight = 35 plf (Assumed per NHDOT BDM 642.3.5)

Nodes = 13

Unit Load = 0.285 klf

Equivalent Point Load = 5.34 k

Pavement:

The weight of pavement will be applied as uniform plate loads to all interior deck plates. For fascia deck plates an equivalent uniform plate load will be used based on the area paved to the area covered by the curb/barrier.

Interior Plates:

Thickness of WS = 0.271 ft

Unit Weight WS = 0.14 kcf

Uniform Load = 0.037917 ksf

Exterior Plates:

Left Plate Width = 5.000 ft (Average)

Curb Width = 1.8333 ft

Equivalent Uniform Load = 0.02401 ksf

Haunch and Detail Factor:

A line load will be added to each girder to account for the haunch concrete and girder detail factor.

Ave Width = 24.0 in

Detail Factor = 10%

Ave Height = 2.0 in

Unit Weight Conc = 0.15 kcf

Girder Section 1 Area = 0.540 ft²

Section 1 Detail Factor = 0.0265 klf

Girder Section 2 Area = 0.918 ft³

Section 2 Detail Factor = 0.0450 klf

Girder Section 3 Area = 0.509 ft⁴

Section 3 Detail Factor = 0.0249 klf

Girder Section 4 Area = 0.965 ft⁵

Section 4 Detail Factor = 0.0473 klf

Girder Section 5 Area = 0.524 ft⁶

Section 5 Detail Factor = 0.0257 klf

Uniform Haunch Load = 0.050 klf

Haunch + Detail Section 1 = 0.08 klf

Haunch + Detail Section 2 = 0.09 klf

Haunch + Detail Section 3 = 0.07 klf

Haunch + Detail Section 4 = 0.10 klf

Haunch + Detail Section 5 = 0.08 klf



Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 4/9/2015
Checked by: CTA	Date: 6/22/2015
Title: LARSA Model Calculations	

Dead Loads (Spans 3-8)

Median Barrier:

Unit Weight Conc = **0.15** kcf

The median barrier load will be applied as a uniform plate load along the plates corresponding to the CL of Construction

Barrier Area = 5.25 ft ²	(Measured in CADD)	Plate Width = 14 ft
Unit Load = 0.7875 klf		Equivalent Uniform Load = 0.05625 ksf

Curb and Rail:

Curb and Rail loads will be applied as a uniform plate load along the deck fascia plates.

Curb = 250 plf	(Maine BDG T3-1)	Left Fascia Plate Width = 5 ft	(Average)
3-Bar Aluminum Rail = 35 plf	(Assumed per NHDOT BDM 642.3.5)		
Unit Load = 0.285 klf		Equivalent Uniform Load = 0.05700 ksf	
		Right Fascia Plate Width = 5 ft	(Average)
		Equivalent Uniform Load = 0.05700 ksf	

Pavement:

The weight of pavement will be applied as uniform plate loads to all interior deck plates, except for the plates along the centerline. For fascia deck plates and plates along the centerline an equivalent uniform plate load will be used based on the area paved to the area covered by the curb/barrier.

Thickness of WS = 0.271 ft	Uniform Load = 0.037917 ksf
Unit Weight WS = 0.14 kcf	

Exterior Plates:

Left Plate Width = 5.000 ft	(Average)	
Curb Width = 1.8333 ft		Equivalent Uniform Load = 0.02401 ksf

Centerline Plates:

Left Plate Width = 14.000 ft		
Curb Width = 2.3333 ft		Equivalent Uniform Load = 0.03160 ksf

Overhead Sign Structure

Apply as point loads corresponding to fascia and centerline plates corresponding with station 168+00, see design sheet 107-138.

Assume similar to OHSS in shop drawing: MDOT_01-#1060010 LOC-7

Dead Load Left Post = 5.2 k	(Assume 3.7k for truss/signs and 1.5k for post)
Dead Load Middle Post = 10.4 k	2x(Assume 3.7k for truss/signs and 1.5k for post)
Dead Load Right Post = 5.2 k	(Assume 3.7k for truss/signs and 1.5k for post)



Computations

Project: **Br # 1558 - 2015 Maine Load Ratings**
 Location: **Bangor/Brewer, ME**
 Calculated by: **JGM**
 Checked by: **CTA**
 Title: **LARSA Model Calculations**

Project #: **55060.00**
 Sheet: _____
 Date: **4/9/2015**
 Date: **6/22/2015**

Dead Loads (Spans 3-8)

Haunch and Detail Factor:

A line load will be added to each girder to account for the haunch concrete and girder detail factor.

Due to varying deck/girder geometry determine two loads one for spans 3 - 4 and another for 5 - 8.

Unit Weight Conc = **0.15** kcf
 Detail Factor = **10%**

	Width	Thickness	Blocking		Haunch Wt.		Area		Detail Wt.
Section 1	24.0	1.375	3.50	in	0.075	klf	Section 1	158.000	in ² 0.0538 klf
Section 2	20.0	1.250	4.00	in	0.082	klf	Section 2	178.000	in ² 0.0606 klf
Section 3	36.0	2.125	4.50	in	0.117	klf	Section 3	229.000	in ² 0.0779 klf
Section 4	44.0	3.000	5.00	in	0.123	klf	Section 4	361.000	in ² 0.1228 klf
Section 5	32.0	2.375	5.00	in	0.119	klf	Section 5	228.000	in ² 0.0776 klf
Section 6	20.0	1.125	5.00	in	0.112	klf	Section 6	175.000	in ² 0.0595 klf
Section 7	20.0	1.250	5.00	in	0.109	klf	Section 7	169.000	in ² 0.0575 klf
Section 8	18.0	1.000	5.00	in	0.106	klf	Section 8	143.000	in ² 0.0487 klf
Section 9	28.0	1.750	5.00	in	0.126	klf	Section 9	174.000	in ² 0.0592 klf
Section 10	36.0	1.875	5.00	in	0.148	klf	Section 10	232.000	in ² 0.0789 klf
Section 11	36.0	3.000	5.00	in	0.106	klf	Section 11	313.000	in ² 0.1065 klf
Section 12	36.0	2.000	5.00	in	0.144	klf	Section 12	241.000	in ² 0.0820 klf
Section 13	28.0	1.500	4.50	in	0.116	klf	Section 13	160.000	in ² 0.0544 klf
Average =					0.114	klf	Average = 0.072 klf		

Total = 0.19 klf
SAY: 0.2 klf

Section 14	16.0	1.000	4.25	in	0.081	klf	Section 14	134.000	in ² 0.0456 klf
Section 15	28.0	1.500	4.00	in	0.098	klf	Section 15	167.000	in ² 0.0568 klf
Section 16	28.0	2.250	3.75	in	0.067	klf	Section 16	209.000	in ² 0.0711 klf
Section 17	28.0	1.500	3.50	in	0.080	klf	Section 17	167.000	in ² 0.0568 klf
Section 18	14.0	0.750	3.50	in	0.062	klf	Section 18	113.000	in ² 0.0385 klf
Section 19	24.0	1.250	3.50	in	0.078	klf	Section 19	136.000	in ² 0.0463 klf
Section 20	24.0	2.000	3.50	in	0.059	klf	Section 20	172.000	in ² 0.0585 klf
Section 21	24.0	1.250	3.50	in	0.078	klf	Section 21	136.000	in ² 0.0463 klf
Section 22	14.0	0.750	3.50	in	0.062	klf	Section 22	103.000	in ² 0.0350 klf
Section 23	24.0	1.250	3.50	in	0.078	klf	Section 23	136.000	in ² 0.0463 klf
Section 24	24.0	2.250	3.50	in	0.053	klf	Section 24	184.000	in ² 0.0626 klf
Section 25	24.0	1.250	3.50	in	0.078	klf	Section 25	136.000	in ² 0.0463 klf
Section 26	16.0	1.000	3.00	in	0.052	klf	Section 26	117.000	in ² 0.0398 klf
Average =					0.071	klf	Average = 0.050 klf		

Total = 0.12 klf
SAY: 0.15 klf



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 4/9/2015

Checked by: CTA

Date: 6/22/2015

Title: LARSA Model Calculations

Deck (Spans 3-8)

Spans 3-8:

Note: Beam nodes are located at the top of the web, and the plate nodes are located at the middle of the deck.

Pier 2:

Web Depth =	111	in	Offset =	65.25	in	=	5.438	ft
Haunch =	3.5	in						
Deck =	12.5	in						

Pier 3:

Web Depth =	111	in	Offset =	66.375	in	=	5.531	ft
Haunch =	5	in						
Deck =	11.75	in						

Pier 4:

Web Depth =	111	in	Offset =	66	in	=	5.500	ft
Haunch =	5	in						
Deck =	11	in						

Pier 5-6:

Web Depth =	111	in	Offset =	64.5	in	=	5.375	ft
Haunch =	3.5	in						
Deck =	11	in						

Abut 2:

Web Depth =	111	in	Offset =	64	in	=	5.333	ft
Haunch =	3	in						
Deck =	11	in						

USE:

Deck

	Thickness(in.)	Offset (ft.)
Span 3:	12.125	5.5
Span 4:	11.375	5.5
Span 5:	11	5.4
Span 6:	11	5.4
Span 7:	11	5.4
Span 8:	11	5.4



Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 4/9/2015
Checked by: CTA	Date: 6/22/2015
Title: LARSA Model Calculations	

Live Load

Centrifugal Force:

Design Velocity =	55	mph	(Google Street View)
Design Velocity = v =	37.5	ft/sec	
Gravity = g =	32.2	ft/sec ²	
f =	1.33		AASHTO LRFD 3.6.3
Radius = R =	2865	ft	

$$C = f \frac{v^2}{gR}$$

Centrifugal Force = C = 0.0203



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
Location: Bangor/Brewer, ME
Calculated by: JGM
Checked by: CTA
Title: LARSA Model Calculations

Project #: 55060.00
Sheet:
Date: 4/7/2015
Date: 6/22/2015

Crossframe Stiffness

Cross-frame stiffness is determined based on the simplified Euler-Bernoulli approximation method outlined in section 3.11.2 of NSBA/AASHTO Steel Bridge Collaboration G13.1 "Guidelines for Steel Girder Bridge Analysis" 2nd ed.

Each crossframe is independently modeled, a unit load is applied to the unsupported end of the crossframe and the deflection is used to determine equivalent stiffness using the shear stiffness method.

Equivalent areas are used to apply the correct crossframe weight to each crossframe member.

Type D-3:

Shear Stiffness:

$\Delta =$	0.0136	in
$L =$	216	in
$E =$	29000	ksi
$P =$	1.0	k

$$\Delta = \frac{PL^3}{12EI}$$

$$I = 2129.3 \text{ in}^4$$

CF10	Length (ft)	Wt/ft	Wt	
W16x26:	18.5625	26	482.6	lb
WT6x13:	20.666	13	268.7	lb
WT7x21.5:	18.3333	21.5	394.2	lb
	$\Sigma =$		1145.4	lb

$$\text{Equivalent Unit Weight} = 61.7 \text{ lb/ft}$$

$$0.126 \text{ ft}^2$$

$$\text{Equivalent Area} = 18.1 \text{ in}^2$$

Type M-1:

Shear Stiffness:

$\Delta =$	0.0152	in
$L =$	192	in
$E =$	29000	ksi
$P =$	1.0	k

$$\Delta = \frac{PL^3}{12EI}$$

$$I = 1338.1 \text{ in}^4$$

	Length (ft)	Wt/ft	Wt	
WT5x11:	33	11	363.0	lb
WT7x21.5:	32.5	21.5	698.8	lb
	$\Sigma =$		1061.8	lb

$$\text{Equivalent Unit Weight} = 65.3 \text{ lb/ft}$$

$$0.133 \text{ ft}^2$$

$$\text{Equivalent Area} = 19.2 \text{ in}^2$$

Type L:

Shear Stiffness:

$\Delta =$	0.019	in
$L =$	192	in
$E =$	29000	ksi
$P =$	1.0	k

$$\Delta = \frac{PL^3}{12EI}$$

$$I = 1070.5 \text{ in}^4$$

	Length (ft)	Wt/ft	Wt	
WT4x9:	33.33	9	300.0	lb
WT7x21.5:	16.25	21.5	349.4	lb
	$\Sigma =$		649.3	lb

$$\text{Equivalent Unit Weight} = 40.0 \text{ lb/ft}$$

$$0.082 \text{ ft}^2$$

$$\text{Equivalent Area} = 11.7 \text{ in}^2$$



Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 4/7/2015
Checked by: CTA	Date: 6/22/2015
Title: LARSA Model Calculations	

Crossframe Stiffness

Type N:

Shear Stiffness:

Δ =	0.004	in
L =	209	in
E =	29000	ksi
P =	1.0	k

$$\Delta = \frac{PL^3}{12EI}$$

$$I = 6558.4 \text{ in}^4$$

	Length (ft.)	Wt/ft	Wt
W6x20	34.83	20	696.6 lb
W6x21	38.3	20	766.0 lb
	Σ =		1462.6 lb

Equivalent Unit Weight = 38.2 lb/ft
0.078 ft²

Equivalent Area = 11.2 in²

Type N:

Shear Stiffness:

Δ =	0.0024	in
L =	168	in
E =	29000	ksi
P =	1.0	k

$$\Delta = \frac{PL^3}{12EI}$$

$$I = 5677.2 \text{ in}^4$$

	Length (ft.)	Wt/ft	Wt
W6x20	28	20	560.0 lb
W6x21	32.2	20	644.0 lb
	11	Σ =	1204.0 lb

Equivalent Unit Weight = 37.4 lb/ft
0.076 ft²

Equivalent Area = 11.0 in²

-2.0-

Spans 1 & 2

Load Rating Calculations





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Spans 1 & 2 Rating

Project #: 55060.00
 Sheet:
 Date: 6/25/2015
 Date: 6/29/2015

Rating Summary

Spans 1 & 2 (All):

			Strength			Service	
			Girder	Inventory	Operating	Inventory	Operating
Exterior Girder	Moment	Span 1	G5-1	1.66	2.15	2.28	2.96
		Pier 1	G5-1	1.63	2.11	2.39	3.11
		Span 2	G5-1	1.73	2.25	2.33	3.03
	Shear	Abut 1	G5-1	1.51	1.95		
		Pier 1	G5-1	2.59	3.36		
		Pier 2	G6-1	1.78	2.31		
Interior Girder	Moment	Span 1	G4-1	2.02	2.61	2.71	3.53
		Pier 1	G9-1	1.84	2.39	2.73	3.55
		Span 2	G9-1	2.08	2.70	2.80	3.64
	Shear	Abut 1	G4-1	1.43	1.86		
		Pier 1	G9-1	2.50	3.24		
		Pier 2	G7-1	1.51	1.96		

RT (Eastbound) Bridge:

			Strength			Service	
			Girder	Inventory	Operating	Inventory	Operating
Exterior Girder	Moment	Span 1	G6-1	2.14	2.78	2.90	3.76
		Pier 1	G6-1	1.90	2.46	2.78	3.62
		Span 2	G6-1	2.00	2.59	2.70	3.51
	Shear	Abut 1	G6-1	2.30	2.99		
		Pier 1	G6-1	3.42	4.43		
		Pier 2	G6-1	1.78	2.31		
Interior Girder	Moment	Span 1	G7-1	2.14	2.77	2.88	3.74
		Pier 1	G9-1	1.84	2.39	2.73	3.55
		Span 2	G9-1	2.08	2.70	2.80	3.64
	Shear	Abut 1	G9-1	1.58	2.04		
		Pier 1	G9-1	2.50	3.24		
		Pier 2	G7-1	1.51	1.96		

LT (Westbound) Bridge:

			Strength			Service	
			Girder	Inventory	Operating	Inventory	Operating
Exterior Girder	Moment	Span 1	G5-1	1.66	2.15	2.28	2.96
		Pier 1	G5-1	1.63	2.11	2.39	3.11
		Span 2	G5-1	1.73	2.25	2.33	3.03
	Shear	Abut 1	G5-1	1.51	1.95		
		Pier 1	G5-1	2.59	3.36		
		Pier 2	G5-1	2.44	3.16		
Interior Girder	Moment	Span 1	G4-1	2.02	2.61	2.71	3.53
		Pier 1	G4-1	1.89	2.45	2.81	3.65
		Span 2	G4-1	2.20	2.86	2.86	3.72
	Shear	Abut 1	G4-1	1.43	1.86		
		Pier 1	G4-1	2.55	3.31		
		Pier 2	G4-1	1.79	2.32		

-2.1-

Spans 1 & 2

Assumptions and Methods





Computations

Project:	Br # 1558 - 2015 Maine Load Ratings	Project #:	55060.00
Location:	Bangor/Brewer, ME	Sheet:	
Calculated by:	JGM	Date:	7/3/2015
Checked by:	CTA	Date:	7/4/2015
Title:	Modeling Assumptions and Methodology		

Model and Rating Layout:

The bridge is broken out into three segments, each segment is modeled and rated separately (see attached sketch). The girder sections for each bridge segment are identical. The three bridge segments are:

1. Spans 1 & 2 - LT (Westbound)
2. Spans 1 & 2 - RT (Eastbound)
3. Spans 3-8

General Model Assumptions:

1. All dimension are per the 1984 As-Built Plans.
2. LARSA 4D Structural and Earthquake Engineering Integrated Analysis and Design Software 7.08 is used to model this bridge.
3. The beams are modeled using line elements which are assigned the appropriate section properties. Beam section properties are generated using the LARSA Section Composer.
4. The deck is modeled using classic plate elements. Plate nodes are offset from the beam nodes and are connected via rigid links.
5. Crossframes are modeled using line elements. Crossframes are modeled separately and the Simplified Euler-Bernoulli Approximation method is used to determine the equivalent stiffness. The moment fixity was released at the end of each crossframe, at the beam connection. An equivalent area is assigned to each crossframe element to account for the dead load of each frame.
6. The effects of superelevation and vertical curve are assumed negligible and are not included in the model.
7. Bottom flange lateral bracing is not included in the model.

Material Properties:

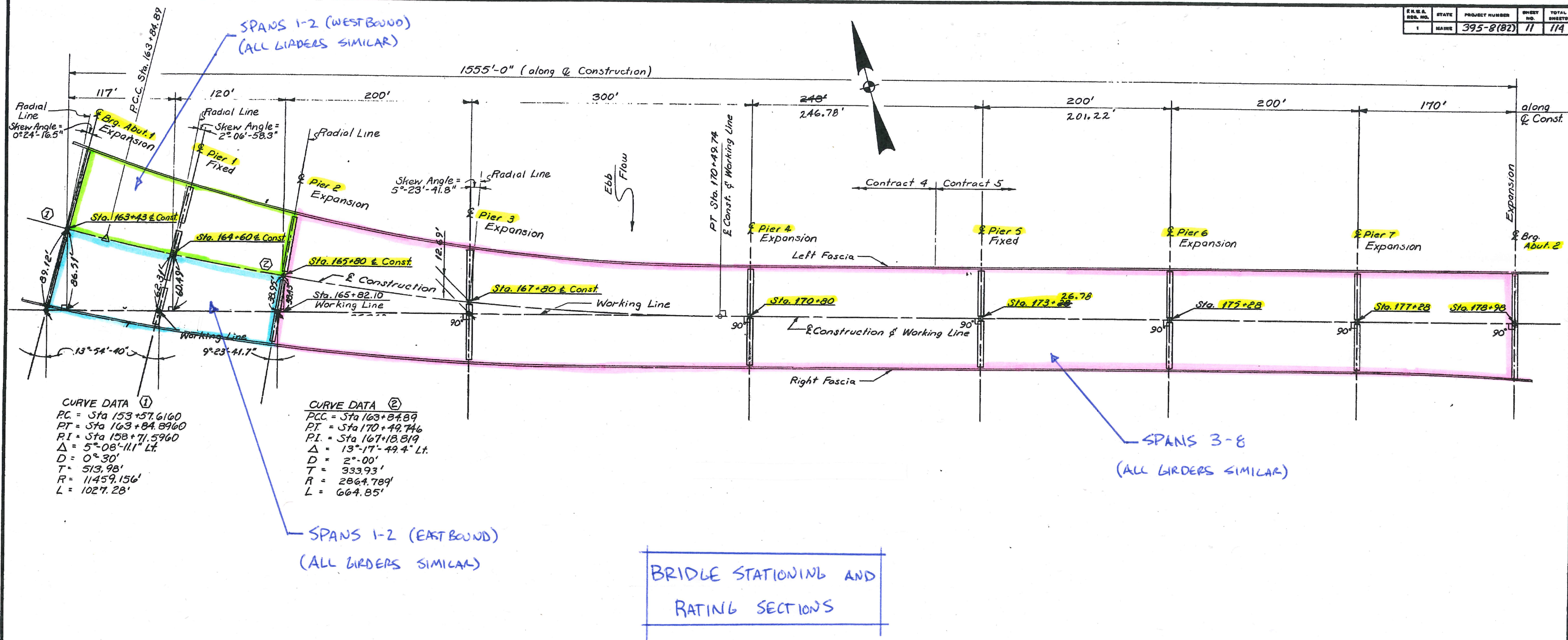
1. Structural Steel - ASTM A588, $F_y = 50\text{ksi}$
2. Reinforcing Steel - ASTM A615, $F_y = 60\text{ksi}$
3. Concrete - Class A, $f'_c = 3.0\text{ksi}$

Dead Loads:

1. Girder and deck self weights are generated by LARSA based on the assigned material properties and beam areas. Deck thickness varies from 12½" to 11", see model calculations.
2. The dead loads due to the median barrier and exterior curb/railing are applied as equivalent point loads to each fascia plate.
3. The dead loads due to deck haunch and detail factor are applied as line load across each girder. See model calculations.
A detail factor of 10% is assumed, this does not include the weight of crossframes.
4. The total wearing surface thickness is 3¾". Although the bridge has been resurfaced, the pavement thickness is assumed to be the same as the stated on the as-built plans. Wearing surface loads are applied as an uniform load to each plate. The uniform load is reduced for fascia plates that are partially covered by a curb or barrier.
5. The dead load of the overhead sign structure is applied as three point loads in span three. The loads are determined based shop drawings for a similar structure.

Rating Notes and Assumptions:

1. The load rating was performed in accordance with Maine Department of Transportation Load Rating Guidelines (April 2015).
2. The girders are rated for the HL-93 load case. All inventory rating factors are greater than 1.0, MaineDOT legal loads are not considered.
3. The bridge was evaluated at the strength and service limit states. The service limit state is only for serviceability considerations and is excluded from rating evaluations per MaineDOT Load Rating Guidelines (3.7.1)
4. Continuous lateral bracing of the top flange assumed per MBE 6A.6.9.3
5. Condition (ϕ_c) and System (ϕ_s) factors are both = 1.0.
6. Capacity was checked in accordance with AASHTO LRFD Design Specification, Section 6.10.
7. Composite action is assume throughout the bridge.
Flexural capacities in positive moment regions are calculated based on the girder steel and transformed concrete deck.
Flexural capacities in negative moment regions are calculated based on the girder steel and reinforcing deck steel.
Lateral Bending Capacities are calculated based on the girder steel properties only.
Shear capacities are calculated based on the girder web steel only.



Revision	Date	STATE OF MAINE DEPARTMENT OF TRANSPORTATION I-395 BRIDGE OVER PENOBSCOT RIVER BANGOR - BREWER PENOBSCOT COUNTY SUBSTRUCTURE LAYOUT AUGUSTA, MAINE Sept. 1983
△ Station change	4-9-84	



Computations

Project: **Br # 1558 - 2015 Maine Load Ratings**
Location: **Bangor/Brewer, ME**
Calculated by: **JGM**
Checked by: **CTA**
Title: **Modeling Assumptions and Methodology**

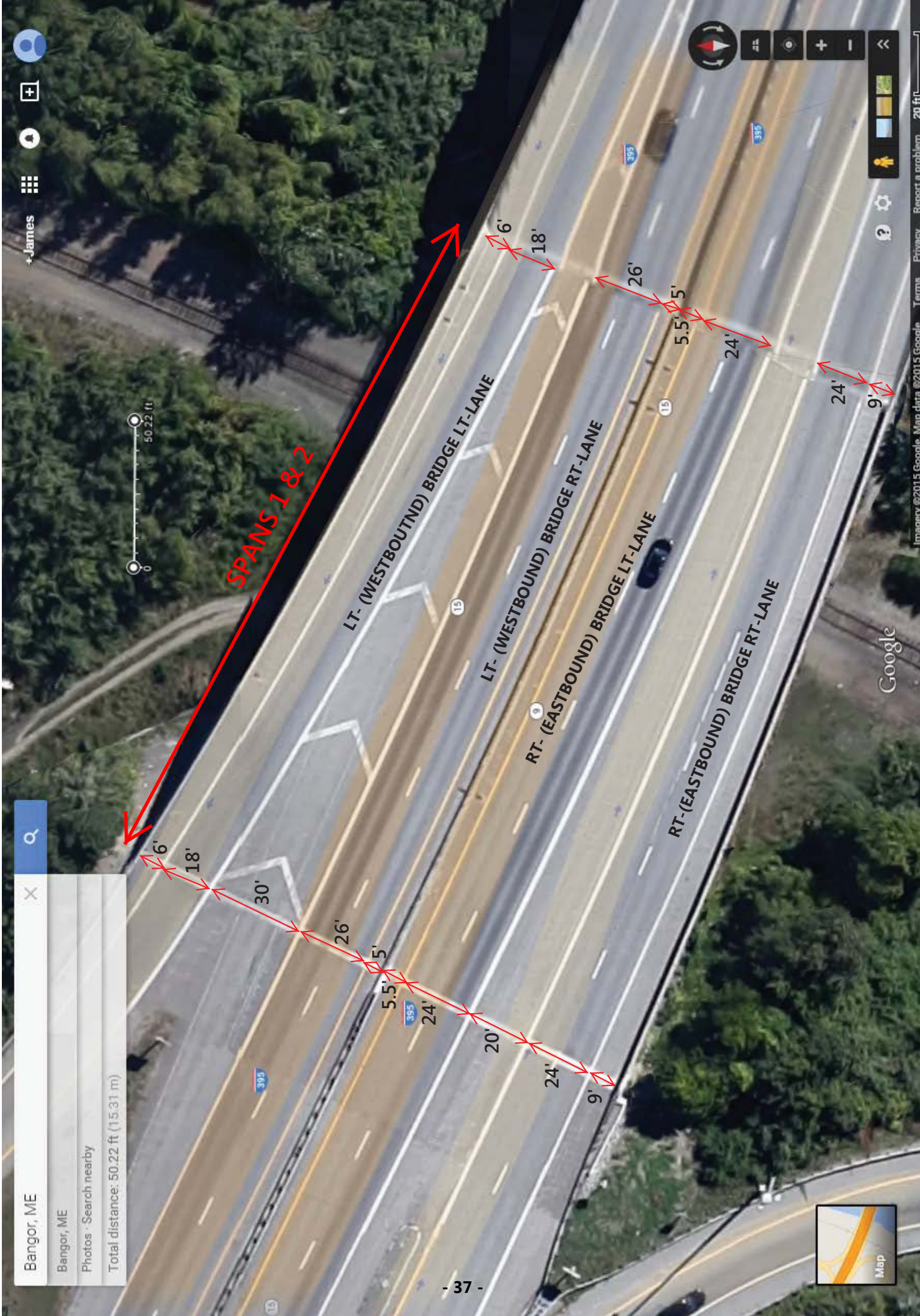
Project #: **55060.00**
Sheet: _____
Date: **7/3/2015**
Date: **7/4/2015**

Live Loading Spans 1 & 2:

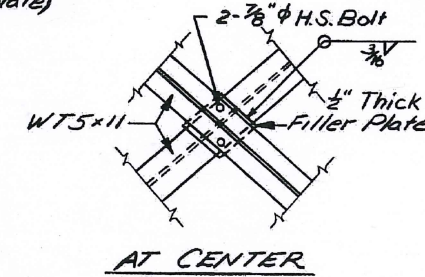
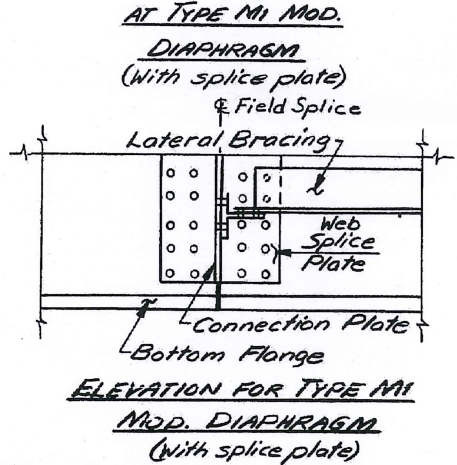
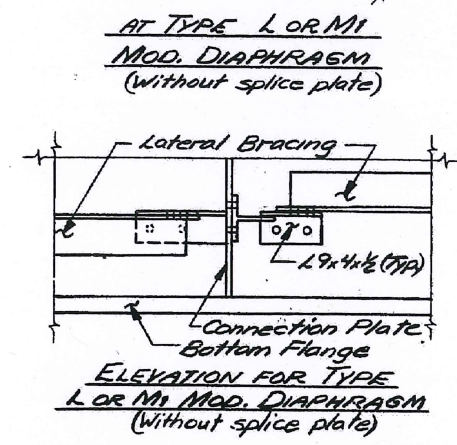
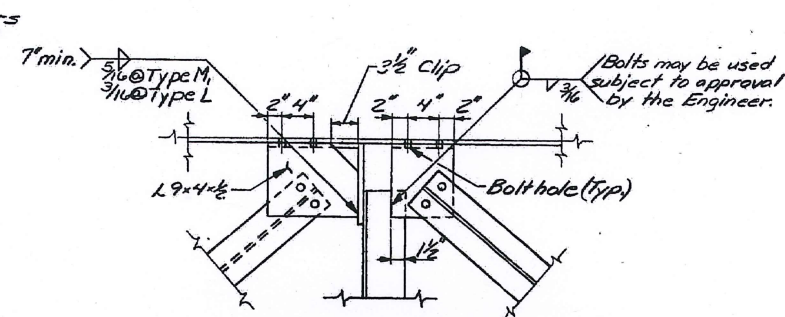
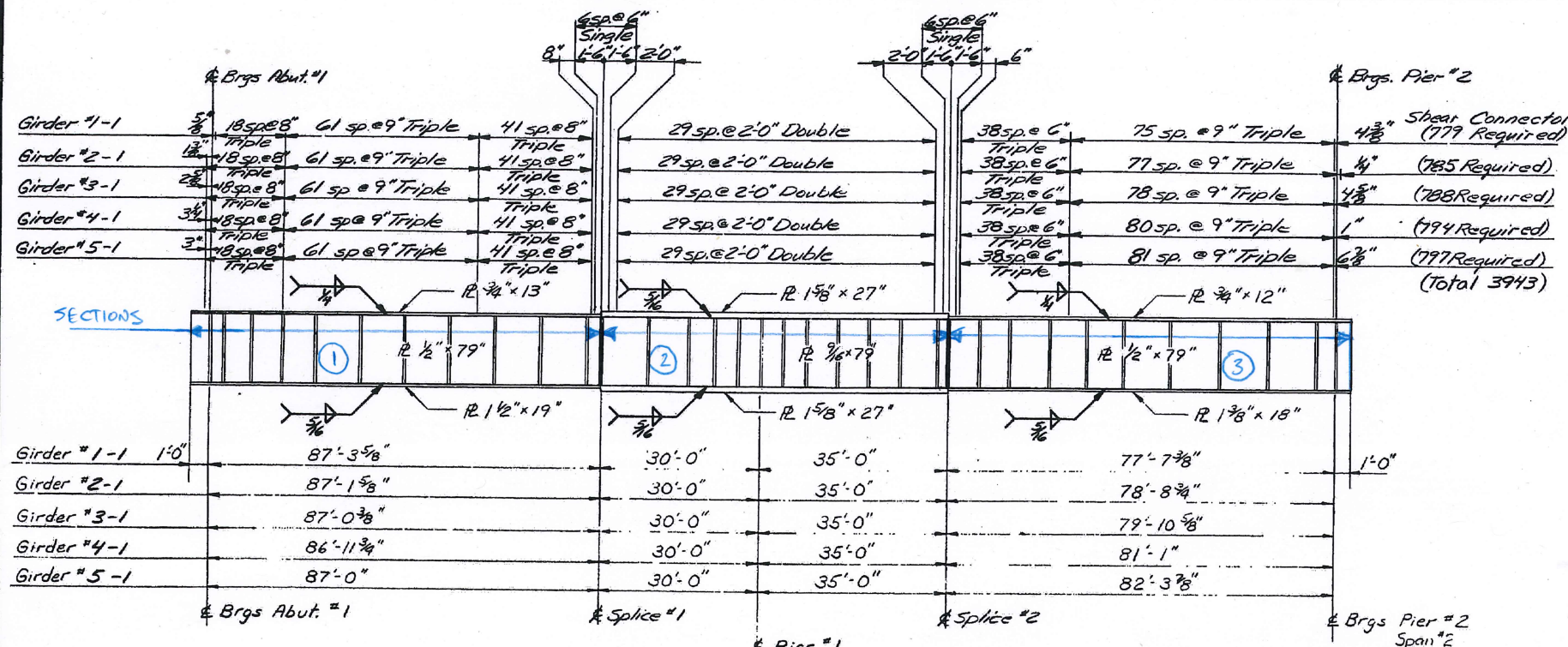
Live loading is developed using the striped lanes only. See attached sketch for assumed lane grouping and dimensions.

The following steps are used to generate the worst case loading for each beam section:

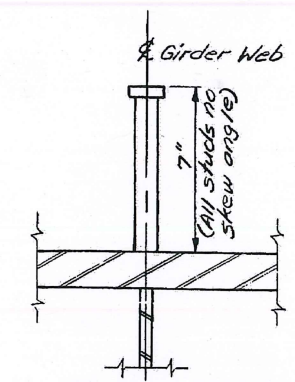
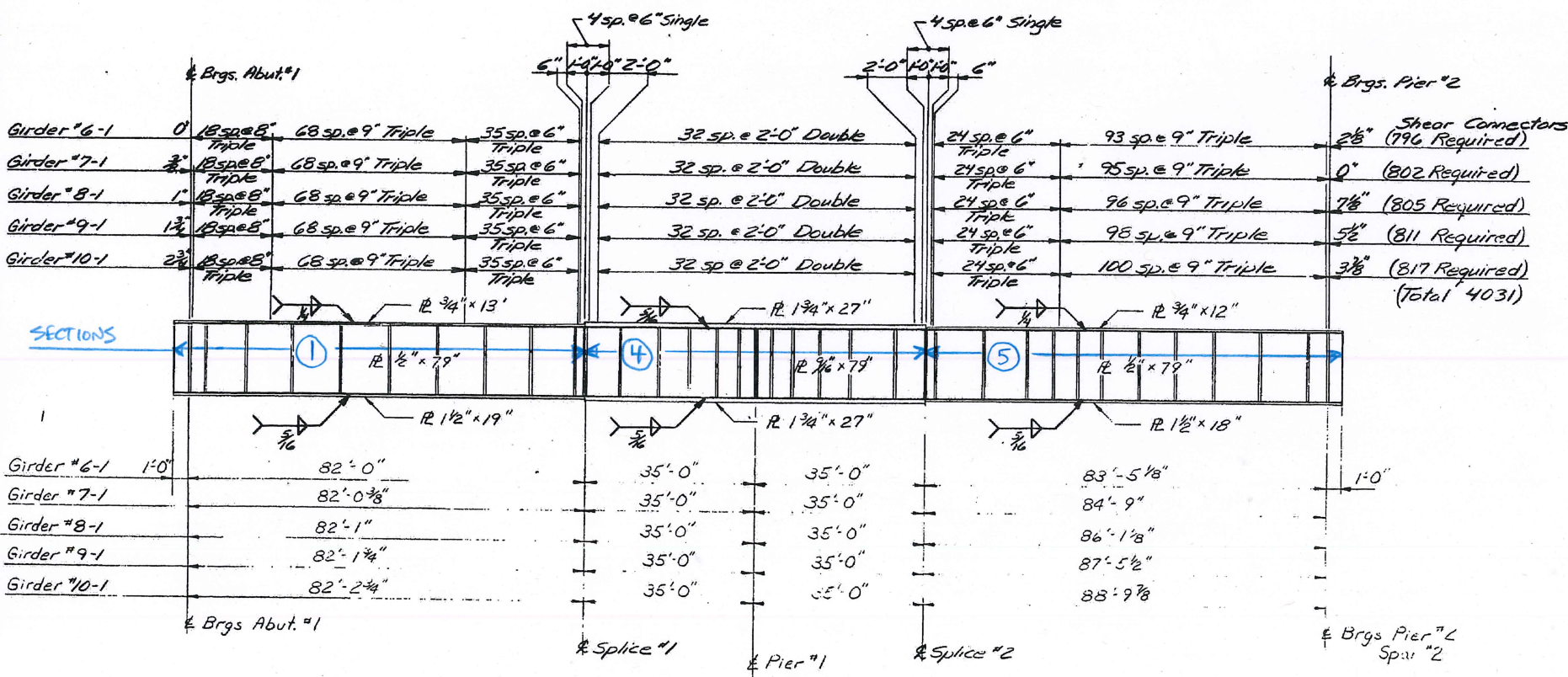
1. A two-dimensional surface is created for each lane grouping.
Each surface has a forward increment of 3.0' and a transverse increment of 3.0'.
2. LARSA is used to generate an "Influence Surface Case", which determines the worst case live load configuration for each point along the surface. The following live load configurations are considered for each surface:
 - HL-93 Truck + Lane
 - HL-93 Tandem + Lane
 - 90% HL-93 Double Truck + 90% Lane (Negative Region Moment Only)Multiple lanes and multipresence factor are applied here.
Centrifugal forces are applied here.
Impact is not added here, it is applied in the actual rating calculations.
3. Each composite girder is defined by grouping each beam element with the adjacent plate elements.
4. Composite shears and moments are generated using the "Compound Element Forces" tool in LARSA.
Each composite beam is sliced at 5.0' intervals along the longitudinal axis of the bridge.
The maximum moments and shears for each girder section are determined based on results of the compound forces.



SPANS 1 & 2 - LANE GROUPING DIAGRAM



LATERAL BRACING CONNECTIONS SPANS #1-2



107-172

REVISIONS	DATE
Δ Addendum #4	1-16-84

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE 217
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
GIRDER ELEVATIONS
(SPANS 1 & 2)
AUGUSTA, MAINE Sept. 1983

-2.2-

Spans 1 & 2 - RT (Eastbound)

Loads Summary





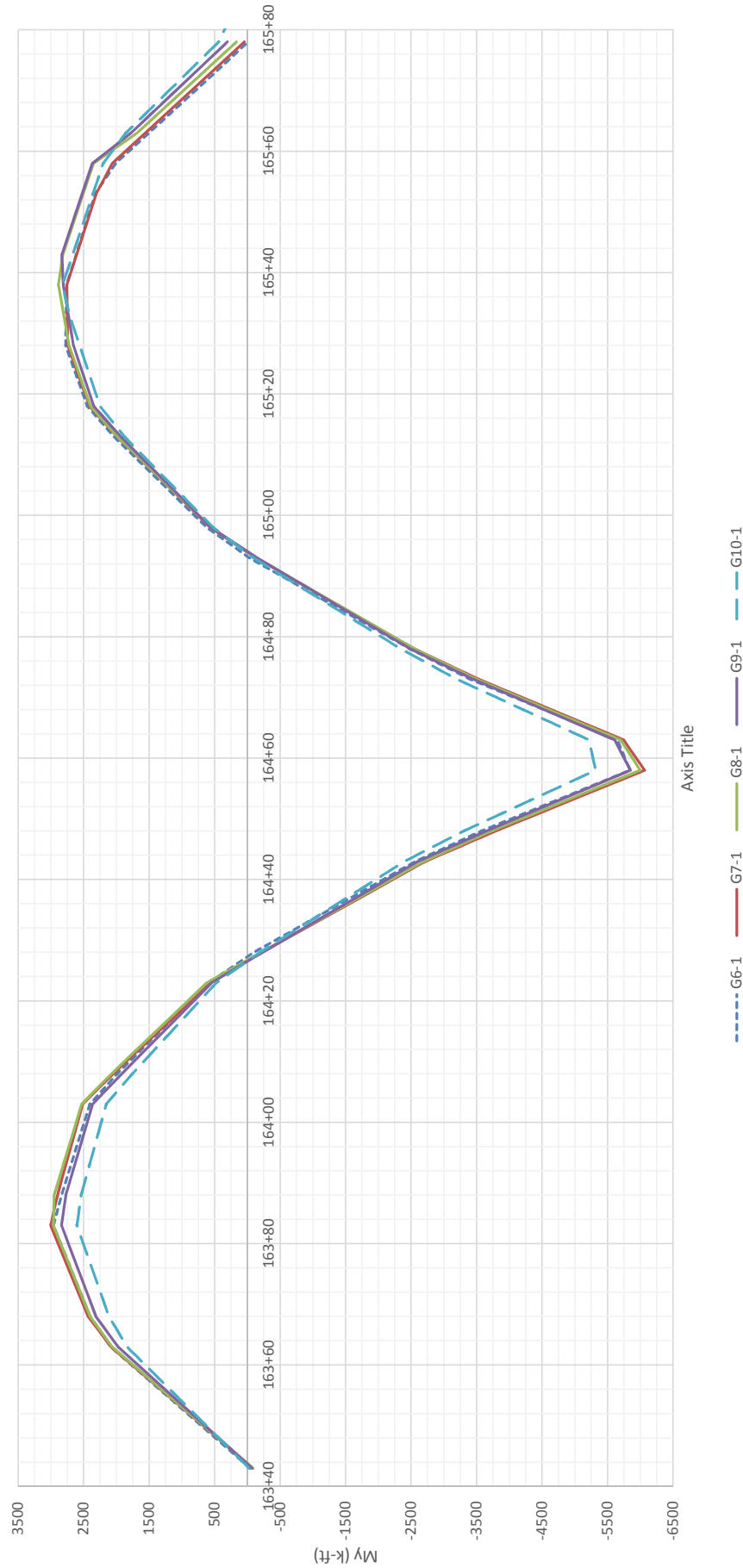
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
Checked by: CTA	Date: 6/24/2015
Title: Spans 1 and 2 Loads	

Dead Loads Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Dead Load Moments - RT (Eastbound) Bridge





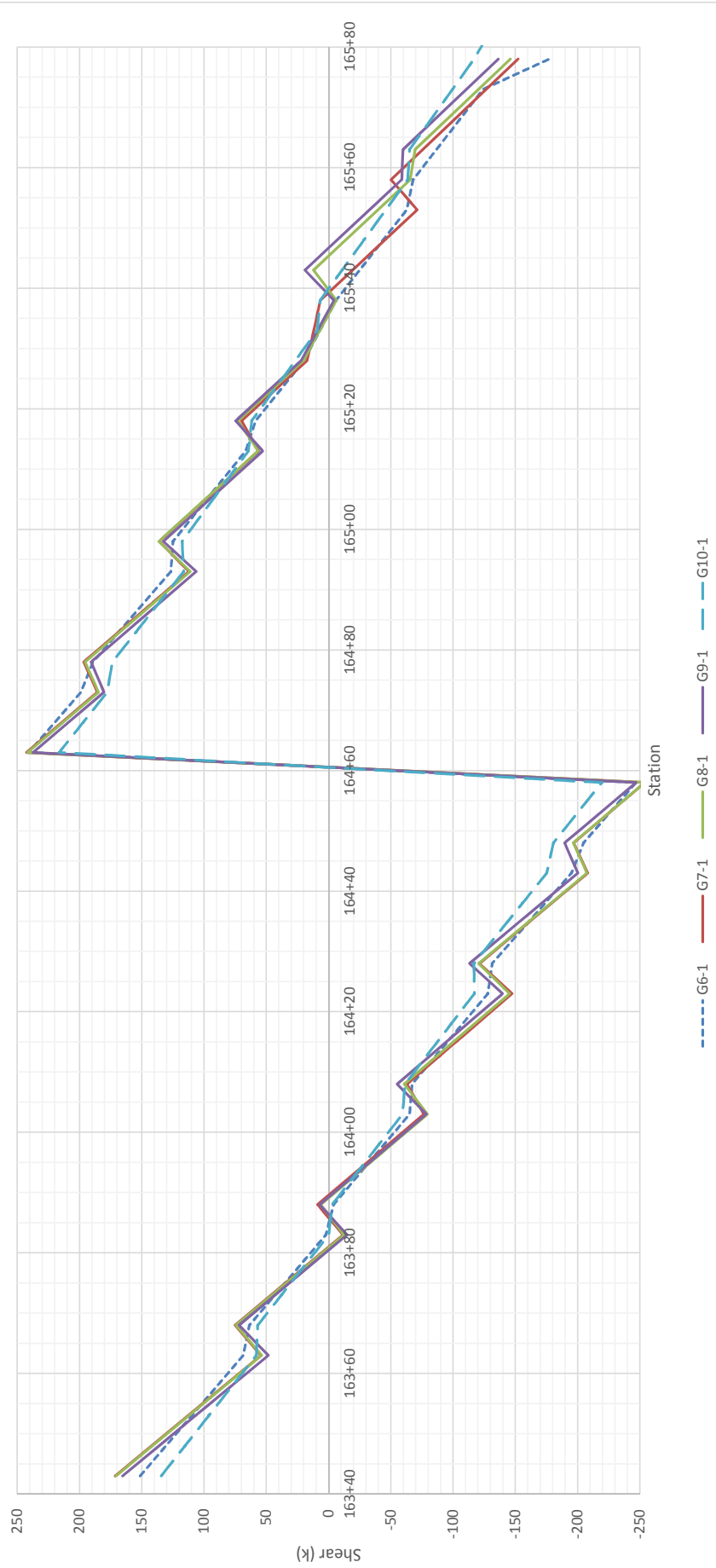
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
Checked by: CTA	Date: 6/24/2015
Title: Spans 1 and 2 Loads	

Dead Loads Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.
Minimum and maximum shear values have been verified by hand calculations and checks.

Dead Load Shears - RT (Eastbound) Bridge





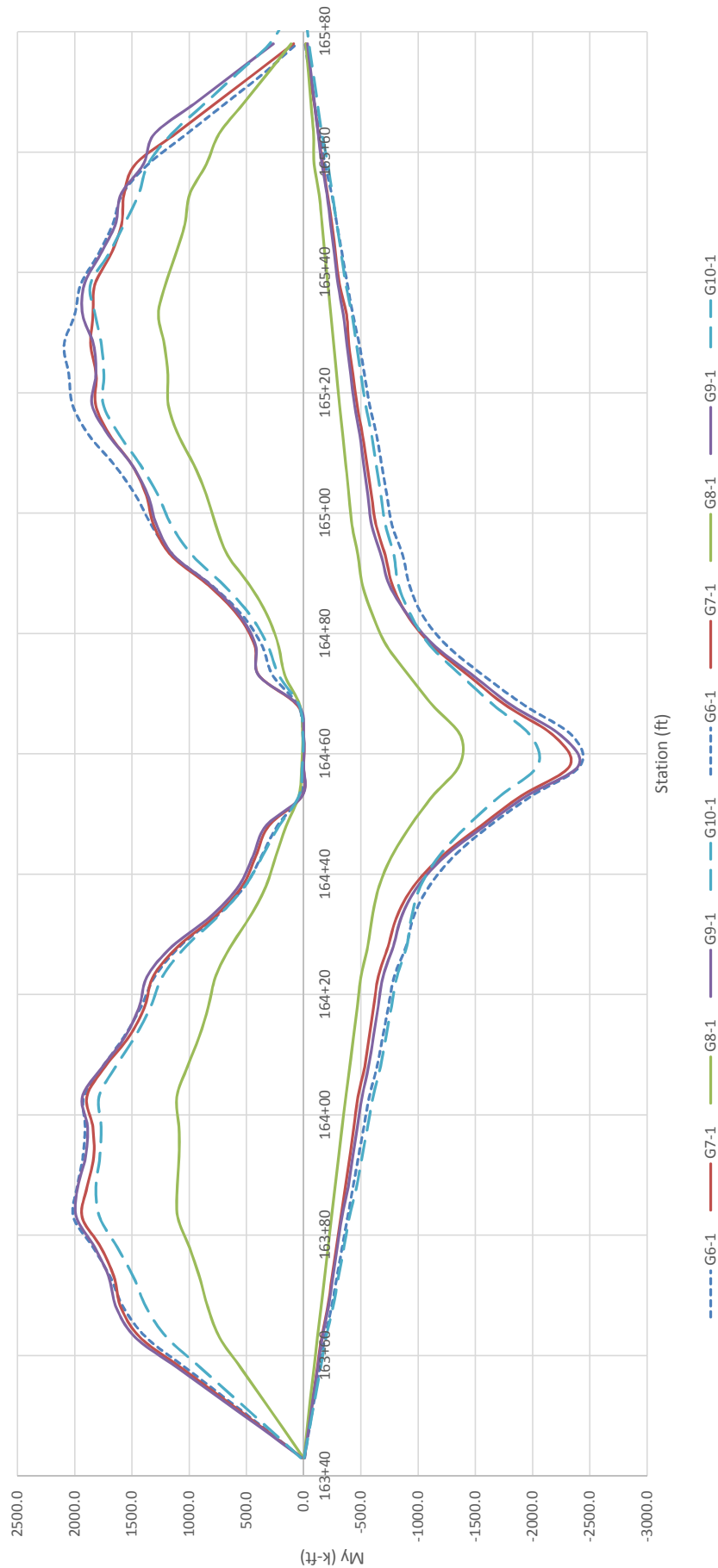
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
Checked by: CTA	Date: 6/23/2015
Title: Spans 1 and 2 Loads	

Live Load Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.
Controlling Ratings Shown: HL-93 Truck and Lane Controls + Moments, HL-93 Double Truck + Lane Controls - Moment

Live Load Moments - RT (Eastbound) Bridge



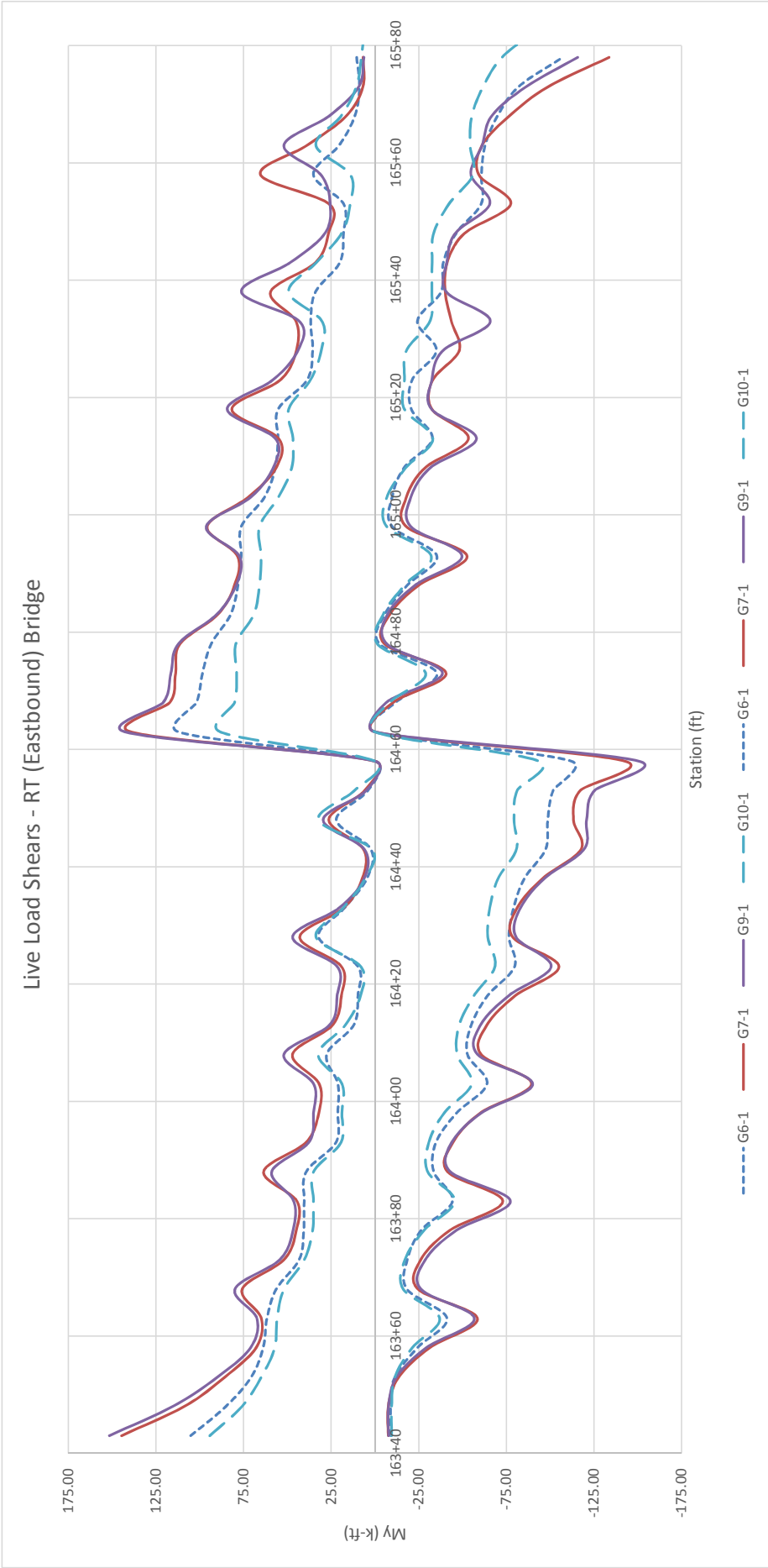


Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
Checked by: CTA	Date: 6/23/2015
Title: Spans 1 and 2 Loads	

Live Load Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.
Minimum and maximum shear values have been verified by hand calculations and checks.



-2.3-

Spans 1 & 2 - RT (Eastbound)
Exterior Girder Rating





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder 6-1 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 1	Inventory	40.05	2.14	3.09	2.30	2.14	52.25	2.90	2.90
		Operating	51.92	2.78	4.01	2.99	2.78	67.93	3.76	3.76
4	Pier 1	Inventory	1.90	3.36	---	3.42	1.90	4.59	2.78	2.78
		Operating	2.46	4.35	---	4.43	2.46	5.97	3.62	3.62
5	Span 2	Inventory	31.24	2.00	1.78	3.58	1.78	40.82	2.70	2.70
		Operating	40.50	2.59	2.31	4.65	2.31	53.06	3.51	3.51

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	Flexure
Inventory:	1.90	1.78	2.70
Operating:	2.46	2.31	3.51



Computations

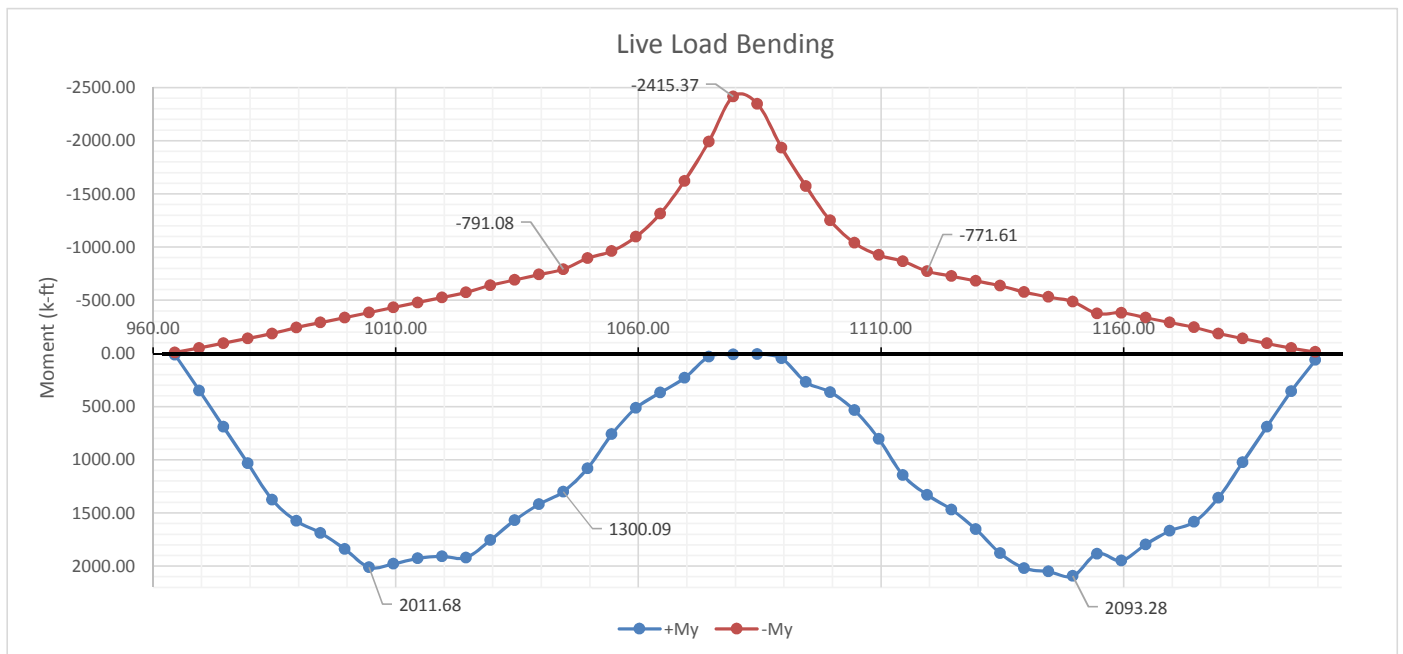
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 6-1 Spans: 1 and 2

HL-93 Live Loads Moments (no IM)

Note: By inspection 2 trucks in the LT lanes control LL for this girder.

LT Lane Only (w/m)		
Sta	M+	M-
964.5		
Section 1:	2011.68	-791.08
1044.5		
Section 4:	1300.09	-2415.37
1116.75		
Section 5:	2093.28	-771.61
1199.5		





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 6-1 Spans: 1 and 2

Lateral Bending

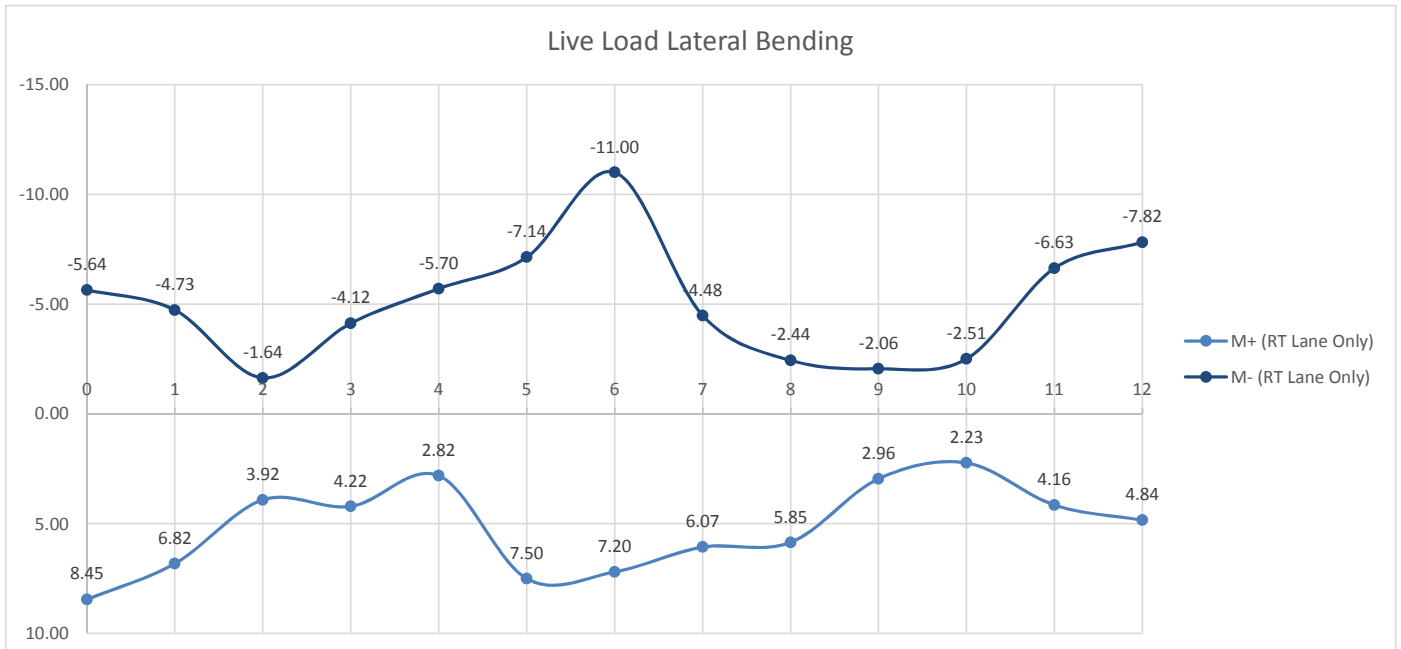
Live Load - RT Lane Only (w/m)

Node	M+	M-
0	111	8.45
1	89	6.82
2	63	3.92
3	35	4.22
4	16	2.82
5	6	7.50
6	2	7.20
7	3	6.07
8	14	5.85
9	32	2.96
10	53	2.23
11	87	4.16
12	110	4.84

Node	DC M	DW M
0	111	0.51
1	89	1.77
2	63	1.97
3	35	0.40
4	16	0.20
5	6	4.49
6	2	4.11
7	3	2.32
8	14	2.03
9	32	0.29
10	53	0.37
11	87	0.70
12	110	0.69

	M+	M-
Section 1:	8	-6
Section 4:	8	-11
Section 5:	6	-8

	M	M
Section 1:	2	0
Section 4:	4	0
Section 5:	2	0





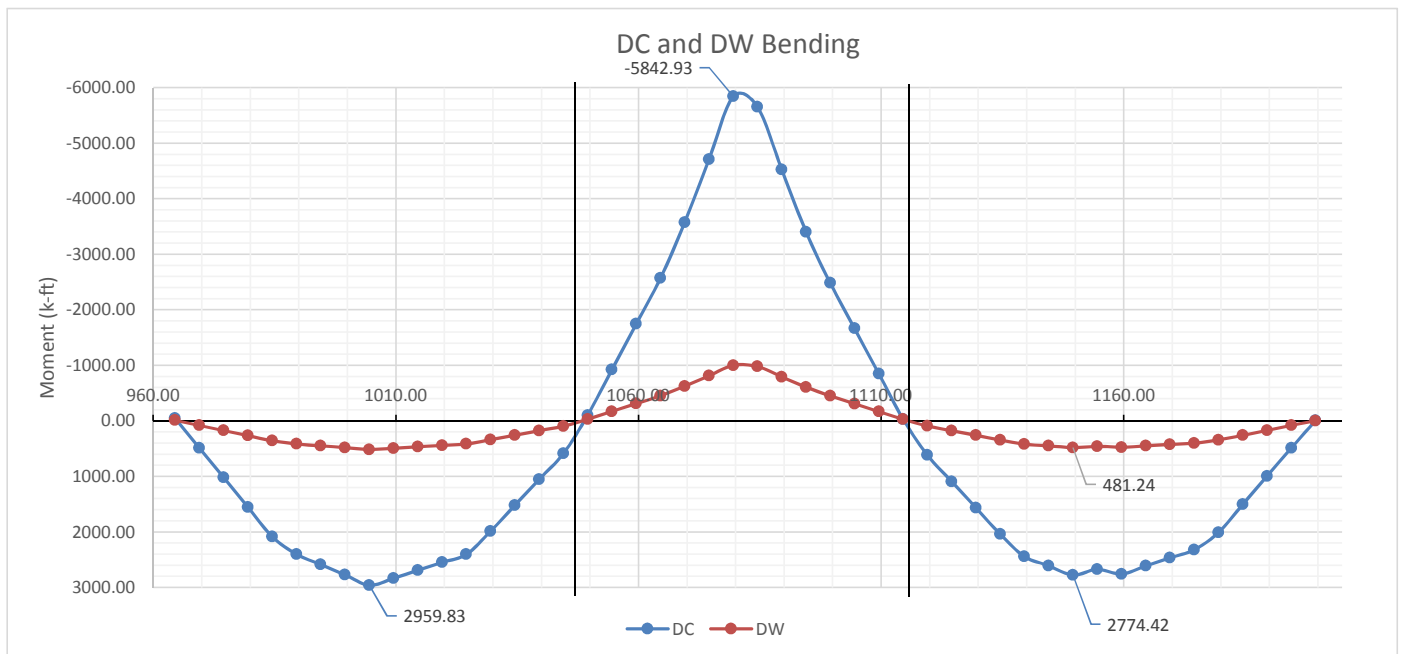
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 6-1 Spans: 1 and 2

Dead and Wearing Surface Moments

Station	DC		DW	
	M+	M-	M+	M-
964.5				
Section 1:	2959.83	-44.08	515.70	-9.40
1044.5				
Section 4:	-30.14	-5842.93	-26.70	-998.25
1116.8				
Section 5:	2774.42	-8.82	481.24	-0.47
1199.5				





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 6-1 Spans: 1 and 2

Shears:

	Station	LL		DC		DW	
		V+	V-	V+	V-	V+	V-
	964.5	105.19	-8.98	151.25	151.25	27.75	27.75
Section 1:		93.09	-79.76	138.84	-127.92	25.16	-23.50
	1034.5						
Section 4:		112.23	-112.09	240.67	-246.83	40.03	-41.18
	1116.75						
Section 5:		76.31	-92.12	124.87	-145.41	23.04	-25.05
	1199.53	10.45	-107.20	-177.21	-177.21	-29.40	-29.40

	LL		DC		DW
	Vmax		Vmax		Vmax
Section 1 (End):	105.2	Section 1 (End):	151.3	Section 1 (End):	27.7
Section 1 (Interior):	93.1	Section 1 (Interior):	138.8	Section 1 (Interior):	25.2
Section 4 (Interior):	112.2	Section 4 (Interior):	246.8	Section 4 (Interior):	41.2
Section 5 (Interior):	92.1	Section 5 (Interior):	145.4	Section 5 (Interior):	25.1
Section 5 (End):	107.2	Section 5 (End):	177.2	Section 5 (End):	29.4



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 1 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 =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
d _o =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

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

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

t _w =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
d _o =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 1 Section: 1

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10764.9 in³
 Short-term S = 49991.3 in³
 Lateral Bending S = 153.0 in³

Bottom Flange:

Long-term S = 3452.1 in³
 Short-term S = 3677.0 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 = 2960 k-ft

Wearing Surface Moment = 516 k-ft

Live Load Moment = 2012 k-ft

Impact = 133%

Dead Load = DC = 3.3 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

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

f_{bu} = 3.3 ksi

f_{bu} = 0.6 ksi

f_{bu} = 0.6 ksi (Impact Added Here)

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

RF = 40.05 (Inv)
 RF = 51.92 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2960 k-ft

Lateral Dead Load Moment = 2 k-ft

Wearing Surface Moment = 516 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2012 k-ft

Lateral Live Load Moment = 8 k-ft

Impact = 133%

Dead Load = DC = 10.4 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 9.2 ksi

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

f_{bu} = 10.3 ksi

f_l = 0.23 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.4 ksi

f_{bu} = 1.8 ksi

f_l = 0.02 ksi

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

f_{bu} = 6.6 ksi

f_l = 0.97 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 = 2.14 (Inv)
 RF = 2.78 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1

Location: Span 1

Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	151.3	k
WS Load = DW =	27.7	k
P =	0	
Live Load = LL =	105.2	k
Impact =	133%	

Live Load = LL + IM = 139.9 k

Capacity = $\phi F_{nc} = C = 987.8$ 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 = 3.09 (Inv)
 RF = 4.01 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	138.8	k
WS Load = DW =	25.2	k
P =	0	
Live Load = LL =	93.1	k
Impact =	133%	

Live Load = LL + IM = 123.8 k

Capacity = $\phi F_{nc} = C = 710.5$ 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 = 2.30 (Inv)
 RF = 2.99 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 1 Section: 1

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10764.9 in³
 Short-term S = 49991.3 in³

Bottom Flange:

Long-term S = 3452.1 in³
 Short-term S = 3677.0 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2960 k-ft

Wearing Surface Moment = 516 k-ft

Live Load Moment = 2012 k-ft
 Impact = 133%

Dead Load = DC = 3.3 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.3 ksi

ff = 0.6 ksi

ff = 0.6 ksi (Impact Added Here)

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

RF = 52.25 (Inv)

RF = 67.93 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2960 k-ft

Lateral Dead Load Moment = 2 k-ft

Wearing Surface Moment = 516 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2012 k-ft

Lateral Live Load Moment = 8 k-ft

Impact = 133%

Dead Load = DC = 10.4 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 9.4 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 10.3 ksi

f_l = 0.23 ksi

DC = ff + f_l/2 = 10.4 ksi

f_{bu} = 1.8 ksi

f_l = 0.02 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 6.6 ksi

f_l = 0.97 ksi

LL + IM = ff + f_l/2 = 9.4 ksi (Impact Added Here)

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

RF = 2.90 (Inv)

RF = 3.76 (Op)



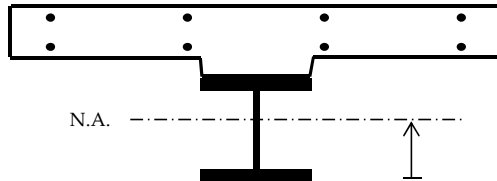
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 1 Section: 1

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	13.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	19.0000 in

Deck Inputs:

Tributary Deck Width =	191.00 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	I
Top Flange	9.75 in ²	80.8750 in	788.53 in ³	49.629 in	24014.2 in ³	24014.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.754 in	3757.8 in ³	24301.0 in ⁴
Bot. Flange	28.50 in ²	0.7500 in	21.38 in ³	30.496 in	26505.8 in ³	26511.2 in ⁴
Σ =	77.75 in ²		2429.41 in ³			74826.9 in ⁴

Neutral Axis = 31.246 in

Total I = I_t 74827 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
1507.7 in ³	1496.4 in ³	2453.6 in ³	2394.7 in ³	153.0 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	44.44 in	153528.6 in ³	228355.5 in ⁴
Slab	254.67 in ²	89.25 in	22729.00 in ³	13.57 in	46872.4 in ³	49928.43 in ⁴
Σ =	332.42 in ²		25158.41 in ³			

Neutral Axis = 75.68 in

Total I = I_t 278284 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
53602.2 in ³	49991.3 in ³	3713.8 in ³	3677.0 in ³	57775.4 in ³	3751.3 in ³	20512.4 in ³	14222.4 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	30.27 in	71262.9 in ³	146089.83 in ⁴
Slab	84.89 in ²	89.25 in	7576.33 in ³	27.73 in	65269.9 in ³	66288.58 in ⁴
Σ =	162.64 in ²		10005.74 in ³			

Neutral Axis = 61.52 in

Total I = I_t 212378 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
10973.5 in ³	10764.9 in ³	3494.7 in ³	3452.1 in ³	11190.3 in ³	3538.4 in ³	7659.1 in ³	6296.6 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Pier 1 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 =	27	in	λ_f =	7.714
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 =	0.5625	in	Dc =	41.25	in (Non-Comp)
Lb =	168.0	in	rt =	7.225	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 ksi

Lp = 174.0 in
 Lr = 653 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)

0.95RhFyf = 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 =	0.5625	in	D/tw =	140.4
D =	79	in	1.12√Ek/fyw =	128.5
do =	42	in	1.4√Ek/fyw =	160.6
			C =	0.91

k = 22.7 in
 Vp = 1288.7 k
 Vn = 1263.2 k

$\phi_v \phi_c \phi_s V_n = 1263.2$ 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Pier 1 Section: 4

Flexure Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6756.2 in³
 Lateral Bending S = 425.3 in³

Bottom Flange S = 4721.6 in³
 Lateral Bending S = 425.3 in³

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 = -5843 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -998 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2415 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 14.9 ksi
 WS Load = DW = 2.5 ksi
 P = 0
 Live Load = LL + IM = 8.3 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 14.8 ksi
 f_l = 0.13 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 14.9 ksi

f_{bu} = 2.5 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.5 ksi

f_{bu} = 6.1 ksi
 f_l = 0.31 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 = 1.90 (Inv)
RF = 2.46 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -5843 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -998 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2415 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 10.4 ksi
 WS Load = DW = 1.8 ksi
 P = 0
 Live Load = LL + IM = 5.8 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.4 ksi
 f_l = 0.13 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 10.4 ksi

f_{bu} = 1.8 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.8 ksi

f_{bu} = 4.3 ksi
 f_l = 0.31 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 = 3.36 (Inv)
RF = 4.35 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/12/2015

Checked by: CTA

Date: 6/23/2015

Title: Capacities and Rating Factors - Spans 1 and 2

Girder: 6-1

Location: Pier 1

Section: 4

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	246.8	k
WS Load = DW =	41.2	k
P =	0	
Live Load = LL =	112.2	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 =	149.3	k
Capacity = ϕF_{nc} = C =	1263.2	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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Pier 1 Section: 4

Service Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6756.2 in³
 Lateral Bending S = 425.3 in³

Bottom Flange S = 4721.6 in³
 Lateral Bending S = 425.3 in³

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 = -5843 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -998 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2415 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 14.9 ksi
 WS Load = DW = 2.5 ksi
 P = 0
 Live Load = LL + IM = 8.3 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 14.8 ksi
 fl = 0.13 ksi

DC = ff + fl/2 = 14.9 ksi

ff = 2.5 ksi
 fl = 0.01 ksi

DW = ff + fl/2 = 2.5 ksi

ff = 6.1 ksi
 fl = 0.31 ksi

LL + IM = ff + fl/2 = 8.3 ksi (Impact Added Here)

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

RF = 2.78 (Inv)
 RF = 3.62 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5843 k-ft
 Lateral Dead Load Moment = 4 k-ft

Wearing Surface Moment = -998 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2415 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 10.4 ksi
 WS Load = DW = 1.8 ksi
 P = 0
 Live Load = LL + IM = 5.9 ksi
 95RhFyf = C = 47.5 ksi

ff = 10.4 ksi
 fl = 0.13 ksi

DC = ff + fl/2 = 10.4 ksi

ff = 1.8 ksi
 fl = 0.01 ksi

DW = ff + fl/2 = 1.8 ksi

ff = 4.3 ksi
 fl = 0.31 ksi

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

RF = 4.59 (Inv)
 RF = 5.97 (Op)



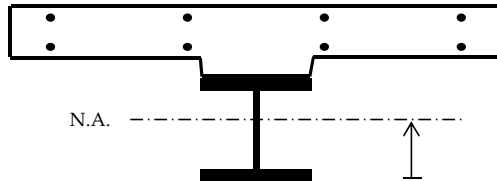
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Pier 1 Section: 4

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.7500 in
Top Flange Width =	27.0000 in
Web Thickness =	0.5625 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.7500 in
Bot. Flange Width =	27.0000 in

Deck Inputs:

Tributary Deck Width =	161.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	7.40 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	11.50 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	I
Top Flange	47.25 in ²	81.6250 in	3856.78 in ³	40.375 in	77024.1 in ³	77036.2 in ⁴
Web	44.44 in ²	41.2500 in	1833.05 in ³	0.000 in	0.0 in ³	23111.2 in ⁴
Bot. Flange	47.25 in ²	0.8750 in	41.34 in ³	40.375 in	77024.1 in ³	77036.2 in ⁴
Σ =	138.94 in ²		5731.17 in ³			177183.6 in ⁴

Neutral Axis = 41.250 in
 Total I = I_t 177184 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
4388.4 in ³	4295.4 in ³	4388.4 in ³	4295.4 in ³	425.3 in ³	425.3 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	I
Girder	138.94 in ²	41.25 in	5731.17 in ³	7.31 in	7428.74 in ³	184612.4 in ⁴
Top Bars	17.09 in ²	94.50 in	1614.79 in ³	45.94 in	36059.90 in ³	36059.9 in ⁴
Bot. Bars	6.19 in ²	85.88 in	531.57 in ³	37.31 in	8618.00 in ³	8618.0 in ⁴
Σ =	162.22 in ²		7877.53 in ³			

Neutral Axis = 48.56 in
 Total I = I_t 229290.3 in⁴

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
	6935.0 in ³	6756.2 in ³	4808.2 in ³	4721.6 in ³	7123.5 in ³	4898.1 in ³	4991.3 in ³	6145.1 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 2 Section: 5

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):

tw =	0.5	in	D/tw =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
do =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then:}$$

$$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

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

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

tw =	0.5	in	D/tw =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
do =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 2 Section: 5

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9508.1 in³
 Short-term S = 40853.8 in³
 Lateral Bending S = 139.5 in³

Bottom Flange:

Long-term S = 3300.2 in³
 Short-term S = 3531.5 in³
 Lateral Bending S = 93.0 in³

Load Factors:

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

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 2774 k-ft

Wearing Surface Moment = 481 k-ft

Live Load Moment = 2093 k-ft

Impact = 133%

Dead Load = DC = 3.5 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.8 ksi

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

f_{bu} = 3.5 ksi

f_{bu} = 0.6 ksi

f_{bu} = 0.8 ksi (Impact Added Here)

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

RF = 31.24 (Inv)
 RF = 40.50 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2774 k-ft

Lateral Dead Load Moment = 2 k-ft

Wearing Surface Moment = 481 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2093 k-ft

Lateral Live Load Moment = 8 k-ft

Impact = 133%

Dead Load = DC = 10.2 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 9.9 ksi

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

f_{bu} = 10.1 ksi

f_l = 0.26 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.2 ksi

f_{bu} = 1.7 ksi

f_l = 0.03 ksi

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

f_{bu} = 7.1 ksi

f_l = 1.01 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.9 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 = 2.59 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 2 Section: 5

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 177.2 k
 WS Load = DW = 29.4 k
 P = 0
 Live Load = LL = 107.2 k
 Impact = 133%

Live Load = LL + IM = 142.6 k

Capacity = $\phi F_{nc} = C$ = 710.5 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 = 1.78 (Inv)
 RF = 2.31 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 145.4 k
 WS Load = DW = 25.1 k
 P = 0
 Live Load = LL = 92.1 k
 Impact = 133%

Live Load = LL + IM = 122.5 k

Capacity = $\phi F_{nc} = C$ = 987.8 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 = 3.58 (Inv)
 RF = 4.65 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1 Location: Span 2 Section: 5

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9508.1 in³
 Short-term S = 40853.8 in³

Bottom Flange:

Long-term S = 3300.2 in³
 Short-term S = 3531.5 in³
 Lateral Bending S = 93.0 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2774 k-ft

Wearing Surface Moment = 481 k-ft

Live Load Moment = 2093 k-ft
 Impact = 133%

Dead Load = DC = 3.5 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.5 ksi

ff = 0.6 ksi

ff = 0.8 ksi (Impact Added Here)

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

RF = 40.82 (Inv)
 RF = 53.06 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2774 k-ft

Lateral Dead Load Moment = 2 k-ft

Wearing Surface Moment = 481 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2093 k-ft

Lateral Live Load Moment = 8 k-ft

Impact = 133%

Dead Load = DC = 10.2 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 10.1 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 10.1 ksi

f_l = 0.26 ksi

DC = ff + f_l/2 = 10.2 ksi

f_{bu} = 1.7 ksi

f_l = 0.03 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 7.1 ksi

f_l = 1.01 ksi

LL + IM = ff + f_l/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 = 2.70 (Inv)
 RF = 3.51 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

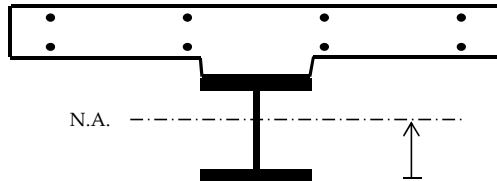
Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 6-1

Location: Span 2

Section: 5

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	12.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	18.0000 in

Deck Inputs:

Tributary Deck Width =	170.00 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	I
Top Flange	9.00 in ²	80.8750 in	727.88 in ³	49.516 in	22066.3 in ³	22066.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.641 in	3671.3 in ³	24214.6 in ⁴
Bot. Flange	27.00 in ²	0.7500 in	20.25 in ³	30.609 in	25297.0 in ³	25302.1 in ⁴
Σ =	75.50 in ²		2367.63 in ³			71583.4 in ⁴

Neutral Axis = 31.359 in

Total I = I_t 71583 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
1445.7 in ³	1434.8 in ³	2338.6 in ³	2282.7 in ³	139.5 in ³	93.0 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	75.50 in ²	31.36 in	2367.63 in ³	43.43 in	142379.4 in ³	213962.8 in ⁴
Slab	226.67 in ²	89.25 in	20230.00 in ³	14.46 in	47424.9 in ³	50144.91 in ⁴
Σ =	302.17 in ²		22597.63 in ³			

Neutral Axis = 74.79 in

Total I = I_t 264108 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
43369.6 in ³	40853.8 in ³	3567.3 in ³	3531.5 in ³	46215.5 in ³	3603.8 in ³	18258.8 in ³	12905.5 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	75.50 in ²	31.36 in	2367.63 in ³	28.96 in	63303.0 in ³	134886.37 in ⁴
Slab	75.56 in ²	89.25 in	6743.33 in ³	28.93 in	63256.5 in ³	64163.13 in ⁴
Σ =	151.06 in ²		9110.96 in ³			

Neutral Axis = 60.32 in

Total I = I_t 199050 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
9681.5 in ³	9508.1 in ³	3341.7 in ³	3300.2 in ³	9861.4 in ³	3384.3 in ³	6879.3 in ³	5697.8 in ³

-2.4-

Spans 1 & 2 - RT (Eastbound)

Interior Girder Rating





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder 9-1 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 1	Inventory	40.61	2.15	2.06	1.58	1.58	53.00	2.90	2.90
		Operating	52.64	2.79	2.67	2.04	2.04	68.90	3.77	3.77
4	Pier 1	Inventory	1.84	3.29	---	2.50	1.84	4.52	2.73	2.73
		Operating	2.39	4.27	---	3.24	2.39	5.88	3.55	3.55
5	Span 2	Inventory	33.65	2.08	1.84	3.41	1.84	44.04	2.80	2.80
		Operating	43.62	2.70	2.39	4.42	2.39	57.25	3.64	3.64

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	Flexure
Inventory:	1.84	1.58	2.73
Operating:	2.39	2.04	3.55



Computations

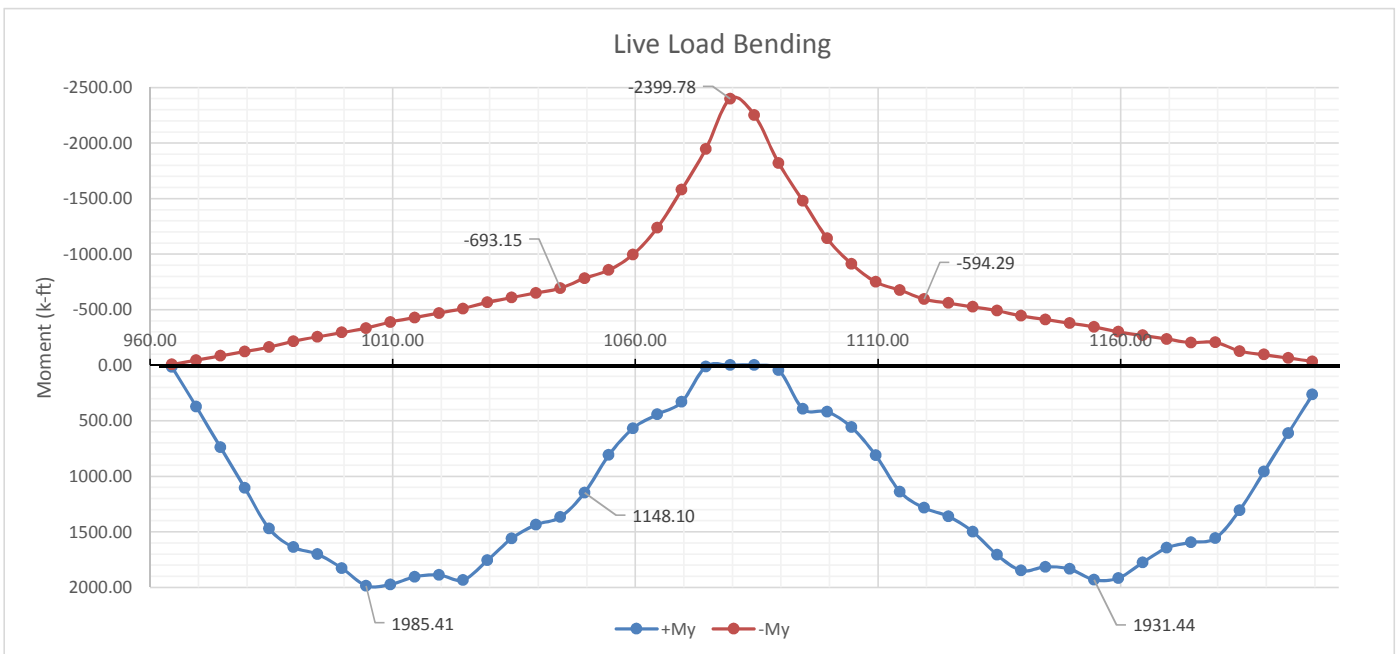
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 9-1 Spans: 1 and 2

HL-93 Live Loads Moments (no IM)

Note: By inspection 2 trucks in the RT lanes control LL for this girder.

RT Lane Only (w/m)		
Sta	M+	M-
964.5		
Section 1:	1985.41	-693.15
1044.5		
Section 4:	1148.10	-2399.78
1116.75		
Section 5:	1931.44	-594.29
1199.5		





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

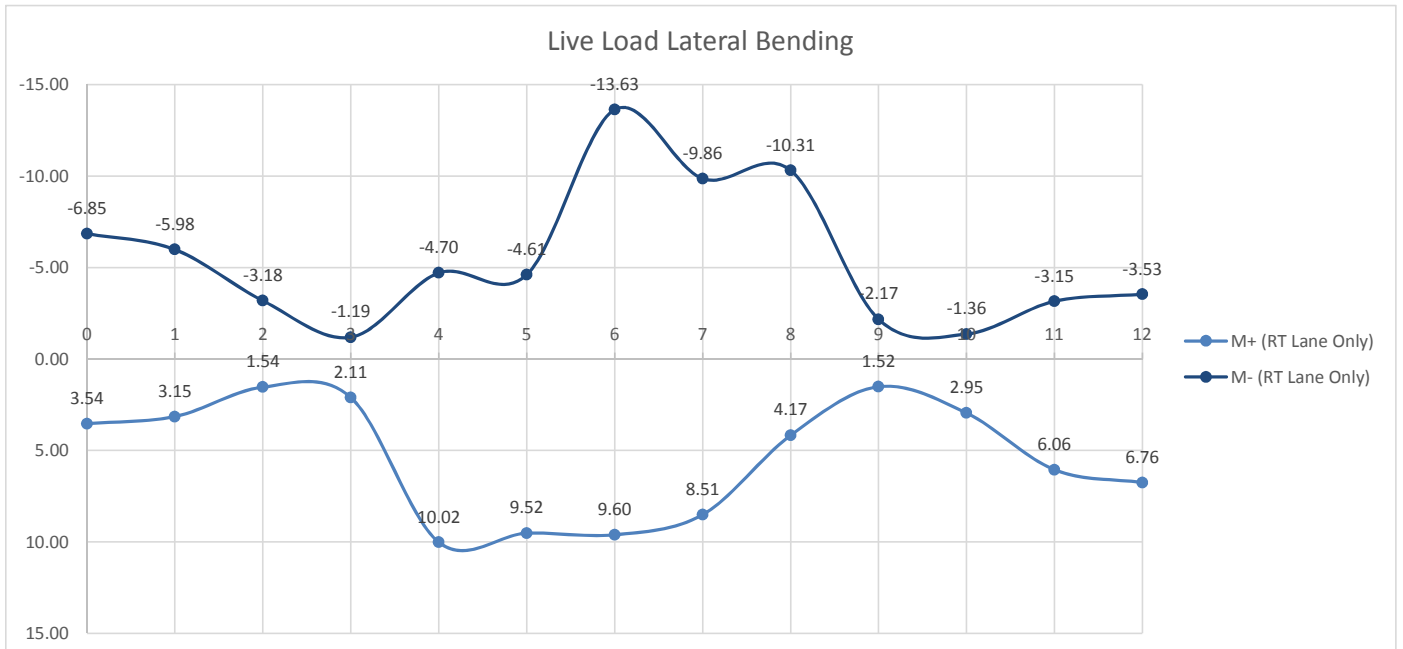
Girder 9-1 Spans: 1 and 2

Lateral Bending

Live Load - RT Land Only (w/m)

	Node	M+	M-		Node	M	M
0	127	3.54	-6.85	0	127	3.04	1.19
1	107	3.15	-5.98	1	107	2.60	1.02
2	93	1.54	-3.18	2	93	2.11	0.68
3	76	2.11	-1.19	3	76	1.13	0.47
4	51	10.02	-4.70	4	51	3.30	1.12
5	43	9.52	-4.61	5	43	7.63	1.84
6	39	9.60	-13.63	6	39	8.93	2.45
7	40	8.51	-9.86	7	40	2.18	0.65
8	47	4.17	-10.31	8	47	1.00	0.49
9	65	1.52	-2.17	9	65	0.66	0.39
10	82	2.95	-1.36	10	82	0.79	0.20
11	103	6.06	-3.15	11	103	0.51	0.46
12	124	6.76	-3.53	12	124	0.02	0.52

	M+	M-		M	M
Section 1:	10	-7	Section 1:	3	0
Section 4:	10	-14	Section 4:	9	0
Section 5:	7	-10	Section 5:	1	0





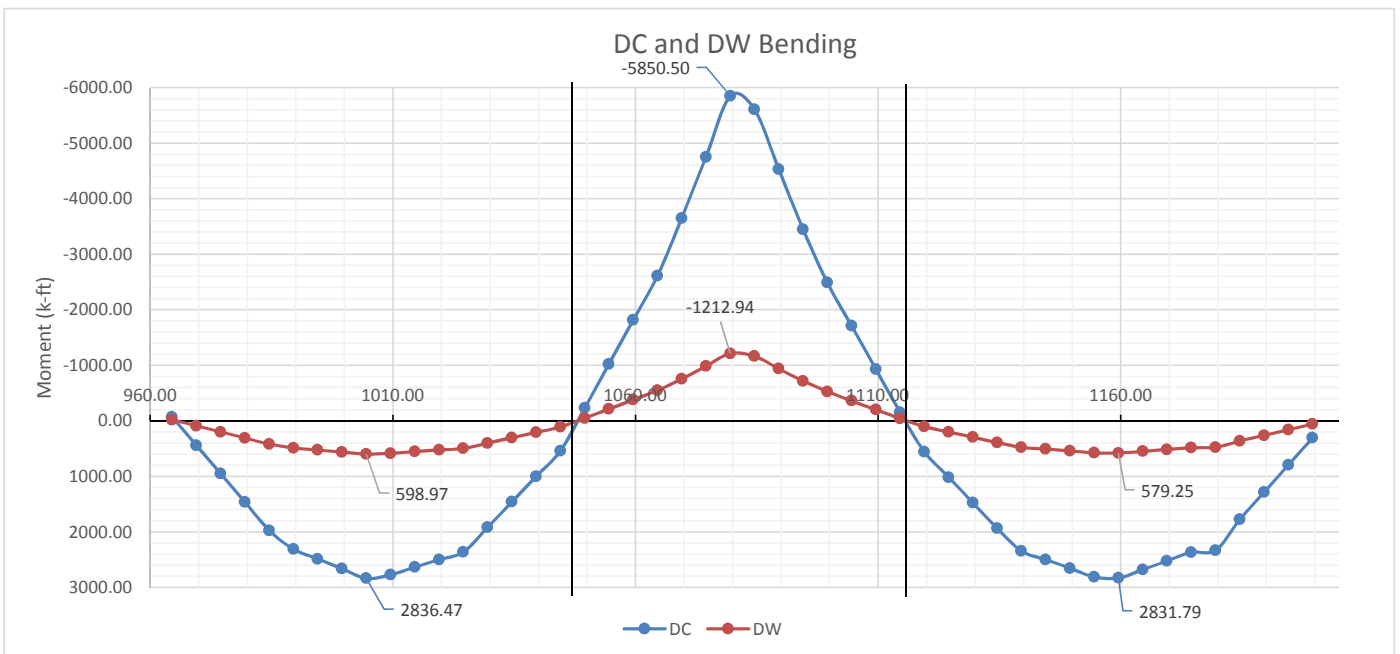
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 9-1 Spans: 1 and 2

Dead and Wearing Surface Moments

Station	DC		DW	
	M+	M-	M+	M-
964.5				
Section 1:	2836.47	-70.21	598.97	-20.17
1044.5				
Section 4:	-150.32	-5850.50	-41.28	-1212.94
1116.8				
Section 5:	2831.79	305.14	579.25	57.83
1199.5				





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 9-1 Spans: 1 and 2

Shears:

	Station	LL		DC		DW	
		V+	V-	V+	V-	V+	V-
	964.5	151.65	-7.78	165.37	165.37	36.95	36.95
Section 1:		129.85	-100.59	147.82	-139.75	32.77	-30.89
	1034.5						
Section 4:		142.75	-150.74	237.25	-246.98	49.29	-51.89
	1116.75						
Section 5:		96.28	-98.13	132.66	-121.06	28.88	-25.88
	0.00	6.32	-115.76	-136.38	-136.38	-29.50	-29.50

	LL		DC		DW
	Vmax		Vmax		Vmax
Section 1 (End):	151.7	Section 1 (End):	165.4	Section 1 (End):	36.9
Section 1 (Interior):	129.8	Section 1 (Interior):	147.8	Section 1 (Interior):	32.8
Section 4 (Interior):	150.7	Section 4 (Interior):	247.0	Section 4 (Interior):	51.9
Section 5 (Interior):	98.1	Section 5 (Interior):	132.7	Section 5 (Interior):	28.9
Section 5 (End):	115.8	Section 5 (End):	136.4	Section 5 (End):	29.5



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 1 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 =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
d _o =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

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

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

t _w =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
d _o =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 1 Section: 1

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10764.9 in³
 Short-term S = 49991.3 in³
 Lateral Bending S = 153.0 in³

Bottom Flange:

Long-term S = 3452.1 in³
 Short-term S = 3677.0 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 = 2836 k-ft

Wearing Surface Moment = 599 k-ft

Live Load Moment = 1985 k-ft

Impact = 133%

Dead Load = DC = 3.2 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

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

f_{bu} = 3.2 ksi

f_{bu} = 0.7 ksi

f_{bu} = 0.6 ksi (Impact Added Here)

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

RF = 40.61 (Inv)
 RF = 52.64 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2836 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 599 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1985 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.0 ksi

WS Load = DW = 2.1 ksi

P = 0

Live Load = LL + IM = 9.1 ksi

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

f_{bu} = 9.9 ksi

f_l = 0.38 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.0 ksi

f_{bu} = 2.1 ksi

f_l = 0.05 ksi

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

f_{bu} = 6.5 ksi

f_l = 1.15 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.1 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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 1 Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	165.4	k
WS Load = DW =	36.9	k
P =	0	
Live Load = LL =	151.7	k
Impact =	133%	

Live Load = LL + IM = 201.7 k

Capacity = $\phi F_{nc} = C$ = 987.8 k

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

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

RF = 2.06 (Inv)
 RF = 2.67 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	147.8	k
WS Load = DW =	32.8	k
P =	0	
Live Load = LL =	129.8	k
Impact =	133%	

Live Load = LL + IM = 172.7 k

Capacity = $\phi F_{nc} = C$ = 710.5 k

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

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

RF = 1.58 (Inv)
 RF = 2.04 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 1 Section: 1

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10764.9 in³
 Short-term S = 49991.3 in³

Bottom Flange:

Long-term S = 3452.1 in³
 Short-term S = 3677.0 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2836 k-ft

Wearing Surface Moment = 599 k-ft

Live Load Moment = 1985 k-ft

Impact = 133%

Dead Load = DC = 3.2 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.2 ksi

ff = 0.7 ksi

ff = 0.6 ksi (Impact Added Here)

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

RF = 53.00 (Inv)
 RF = 68.90 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2836 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 599 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1985 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.0 ksi

WS Load = DW = 2.1 ksi

P = 0

Live Load = LL + IM = 9.4 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 9.9 ksi

f_l = 0.38 ksi

DC = ff + f_l/2 = 10.0 ksi

f_{bu} = 2.1 ksi

f_l = 0.05 ksi

DW = ff + f_l/2 = 2.1 ksi

f_{bu} = 6.5 ksi

f_l = 1.15 ksi

LL + IM = ff + f_l/2 = 9.4 ksi (Impact Added Here)

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

RF = 2.90 (Inv)
 RF = 3.77 (Op)



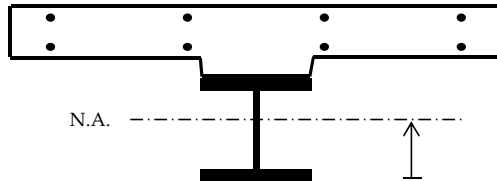
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 1 Section: 1

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	13.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	19.0000 in

Deck Inputs:

Tributary Deck Width =	191.00 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	I
Top Flange	9.75 in ²	80.8750 in	788.53 in ³	49.629 in	24014.2 in ³	24014.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.754 in	3757.8 in ³	24301.0 in ⁴
Bot. Flange	28.50 in ²	0.7500 in	21.38 in ³	30.496 in	26505.8 in ³	26511.2 in ⁴
Σ =	77.75 in ²		2429.41 in ³			74826.9 in ⁴

Neutral Axis = 31.246 in

Total I = I_t 74827 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
1507.7 in ³	1496.4 in ³	2453.6 in ³	2394.7 in ³	153.0 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	44.44 in	153528.6 in ³	228355.5 in ⁴
Slab	254.67 in ²	89.25 in	22729.00 in ³	13.57 in	46872.4 in ³	49928.43 in ⁴
Σ =	332.42 in ²		25158.41 in ³			

Neutral Axis = 75.68 in

Total I = I_t 278284 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
53602.2 in ³	49991.3 in ³	3713.8 in ³	3677.0 in ³	57775.4 in ³	3751.3 in ³	20512.4 in ³	14222.4 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	30.27 in	71262.9 in ³	146089.83 in ⁴
Slab	84.89 in ²	89.25 in	7576.33 in ³	27.73 in	65269.9 in ³	66288.58 in ⁴
Σ =	162.64 in ²		10005.74 in ³			

Neutral Axis = 61.52 in

Total I = I_t 212378 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
10973.5 in ³	10764.9 in ³	3494.7 in ³	3452.1 in ³	11190.3 in ³	3538.4 in ³	7659.1 in ³	6296.6 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Pier 1 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 =	27	in	λ_f =	7.714
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 =	0.5625	in	Dc =	41.25	in (Non-Comp)
Lb =	168.0	in	rt =	7.225	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 ksi

Lp = 174.0 in
 Lr = 653 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)

0.95RhFyf = 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 =	0.5625	in	D/tw =	140.4
D =	79	in	1.12√Ek/fyw =	128.5
do =	42	in	1.4√Ek/fyw =	160.6
			C =	0.91

k = 22.7 in
 Vp = 1288.7 k
 Vn = 1263.2 k

$\phi_v \phi_c \phi_s V_n = 1263.2$ 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Pier 1 Section: 4

Flexure Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6756.2 in³
 Lateral Bending S = 425.3 in³

Bottom Flange S = 4721.6 in³
 Lateral Bending S = 425.3 in³

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 = -5850 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1213 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2400 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 15.0 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 8.3 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 14.9 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 15.0 ksi

f_{bu} = 3.1 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 3.1 ksi

f_{bu} = 6.1 ksi
 f_l = 0.38 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 8.3 ksi (Impact Added Here)

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

RF = 1.84 (Inv)
RF = 2.39 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -5850 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1213 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2400 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 10.5 ksi
 WS Load = DW = 2.2 ksi
 P = 0
 Live Load = LL + IM = 5.8 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.4 ksi
 f_l = 0.25 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 10.5 ksi

f_{bu} = 2.2 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 2.2 ksi

f_{bu} = 4.3 ksi
 f_l = 0.38 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 5.8 ksi (Impact Added Here)

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

RF = 3.29 (Inv)
RF = 4.27 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/12/2015

Checked by: CTA

Date: 6/23/2015

Title: Capacities and Rating Factors - Spans 1 and 2

Girder: 9-1

Location: Pier 1

Section: 4

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	247.0	k
WS Load = DW =	51.9	k
P =	0	
Live Load = LL =	150.7	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 =	200.5	k
Capacity = ϕF_{nc} = C =	1263.2	k

RF =	2.50	(Inv)
RF =	3.24	(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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Pier 1 Section: 4

Service Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6756.2 in³
 Lateral Bending S = 425.3 in³

Bottom Flange S = 4721.6 in³
 Lateral Bending S = 425.3 in³

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 = -5850 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1213 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2400 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 15.0 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 8.3 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 14.9 ksi
 f_l = 0.25 ksi
 $DC = f_f + f_l/2 = 15.0$ ksi

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

f_f = 6.1 ksi
 f_l = 0.38 ksi
 $LL + IM = f_f + f_l/2 = 8.3$ ksi (Impact Added Here)

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

RF = 2.73 (Inv)
 RF = 3.55 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5850 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -1213 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2400 k-ft
 Lateral Live Load Moment = 14 k-ft
 Impact = 133%

Dead Load = DC = 10.5 ksi
 WS Load = DW = 2.2 ksi
 P = 0
 Live Load = LL + IM = 5.9 ksi
 95RhFyf = C = 47.5 ksi

f_f = 10.4 ksi
 f_l = 0.25 ksi
 $DC = f_f + f_l/2 = 10.5$ ksi

f_f = 2.2 ksi
 f_l = 0.01 ksi
 $DW = f_f + f_l/2 = 2.2$ ksi

f_f = 4.3 ksi
 f_l = 0.38 ksi
 $LL + IM = f_f + f_l/2 = 5.9$ ksi (Impact Added Here)

RF = 4.52 (Inv)
 RF = 5.88 (Op)



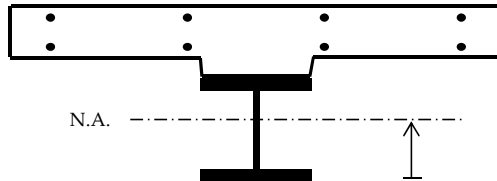
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Pier 1 Section: 4

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.7500 in
Top Flange Width =	27.0000 in
Web Thickness =	0.5625 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.7500 in
Bot. Flange Width =	27.0000 in

Deck Inputs:

Tributary Deck Width =	161.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	7.40 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	11.50 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	I
Top Flange	47.25 in ²	81.6250 in	3856.78 in ³	40.375 in	77024.1 in ³	77036.2 in ⁴
Web	44.44 in ²	41.2500 in	1833.05 in ³	0.000 in	0.0 in ³	23111.2 in ⁴
Bot. Flange	47.25 in ²	0.8750 in	41.34 in ³	40.375 in	77024.1 in ³	77036.2 in ⁴
Σ =	138.94 in ²		5731.17 in ³			177183.6 in ⁴

Neutral Axis = 41.250 in
 Total I = I_t 177184 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
4388.4 in ³	4295.4 in ³	4388.4 in ³	4295.4 in ³	425.3 in ³	425.3 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	I
Girder	138.94 in ²	41.25 in	5731.17 in ³	7.31 in	7428.74 in ³	184612.4 in ⁴
Top Bars	17.09 in ²	94.50 in	1614.79 in ³	45.94 in	36059.90 in ³	36059.9 in ⁴
Bot. Bars	6.19 in ²	85.88 in	531.57 in ³	37.31 in	8618.00 in ³	8618.0 in ⁴
Σ =	162.22 in ²		7877.53 in ³			

Neutral Axis = 48.56 in
 Total I = I_t 229290.3 in⁴

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
	6935.0 in ³	6756.2 in ³	4808.2 in ³	4721.6 in ³	7123.5 in ³	4898.1 in ³	4991.3 in ³	6145.1 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 2 Section: 5

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):

tw =	0.5	in	D/tw =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
do =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then:}$$

$$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

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

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

tw =	0.5	in	D/tw =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
do =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 2 Section: 5

Flexure Rating Factors:

Positive Moment

Composite Section

Load Factors:

Section Properties:

Top Flange:

Long-term S = 9508.1 in³
 Short-term S = 40853.8 in³
 Lateral Bending S = 139.5 in³

Bottom Flange:

Long-term S = 3300.2 in³
 Short-term S = 3531.5 in³
 Lateral Bending S = 93.0 in³

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 = 2832 k-ft

Wearing Surface Moment = 579 k-ft

Live Load Moment = 1931 k-ft

Impact = 133%

Dead Load = DC = 3.6 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.8 ksi

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

f_{bu} = 3.6 ksi

f_{bu} = 0.7 ksi

f_{bu} = 0.8 ksi (Impact Added Here)

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

RF = 33.65 (Inv)
 RF = 43.62 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2832 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 579 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1931 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.3 ksi

WS Load = DW = 2.1 ksi

P = 0

Live Load = LL + IM = 9.3 ksi

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

f_{bu} = 10.3 ksi

f_l = 0.13 ksi

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

f_{bu} = 2.1 ksi

f_l = 0.03 ksi

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

f_{bu} = 6.6 ksi

f_l = 1.33 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.3 ksi (Impact Added Here)

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

RF = 2.08 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 2 Section: 5

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 136.4 k
 WS Load = DW = 29.5 k
 P = 0
 Live Load = LL = 115.8 k
 Impact = 133%

Live Load = LL + IM = 154.0 k

Capacity = $\phi F_{nc} = C$ = 710.5 k

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

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

RF = 1.84 (Inv)
 RF = 2.39 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 132.7 k
 WS Load = DW = 28.9 k
 P = 0
 Live Load = LL = 98.1 k
 Impact = 133%

Live Load = LL + IM = 130.5 k

Capacity = $\phi F_{nc} = C$ = 987.8 k

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

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

RF = 3.41 (Inv)
 RF = 4.42 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1 Location: Span 2 Section: 5

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9508.1 in³
 Short-term S = 40853.8 in³

Bottom Flange:

Long-term S = 3300.2 in³
 Short-term S = 3531.5 in³
 Lateral Bending S = 93.0 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2832 k-ft

Wearing Surface Moment = 579 k-ft

Live Load Moment = 1931 k-ft
 Impact = 133%

Dead Load = DC = 3.6 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.6 ksi

ff = 0.7 ksi

ff = 0.8 ksi (Impact Added Here)

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

RF = 44.04 (Inv)
 RF = 57.25 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2832 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 579 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1931 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.4 ksi

WS Load = DW = 2.1 ksi

P = 0

Live Load = LL + IM = 9.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 10.3 ksi

f_l = 0.13 ksi

DC = ff + f_l/2 = 10.4 ksi

f_{bu} = 2.1 ksi

f_l = 0.03 ksi

DW = ff + f_l/2 = 2.1 ksi

f_{bu} = 6.6 ksi

f_l = 1.33 ksi

LL + IM = ff + f_l/2 = 9.6 ksi (Impact Added Here)

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

RF = 2.80 (Inv)
 RF = 3.64 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

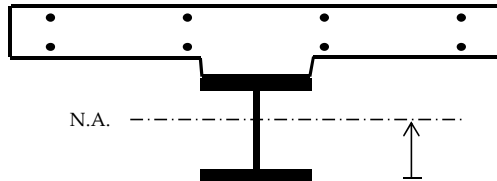
Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 9-1

Location: Span 2

Section: 5

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	12.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	18.0000 in

Deck Inputs:

Tributary Deck Width =	170.00 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	I
Top Flange	9.00 in ²	80.8750 in	727.88 in ³	49.516 in	22066.3 in ³	22066.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.641 in	3671.3 in ³	24214.6 in ⁴
Bot. Flange	27.00 in ²	0.7500 in	20.25 in ³	30.609 in	25297.0 in ³	25302.1 in ⁴
Σ =	75.50 in ²		2367.63 in ³			71583.4 in ⁴

Neutral Axis = 31.359 in

Total I = I_t 71583 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
1445.7 in ³	1434.8 in ³	2338.6 in ³	2282.7 in ³	139.5 in ³	93.0 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	75.50 in ²	31.36 in	2367.63 in ³	43.43 in	142379.4 in ³	213962.8 in ⁴
Slab	226.67 in ²	89.25 in	20230.00 in ³	14.46 in	47424.9 in ³	50144.91 in ⁴
Σ =	302.17 in ²		22597.63 in ³			

Neutral Axis = 74.79 in

Total I = I_t 264108 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
43369.6 in ³	40853.8 in ³	3567.3 in ³	3531.5 in ³	46215.5 in ³	3603.8 in ³	18258.8 in ³	12905.5 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	75.50 in ²	31.36 in	2367.63 in ³	28.96 in	63303.0 in ³	134886.37 in ⁴
Slab	75.56 in ²	89.25 in	6743.33 in ³	28.93 in	63256.5 in ³	64163.13 in ⁴
Σ =	151.06 in ²		9110.96 in ³			

Neutral Axis = 60.32 in

Total I = I_t 199050 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
9681.5 in ³	9508.1 in ³	3341.7 in ³	3300.2 in ³	9861.4 in ³	3384.3 in ³	6879.3 in ³	5697.8 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder 7-1 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 1	Inventory	41.40	2.14	2.13	1.63	1.63	54.10	2.88	2.88
		Operating	53.67	2.77	2.76	2.12	2.12	70.33	3.74	3.74
4	Pier 1	Inventory	1.85	3.33	---	2.61	1.85	4.58	2.77	2.77
		Operating	2.39	4.32	---	3.38	2.39	5.96	3.60	3.60
5	Span 2	Inventory	35.06	2.18	1.51	2.94	1.51	45.84	2.92	2.92
		Operating	45.45	2.82	1.96	3.81	1.96	59.60	3.79	3.79

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	Flexure
Inventory:	1.85	1.51	2.77
Operating:	2.39	1.96	3.60



Computations

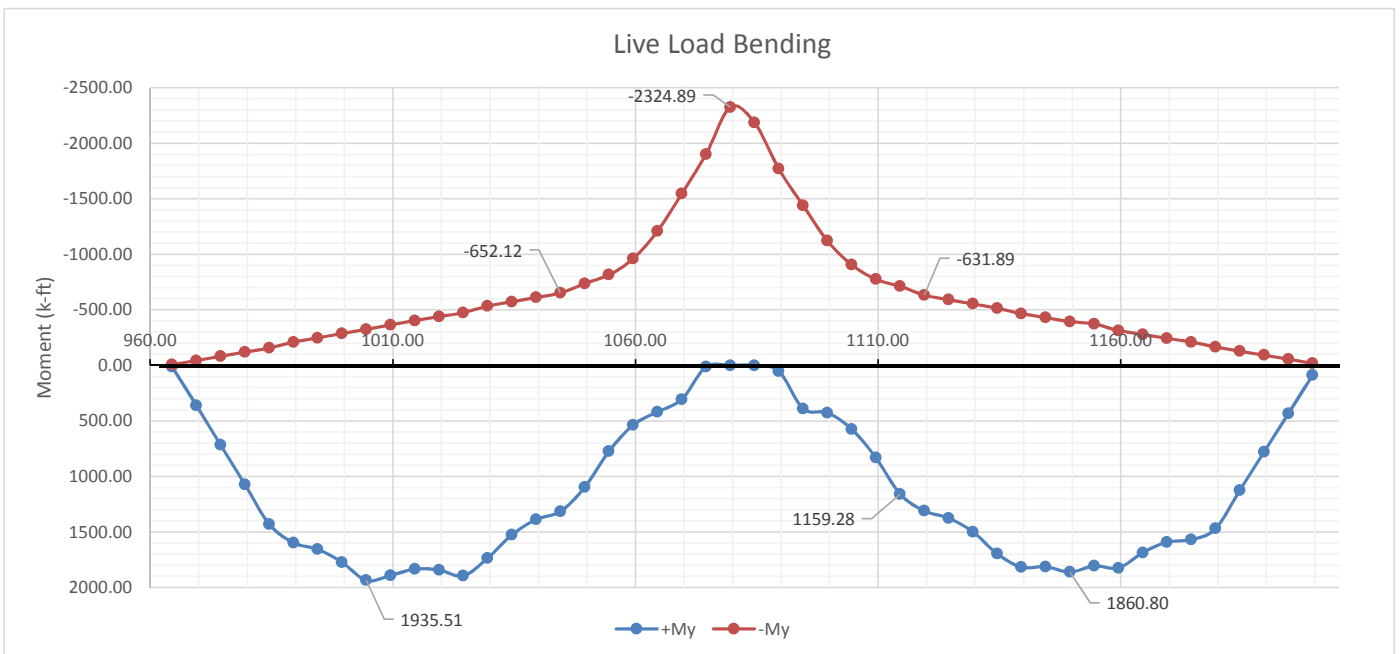
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/12/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 7-1 Spans: 1 and 2

HL-93 Live Loads Moments (no IM)

Note: By inspection 2 trucks in the RT lanes control LL for this girder.

RT Lane Only (w/m)			
Sta	M+	M-	
964.5			
Section 1:	1935.51	-652.12	
1044.5			
Section 4:	1159.28	-2324.89	
1116.75			
Section 5:	1860.80	-631.89	
1199.5			





Computations

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Title: Loads - Spans: 1 and 2	

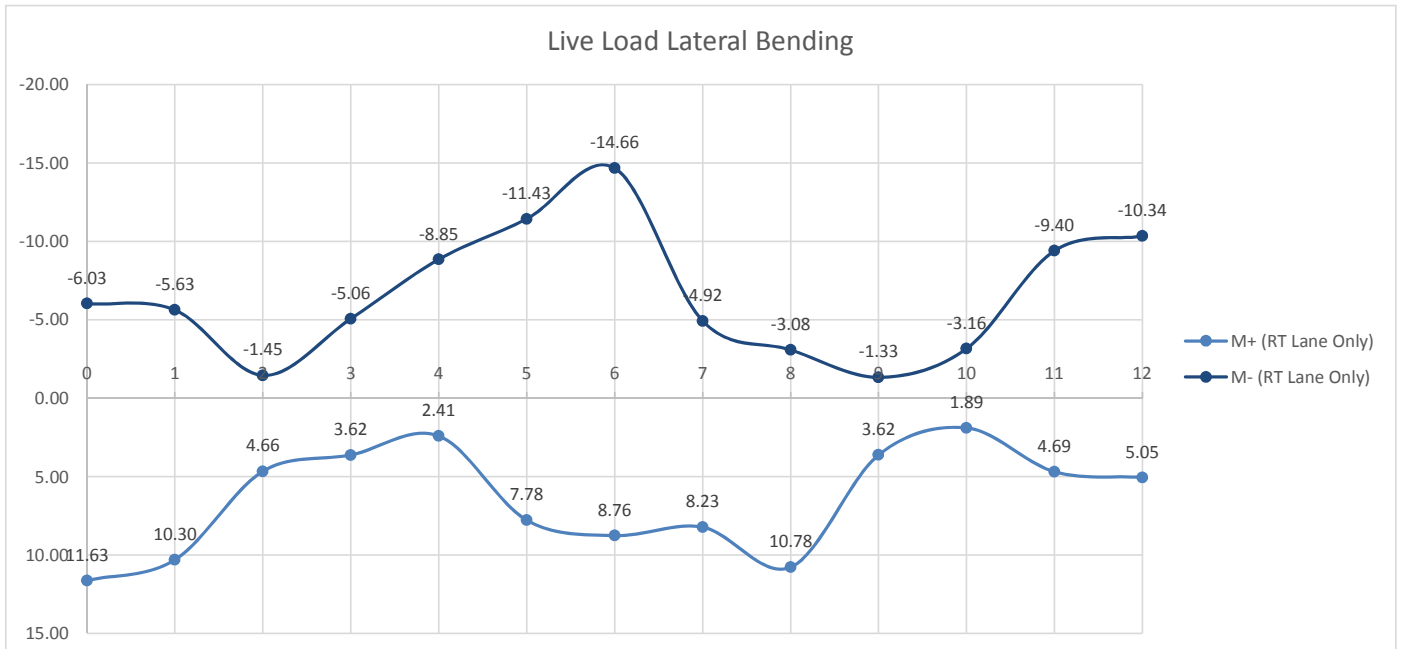
Girder 7-1 Spans: 1 and 2

Lateral Bending

Live Load - RT Lane Only (w/m)

Node	M+	M-	Node	DC M	DW M
0	116	11.63	0	116	0.44
1	95	10.30	1	95	1.74
2	72	4.66	2	72	1.60
3	44	3.62	3	44	1.28
4	25	2.41	4	25	0.78
5	12	7.78	5	12	8.31
6	8	8.76	6	8	9.60
7	10	8.23	7	10	2.99
8	19	10.78	8	19	2.60
9	41	3.62	9	41	0.52
10	59	1.89	10	59	0.61
11	91	4.69	11	91	1.47
12	115	5.05	12	115	1.56

	M+	M-		M	M
Section 1:	12	-9	Section 1:	2	0
Section 4:	11	-15	Section 4:	10	1
Section 5:	11	-10	Section 5:	3	0





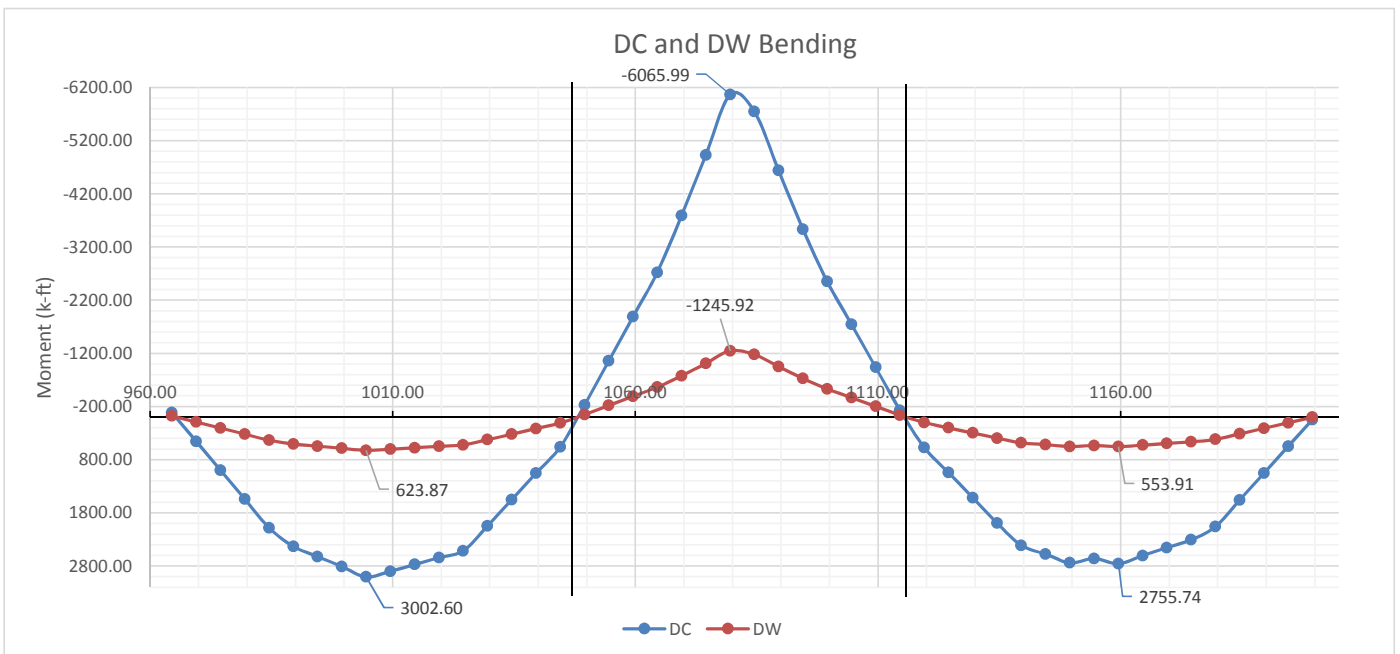
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
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Title: Loads - Spans: 1 and 2	

Girder 7-1 Spans: 1 and 2

Dead and Wearing Surface Moments

Station	DC		DW	
	M+	M-	M+	M-
964.5				
Section 1:	3002.60	-81.87	623.87	-22.71
1044.5				
Section 4:	-128.38	-6065.99	-37.57	-1245.92
1116.8				
Section 5:	2755.74	46.01	553.91	3.27
1199.5				





Computations

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Title: Loads - Spans: 1 and 2	

Girder 7-1 Spans: 1 and 2

Shears:

	Station	LL		DC		DW	
		V+	V-	V+	V-	V+	V-
	964.5	144.67	-7.60	171.34	171.34	37.87	37.87
Section 1:		123.10	-105.00	153.79	-147.39	33.70	-32.28
	1034.5						
Section 4:		139.49	-142.76	242.51	-254.12	50.03	-52.99
	1116.75						
Section 5:		95.82	-112.85	135.94	-136.90	29.27	-29.20
	0.00	6.82	-133.67	-152.20	-152.20	-32.81	-32.81

	LL		DC		DW
	Vmax		Vmax		Vmax
Section 1 (End):	144.7	Section 1 (End):	171.3	Section 1 (End):	37.9
Section 1 (Interior):	123.1	Section 1 (Interior):	153.8	Section 1 (Interior):	33.7
Section 4 (Interior):	142.8	Section 4 (Interior):	254.1	Section 4 (Interior):	53.0
Section 5 (Interior):	112.8	Section 5 (Interior):	136.9	Section 5 (Interior):	29.3
Section 5 (End):	133.7	Section 5 (End):	152.2	Section 5 (End):	32.8



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 1 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 =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
d _o =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

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

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

t _w =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
d _o =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 1 Section: 1

Flexure Rating Factors:

Positive Moment

Composite Section

Load Factors:

Section Properties:

Top Flange:

Long-term S = 10764.9 in³
 Short-term S = 49991.3 in³
 Lateral Bending S = 153.0 in³

Bottom Flange:

Long-term S = 3452.1 in³
 Short-term S = 3677.0 in³
 Lateral Bending S = 104.7 in³

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 = 3003 k-ft

Wearing Surface Moment = 624 k-ft

Live Load Moment = 1936 k-ft

Impact = 133%

Dead Load = DC = 3.3 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

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

f_{bu} = 3.3 ksi

f_{bu} = 0.7 ksi

f_{bu} = 0.6 ksi (Impact Added Here)

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

RF = 41.40 (Inv)
 RF = 53.67 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3003 k-ft

Lateral Dead Load Moment = 2 k-ft

Wearing Surface Moment = 624 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1936 k-ft

Lateral Live Load Moment = 12 k-ft

Impact = 133%

Dead Load = DC = 10.5 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 9.0 ksi

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

f_{bu} = 10.4 ksi

f_l = 0.20 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.5 ksi

f_{bu} = 2.2 ksi

f_l = 0.03 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.2 ksi

f_{bu} = 6.3 ksi

f_l = 1.33 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 = 2.14 (Inv)
 RF = 2.77 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 1 Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	171.3	k
WS Load = DW =	37.9	k
P =	0	
Live Load = LL =	144.7	k
Impact =	133%	

Live Load = LL + IM = 192.4 k

Capacity = $\phi F_{nc} = C = 987.8$ 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 = 2.13 (Inv)
 RF = 2.76 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	153.8	k
WS Load = DW =	33.7	k
P =	0	
Live Load = LL =	123.1	k
Impact =	133%	

Live Load = LL + IM = 163.7 k

Capacity = $\phi F_{nc} = C = 710.5$ 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 = 1.63 (Inv)
 RF = 2.12 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 1 Section: 1

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10764.9 in³
 Short-term S = 49991.3 in³

Bottom Flange:

Long-term S = 3452.1 in³
 Short-term S = 3677.0 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3003 k-ft

Wearing Surface Moment = 624 k-ft

Live Load Moment = 1936 k-ft
 Impact = 133%

Dead Load = DC = 3.3 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.3 ksi

ff = 0.7 ksi

ff = 0.6 ksi (Impact Added Here)

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

RF = 54.10 (Inv)
 RF = 70.33 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3003 k-ft

Lateral Dead Load Moment = 2 k-ft

Wearing Surface Moment = 624 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1936 k-ft

Lateral Live Load Moment = 12 k-ft

Impact = 133%

Dead Load = DC = 10.5 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 9.3 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 10.4 ksi

f_l = 0.20 ksi

DC = ff + f_l/2 = 10.5 ksi

f_{bu} = 2.2 ksi

f_l = 0.03 ksi

DW = ff + f_l/2 = 2.2 ksi

f_{bu} = 6.3 ksi

f_l = 1.33 ksi

LL + IM = ff + f_l/2 = 9.3 ksi (Impact Added Here)

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

RF = 2.88 (Inv)
 RF = 3.74 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

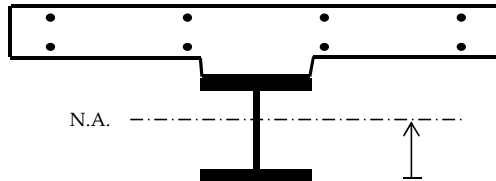
Project #: 55060.00
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 Date: 6/12/2015
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Girder: 7-1

Location: Span 1

Section: 1

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	13.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	19.0000 in

Deck Inputs:

Tributary Deck Width =	191.00 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	I
Top Flange	9.75 in ²	80.8750 in	788.53 in ³	49.629 in	24014.2 in ³	24014.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.754 in	3757.8 in ³	24301.0 in ⁴
Bot. Flange	28.50 in ²	0.7500 in	21.38 in ³	30.496 in	26505.8 in ³	26511.2 in ⁴
Σ =	77.75 in ²		2429.41 in ³			74826.9 in ⁴

Neutral Axis = 31.246 in

Total I = I_t 74827 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
1507.7 in ³	1496.4 in ³	2453.6 in ³	2394.7 in ³	153.0 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	44.44 in	153528.6 in ³	228355.5 in ⁴
Slab	254.67 in ²	89.25 in	22729.00 in ³	13.57 in	46872.4 in ³	49928.43 in ⁴
Σ =	332.42 in ²		25158.41 in ³			

Neutral Axis = 75.68 in

Total I = I_t 278284 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
53602.2 in ³	49991.3 in ³	3713.8 in ³	3677.0 in ³	57775.4 in ³	3751.3 in ³	20512.4 in ³	14222.4 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	30.27 in	71262.9 in ³	146089.83 in ⁴
Slab	84.89 in ²	89.25 in	7576.33 in ³	27.73 in	65269.9 in ³	66288.58 in ⁴
Σ =	162.64 in ²		10005.74 in ³			

Neutral Axis = 61.52 in

Total I = I_t 212378 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
10973.5 in ³	10764.9 in ³	3494.7 in ³	3452.1 in ³	11190.3 in ³	3538.4 in ³	7659.1 in ³	6296.6 in ³



Computations

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Sheet:
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 Date: 6/23/2015

Girder: 7-1 Location: Pier 1 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 =	27	in	λ_f =	7.714
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 =	0.5625	in	Dc =	41.25	in (Non-Comp)
Lb =	168.0	in	rt =	7.225	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 ksi

Lp = 174.0 in
 Lr = 653 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)

0.95RhFyf = 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 =	0.5625	in	D/tw =	140.4
D =	79	in	1.12√Ek/fyw =	128.5
do =	42	in	1.4√Ek/fyw =	160.6
			C =	0.91

k = 22.7 in
 Vp = 1288.7 k
 Vn = 1263.2 k

$\phi_v \phi_c \phi_s V_n = 1263.2$ 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

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Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Pier 1 Section: 4

Flexure Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6756.2 in³
 Lateral Bending S = 425.3 in³

Bottom Flange S = 4721.6 in³
 Lateral Bending S = 425.3 in³

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 = -6066 k-ft
 Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = -1246 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2325 k-ft
 Lateral Live Load Moment = 15 k-ft
 Impact = 133%

Dead Load = DC = 15.4 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 8.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 15.4 ksi
 f_l = 0.00 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 15.4 ksi

f_{bu} = 3.2 ksi
 f_l = 0.00 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.2 ksi

f_{bu} = 5.9 ksi
 f_l = 0.41 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.0 ksi (Impact Added Here)

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

RF = 1.85 (Inv)
RF = 2.39 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -6066 k-ft
 Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = -1246 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2325 k-ft
 Lateral Live Load Moment = 15 k-ft
 Impact = 133%

Dead Load = DC = 10.9 ksi
 WS Load = DW = 2.2 ksi
 P = 0
 Live Load = LL + IM = 5.7 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.8 ksi
 f_l = 0.27 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 10.9 ksi

f_{bu} = 2.2 ksi
 f_l = 0.03 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.2 ksi

f_{bu} = 4.1 ksi
 f_l = 0.41 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 = 3.33 (Inv)
RF = 4.32 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Pier 1 Section: 4

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	254.1	k
WS Load = DW =	53.0	k
P =	0	
Live Load = LL =	142.8	k
Impact =	133%	
Live Load = LL + IM =	189.9	k
Capacity = $\phi F_{nc} = C =$	1263.2	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 =	2.61	(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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Pier 1 Section: 4

Service Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6756.2 in³
 Lateral Bending S = 425.3 in³

Bottom Flange S = 4721.6 in³
 Lateral Bending S = 425.3 in³

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 = -6066 k-ft
 Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = -1246 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2325 k-ft
 Lateral Live Load Moment = 15 k-ft
 Impact = 133%

Dead Load = DC = 15.4 ksi
 WS Load = DW = 3.2 ksi
 P = 0
 Live Load = LL + IM = 8.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 15.4 ksi
 fl = 0.00 ksi

DC = ff + fl/2 = 15.4 ksi

ff = 3.2 ksi
 fl = 0.00 ksi

DW = ff + fl/2 = 3.2 ksi

ff = 5.9 ksi
 fl = 0.41 ksi

LL + IM = ff + fl/2 = 8.0 ksi (Impact Added Here)

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

RF = 2.77 (Inv)
 RF = 3.60 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -6066 k-ft
 Lateral Dead Load Moment = 10 k-ft

Wearing Surface Moment = -1246 k-ft
 Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = -2325 k-ft
 Lateral Live Load Moment = 15 k-ft
 Impact = 133%

Dead Load = DC = 10.9 ksi
 WS Load = DW = 2.2 ksi
 P = 0
 Live Load = LL + IM = 5.8 ksi
 95RhFyf = C = 47.5 ksi

ff = 10.8 ksi
 fl = 0.27 ksi

DC = ff + fl/2 = 10.9 ksi

ff = 2.2 ksi
 fl = 0.03 ksi

DW = ff + fl/2 = 2.2 ksi

ff = 4.1 ksi
 fl = 0.41 ksi

LL + IM = ff + fl/2 = 5.8 ksi (Impact Added Here)

RF = 4.58 (Inv)
 RF = 5.96 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

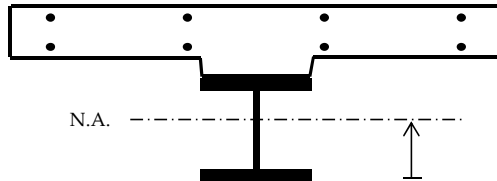
Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1

Location: Pier 1

Section: 4

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.7500 in
Top Flange Width =	27.0000 in
Web Thickness =	0.5625 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.7500 in
Bot. Flange Width =	27.0000 in

Deck Inputs:

Tributary Deck Width =	161.00 in
Deck Thickness =	12.00 in
Haunch Height =	2.00 in
n =	9

Reinforcing Inputs:

Top Bar Number =	# 8
Top Bar Spacing =	7.40 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	11.50 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	I
Top Flange	47.25 in ²	81.6250 in	3856.78 in ³	40.375 in	77024.1 in ³	77036.2 in ⁴
Web	44.44 in ²	41.2500 in	1833.05 in ³	0.000 in	0.0 in ³	23111.2 in ⁴
Bot. Flange	47.25 in ²	0.8750 in	41.34 in ³	40.375 in	77024.1 in ³	77036.2 in ⁴
Σ =	138.94 in ²		5731.17 in ³			177183.6 in ⁴

$$\text{Neutral Axis} = 41.250 \text{ in}$$

$$\text{Total } I = I_t = 177184 \text{ in}^4$$

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

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

Section Modulus = S =

Top Flange		Bot. Flange		Lateral Bending	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top FL	Bott. FL
4388.4 in ³	4295.4 in ³	4388.4 in ³	4295.4 in ³	425.3 in ³	425.3 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	I
Girder	138.94 in ²	41.25 in	5731.17 in ³	7.31 in	7428.74 in ³	184612.4 in ⁴
Top Bars	17.09 in ²	94.50 in	1614.79 in ³	45.94 in	36059.90 in ³	36059.9 in ⁴
Bot. Bars	6.19 in ²	85.88 in	531.57 in ³	37.31 in	8618.00 in ³	8618.0 in ⁴
Σ =	162.22 in ²		7877.53 in ³			

$$\text{Neutral Axis} = 48.56 \text{ in}$$

$$\text{Total } I = I_t = 229290.3 \text{ in}^4$$

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
	6935.0 in ³	6756.2 in ³	4808.2 in ³	4721.6 in ³	7123.5 in ³	4898.1 in ³	4991.3 in ³	6145.1 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 2 Section: 5

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

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):

tw =	0.5	in	D/tw =	158.0
D =	79	in	$1.12 \sqrt{E k} / f_{yw}$ =	136.3
do =	39	in	$1.4 \sqrt{E k} / f_{yw}$ =	170.3

Vp =	1145.5	k	k =	25.5	in
Vn =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{E k}{F_{yw}}}, \text{ then:}$$

$$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{E k}{F_{yw}}\right)$$

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

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

tw =	0.5	in	D/tw =	158.0
D =	79	in	$1.12 \sqrt{E k} / f_{yw}$ =	72.6
do =	118	in	$1.4 \sqrt{E k} / f_{yw}$ =	90.7

Vp =	1145.5	k	k =	7.2	in
Vn =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:

Date: 6/12/2015

Date: 6/23/2015

Girder: 7-1

Location: Span 2

Section: 5

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9508.1 in³

Short-term S = 40853.8 in³

Lateral Bending S = 139.5 in³

Bottom Flange:

Long-term S = 3300.2 in³

Short-term S = 3531.5 in³

Lateral Bending S = 93.0 in³

Load Factors:

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

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 2756 k-ft

Wearing Surface Moment = 554 k-ft

Live Load Moment = 1861 k-ft

Impact = 133%

Dead Load = DC = 3.5 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.7 ksi

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

f_{bu} = 3.5 ksi

f_{bu} = 0.7 ksi

f_{bu} = 0.7 ksi (Impact Added Here)

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

RF = 35.06 (Inv)
 RF = 45.45 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2756 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 554 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1861 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.1 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 9.0 ksi

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

f_{bu} = 10.0 ksi

f_l = 0.34 ksi

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

f_{bu} = 2.0 ksi

f_l = 0.03 ksi

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

f_{bu} = 6.3 ksi

f_l = 1.33 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 = 2.18 (Inv)
 RF = 2.82 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 2 Section: 5

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 152.2 k
 WS Load = DW = 32.8 k
 P = 0
 Live Load = LL = 133.7 k
 Impact = 133%

Live Load = LL + IM = 177.8 k

Capacity = $\phi F_{nc} = C$ = 710.5 k

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

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

RF = 1.51 (Inv)
 RF = 1.96 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 136.9 k
 WS Load = DW = 29.3 k
 P = 0
 Live Load = LL = 112.8 k
 Impact = 133%

Live Load = LL + IM = 150.1 k

Capacity = $\phi F_{nc} = C$ = 987.8 k

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

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

RF = 2.94 (Inv)
 RF = 3.81 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 2 Section: 5

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9508.1 in³
 Short-term S = 40853.8 in³

Bottom Flange:

Long-term S = 3300.2 in³
 Short-term S = 3531.5 in³
 Lateral Bending S = 93.0 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2756 k-ft

Wearing Surface Moment = 554 k-ft

Live Load Moment = 1861 k-ft
 Impact = 133%

Dead Load = DC = 3.5 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.5 ksi

ff = 0.7 ksi

ff = 0.7 ksi (Impact Added Here)

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

RF = 45.84 (Inv)
 RF = 59.60 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2756 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 554 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1861 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.2 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 9.3 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 10.0 ksi

f_l = 0.34 ksi

DC = ff + f_l/2 = 10.2 ksi

f_{bu} = 2.0 ksi

f_l = 0.03 ksi

DW = ff + f_l/2 = 2.0 ksi

f_{bu} = 6.3 ksi

f_l = 1.33 ksi

LL + IM = ff + f_l/2 = 9.3 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 = 3.79 (Op)



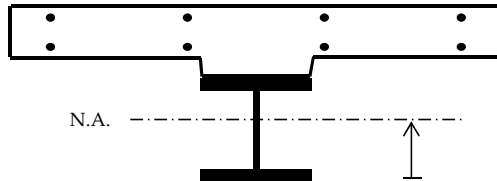
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/12/2015
 Date: 6/23/2015

Girder: 7-1 Location: Span 2 Section: 5

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	12.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	18.0000 in

Deck Inputs:

Tributary Deck Width =	170.00 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	I
Top Flange	9.00 in ²	80.8750 in	727.88 in ³	49.516 in	22066.3 in ³	22066.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.641 in	3671.3 in ³	24214.6 in ⁴
Bot. Flange	27.00 in ²	0.7500 in	20.25 in ³	30.609 in	25297.0 in ³	25302.1 in ⁴
Σ =	75.50 in ²		2367.63 in ³			71583.4 in ⁴

Neutral Axis = 31.359 in

Total I = I_t 71583 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
1445.7 in ³	1434.8 in ³	2338.6 in ³	2282.7 in ³	139.5 in ³	93.0 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	75.50 in ²	31.36 in	2367.63 in ³	43.43 in	142379.4 in ³	213962.8 in ⁴
Slab	226.67 in ²	89.25 in	20230.00 in ³	14.46 in	47424.9 in ³	50144.91 in ⁴
Σ =	302.17 in ²		22597.63 in ³			

Neutral Axis = 74.79 in

Total I = I_t 264108 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
43369.6 in ³	40853.8 in ³	3567.3 in ³	3531.5 in ³	46215.5 in ³	3603.8 in ³	18258.8 in ³	12905.5 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	75.50 in ²	31.36 in	2367.63 in ³	28.96 in	63303.0 in ³	134886.37 in ⁴
Slab	75.56 in ²	89.25 in	6743.33 in ³	28.93 in	63256.5 in ³	64163.13 in ⁴
Σ =	151.06 in ²		9110.96 in ³			

Neutral Axis = 60.32 in

Total I = I_t 199050 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
9681.5 in ³	9508.1 in ³	3341.7 in ³	3300.2 in ³	9861.4 in ³	3384.3 in ³	6879.3 in ³	5697.8 in ³

-2.5-

**Spans 1 & 2 - LT
(Westbound)
Loads Summary**





Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Location: Bangor/Brewer, ME

Project #: 55060.00

Sheet:

Date: 6/23/2015

Calculated by: JGM

Date: 6/23/2015

Checked by: CTA

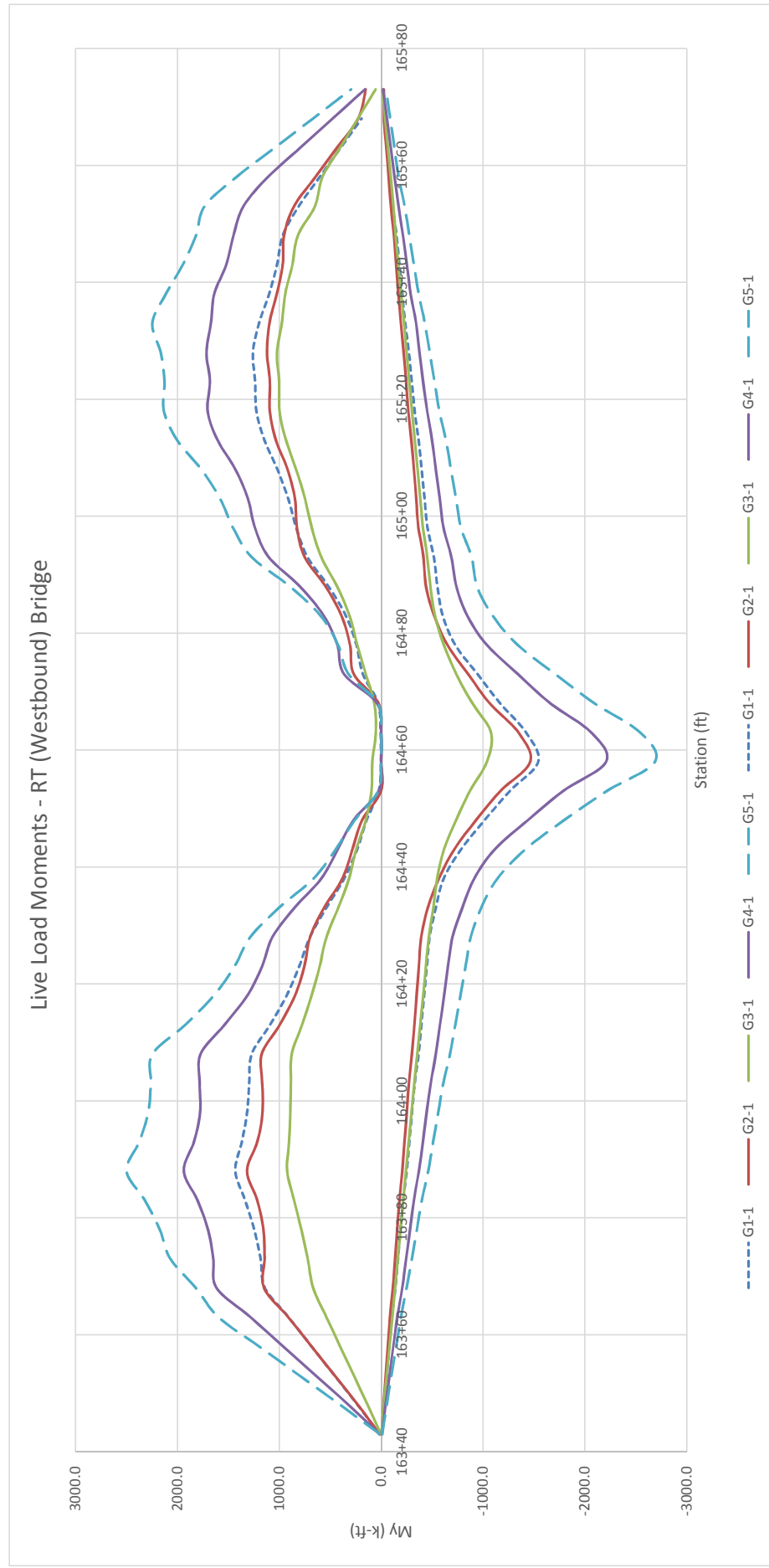
Title: Spans 1 and 2 Loads

Live Load Summary

Note: Stations refer to centerline of construction in 1984 As-Built Plans.

Controlling Ratings Shown: HL-93 Truck and Lane Controls + Moments, HL-93 Double Truck + Lane Controls - Moment

Live Load Moments - RT (Westbound) Bridge





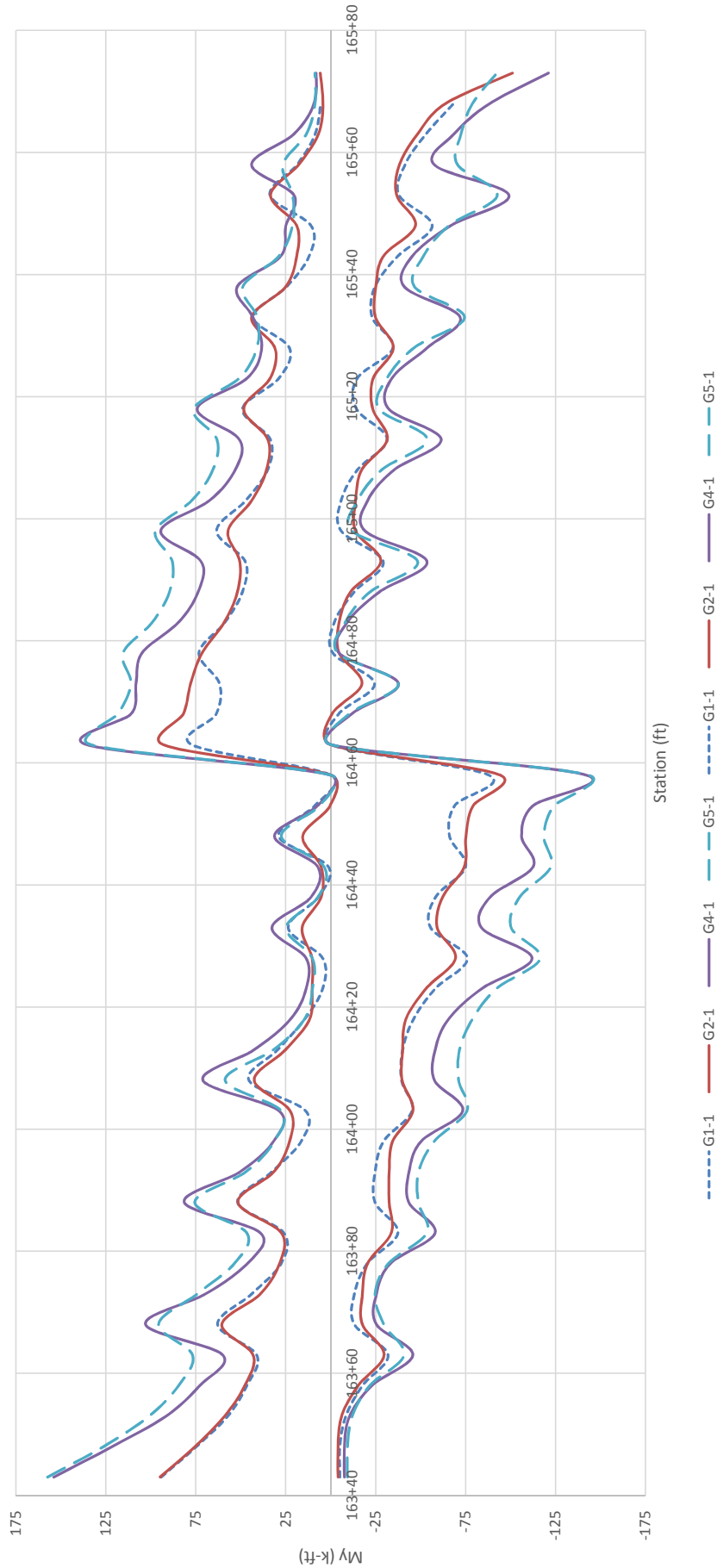
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
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Title: Spans 1 and 2 Loads	

Live Load Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.
Minimum and maximum shear values have been verified by hand calculations and checks.

Live Load Shears - RT (Westbound) Bridge





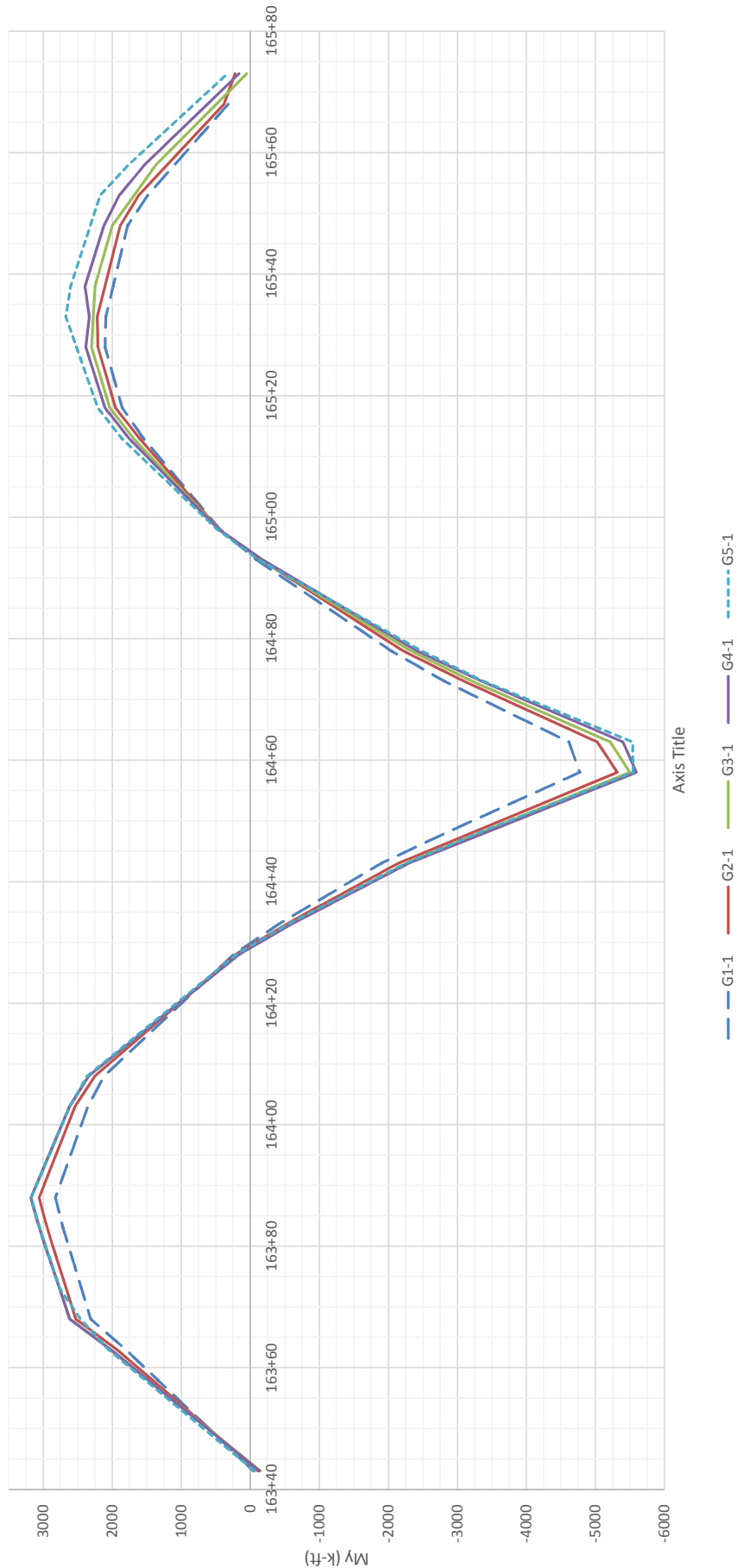
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
Checked by: CTA	Date: 6/24/2015
Title: Spans 1 and 2 Loads	

Dead Loads Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Dead Load Moments - LT (Westbound) Bridge





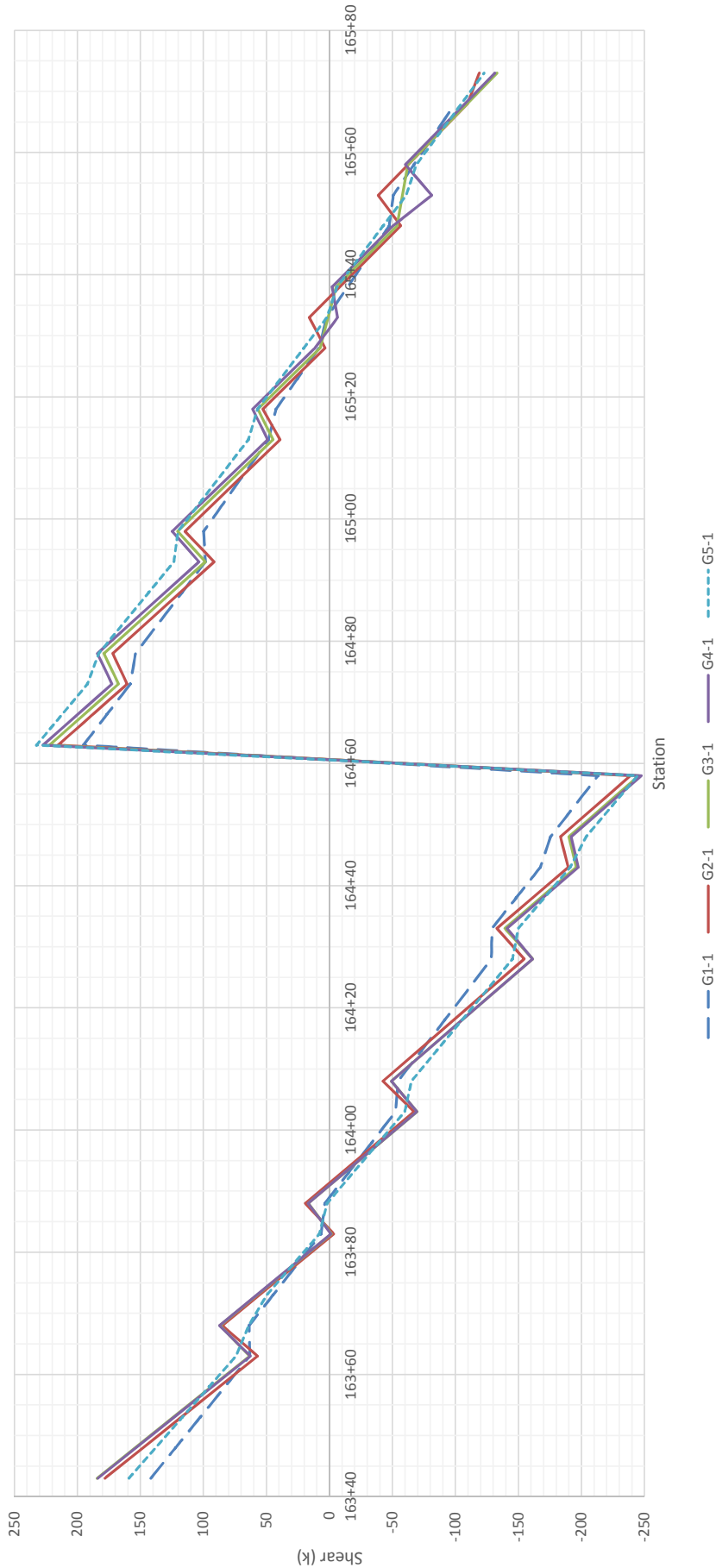
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 6/23/2015
Checked by: CTA	Date: 6/24/2015
Title: Spans 1 and 2 Loads	

Dead Loads Summary

Note: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.
Minimum and maximum shear values have been verified by hand calculations and checks.

Dead Load Shears - LT (Westbound) Bridge



-2.6-

**Spans 1 & 2 - LT
(Westbound)**

Exterior Girder Rating





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 1 and 2

Project #: 55060.00
 Sheet: _____
 Date: 6/22/2015
 Date: 6/23/2015

Girder 5-1 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 1	Inventory	28.20	1.66	2.03	1.51	1.51	36.91	2.28	2.28
		Operating	36.56	2.15	2.63	1.95	1.95	47.99	2.96	2.96
2	Pier 1	Inventory	1.63	3.10	---	2.59	1.63	4.22	2.39	2.39
		Operating	2.11	4.02	---	3.36	2.11	5.49	3.11	3.11
3	Span 2	Inventory	30.50	1.73	2.44	3.55	1.73	39.80	2.33	2.33
		Operating	39.54	2.25	3.16	4.60	2.25	51.74	3.03	3.03

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	Flexure
Inventory:	1.63	1.51	2.28
Operating:	2.11	1.95	2.96



Computations

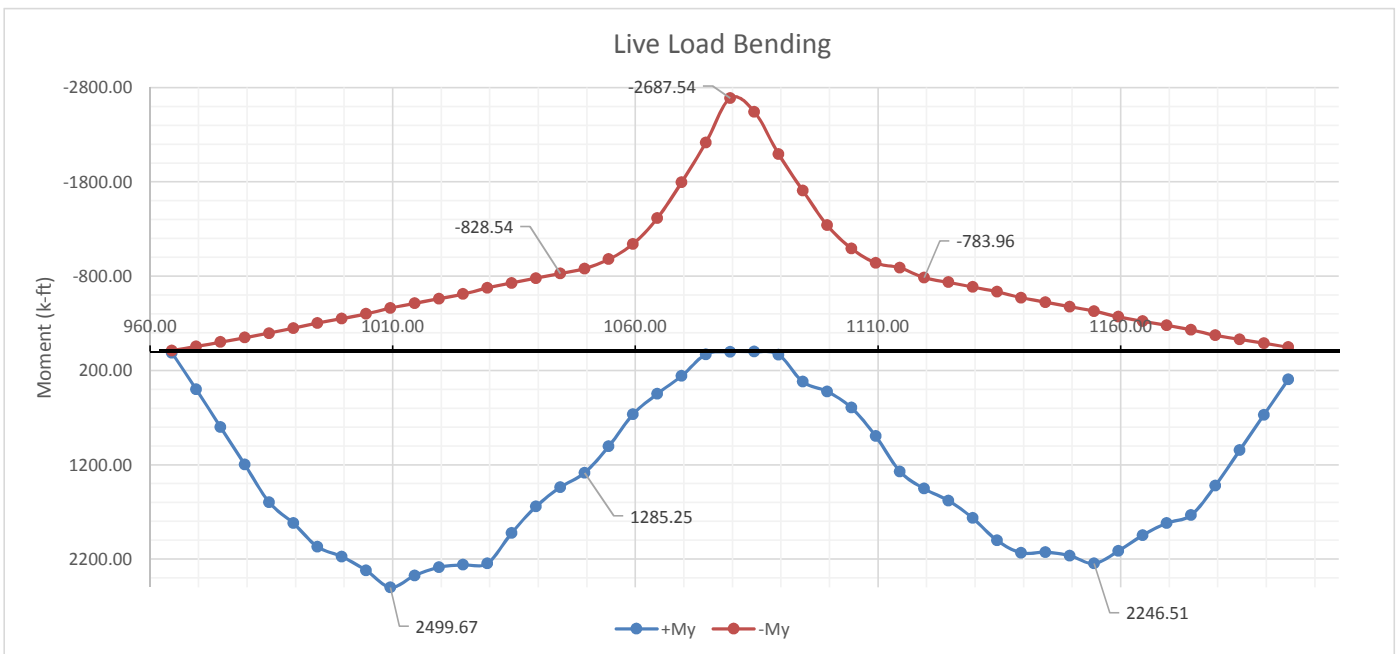
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 5-1 Spans: 1 and 2

HL-93 Live Loads Moments (no IM)

Note: By inspection 2 trucks in the RT lanes control LL for this girder.

RT Lane Only (w/m)		
Sta	M+	M-
964.5		
Section 1:	2499.67	-828.54
1044.5		
Section 4:	1285.25	-2687.54
1116.75		
Section 5:	2246.51	-783.96
0.0		





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 5-1 Spans: 1 and 2

Lateral Bending

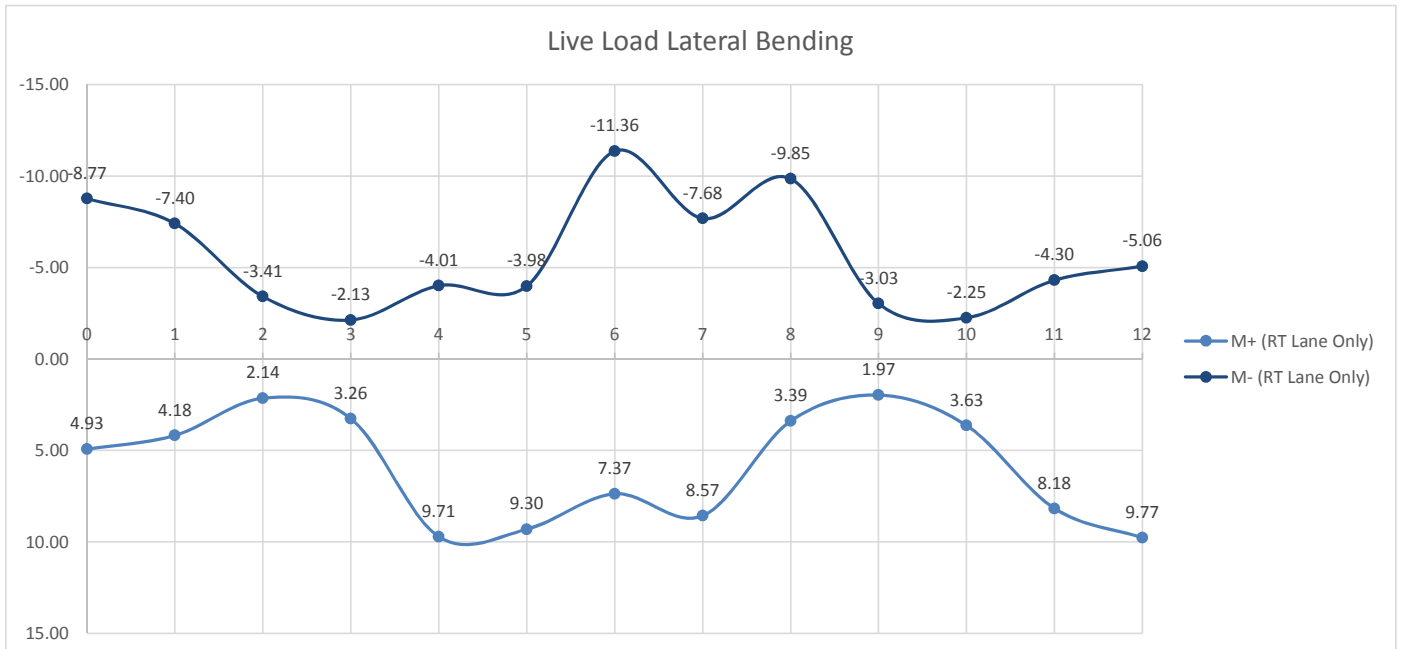
Live Load - RT Land Only (w/m)

Node	M+	M-
0	4.93	-8.77
1	4.18	-7.40
2	2.14	-3.41
3	3.26	-2.13
4	9.71	-4.01
5	9.30	-3.98
6	7.37	-11.36
7	8.57	-7.68
8	3.39	-9.85
9	1.97	-3.03
10	3.63	-2.25
11	8.18	-4.30
12	108	9.77

Node	DC M	DW M
0	109	0.73
1	83	0.78
2	54	0.12
3	30	0.21
4	13	0.57
5	5	1.79
6	1	0.80
7	4	1.33
8	15	2.50
9	33	0.82
10	57	0.71
11	86	2.39
12	108	2.89

	M+	M-
Section 1:	10	-9
Section 4:	10	-11
Section 5:	10	-10

	M	M
Section 1:	1	0
Section 4:	3	0
Section 5:	3	0





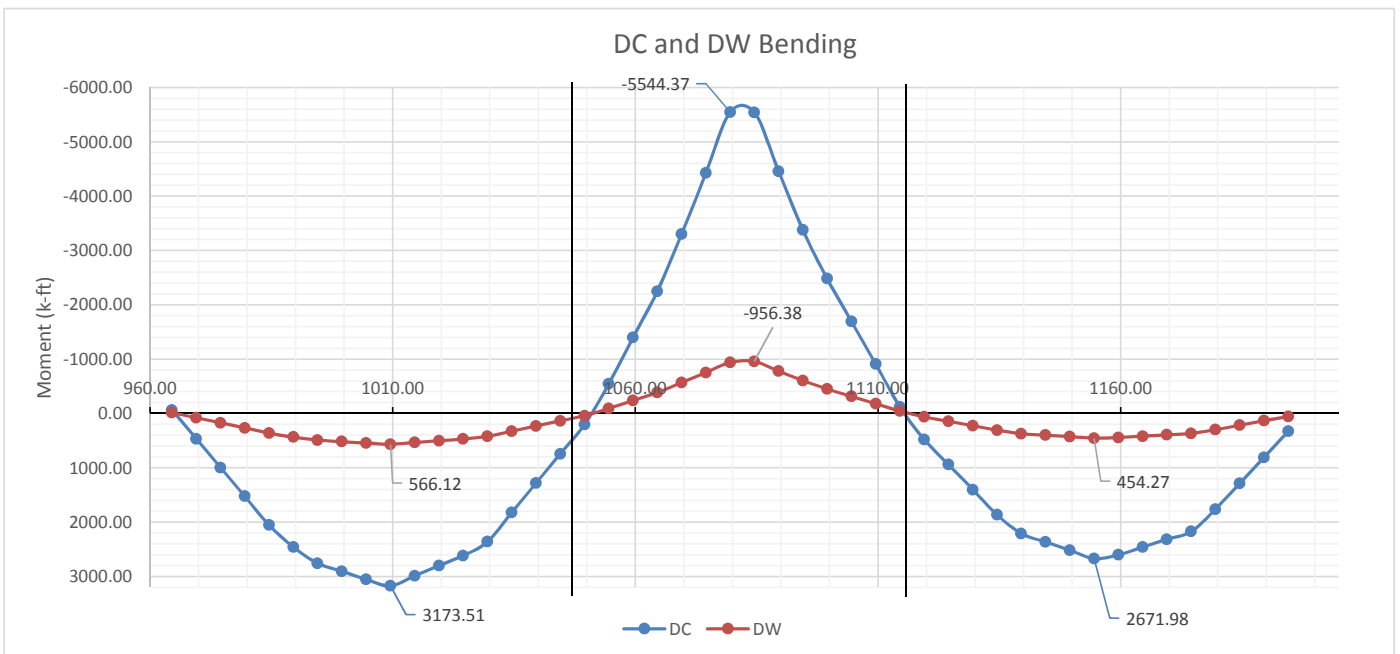
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 5-1 Spans: 1 and 2

Dead and Wearing Surface Moments

Station	DC		DW	
	M+	M-	M+	M-
964.5				
Section 1:	3173.51	-62.76	566.12	-14.10
1044.5				
Section 4:	203.82	-5544.37	42.38	-956.38
1116.8				
Section 5:	2671.98	330.45	454.27	54.27
0.0				





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 5-1 Spans: 1 and 2

Shears:

	Station	LL		DC		DW	
		V+	V-	V+	V-	V+	V-
	964.5	157.44	-9.31	159.13	159.13	29.86	29.86
Section 1:		138.70	-92.11	146.38	-125.24	27.19	-22.54
	1034.5						
Section 4:		133.58	-143.27	232.43	-244.54	38.57	-41.05
	1116.75						
Section 5:		97.43	-92.64	120.15	-111.98	21.97	-19.51
	0.00	8.71	-92.39	-122.74	-122.74	-21.69	-21.69

	LL		DC		DW
	Vmax		Vmax		Vmax
Section 1 (End):	157.4	Section 1 (End):	159.1	Section 1 (End):	29.9
Section 1 (Interior):	138.7	Section 1 (Interior):	146.4	Section 1 (Interior):	27.2
Section 4 (Interior):	143.3	Section 4 (Interior):	244.5	Section 4 (Interior):	41.0
Section 5 (Interior):	97.4	Section 5 (Interior):	120.1	Section 5 (Interior):	22.0
Section 5 (End):	92.4	Section 5 (End):	122.7	Section 5 (End):	21.7



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Span 1 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 =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
d _o =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

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

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

t _w =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
d _o =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Span 1 Section: 1

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10124.5 in³
 Short-term S = 44451.8 in³
 Lateral Bending S = 153.0 in³

Bottom Flange:

Long-term S = 3436.2 in³
 Short-term S = 3667.7 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 = 3174 k-ft

Wearing Surface Moment = 566 k-ft

Live Load Moment = 2500 k-ft

Impact = 133%

Dead Load = DC = 3.8 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.9 ksi

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

f_{bu} = 3.8 ksi

f_{bu} = 0.7 ksi

f_{bu} = 0.9 ksi (Impact Added Here)

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

RF = 28.20 (Inv)
 RF = 36.56 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3174 k-ft

Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = 566 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2500 k-ft

Lateral Live Load Moment = 11 k-ft

Impact = 133%

Dead Load = DC = 11.1 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 11.5 ksi

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

f_{bu} = 11.1 ksi

f_l = 0.00 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 11.1 ksi

f_{bu} = 2.0 ksi

f_l = 0.00 ksi

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

f_{bu} = 8.2 ksi

f_l = 1.30 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 = 1.66 (Inv)
 RF = 2.15 (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 1 and 2

Project #: 55060.00

Sheet:

Date: 6/22/2015

Date: 6/23/2015

Girder: 5-1

Location: Span 1

Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 159.1 k

WS Load = DW = 29.9 k

P = 0

Live Load = LL = 157.4 k

Impact = 133%

Live Load = LL + IM = 209.4 k

Capacity = $\phi F_{nc} = C$ = 987.8 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 = 2.03 (Inv)

RF = 2.63 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 146.4 k

WS Load = DW = 27.2 k

P = 0

Live Load = LL = 138.7 k

Impact = 133%

Live Load = LL + IM = 184.5 k

Capacity = $\phi F_{nc} = C$ = 710.5 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 = 1.51 (Inv)

RF = 1.95 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Span 1 Section: 1

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10124.5 in³
 Short-term S = 44451.8 in³

Bottom Flange:

Long-term S = 3436.2 in³
 Short-term S = 3667.7 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3174 k-ft

Wearing Surface Moment = 566 k-ft

Live Load Moment = 2500 k-ft

Impact = 133%

Dead Load = DC = 3.8 ksi

WS Load = DW = 0.7 ksi

P = 0

Live Load = LL + IM = 0.9 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.8 ksi

ff = 0.7 ksi

ff = 0.9 ksi (Impact Added Here)

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

RF = 36.91 (Inv)
 RF = 47.99 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3174 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 566 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2500 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 11.1 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 11.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 11.1 ksi

f_l = 0.09 ksi

DC = ff + f_l/2 = 11.1 ksi

f_{bu} = 2.0 ksi

f_l = 0.02 ksi

DW = ff + f_l/2 = 2.0 ksi

f_{bu} = 8.2 ksi

f_l = 1.11 ksi

LL + IM = ff + f_l/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 = 2.28 (Inv)
 RF = 2.96 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

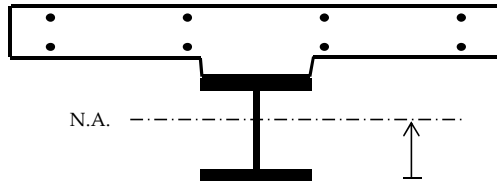
Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1

Location: Span 1

Section: 1

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	13.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	19.0000 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. =	0.000 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	I
Top Flange	9.75 in ²	80.8750 in	788.53 in ³	49.629 in	24014.2 in ³	24014.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.754 in	3757.8 in ³	24301.0 in ⁴
Bot. Flange	28.50 in ²	0.7500 in	21.38 in ³	30.496 in	26505.8 in ³	26511.2 in ⁴
Σ =	77.75 in ²		2429.41 in ³			74826.9 in ⁴

Neutral Axis = 31.246 in

Total I = I_t 74827 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
1507.7 in ³	1496.4 in ³	2453.6 in ³	2394.7 in ³	153.0 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	43.81 in	149232.0 in ³	224058.9 in ⁴
Slab	240.00 in ²	89.25 in	21420.00 in ³	14.19 in	48344.9 in ³	51224.95 in ⁴
Σ =	317.75 in ²		23849.41 in ³			

Neutral Axis = 75.06 in

Total I = I_t 275284 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
47317.0 in ³	44451.8 in ³	3704.7 in ³	3667.7 in ³	50577.1 in ³	3742.4 in ³	19395.9 in ³	13632.7 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	29.42 in	67274.7 in ³	142101.63 in ⁴
Slab	80.00 in ²	89.25 in	7140.00 in ³	28.59 in	65382.6 in ³	66342.60 in ⁴
Σ =	157.75 in ²		9569.41 in ³			

Neutral Axis = 60.66 in

Total I = I_t 208444 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
10312.3 in ³	10124.5 in ³	3479.2 in ³	3436.2 in ³	10507.2 in ³	3523.3 in ³	7291.3 in ³	6026.5 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Pier 1 Section: 2

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 =	27	in	λ_f =	7.714
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 =	0.5625	in	Dc =	41.13	in (Non-Comp)
Lb =	168.0	in	rt =	7.227	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 ksi

Lp = 174.0 in
 Lr = 654 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)

0.95RhFyf = 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 =	0.5625	in	D/tw =	140.4
D =	79	in	1.12√Ek/fyw =	116.2
do =	48	in	1.4√Ek/fyw =	145.2
			C =	0.83

k = 18.5 in
 Vp = 1288.7 k
 Vn = 1231.5 k

$\phi_v \phi_c \phi_s V_n = 1231.5$ 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Pier 1 Section: 2

Flexure Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6783.9 in³
 Lateral Bending S = 394.9 in³

Bottom Flange S = 4492.0 in³
 Lateral Bending S = 394.9 in³

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 = -5544 k-ft
 Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = -956 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2688 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 14.8 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 9.7 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 14.8 ksi
 f_l = 0.00 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 14.8 ksi

f_{bu} = 2.6 ksi
 f_l = 0.00 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.6 ksi

f_{bu} = 7.2 ksi
 f_l = 0.35 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.7 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)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -5544 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -956 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2688 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 9.8 ksi
 WS Load = DW = 1.7 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 9.8 ksi
 f_l = 0.08 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 9.8 ksi

f_{bu} = 1.7 ksi
 f_l = 0.01 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 1.7 ksi

f_{bu} = 4.8 ksi
 f_l = 0.35 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 = 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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Pier 1 Section: 2

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	244.5	k
WS Load = DW =	41.0	k
P =	0	
Live Load = LL =	143.3	k
Impact =	133%	
Live Load = LL + IM =	190.6	k
Capacity = ϕF_{nc} = C =	1231.5	k

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

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

RF =	2.59	(Inv)
RF =	3.36	(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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Pier 1 Section: 2

Service Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6783.9 in³
 Lateral Bending S = 394.9 in³

Bottom Flange S = 4492.0 in³
 Lateral Bending S = 394.9 in³

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 = -5544 k-ft
 Lateral Dead Load Moment = 0 k-ft

Wearing Surface Moment = -956 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2688 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 14.8 ksi
 WS Load = DW = 2.6 ksi
 P = 0
 Live Load = LL + IM = 9.7 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 14.8 ksi
 f_l = 0.00 ksi
 $DC = f_f + f_l/2 = 14.8$ ksi

f_f = 2.6 ksi
 f_l = 0.00 ksi
 $DW = f_f + f_l/2 = 2.6$ ksi

f_f = 7.2 ksi
 f_l = 0.35 ksi
 $LL + IM = f_f + f_l/2 = 9.7$ ksi (Impact Added Here)

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

RF = 2.39 (Inv)
 RF = 3.11 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5544 k-ft
 Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = -956 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2688 k-ft
 Lateral Live Load Moment = 11 k-ft
 Impact = 133%

Dead Load = DC = 9.8 ksi
 WS Load = DW = 1.7 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 95RhFyf = C = 47.5 ksi

f_f = 9.8 ksi
 f_l = 0.08 ksi
 $DC = f_f + f_l/2 = 9.8$ ksi

f_f = 1.7 ksi
 f_l = 0.01 ksi
 $DW = f_f + f_l/2 = 1.7$ ksi

f_f = 4.8 ksi
 f_l = 0.35 ksi
 $LL + IM = f_f + f_l/2 = 6.6$ ksi (Impact Added Here)

RF = 4.22 (Inv)
 RF = 5.49 (Op)



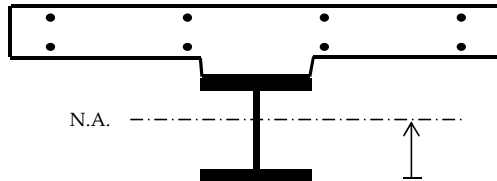
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Pier 1 Section: 2

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.6250 in
Top Flange Width =	27.0000 in
Web Thickness =	0.5625 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.6250 in
Bot. Flange Width =	27.0000 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 =	# 8
Top Bar Spacing =	7.40 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	11.50 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	I
Top Flange	43.88 in ²	81.4375 in	3573.07 in ³	40.313 in	71301.2 in ³	71310.8 in ⁴
Web	44.44 in ²	41.1250 in	1827.49 in ³	0.000 in	0.0 in ³	23111.2 in ⁴
Bot. Flange	43.88 in ²	0.8125 in	35.65 in ³	40.313 in	71301.2 in ³	71310.8 in ⁴
Σ =	132.19 in ²		5436.21 in ³			165732.8 in ⁴

Neutral Axis = 41.125 in
 Total I = I_t = 165733 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
4111.2 in ³	4030.0 in ³	4111.2 in ³	4030.0 in ³	394.9 in ³	394.9 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	I
Girder	132.19 in ²	41.13 in	5436.21 in ³	8.36 in	9236.34 in ³	174969.2 in ⁴
Top Bars	19.10 in ²	94.25 in	1800.58 in ³	44.77 in	38284.86 in ³	38284.9 in ⁴
Bot. Bars	6.91 in ²	85.63 in	591.67 in ³	36.14 in	9025.64 in ³	9025.7 in ⁴
Σ =	158.20 in ²		7828.46 in ³			

Neutral Axis = 49.48 in
 Total I = I_t = 222279.7 in⁴

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
	6956.4 in ³	6783.9 in ³	4566.9 in ³	4492.0 in ³	7137.9 in ³	4644.5 in ³	4965.4 in ³	6150.3 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Span 2 Section: 3

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):

tw =	0.5	in	D/tw =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
do =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{Ek}{F_{yw}}}, \text{ then:}$$

$$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{Ek}{F_{yw}}\right)$$

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

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

tw =	0.5	in	D/tw =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
do =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Span 2 Section: 3

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9526.6 in³
 Short-term S = 42589.0 in³
 Lateral Bending S = 129.4 in³

Bottom Flange:

Long-term S = 3122.0 in³
 Short-term S = 3342.8 in³
 Lateral Bending S = 86.3 in³

Load Factors:

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

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 2672 k-ft

Wearing Surface Moment = 454 k-ft

Live Load Moment = 2247 k-ft

Impact = 133%

Dead Load = DC = 3.4 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.8 ksi

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

f_{bu} = 3.4 ksi

f_{bu} = 0.6 ksi

f_{bu} = 0.8 ksi (Impact Added Here)

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

RF = 30.50 (Inv)
 RF = 39.54 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2672 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 454 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2247 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.4 ksi

WS Load = DW = 1.7 ksi

P = 0

Live Load = LL + IM = 11.3 ksi

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

f_{bu} = 10.3 ksi

f_l = 0.40 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 10.4 ksi

f_{bu} = 1.7 ksi

f_l = 0.01 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.7 ksi

f_{bu} = 8.1 ksi

f_l = 1.37 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.3 ksi (Impact Added Here)

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

RF = 1.73 (Inv)
 RF = 2.25 (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 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1

Location: Span 2

Section: 3

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 122.7 k
 WS Load = DW = 21.7 k
 P = 0
 Live Load = LL = 92.4 k
 Impact = 133%

Live Load = LL + IM = 122.9 k

Capacity = $\phi F_{nc} = C$ = 710.5 k

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

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

RF = 2.44 (Inv)
 RF = 3.16 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 120.1 k
 WS Load = DW = 22.0 k
 P = 0
 Live Load = LL = 97.4 k
 Impact = 133%

Live Load = LL + IM = 129.6 k

Capacity = $\phi F_{nc} = C$ = 987.8 k

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

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

RF = 3.55 (Inv)
 RF = 4.60 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1 Location: Span 2 Section: 3

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9526.6 in³
 Short-term S = 42589.0 in³

Bottom Flange:

Long-term S = 3122.0 in³
 Short-term S = 3342.8 in³
 Lateral Bending S = 86.3 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2672 k-ft

Wearing Surface Moment = 454 k-ft

Live Load Moment = 2247 k-ft
 Impact = 133%

Dead Load = DC = 3.4 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.4 ksi

ff = 0.6 ksi

ff = 0.8 ksi (Impact Added Here)

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

RF = 39.80 (Inv)
 RF = 51.74 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2672 k-ft

Lateral Dead Load Moment = 3 k-ft

Wearing Surface Moment = 454 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 2247 k-ft

Lateral Live Load Moment = 10 k-ft

Impact = 133%

Dead Load = DC = 10.5 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 11.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 10.3 ksi

f_l = 0.40 ksi

DC = ff + f_l/2 = 10.5 ksi

f_{bu} = 1.7 ksi

f_l = 0.01 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 8.1 ksi

f_l = 1.37 ksi

LL + IM = ff + f_l/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 = 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: Girder Section Properties - Span 1 & 2

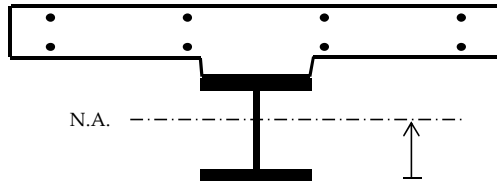
Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 5-1

Location: Span 2

Section: 3

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	12.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.3750 in
Bot. Flange Width =	18.0000 in

Deck Inputs:

Tributary Deck Width =	170.00 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	I
Top Flange	9.00 in ²	80.7500 in	726.75 in ³	48.554 in	21217.8 in ³	21218.2 in ⁴
Web	39.50 in ²	40.8750 in	1614.56 in ³	8.679 in	2975.6 in ³	23518.9 in ⁴
Bot. Flange	24.75 in ²	0.6875 in	17.02 in ³	31.508 in	24570.8 in ³	24574.7 in ⁴
Σ =	73.25 in ²		2358.33 in ³			69311.8 in ⁴

Neutral Axis = 32.196 in

Total I = I_t 69312 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
1427.5 in ³	1416.6 in ³	2199.8 in ³	2152.8 in ³	129.4 in ³	86.3 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	73.25 in ²	32.20 in	2358.33 in ³	43.03 in	135598.5 in ³	204910.3 in ⁴
Slab	226.67 in ²	89.13 in	20201.67 in ³	13.90 in	43820.2 in ³	46540.25 in ⁴
Σ =	299.92 in ²		22559.99 in ³			

Neutral Axis = 75.22 in

Total I = I_t 251451 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
45477.5 in ³	42589.0 in ³	3373.7 in ³	3342.8 in ³	48786.3 in ³	3405.1 in ³	18084.6 in ³	12633.1 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	73.25 in ²	32.20 in	2358.33 in ³	28.91 in	61203.4 in ³	130515.17 in ⁴
Slab	75.56 in ²	89.13 in	6733.89 in ³	28.02 in	59335.8 in ³	60242.42 in ⁴
Σ =	148.81 in ²		9092.22 in ³			

Neutral Axis = 61.10 in

Total I = I_t 190758 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
9708.4 in ³	9526.6 in ³	3157.5 in ³	3122.0 in ³	9897.3 in ³	3193.9 in ³	6807.0 in ³	5606.6 in ³

-2.7-

**Spans 1 & 2 - LT
(Westbound)**

Interior Girder Rating





Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Rating - Spans 1 and 2

Project #: 55060.00
 Sheet: _____
 Date: 6/22/2015
 Date: 6/23/2015

Girder 4-1 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 1	Inventory	36.23	2.02	1.94	1.43	1.43	47.48	2.71	2.71
		Operating	46.96	2.61	2.52	1.86	1.86	61.73	3.53	3.53
2	Pier 1	Inventory	1.89	3.64	---	2.55	1.89	4.94	2.81	2.81
		Operating	2.45	4.72	---	3.31	2.45	6.42	3.65	3.65
3	Span 2	Inventory	40.31	2.20	1.79	3.36	1.79	52.53	2.86	2.86
		Operating	52.26	2.86	2.32	4.35	2.32	68.29	3.72	3.72

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	Flexure
Inventory:	1.89	1.43	2.71
Operating:	2.45	1.86	3.53



Computations

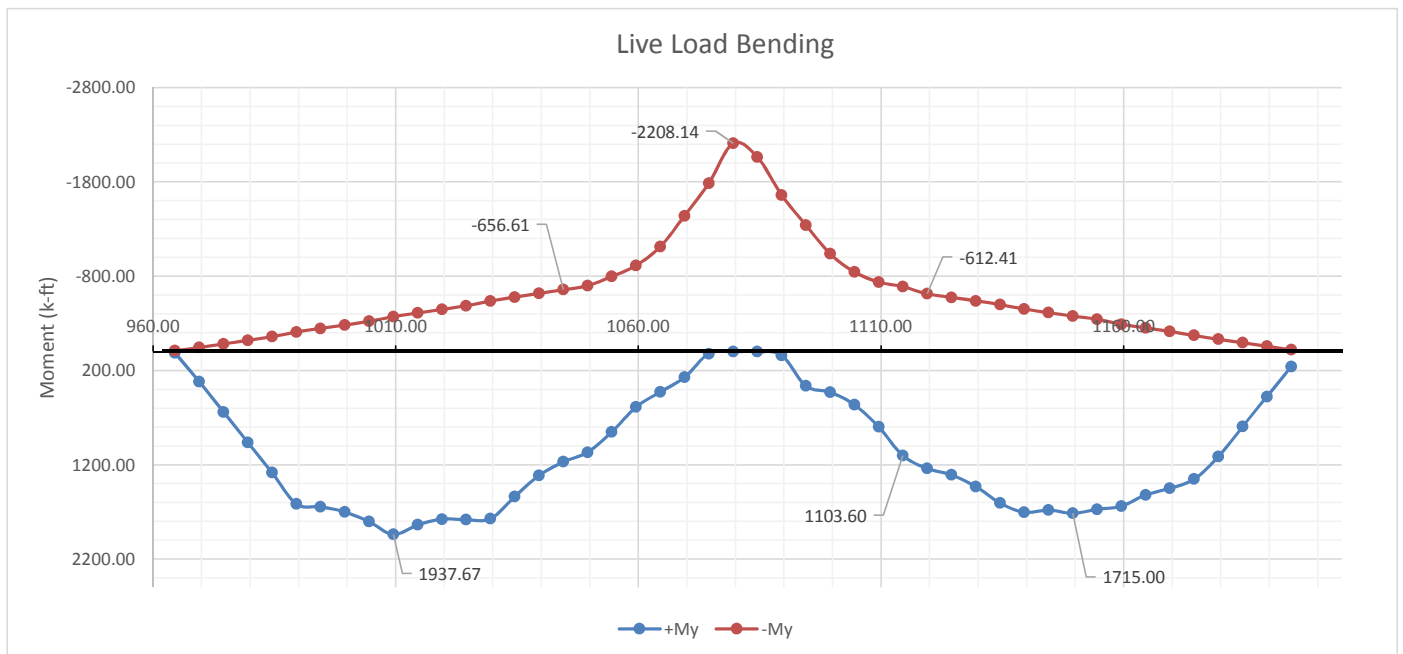
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 4-1 Spans: 1 and 2

HL-93 Live Loads Moments (no IM)

Note: By inspection 2 trucks in the RT lanes control LL for this girder.

RT Lane Only (w/m)			
Sta	M+	M-	
964.5			
Section 1:	1937.67	-656.61	
1044.5			
Section 4:	1103.60	-2208.14	
1116.75			
Section 5:	1715.00	-612.41	
0.0			





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

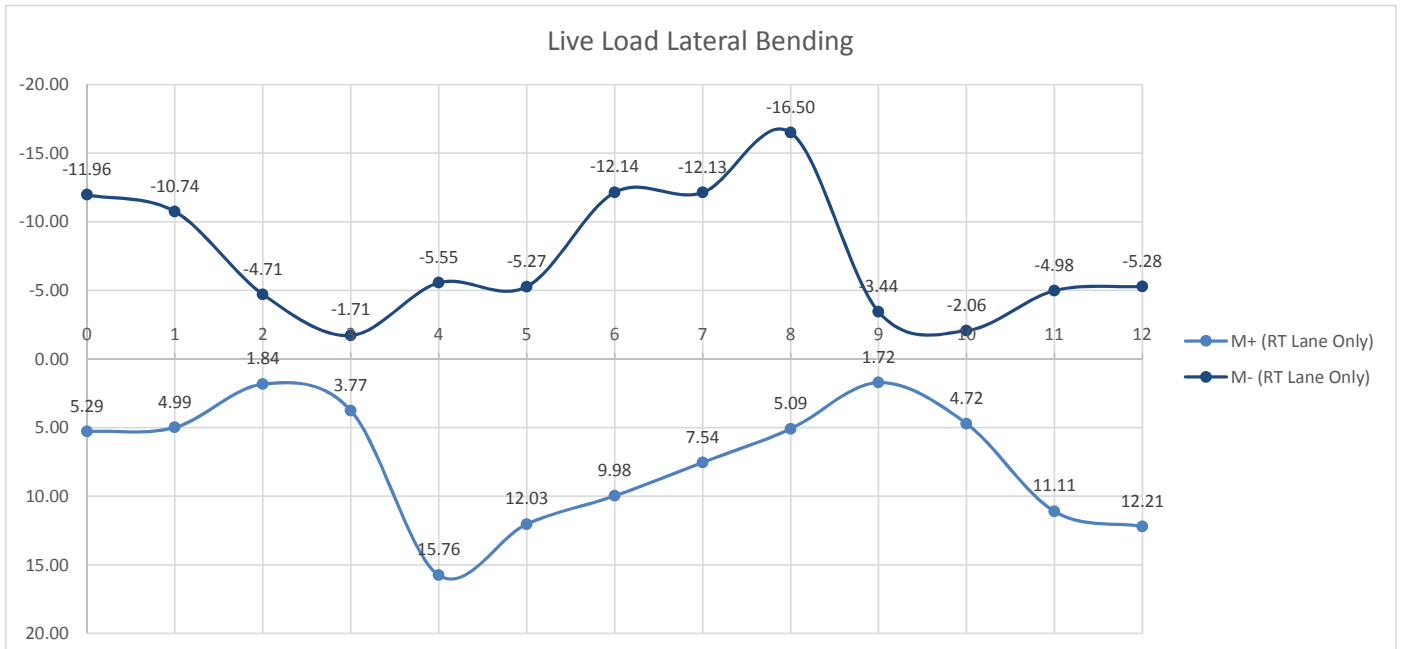
Girder 4-1 Spans: 1 and 2

Lateral Bending

Live Load - RT Lane Only (w/m)

	Node	M+	M-		Node	M	M
0	114	5.29	-11.96	0	114	1.00	0.84
1	88	4.99	-10.74	1	88	0.99	0.74
2	62	1.84	-4.71	2	62	0.36	0.19
3	37	3.77	-1.71	3	37	0.32	0.40
4	17	15.76	-5.55	4	17	1.33	0.59
5	11	12.03	-5.27	5	11	2.77	0.75
6	7	9.98	-12.14	6	7	1.96	1.05
7	9	7.54	-12.13	7	9	3.87	0.18
8	21	5.09	-16.50	8	21	4.53	0.13
9	42	1.72	-3.44	9	42	0.76	0.12
10	64	4.72	-2.06	10	64	0.99	0.06
11	90	11.11	-4.98	11	90	2.56	0.08
12	112	12.21	-5.28	12	112	2.83	0.09

	M+	M-		M	M
Section 1:	16	-12	Section 1:	1	0
Section 4:	16	-17	Section 4:	5	0
Section 5:	12	-17	Section 5:	5	0





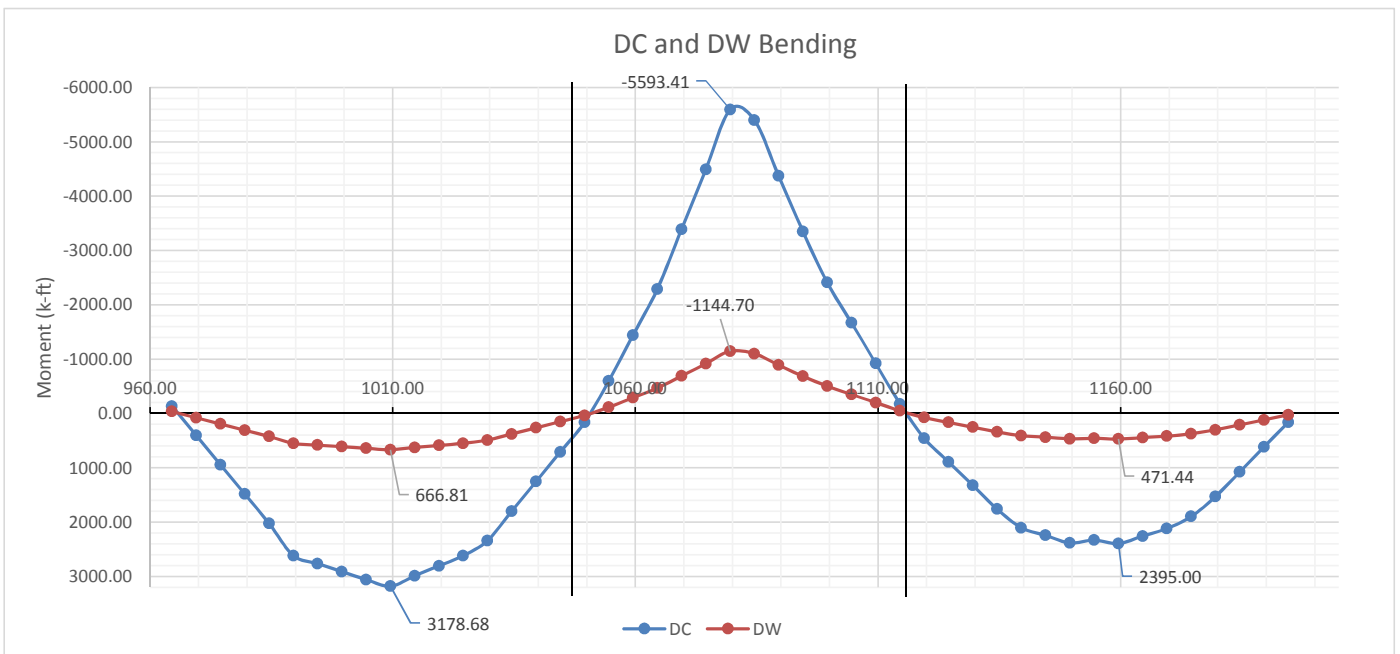
Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 4-1 Spans: 1 and 2

Dead and Wearing Surface Moments

Station	DC		DW	
	M+	M-	M+	M-
964.5				
Section 1:	3178.68	-134.11	666.81	-35.27
1044.5				
Section 4:	165.19	-5593.41	37.00	-1144.70
1116.8				
Section 5:	2395.00	162.36	471.44	27.33
0.0				





Computations

Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet: _____
Calculated by: JGM	Date: 6/22/2015
Checked by: CTA	Date: 6/23/2015
Title: Loads - Spans: 1 and 2	

Girder 4-1 Spans: 1 and 2

Shears:

	Station	LL		DC		DW	
		V+	V-	V+	V-	V+	V-
	964.5	153.98	-7.64	183.75	183.75	41.04	41.04
Section 1:		134.46	-83.84	165.59	-133.24	36.71	-28.50
	1034.5						
Section 4:		135.84	-142.09	227.30	-247.52	46.69	-51.82
	1116.75						
Section 5:		94.50	-101.41	124.78	-117.01	26.55	-24.35
	0.00	8.09	-121.05	-131.19	-131.19	-27.68	-27.68

	LL		DC		DW
	Vmax		Vmax		Vmax
Section 1 (End):	154.0	Section 1 (End):	183.7	Section 1 (End):	41.0
Section 1 (Interior):	134.5	Section 1 (Interior):	165.6	Section 1 (Interior):	36.7
Section 4 (Interior):	142.1	Section 4 (Interior):	247.5	Section 4 (Interior):	51.8
Section 5 (Interior):	101.4	Section 5 (Interior):	124.8	Section 5 (Interior):	26.5
Section 5 (End):	121.0	Section 5 (End):	131.2	Section 5 (End):	27.7



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 1 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 =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	136.3
d _o =	39	in	1.4√Ek/f _{yw} =	170.3

V _p =	1145.5	k	k =	25.5	in
V _n =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

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

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

t _w =	0.5	in	D/t _w =	158.0
D =	79	in	1.12√Ek/f _{yw} =	72.6
d _o =	118	in	1.4√Ek/f _{yw} =	90.7

V _p =	1145.5	k	k =	7.2	in
V _n =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 1 Section: 1

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10124.5 in³
 Short-term S = 44451.8 in³
 Lateral Bending S = 153.0 in³

Bottom Flange:

Long-term S = 3436.2 in³
 Short-term S = 3667.7 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 = 3179 k-ft

Wearing Surface Moment = 667 k-ft

Live Load Moment = 1938 k-ft

Impact = 133%

Dead Load = DC = 3.8 ksi

WS Load = DW = 0.8 ksi

P = 0

Live Load = LL + IM = 0.7 ksi

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

f_{bu} = 3.8 ksi

f_{bu} = 0.8 ksi

f_{bu} = 0.7 ksi (Impact Added Here)

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

RF = 36.23 (Inv)
 RF = 46.96 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 3179 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 667 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1938 k-ft

Lateral Live Load Moment = 16 k-ft

Impact = 133%

Dead Load = DC = 11.2 ksi

WS Load = DW = 2.3 ksi

P = 0

Live Load = LL + IM = 9.2 ksi

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

f_{bu} = 11.1 ksi

f_l = 0.15 ksi

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

f_{bu} = 2.3 ksi

f_l = 0.02 ksi

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

f_{bu} = 6.3 ksi

f_l = 1.81 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 = 2.02 (Inv)
 RF = 2.61 (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 1 and 2

Project #: 55060.00

Sheet:

Date: 6/22/2015

Date: 6/23/2015

Girder: 4-1

Location: Span 1

Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	183.7	k
WS Load = DW =	41.0	k
P =	0	
Live Load = LL =	154.0	k
Impact =	133%	

Live Load = LL + IM = 204.8 k

Capacity = $\phi F_{nc} = C$ = 987.8 k

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

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

RF = 1.94 (Inv)
 RF = 2.52 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	165.6	k
WS Load = DW =	36.7	k
P =	0	
Live Load = LL =	134.5	k
Impact =	133%	

Live Load = LL + IM = 178.8 k

Capacity = $\phi F_{nc} = C$ = 710.5 k

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

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

RF = 1.43 (Inv)
 RF = 1.86 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 1 Section: 1

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 10124.5 in³
 Short-term S = 44451.8 in³

Bottom Flange:

Long-term S = 3436.2 in³
 Short-term S = 3667.7 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 3179 k-ft

Wearing Surface Moment = 667 k-ft

Live Load Moment = 1938 k-ft
 Impact = 133%

Dead Load = DC = 3.8 ksi

WS Load = DW = 0.8 ksi

P = 0

Live Load = LL + IM = 0.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.8 ksi

ff = 0.8 ksi

ff = 0.7 ksi (Impact Added Here)

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

RF = 47.48 (Inv)
 RF = 61.73 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 3179 k-ft

Lateral Dead Load Moment = 1 k-ft

Wearing Surface Moment = 667 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1938 k-ft

Lateral Live Load Moment = 16 k-ft

Impact = 133%

Dead Load = DC = 11.2 ksi

WS Load = DW = 2.3 ksi

P = 0

Live Load = LL + IM = 9.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 11.1 ksi

f_l = 0.15 ksi

DC = ff + f_l/2 = 11.2 ksi

f_{bu} = 2.3 ksi

f_l = 0.02 ksi

DW = ff + f_l/2 = 2.3 ksi

f_{bu} = 6.3 ksi

f_l = 1.81 ksi

LL + IM = ff + f_l/2 = 9.6 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)



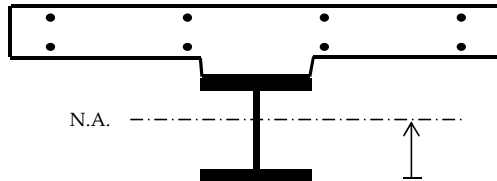
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 1 Section: 1

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	13.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.5000 in
Bot. Flange Width =	19.0000 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	I
Top Flange	9.75 in ²	80.8750 in	788.53 in ³	49.629 in	24014.2 in ³	24014.7 in ⁴
Web	39.50 in ²	41.0000 in	1619.50 in ³	9.754 in	3757.8 in ³	24301.0 in ⁴
Bot. Flange	28.50 in ²	0.7500 in	21.38 in ³	30.496 in	26505.8 in ³	26511.2 in ⁴
Σ =	77.75 in ²		2429.41 in ³			74826.9 in ⁴

Neutral Axis = 31.246 in

Total I = I_t 74827 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
1507.7 in ³	1496.4 in ³	2453.6 in ³	2394.7 in ³	153.0 in ³	104.7 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	43.81 in	149232.0 in ³	224058.9 in ⁴
Slab	240.00 in ²	89.25 in	21420.00 in ³	14.19 in	48344.9 in ³	51224.95 in ⁴
Σ =	317.75 in ²		23849.41 in ³			

Neutral Axis = 75.06 in

Total I = I_t 275284 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
47317.0 in ³	44451.8 in ³	3704.7 in ³	3667.7 in ³	50577.1 in ³	3742.4 in ³	19395.9 in ³	13632.7 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	77.75 in ²	31.25 in	2429.41 in ³	29.42 in	67274.7 in ³	142101.63 in ⁴
Slab	80.00 in ²	89.25 in	7140.00 in ³	28.59 in	65382.6 in ³	66342.60 in ⁴
Σ =	157.75 in ²		9569.41 in ³			

Neutral Axis = 60.66 in

Total I = I_t 208444 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
10312.3 in ³	10124.5 in ³	3479.2 in ³	3436.2 in ³	10507.2 in ³	3523.3 in ³	7291.3 in ³	6026.5 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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Pier 1 Section: 2

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 =	27	in	λ_f =	7.714
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 =	0.5625	in	Dc =	41.13	in (Non-Comp)
Lb =	168.0	in	rt =	7.227	in
Cb =	1.0	(Conservative)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 ksi

Lp = 174.0 in
 Lr = 654 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)

0.95RhFyf = 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 =	0.5625	in	D/tw =	140.4
D =	79	in	1.12√Ek/fyw =	116.2
do =	48	in	1.4√Ek/fyw =	145.2
			C =	0.83

k = 18.5 in
 Vp = 1288.7 k
 Vn = 1231.5 k

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

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

$\phi_v \phi_c \phi_s V_n = 1231.5$ 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 1 and 2

Project #: 55060.00

Sheet:

Date: 6/22/2015

Date: 6/23/2015

Girder: 4-1

Location: Pier 1

Section: 2

Flexure Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6783.9 in³
 Lateral Bending S = 394.9 in³

Bottom Flange S = 4492.0 in³
 Lateral Bending S = 394.9 in³

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 = -5593 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1145 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2208 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 15.0 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 8.1 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 14.9 ksi
 f_l = 0.14 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 15.0 ksi

f_{bu} = 3.1 ksi
 f_l = 0.00 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 3.1 ksi

f_{bu} = 5.9 ksi
 f_l = 0.50 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 8.1 ksi (Impact Added Here)

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

RF = 1.89 (Inv)
RF = 2.45 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -5593 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1145 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2208 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 9.9 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 5.4 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 9.9 ksi
 f_l = 0.14 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 9.9 ksi

f_{bu} = 2.0 ksi
 f_l = 0.00 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 2.0 ksi

f_{bu} = 3.9 ksi
 f_l = 0.50 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 5.4 ksi (Impact Added Here)

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

RF = 3.64 (Inv)
RF = 4.72 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/22/2015

Checked by: CTA

Date: 6/23/2015

Title: Capacities and Rating Factors - Spans 1 and 2

Girder: 4-1

Location: Pier 1

Section: 2

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	247.5	k
WS Load = DW =	51.8	k
P =	0	
Live Load = LL =	142.1	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 =	189.0	k
Capacity = ϕF_{nc} = C =	1231.5	k

RF =	2.55	(Inv)
RF =	3.31	(Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
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 Checked by: CTA
 Title: Capacities and Rating Factors - Spans 1 and 2

Project #: 55060.00

Sheet:

Date: 6/22/2015

Date: 6/23/2015

Girder: 4-1

Location: Pier 1

Section: 2

Service Rating Factors:

Negative Moment

Noncomposite Section w/ Rebar

Load Factors:

Section Properties:

Top Flange S = 6783.9 in³
 Lateral Bending S = 394.9 in³

Bottom Flange S = 4492.0 in³
 Lateral Bending S = 394.9 in³

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 = -5593 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1145 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2208 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 15.0 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 8.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

f_f = 14.9 ksi
 f_l = 0.14 ksi
 $DC = f_f + f_l/2 = 15.0$ ksi

f_f = 3.1 ksi
 f_l = 0.00 ksi
 $DW = f_f + f_l/2 = 3.1$ ksi

f_f = 5.9 ksi
 f_l = 0.50 ksi
 $LL + IM = f_f + f_l/2 = 8.1$ ksi (Impact Added Here)

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

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

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -5593 k-ft
 Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = -1145 k-ft
 Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = -2208 k-ft
 Lateral Live Load Moment = 17 k-ft
 Impact = 133%

Dead Load = DC = 10.0 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 5.5 ksi
 95RhFyf = C = 47.5 ksi

f_f = 9.9 ksi
 f_l = 0.14 ksi
 $DC = f_f + f_l/2 = 10.0$ ksi

f_f = 2.0 ksi
 f_l = 0.00 ksi
 $DW = f_f + f_l/2 = 2.0$ ksi

f_f = 3.9 ksi
 f_l = 0.50 ksi
 $LL + IM = f_f + f_l/2 = 5.5$ ksi (Impact Added Here)

RF = 4.94 (Inv)
 RF = 6.42 (Op)



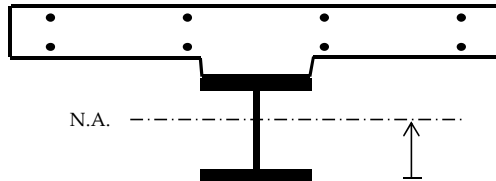
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Pier 1 Section: 2

Non-Composite Section Properties w/ Rebar:



Girder Inputs:

Top Flange Thickness =	1.6250 in
Top Flange Width =	27.0000 in
Web Thickness =	0.5625 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.6250 in
Bot. Flange Width =	27.0000 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 =	# 8
Top Bar Spacing =	7.40 in
Top C.C. =	2.00 in
Bot. Bar Number =	# 6
Bot. Bar Spacing =	11.50 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	I
Top Flange	43.88 in ²	81.4375 in	3573.07 in ³	40.313 in	71301.2 in ³	71310.8 in ⁴
Web	44.44 in ²	41.1250 in	1827.49 in ³	0.000 in	0.0 in ³	23111.2 in ⁴
Bot. Flange	43.88 in ²	0.8125 in	35.65 in ³	40.313 in	71301.2 in ³	71310.8 in ⁴
Σ =	132.19 in ²		5436.21 in ³			165732.8 in ⁴

Neutral Axis = 41.125 in
 Total I = I_t 165733 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
4111.2 in ³	4030.0 in ³	4111.2 in ³	4030.0 in ³	394.9 in ³	394.9 in ³

With Reinforcing Steel:

Component	Area	d	A*d	Y	A*Y ²	I
Girder	132.19 in ²	41.13 in	5436.21 in ³	8.36 in	9236.34 in ³	174969.2 in ⁴
Top Bars	19.10 in ²	94.25 in	1800.58 in ³	44.77 in	38284.86 in ³	38284.9 in ⁴
Bot. Bars	6.91 in ²	85.63 in	591.67 in ³	36.14 in	9025.64 in ³	9025.7 in ⁴
Σ =	158.20 in ²		7828.46 in ³			

Neutral Axis = 49.48 in
 Total I = I_t 222279.7 in⁴

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
	6956.4 in ³	6783.9 in ³	4566.9 in ³	4492.0 in ³	7137.9 in ³	4644.5 in ³	4965.4 in ³	6150.3 in ³



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
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 Checked by: CTA
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Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 2 Section: 3

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 (End Panels) (6.10.9.3.3):

tw =	0.5	in	D/tw =	158.0
D =	79	in	$1.12 \sqrt{E k} / f_{yw} =$	136.3
do =	39	in	$1.4 \sqrt{E k} / f_{yw} =$	170.3

Vp =	1145.5	k	k =	25.5	in
Vn =	987.8	k	C =	0.86	

$$\phi_v \phi_c \phi_s V_n = 987.8 \text{ k}$$

$$V_n = C V_p$$

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

$$\frac{D}{t_w} > 1.40 \sqrt{\frac{E k}{F_{yw}}}, \text{ then:}$$

$$C = \frac{1.57}{\left(\frac{D}{t_w}\right)^2} \left(\frac{E k}{F_{yw}}\right)$$

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

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

tw =	0.5	in	D/tw =	158.0
D =	79	in	$1.12 \sqrt{E k} / f_{yw} =$	72.6
do =	118	in	$1.4 \sqrt{E k} / f_{yw} =$	90.7

Vp =	1145.5	k	k =	7.2	in
Vn =	710.5	k	C =	0.26	

$$\phi_v \phi_c \phi_s V_n = 710.5 \text{ k}$$

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



Computations

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Sheet:

Date: 6/22/2015

Date: 6/23/2015

Girder: 4-1

Location: Span 2

Section: 3

Flexure Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9526.6 in³

Short-term S = 42589.0 in³

Lateral Bending S = 129.4 in³

Bottom Flange:

Long-term S = 3122.0 in³

Short-term S = 3342.8 in³

Lateral Bending S = 86.3 in³

Load Factors:

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

Top Flange (Compression):

Noncompact Sections (LRFD 6.10.7.2.1):

Dead Load Moment = 2395 k-ft

Wearing Surface Moment = 471 k-ft

Live Load Moment = 1715 k-ft

Impact = 133%

Dead Load = DC = 3.0 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

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

$f_{bu} = 3.0$ ksi

$f_{bu} = 0.6$ ksi

$f_{bu} = 0.6$ ksi (Impact Added Here)

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

RF = 40.31 (Inv)
 RF = 52.26 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 2395 k-ft

Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = 471 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1715 k-ft

Lateral Live Load Moment = 17 k-ft

Impact = 133%

Dead Load = DC = 9.4 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 9.2 ksi

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

$f_{bu} = 9.2$ ksi

$f_l = 0.63$ ksi

DC = $f_{bu} + \frac{1}{2}f_l = 9.4$ ksi

$f_{bu} = 1.8$ ksi

$f_l = 0.01$ ksi

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

$f_{bu} = 6.2$ ksi

$f_l = 2.30$ 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 = 2.20 (Inv)
 RF = 2.86 (Op)



Computations

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Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 2 Section: 3

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 131.2 k
 WS Load = DW = 27.7 k
 P = 0
 Live Load = LL = 121.0 k
 Impact = 133%

Live Load = LL + IM = 161.0 k

Capacity = $\phi F_{nc} = C$ = 710.5 k

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

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

RF = 1.79 (Inv)
 RF = 2.32 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC = 124.8 k
 WS Load = DW = 26.5 k
 P = 0
 Live Load = LL = 101.4 k
 Impact = 133%

Live Load = LL + IM = 134.9 k

Capacity = $\phi F_{nc} = C$ = 987.8 k

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

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

RF = 3.36 (Inv)
 RF = 4.35 (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 1 and 2

Project #: 55060.00

Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 2 Section: 3

Service Rating Factors:

Positive Moment

Composite Section

Section Properties:

Top Flange:

Long-term S = 9526.6 in³
 Short-term S = 42589.0 in³

Bottom Flange:

Long-term S = 3122.0 in³
 Short-term S = 3342.8 in³
 Lateral Bending S = 86.3 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 Requirements (LRFD 6.10.4.2.2-1)

Dead Load Moment = 2395 k-ft

Wearing Surface Moment = 471 k-ft

Live Load Moment = 1715 k-ft
 Impact = 133%

Dead Load = DC = 3.0 ksi

WS Load = DW = 0.6 ksi

P = 0

Live Load = LL + IM = 0.6 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 3.0 ksi

ff = 0.6 ksi

ff = 0.6 ksi (Impact Added Here)

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

RF = 52.53 (Inv)
 RF = 68.29 (Op)

Bottom Flange (Tension):

Service Flexural Requirements (LRFD 6.10.4.2.2-2)

Dead Load Moment = 2395 k-ft

Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = 471 k-ft

Lat. Wearing Surface Moment = 0 k-ft

Live Load Moment = 1715 k-ft

Lateral Live Load Moment = 17 k-ft

Impact = 133%

Dead Load = DC = 9.5 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 9.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 9.2 ksi

f_l = 0.63 ksi

DC = ff + f_l/2 = 9.5 ksi

f_{bu} = 1.8 ksi

f_l = 0.01 ksi

DW = ff + f_l/2 = 1.8 ksi

f_{bu} = 6.2 ksi

f_l = 2.30 ksi

LL + IM = ff + f_l/2 = 9.7 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)



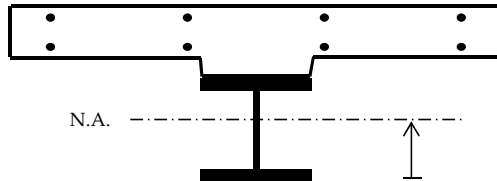
Computations

Project: Br # 1558 - 2015 Maine Load Ratings
 Location: Bangor/Brewer, ME
 Calculated by: JGM
 Checked by: CTA
 Title: Girder Section Properties - Span 1 & 2

Project #: 55060.00
 Sheet:
 Date: 6/22/2015
 Date: 6/23/2015

Girder: 4-1 Location: Span 2 Section: 3

Composite Section Properties:



Girder Inputs:

Top Flange Thickness =	0.7500 in
Top Flange Width =	12.0000 in
Web Thickness =	0.5000 in
Web Depth =	79.0000 in
Bot. Flange Thickness =	1.3750 in
Bot. Flange Width =	18.0000 in

Deck Inputs:

Tributary Deck Width =	170.00 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	I
Top Flange	9.00 in ²	80.7500 in	726.75 in ³	48.554 in	21217.8 in ³	21218.2 in ⁴
Web	39.50 in ²	40.8750 in	1614.56 in ³	8.679 in	2975.6 in ³	23518.9 in ⁴
Bot. Flange	24.75 in ²	0.6875 in	17.02 in ³	31.508 in	24570.8 in ³	24574.7 in ⁴
Σ =	73.25 in ²		2358.33 in ³			69311.8 in ⁴

Neutral Axis = 32.196 in
 Total I = I_t = 69312 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
1427.5 in ³	1416.6 in ³	2199.8 in ³	2152.8 in ³	129.4 in ³	86.3 in ³

Short Term Composite (n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	73.25 in ²	32.20 in	2358.33 in ³	43.03 in	135598.5 in ³	204910.3 in ⁴
Slab	226.67 in ²	89.13 in	20201.67 in ³	13.90 in	43820.2 in ³	46540.25 in ⁴
Σ =	299.92 in ²		22559.99 in ³			

Neutral Axis = 75.22 in
 Total I = I_t = 251451 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
45477.5 in ³	42589.0 in ³	3373.7 in ³	3342.8 in ³	48786.3 in ³	3405.1 in ³	18084.6 in ³	12633.1 in ³

Long Term Composite (3n):

Component	Area	d	A*d	Y	A*Y ²	I
Girder	73.25 in ²	32.20 in	2358.33 in ³	28.91 in	61203.4 in ³	130515.17 in ⁴
Slab	75.56 in ²	89.13 in	6733.89 in ³	28.02 in	59335.8 in ³	60242.42 in ⁴
Σ =	148.81 in ²		9092.22 in ³			

Neutral Axis = 61.10 in
 Total I = I_t = 190758 in⁴

Section Mod. = S =

Top Flange		Bot. Flange		Web		Slab	
Mid Flange	Extm. Fiber	Mid Flange	Extm. Fiber	Top	Bott	Mid	Extm. Fiber
9708.4 in ³	9526.6 in ³	3157.5 in ³	3122.0 in ³	9897.3 in ³	3193.9 in ³	6807.0 in ³	5606.6 in ³

-3.0-

Spans 3-8

Load Rating Calculations





Computations

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

Project #: 55060.00
 Sheet:
 Date: 7/18/2015
 Date: 7/20/2015

Spans 3-8 Rating Summary

			Strength		Service	
			Inventory	Operating	Inventory	Operating
Interior Grider (G7-2)	Moment	Span 3	1.56	2.02	2.27	2.95
		Pier 3	1.05	1.86	1.82	2.37
		Span 4	1.07	1.39	1.75	2.27
		Pier 4	1.01	1.31	1.88	2.45
		Span 5	1.88	2.43	2.57	3.34
		Pier 5	1.25	1.62	2.17	2.82
		Span 6	2.01	2.61	2.72	3.54
		Pier 6	1.12	1.45	2.15	2.80
		Span 7	1.69	2.19	2.33	3.03
		Pier 7	1.14	1.48	2.15	2.79
		Span 8	1.63	2.11	2.33	3.02
	Shear	Pier 2	1.36	1.77		
		Pier 3	2.40	3.11		
		Pier 4	2.22	2.87		
		Pier 5	1.90	2.47		
		Pier 6	1.85	2.39		
		Pier 7	1.96	2.55		
		Abut 2	1.40	1.82		

			Strength		Service	
			Inventory	Operating	Inventory	Operating
Exterior Grider (G8-2)	Moment	Span 3	1.40	1.81	2.00	2.60
		Pier 3	1.49	2.77	2.51	3.27
		Span 4	1.16	1.50	1.74	2.27
		Pier 4	1.44	1.87	2.60	3.38
		Span 5	1.87	2.42	2.54	3.31
		Pier 5	1.78	2.31	2.96	3.85
		Span 6	1.93	2.50	2.60	3.38
		Pier 6	1.56	2.02	2.86	3.72
		Span 7	1.57	2.03	2.15	2.79
		Pier 7	1.57	2.04	2.96	3.85
		Span 8	1.55	2.01	2.18	2.84
	Shear	Pier 2	1.43	1.86		
		Pier 3	2.71	3.52		
		Pier 4	2.39	3.10		
		Pier 5	2.38	3.08		
		Pier 6	2.39	3.10		
		Pier 7	2.55	3.30		
		Abut 2	1.88	2.44		

-3.1-

Spans 3-8

Assumptions and Methods





Computations

Project:	Br # 1558 - 2015 Maine Load Ratings	Project #:	55060.00
Location:	Bangor/Brewer, ME	Sheet:	
Calculated by:	JGM	Date:	7/3/2015
Checked by:	CTA	Date:	7/4/2015
Title:	Modeling Assumptions and Methodology		

Model and Rating Layout:

The bridge is broken out into three segments, each segment is modeled and rated separately (see attached sketch). The girder sections for each bridge segment are identical. The three bridge segments are:

1. Spans 1 & 2 - LT (Westbound)
2. Spans 1 & 2 - RT (Eastbound)
3. Spans 3-8

General Model Assumptions:

1. All dimension are per the 1984 As-Built Plans.
2. LARSA 4D Structural and Earthquake Engineering Integrated Analysis and Design Software 7.08 is used to model this bridge.
3. The beams are modeled using line elements which are assigned the appropriate section properties. Beam section properties are generated using the LARSA Section Composer.
4. The deck is modeled using classic plate elements. Plate nodes are offset from the beam nodes and are connected via rigid links.
5. Crossframes are modeled using line elements. Crossframes are modeled separately and the Simplified Euler-Bernoulli Approximation method is used to determine the equivalent stiffness. The moment fixity was released at the end of each crossframe, at the beam connection. An equivalent area is assigned to each crossframe element to account for the dead load of each frame.
6. The effects of superelevation and vertical curve are assumed negligible and are not included in the model.
7. Bottom flange lateral bracing is not included in the model.

Material Properties:

1. Structural Steel - ASTM A588, $F_y = 50\text{ksi}$
2. Reinforcing Steel - ASTM A615, $F_y = 60\text{ksi}$
3. Concrete - Class A, $f'_c = 3.0\text{ksi}$

Dead Loads:

1. Girder and deck self weights are generated by LARSA based on the assigned material properties and beam areas. Deck thickness varies from 12½" to 11", see model calculations.
2. The dead loads due to the median barrier and exterior curb/railing are applied as equivalent point loads to each fascia plate.
3. The dead loads due to deck haunch and detail factor are applied as line load across each girder. See model calculations.
A detail factor of 10% is assumed, this does not include the weight of crossframes.
4. The total wearing surface thickness is 3¾". Although the bridge has been resurfaced, the pavement thickness is assumed to be the same as the stated on the as-built plans. Wearing surface loads are applied as an uniform load to each plate. The uniform load is reduced for fascia plates that are partially covered by a curb or barrier.
5. The dead load of the overhead sign structure is applied as three point loads in span three. The loads are determined based shop drawings for a similar structure.

Rating Notes and Assumptions:

1. The load rating was performed in accordance with Maine Department of Transportation Load Rating Guidelines (April 2015).
2. The girders are rated for the HL-93 load case. All inventory rating factors are greater than 1.0, MaineDOT legal loads are not considered.
3. The bridge was evaluated at the strength and service limit states. The service limit state is only for serviceability considerations and is excluded from rating evaluations per MaineDOT Load Rating Guidelines (3.7.1)
4. Continuous lateral bracing of the top flange assumed per MBE 6A.6.9.3
5. Condition (ϕ_c) and System (ϕ_s) factors are both = 1.0.
6. Capacity was checked in accordance with AASHTO LRFD Design Specification, Section 6.10.
7. Composite action is assume throughout the bridge.
Flexural capacities in positive moment regions are calculated based on the girder steel and transformed concrete deck.
Flexural capacities in negative moment regions are calculated based on the girder steel and reinforcing deck steel.
Lateral Bending Capacities are calculated based on the girder steel properties only.
Shear capacities are calculated based on the girder web steel only.



Computations

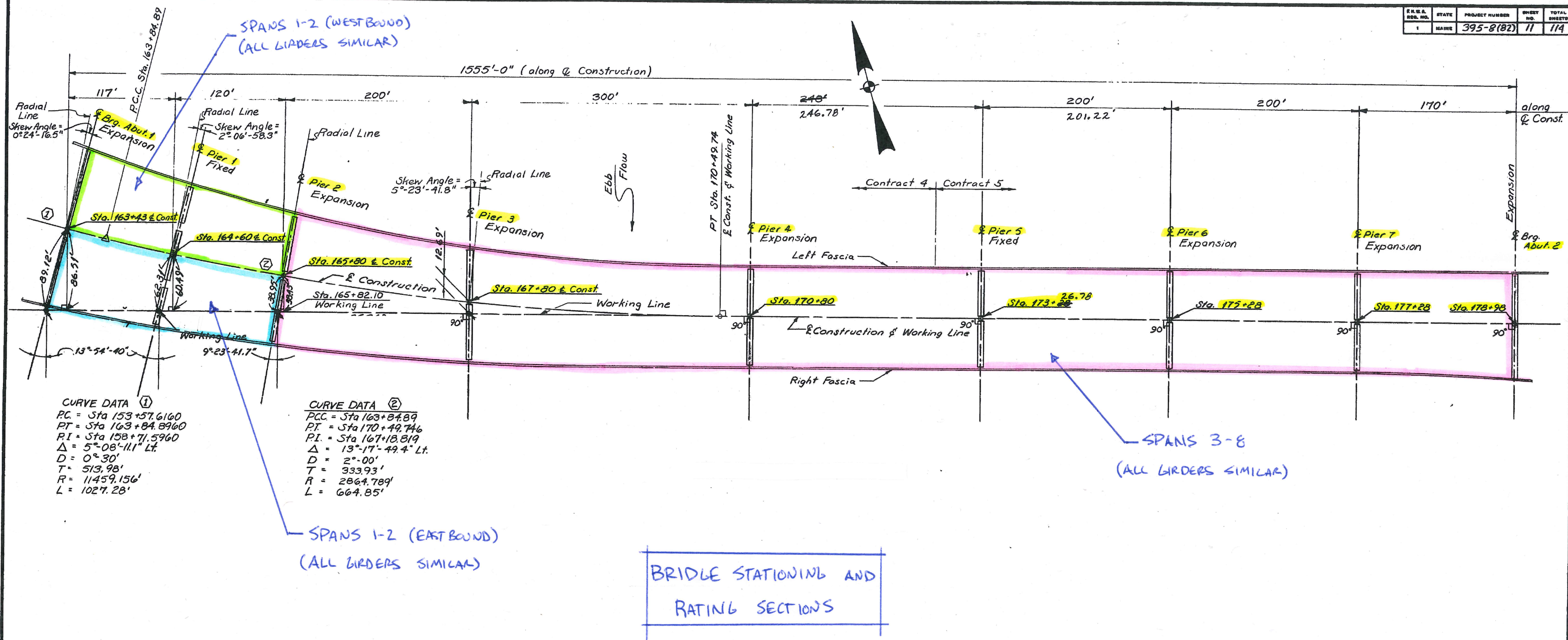
Project: Br # 1558 - 2015 Maine Load Ratings	Project #: 55060.00
Location: Bangor/Brewer, ME	Sheet:
Calculated by: JGM	Date: 7/18/2015
Checked by: CTA	Date: 7/20/2015
Title: Modeling Assumptions and Methodology	

Live Loading Spans 3-8:

Note: Due to the size and complexity of the spans 3-8 model, live load surfaces can not be used efficiently. The method outlined below has been checked to ensure accuracy and proper distribution of live load to all girders across the bridge.

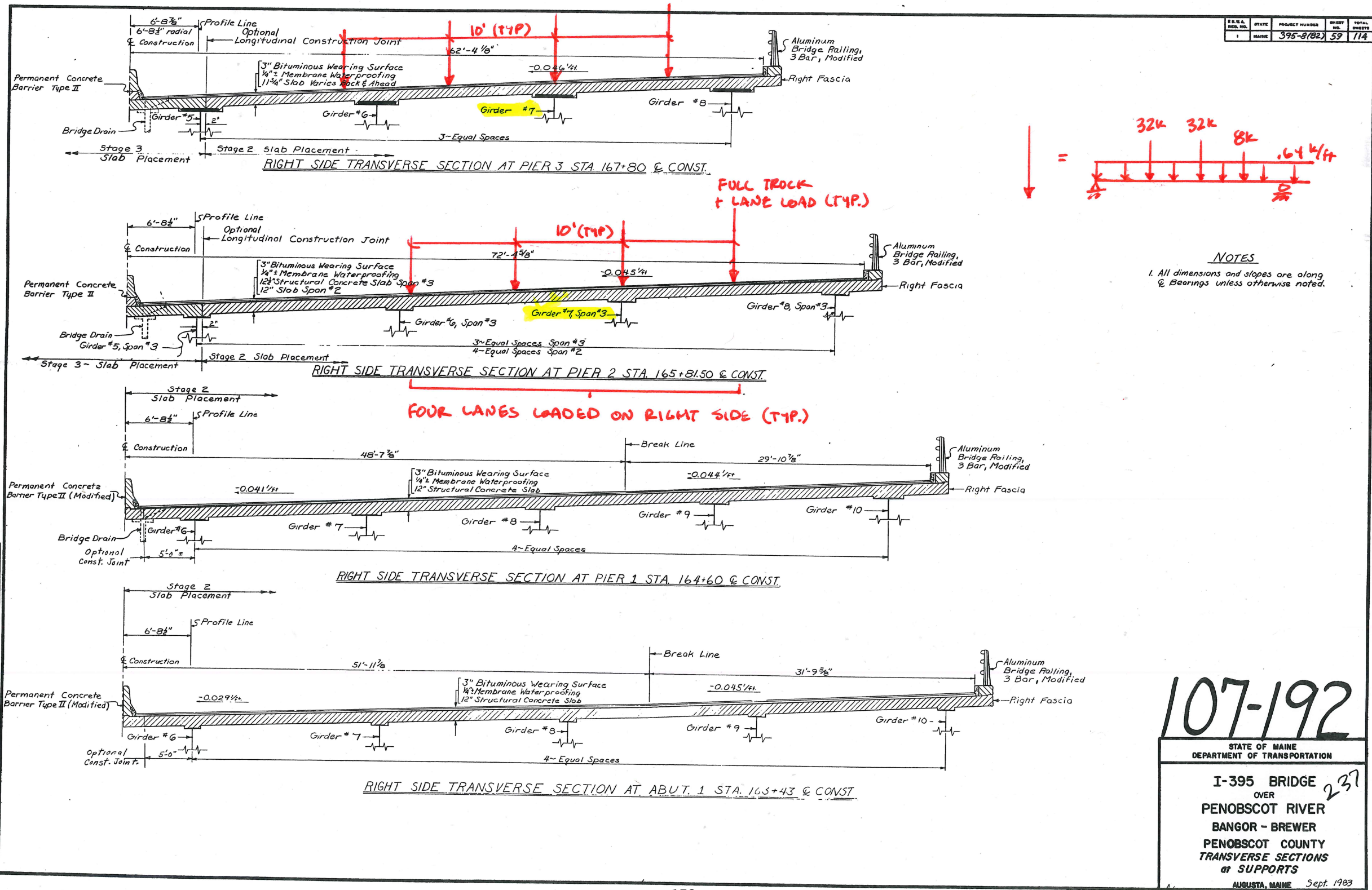
The following steps are used to generate the worst case loading for each beam section:

1. Each lane is represented using a single line/influence load. The first line (lane) load is placed to create the worst case loading to the girder in question. Each subsequent line (lane) load is placed 10.0' to the right or left as appropriate. See attached sketches for assumed lane spacing and grouping.
Each lane/influence load has a forward increment of 2.0'.
2. LARSA is used to generate an "Influence Line Case", which applies difference live load configuration for each point along influence line. The following live load configurations are considered for each influence line:
 - HL-93 Truck + Lane
 - HL-93 Tandem + Lane
 - 90% HL-93 Double Truck + 90% Lane (Negative Moment Region Only)Centrifugal forces are applied here.
Impact is not added here, it is applied in the actual rating calculations.
Only one lane is loaded at a time, multipresence factor are not applied here. They are applied in the actual rating calculations.
3. Each composite girder is defined by grouping each beam element with the adjacent plate elements.
4. Composite shears and moments are generated using the "Compound Element Forces" tool in LARSA.
Each composite beam is sliced at 5.0' intervals along the longitudinal axis of the bridge.
5. Spreadsheets are used to combine lanes and determine the maximum moments and shears for each girder section.
Multipresence factors are applied here.



Revision	Date	STATE OF MAINE DEPARTMENT OF TRANSPORTATION I-395 BRIDGE OVER PENOBSCOT RIVER BANGOR - BREWER PENOBSCOT COUNTY SUBSTRUCTURE LAYOUT AUGUSTA, MAINE Sept. 1983
△ Station change	4-9-84	

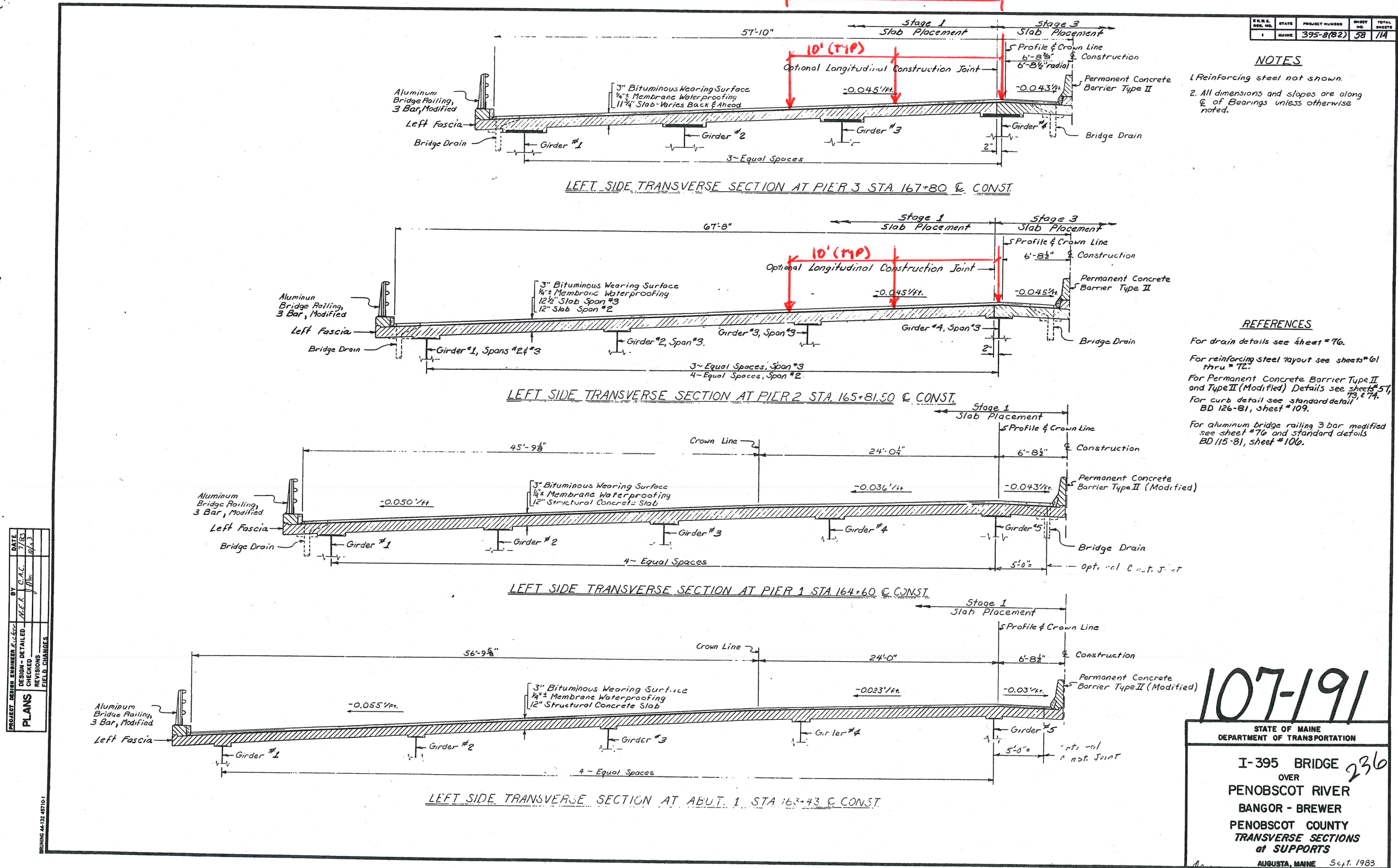
GIRDER #7-2 LIVE LOADING (SPANS 3-8)



GIRDER # 7-2 LIVE LOADING

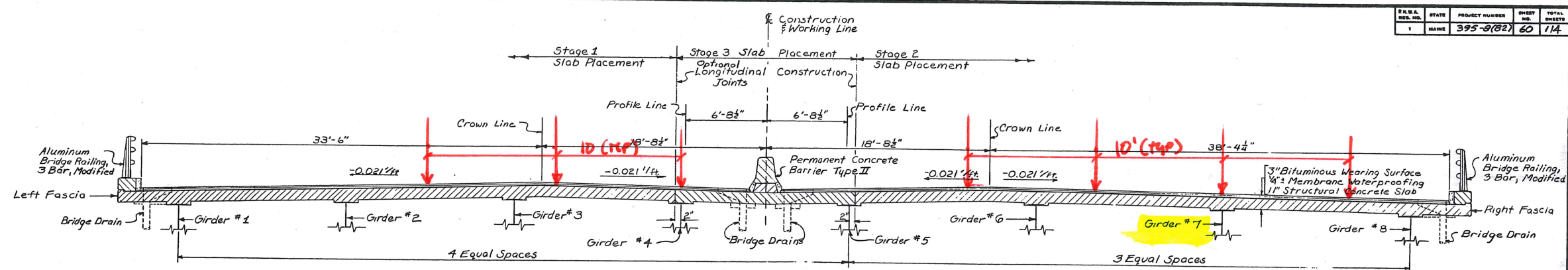
(SPANS 3-8)

THREE LANES LOADED ON LEFT SIDE (TYP.)

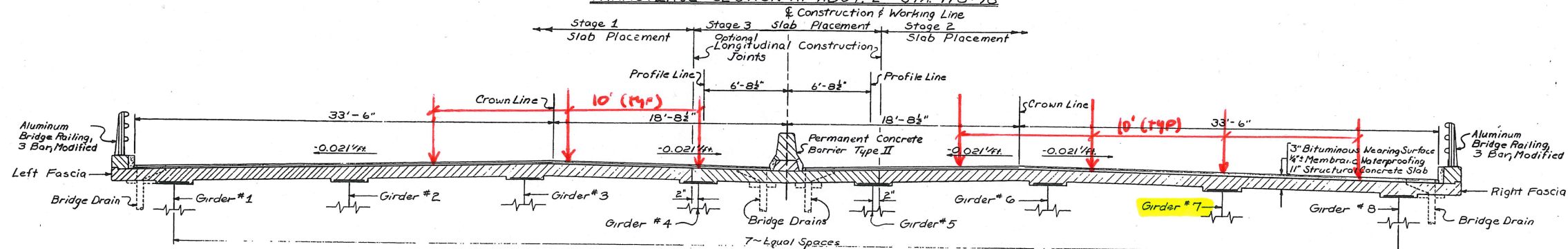


GIRDER # 7-2 LIVE LOADING

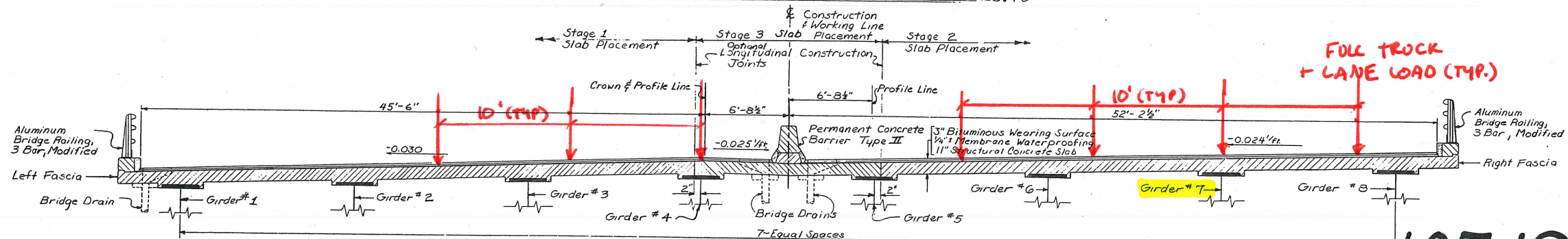
(SPANS 3-8)



TRANSVERSE SECTION AT ABUT. 2 STA. 178+98



TRANSVERSE SECTION AT PIER 5 STA. 173+26.78



TRANSVERSE SECTION AT PIER 4 STA. 170+80

THREE LANES LOADED ON
LEFT SIDE (TYP.)

FOUR LANES LOADED ON RIGHT SIDE
(TYP.)

107-193

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY

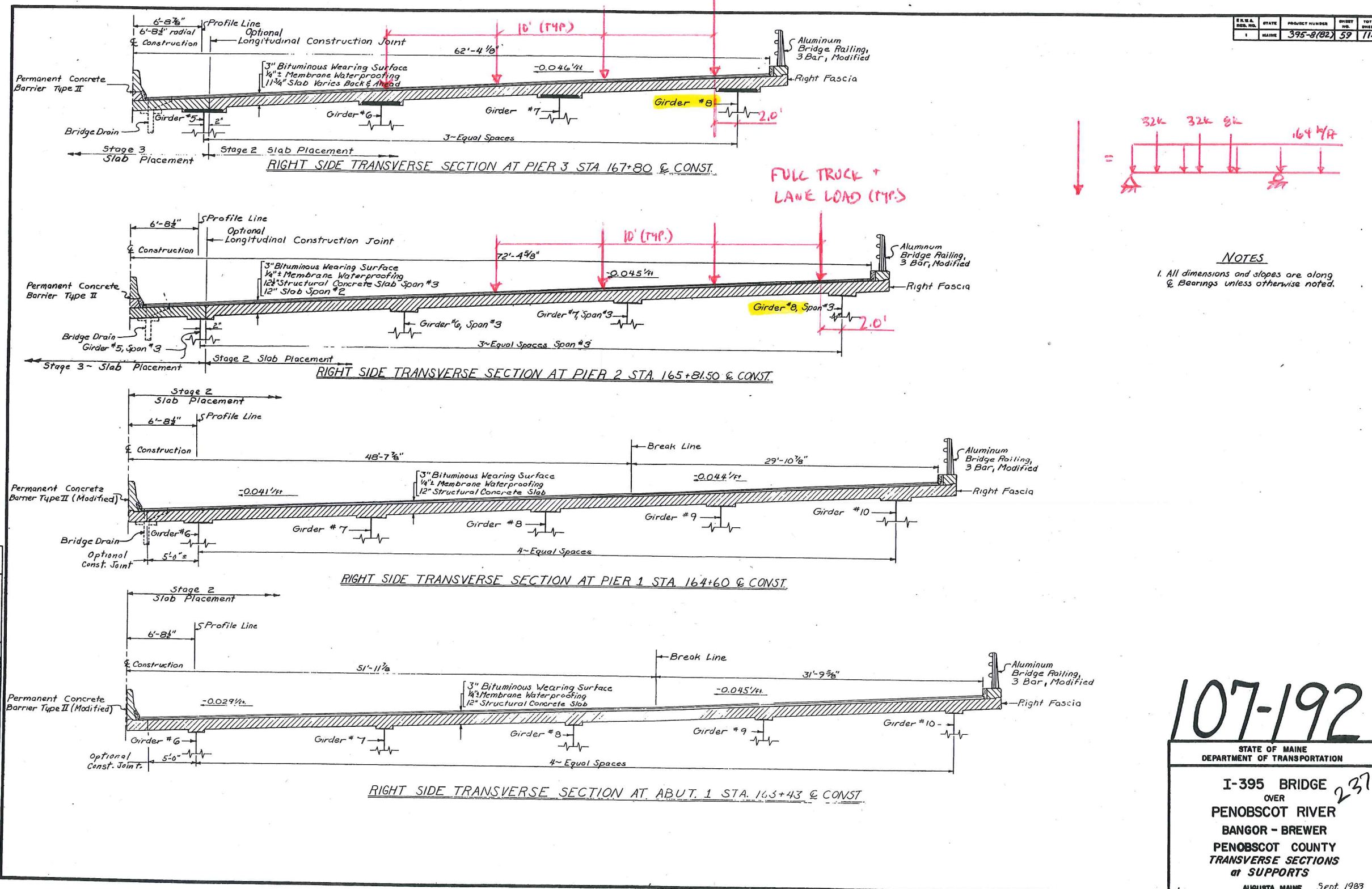
TRANSVERSE SECTIONS
of SUPPORTS
AUGUSTA, MAINE Sept. 1983

DATE	BY	REVISIONS
7/1/83	C.A.C.	DESIGN - DETAILED
7/1/83	J.M.	REVISIONS
7/1/83	J.M.	FIELD CHANGES

BRIDGE 44-132-4510-1

GIRDER 8-2 LIVE LOADING
(SPANS 3-8)

FOUR LANES LOADED ON THE RIGHT SIDE
(TYP.)



PROJECT DESIGN ENGINEER	DATE
DESIGN - DETAIL	7/83
CHECKED	10/12
FIELD CHANGES	

107-192

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
at SUPPORTS

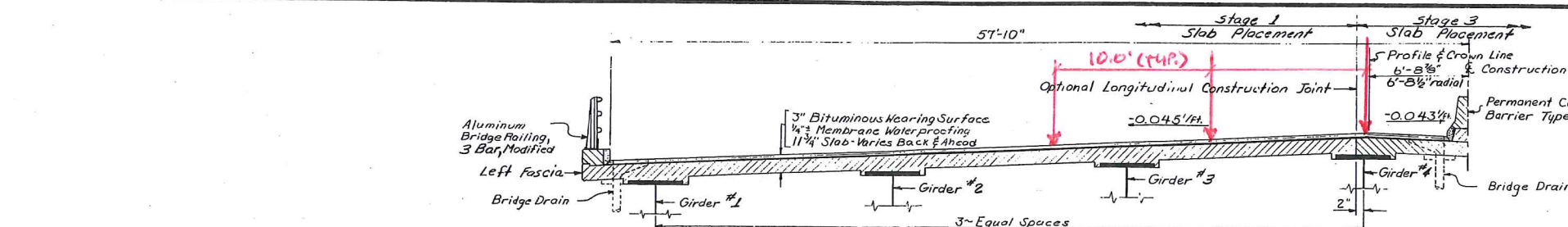
AUGUSTA, MAINE Sept. 1983

As Built for Annual 99A-Steel

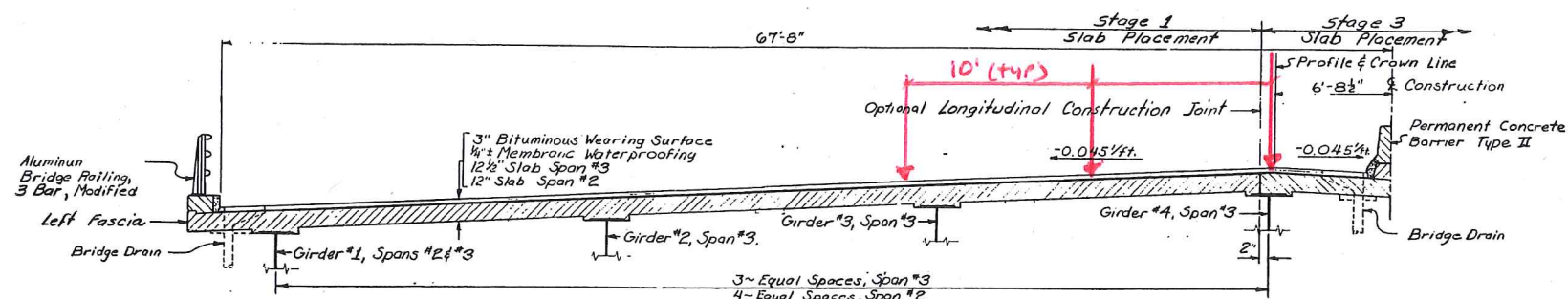
GIRDER #8-2 - LIVE LOADING
(SPANS 3-8)

THREE LANES LOADED ON LEFT SIDE
(TYP.)

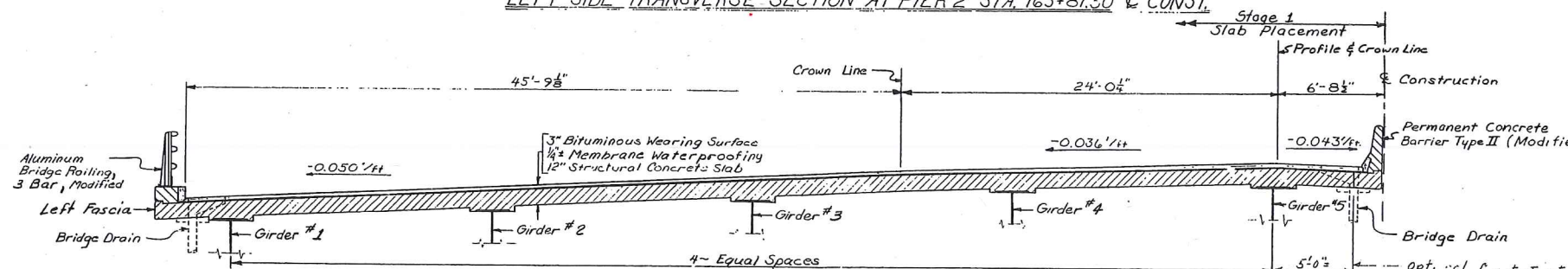
PROJECT	ENGINEER	DATE
BRIDGE 236	W.E.B.	1/83
REVISIONS	BY	DATE
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2	W.E.B.	1/83
3	W.E.B.	1/83
4	W.E.B.	1/83
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6	W.E.B.	1/83
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99	W.E.B.	1/83
100	W.E.B.	1/83



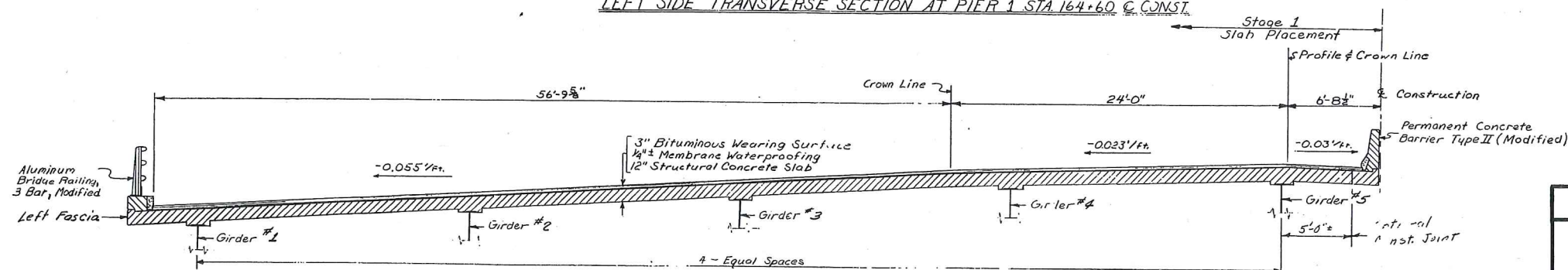
LEFT SIDE TRANSVERSE SECTION AT PIER 3 STA 167+80 & CONST.



LEFT SIDE TRANSVERSE SECTION AT PIER 2 STA 165+81.50 & CONST.



LEFT SIDE TRANSVERSE SECTION AT PIER 1 STA 164+60 & CONST.



LEFT SIDE TRANSVERSE SECTION AT ABUT. 1 STA 163+43 & CONST.

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
MAINE	395-8(2)	58	114

NOTES

1. Reinforcing steel not shown.
2. All dimensions and slopes are along & of Bearings unless otherwise noted.

REFERENCES

- For drain details see sheet #76.
- For reinforcing steel layout see sheets #61 thru #72.
- For Permanent Concrete Barrier Type II and Type II (Modified) Details see sheets #57, #73, & #74.
- For curb detail see standard detail BD 126-B1, sheet #109.
- For aluminum bridge railing 3 bar modified see sheet #76 and standard details BD 115-B1, sheet #106.

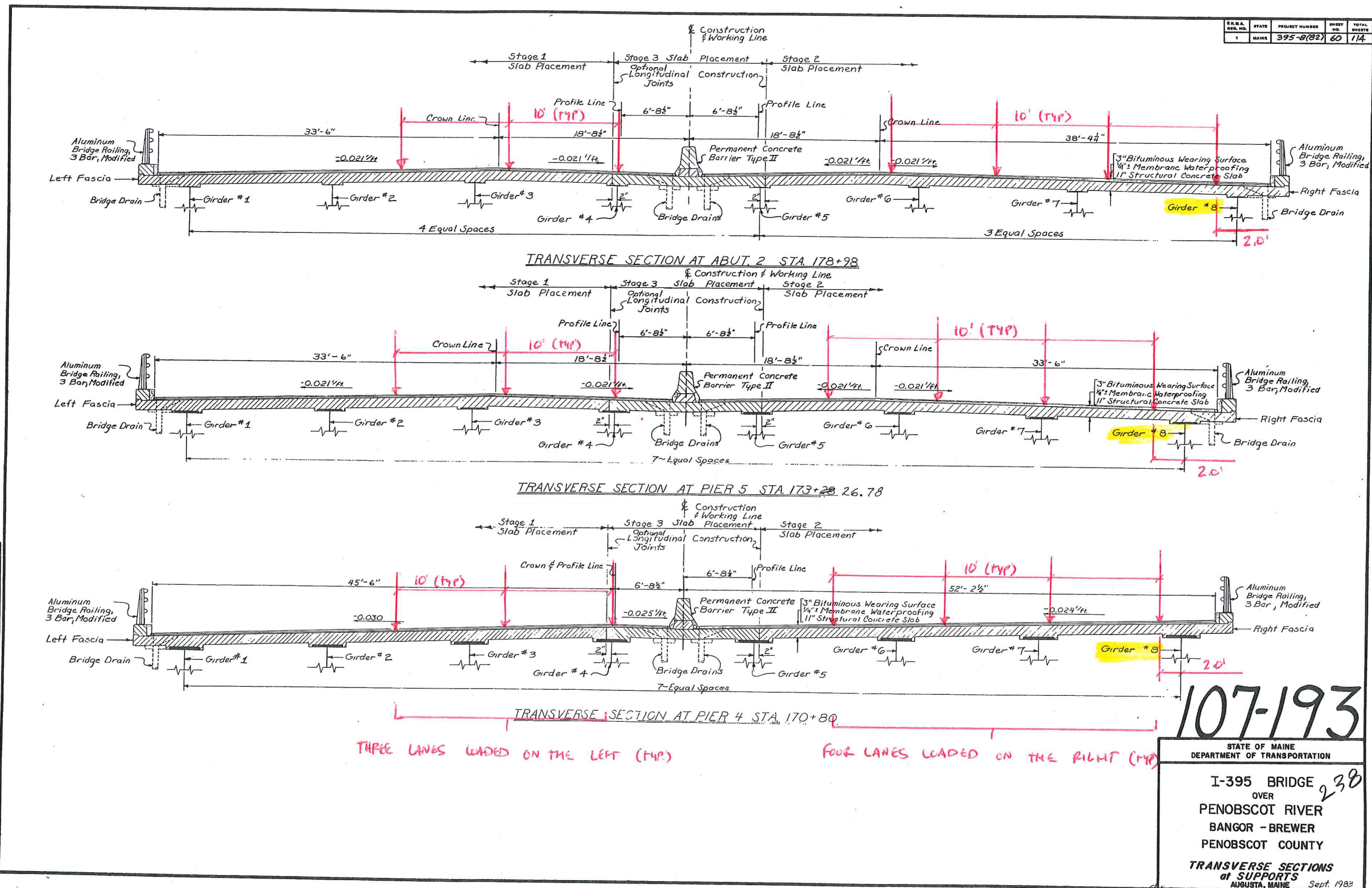
107-191

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE 236
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
TRANSVERSE SECTIONS
at SUPPORTS

AUGUSTA, MAINE Sept. 1983

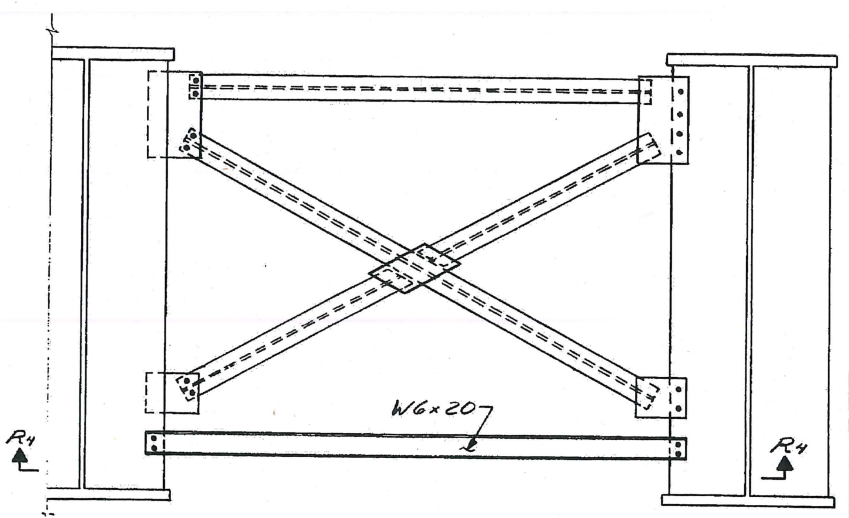
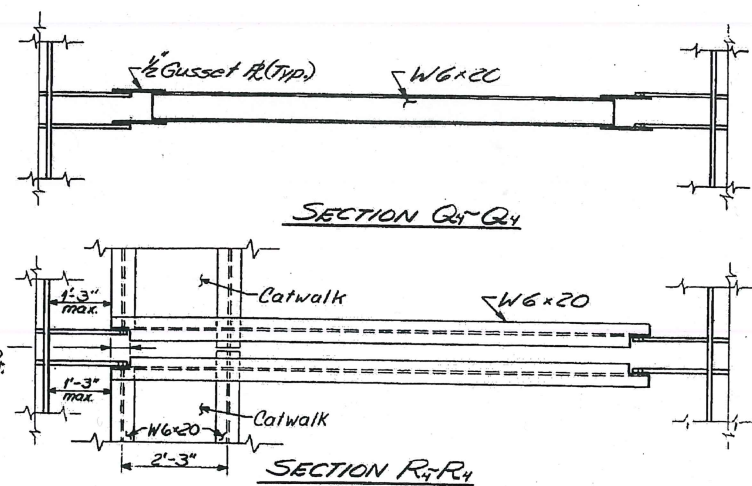
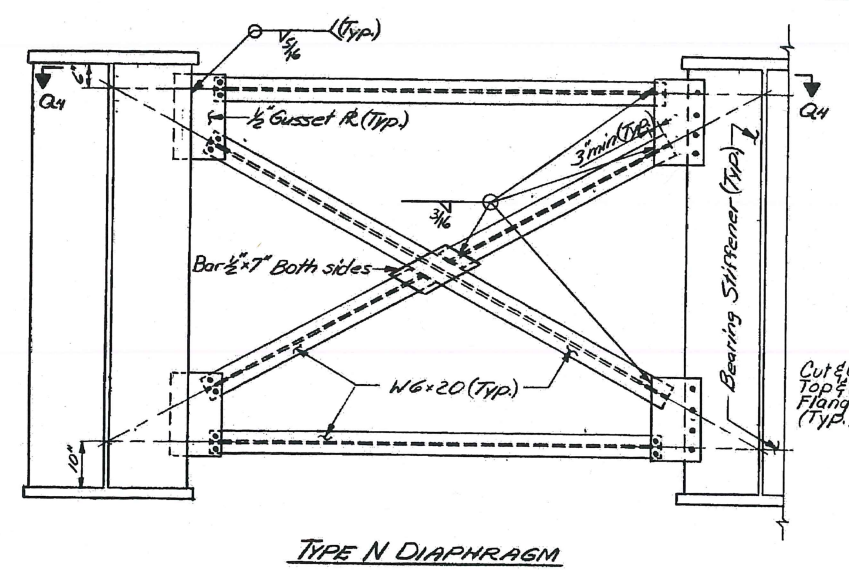
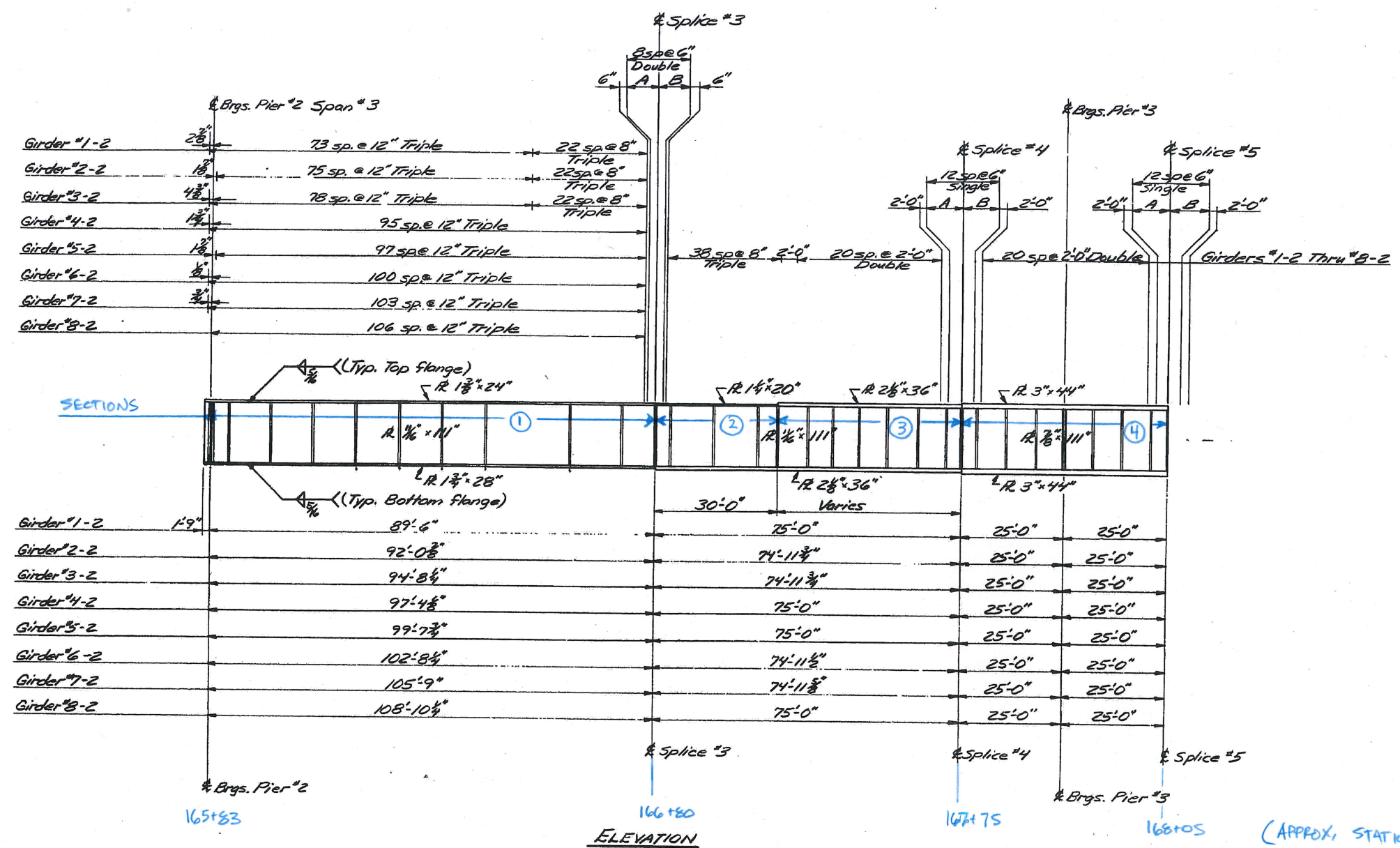
GIRDER 8-2 LIVE LOADING
(SPANS 3-8)



PROJECT DESIGN ENGINEER	DATE
BY	7/83
CHECKED	7/83
REVISIONS	
FIELD CHANGES	

SHEAR CONNECTOR LAYOUT - SPLICES #3-6

Location	Splice #3		Splice #4		Splice #5		Splice #6	
	A	B	A	B	A	B	A	B
Girder #1-2	1'-6"	2'-5"	2'-8"	3'-3"	2'-8"	3'-3"	6'	1'-5"
Girder #2-2	1'-9"	2'-3"	2'-10"	3'-1"	2'-10"	3'-1"	8'	1'-3"
Girder #3-2	1'-10"	2'-1"	3'-0"	2'-11"	3'-0"	2'-11"	10'	1'-1"
Girder #4-2	1'-11"	2'-0"	3'-1"	2'-10"	3'-1"	2'-10"	11'	1'-0"
Girder #5-2	1'-11"	2'-0"	3'-1"	2'-10"	3'-1"	2'-10"	11'	1'-0"
Girder #6-2	2'-2"	1'-9"	3'-3"	2'-8"	3'-3"	2'-8"	1'-12"	10'
Girder #7-2	2'-3"	1'-8"	3'-5"	2'-6"	3'-5"	2'-6"	1'-3"	9'
Girder #8-2	2'-4"	1'-7"	3'-6"	2'-5"	3'-6"	2'-5"	1'-4"	7'



107-174

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

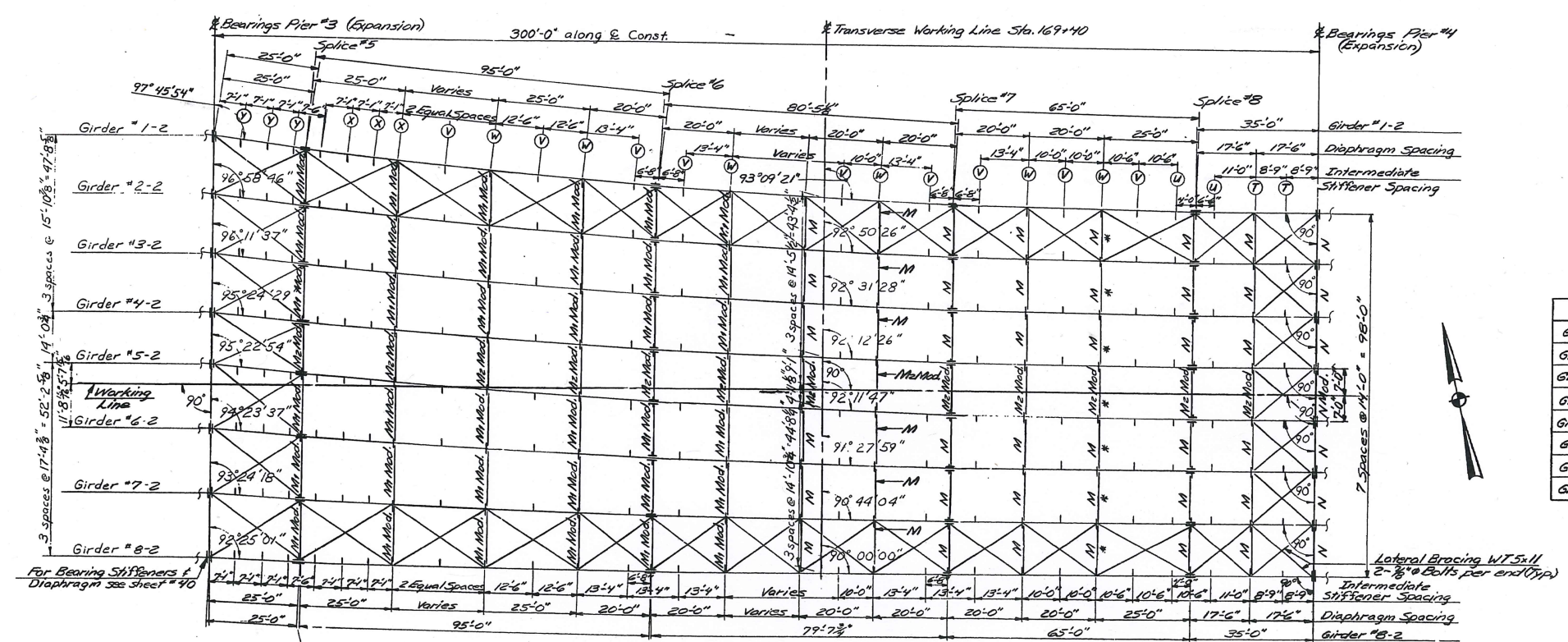
I-395 BRIDGE
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
GIRDER ELEVATIONS
(SPAN 3)
AUGUSTA, MAINE

219

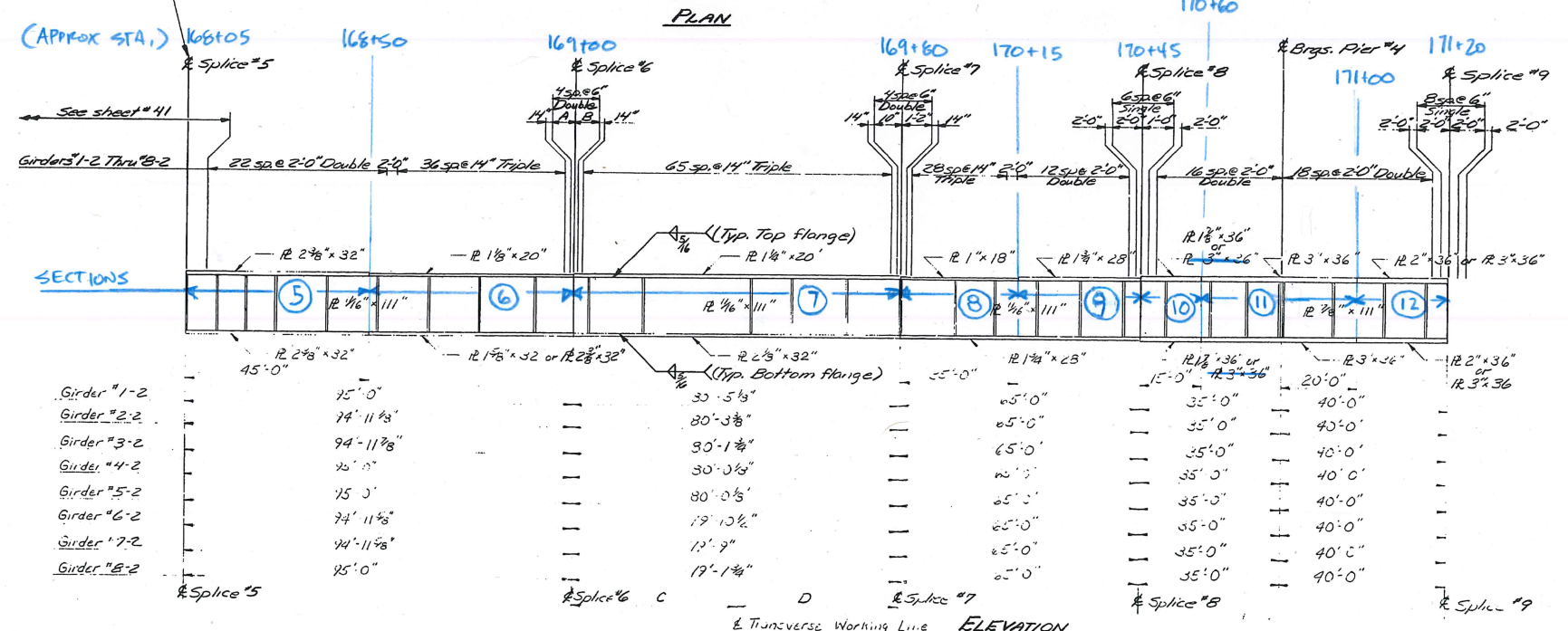
Sept. 1993

As BUILT JAH/LLM 5/9A

S.E.A.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE	395-8(82)	42	114



	C	D
Girder #1-2	40'-9"	39'-8 1/2"
Girder #2-2	40'-7 1/2"	39'-7 3/8"
Girder #3-2	40'-6"	39'-7 1/2"
Girder #4-2	40'-4 1/2"	39'-7 1/8"
Girder #5-2	40'-4 1/2"	39'-7 1/8"
Girder #6-2	40'-3 3/8"	39'-7 3/8"
Girder #7-2	40'-1 3/4"	39'-7 1/4"
Girder #8-2	40'-0 1/2"	39'-7 1/4"



INTERMEDIATE STIFFENERS One side only	
Type	Plate Size
T	7/16" x 7"
U	7/16" x 6"
V	1/2" x 5"
W	1/2" x 7"
X	5/8" x 7"
Y	3/4" x 8"

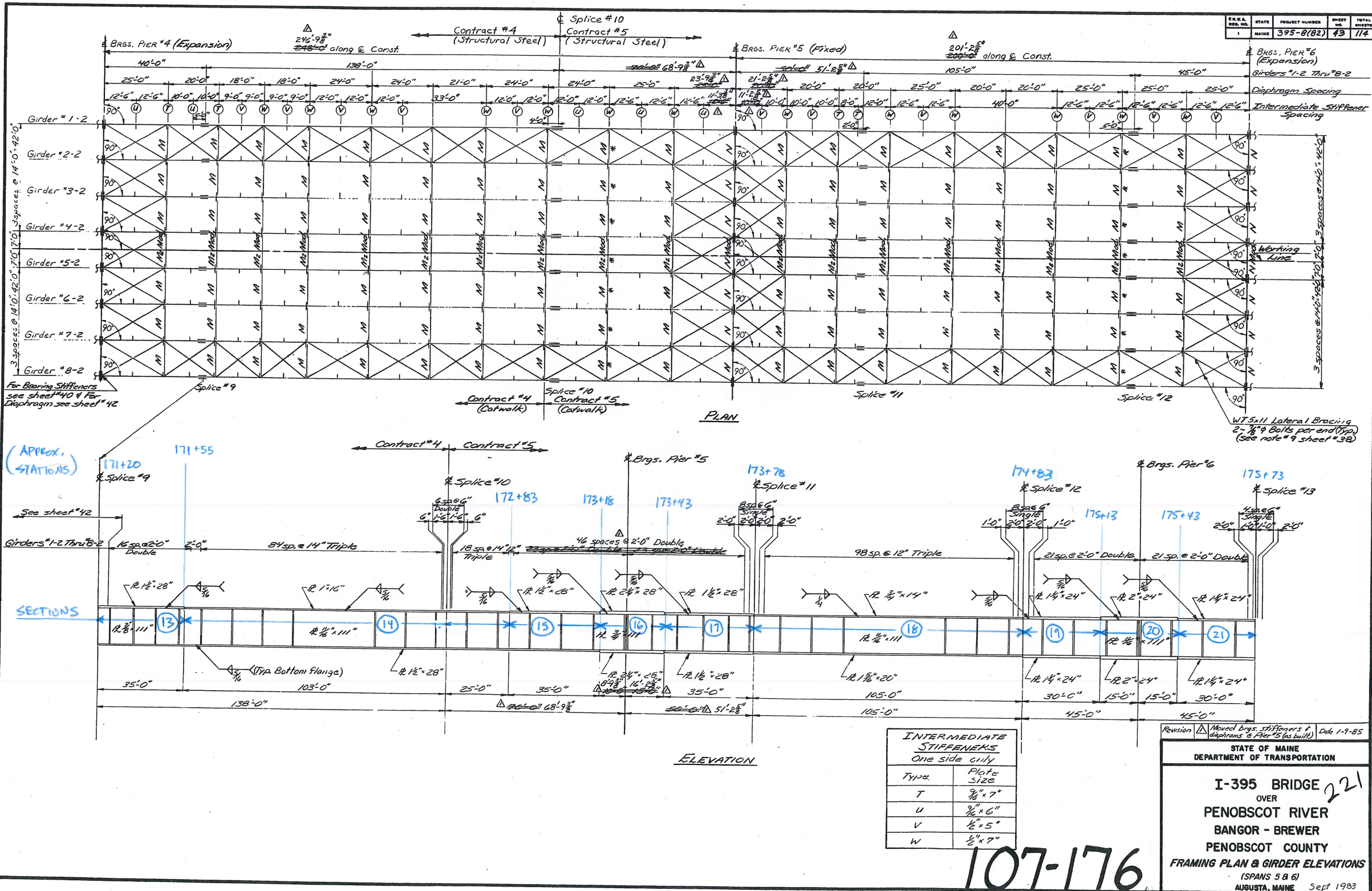
PROJECT ENGINEER	DATE
BY	4-83
CHECKED	4-83
DESIGNED	4-83
REVISIONS	
FIELD CHANGES	

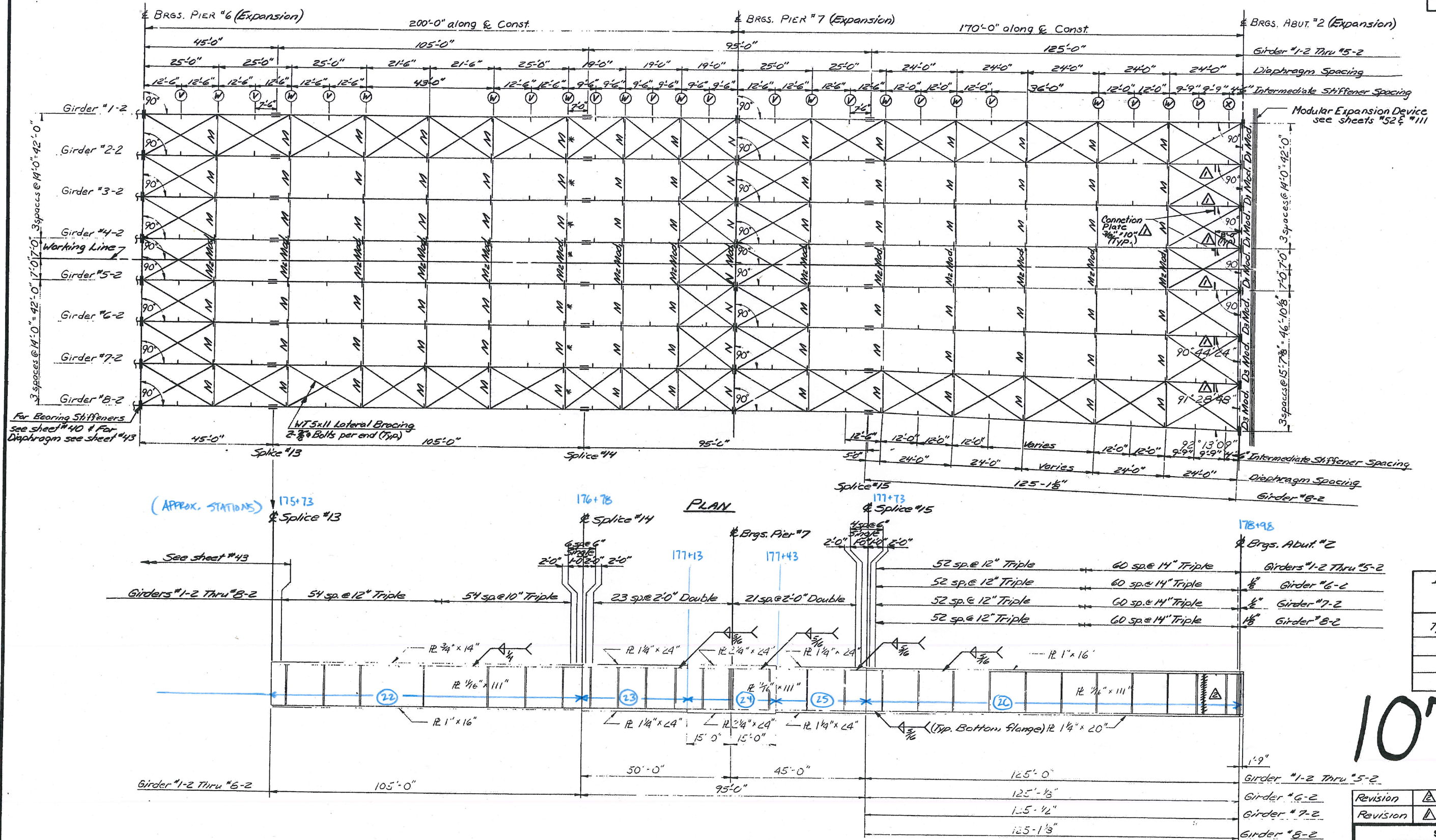
107-175

STATE OF MAINE
 DEPARTMENT OF TRANSPORTATION
I-395 BRIDGE
 OVER
PENOBSCOT RIVER
 BANGOR - BREWER
 PENOBSCOT COUNTY
FRAMING PLAN & GIRDER ELEVATIONS
 (SPAN 4)
 AUGUSTA, MAINE Sept. 1933

A: POINT S.M. Schmitz 5/14/34

PROJECT NAME	ENGINEER	DATE
DESIGN - DETAIL	BY	1-9-85
REVISIONS	DATE	
FIELD CHANGES		





107-177

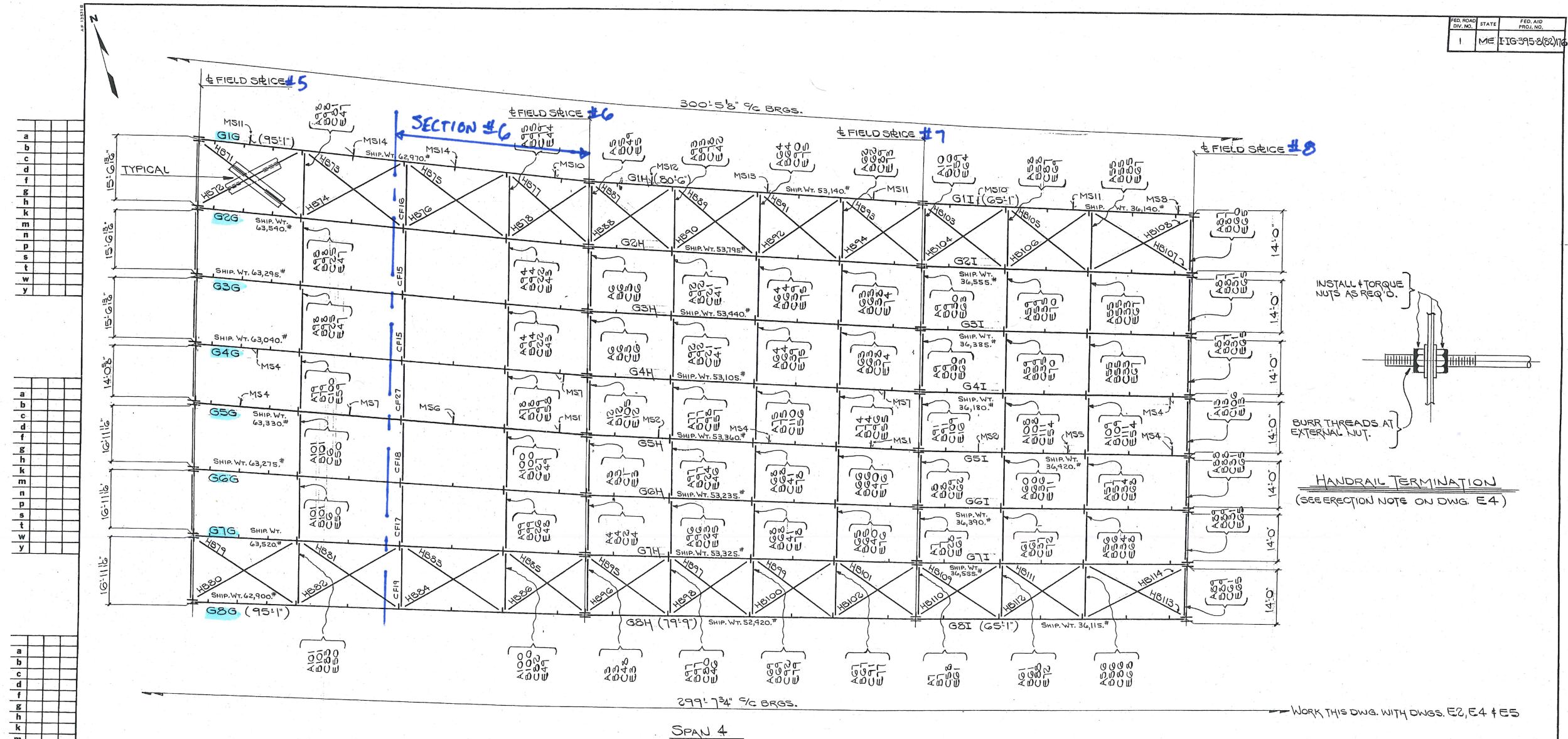
Revision	Δ	Location Stiffener	Date 7-984
Revision	Δ	5-8/10" Conn. Plate	Date 7-3-84

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

I-395 BRIDGE 222
OVER
PENOBSCOT RIVER
BANGOR - BREWER
PENOBSCOT COUNTY
FRAMING PLAN & GIRDER ELEVATIONS
(SPANS 7 & 8)
AUGUSTA, MAINE Sept. 1983

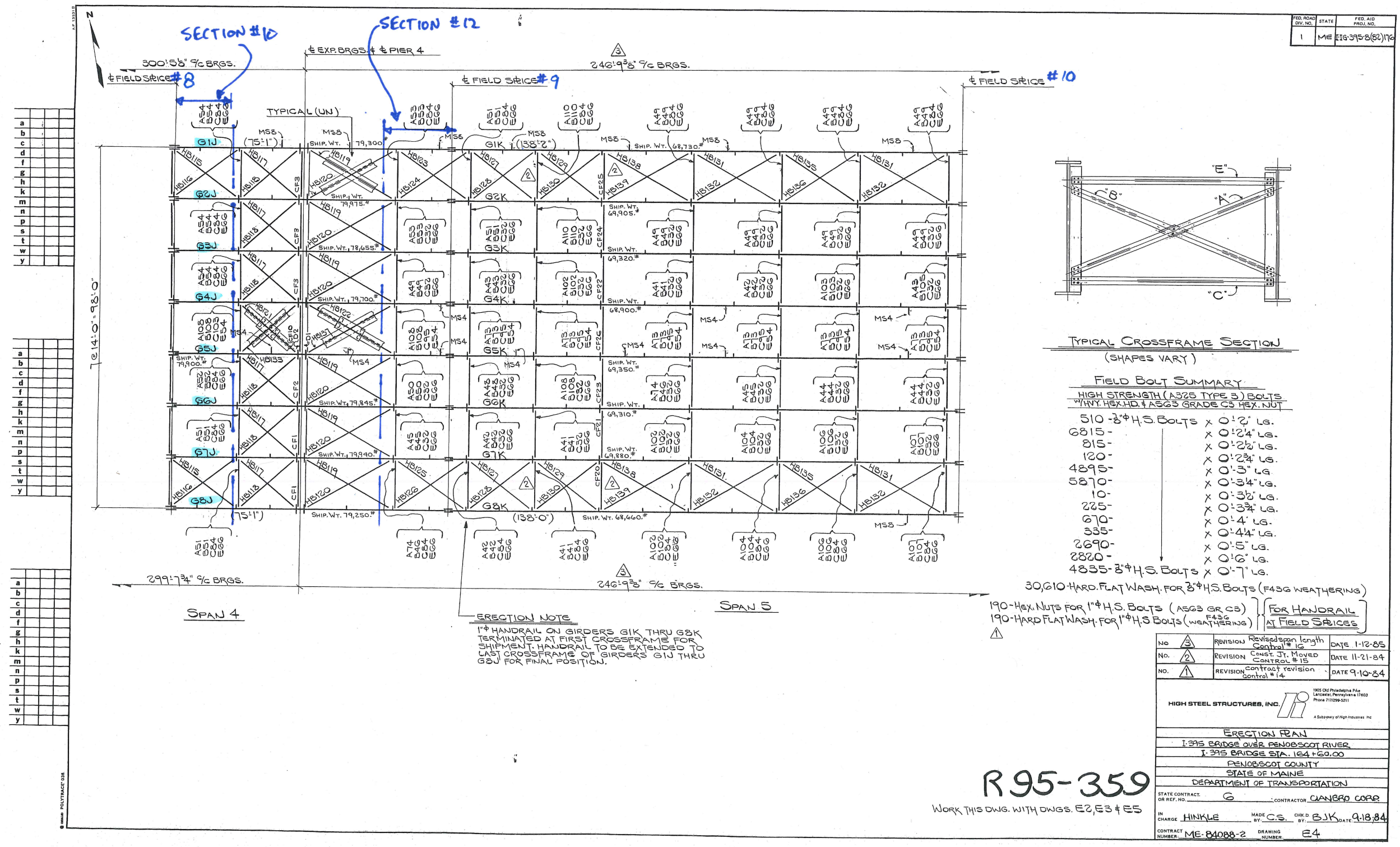
As Built M.L. Miller steel

FED. ROAD DIV. NO.	STATE	FED. AID PROJ. NO.
1	ME	11G-395-2(82)116



NO.	REVISION	DATE
HIGH STEEL STRUCTURES, INC. 1905 Old Philadelphia Pike Lancaster, Pennsylvania 17603 Phone 717/299-5211 A Subsidiary of High Industries Inc.		
ERECTOR PLAN		
I-295 BRIDGE OVER PENOBSCOT RIVER		
I-295 BRIDGE STA. 164+60.00		
PENOBSCOT COUNTY		
STATE OF MAINE		
DEPARTMENT OF TRANSPORTATION		
STATE CONTRACT OR REF. NO.	6	CONTRACTOR, CLANBRO CORP.
IN CHARGE	HINKLE	MADE BY C.S. CHK'D BY BJK DATE 9-18-84
CONTRACT NUMBER	ME-84088-2	DRAWING NUMBER E3

R95-358

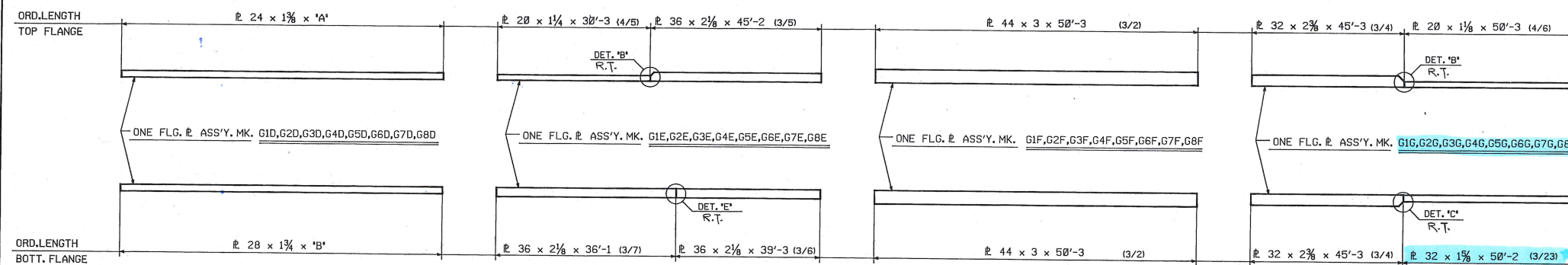


R 95-359

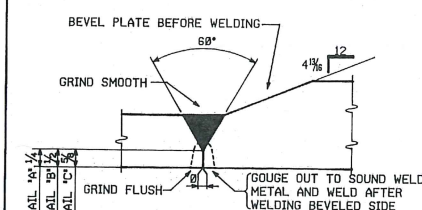
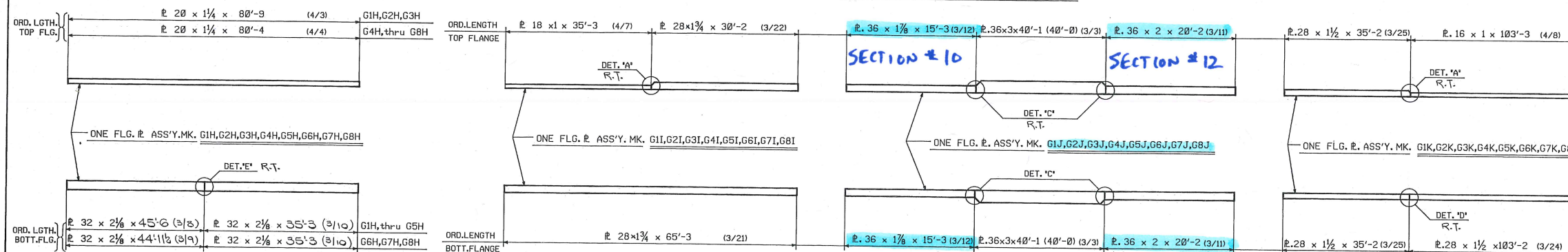
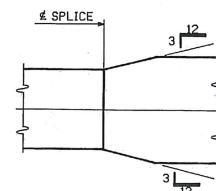
WORK THIS DWG. WITH DWGS. E2, E3 & E5

NO. 1	REVISION	Revised span length	DATE 1-12-85
NO. 2	REVISION	Const. Jt. Moved	DATE 11-21-84
NO. 3	REVISION	Contract revision	DATE 9-10-84
HIGH STEEL STRUCTURES, INC.			
ERECTOR PLAN			
I-395 BRIDGE OVER PENOBSCOT RIVER			
I-395 BRIDGE STA. 164+60.00			
PENOBSCOT COUNTY			
STATE OF MAINE			
DEPARTMENT OF TRANSPORTATION			
STATE CONTRACT	6	CONTRACTOR	CLANBRO CORP.
IN CHARGE	HINKLE	MADE BY	C.S.
CONTRACT NUMBER	ME-84088-2	CHK'D BY	BJK
		DATE	9-18-84
		DRAWING NUMBER	E4

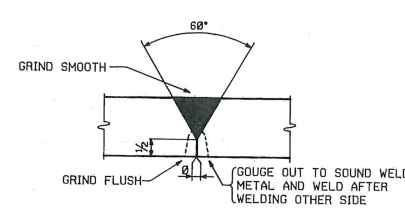
FED. ROAD DIV. NO.	STATE	FED. AID PROJ. NO.
1	ME.	I-10-395-8(82)176



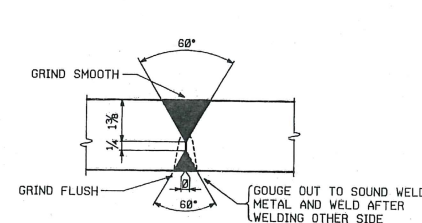
MARK	'A'	'B'
G1D	91'-4 (4/2)	91'-5 (3/20)
G2D	93'-11 (3/32)	93'-11 (3/19)
G3D	96'-6 (3/31)	96'-7 (3/18)
G4D	99'-2 (3/30)	99'-3 (3/17)
G5D	101'-6 (3/29)	101'-6 (3/16)
G6D	104'-6 (3/28)	104'-7 (3/15)
G7D	107'-7 (3/27)	107'-7 (3/14)
G8D	110'-9 (3/26)	110'-8 (3/13)



DETAILS 'A', 'B', 'C'



DETAIL 'D'



DETAIL 'E'

NOTES:

FOR GENERAL NOTES, SEE DRAWING N1.
ALL STEEL TO BE ASTM A588. WITH
CHARPY V-NOTCH TEST REQUIRED

TESTING TO BE DONE BY A QUALIFIED TECHNICIAN.
DIMENSIONS SHOWN THUS (40'-0") ARE THE ACTUAL DIMENSIONS
THAT WILL APPEAR ON THE GIRDER DETAIL DRAWINGS.
R.T. INDICATES SPICES TO BE RADIOGRAPHICALLY
TESTED 100%. TEST 25% OF REMAINDER.
TESTING TO BE DONE BY A QUALIFIED TECHNICIAN.

NO.	REVISION	DATE
1		
HIGH STEEL STRUCTURES, INC. 1905 Mt. Pleasant Pkwy. Lancaster, Pennsylvania 17603 Phone 717/299-5131 A Subsidiary of High Industries, Inc.		
FLANGE PLATE DETAILS I-395 BRIDGE OVER PENOBSCOT RIVER I-395 BRIDGE STA. 164+60.00 PENOBSCOT COUNTY STATE OF MAINE DEPARTMENT OF TRANSPORTATION		
STATE CONTRACT OR REF. NO. 6 CONTRACTOR CIANBRO CORP.		
IN CHARGE: HINKLE MADE BY: C.S. CHK'D BY: G.F.Z. DATE: 7-20-84		
CONTRACT NUMBER: ME-84088-2 DRAWING NUMBER: FS1		

R95-361

CODE 14000

-3.2-

Spans 3-8

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

Girder 7-2 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	15.35	1.56	1.36	2.67	1.36	20.49	2.27	2.27
		Operating	19.90	2.02	1.77	3.46	1.77	26.64	2.95	2.95
2	Span 3	Inventory	12.70	2.74	---	2.40	2.40	16.85	3.69	3.69
		Operating	16.47	3.56	---	3.11	3.11	21.91	4.80	4.80
3	Pier 3	Inventory	1.05	1.72	---	2.63	1.05	1.82	2.63	1.82
		Operating	1.86	2.55	---	3.42	1.86	2.37	3.41	2.37
4	Pier 3	Inventory	1.43	1.96	---	3.14	1.43	2.40	3.03	2.40
		Operating	1.86	2.55	---	4.07	1.86	3.11	3.94	3.11
5	Span 4	Inventory	1.07	1.75	---	2.57	1.07	1.89	2.69	1.89
		Operating	1.39	2.27	---	3.33	1.39	2.46	3.50	2.46
6	Span 4	Inventory	7.88	1.13	---	2.82	1.13	10.93	1.75	1.75
		Operating	10.21	1.46	---	3.66	1.46	14.21	2.27	2.27
7	Span 4	Inventory	6.49	1.42	---	2.86	1.42	9.14	2.16	2.16
		Operating	8.41	1.85	---	3.71	1.85	11.88	2.80	2.80
8	Span 4	Inventory	8.02	1.31	---	2.52	1.31	11.04	1.96	1.96
		Operating	10.40	1.70	---	3.26	1.70	14.36	2.55	2.55
9	Span 4	Inventory	1.39	2.39	---	2.22	1.39	2.47	3.36	2.47
		Operating	1.80	3.10	---	2.87	1.80	3.22	4.36	3.22
10	Pier 4	Inventory	1.01	1.65	---	3.01	1.01	1.88	2.54	1.88
		Operating	1.31	2.14	---	3.90	1.31	2.45	3.31	2.45
11	Pier 4	Inventory	1.23	1.78	---	2.51	1.23	2.20	2.70	2.20
		Operating	1.60	2.30	---	3.26	1.60	2.86	3.50	2.86
12	Pier 4	Inventory	1.29	1.98	---	3.57	1.29	2.27	2.94	2.27
		Operating	1.68	2.57	---	4.63	1.68	2.95	3.83	2.95
13	Pier 4	Inventory	1.54	2.41	---	4.90	1.54	2.53	3.36	2.53
		Operating	2.00	3.13	---	6.35	2.00	3.28	4.37	3.28
14	Span 5	Inventory	10.76	1.88	---	2.69	1.88	14.31	2.57	2.57
		Operating	13.95	2.43	---	3.48	2.43	18.60	3.34	3.34
15	Pier 5	Inventory	1.83	2.91	---	2.48	1.83	2.98	3.92	2.98
		Operating	2.37	3.77	---	3.21	2.37	3.87	5.10	3.87
16	Pier 5	Inventory	1.25	1.99	---	1.90	1.25	2.17	2.81	2.17
		Operating	1.62	2.57	---	2.47	1.62	2.82	3.65	2.82
17	Pier 5	Inventory	1.72	2.65	---	3.70	1.72	2.71	3.62	2.71
		Operating	2.23	3.44	---	4.79	2.23	3.53	4.70	3.53
18	Span 6	Inventory	14.77	2.01	---	2.21	2.01	19.38	2.72	2.72
		Operating	19.15	2.61	---	2.87	2.61	25.20	3.54	3.54



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

Girder 7-2 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	1.68	3.01	---	2.43	1.68	2.92	3.97	2.92
		Operating	2.17	3.90	---	3.16	2.17	3.80	5.17	3.80
20	Pier 6	Inventory	1.12	2.09	---	1.85	1.12	2.15	2.91	2.15
		Operating	1.45	2.70	---	2.39	1.45	2.80	3.79	2.80
21	Pier 6	Inventory	1.86	3.28	---	3.00	1.86	3.18	4.32	3.18
		Operating	2.42	4.25	---	3.89	2.42	4.13	5.62	4.13
22	Span 7	Inventory	16.86	1.69	---	3.84	1.69	22.13	2.33	2.33
		Operating	21.86	2.19	---	4.98	2.19	28.77	3.03	3.03
23	Pier 7	Inventory	1.19	2.26	---	3.13	1.19	2.15	3.16	2.15
		Operating	1.55	2.93	---	4.05	1.55	2.79	4.11	2.79
24	Pier 7	Inventory	1.14	2.15	---	1.96	1.14	2.27	3.06	2.27
		Operating	1.48	2.79	---	2.55	1.48	2.95	3.98	2.95
25	Pier 7	Inventory	1.67	3.10	---	2.97	1.67	2.99	4.14	2.99
		Operating	2.17	4.02	---	3.84	2.17	3.89	5.39	3.89
26	Span 8	Inventory	14.30	1.63	3.08	1.40	1.40	19.00	2.33	2.33
		Operating	18.54	2.11	4.00	1.82	1.82	24.70	3.02	3.02

Controlling Girder Ratings:

	Strength		Service
	Flexure	Shear	
Inventory:	1.01	1.36	1.75
Operating:	1.31	1.77	2.27

-3.3-

Spans 3-8

Interior Girder Loads

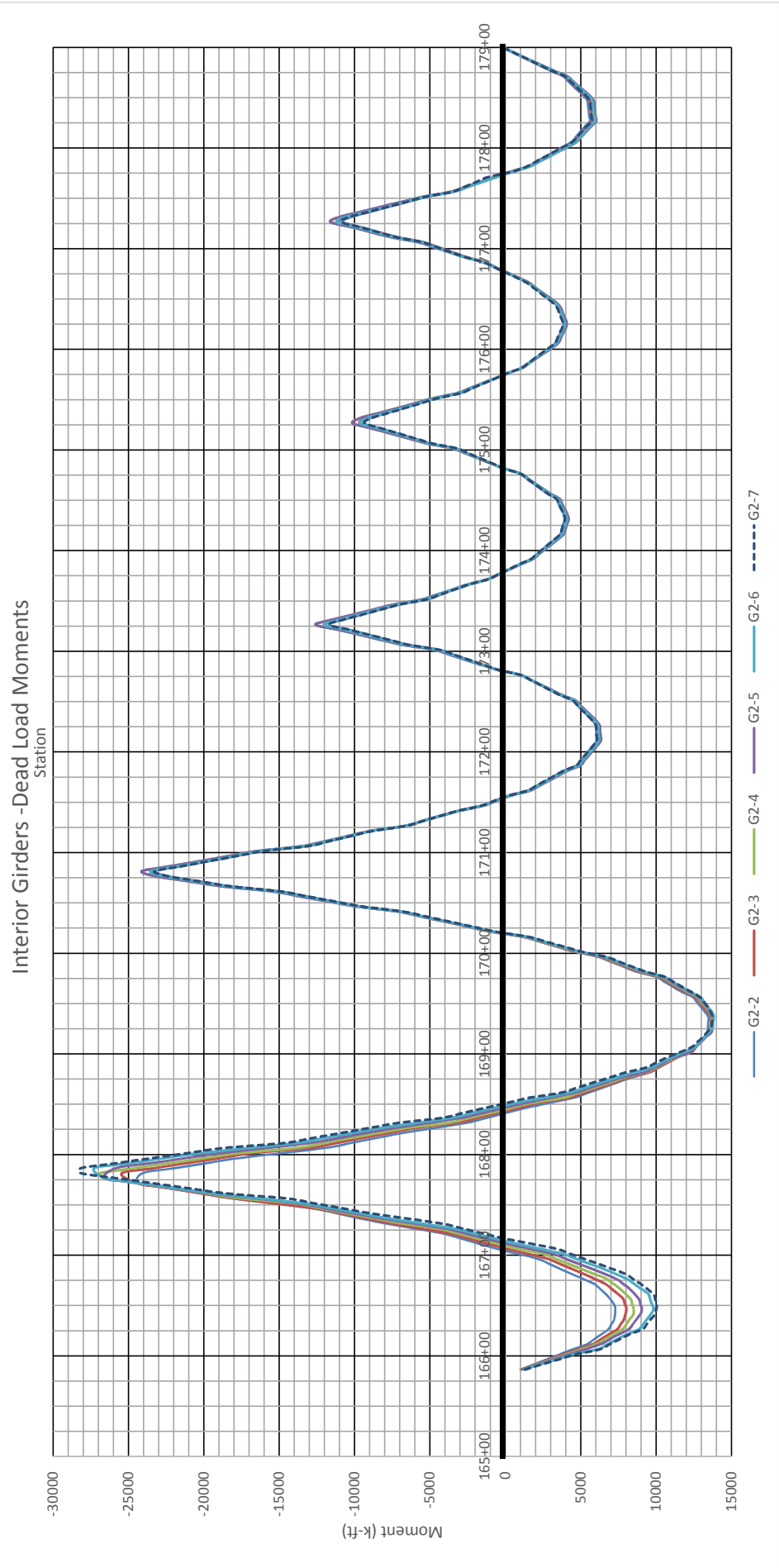




Computation

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	1299	10058	273	<u>1</u>	165+86	273
Section 1	165+91	2418	1299	237		165+91	-141
	165+96	3537		202		165+96	
	166+01	4657		166		166+01	
	166+06	6257		197		166+06	
	166+11	6922		162		166+11	
	166+16	7588		127		166+16	
	166+21	8253		92		166+21	
	166+26	9108		117		166+26	
	166+31	9377		82		166+31	
	166+36	9646		48		166+36	
	166+41	9915		13		166+41	
	166+51	10058	<u>1</u>	4		166+51	
	166+56	9937		-30		166+56	
	166+61	9815		-64		166+61	
	166+71	8971		-72		166+71	
	166+76	8460		-106		166+76	
	166+81	7950	<u>2</u>	-139		166+81	
Section 2	166+91	6155	7950	-141		166+91	-139
	166+96	5219	-21	-175		166+96	-241
	167+01	4283		-208		167+01	
	167+06	3347		-241	<u>2</u>	167+06	
Section 3	167+16	-21	3347	-237		167+16	-237
	167+21	-1429	-18566	-271		167+21	-436
	167+26	-2838		-304		167+26	
	167+31	-4246		-338		167+31	
	167+41	-8853		-338		167+41	
	167+46	-10750		-370		167+46	
	167+51	-12648		-403		167+51	
	167+56	-14545		-436	<u>3</u>	167+56	
Section 4	167+61	-18566	<u>3</u>	-403		167+61	529
	167+66	-20966	-28166	-437		167+66	-540
	167+71	-23366		-471		167+71	
	167+76	-25766		-506		167+76	
PIER 3	167+81	-28166	<u>4</u>	-540	<u>4</u>	167+81	
Section 4	167+86	-28154		529		167+86	
	167+91	-25793		497		167+91	
	167+96	-23433		464		167+96	
	168+01	-21072		432		168+01	
	168+06	-18713	<u>5</u>	400		168+06	

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
Section 5	168+11	-14687	3710	429	5	168+11	429
	168+16	-12788	-18713	400		168+16	225
	168+21	-10890		371		168+21	
	168+26	-8992		341		168+26	
	168+31	-7095		312		168+31	
	168+36	-4224		339		168+36	
	168+41	-2765		311		168+41	
	168+46	-1306		282		168+46	
	168+51	152		254		168+51	
	168+56	1611		225		168+56	
Section 6	168+61	3710	12338	255	6	168+61	255
	168+66	4772	1611	229		168+66	102
	168+71	5834		202		168+71	
	168+76	6896		176		168+76	
	168+81	7958		149		168+81	
	168+86	9337		168		168+86	
	168+91	10033		142		168+91	
	168+96	10730		116		168+96	
Section 7	169+06	12338	6	13756		169+06	116
	169+11	12710	9359	76		169+11	-142
	169+16	13082		50		169+16	
	169+26	13645		36		169+26	
	169+31	13700		11		169+31	
	169+36	13756	7	-15		169+36	
	169+46	13438		-28		169+46	
	169+51	13177		-54		169+51	
	169+56	12916		-79		169+56	
	169+66	11741		-92		169+66	
	169+71	11164		-117		169+71	
	169+76	10587	8	-142	7	169+76	
Section 8	169+81	9359	10587	-133		169+81	-133
	169+86	8461	-637	-157		169+86	-265
	169+91	7564		-181		169+91	
	169+96	6666		-205		169+96	
	170+01	5097		-193		170+01	
	170+06	3901		-217		170+06	
	170+11	2704		-241		170+11	
	170+16	1508		-265	8	170+16	
Section 9	170+21	-637	1508	-249		170+21	-249
	170+26	-2174	-9520	-273		170+26	-346
	170+31	-3711		-297		170+31	
	170+36	-5249		-322		170+36	
	170+41	-6786		-346	9	170+41	

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
Section 10	<u>170+46</u>	<u>-9520</u>	<u>9</u>	-325	170+46	-325
	170+51	-11341	See Section 10 Load Table	-350	170+51	-399
	170+56	-13147		-375	170+56	
	170+61	-14953		<u>-399</u>	<u>10</u> <u>170+61</u>	
Section 11	170+66	-18211	-13074	-391	170+66	417
	170+71	-20294	-23274	-418	170+71	-444
PIER 4	170+76	-22378		<u>-444</u>	<u>11</u> <u>170+76</u>	
	<u>170+81</u>	<u>-23274</u>	<u>11</u>	417	170+81	
Section 11	170+86	-21472		391	170+86	
	170+91	-19670		365	170+91	
	170+96	-17868		340	170+96	
	<u>171+01</u>	<u>-16066</u>	<u>12</u>	314	171+01	
Section 12	171+06	-13074	-6602	<u>329</u>	<u>12</u> <u>171+06</u>	329
	171+11	-11651	-16066	305	171+11	256
	171+16	-10227		280	171+16	
	<u>171+21</u>	<u>-8804</u>	<u>13</u>	256	171+21	
Section 13	171+26	-6602	1450	<u>265</u>	<u>13</u> <u>171+26</u>	<u>265</u>
	171+31	-5453	-8804	242	171+31	157
	171+36	-4304		218	171+36	
	171+41	-3155		195	171+41	
	171+46	-1609		204	171+46	
	171+51	-720		180	171+51	
	171+56	169		157	171+56	

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
Section 14	171+61	1450	6069	174	171+61	174
	171+66	2061	-433	151	171+66	-177
	171+71	2672		129	171+71	
	171+76	3283		107	171+76	
	171+81	3893		85	171+81	
	171+86	4700		104	171+86	
	171+91	4984		82	171+91	
	171+96	5268		59	171+96	
	172+01	5552		37	172+01	
	172+06	5836		15	172+06	
	172+11	6069	14	31	172+11	
	172+16	6047		9	172+16	
	172+21	6024		-13	172+21	
	172+26	6001		-36	172+26	
	172+31	5756		-19	172+31	
	172+36	5427		-41	172+36	
	172+41	5097		-63	172+41	
	172+46	4768		-86	172+46	
	172+51	4439		-108	172+51	
	172+56	3623		-88	172+56	
	172+61	2970		-110	172+61	
	172+66	2316		-133	172+66	
	172+71	1662		-155	172+71	
	172+76	1009		-177	14	172+76
Section 15	172+81	-433	1009	-155	172+81	-155
	172+86	-1416	-6419	-178	172+86	-247
	172+91	-2400		-201	172+91	
	172+96	-3384		-224	172+96	
	173+01	-4367		-247	15	173+01
Section 16	173+06	-6419	15	-224	173+06	276
	173+11	-7738	-11696	-248	173+11	-318
	173+16	-9057		-271	173+16	
	173+21	-10376		-295	173+21	
PIER 5	173+26	-11696	16	-318	16	173+26
Section 16	173+31	-10724		276	173+31	
	173+36	-9484		252	173+36	
	173+41	-8244		229	173+41	
	173+46	-7004	17	205	173+46	
Section 17	173+51	-5232	-1151	220	17	173+51
	173+56	-4281	-7004	197	173+56	152
	173+61	-3330		175	173+61	
	173+66	-2378		152	173+66	

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
Section 18	173+71	-1151	3954	167	18	173+71	167
	173+76	-458	-1151	145		173+76	-140
	173+81	234		123		173+81	
	173+86	927		101		173+86	
	173+91	1674		120		173+91	
	173+96	2078		99		173+96	
	174+01	2482		77		174+01	
	174+06	2886		55		174+06	
	174+11	3289		33		174+11	
	174+16	3647		49		174+16	
	174+21	3749		27		174+21	
	174+26	3852		5		174+26	
	174+31	3954	18	-17		174+31	
	174+36	3863		-3		174+36	
	174+41	3703		-25		174+41	
	174+46	3542		-47		174+46	
	174+51	3382		-69		174+51	
	174+56	2822		-53		174+56	
	174+61	2361		-74		174+61	
	174+66	1900		-96		174+66	
	174+71	1439		-118		174+71	
	174+76	978		-140		174+76	
Section 19	174+81	-62	978	-117		174+81	-117
	174+86	-849	-4859	-139		174+86	-206
	174+91	-1636		-162		174+91	
	174+96	-2422		-184		174+96	
	175+01	-3209		-206	19	175+01	

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Section	Sta.	My (k-ft)	Max/Min	Fz (k)	Sta	Max/Min
Section 20	<u>175+06</u>	<u>-4859</u>	<u>19</u>	-2945	-182	175+06 264
	175+11	-5978	-9335	-205	-274	175+11 -274
	175+16	-7097		-228		175+16
	175+21	-8216		-251		175+21
PIER 6	<u>175+26</u>	<u>-9335</u>	<u>20</u>	<u>-274</u>	<u>20</u>	<u>175+26</u>
Section 20	175+31	-8919		264		175+31
	175+36	-7805		241		175+36
	175+41	-6690		219		175+41
	175+46	-5576		196		175+46
	<u>175+51</u>	<u>-4461</u>	<u>21</u>	173		175+51
Section 21	175+56	-2945	1062	<u>197</u>	<u>21</u>	<u>175+56</u> 197
	175+61	-2163	-4461	174		175+61 108
	175+66	-1381		152		175+66
	175+71	-600		130		175+71
	175+76	182		108		175+76
Section 22	175+81	1062	3815	<u>132</u>	<u>22</u>	<u>175+81</u> 132
	175+86	1523	1062	110		175+86 -122
	175+91	1984		88		175+91
	175+96	2444		66		175+96
	176+01	2905		45		176+01
	176+06	3309		62		176+06
	176+11	3462		41		176+11
	176+16	3614		19		176+16
	176+21	3767		-3		176+21
	<u>176+26</u>	<u>3815</u>	<u>22</u>	13		176+26
	176+31	3687		-9		176+31
	176+36	3558		-31		176+36
	176+41	3430		-53		176+41
	176+46	3131		-35		176+46
	176+51	2694		-57		176+51
	176+56	2257		-78		176+56
	176+61	1820		-100		176+61
	176+66	1383		-122		176+66
Section 23	176+71	692	1383	-102		176+71 -102
	176+76	-18	-7261	-124		176+76 -224
	176+81	-729		-146		176+81
	176+86	-1439		-169		176+86
	176+91	-2637		-157		176+91
	176+96	-3601		-179		176+96
	177+01	-4566		-202		177+01
	177+06	-5530		<u>-224</u>	<u>23</u>	<u>177+06</u>

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Section	Sta.	My (k-ft)	Max/Min	Fz (k)	Sta	Max/Min
Section 24	<u>177+11</u>	<u>-7261</u>	<u>23</u>	-3523	-211	177+11 295
	177+16	-8477	-10909	-234	-280	177+16 -280
	177+21	-9693		-257		177+21
PIER 7	<u>177+26</u>	<u>-10909</u>	<u>24</u>	<u>-280</u>	<u>24</u>	<u>177+26</u> <u>LL Cntrls.</u>
Section 24	177+31	-10361		295		177+31
	177+36	-9095		272		177+36
	177+41	-7829		249		177+41
	177+46	-6563		226		177+46
	<u>177+51</u>	<u>-5297</u>	<u>25</u>	203		177+51
Section 25	177+56	-3523	478	<u>228</u>	<u>25</u>	<u>177+56</u> 228
	177+61	-2706	-5297	205		177+61 144
	177+66	-1890		183		177+66
	177+71	-1073		160		177+71
Section 26	177+76	478	5734	144		177+76 163
	177+81	1405	-1073	163		177+81 -197
	177+86	2029		141		177+86
	177+91	2652		118		177+91
	177+96	3275		96		177+96
	178+01	3899		74		178+01
	178+06	4491		95		178+06
	178+11	4792		72		178+11
	178+16	5092		49		178+16
	178+21	5393		27		178+21
	<u>178+26</u>	<u>5734</u>	<u>26</u>	48		178+26
	178+31	5704		25		178+31
	178+36	5675		2		178+36
	178+41	5645		-21		178+41
	178+46	5616		-45		178+46
	178+51	5383		-23		178+51
	178+56	5020		-46		178+56
	178+61	4657		-70		178+61
	178+66	4294		-93		178+66
	178+71	3931		-117		178+71
	178+76	3116		-94		178+76
	178+81	2417		-118		178+81
	178+86	1718		-142		178+86
	178+91	1019		-166		178+91
	178+96	320		-190		178+96
ABUT 2	178+98	102		<u>-197</u>	<u>26</u>	<u>178+98</u>

Section	Sta.	My (k-ft)	My (k-ft)
		DC	DW
Section 9	170+21	-567	-165
	170+22	-874	-223
	170+23	-1182	-281
	170+24	-1489	-339
	170+25	-1796	-397
	170+26	-2104	-455
	170+27	-2411	-513
	170+28	-2719	-571
	170+29	-3026	-629
	170+30	-3334	-687
	170+31	-3641	-745
	170+32	-3948	-803
	170+33	-4256	-861
	170+34	-4563	-919
	170+35	-4871	-977
	170+36	-5178	-1035
	170+37	-5486	-1093
	170+38	-5793	-1151
	170+39	-6101	-1209
	170+40	-6408	-1267
	170+41	-6715	-1325
	170+42	-7023	-1383
	170+43	-7330	-1441
	170+44	-7638	-1499
Section 10	170+45	-9071	-1768
	170+46	-9437	-1837
	170+47	-9802	-1905
	170+48	-10168	-1973
	170+49	-10534	-2042
	170+50	-10897	-2110
	170+51	-11258	-2177
	170+52	-11620	-2245
	170+53	-11981	-2312
	170+54	-12342	-2380
	170+55	-12703	-2447
	170+56	-13065	-2515
	170+57	-13426	-2582
	170+58	-13787	-2650
	170+59	-14148	-2717
	170+60	-14509	-2785
	170+61	-14871	-2853
	170+62	-15232	-2920

Section	Sta.	My (k-ft)	10	My (k-ft)
		DC		DW
Section 11	<u>170+63</u>	<u>-16865</u>		<u>-3220</u>
	170+64	-17282		-3297
	170+65	-17699		-3373
	170+66	-18115		-3450
	170+67	-18532		-3527
	170+68	-18949		-3604
	170+69	-19365		-3680
	170+70	-19782		-3757
	170+71	-20199		-3834
	170+72	-20616		-3911
	170+73	-21032		-3988
	170+74	-21449		-4064
	170+75	-21866		-4141
	170+76	-22282		-4218
	170+77	-22699		-4295
	170+78	-23116		-4372
	170+79	-23532		-4448
	170+80	-23861		-4509

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Section	Sta.	My (k-ft)	Max/Min	Fz (k)		Sta	Max/Min
PIER 2	165+86	232	1842	53	<u>1</u>	165+86	53
Section 1	165+91	441	232	45		165+91	-28
	165+96	651		37		165+96	
	166+01	861		29		166+01	
	166+06	1163		39		166+06	
	166+11	1284		31		166+11	
	166+16	1406		23		166+16	
	166+21	1527		15		166+21	
	166+26	1684		23		166+26	
	166+31	1730		16		166+31	
	166+36	1776		8		166+36	
	166+41	1822		0		166+41	
	166+51	1842	<u>1</u>	1		166+51	
	166+56	1815		-6		166+56	
	166+61	1789		-14		166+61	
	166+71	1626		-13		166+71	
	166+76	1527		-20		166+76	
	166+81	1429	<u>2</u>	-28		166+81	
Section 2	166+91	1083	1429	-25		166+91	-25
	166+96	906	-74	-33		166+96	-47
	167+01	730		-40		167+01	
	167+06	553		-47	<u>2</u>	167+06	
Section 3	167+16	-74	553	-43		167+16	-43
	167+21	-336	-3467	-50		167+21	-82
	167+26	-597		-57		167+26	
	167+31	-858		-64		167+31	
	167+41	-1703		-61		167+41	
	167+46	-2050		-68		167+46	
	167+51	-2398		-75		167+51	
	167+56	-2745		-82	<u>3</u>	167+56	
Section 4	167+61	-3467	<u>3</u>	-2714		167+61	99
	167+66	-3899	-5195	-78		167+66	-98
	167+71	-4331		-85		167+71	
	167+76	-4763		-92		167+76	
PIER 3	167+81	-5195	<u>4</u>	-98	<u>4</u>	167+81	
Section 4	167+86	-5186		99		167+86	
	167+91	-4752		92		167+91	
	167+96	-4318		85		167+96	
	168+01	-3884		79		168+01	
	168+06	-3449	<u>5</u>	72		168+06	

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Section 5	168+11	-2714	727	<u>82</u>	<u>5</u>	<u>168+11</u>	82
	168+16	-2361	-3449	75		168+16	40
	168+21	-2008		69		168+21	
	168+26	-1654		62		168+26	
	168+31	-1301		56		168+31	
	168+36	-765		65		168+36	
	168+41	-492		59		168+41	
	168+46	-220		53		168+46	
	168+51	53		46		168+51	
	168+56	326		40		168+56	
Section 6	168+61	727	2345	<u>50</u>	<u>6</u>	<u>168+61</u>	50
	168+66	925	326	44		168+66	20
	168+71	1123		38		168+71	
	168+76	1322		31		168+76	
	168+81	1520		25		168+81	
	168+86	1787		32		168+86	
	168+91	1915		26		168+91	
	168+96	2043		20		168+96	
Section 7	<u>169+06</u>	<u>2345</u>	<u>6</u> 2592	20		169+06	20
	169+11	2411	1732	14		169+11	-28
	169+16	2477		8		169+16	
	169+26	2578		7		169+26	
	169+31	2585		2		169+31	
	<u>169+36</u>	<u>2592</u>	<u>7</u>	-4		169+36	
	169+46	2525		-5		169+46	
	169+51	2473		-11		169+51	
	169+56	2421		-16		169+56	
	169+66	2192		-17		169+66	
	169+71	2081		-22		169+71	
	<u>169+76</u>	<u>1971</u>	<u>8</u>	<u>-28</u>	<u>7</u>	<u>169+76</u>	
	169+81	1732	1971	-23		169+81	-23
Section 8	169+86	1562	-178	-29		169+86	-51
	169+91	1391		-34		169+91	
	169+96	1221		-40		169+96	
	170+01	917		-35		170+01	
	170+06	690		-40		170+06	
	170+11	463		-46		170+11	
	170+16	236		<u>-51</u>	<u>8</u>	<u>170+16</u>	
	170+21	-178	236	-45		170+21	-45
Section 9	170+26	-468	-1852	-50		170+26	-67
	170+31	-758		-56		170+31	
	170+36	-1048		-61		170+36	
	170+41	-1338		<u>-67</u>	<u>9</u>	<u>170+41</u>	
	<u>170+46</u>	<u>-1852</u>	<u>9</u>	-60		170+46	-60
Section 10	170+51	-2193	See Section	-65		170+51	-76
	170+56	-2530	10 Load	-70		170+56	
	170+61	-2868	Table	<u>-76</u>	<u>10</u>	<u>170+61</u>	

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Section 11	<u>170+66</u>	<u>-3468</u>	<u>10</u>	-2502	-72	170+66	79
	170+71	-3852		-4405	-77	170+71	-82
PIER 4	170+76	-4236			<u>-82</u>	<u>11</u>	<u>170+76</u>
	<u>170+81</u>	<u>-4405</u>	<u>11</u>		79		170+81
Section 11	170+86	-4069			73		170+86
	170+91	-3734			68		170+91
	170+96	-3399			63		170+96
	<u>171+01</u>	<u>-3063</u>	<u>12</u>		58		171+01
Section 12	171+06	-2502		-1263	<u>64</u>	<u>12</u>	<u>171+06</u>
	171+11	-2232		-3063	58		171+11
	171+16	-1961			53		171+16
	<u>171+21</u>	<u>-1690</u>	<u>13</u>		48		171+21
Section 13	171+26	-1263		309	<u>52</u>	<u>13</u>	<u>171+26</u>
	171+31	-1042		-1690	47		171+31
	171+36	-820			42		171+36
	171+41	-598			36		171+41
	171+46	-292			41		171+46
	171+51	-118			35		171+51
	171+56	56			30		171+56
Section 14	171+61	309		1220	36		171+61
	171+66	430		-115	31		171+66
	171+71	550			26		171+71
	171+76	670			20		171+76
	171+81	791			15		171+81
	171+86	953			22		171+86
	171+91	1008			17		171+91
	171+96	1063			12		171+96
	172+01	1119			6		172+01
	172+06	1174			1		172+06
	<u>172+11</u>	<u>1220</u>	<u>14</u>		7		172+11
	172+16	1214			2		172+16
	172+21	1208			-3		172+21
	172+26	1202			-9		172+26
	172+31	1145			-2		172+31
	172+36	1078			-8		172+36
	172+41	1011			-13		172+41
	172+46	944			-18		172+46
	172+51	877			-23		172+51
	172+56	706			-16		172+56
	172+61	574			-22		172+61
	172+66	442			-27		172+66
	172+71	310			-32		172+71
	172+76	178			<u>-37</u>	<u>14</u>	<u>172+76</u>

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Section 15	172+81	-115	178	-30	172+81	-30
	172+86	-312	-1306	-35	172+86	-51
	172+91	-508		-40	172+91	
	172+96	-705		-46	172+96	
	173+01	-902		-51	15	173+01
Section 16	173+06	-1306	15	-902	-43	173+06 56
	173+11	-1567		-2349	-48	173+11 -64
	173+16	-1828			-54	173+16
	173+21	-2088			-59	173+21
PIER 5	173+26	-2349	16	-64	16	173+26
	173+31	-2158		56		173+31
Section 16	173+36	-1911		50		173+36
	173+41	-1664		45		173+41
	173+46	-1417	17	40		173+46
Section 17	173+51	-1065		-239	45	17 173+51 45
	173+56	-873		-1417	40	173+56 29
	173+61	-681			35	173+61
	173+66	-489			29	173+66
Section 18	173+71	-239	799	35	18	173+71 35
	173+76	-99	-239	30		173+76 -30
	173+81	42		24		173+81
	173+86	183		19		173+86
	173+91	334		26		173+91
	173+96	416		21		173+96
	174+01	498		15		174+01
	174+06	579		10		174+06
	174+11	661		5		174+11
	174+16	738		11		174+16
	174+21	758		6		174+21
	174+26	779		0		174+26
	174+31	799	18	-5		174+31
	174+36	779		0		174+36
	174+41	746		-5		174+41
	174+46	713		-10		174+46
	174+51	680		-16		174+51
	174+56	560		-9		174+56
	174+61	466		-15		174+61
	174+66	371		-20		174+66
	174+71	277		-25		174+71
	174+76	183		-30		174+76
Section 19	174+81	-32	183	-22		174+81 -22
	174+86	-192	-1004	-28		174+86 -44
	174+91	-352		-33		174+91
	174+96	-512		-38		174+96
	175+01	-672		-44	19	175+01

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 20	<u>175+06</u>	<u>-1004</u>	<u>19</u>	-610	-36	175+06	55
	175+11	-1230		-1909	-41	175+11	-57
	175+16	-1456			-46	175+16	
	175+21	-1682			-52	175+21	
PIER 6	<u>175+26</u>	<u>-1909</u>	<u>20</u>		<u>-57</u>	<u>20</u>	<u>175+26</u>
Section 20	175+31	-1823			55	175+31	
	175+36	-1597			50	175+36	
	175+41	-1370			44	175+41	
	175+46	-1144			39	175+46	
	<u>175+51</u>	<u>-918</u>	<u>21</u>		34	175+51	
Section 21	175+56	-610		215	<u>42</u>	<u>21</u>	<u>175+56</u>
	175+61	-450		-918	36	175+61	20
	175+66	-290			31	175+66	
	175+71	-129			26	175+71	
	175+76	31			20	175+76	
Section 22	175+81	215		786	<u>29</u>	<u>22</u>	<u>175+81</u>
	175+86	310		215	23	175+86	-27
	175+91	405			18	175+91	
	175+96	500			13	175+96	
	176+01	594			7	176+01	
	176+06	682			14	176+06	
	176+11	713			9	176+11	
	176+16	745			3	176+16	
	176+21	776			-2	176+21	
	<u>176+26</u>	<u>786</u>	<u>22</u>		4	176+26	
	176+31	759			-1	176+31	
	176+36	732			-7	176+36	
	176+41	706			-12	176+41	
	176+46	639			-5	176+46	
	176+51	549			-11	176+51	
	176+56	458			-16	176+56	
	176+61	368			-21	176+61	
	176+66	277			-27	176+66	
	176+71	134		277	-20	176+71	-20
Section 23	176+76	-12		-1489	-25	176+76	-47
	176+81	-158			-30	176+81	
	176+86	-304			-36	176+86	
	176+91	-550			-31	176+91	
	176+96	-747			-36	176+96	
	177+01	-944			-41	177+01	
	177+06	-1140			<u>-47</u>	<u>23</u>	<u>177+06</u>

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

Section 24	<u>177+11</u>	<u>-1489</u>	<u>23</u>	-742	-42	177+11	61
	177+16	-1736		-2229	-47	177+16	-58
	177+21	-1982			-52	177+21	
PIER 7	<u>177+26</u>	<u>-2229</u>	<u>24</u>		<u>-58</u>	<u>24</u>	<u>177+26</u> <u>LL Cntrl.</u>
Section 24	177+31	-2122			61	177+31	
	177+36	-1866			55	177+36	
	177+41	-1610			50	177+41	
	177+46	-1354			45	177+46	
	<u>177+51</u>	<u>-1098</u>	<u>25</u>		40	177+51	
Section 25	177+56	-742		74	<u>48</u>	<u>25</u>	<u>177+56</u> 48
	177+61	-577		-1098	42	177+61	28
	177+66	-412			37	177+66	
	177+71	-247			31	177+71	
Section 26	177+76	74		1167	28	177+76	35
	177+81	271		-247	35	177+81	-43
	177+86	399			29	177+86	
	177+91	527			24	177+91	
	177+96	655			19	177+96	
	178+01	783			13	178+01	
	178+06	909			21	178+06	
	178+11	971			15	178+11	
	178+16	1034			10	178+16	
	178+21	1096			4	178+21	
	<u>178+26</u>	<u>1167</u>	<u>26</u>		12	178+26	
	178+31	1162			6	178+31	
	178+36	1157			1	178+36	
	178+41	1152			-5	178+41	
	178+46	1148			-10	178+46	
	178+51	1099			-3	178+51	
	178+56	1025			-8	178+56	
	178+61	951			-14	178+61	
	178+66	878			-20	178+66	
	178+71	804			-26	178+71	
	178+76	635			-18	178+76	
	178+81	491			-24	178+81	
	178+86	347			-29	178+86	
	178+91	203			-35	178+91	
	178+96	59			-41	178+96	
	<u>ABUT 2</u>	178+98			<u>-43</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	355	10	1
	355	10	1
	355	8	0
	355	8	0
	356	2	1
	356	2	1
	356	4	1
	356	4	1
	357	3	0
	357	3	0
	357	4	0
	357	4	0
	358	0	0
	358	0	0
	358	7	2
	358	7	2
	359	22	4
	359	22	4
	359	32	6
	359	32	6
Section 1	360	37	5
	360	37	5
	360	28	4
	360	28	4
Section 2	361	14	4
	361	14	4
	361	26	6
	361	26	6
	362	48	8
	362	48	8
	362	72	12
	362	72	12
Section 3	363	67	12
	363	67	12
	363	137	29
	363	137	29
Section 4	364	176	35
	364	176	35
PIER 3	364	143	26
	364	143	26

NOTE: Member refers to the LARSA member ID.

Section	Member	Mz (k-ft) Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
Section 5	365	109	5
	365	109	19
	365	51	8
	365	51	8
	366	32	7
	366	32	7
	366	5	3
	366	5	3
Section 6	367	0	1
	367	0	1
	367	10	3
	367	10	3
	368	29	5
	368	29	5
	368	38	7
	368	38	6
Section 7	369	34	7
	369	34	7
	369	25	5
	369	25	5
	370	13	3
	370	13	3
	370	2	0
	370	2	0
	371	5	1
	371	5	7
	371	0	0
	371	0	0
	372	12	3
	372	12	3
	372	16	4
	372	16	8
Section 8	373	10	1
	373	10	1
	373	6	0
	373	6	0
	374	3	2
	374	3	2
	374	3	2
	374	3	2
Section 9	375	5	0
	375	5	0
	375	8	0
	375	8	0

NOTE: Member refers to the LARSA member ID.

Section	Member	Mz (k-ft) Lateral Bending		
		DC		DW
		ABS(MAX)		ABS(Max)
Section 10	<u>376</u>	<u>12</u>	<u>9</u>	<u>4</u>
	376	12		4
	376	11		4
	<u>376</u>	<u>11</u>	<u>10</u>	<u>4</u>
Section 11	377	6		1
	377	6		1
	377	9		4
PIER 4	<u>377</u>	<u>9</u>	<u>11</u>	<u>4</u>
	378	12		4
Section 11	378	12		4
	378	3		1
	<u>378</u>	<u>3</u>	<u>12</u>	<u>1</u>
Section 12	379	2		2
	379	2		2
	379	3		2
	<u>379</u>	<u>3</u>	<u>13</u>	<u>2</u>
Section 13	380	2		1
	380	2		1
	380	2		2
	380	2		2
	381	2		2
	381	2		2
	381	2		2
	381	2		2

NOTE: Member refers to the LARSA member ID.

Section	Member	Lateral Bending	
		DC	DW
		ABS(MAX)	ABS(Max)
Section 14	382	1	1
	382	1	1
	382	1	1
	382	1	1
	383	0	0
	383	0	0
	383	0	0
	383	0	0
	384	1	0
	384	1	0
	384	0	0
	384	0	0
	385	1	1
	385	<u>1</u>	<u>1</u>
	385	1	1
	385	1	1
	386	2	2
	386	2	2
	386	1	1
	386	1	1
Section 15	387	2	2
	387	2	2
	387	2	2
	387	2	2
Section 16	388	<u>3</u>	<u>1</u>
	388	3	1
	388	5	2
PIER 5	388	<u>5</u>	<u>2</u>
	389	6	2
Section 16	389	6	2
	389	3	1
	389	<u>3</u>	<u>1</u>
Section 17	390	1	1
	390	1	1
	390	2	2
	390	2	2

NOTE: Member refers to the LARSA member ID.

Mz (k-ft)		Lateral Bending	
Section	Member	DC	DW
		ABS(MAX)	ABS(Max)
Section 18	391	1	1
	391	1	1
	391	1	1
	391	1	1
	392	1	0
	392	1	0
	392	1	0
	392	1	0
	393	0	0
	393	0	0
	393	0	0
	393	0	0
	394	0	0
	394	0	0
	394	0	0
	394	0	0
	395	1	1
	395	1	1
	395	0	0
	395	0	0
Section 19	396	1	1
	396	1	1
	396	1	1
	396	1	1
Section 20	397	3	1
	397	3	1
	397	4	2
PIER 6	397	4	2
	398	5	2
Section 20	398	5	2
	398	3	1
	398	3	1
Section 21	399	1	1
	399	1	1
	399	2	2
	399	2	2

NOTE: Member refers to the LARSA member ID.

Mz (k-ft)		Lateral Bending	
Section	Member	DC	DW
		ABS(MAX)	ABS(Max)
Section 22	400	0	0
	400	0	0
	400	0	0
	400	0	0
	401	0	0
	401	0	0
	401	0	0
	401	0	0
	402	0	0
	402	0	0
	402	0	0
	402	0	0
	403	0	0
	403	0	0
	403	0	0
	403	0	0
Section 23	404	2	2
	404	2	2
	404	2	2
	404	2	2
	405	2	1
	405	2	1
	405	1	1
Section 24	406	5	1
	406	7	2
	406	7	2
PIER 7	407	4	2
	407	4	2
Section 24	407	7	2
	407	7	2
Section 25	408	13	2
	408	13	2
	408	7	1
	408	7	1

NOTE: Member refers to the LARSA member ID.

Mz (k-ft)		Lateral Bending	
Section	Member	DC	DW
		ABS(MAX)	ABS(Max)
Section 26	409	7	1
	409	7	1
	409	4	0
	409	4	0
	410	2	1
	410	2	1
	410	1	1
	410	1	1
	411	0	0
	411	0	0
	411	0	0
	411	0	0
	412	0	0
	412	0	0
	412	0	0
	412	0	0
	413	1	1
	413	1	1
	413	1	1
	413	1	1
	414	1	1
	414	1	1
	414	1	1
	414	1	1
ABUT 2	414	1	1

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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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
391	599	561	709	601	683	PIER 2	165+86	709	5519
752	1124	1061	1325	1111	1248	Section 1	165+91	1325	709
1114	1649	1562	1940	1623	1815		165+96	1940	
1476	2175	2062	2556	2135	2382		166+01	2556	
1860	2776	2617	3267	2742	3089		166+06	3267	
1952	2948	2765	3473	2936	3325		166+11	3473	
2087	3192	2977	3765	3184	3627		166+16	3765	
2280	3507	3258	4135	3491	3988		166+21	4135	
2522	3903	3613	4602	3892	4472		166+26	4602	
2530	3962	3653	4680	3971	4586		166+31	4680	
2561	4059	3723	4801	4076	4734		166+36	4801	
2674	4245	3889	5019	4264	4958		166+41	5019	
2791	4476	4082	5297	4516	5286		<u>166+51</u>	<u>5297</u>	<u>1</u>
2781	4486	4084	5315	4536	5327		166+56	5327	
2856	4601	4188	5448	4645	5456		166+61	5456	
2871	4622	4214	5477	4694	5519		166+71	5519	
2832	4571	4163	5418	4643	5472		166+76	5472	
2878	4618	4212	5467	4677	5508		<u>166+81</u>	<u>5508</u>	<u>2</u>
2819	4508	4127	5343	4598	5418	Section 2	166+91	5418	5508
2711	4349	3974	5154	4434	5242		166+96	5242	4438
2677	4278	3911	5064	4347	5141		167+01	5141	
2689	4264	3904	5038	4309	5090		167+06	5090	
2381	3725	3442	4406	3781	4438	Section 3	167+16	4438	5090
2209	3460	3193	4091	3513	4141		167+21	4141	1678
2119	3288	3039	3877	3327	3922		167+26	3922	
2074	3182	2945	3739	3195	3763		167+31	3763	
1665	2476	2327	2903	2488	2910		167+41	2910	
1428	2130	1996	2495	2134	2524		167+46	2524	
1283	1902	1781	2221	1889	2248		167+51	2248	
1201	1760	1648	2045	1725	2064		167+56	2064	
1001	1428	1348	1650	1401	1678	Section 4	<u>167+61</u>	1678	<u>3</u> 2064
656	1044	923	1207	1033	1328		167+66	1328	1045
503	897	774	1063	905	1214		167+71	1214	
499	895	769	1061	903	1212		167+76	1212	
510	915	787	1085	923	1234	PIER 3	<u>167+81</u>	1234	<u>4</u>
494	886	761	1050	893	1185		167+86	1185	
465	834	717	989	840	1113	Section 4	167+91	1113	
441	786	676	931	791	1045		167+96	1045	
534	854	753	988	842	1065		168+01	1065	
842	1128	1079	1279	1107	1266		<u>168+06</u>	1279	<u>5</u>

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
990	1355	1294	1550	1279	1442	Section 5	168+11	1550	3913
1032	1423	1359	1633	1344	1502		168+16	1633	1279
1127	1558	1488	1791	1482	1634		168+21	1791	
1320	1819	1740	2090	1731	1884		168+26	2090	
1552	2135	2042	2452	2031	2196		168+31	2452	
1648	2343	2216	2708	2272	2516		168+36	2708	
1650	2403	2254	2789	2346	2639		168+41	2789	
1693	2522	2347	2940	2476	2826		168+46	2940	
1845	2770	2568	3230	2720	3129		168+51	3230	
2035	3066	2836	3575	3010	3480		168+56	3575	
2169	3340	3071	3913	3321	3908	Section 6	168+61	3913	6074
2190	3444	3139	4044	3434	4090		168+66	4090	3575
2254	3600	3258	4233	3593	4319		168+71	4319	
2402	3851	3474	4524	3836	4629		168+76	4629	
2576	4131	3720	4848	4107	4965		168+81	4965	
2674	4333	3897	5102	4341	5285		168+86	5285	
2684	4403	3939	5189	4413	5409		168+91	5409	
2774	4559	4070	5369	4562	5607		168+96	5607	
2962	4895	4363	5771	4914	6074	Section 7	<u>169+06</u>	<u>6074</u>	<u>6</u> 6440
2953	4919	4368	5802	4935	6127		169+11	6127	5335
3021	5027	4458	5922	5031	6250		169+16	6250	
3092	5144	4564	6062	5154	6411		169+26	6411	
3058	5115	4526	6029	5122	6392		169+31	6392	
3096	5166	4570	6082	5162	6440		<u>169+36</u>	<u>6440</u>	<u>7</u>
3072	5111	4525	6014	5106	6367		169+46	6367	
3004	5018	4435	5907	5014	6267		169+51	6267	
3005	5003	4424	5884	4990	6232		169+56	6232	
2882	4774	4228	5610	4757	5931		169+66	5931	
2779	4619	4085	5430	4605	5752	Section 8	169+71	5752	
2744	4543	4021	5337	4521	5640		<u>169+76</u>	<u>5640</u>	<u>8</u>
2658	4342	3860	5089	4308	5335		169+81	5335	5640
2499	4100	3640	4809	4069	5051		169+86	5051	2963
2376	3894	3458	4567	3866	4799		169+91	4799	
2328	3775	3362	4417	3737	4619		169+96	4619	
2219	3532	3165	4121	3483	4262		170+01	4262	
2034	3233	2901	3773	3192	3906		170+06	3906	
1882	2981	2676	3475	2937	3591		170+11	3591	
1831	2845	2567	3304	2790	3379		170+16	3379	
1726	2571	2354	2963	2503	2954	Section 9	170+21	2963	3379
1521	2262	2074	2608	2202	2594		170+26	2608	1815
1352	2002	1838	2306	1946	2284		170+31	2306	
1263	1838	1694	2107	1778	2068		170+36	2107	
1237	1756	1628	2001	1685	1938		170+41	2001	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
1174	1605	1509	1815	1526	1740	Section 10	170+46	1815	9 See Section 10 Load Table
971	1350	1262	1533	1290	1503		170+51	1533	
826	1165	1082	1324	1130	1341		170+56	1341	
744	1058	977	1203	1044	1254		170+61	1254	
530	866	763	1009	874	1127	Section 11	170+66	1127	1684
458	820	710	976	842	1118		170+71	1118	1098
482	863	748	1028	887	1174	PIER 4	170+76	1174	
489	875	760	1043	901	1193		170+81	1193	11
470	841	730	1002	866	1143	Section 11	170+86	1143	
456	813	705	967	835	1098		170+91	1098	
559	897	794	1041	903	1142		170+96	1142	
839	1147	1071	1291	1135	1322		171+01	1322	12
1063	1489	1378	1684	1414	1637	Section 12	171+06	1684	2610
1106	1576	1454	1792	1506	1740		171+11	1792	1322
1206	1732	1597	1975	1659	1914		171+16	1975	
1375	1971	1821	2249	1892	2173		171+21	2249	13
1536	2279	2072	2610	2189	2557	Section 13	171+26	2610	4285
1566	2376	2147	2735	2292	2706		171+31	2735	2249
1650	2538	2284	2930	2454	2918		171+36	2930	
1794	2770	2494	3204	2688	3202		171+41	3204	
1923	3040	2711	3526	2955	3556		171+46	3556	
1972	3151	2804	3665	3072	3718		171+51	3718	
2083	3333	2965	3877	3248	3936		171+56	3936	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
2263	3626	3219	4216	3533	4285	Section 14	171+61	4285	4932
2237	3629	3210	4229	3545	4328		171+66	4328	2219
2236	3658	3231	4272	3586	4397		171+71	4397	
2298	3763	3324	4396	3689	4529		171+76	4529	
2409	3920	3469	4574	3838	4704		171+81	4704	
2510	4082	3607	4758	3991	4886		171+86	4886	
2439	4005	3532	4679	3928	4834		171+91	4834	
2393	3957	3485	4631	3890	4807		171+96	4807	
2426	3997	3526	4676	3929	4854		172+01	4854	
2492	4074	3603	4761	4001	4932		172+06	4932	
2489	4064	3592	4745	3986	4906		172+11	4906	14
2392	3930	3472	4597	3865	4777		172+16	4777	
2349	3851	3408	4506	3794	4694		172+21	4694	
2366	3840	3410	4487	3782	4666		172+26	4666	
2318	3735	3324	4358	3669	4507		172+31	4507	
2177	3521	3133	4114	3467	4279		172+36	4279	
2056	3330	2965	3894	3288	4073		172+41	4073	
2010	3219	2879	3760	3179	3932		172+46	3932	
2003	3155	2837	3674	3110	3831		172+51	3831	
1860	2893	2613	3362	2841	3476		172+56	3476	
1662	2592	2344	3018	2556	3151		172+61	3151	
1494	2324	2105	2706	2299	2855		172+66	2855	
1442	2201	1999	2548	2158	2678		172+71	2678	
1445	2155	1968	2481	2102	2587		172+76	2587	
1301	1885	1744	2164	1831	2219	Section 15	172+81	2219	2587
1097	1621	1489	1866	1578	1952		172+86	1952	1460
951	1426	1298	1642	1390	1754		172+91	1754	
895	1346	1221	1548	1306	1662		172+96	1662	
894	1329	1206	1521	1283	1630		173+01	1630	
769	1188	1042	1351	1148	1460	Section 16	173+06	1460	15 1733
602	1076	917	1268	1062	1421		173+11	1421	1421
633	1141	969	1346	1128	1510		173+16	1510	
681	1229	1044	1450	1216	1621		173+21	1621	
730	1317	1119	1554	1304	1733	PIER 5	173+26	1733	16
649	1163	1001	1380	1174	1616		173+31	1616	
619	1109	955	1316	1122	1548	Section 16	173+36	1548	
614	1088	940	1289	1098	1509		173+41	1509	
800	1235	1095	1413	1219	1588	Section 17	173+46	1588	17
829	1278	1153	1480	1265	1670		173+51	1670	2385
890	1367	1237	1583	1349	1760		173+56	1760	1588
1027	1546	1412	1787	1520	1936		173+61	1936	
1228	1800	1658	2069	1761	2180		173+66	2180	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
1260	1912	1740	2212	1886	2385	Section 18	173+71	2385	3807
1303	2004	1821	2328	1991	2506		173+76	2506	2266
1428	2208	2005	2570	2186	2724		173+81	2724	
1605	2468	2242	2867	2431	2989		173+86	2989	
1663	2602	2349	3030	2571	3182		173+91	3182	
1666	2644	2375	3087	2614	3240		173+96	3240	
1706	2735	2446	3195	2700	3340		174+01	3340	
1813	2895	2590	3378	2848	3499		174+06	3499	
1942	3080	2759	3588	3020	3680		174+11	3680	
1952	3120	2786	3638	3062	3745		174+16	3745	
1914	3090	2750	3609	3034	3715		174+21	3715	
1938	3129	2782	3651	3065	3742		174+26	3742	
2003	3212	2860	3743	3138	3807		174+31	3807	18
1955	3137	2791	3654	3063	3718		174+36	3718	
1888	3042	2703	3546	2971	3604		174+41	3604	
1879	3013	2680	3508	2937	3546		174+46	3546	
1914	3031	2706	3520	2944	3528		174+51	3528	
1795	2819	2525	3271	2738	3269		174+56	3271	
1664	2622	2346	3044	2545	3038		174+61	3044	
1564	2458	2200	2852	2384	2836		174+66	2852	
1543	2379	2143	2751	2298	2705		174+71	2751	
1548	2333	2115	2684	2242	2603		174+76	2684	
1350	1978	1813	2266	1895	2169	Section 19	174+81	2266	2684
1173	1715	1572	1964	1640	1869		174+86	1964	1234
1045	1518	1393	1734	1450	1649		174+91	1734	
999	1422	1312	1617	1350	1528		174+96	1617	
991	1378	1280	1557	1300	1472		175+01	1557	
804	1096	1025	1234	1058	1214	Section 20	175+06	1234	19 1557
542	848	745	970	827	1033		175+11	1033	1005
426	759	651	897	757	1005		175+16	1005	
447	802	687	949	802	1077		175+21	1077	
475	852	730	1009	854	1155		175+26	1155	20
470	840	727	999	854	1147	Section 20	175+31	1147	
446	797	690	948	811	1091		175+36	1091	
442	774	674	918	786	1051		175+41	1051	
627	925	831	1048	911	1136		175+46	1136	
895	1198	1132	1346	1163	1355		175+51	1355	21
983	1373	1278	1557	1306	1523	Section 21	175+56	1557	2523
998	1424	1320	1626	1367	1596		175+61	1626	1355
1057	1537	1418	1764	1484	1731		175+66	1764	
1201	1753	1615	2012	1692	1964		175+71	2012	
1378	2013	1852	2309	1941	2247		175+76	2309	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
1440	2186	1982	2523	2115	2489	Section 22	175+81	2523	3406
1438	2233	2010	2588	2168	2574		175+86	2588	2523
1474	2329	2082	2706	2262	2703		175+91	2706	
1582	2501	2234	2904	2425	2894		175+96	2904	
1713	2697	2411	3129	2614	3109		176+01	3129	
1745	2781	2472	3229	2696	3223		176+06	3229	
1708	2759	2442	3211	2678	3220		176+11	3220	
1733	2802	2478	3261	2720	3270		176+16	3270	
1806	2902	2570	3372	2811	3369		176+21	3372	
1827	2932	2598	3406	2839	3398		176+26	3406	22
1750	2831	2502	3293	2745	3295		176+31	3295	
1712	2774	2451	3229	2691	3231		176+36	3231	
1743	2791	2476	3242	2703	3229		176+41	3242	
1758	2777	2474	3218	2681	3177		176+46	3218	
1626	2580	2296	2993	2492	2959		176+51	2993	
1512	2404	2138	2790	2323	2761		176+56	2790	
1459	2293	2046	2655	2212	2616		176+61	2655	
1450	2239	2009	2583	2150	2521		176+66	2583	
1417	2125	1928	2442	2030	2339	Section 23	176+71	2442	2583
1250	1865	1695	2140	1780	2046		176+76	2140	710
1131	1657	1515	1896	1580	1799		176+81	1896	
1097	1564	1442	1778	1482	1663		176+86	1778	
1031	1395	1313	1571	1310	1426		176+91	1571	
857	1155	1089	1301	1082	1175		176+96	1301	
729	978	919	1096	910	988		177+01	1096	
663	877	825	977	808	885		177+06	977	
499	645	606	710	620	694	Section 24	177+11	710	23 1481
267	464	399	544	456	587		177+16	587	587
273	492	419	581	488	638	PIER 7	177+21	638	
303	546	464	644	541	709		177+26	709	24
309	557	475	658	554	726	Section 24	177+31	726	
300	540	461	638	537	705		177+36	705	
310	545	468	642	540	703		177+41	703	
514	727	651	808	696	829		177+46	829	
794	1039	980	1153	979	1098	Section 25	177+51	1153	25
925	1322	1192	1481	1214	1406		177+56	1481	2562
952	1408	1256	1590	1303	1524		177+61	1590	1153
1013	1548	1359	1753	1433	1693		177+66	1753	
1128	1756	1537	2000	1630	1930		177+71	2000	

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+ My (k-ft) (HL-93 Double Truck + Lane)									
1 Lane	2 Lanes	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	My Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
1462	2248	1985	2562	2093	2446	Section 26	177+76	2562	3786
1484	2315	2051	2660	2199	2590		177+81	2660	95
1503	2381	2105	2748	2278	2693		177+86	2748	
1578	2517	2228	2916	2417	2858		177+91	2916	
1717	2717	2416	3147	2614	3074		177+96	3147	
1877	2947	2633	3413	2836	3316		178+01	3413	
1885	3001	2666	3482	2894	3406		178+06	3482	
1870	2994	2658	3480	2896	3413		178+11	3480	
1908	3051	2714	3549	2954	3476		178+16	3549	
1999	3164	2827	3677	3062	3584		178+21	3677	
2075	3262	2921	3786	3149	3670		178+26	3786	26
1991	3143	2812	3651	3039	3545		178+31	3651	
1926	3042	2725	3538	2947	3436		178+36	3538	
1924	3009	2708	3496	2915	3383		178+41	3496	
1965	3028	2739	3510	2926	3373		178+46	3510	
1933	2930	2666	3388	2822	3221		178+51	3388	
1784	2695	2453	3113	2597	2961		178+56	3113	
1641	2469	2255	2853	2384	2712		178+61	2853	
1546	2292	2101	2639	2210	2499		178+66	2639	
1511	2190	2028	2515	2105	2355		178+71	2515	
1322	1856	1742	2122	1768	1942		178+76	2122	
1018	1438	1347	1647	1372	1512		178+81	1647	
713	1020	952	1171	976	1081		178+86	1171	
409	602	557	695	579	651		178+91	695	
104	184	161	220	185	222		178+96	222	
22	64	48	80	71	95	ABUT 2	178+98	95	

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- My (k-ft) (HL-93 Double Truck + Lane)									
1 Lane	2 Lanes	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-63	-113	-102	-139	-119	-156	PIER 2	165+86	-156	-156
-110	-200	-179	-244	-209	-275		165+91	-275	-3018
-158	-286	-256	-349	-299	-393		165+96	-393	
-205	-373	-333	-454	-389	-512		166+01	-512	
-278	-503	-450	-614	-527	-692		166+06	-692	
-326	-590	-528	-720	-618	-811		166+11	-811	
-374	-677	-605	-826	-708	-929		166+16	-929	
-421	-764	-683	-932	-798	-1047		166+21	-1047	
-494	-895	-801	-1092	-937	-1227		166+26	-1227	
-543	-983	-879	-1199	-1028	-1345	Section 1	166+31	-1345	
-591	-1071	-958	-1305	-1119	-1462		166+36	-1462	
-640	-1159	-1036	-1412	-1210	-1580		166+41	-1580	
-764	-1380	-1235	-1682	-1441	-1878		<u>166+51</u>	-1878	<u>1</u>
-813	-1468	-1315	-1789	-1533	-1994		166+56	-1994	
-863	-1556	-1394	-1897	-1625	-2110		166+61	-2110	
-988	-1776	-1594	-2165	-1855	-2401		166+71	-2401	
-1040	-1866	-1675	-2274	-1948	-2515		166+76	-2515	
-1091	-1956	-1757	-2383	-2040	-2630		<u>166+81</u>	-2630	<u>2</u>
-1260	-2250	-2027	-2743	-2350	-3018		166+91	-3018	-2630
-1319	-2348	-2117	-2860	-2450	-3136	Section 2	166+96	-3136	-3612
-1378	-2446	-2207	-2978	-2550	-3255		167+01	-3255	
-1437	-2543	-2297	-3096	-2649	-3373		167+06	-3373	
-1556	-2739	-2479	-3334	-2851	-3612		167+16	-3612	-3373
-1624	-2845	-2579	-3461	-2958	-3734		167+21	-3734	-5713
-1693	-2952	-2680	-3588	-3065	-3856		167+26	-3856	
-1765	-3061	-2783	-3717	-3175	-3980	Section 3	167+31	-3980	
-2034	-3420	-3129	-4126	-3527	-4357		167+41	-4357	
-2186	-3622	-3319	-4352	-3710	-4552		167+46	-4552	
-2360	-3879	-3537	-4632	-3921	-4792		167+51	-4792	
-2564	-4180	-3790	-4958	-4191	-5089		167+56	-5089	
-2897	-4767	-4244	-5607	-4716	-5713		<u>167+61</u>	-5713	<u>3</u>
-3167	-5172	-4583	-6048	-5087	-6119	Section 4	167+66	-6119	-4424
-3480	-5629	-4970	-6544	-5507	-6577		167+71	-6577	-7761
-3863	-6166	-5437	-7126	-5998	-7110		167+76	-7126	
-4290	-6756	-5950	-7761	-6532	-7690	PIER 3	<u>167+81</u>	-7761	<u>4</u>
-4256	-6711	-5857	-7668	-6447	-7600		167+86	-7668	
-3830	-6111	-5287	-6975	-5862	-6953		167+91	-6975	
-3431	-5536	-4742	-6306	-5301	-6328	Section 4	167+96	-6328	
-3096	-5033	-4274	-5718	-4806	-5766		168+01	-5766	
-2791	-4568	-3859	-5186	-4360	-5250		<u>168+06</u>	-5250	<u>5</u>

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-2393	-3862	-3319	-4409	-3713	-4424	Section 5	168+11	-4424	-1743
-2148	-3483	-3002	-3991	-3364	-4007		168+16	-4007	-5250
-1922	-3133	-2710	-3605	-3042	-3622		168+21	-3622	
-1718	-2813	-2444	-3252	-2749	-3270		168+26	-3270	
-1529	-2519	-2199	-2927	-2481	-2952		168+31	-2952	
-1286	-2112	-1886	-2488	-2122	-2511		168+36	-2511	
-1149	-1903	-1710	-2257	-1930	-2293		168+41	-2293	
-1026	-1719	-1554	-2055	-1763	-2110		168+46	-2110	
-918	-1560	-1417	-1881	-1618	-1958		168+51	-1958	
-823	-1425	-1298	-1731	-1494	-1832		168+56	-1832	
-752	-1310	-1212	-1611	-1409	-1743	Section 6	168+61	-1743	-1743
-742	-1305	-1193	-1597	-1395	-1747		168+66	-1747	-1844
-733	-1299	-1175	-1584	-1382	-1752		168+71	-1752	
-724	-1294	-1157	-1570	-1368	-1757		168+76	-1757	
-715	-1289	-1138	-1557	-1355	-1762		168+81	-1762	
-724	-1301	-1139	-1562	-1361	-1780		168+86	-1780	
-723	-1304	-1131	-1557	-1355	-1788		168+91	-1788	
-722	-1307	-1122	-1553	-1350	-1797		168+96	-1797	
-738	-1338	-1128	-1573	-1365	-1844	Section 7	<u>169+06</u>	-1844	<u>6</u> -1797
-742	-1346	-1126	-1576	-1365	-1853		169+11	-1853	-2091
-745	-1354	-1123	-1578	-1365	-1863		169+16	-1863	
-757	-1375	-1121	-1585	-1368	-1884		169+26	-1884	
-763	-1387	-1127	-1596	-1375	-1898		169+31	-1898	
-769	-1398	-1144	-1616	-1392	-1919		169+36	-1919	<u>7</u>
-784	-1424	-1187	-1664	-1434	-1967		169+46	-1967	
-792	-1437	-1206	-1686	-1452	-1987		169+51	-1987	
-800	-1451	-1225	-1708	-1470	-2006		169+56	-2006	
-817	-1479	-1270	-1759	-1514	-2052		169+66	-2052	
-827	-1495	-1292	-1784	-1534	-2071	Section 8	169+71	-2071	
-836	-1511	-1313	-1808	-1554	-2090		<u>169+76</u>	-2090	<u>8</u>
-835	-1510	-1323	-1817	-1560	-2091		169+81	-2091	-2090
-848	-1530	-1348	-1845	-1583	-2108		169+86	-2108	-2483
-861	-1549	-1373	-1873	-1605	-2126		169+91	-2126	
-875	-1568	-1398	-1901	-1628	-2143		169+96	-2143	
-892	-1600	-1430	-1944	-1660	-2179		170+01	-2179	
-921	-1642	-1470	-1993	-1699	-2213		170+06	-2213	
-958	-1696	-1518	-2053	-1746	-2258		170+11	-2258	
-1011	-1774	-1591	-2144	-1819	-2333		170+16	-2333	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-1122	-1939	-1728	-2322	-1958	-2483	Section 9	170+21	-2483	-2333
-1239	-2116	-1873	-2513	-2114	-2652		170+26	-2652	-3917
-1369	-2319	-2037	-2733	-2292	-2850		170+31	-2850	
-1514	-2548	-2222	-2981	-2496	-3085		170+36	-3085	
-1678	-2807	-2431	-3263	-2728	-3361		170+41	-3361	
-1955	-3288	-2801	-3791	-3160	-3917	Section 10	170+46	-3917	9
-2166	-3621	-3071	-4154	-3458	-4279		170+51	-4279	See Section 10 Load Table
-2395	-3979	-3362	-4543	-3781	-4670		170+56	-4670	
-2649	-4370	-3682	-4967	-4133	-5094		170+61	-5094	
-3022	-5003	-4174	-5660	-4699	-5816	Section 11	170+66	-5816	-4611
-3346	-5481	-4599	-6198	-5150	-6337		170+71	-6337	-7160
-3728	-6018	-5102	-6811	-5670	-6919	PIER 4	170+76	-6919	
-3895	-6228	-5337	-7071	-5899	-7160		170+81	-7160	11
-3518	-5704	-4890	-6512	-5432	-6626	Section 11	170+86	-6626	
-3170	-5209	-4467	-5980	-4986	-6115		170+91	-6115	
-2887	-4785	-4114	-5520	-4604	-5663		170+96	-5663	
-2635	-4398	-3796	-5098	-4256	-5245		171+01	-5245	12
-2311	-3833	-3361	-4477	-3757	-4611	Section 12	171+06	-4611	-3392
-2112	-3527	-3110	-4146	-3484	-4286		171+11	-4286	-5245
-1937	-3255	-2887	-3849	-3240	-3996		171+16	-3996	
-1779	-3012	-2686	-3583	-3023	-3741		171+21	-3741	13
-1576	-2685	-2424	-3227	-2732	-3392	Section 13	171+26	-3392	-2720
-1459	-2513	-2275	-3037	-2576	-3218		171+31	-3218	-3741
-1356	-2366	-2144	-2873	-2442	-3078		171+36	-3078	
-1273	-2258	-2041	-2752	-2344	-2985		171+41	-2985	
-1240	-2201	-1978	-2674	-2278	-2910		171+46	-2910	
-1204	-2144	-1920	-2601	-2218	-2853		171+51	-2853	
-1168	-2087	-1862	-2529	-2159	-2795		171+56	-2795	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-1138	-2035	-1801	-2454	-2095	-2720	Section 14	171+61	-2720	-1617
-1108	-1983	-1749	-2388	-2040	-2663		171+66	-2663	-2720
-1078	-1932	-1697	-2321	-1986	-2607		171+71	-2607	
-1048	-1881	-1645	-2255	-1931	-2551		171+76	-2551	
-1018	-1830	-1593	-2188	-1877	-2495		171+81	-2495	
-991	-1782	-1534	-2117	-1812	-2414		171+86	-2414	
-965	-1735	-1487	-2055	-1761	-2359		171+91	-2359	
-939	-1688	-1439	-1993	-1709	-2304		171+96	-2304	
-913	-1641	-1392	-1931	-1658	-2249		172+01	-2249	
-887	-1594	-1344	-1869	-1607	-2193		172+06	-2193	
-862	-1549	-1287	-1801	-1544	-2115		<u>172+11</u>	-2115	<u>14</u>
-838	-1505	-1243	-1742	-1495	-2060		172+16	-2060	
-814	-1461	-1201	-1686	-1449	-2007		172+21	-2007	
-790	-1416	-1175	-1644	-1416	-1965		172+26	-1965	
-765	-1373	-1152	-1605	-1382	-1908		172+31	-1908	
-742	-1330	-1128	-1564	-1350	-1865		172+36	-1865	
-720	-1288	-1104	-1524	-1319	-1822		172+41	-1822	
-697	-1246	-1080	-1483	-1287	-1779		172+46	-1779	
-675	-1204	-1056	-1443	-1256	-1737		172+51	-1737	
-651	-1166	-1035	-1410	-1222	-1677		172+56	-1677	
-631	-1127	-1014	-1373	-1192	-1635		172+61	-1635	
-631	-1120	-1009	-1363	-1181	-1617		172+66	-1617	
-667	-1166	-1046	-1408	-1210	-1645		172+71	-1645	
-745	-1273	-1140	-1523	-1303	-1742		172+76	-1742	
-915	-1539	-1344	-1802	-1511	-1968	Section 15	172+81	-1968	-1742
-1033	-1733	-1491	-2009	-1674	-2161		172+86	-2161	-3509
-1171	-1959	-1664	-2250	-1866	-2389		172+91	-2389	
-1332	-2219	-1864	-2527	-2089	-2653		172+96	-2653	
-1525	-2519	-2100	-2846	-2348	-2958	Section 16	173+01	-2958	
-1851	-3068	-2528	-3445	-2827	-3509		<u>173+06</u>	<u>-3509</u>	<u>15</u> -2958
-2097	-3444	-2845	-3860	-3171	-3909		173+11	-3909	-5509
-2405	-3884	-3257	-4367	-3597	-4382		173+16	-4382	
-2762	-4375	-3722	-4926	-4071	-4898	PIER 5	173+21	-4926	
-3144	-4888	-4213	-5509	-4568	-5434		<u>173+26</u>	<u>-5509</u>	<u>16</u>
-2818	-4411	-3730	-4924	-4080	-4963	Section 16	173+31	-4963	
-2459	-3928	-3321	-4420	-3660	-4500		173+36	-4500	
-2154	-3503	-2967	-3974	-3289	-4083		173+41	-4083	
-1903	-3135	-2667	-3584	-2968	-3713	Section 17	<u>173+46</u>	<u>-3713</u>	<u>17</u>
-1593	-2620	-2265	-3023	-2526	-3222		173+51	-3222	-2251
-1409	-2340	-2042	-2727	-2285	-2942		173+56	-2942	-3713
-1256	-2100	-1854	-2472	-2081	-2700		173+61	-2700	
-1130	-1899	-1698	-2257	-1918	-2500		173+66	-2500	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-951	-1620	-1467	-1950	-1684	-2251	Section 18	173+71	-2251	-1674
-862	-1506	-1363	-1827	-1584	-2140		173+76	-2140	-2251
-816	-1450	-1309	-1768	-1530	-2079		173+81	-2079	
-796	-1424	-1278	-1733	-1500	-2043		173+86	-2043	
-774	-1384	-1231	-1674	-1455	-1997		173+91	-1997	
-771	-1382	-1215	-1661	-1439	-1974		173+96	-1974	
-769	-1379	-1199	-1647	-1422	-1952		174+01	-1952	
-766	-1377	-1183	-1633	-1406	-1929		174+06	-1929	
-763	-1374	-1167	-1620	-1390	-1907		174+11	-1907	
-745	-1341	-1124	-1568	-1347	-1861		174+16	-1861	
-745	-1342	-1112	-1558	-1334	-1839		174+21	-1839	
-745	-1343	-1099	-1548	-1320	-1817		174+26	-1817	
-746	-1344	-1087	-1539	-1308	-1796		174+31	-1796	18
-731	-1318	-1082	-1522	-1296	-1772		174+36	-1772	
-736	-1323	-1095	-1534	-1304	-1764		174+41	-1764	
-740	-1328	-1109	-1547	-1312	-1757		174+46	-1757	
-744	-1333	-1122	-1560	-1320	-1749		174+51	-1749	
-730	-1307	-1116	-1542	-1306	-1723		174+56	-1723	
-741	-1318	-1137	-1562	-1320	-1717		174+61	-1717	
-753	-1329	-1158	-1581	-1334	-1711		174+66	-1711	
-765	-1341	-1180	-1601	-1348	-1706		174+71	-1706	
-777	-1354	-1202	-1622	-1363	-1701		174+76	-1701	
-786	-1343	-1212	-1615	-1358	-1674	Section 19	174+81	-1674	-1674
-874	-1449	-1314	-1730	-1449	-1747		174+86	-1747	-2772
-985	-1601	-1449	-1895	-1585	-1891		174+91	-1895	
-1111	-1781	-1603	-2090	-1746	-2071		174+96	-2090	
-1261	-2001	-1786	-2326	-1941	-2295	Section 20	175+01	-2326	
-1507	-2416	-2101	-2772	-2296	-2742		175+06	-2772	19 -2249
-1712	-2723	-2353	-3102	-2569	-3066		175+11	-3102	-4400
-1947	-3068	-2638	-3471	-2877	-3428	PIER 6	175+16	-3471	
-2251	-3490	-2997	-3920	-3251	-3855		175+21	-3920	
-2589	-3947	-3387	-4400	-3654	-4308	Section 20	175+26	-4400	20
-2474	-3796	-3213	-4205	-3484	-4131		175+31	-4205	
-2151	-3355	-2841	-3743	-3098	-3701	Section 20	175+36	-3743	
-1877	-2962	-2515	-3326	-2754	-3307		175+41	-3326	
-1655	-2631	-2247	-2974	-2463	-2968		175+46	-2974	
-1456	-2331	-2006	-2655	-2200	-2660	Section 21	175+51	-2660	21
-1227	-1940	-1716	-2238	-1870	-2249		175+56	-2249	-1560
-1079	-1719	-1538	-2005	-1679	-2035		175+61	-2035	-2660
-951	-1531	-1385	-1805	-1526	-1864		175+66	-1864	
-840	-1394	-1253	-1654	-1399	-1737		175+71	-1737	
-742	-1277	-1137	-1527	-1291	-1634		175+76	-1634	

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	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max	Max/Min
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-697	-1212	-1080	-1454	-1230	-1560	Section 22	175+81	-1560	-1375
-667	-1173	-1039	-1408	-1191	-1523		175+86	-1523	-1560
-650	-1155	-1010	-1380	-1165	-1504		175+91	-1504	
-634	-1138	-980	-1352	-1140	-1485		175+96	-1485	
-619	-1122	-952	-1324	-1116	-1467		176+01	-1467	
-616	-1115	-933	-1305	-1099	-1450		176+06	-1450	
-609	-1106	-914	-1286	-1081	-1434		176+11	-1434	
-602	-1097	-894	-1266	-1063	-1418		176+16	-1418	
-595	-1088	-875	-1247	-1045	-1402		176+21	-1402	
-591	-1083	-855	-1228	-1027	-1383		176+26	-1383	22
-591	-1079	-862	-1232	-1031	-1380		176+31	-1380	
-590	-1076	-869	-1236	-1036	-1378		176+36	-1378	
-589	-1073	-877	-1240	-1040	-1377		176+41	-1377	
-586	-1070	-884	-1246	-1045	-1375		176+46	-1375	
-593	-1074	-901	-1259	-1056	-1375		176+51	-1375	
-600	-1078	-917	-1271	-1067	-1375		176+56	-1375	
-608	-1083	-934	-1284	-1079	-1375		176+61	-1375	
-616	-1087	-951	-1296	-1090	-1375		176+66	-1375	
-617	-1092	-965	-1311	-1101	-1379	Section 23	176+71	-1379	-1375
-648	-1116	-1003	-1342	-1129	-1389		176+76	-1389	-3060
-717	-1180	-1077	-1410	-1188	-1427		176+81	-1427	
-817	-1309	-1196	-1551	-1302	-1538		176+86	-1551	
-975	-1548	-1388	-1805	-1505	-1768		176+91	-1805	
-1119	-1758	-1562	-2029	-1688	-1969		176+96	-2029	
-1278	-1996	-1755	-2283	-1895	-2204		177+01	-2283	
-1464	-2271	-1979	-2576	-2135	-2482		177+06	-2576	
-1732	-2722	-2321	-3060	-2524	-2967	Section 24	177+11	-3060	23 -2268
-1973	-3076	-2613	-3438	-2836	-3328		177+16	-3438	-4357
-2270	-3490	-2962	-3876	-3202	-3739	PIER 7	177+21	-3876	
-2609	-3948	-3353	-4357	-3603	-4184		177+26	-4357	24
-2497	-3776	-3237	-4192	-3474	-4025	Section 24	177+31	-4192	
-2165	-3326	-2859	-3724	-3084	-3597		177+36	-3724	
-1870	-2916	-2518	-3295	-2728	-3201		177+41	-3295	
-1642	-2579	-2247	-2939	-2435	-2868		177+46	-2939	
-1436	-2276	-2002	-2619	-2171	-2573	Section 25	177+51	-2619	25
-1229	-1937	-1754	-2268	-1899	-2250		177+56	-2268	-1782
-1105	-1788	-1613	-2108	-1766	-2117		177+61	-2117	-2619
-1005	-1678	-1499	-1989	-1661	-2019		177+66	-2019	
-934	-1597	-1417	-1901	-1583	-1944		177+71	-1944	

NOTE: Stations refer to stationing along centerline of construction in 1984 As-Built Plans.

- My (k-ft) (HL-93 Double Truck + Lane)						Section	Sta.	Max	Max/Min
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				
-820	-1442	-1267	-1722	-1431	-1782	Section 26	177+76	-1782	-19
-758	-1323	-1170	-1582	-1322	-1646		177+81	-1646	-1944
-716	-1259	-1111	-1507	-1260	-1577		177+86	-1577	
-675	-1195	-1052	-1433	-1199	-1509		177+91	-1509	
-634	-1132	-994	-1358	-1137	-1440		177+96	-1440	
-593	-1068	-935	-1283	-1076	-1372		178+01	-1372	
-558	-1002	-879	-1204	-1010	-1286		178+06	-1286	
-526	-948	-830	-1139	-956	-1222		178+11	-1222	
-494	-893	-782	-1074	-903	-1158		178+16	-1158	
-462	-839	-734	-1010	-850	-1094		178+21	-1094	
-419	-764	-666	-919	-772	-995		178+26	-995	<u>26</u>
-391	-713	-622	-858	-722	-933		178+31	-933	
-363	-663	-578	-798	-672	-870		178+36	-870	
-335	-612	-534	-738	-622	-807		178+41	-807	
-307	-562	-491	-677	-572	-744		178+46	-744	
-267	-490	-426	-590	-496	-646		178+51	-646	
-240	-441	-384	-531	-447	-583		178+56	-583	
-214	-393	-342	-473	-398	-519		178+61	-519	
-187	-344	-299	-414	-349	-456		178+66	-456	
-161	-295	-257	-355	-300	-393		178+71	-393	
-120	-221	-191	-266	-223	-293		178+76	-293	
-94	-173	-150	-208	-175	-229		178+81	-229	
-68	-124	-108	-150	-126	-165		178+86	-165	
-41	-76	-66	-92	-78	-102		178+91	-102	
-15	-28	-25	-33	-29	-38		178+96	-38	
-8	-13	-12	-16	-14	-19	ABUT 2	178+98	-19	

- My (k-ft) (HL-93 Double Truck + Lane)								
1 Lane	2 Lanes	2 Lanes	3 Lanes	3 Lanes	7 Lanes	Section	Sta.	Max
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4				
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65			
-1117	-1932	-1675	-2274	-1912	-2265	Section 9	170+21	-2274
-1140	-1965	-1705	-2312	-1944	-2296		170+22	-2312
-1163	-2000	-1736	-2352	-1976	-2328		170+23	-2352
-1186	-2035	-1768	-2392	-2009	-2361		170+24	-2392
-1209	-2071	-1800	-2434	-2043	-2395		170+25	-2434
-1234	-2108	-1834	-2476	-2078	-2430		170+26	-2476
-1258	-2146	-1868	-2520	-2115	-2466		170+27	-2520
-1283	-2184	-1903	-2565	-2152	-2504		170+28	-2565
-1310	-2225	-1939	-2612	-2190	-2544		170+29	-2612
-1336	-2267	-1976	-2660	-2230	-2584		170+30	-2660
-1363	-2309	-2014	-2709	-2270	-2625		170+31	-2709
-1391	-2352	-2052	-2758	-2311	-2668		170+32	-2758
-1419	-2397	-2092	-2810	-2354	-2711		170+33	-2810
-1448	-2442	-2132	-2862	-2398	-2759		170+34	-2862
-1477	-2489	-2173	-2916	-2443	-2804		170+35	-2916
-1508	-2536	-2216	-2972	-2488	-2850		170+36	-2972
-1538	-2585	-2259	-3028	-2535	-2896		170+37	-3028
-1570	-2635	-2304	-3086	-2584	-2945		170+38	-3086
-1602	-2687	-2349	-3146	-2634	-2992		170+39	-3146
-1636	-2740	-2396	-3207	-2685	-3040		170+40	-3207
-1670	-2794	-2445	-3270	-2737	-3088		170+41	-3270
-1705	-2849	-2494	-3334	-2791	-3136		170+42	-3334
-1741	-2906	-2545	-3400	-2846	-3187		170+43	-3400
-1779	-2965	-2597	-3467	-2902	-3237		170+44	-3467
-1905	-3210	-2799	-3758	-3142	-3668	Section 10	170+45	-3758
-1945	-3273	-2855	-3831	-3203	-3734		170+46	-3831
-1986	-3338	-2913	-3906	-3265	-3803		170+47	-3906
-2028	-3403	-2971	-3982	-3328	-3870		170+48	-3982
-2070	-3470	-3030	-4058	-3392	-3938		170+49	-4058
-2113	-3537	-3089	-4136	-3457	-4008		170+50	-4136
-2156	-3605	-3150	-4215	-3523	-4076		170+51	-4215
-2200	-3674	-3212	-4295	-3589	-4145		170+52	-4295
-2245	-3745	-3274	-4376	-3657	-4215		170+53	-4376
-2291	-3816	-3338	-4458	-3726	-4285		170+54	-4458
-2337	-3888	-3402	-4541	-3796	-4357		170+55	-4541
-2384	-3962	-3467	-4626	-3867	-4429		170+56	-4626
-2432	-4037	-3535	-4713	-3940	-4503		170+57	-4713
-2482	-4113	-3603	-4801	-4014	-4578		170+58	-4801
-2532	-4191	-3673	-4891	-4089	-4653		170+59	-4891
-2584	-4270	-3744	-4982	-4165	-4730		170+60	-4982
-2637	-4351	-3817	-5075	-4244	-4808		170+61	-5075
-2691	-4434	-3891	-5170	-4323	-4888		170+62	-5170

- My (k-ft) (HL-93 Double Truck + Lane)						Section	Sta.	Max	
1 Lane	2 Lanes	2 Lanes	3 Lanes	3 Lanes	7 Lanes				
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4					
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65				
-2832	-4717	-4121	-5506	-4597	-5311	Section 11	170+63	-5506	10
-2890	-4804	-4200	-5606	-4682	-5402		170+64	-5606	
-2948	-4892	-4280	-5708	-4767	-5493		170+65	-5708	
-3008	-4982	-4360	-5810	-4853	-5587		170+66	-5810	
-3070	-5074	-4444	-5916	-4942	-5681		170+67	-5916	
-3133	-5167	-4529	-6023	-5032	-5776		170+68	-6023	
-3197	-5261	-4615	-6131	-5124	-5871		170+69	-6131	
-3263	-5358	-4704	-6242	-5217	-5969		170+70	-6242	
-3331	-5458	-4794	-6355	-5312	-6068		170+71	-6355	
-3403	-5562	-4890	-6473	-5412	-6173		170+72	-6473	
-3478	-5668	-4987	-6593	-5513	-6277		170+73	-6593	
-3554	-5775	-5086	-6715	-5615	-6383		170+74	-6715	
-3632	-5884	-5187	-6837	-5719	-6490		170+75	-6837	
-3710	-5993	-5287	-6960	-5823	-6597		170+76	-6960	
-3790	-6104	-5390	-7085	-5928	-6705		170+77	-7085	
-3870	-6215	-5492	-7210	-6034	-6810		170+78	-7210	
-3951	-6327	-5596	-7335	-6140	-6919		170+79	-7335	
-4015	-6415	-5677	-7434	-6224	-7005		170+80	-7434	

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			
-8	-21	-9	-19	-18	-19	PIER 2	355	21
5	10	7	11	13	20	Section 1	355	20
-6	-15	-6	-14	-13	-13		355	15
4	7	5	8	9	14		355	14
-3	-8	-3	-8	-7	-8		356	8
2	5	3	5	6	8		356	8
-4	-11	-4	-10	-9	-10		356	11
3	6	4	6	7	10		356	10
-3	-7	-3	-7	-7	-7		357	7
2	5	3	5	5	7		357	7
-4	-10	-4	-9	-8	-9		357	10
3	5	4	6	6	9		357	9
-1	-3	-2	-3	-4	-5		358	5
1	3	2	3	4	5		358	5
-1	-2	-1	-2	-2	-4		358	4
1	2	3	3	4	7		358	7
-7	-12	-11	-14	-14	-16		359	16
4	8	6	9	8	9		359	9
-11	-20	-17	-23	-22	-23		359	23
6	12	10	14	13	14		359	14
-6	-11	-10	-13	-12	-15	Section 2	360	15
13	26	18	28	26	26		360	28
-3	-5	-5	-7	-7	-10		360	10
9	17	13	19	18	19		360	19
-2	-3	-5	-5	-6	-13	Section 3	361	13
0	4	1	3	4	7		361	7
-3	-5	-5	-6	-7	-11		361	11
2	6	3	6	6	6		361	6
-1	-3	-2	-3	-5	-10		362	10
6	15	8	15	14	19		362	19
-3	-6	-5	-7	-8	-12		362	12
12	24	18	27	25	27		362	27

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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			
-21	-43	-30	-46	-43	-45	Section 4	363	46
9	20	11	21	19	23		363	23
-16	-30	-26	-36	-36	-47		363	47
5	18	8	17	17	16		363	18
-7	-23	-7	-20	-20	-21	PIER 3	364	23
16	28	23	33	33	54		364	54
-5	-13	-6	-13	-12	-16	Section 4	364	16
17	34	25	37	35	44		364	44
-20	-39	-28	-42	-39	-40	Section 5	365	42
5	8	7	10	9	15		365	15
-13	-26	-17	-28	-26	-28		365	28
3	6	4	7	7	14		365	14
-8	-19	-10	-18	-17	-17		366	19
5	10	8	11	11	20		366	20
-12	-26	-14	-26	-23	-24		366	26
5	10	7	11	10	20		366	20
-7	-15	-9	-15	-14	-15	Section 6	367	15
2	5	4	5	5	11		367	11
-7	-16	-9	-16	-15	-16		367	16
3	5	4	6	6	13		367	13
-10	-21	-15	-23	-21	-23		368	23
3	6	5	7	7	11		368	11
-14	-26	-20	-29	-27	-28		368	29
4	8	6	9	9	12		368	12

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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				
-3	-8	-4	-8	-8	-9	Section 7	369	9	7
6	12	8	14	14	19		369	19	
-4	-10	-4	-10	-10	-10		369	10	
2	7	4	7	8	14		369	14	
-3	-8	-5	-9	-9	-12		370	12	
2	7	3	6	7	8		370	8	
-4	-11	-6	-11	-11	-13		370	13	
2	6	3	6	7	10		370	10	
-2	-5	-3	-5	-6	-10		371	10	
5	12	6	12	12	12		371	12	
-2	-7	-3	-7	-7	-10		371	10	
3	9	4	9	9	11		371	11	
-2	-5	-3	-5	-6	-13		372	13	
6	15	8	15	14	14		372	15	
-3	-7	-4	-7	-8	-13		372	13	
5	14	6	13	13	12		372	14	
-3	-6	-4	-6	-6	-11	Section 8	373	11	8
9	19	12	20	18	18		373	20	
-3	-5	-4	-6	-5	-11		373	11	
8	17	10	18	17	16		373	18	
-3	-6	-5	-7	-7	-15		374	15	
9	21	12	21	19	19		374	21	
-3	-6	-5	-7	-6	-14		374	14	
9	20	11	20	18	18		374	20	
-5	-10	-7	-10	-10	-19	Section 9	375	19	
11	25	14	26	23	25		375	26	
-3	-6	-4	-6	-6	-14		375	14	
10	21	12	21	19	20	Section 10	375	21	
-12	-24	-15	-25	-23	-35		376	35	
15	35	19	35	32	36		376	36	
-7	-13	-10	-14	-13	-24		376	24	
14	30	17	31	28	28		376	31	

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			
-11	-25	-13	-25	-24	-30	Section 11	377	30
11	25	14	25	23	32		377	32
-26	-58	-32	-58	-55	-82		377	82
38	84	48	85	78	91	PIER 4	377	91
-35	-79	-43	-79	-72	-91		378	91
33	70	43	73	67	93		378	93
-16	-35	-19	-35	-32	-45	Section 11	378	45
19	41	25	43	39	50		378	50
-8	-18	-9	-18	-16	-15	Section 12	379	18
2	3	3	4	5	12		379	12
-13	-31	-16	-30	-27	-33		379	33
11	23	15	24	22	33		379	33
-6	-15	-7	-14	-13	-13	Section 13	380	15
2	5	3	5	5	11		380	11
-9	-20	-10	-20	-18	-19		380	20
5	10	7	11	10	18		380	18
-6	-16	-7	-15	-14	-14		381	16
3	5	4	6	6	12		381	12
-8	-20	-10	-19	-18	-18		381	20
4	7	6	8	8	15		381	15

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			
-3	-9	-4	-8	-8	-8	Section 14	382	9
1	3	2	3	3	6		382	6
-4	-11	-5	-10	-10	-10		382	11
2	3	2	4	4	8		382	8
-2	-6	-3	-7	-7	-8		383	8
1	5	2	5	5	7		383	7
-2	-7	-4	-7	-7	-8		383	8
1	4	2	4	5	7		383	7
-3	-6	-4	-6	-6	-9		384	9
3	9	5	9	9	10		384	10
-3	-6	-4	-6	-7	-9		384	9
3	8	4	8	8	9		384	9
-3	-6	-4	-7	-6	-11		385	11
5	12	6	12	12	13		385	13
-3	-6	-4	-6	-6	-10		385	10
4	11	5	11	11	11		385	11
-4	-7	-5	-8	-7	-13		386	13
7	16	8	15	14	15		386	16
-3	-6	-5	-7	-7	-12		386	12
6	14	7	14	13	14		386	14
-5	-9	-6	-10	-9	-16	Section 15	387	16
8	19	9	19	17	18		387	19
-3	-6	-5	-7	-7	-13		387	13
7	16	8	15	14	14		387	16
-9	-17	-12	-19	-17	-25	Section 16	388	25
10	22	13	23	20	26		388	26
-12	-24	-17	-27	-24	-38		388	38
16	35	21	36	33	40	PIER 5	388	40
-13	-30	-17	-30	-27	-35		389	35
13	25	18	28	25	36	Section 16	389	36
-8	-18	-10	-18	-16	-22		389	22
9	18	12	19	17	23	Section 17	389	23
-6	-14	-6	-13	-12	-13		390	14
3	5	4	6	6	11		390	11
-8	-19	-8	-18	-17	-18		390	19
5	10	7	11	11	17		390	17

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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	-6	-2	-6	-5	-5	Section 18	391	6
1	2	2	3	3	5		391	5
-3	-7	-3	-7	-7	-7		391	7
2	3	2	3	4	6		391	6
-2	-5	-2	-4	-4	-4		392	5
1	2	1	2	2	4		392	4
-2	-5	-2	-5	-4	-5		392	5
1	2	1	2	2	4		392	4
-1	-4	-2	-4	-4	-4		393	4
1	3	2	3	3	4		393	4
-1	-3	-2	-4	-4	-4		393	4
1	3	2	3	3	4		393	4
-1	-2	-2	-3	-3	-4		394	4
1	4	2	4	4	5		394	5
-1	-2	-2	-3	-3	-4		394	4
1	4	2	4	4	5		394	5
-1	-2	-2	-3	-3	-5		395	5
2	6	3	5	5	5		395	6
-1	-2	-2	-2	-3	-4		395	4
2	5	2	5	5	5		395	5
-3	-7	-5	-7	-8	-12	Section 19	396	12
5	14	6	13	12	13		396	14
-2	-4	-3	-5	-5	-9		396	9
4	11	4	10	10	10		396	11
-9	-20	-11	-20	-20	-26	Section 20	397	26
9	23	11	22	21	26		397	26
-11	-26	-14	-26	-26	-35		397	35
12	30	14	29	28	34	PIER 6	397	34
-10	-27	-12	-26	-25	-29	Section 20	398	29
8	21	10	20	21	29		398	29
-8	-20	-8	-19	-18	-21		398	21
6	15	8	15	16	22	Section 21	398	22
-5	-14	-5	-12	-12	-12		399	14
3	5	4	6	6	11		399	11
-6	-16	-6	-15	-14	-15		399	16
3	7	5	7	8	14		399	14

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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	2 Lanes	2 Lanes	3 Lanes	3 Lanes	7 Lanes			
L1	L1+L2	L1+L3	L1+L2+L3	L1+L3+L4				
m= 1.20	m= 1.00	m= 1.00	m= 0.85	m= 0.85	m= 0.65			
-1	-3	-1	-3	-3	-3	Section 22	400	3
1	1	1	1	1	2		400	2
-1	-3	-1	-3	-3	-3		400	3
1	1	1	1	2	3		400	3
-1	-3	-1	-3	-3	-3		401	3
1	1	1	1	2	2		401	2
-1	-2	-1	-3	-2	-3		401	3
0	1	1	1	2	2		401	2
0	-1	-1	-2	-2	-2		402	2
1	2	1	2	2	2		402	2
0	-1	-1	-2	-2	-2		402	2
1	2	1	2	2	3		402	3
-1	-1	-1	-1	-1	-2		403	2
1	3	1	3	3	3		403	3
0	-1	-1	-1	-1	-2		403	2
1	3	1	2	2	2		403	3
-3	-7	-5	-7	-8	-14	Section 23	404	14
7	18	7	16	16	16		404	18
-3	-6	-4	-6	-7	-12		404	12
6	16	6	14	13	13		404	16
-4	-8	-5	-8	-9	-14		405	14
6	15	6	14	13	14		405	15
-3	-6	-4	-6	-7	-11		405	11
5	13	6	13	12	12		405	13
-8	-19	-9	-18	-19	-24	Section 24	406	24
8	21	9	19	19	23		406	23
-12	-28	-13	-27	-28	-36	PIER 7	406	36
13	32	14	30	30	35		406	35
-11	-29	-12	-27	-27	-32	Section 24	407	32
10	23	12	23	24	32		407	32
-7	-19	-7	-17	-18	-22	Section 24	407	22
7	17	9	17	18	25		407	25
-10	-19	-12	-19	-17	-15	Section 25	408	19
2	5	4	6	5	8		408	8
-5	-7	-6	-8	-8	-9		408	9
4	4	5	5	5	8		408	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			
-4	-4	-5	-5	-5	-8	Section 26	409	8
5	7	6	8	8	9		409	9
-19	-32	-24	-34	-30	-30		409	34
12	21	17	24	22	24		409	24
-2	-5	-2	-5	-5	-5		410	5
2	2	3	3	3	5		410	5
-1	-4	-1	-4	-4	-4		410	4
0	0	1	1	1	3		410	3
-1	-2	-1	-3	-3	-3		411	3
0	2	1	2	2	3		411	3
-1	-2	-1	-3	-3	-3		411	3
0	1	1	2	2	3		411	3
-1	-2	-1	-2	-3	-4		412	4
2	4	2	4	4	5		412	5
-1	-2	-2	-2	-3	-4		412	4
1	4	2	4	4	4		412	4
-1	-3	-2	-3	-4	-6		413	6
3	8	3	7	7	6		413	8
-1	-3	-2	-3	-4	-6		413	6
3	8	2	7	6	6		413	8
-1	-3	-2	-3	-4	-8		414	8
3	10	3	9	9	8		414	10
-2	-3	-3	-4	-5	-9		414	9
4	11	4	10	10	9		ABUT 2	11

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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			
-8	-19	-8	-18	-17	-18	PIER 2	355	19
5	9	7	10	12	19	Section 1	355	12
-5	-14	-6	-13	-12	-13		355	14
3	6	5	7	8	13		355	8
-3	-8	-3	-7	-7	-7		356	8
2	4	3	5	6	8		356	6
-4	-10	-4	-9	-9	-9		356	10
3	5	4	6	6	10		356	6
-3	-7	-3	-7	-6	-7		357	7
2	4	3	5	5	7		357	5
-4	-9	-4	-9	-8	-9		357	9
2	5	3	5	6	9		357	6
-1	-3	-2	-3	-3	-4		358	3
1	3	2	3	4	5		358	4
-1	-2	-1	-2	-2	-4		358	2
1	2	3	3	4	7		358	4
-6	-11	-10	-13	-13	-15		359	13
4	7	6	8	8	8		359	8
-11	-19	-16	-22	-21	-22		359	22
6	11	9	13	12	13		359	13
-6	-10	-9	-12	-11	-14	Section 2	360	12
12	24	17	26	24	24		360	26
-3	-5	-5	-6	-6	-9		360	6
8	15	12	17	16	18	Section 3	360	17
-2	-3	-4	-4	-6	-12		361	6
0	3	1	3	3	6		361	3
-3	-4	-5	-6	-7	-11		361	7
2	6	3	6	6	6		361	6
-1	-3	-2	-3	-4	-10		362	4
6	13	8	14	13	18		362	14
-4	-7	-6	-8	-8	-13		362	8
13	27	19	29	27	28		362	29

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				
-20	-39	-28	-43	-40	-42	Section 4	363	43	3
10	21	12	22	20	24		363	22	
-15	-28	-25	-34	-35	-47		363	35	
6	18	7	18	17	16		363	18	
-7	-21	-7	-19	-18	-20	PIER 3	364	21	4
14	26	22	31	32	51		364	32	
-5	-13	-6	-12	-12	-16	Section 4	364	13	
16	31	24	35	33	41		364	35	
-20	-39	-29	-43	-40	-41	Section 5	365	43	5
5	9	7	10	10	15		365	10	
-12	-24	-16	-26	-24	-27		365	26	
3	7	5	7	8	14		365	8	
-7	-17	-9	-17	-16	-16		366	17	
6	10	8	12	11	19		366	12	
-11	-23	-13	-24	-21	-23		366	24	
6	11	8	12	11	20		366	12	
-6	-14	-8	-14	-13	-13	Section 6	367	14	
2	4	4	5	5	10		367	5	
-7	-15	-8	-15	-14	-15		367	15	
3	5	4	6	6	13		367	6	
-9	-19	-14	-21	-20	-21		368	21	
4	6	5	8	7	11		368	8	
-12	-24	-18	-27	-25	-26		368	27	
5	8	7	10	9	13		368	10	

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	-9	-4	-9	-9	-10	Section 7	369	9
6	12	8	14	13	18		369	14
-4	-10	-4	-10	-10	-10		369	10
3	7	4	8	8	14		369	8
-3	-8	-5	-9	-9	-12		370	9
2	7	3	7	7	9		370	7
-4	-10	-6	-11	-11	-12		370	11
2	7	3	7	7	10		370	7
-2	-6	-3	-6	-6	-10		371	6
5	12	6	12	11	12		371	12
-2	-7	-3	-7	-8	-11		371	8
3	9	4	9	9	11		371	9
-2	-5	-3	-6	-6	-12		372	6
6	14	7	14	13	13		372	14
-3	-7	-4	-8	-8	-13		372	8
5	14	6	13	13	12		372	14
-3	-6	-5	-7	-6	-11	Section 8	373	7
8	17	11	18	17	17		373	18
-3	-5	-4	-6	-5	-10		373	6
7	16	9	16	15	15		373	16
-4	-7	-6	-8	-7	-15		374	8
9	19	11	19	17	18		374	19
-3	-6	-5	-7	-7	-14		374	7
8	18	10	18	16	17	Section 9	374	18
-5	-10	-7	-11	-11	-19		375	11
11	23	13	24	21	24		375	24
-3	-6	-4	-6	-6	-14	Section 10	375	6
9	19	11	19	18	19		375	19
-11	-24	-15	-25	-23	-34		376	25
14	32	18	32	29	34		376	32
-7	-13	-10	-15	-14	-24		376	15
13	28	16	29	26	27		376	29

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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				
-10	-24	-13	-24	-23	-29	Section 11	377	24	
11	23	13	24	23	30		377	24	
-26	-57	-32	-58	-55	-79		377	58	
35	77	44	78	72	85	PIER 4	377	78	11
-34	-75	-42	-76	-69	-89		378	76	
33	69	44	73	67	92	Section 11	378	73	
-15	-34	-19	-35	-32	-44		378	35	
19	40	25	42	39	49		378	42	12
-7	-17	-8	-16	-15	-14	Section 12	379	17	
2	4	4	5	5	11		379	5	13
-13	-29	-15	-29	-26	-32		379	29	
11	23	15	24	23	32		379	24	
-6	-14	-7	-13	-12	-12	Section 13	380	14	
3	5	4	6	6	11		380	6	
-8	-19	-10	-18	-16	-19		380	19	
5	11	8	12	11	17		380	12	
-6	-15	-7	-14	-13	-14		381	15	
3	6	4	6	7	12		381	7	
-8	-18	-9	-18	-16	-18		381	18	
4	8	6	9	9	16		381	9	

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				
-3	-8	-4	-8	-8	-8	Section 14	382	8	
1	3	2	3	4	6		382	4	
-4	-10	-5	-10	-9	-9		382	10	
2	3	2	4	4	8		382	4	
-2	-7	-4	-7	-7	-8		383	7	
2	5	3	5	5	7		383	5	
-3	-7	-4	-8	-7	-8		383	8	
1	4	2	5	5	7		383	5	
-2	-6	-4	-7	-7	-9		384	7	
3	9	4	9	8	10		384	9	
-2	-6	-4	-7	-7	-9		384	7	
3	8	4	8	8	9		384	8	
-3	-6	-4	-6	-6	-10		385	6	
5	12	6	12	11	12		385	12	
-3	-6	-4	-6	-6	-10		385	6	
4	11	5	10	10	11		385	11	
-4	-7	-5	-8	-8	-13		386	8	
6	15	7	14	13	14		386	15	
-3	-6	-5	-7	-7	-12		386	7	
6	13	6	13	12	13		386	13	
-5	-10	-7	-11	-10	-17	Section 15	387	11	
8	18	9	17	16	18		387	18	
-3	-6	-5	-7	-7	-12		387	7	
6	14	7	14	13	13		387	14	
-9	-18	-12	-19	-18	-25	Section 16	388	19	15
10	22	13	22	20	25		388	22	
-13	-26	-18	-28	-26	-38		388	28	
16	34	21	35	31	39	PIER 5	388	35	16
-14	-29	-18	-30	-27	-35		389	30	
13	26	18	28	25	36	Section 16	389	28	
-8	-18	-10	-18	-16	-22		389	18	
9	17	12	19	17	23	Section 17	389	19	17
-5	-13	-6	-12	-11	-12		390	13	
3	6	4	7	7	11		390	7	
-7	-18	-8	-17	-16	-18		390	18	
6	11	8	12	12	18		390	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				
-2	-6	-2	-5	-5	-5	Section 18	391	6	
1	2	2	3	3	5		391	3	
-3	-7	-3	-6	-6	-7		391	7	
2	3	2	4	4	6		391	4	
-2	-4	-2	-4	-4	-4		392	4	
1	2	1	2	2	4		392	2	
-2	-4	-2	-4	-4	-4		392	4	
1	2	1	2	2	4		392	2	
-1	-4	-2	-4	-4	-4		393	4	
1	3	2	3	3	4		393	<u>3</u>	
-1	-4	-2	-4	-4	-4		393	4	
1	3	2	3	3	4		393	3	
-1	-3	-2	-3	-3	-4		394	3	
1	4	2	4	4	5		394	4	
-1	-3	-2	-3	-3	-4		394	3	
1	4	2	4	4	5		394	4	
-1	-2	-2	-3	-3	-5		395	3	
2	5	3	5	5	5		395	5	
-1	-2	-2	-2	-3	-4		395	3	
2	5	2	5	4	5		395	5	
-4	-8	-5	-8	-8	-13	Section 19	396	8	
5	13	6	12	12	13		396	13	
-3	-5	-3	-5	-6	-9		396	6	
4	11	4	10	9	10		396	11	
-9	-20	-12	-21	-20	-27	Section 20	<u>397</u>	<u>21</u>	<u>19</u>
9	22	11	21	20	26		397	22	
-12	-27	-15	-27	-27	-35		397	27	
12	30	14	29	27	34	PIER 6	<u>397</u>	<u>30</u>	<u>20</u>
-10	-25	-11	-24	-24	-28		398	25	
9	21	11	21	21	29	Section 20	398	21	
-7	-19	-8	-17	-17	-20		398	19	
7	16	8	16	16	21		<u>398</u>	<u>16</u>	
-5	-13	-5	-12	-11	-12	Section 21	399	13	<u>21</u>
3	6	4	7	7	11		399	7	
-6	-15	-6	-14	-13	-14		399	15	
4	8	5	9	9	14		399	9	

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				
-1	-3	-1	-3	-2	-3	Section 22	400	3	
1	1	1	1	1	2		400	1	
-1	-3	-1	-3	-3	-3		400	3	
1	1	1	1	2	3		400	2	
-1	-2	-1	-2	-2	-3		401	2	
0	1	1	2	2	2		401	2	
-1	-2	-1	-2	-2	-3		401	2	
0	1	1	2	2	2		401	2	
0	-2	-1	-2	-2	-2		402	<u>2</u>	
1	2	1	2	2	3		402	2	
0	-2	-1	-2	-2	-2		402	2	
1	2	1	2	2	3		402	2	
-1	-1	-1	-1	-1	-2		403	1	
1	3	1	3	3	3		403	3	
0	-1	-1	-1	-1	-2		403	1	
1	2	1	2	2	2		403	2	
-4	-8	-5	-9	-9	-15	Section 23	404	9	
6	17	7	15	14	15		404	17	
-3	-7	-4	-7	-8	-13		404	8	
5	14	6	13	12	13		404	14	
-4	-9	-5	-9	-9	-14		405	9	
5	14	6	13	12	14		405	14	
-3	-7	-4	-7	-7	-11		405	7	
5	12	5	12	11	12	Section 24	405	12	
-8	-19	-10	-19	-19	-24		406	19	
7	19	8	18	17	22		406	19	<u>23</u>
-12	-28	-14	-28	-28	-35	PIER 7	406	28	
11	29	13	28	27	33		406	29	<u>24</u>
-11	-28	-12	-27	-26	-31	Section 24	407	28	
9	22	12	22	22	32		407	22	<u>25</u>
-7	-19	-7	-17	-18	-22	Section 25	407	19	
7	16	9	17	17	24		407	17	
-9	-17	-11	-17	-16	-14	Section 25	408	17	
2	5	3	5	5	7		408	5	
-5	-8	-7	-9	-9	-10		408	9	
4	4	5	5	5	8		408	5	

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	-5	-5	-5	-8	Section 26	409	5
5	8	7	9	9	10		409	9
-18	-31	-23	-33	-30	-29		409	33
11	19	16	22	21	23		409	22
-2	-5	-2	-5	-5	-5		410	5
2	2	3	3	3	5		410	3
-1	-4	-1	-4	-4	-3		410	4
0	0	1	1	1	3		410	1
-1	-3	-1	-3	-3	-3		411	3
0	1	1	2	2	3		411	2
-1	-3	-1	-3	-3	-3		411	3
0	1	1	2	2	3		411	2
-1	-2	-1	-2	-3	-4		412	3
1	4	2	4	4	4		412	4
-1	-2	-2	-2	-3	-4		412	3
1	4	2	4	4	4		412	4
-1	-3	-2	-3	-3	-6		413	3
3	7	2	6	6	6		413	7
-1	-3	-2	-3	-3	-6		413	3
2	7	2	6	6	6		413	7
-1	-3	-2	-3	-4	-8		414	4
3	9	3	8	8	8		414	9
-1	-3	-3	-4	-5	-9		414	5
4	10	3	9	9	8		414	10
						ABUT 2		

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	181	-33	-32	PIER 2	165+86	181	<u>1</u> 181
165+91	148	-40	-38	Section 1	165+91	148	
165+96	124	-54	-56		165+96	124	
166+01	113	-87	-85		166+01	113	
166+06	160	-47	-50		166+06	160	
166+11	122	-48	-52		166+11	122	
166+16	97	-64	-66		166+16	97	
166+21	89	-96	-95		166+21	96	
166+26	146	-64	-64		166+26	146	
166+31	107	-64	-66		166+31	107	
166+36	84	-80	-81		166+36	84	
166+41	75	-112	-110		166+41	112	
166+51	94	-78	-79		166+51	94	
166+56	71	-96	-96		166+56	96	
166+61	65	-128	-124		166+61	128	
166+71	82	-89	-89		166+71	89	
166+76	62	-107	-106		166+76	107	
166+81	58	-139	-135		166+81	139	
166+91	83	-101	-102	Section 2	166+91	102	180
166+96	57	-114	-114		166+96	114	
167+01	44	-139	-136		167+01	139	
167+06	44	-180	-173	Section 3	167+06	180	<u>2</u>
167+16	67	-128	-127		167+16	128	244
167+21	44	-143	-141		167+21	143	
167+26	32	-168	-163		167+26	168	
167+31	31	-212	-203		167+31	212	
167+41	50	-154	-152		167+41	154	<u>3</u> 273
167+46	30	-172	-169		167+46	172	
167+51	19	-199	-194		167+51	199	
167+56	15	-244	-235	Section 4	167+56	244	
167+61	69	-187	-184		167+61	187	<u>4</u>
167+66	38	-191	-188		167+66	191	
167+71	19	-205	-201		167+71	205	
167+76	11	-233	-226	PIER 3	167+76	233	
167+81	6	-273	-263		167+81	273	
167+86	242	-21	-21	Section 4	167+86	242	
167+91	208	-21	-21		167+91	208	
167+96	186	-25	-27		167+96	186	
168+01	171	-38	-39		168+01	171	
168+06	168	-64	-65		168+06	168	

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	201	-27	-30	Section 5	168+11	201	<u>5</u> 201
168+16	168	-27	-30		168+16	168	
168+21	149	-36	-38		168+21	149	
168+26	137	-51	-52		168+26	137	
168+31	135	-85	-82		168+31	135	
168+36	173	-37	-39		168+36	173	
168+41	140	-37	-39		168+41	140	
168+46	122	-49	-49		168+46	122	
168+51	112	-66	-64		168+51	112	
168+56	111	-104	-98		168+56	111	
168+61	151	-46	-47	Section 6	168+61	151	<u>6</u> 151
168+66	119	-47	-47		168+66	119	
168+71	102	-60	-59		168+71	102	
168+76	93	-76	-76		168+76	93	
168+81	92	-118	-111		168+81	118	
168+86	121	-56	-55		168+86	121	
168+91	97	-62	-62		168+91	97	
168+96	82	-81	-79		168+96	82	
169+06	109	-61	-61	Section 7	169+06	109	133
169+11	85	-70	-69		169+11	85	
169+16	71	-90	-88		169+16	90	
169+26	98	-70	-69		169+26	98	
169+31	75	-81	-80		169+31	81	
169+36	62	-103	-99		169+36	103	
169+46	86	-80	-79		169+46	86	
169+51	65	-93	-91		169+51	93	
169+56	53	-116	-111		169+56	116	
169+66	76	-93	-91		169+66	93	
169+71	54	-108	-105	Section 8	169+71	108	<u>7</u> 167
169+76	44	-133	-127		169+76	133	
169+81	103	-109	-105		169+81	109	
169+86	67	-110	-106		169+86	110	
169+91	47	-126	-121		169+91	126	
169+96	39	-150	-142		169+96	150	
170+01	95	-124	-119		170+01	124	
170+06	60	-125	-120		170+06	125	
170+11	41	-142	-135		170+11	142	
170+16	32	-167	-157		170+16	167	
170+21	96	-141	-135	Section 9	170+21	141	<u>8</u> 200
170+26	57	-141	-136		170+26	141	
170+31	36	-151	-146		170+31	151	
170+36	23	-171	-163		170+36	171	
170+41	22	-200	-191		170+41	200	
							<u>9</u>

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+46	65	-166	-160	Section 10	170+46	166	223
170+51	34	-170	-165		170+51	170	
170+56	18	-193	-185		170+56	193	
170+61	16	-223	-215		170+61	223	10
170+66	36	-190	-183	Section 11	170+66	190	235
170+71	19	-206	-199		170+71	206	
170+76	13	-235	-224	PIER 4	170+76	235	11
170+81	227	-17	-18		170+81	227	
170+86	189	-17	-18	Section 11	170+86	189	
170+91	163	-23	-24		170+91	163	
170+96	145	-36	-36		170+96	145	
171+01	139	-57	-58		171+01	139	
171+06	186	-25	-27	Section 12	171+06	186	12 186
171+11	150	-25	-27		171+11	150	
171+16	128	-38	-39		171+16	128	
171+21	115	-62	-60		171+21	115	
171+26	163	-35	-35	Section 13	171+26	163	13 163
171+31	129	-36	-36		171+31	129	
171+36	108	-52	-52		171+36	108	
171+41	101	-80	-77		171+41	101	
171+46	135	-41	-41		171+46	135	
171+51	108	-49	-48		171+51	108	
171+56	90	-70	-67		171+56	90	

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	163	-47	-47	Section 14	171+61	163	190
171+66	124	-47	-47		171+66	124	
171+71	97	-55	-55		171+71	97	
171+76	81	-71	-70		171+76	81	
171+81	74	-100	-96		171+81	100	
171+86	140	-60	-59		171+86	140	
171+91	102	-60	-59		171+91	102	
171+96	80	-71	-69		171+96	80	
172+01	65	-90	-86		172+01	90	
172+06	61	-122	-115		172+06	122	
172+11	113	-75	-73		172+11	113	
172+16	80	-80	-78		172+16	80	
172+21	62	-97	-93		172+21	97	
172+26	53	-125	-119		172+26	125	
172+31	115	-90	-86		172+31	115	
172+36	77	-91	-87		172+36	91	
172+41	57	-105	-100		172+41	105	
172+46	44	-125	-117		172+46	125	
172+51	42	-160	-148		172+51	160	
172+56	94	-110	-105		172+56	110	
172+61	61	-114	-108		172+61	114	
172+66	44	-130	-122		172+66	130	
172+71	34	-152	-142		172+71	152	
172+76	34	-190	-177		172+76	190	14
172+81	74	-133	-126	Section 15	172+81	133	215
172+86	45	-137	-130		172+86	137	
172+91	31	-154	-144		172+91	154	
172+96	26	-177	-166		172+96	177	
173+01	26	-215	-200	Section 16	173+01	215	15
173+06	60	-164	-155		173+06	164	255
173+11	38	-171	-161		173+11	171	
173+16	26	-189	-177		173+16	189	
173+21	23	-214	-200	PIER 5	173+21	214	
173+26	23	-255	-236		173+26	255	16
173+31	183	-25	-25	Section 16	173+31	183	
173+36	157	-29	-32		173+36	157	
173+41	139	-44	-45		173+41	139	
173+46	133	-71	-70	Section 17	173+46	133	
173+51	159	-28	-30		173+51	159	17
173+56	131	-33	-36		173+56	131	159
173+61	112	-49	-50		173+61	112	
173+66	107	-81	-79		173+66	107	

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	139	-36	-38	Section 18	173+71	139	18 172
173+76	112	-43	-46		173+76	112	
173+81	93	-61	-62		173+81	93	
173+86	89	-94	-91		173+86	94	
173+91	135	-44	-47		173+91	135	
173+96	103	-47	-49		173+96	103	
174+01	83	-60	-61		174+01	83	
174+06	70	-79	-80		174+06	80	
174+11	69	-119	-114		174+11	119	
174+16	108	-60	-62		174+16	108	
174+21	81	-67	-68		174+21	81	
174+26	64	-86	-86		174+26	86	
174+31	58	-117	-114		174+31	117	
174+36	98	-73	-75		174+36	98	
174+41	71	-81	-82		174+41	82	
174+46	54	-101	-100		174+46	101	
174+51	49	-133	-129		174+51	133	
174+56	99	-90	-91		174+56	99	
174+61	67	-96	-96		174+61	96	
174+66	49	-111	-109		174+66	111	
174+71	37	-132	-131		174+71	132	
174+76	36	-172	-165		174+76	172	
174+81	80	-114	-113	Section 19	174+81	114	196
174+86	49	-118	-117		174+86	118	
174+91	33	-134	-132		174+91	134	
174+96	25	-156	-154		174+96	156	
175+01	25	-196	-188	Section 20	175+01	196	19
175+06	63	-145	-143		175+06	145	234
175+11	36	-152	-150		175+11	152	
175+16	25	-170	-166		175+16	170	
175+21	20	-195	-189	PIER 6	175+21	195	
175+26	20	-234	-224		175+26	234	20
175+31	191	-21	-21	Section 20	175+31	191	
175+36	158	-21	-22		175+36	158	
175+41	135	-30	-32		175+41	135	
175+46	119	-43	-45		175+46	119	
175+51	117	-77	-75	Section 21	175+51	117	
175+56	161	-28	-30		175+56	161	21 161
175+61	128	-30	-32		175+61	128	
175+66	107	-42	-44		175+66	107	
175+71	92	-62	-62		175+71	92	
175+76	90	-100	-95		175+76	100	

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	137	-38	-41	Section 22	<u>175+81</u>	<u>137</u>	<u>22</u> 137
175+86	105	-41	-43		175+86	105	
175+91	85	-54	-54		175+91	85	
175+96	71	-72	-74		175+96	74	
176+01	71	-113	-107		176+01	113	
176+06	115	-51	-53		176+06	115	
176+11	84	-58	-59		176+11	84	
176+16	67	-75	-74		176+16	75	
176+21	59	-105	-100		176+21	105	
176+26	113	-63	-64		176+26	113	
176+31	79	-67	-68		176+31	79	
176+36	59	-83	-82		176+36	83	
176+41	47	-109	-100		176+41	109	
176+46	120	-81	-81		176+46	120	
176+51	81	-82	-82		176+51	82	
176+56	55	-91	-89		176+56	91	
176+61	41	-109	-105		176+61	109	
176+66	34	-137	-130		176+66	137	
176+71	96	-104	-103	Section 23	176+71	104	177
176+76	58	-106	-105		176+76	106	
176+81	38	-125	-122		176+81	125	
176+86	27	-152	-146		176+86	152	
176+91	70	-124	-123		176+91	124	
176+96	39	-127	-125		176+96	127	
177+01	20	-148	-145		177+01	148	
177+06	18	-177	-171	Section 24	<u>177+06</u>	<u>177</u>	<u>23</u>
177+11	50	-151	-148		177+11	151	218
177+16	28	-161	-157		177+16	161	
177+21	15	-185	-178		177+21	185	LL Cntrs.
177+26	15	-218	-209	PIER 7	<u>177+26</u>	<u>218</u>	<u>24</u>
177+31	190	-6	-6	Section 24	177+31	190	
177+36	156	-8	-8		177+36	156	
177+41	133	-20	-19		177+41	133	
177+46	118	-36	-34		177+46	118	
177+51	115	-71	-65	Section 25	177+51	115	
177+56	156	-15	-15		<u>177+56</u>	<u>156</u>	<u>25</u> 156
177+61	124	-19	-19		177+61	124	
177+66	104	-32	-31		177+66	104	
177+71	92	-57	-52		177+71	92	

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	91	-76	-69	Section 26	177+76	91	220
177+81	137	-25	-24		177+81	137	
177+86	105	-30	-28		177+86	105	
177+91	86	-43	-41		177+91	86	
177+96	74	-64	-58		177+96	74	
178+01	73	-107	-97		178+01	107	
178+06	112	-37	-35		178+06	112	
178+11	84	-43	-42		178+11	84	
178+16	67	-60	-55		178+16	67	
178+21	58	-88	-81		178+21	88	
178+26	129	-54	-50		178+26	129	
178+31	90	-54	-50		178+31	90	
178+36	65	-64	-60		178+36	65	
178+41	51	-81	-75		178+41	81	
178+46	45	-112	-103		178+46	112	
178+51	104	-73	-68		178+51	104	
178+56	65	-74	-69		178+56	74	
178+61	42	-88	-82		178+61	88	
178+66	28	-110	-101		178+66	110	
178+71	26	-145	-134		178+71	145	
178+76	66	-104	-96		178+76	104	
178+81	33	-113	-104		178+81	113	
178+86	18	-135	-124		178+86	135	
178+91	13	-164	-149		178+91	164	
178+96	13	-206	-188		178+96	206	
178+98	13	-220	-201	ABUT 2	178+98	<u>220</u>	<u>26</u>

-3.4-

Spans 3-8

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

Girder 7-2

Spans: 3-8

Section	Moments (k-ft)							Shears (k)			
	Station	DC	DC _{LAT}	DW	DW _{LAT}	LL	LL _{LAT}	Station	DC	DW	LL
1 (End)								165+86	273	53	181
1	166+51	10058	22	1842	4	5297	16	165+89	251	42	161
2	166+81	7950	37	1429	5	5508	15	167+06	241	47	180
3	167+61	-18566	67	-3467	12	-5713	43	167+56	436	82	244
4	167+81	-28166	176	-5195	35	-7761	32	167+86	540	98	273
5	168+06	-18713	109	-3449	19	-5250	43	168+11	429	82	201
6	169+06	12338	38	2345	7	6074	12	168+61	255	50	151
7	169+36	13756	5	2592	1	6440	12	169+76	142	28	133
8	169+76	10587	16	1971	4	5640	14	170+16	265	51	167
9	170+46	-9520	12	-1852	4	-3917	25	170+41	346	67	200
10	170+66	-16865	11	-3220	4	-5506	29	170+61	399	76	223
11	170+81	-23274	9	-4405	4	-7160	78	170+76	444	82	235
12	171+01	-16066	3	-3063	1	-5245	42	171+06	329	64	186
13	171+21	-8804	3	-1690	2	-3741	24	171+26	265	52	163
14	172+11	6069	1	1220	1	4906	13	172+76	177	37	190
15	173+06	-6419	3	-1306	1	-3509	19	173+01	247	51	215
16	173+26	-11696	5	-2349	2	-5509	35	173+26	318	64	255
17	173+46	-7004	3	-1417	1	-3713	19	173+51	220	45	159
18	174+31	3954	0	799	0	3807	4	174+76	140	30	172
19	175+06	-4859	3	-1004	1	-2772	21	175+01	206	44	196
20	175+26	-9335	4	-1909	2	-4400	30	175+26	274	57	234
21	175+51	-4461	3	-918	1	-2660	16	175+56	197	42	161
22	176+26	3815	0	786	0	3406	2	175+81	132	29	137
23	177+11	-7261	5	-1489	1	-3060	19	177+06	224	47	177
24	177+26	-10909	4	-2229	2	-4357	28	177+26	280	58	218
25	177+51	-5297	7	-1098	2	-2619	17	177+56	228	48	156
26	178+26	5734	0	1167	0	3786	4	178+95	193	43	212
26 (End)								178+98	197	43	220



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

Girder: 7-2 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 = 10058 k-ft

Wearing Surface Moment = 1842 k-ft

Live Load Moment = 5297 k-ft

Impact = 133%

Dead Load = DC = 6.3 ksi

WS Load = DW = 1.2 ksi

P = 0

Live Load = LL + IM = 1.5 ksi

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

f_{bu} = 6.3 ksi

f_{bu} = 1.2 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 = 15.35 (Inv)
 RF = 19.90 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 10058 k-ft

Lateral Dead Load Moment = 22 k-ft

Wearing Surface Moment = 1842 k-ft

Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = 5297 k-ft

Lateral Live Load Moment = 16 k-ft

Impact = 133%

Dead Load = DC = 15.1 ksi

WS Load = DW = 2.8 ksi

P = 0

Live Load = LL + IM = 9.9 ksi

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

f_{bu} = 14.8 ksi

f_l = 0.77 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 15.1 ksi

f_{bu} = 2.7 ksi

f_l = 0.14 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 2.8 ksi

f_{bu} = 7.3 ksi

f_l = 0.56 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.9 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)



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 3 Section: 1

Shear Rating Factors:

Web (End Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	273	k
WS Load = DW =	53	k
P =	0	
Live Load = LL =	181	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 = 240.7 k

Capacity = $\phi F_{nc} = C$ = 995 k

RF = 1.36 (Inv)
 RF = 1.77 (Op)

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	251	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 = $\phi F_{nc} = C$ = 1377 k

RF = 2.67 (Inv)
 RF = 3.46 (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 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 = 10058 k-ft

Wearing Surface Moment = 1842 k-ft

Live Load Moment = 5297 k-ft
 Impact = 133%

Dead Load = DC = 6.3 ksi

WS Load = DW = 1.2 ksi

P = 0

Live Load = LL + IM = 1.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 6.3 ksi

ff = 1.2 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 = 20.49 (Inv)
 RF = 26.64 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 10058 k-ft

Lateral Dead Load Moment = 22 k-ft

Wearing Surface Moment = 1842 k-ft

Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = 5297 k-ft

Lateral Live Load Moment = 16 k-ft

Impact = 133%

Dead Load = DC = 15.2 ksi

WS Load = DW = 2.8 ksi

P = 0

Live Load = LL + IM = 10.0 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 14.8 ksi

fl = 0.77 ksi

DC = ff + fl/2 = 15.2 ksi

fbu = 2.7 ksi

fl = 0.14 ksi

DW = ff + f/2l = 2.8 ksi

fbu = 7.3 ksi

fl = 0.56 ksi

LL + IM = ff + fl/2 = 10.0 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)



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

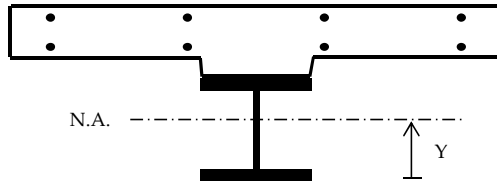
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

Location: Span 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 Location: Span 3 Section: 2

Flexure Rating Factors:

Postive Moment

Section Properties:

Top Flange:

Long-term S = 17124.9 in³
 Short-term S = 47056.8 in³
 Lateral Bending S = 909.5 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} = 1.25
 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 = 7950 k-ft

Wearing Surface Moment = 1429 k-ft

Live Load Moment = 5508 k-ft

Impact = 133%

Dead Load = DC = 5.6 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 1.9 ksi

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

f_{bu} = 5.6 ksi

f_{bu} = 1.0 ksi

f_{bu} = 1.9 ksi (Impact Added Here)

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

RF = 12.70 (Inv)
 RF = 16.47 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 7950 k-ft

Lateral Dead Load Moment = 37 k-ft

Wearing Surface Moment = 1429 k-ft

Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = 5508 k-ft

Lateral Live Load Moment = 15 k-ft

Impact = 133%

Dead Load = DC = 9.0 ksi

WS Load = DW = 1.6 ksi

P = 0

Live Load = LL + IM = 7.6 ksi

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

f_{bu} = 8.7 ksi

f_l = 0.88 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 9.0 ksi

f_{bu} = 1.6 ksi

f_l = 0.12 ksi

DW = $f_{bu} + \frac{1}{2}f_l$ = 1.6 ksi

f_{bu} = 5.6 ksi

f_l = 0.36 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 = 2.74 (Inv)
 RF = 3.56 (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 3

Section: 2

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	241	k
WS Load = DW =	47	k
P =	0	
Live Load = LL =	180	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 = 239.4 k

Capacity = $\phi F_{nc} = C$ = 1377.0 k

RF = 2.40 (Inv)

RF = 3.11 (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 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 = 7950 k-ft

Wearing Surface Moment = 1429 k-ft

Live Load Moment = 5508 k-ft
 Impact = 133%

Dead Load = DC = 5.6 ksi

WS Load = DW = 1.0 ksi

P = 0

Live Load = LL + IM = 1.9 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 5.6 ksi

ff = 1.0 ksi

ff = 1.9 ksi (Impact Added Here)

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

RF = 16.85 (Inv)
 RF = 21.91 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 7950 k-ft

Lateral Dead Load Moment = 37 k-ft

Wearing Surface Moment = 1429 k-ft

Lat. Wearing Surface Moment = 5 k-ft

Live Load Moment = 5508 k-ft

Lateral Live Load Moment = 15 k-ft

Impact = 133%

Dead Load = DC = 9.1 ksi

WS Load = DW = 1.6 ksi

P = 0

Live Load = LL + IM = 7.7 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 8.7 ksi

fl = 0.88 ksi

DC = ff + fl/2 = 9.1 ksi

fbu = 1.6 ksi

fl = 0.12 ksi

DW = ff + f/2l = 1.6 ksi

fbu = 5.6 ksi

fl = 0.36 ksi

LL + IM = ff + fl/2 = 7.7 ksi (Impact Added Here)

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

RF = 3.69 (Inv)
 RF = 4.80 (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

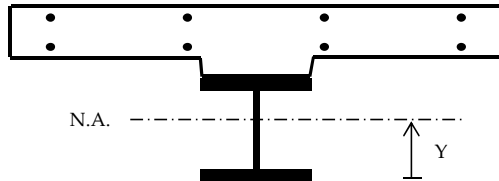
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

Location: Span 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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)

0.95RhFyf = 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 =	144.5
do =	51	in	1.4√Ek/fyw =	180.6
			C =	0.89

k = 28.7 in
 Vp = 2213.1 k
 Vn = 2164.3 k

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

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

$\phi_v \phi_c \phi_s V_n = 2164.3$ 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 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 = -18566 k-ft
 Lateral Dead Load Moment = 67 k-ft

Wearing Surface Moment = -3467 k-ft
 Lat. Wearing Surface Moment = 12 k-ft

Live Load Moment = -5713 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 21.8 ksi
 WS Load = DW = 4.1 ksi
 P = 0
 Live Load = LL + IM = 9.1 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 21.5 ksi
 f_l = 0.88 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 21.8 ksi

f_{bu} = 4.0 ksi
 f_l = 0.16 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 4.1 ksi

f_{bu} = 6.6 ksi
 f_l = 0.56 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.1 ksi (Impact Added Here)

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

RF = 1.05 (Inv)
RF = 1.36 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -18566 k-ft
 Lateral Dead Load Moment = 67 k-ft

Wearing Surface Moment = -3467 k-ft
 Lat. Wearing Surface Moment = 12 k-ft

Live Load Moment = -5713 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 18.0 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 7.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 17.7 ksi
 f_l = 0.88 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 18.0 ksi

f_{bu} = 3.3 ksi
 f_l = 0.16 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.4 ksi

f_{bu} = 5.4 ksi
 f_l = 0.56 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 = 1.72 (Inv)
RF = 2.23 (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 3

Section: 3

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	436	k
WS Load = DW =	82	k
P =	0	
Live Load = LL =	244	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 = 324.5 k

Capacity = $\phi F_{nc} = C$ = 2164.3 k

RF =	2.63	(Inv)
RF =	3.42	(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 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 = -18566 k-ft
 Lateral Dead Load Moment = 67 k-ft

Wearing Surface Moment = -3467 k-ft
 Lat. Wearing Surface Moment = 12 k-ft

Live Load Moment = -5713 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 22.0 ksi
 WS Load = DW = 4.1 ksi
 P = 0
 Live Load = LL + IM = 9.1 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 21.5 ksi
 fl = 0.88 ksi

DC = ff + fl/2 = 22.0 ksi

ff = 4.0 ksi
 fl = 0.16 ksi

DW = ff + fl/2 = 4.1 ksi

ff = 6.6 ksi
 fl = 0.56 ksi

LL + IM = ff + fl/2 = 9.1 ksi (Impact Added Here)

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

RF = 1.82 (Inv)
 RF = 2.37 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -18566 k-ft
 Lateral Dead Load Moment = 67 k-ft

Wearing Surface Moment = -3467 k-ft
 Lat. Wearing Surface Moment = 12 k-ft

Live Load Moment = -5713 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 18.1 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 7.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.7 ksi
 fl = 0.88 ksi

DC = ff + fl/2 = 18.1 ksi

ff = 3.3 ksi
 fl = 0.16 ksi

DW = ff + fl/2 = 3.4 ksi

ff = 5.4 ksi
 fl = 0.56 ksi

LL + IM = ff + fl/2 = 7.6 ksi (Impact Added Here)

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

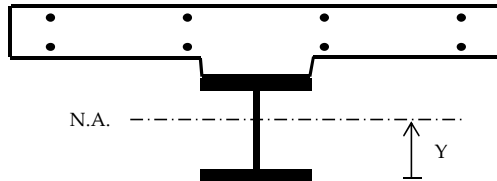
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

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			

$$\text{Neutral Axis} = 63.26 \text{ in}$$

$$\text{Total MOI} = 654945.5 \text{ in}^4$$

	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 =	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

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 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)

0.95RhFyf = 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/tw =	126.9
D =	111	in	1.12√Ek/fyw =	144.5
do =	51	in	1.4√Ek/fyw =	180.6
			C =	1.00

k = 28.7 in
 Vp = 2816.6 k
 Vn = 2816.6 k

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

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

$\phi_v \phi_c \phi_s V_n = 2816.6$ 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 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 = -28166 k-ft
 Lateral Dead Load Moment = 176 k-ft

Wearing Surface Moment = -5195 k-ft
 Lat. Wearing Surface Moment = 35 k-ft

Live Load Moment = -7761 k-ft
 Lateral Live Load Moment = 32 k-ft
 Impact = 133%

Dead Load = DC = 20.4 ksi
 WS Load = DW = 3.8 ksi
 P = 0
 Live Load = LL + IM = 7.4 ksi
 Capacity = $\phi F_{nc} = C$ = 49.8 ksi

f_{bu} = 20.0 ksi
 f_l = 1.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 20.4 ksi

f_{bu} = 3.7 ksi
 f_l = 0.22 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.8 ksi

f_{bu} = 5.5 ksi
 f_l = 0.20 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 = 1.43 (Inv)
RF = 1.86 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -28166 k-ft
 Lateral Dead Load Moment = 176 k-ft

Wearing Surface Moment = -5195 k-ft
 Lat. Wearing Surface Moment = 35 k-ft

Live Load Moment = -7761 k-ft
 Lateral Live Load Moment = 32 k-ft
 Impact = 133%

Dead Load = DC = 18.0 ksi
 WS Load = DW = 3.3 ksi
 P = 0
 Live Load = LL + IM = 6.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 17.6 ksi
 f_l = 1.09 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 18.0 ksi

f_{bu} = 3.3 ksi
 f_l = 0.22 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.3 ksi

f_{bu} = 4.9 ksi
 f_l = 0.20 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 = 1.96 (Inv)
RF = 2.55 (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 3

Section: 4

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	540	k
WS Load = DW =	98	k
P =	0	
Live Load = LL =	273	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 = 363.1 k

Capacity = $\phi F_{nc} = C$ = 2816.6 k

RF = 3.14 (Inv)

RF = 4.07 (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 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 = -28166 k-ft
 Lateral Dead Load Moment = 176 k-ft

Wearing Surface Moment = -5195 k-ft
 Lat. Wearing Surface Moment = 35 k-ft

Live Load Moment = -7761 k-ft
 Lateral Live Load Moment = 32 k-ft
 Impact = 133%

Dead Load = DC = 20.6 ksi
 WS Load = DW = 3.8 ksi
 P = 0
 Live Load = LL + IM = 7.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 20.0 ksi
 fl = 1.09 ksi
 $DC = ff + fl/2 = 20.6$ ksi

ff = 3.7 ksi
 fl = 0.22 ksi
 $DW = ff + fl/2 = 3.8$ ksi

ff = 5.5 ksi
 fl = 0.20 ksi
 $LL + IM = ff + fl/2 = 7.4$ ksi (Impact Added Here)

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

RF = 2.40 (Inv)
 RF = 3.11 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -28166 k-ft
 Lateral Dead Load Moment = 176 k-ft

Wearing Surface Moment = -5195 k-ft
 Lat. Wearing Surface Moment = 35 k-ft

Live Load Moment = -7761 k-ft
 Lateral Live Load Moment = 32 k-ft
 Impact = 133%

Dead Load = DC = 18.2 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 6.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.6 ksi
 fl = 1.09 ksi
 $DC = ff + fl/2 = 18.2$ ksi

ff = 3.3 ksi
 fl = 0.22 ksi
 $DW = ff + fl/2 = 3.4$ ksi

ff = 4.9 ksi
 fl = 0.20 ksi
 $LL + IM = ff + fl/2 = 6.6$ ksi (Impact Added Here)

RF = 3.03 (Inv)
 RF = 3.94 (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

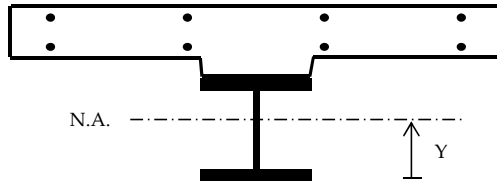
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

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

$$\Sigma = 361.13 \text{ in}^2 \quad 21125.81 \text{ in}^3$$

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

$$\text{Neutral Axis} = Y = 58.500 \text{ in}$$

$$\text{Total MOI} = 957657 \text{ in}^4$$

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

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

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

$$\Sigma = 382.11 \text{ in}^2 \quad 23781.08 \text{ in}^3$$

$$\text{Neutral Axis} = 62.24 \text{ in}$$

$$\text{Total MOI} = 1049779.3 \text{ in}^4$$

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

Girder: 7-2 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

$\phi_f =$	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 =	32	in	$\lambda_f =$	6.737
tfc =	2.375	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 =	0.6875	in	Dc =	57.88	in (Non-Comp)
Lb =	300.0	in	rt =	8.524	in
Cb =	1.3	(**See Attached)	Fyr = 0.7Fy =	35	ksi

Fnc = 50.00 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 = 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	$1.12 \sqrt{Ek}/f_{yw} =$	99.9
do =	84	in	$1.4 \sqrt{Ek}/f_{yw} =$	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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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 = -18713 k-ft
 Lateral Dead Load Moment = 109 k-ft

Wearing Surface Moment = -3449 k-ft
 Lat. Wearing Surface Moment = 19 k-ft

Live Load Moment = -5250 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 22.4 ksi
 WS Load = DW = 4.1 ksi
 P = 0
 Live Load = LL + IM = 8.4 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 21.8 ksi
 f_l = 1.61 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 22.4 ksi

f_{bu} = 4.0 ksi
 f_l = 0.28 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 4.1 ksi

f_{bu} = 6.1 ksi
 f_l = 0.64 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 = 1.07 (Inv)
RF = 1.39 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -18713 k-ft
 Lateral Dead Load Moment = 109 k-ft

Wearing Surface Moment = -3449 k-ft
 Lat. Wearing Surface Moment = 19 k-ft

Live Load Moment = -5250 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 18.6 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 7.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 18.1 ksi
 f_l = 1.61 ksi
DC = $f_{bu} + \frac{1}{3}f_l$ = 18.6 ksi

f_{bu} = 3.3 ksi
 f_l = 0.28 ksi
DW = $f_{bu} + \frac{1}{3}f_l$ = 3.4 ksi

f_{bu} = 5.1 ksi
 f_l = 0.64 ksi
LL + IM = $f_{bu} + \frac{1}{3}f_l$ = 7.0 ksi (Impact Added Here)

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

RF = 1.75 (Inv)
RF = 2.27 (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 4

Section: 5

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	429	k
WS Load = DW =	82	k
P =	0	
Live Load = LL =	201	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 = 267.3 k

Capacity = $\phi F_{nc} = C$ = 1860.4 k

RF = 2.57 (Inv)

RF = 3.33 (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 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 = -18713 k-ft
 Lateral Dead Load Moment = 109 k-ft

Wearing Surface Moment = -3449 k-ft
 Lat. Wearing Surface Moment = 19 k-ft

Live Load Moment = -5250 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 22.7 ksi
 WS Load = DW = 4.1 ksi
 P = 0
 Live Load = LL + IM = 8.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 21.8 ksi
 fl = 1.61 ksi

DC = ff + fl/2 = 22.7 ksi

ff = 4.0 ksi
 fl = 0.28 ksi

DW = ff + fl/2 = 4.1 ksi

ff = 6.1 ksi
 fl = 0.64 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 = 1.89 (Inv)
 RF = 2.46 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -18713 k-ft
 Lateral Dead Load Moment = 109 k-ft

Wearing Surface Moment = -3449 k-ft
 Lat. Wearing Surface Moment = 19 k-ft

Live Load Moment = -5250 k-ft
 Lateral Live Load Moment = 43 k-ft
 Impact = 133%

Dead Load = DC = 18.9 ksi
 WS Load = DW = 3.5 ksi
 P = 0
 Live Load = LL + IM = 7.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 18.1 ksi
 fl = 1.61 ksi

DC = ff + fl/2 = 18.9 ksi

ff = 3.3 ksi
 fl = 0.28 ksi

DW = ff + fl/2 = 3.5 ksi

ff = 5.1 ksi
 fl = 0.64 ksi

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

RF = 2.69 (Inv)
 RF = 3.50 (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

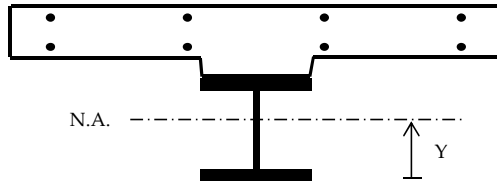
Project #: 55060.00
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Girder: 7-2

Location: 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			

$$\text{Neutral Axis} = 63.30 \text{ in}$$

$$\text{Total MOI} = 650672.4 \text{ in}^4$$

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
	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

Project #: 55060.00

Location: Bangor/Brewer, ME

Sheet:

Calculated by: JGM

Date: 6/23/2015

Checked by: CTA

Date: 6/24/2015

Title: Capacities and Rating Factors - Spans 3-8

Section 5 - Moment Gradient Modifier (Cb)

This calculation is used to determine the moment gradient modifier (Cb) used for calculating lateral torsion buckling resistance.

The controlling location for this girder section is between the first and second crossframe in Span 4 after Pier 3.

See Stress Calculations Below

(STR I)

Interval (ft)	Stress (ksi)
16806.5	44.96
16811.5	35.93
16816.5	31.61
16821.5	27.35
16826.5	23.16
16831.5	19.04
16836.5	12.89
16841.5	9.78
16846.5	6.73
16851.5	3.76
16856.5	0.84
16861.5	3.19

Determine Stress at Brace Points and Mid Point:

Equation Coefficients:

x^6	
x^5	
x^4	
x^3	-2E-05
x^2	0.9
x	-15247
x_{INT}	9E+07

	Interval (ft)	Stress (ksi)
Cross Frame 1:	16806	45.0
Mid-Point:	16816	34.1
Cross Frame 2:	16826	23.2

$f_2 =$	45.0	ksi
$f_0 =$	23.2	ksi
$f_{mid} =$	34.1	ksi
$f_1 =$	23.2	ksi

Concave Moment: (Y/N)

AASHTO 6.10.8.2.3-10/11

f_2 = largest compressive stress at any brace point
 f_0 = compressive stress at brace point opposite f_2
 f_{mid} = compressive stress at mid point

when moment is concave:

$$f_1 = f_0$$

otherwise:

$$f_1 = 2f_{mid} - f_2 \geq f_0$$

if: $f_{mid}/f_2 > 1$ or $f_2 = 0$

$$C_b = 1.0$$

otherwise:

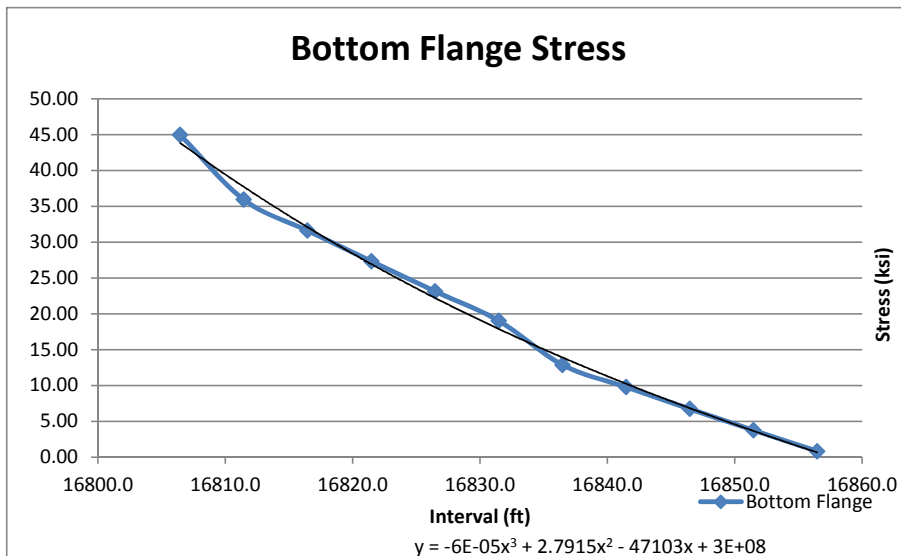
$$C_b = 1.75 - 1.05 \left(\frac{f_1}{f_2} \right) + 0.3 \left(\frac{f_1}{f_2} \right)^2 \leq 2.3$$

Determine Cb:

$$f_{mid}/f_2 = 0.76$$

$$C_b = 1.29$$

AASHTO 6.10.8.2.3-6/7





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: 6/23/2015
 Date: 6/24/2015

Section 5 - Moment Gradient Modifier (Cb)

See LARSA Output for Moments

	MDC (k-ft)	MDW (k-ft)	MLL (k-ft)	Stress (ksi)
168+06	-18713	-3449	-5250	-44.96
168+11	-14687	-2714	-4424	-35.93
168+16	-12788	-2361	-4007	-31.61
168+21	-10890	-2008	-3622	-27.35
168+26	-8992	-1654	-3270	-23.16
168+31	-7095	-1301	-2952	-19.04
168+36	-4224	-765	-2511	-12.89
168+41	-2765	-492	-2293	-9.78
168+46	-1306	-220	-2110	-6.73
168+51	152	53	-1958	-3.76
168+56	1611	326	-1832	-0.84
168+61	3710	727	-1743	3.19

Bottom Flange S =	10075.5	in ³
γ_{DC} =	1.25	
γ_{DW} =	1.5	
γ_{LL} =	1.75	(Inv)



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

Girder: 7-2 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 = 12338 k-ft

Wearing Surface Moment = 2345 k-ft

Live Load Moment = 6074 k-ft
 Impact = 133%

Dead Load = DC = 10.3 ksi
 WS Load = DW = 2.0 ksi
 P = 0
 Live Load = LL + IM = 2.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 10.3 ksi

f_{bu} = 2.0 ksi

f_{bu} = 2.5 ksi (Impact Added Here)

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

RF = 7.88 (Inv)
 RF = 10.21 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 12338 k-ft
 Lateral Dead Load Moment = 38 k-ft

Wearing Surface Moment = 2345 k-ft
 Lat. Wearing Surface Moment = 7 k-ft

Live Load Moment = 6074 k-ft
 Lateral Live Load Moment = 12 k-ft
 Impact = 133%

Dead Load = DC = 18.4 ksi
 WS Load = DW = 3.5 ksi
 P = 0
 Live Load = LL + IM = 11.0 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 18.0 ksi
 f_l = 1.41 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 18.4 ksi

f_{bu} = 3.4 ksi
 f_l = 0.26 ksi
 DW = $f_{bu} + \frac{1}{2}f_l$ = 3.5 ksi

f_{bu} = 8.1 ksi
 f_l = 0.44 ksi
 LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 11.0 ksi (Impact Added Here)

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

RF = 1.13 (Inv)
 RF = 1.46 (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 4

Section: 6

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	255	k
WS Load = DW =	50	k
P =	0	
Live Load = LL =	151	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 = 200.8 k

Capacity = ϕF_{nc} = C = 1386.1 k

RF =	2.82	(Inv)
RF =	3.66	(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 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 = 12338 k-ft

Wearing Surface Moment = 2345 k-ft

Live Load Moment = 6074 k-ft
 Impact = 133%

Dead Load = DC = 10.3 ksi

WS Load = DW = 2.0 ksi

P = 0

Live Load = LL + IM = 2.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 10.3 ksi

ff = 2.0 ksi

ff = 2.5 ksi (Impact Added Here)

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

RF = 10.93 (Inv)
 RF = 14.21 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 12338 k-ft

Lateral Dead Load Moment = 38 k-ft

Wearing Surface Moment = 2345 k-ft

Lat. Wearing Surface Moment = 7 k-ft

Live Load Moment = 6074 k-ft

Lateral Live Load Moment = 12 k-ft

Impact = 133%

Dead Load = DC = 18.7 ksi

WS Load = DW = 3.5 ksi

P = 0

Live Load = LL + IM = 11.1 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 18.0 ksi

fl = 1.41 ksi

DC = ff + fl/2 = 18.7 ksi

fbu = 3.4 ksi

fl = 0.26 ksi

DW = ff + f/2l = 3.5 ksi

fbu = 8.1 ksi

fl = 0.44 ksi

LL + IM = ff + fl/2 = 11.1 ksi (Impact Added Here)

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

RF = 1.75 (Inv)
 RF = 2.27 (Op)



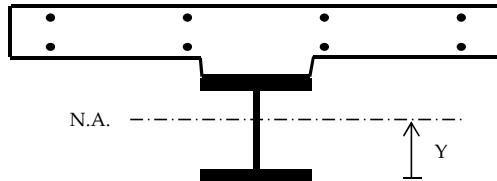
Computations

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

Girder: 7-2 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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 = 13756 k-ft

Wearing Surface Moment = 2592 k-ft

Live Load Moment = 6440 k-ft

Impact = 133%

Dead Load = DC = 11.7 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 2.8 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 11.7 ksi

f_{bu} = 2.2 ksi

f_{bu} = 2.8 ksi (Impact Added Here)

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

RF = 6.49 (Inv)
 RF = 8.41 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 13756 k-ft

Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = 2592 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 6440 k-ft

Lateral Live Load Moment = 12 k-ft

Impact = 133%

Dead Load = DC = 16.8 ksi

WS Load = DW = 3.2 ksi

P = 0

Live Load = LL + IM = 9.7 ksi

Capacity = ϕF_{nc} = C = 50.0 ksi

f_{bu} = 16.7 ksi

f_l = 0.14 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 16.8 ksi

f_{bu} = 3.2 ksi

f_l = 0.03 ksi

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

f_{bu} = 7.2 ksi

f_l = 0.35 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 9.7 ksi (Impact Added Here)

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

RF = 1.42 (Inv)
 RF = 1.85 (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 4

Section: 7

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	142	k
WS Load = DW =	28	k
P =	0	
Live Load = LL =	133	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 = 176.9 k

Capacity = ϕF_{nc} = C = 1106.1 k

RF = 2.86 (Inv)

RF = 3.71 (Op)



Computations

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

Girder: 7-2 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 = 13756 k-ft

Wearing Surface Moment = 2592 k-ft

Live Load Moment = 6440 k-ft
 Impact = 133%

Dead Load = DC = 11.7 ksi

WS Load = DW = 2.2 ksi

P = 0

Live Load = LL + IM = 2.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 11.7 ksi

ff = 2.2 ksi

ff = 2.8 ksi (Impact Added Here)

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

RF = 9.14 (Inv)
 RF = 11.88 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 13756 k-ft

Lateral Dead Load Moment = 5 k-ft

Wearing Surface Moment = 2592 k-ft

Lat. Wearing Surface Moment = 1 k-ft

Live Load Moment = 6440 k-ft

Lateral Live Load Moment = 12 k-ft

Impact = 133%

Dead Load = DC = 16.8 ksi

WS Load = DW = 3.2 ksi

P = 0

Live Load = LL + IM = 9.8 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

fbu = 16.7 ksi

fl = 0.14 ksi

DC = ff + fl/2 = 16.8 ksi

fbu = 3.2 ksi

fl = 0.03 ksi

DW = ff + f/2l = 3.2 ksi

fbu = 7.2 ksi

fl = 0.35 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 = 2.16 (Inv)
 RF = 2.80 (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

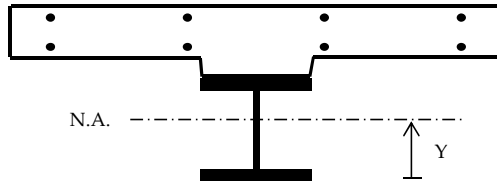
Project #: 55060.00
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 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

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
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Project #: 55060.00

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

Girder: 7-2 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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 = 10587 k-ft

Wearing Surface Moment = 1971 k-ft

Live Load Moment = 5640 k-ft

Impact = 133%

Dead Load = DC = 9.6 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 2.5 ksi

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

f_{bu} = 9.6 ksi

f_{bu} = 1.8 ksi

f_{bu} = 2.5 ksi (Impact Added Here)

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

RF = 8.02 (Inv)
 RF = 10.40 (Op)

Bottom Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = 10587 k-ft

Lateral Dead Load Moment = 16 k-ft

Wearing Surface Moment = 1971 k-ft

Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = 5640 k-ft

Lateral Live Load Moment = 14 k-ft

Impact = 133%

Dead Load = DC = 16.4 ksi

WS Load = DW = 3.1 ksi

P = 0

Live Load = LL + IM = 10.8 ksi

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

f_{bu} = 16.2 ksi

f_l = 0.73 ksi

DC = $f_{bu} + \frac{1}{2}f_l$ = 16.4 ksi

f_{bu} = 3.0 ksi

f_l = 0.18 ksi

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

f_{bu} = 7.9 ksi

f_l = 0.64 ksi

LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 10.8 ksi (Impact Added Here)

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

RF = 1.31 (Inv)
 RF = 1.70 (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: Span 4 Section: 8

Shear Rating Factors:

Web (Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	265	k
WS Load = DW =	51	k
P =	0	
Live Load = LL =	167	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 = 222.1 k

Capacity = $\phi F_{nc} = C$ = 1386.1 k

RF =	2.52	(Inv)
RF =	3.26	(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: 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 = 10587 k-ft

Wearing Surface Moment = 1971 k-ft

Live Load Moment = 5640 k-ft
 Impact = 133%

Dead Load = DC = 9.6 ksi

WS Load = DW = 1.8 ksi

P = 0

Live Load = LL + IM = 2.5 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 9.6 ksi

ff = 1.8 ksi

ff = 2.5 ksi (Impact Added Here)

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

RF = 11.04 (Inv)
 RF = 14.36 (Op)

Bottom Flange (Tension):

Service Flexural Requirments (LRFD 6.10.4.2.2-2)

Dead Load Moment = 10587 k-ft

Lateral Dead Load Moment = 16 k-ft

Wearing Surface Moment = 1971 k-ft

Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = 5640 k-ft

Lateral Live Load Moment = 14 k-ft

Impact = 133%

Dead Load = DC = 16.6 ksi

WS Load = DW = 3.1 ksi

P = 0

Live Load = LL + IM = 10.9 ksi

Capacity = 0.95RhFyf = C = 47.5 ksi

f_{bu} = 16.2 ksi

f_l = 0.73 ksi

DC = ff + f_l/2 = 16.6 ksi

f_{bu} = 3.0 ksi

f_l = 0.18 ksi

DW = ff + f_l/2 = 3.1 ksi

f_{bu} = 7.9 ksi

f_l = 0.64 ksi

LL + IM = ff + f_l/2 = 10.9 ksi (Impact Added Here)

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

RF = 1.96 (Inv)
 RF = 2.55 (Op)



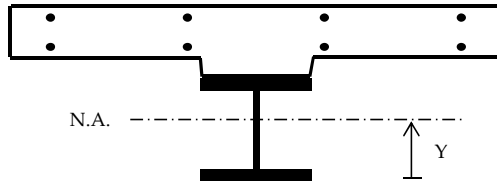
Computations

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: 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

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Project #: 55060.00

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

Girder: 7-2 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
 Vp = 2213.1 k
 Vn = 1564.4 k

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

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

$\phi_v \phi_c \phi_s V_n = 1564.4$ 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
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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 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 = -9520 k-ft
 Lateral Dead Load Moment = 12 k-ft

Wearing Surface Moment = -1852 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -3917 k-ft
 Lateral Live Load Moment = 25 k-ft
 Impact = 133%

Dead Load = DC = 15.8 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 8.9 ksi

Capacity = $\phi F_{nc} = C$ = 46.0 ksi

f_{bu} = 15.7 ksi
 f_l = 0.31 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 15.8 ksi

f_{bu} = 3.1 ksi
 f_l = 0.10 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.1 ksi

f_{bu} = 6.5 ksi
 f_l = 0.66 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 = 1.39 (Inv)
RF = 1.80 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -9520 k-ft
 Lateral Dead Load Moment = 12 k-ft

Wearing Surface Moment = -1852 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -3917 k-ft
 Lateral Live Load Moment = 25 k-ft
 Impact = 133%

Dead Load = DC = 12.8 ksi
 WS Load = DW = 2.5 ksi
 P = 0
 Live Load = LL + IM = 7.2 ksi

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

f_{bu} = 12.7 ksi
 f_l = 0.31 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 12.8 ksi

f_{bu} = 2.5 ksi
 f_l = 0.10 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 2.5 ksi

f_{bu} = 5.2 ksi
 f_l = 0.66 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 7.2 ksi (Impact Added Here)

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

RF = 2.39 (Inv)
RF = 3.10 (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 4

Section: 9

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	346	k
WS Load = DW =	67	k
P =	0	
Live Load = LL =	200	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 = 266.0 k

Capacity = $\phi F_{nc} = C$ = 1564.4 k

RF = 2.22 (Inv)

RF = 2.87 (Op)



Computations

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

Girder: 7-2 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 = -9520 k-ft
 Lateral Dead Load Moment = 12 k-ft

Wearing Surface Moment = -1852 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -3917 k-ft
 Lateral Live Load Moment = 25 k-ft
 Impact = 133%

Dead Load = DC = 15.9 ksi
 WS Load = DW = 3.1 ksi
 P = 0
 Live Load = LL + IM = 8.9 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 15.7 ksi
 fl = 0.31 ksi
 $DC = ff + fl/2 = 15.9$ ksi

ff = 3.1 ksi
 fl = 0.10 ksi
 $DW = ff + fl/2 = 3.1$ ksi

ff = 6.5 ksi
 fl = 0.66 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 = 2.47 (Inv)
 RF = 3.22 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -9520 k-ft
 Lateral Dead Load Moment = 12 k-ft

Wearing Surface Moment = -1852 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -3917 k-ft
 Lateral Live Load Moment = 25 k-ft
 Impact = 133%

Dead Load = DC = 12.8 ksi
 WS Load = DW = 2.5 ksi
 P = 0
 Live Load = LL + IM = 7.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 12.7 ksi
 fl = 0.31 ksi
 $DC = ff + fl/2 = 12.8$ ksi

ff = 2.5 ksi
 fl = 0.10 ksi
 $DW = ff + fl/2 = 2.5$ ksi

ff = 5.2 ksi
 fl = 0.66 ksi
 $LL + IM = ff + fl/2 = 7.4$ ksi (Impact Added Here)

RF = 3.36 (Inv)
 RF = 4.36 (Op)



Computations

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 Location: Bangor/Brewer, ME
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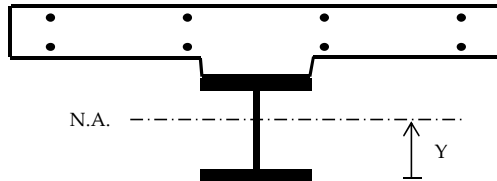
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 Date: 6/24/2015

Girder: 7-2

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			

$$\text{Neutral Axis} = 63.35 \text{ in}$$

$$\text{Total MOI} = 461152.8 \text{ in}^4$$

	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 =	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

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Project #: 55060.00

Sheet:

Date: 6/24/2015

Date: 6/24/2015

Girder: 7-2

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

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

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

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

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

$$F_{nc} = 48.4 \text{ ksi}$$

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

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

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

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

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

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

Lp =	224.0	in
Lr =	841	in

Controlling Resistance:

$$F_{nc} = 48.45 \text{ ksi}$$

$$\phi_f \phi_c \phi_s F_{nc} = 48.4 \text{ ksi}$$

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 =	0.875	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

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

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

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

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

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

$$\phi_v \phi_c \phi_s V_n = 2175.8 \text{ k}$$



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 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 = -16865 k-ft
 Lateral Dead Load Moment = 11 k-ft

Wearing Surface Moment = -3220 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -5506 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 20.9 ksi
 WS Load = DW = 4.0 ksi
 P = 0
 Live Load = LL + IM = 9.2 ksi
 Capacity = $\phi F_{nc} = C$ = 48.4 ksi

f_{bu} = 20.8 ksi
 f_l = 0.16 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 20.9 ksi

f_{bu} = 4.0 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 4.0 ksi

f_{bu} = 6.8 ksi
 f_l = 0.43 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 = 1.01 (Inv)
RF = 1.31 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -16865 k-ft
 Lateral Dead Load Moment = 11 k-ft

Wearing Surface Moment = -3220 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -5506 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 17.7 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 7.9 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 17.7 ksi
 f_l = 0.16 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 17.7 ksi

f_{bu} = 3.4 ksi
 f_l = 0.06 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.4 ksi

f_{bu} = 5.8 ksi
 f_l = 0.43 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 = 1.65 (Inv)
RF = 2.14 (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 4 Section: 10

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	399	k
WS Load = DW =	76	k
P =	0	
Live Load = LL =	223	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 = 296.6 k

Capacity = $\phi F_{nc} = C$ = 2175.8 k

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



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
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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 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 = -16865 k-ft
 Lateral Dead Load Moment = 11 k-ft

Wearing Surface Moment = -3220 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -5506 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 20.9 ksi
 WS Load = DW = 4.0 ksi
 P = 0
 Live Load = LL + IM = 9.2 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 20.8 ksi
 fl = 0.16 ksi

DC = ff + fl/2 = 20.9 ksi

ff = 4.0 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 4.0 ksi

ff = 6.8 ksi
 fl = 0.43 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 = 1.88 (Inv)
 RF = 2.45 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -16865 k-ft
 Lateral Dead Load Moment = 11 k-ft

Wearing Surface Moment = -3220 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -5506 k-ft
 Lateral Live Load Moment = 29 k-ft
 Impact = 133%

Dead Load = DC = 17.8 ksi
 WS Load = DW = 3.4 ksi
 P = 0
 Live Load = LL + IM = 8.0 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.7 ksi
 fl = 0.16 ksi

DC = ff + fl/2 = 17.8 ksi

ff = 3.4 ksi
 fl = 0.06 ksi

DW = ff + fl/2 = 3.4 ksi

ff = 5.8 ksi
 fl = 0.43 ksi

LL + IM = ff + fl/2 = 8.0 ksi (Impact Added Here)

RF = 2.54 (Inv)
 RF = 3.31 (Op)



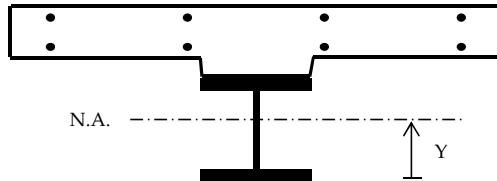
Computations

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

Girder: 7-2 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

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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 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)

0.95RhFyf = 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/tw =	126.9
D =	111	in	1.12√Ek/fyw =	75.0
do =	150	in	1.4√Ek/fyw =	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
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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 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 = -23274 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -4405 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -7160 k-ft
 Lateral Live Load Moment = 78 k-ft
 Impact = 133%

Dead Load = DC = 19.8 ksi
 WS Load = DW = 3.7 ksi
 P = 0
 Live Load = LL + IM = 8.4 ksi
 Capacity = $\phi F_{nc} = C$ = 48.4 ksi

f_{bu} = 19.7 ksi
 f_l = 0.08 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 19.8 ksi

f_{bu} = 3.7 ksi
 f_l = 0.04 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.7 ksi

f_{bu} = 6.1 ksi
 f_l = 0.72 ksi
LL + IM = $f_{bu} + \frac{1}{2}f_l$ = 8.4 ksi (Impact Added Here)

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

RF = 1.23 (Inv)
RF = 1.60 (Op)

Top Flange (Tension):

Discretely Braced Flanges in Tension (LRFD 6.10.8.1.2):

Dead Load Moment = -23274 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -4405 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -7160 k-ft
 Lateral Live Load Moment = 78 k-ft
 Impact = 133%

Dead Load = DC = 17.5 ksi
 WS Load = DW = 3.3 ksi
 P = 0
 Live Load = LL + IM = 7.5 ksi
 Capacity = $\phi F_{nc} = C$ = 50.0 ksi

f_{bu} = 17.4 ksi
 f_l = 0.08 ksi
DC = $f_{bu} + \frac{1}{2}f_l$ = 17.5 ksi

f_{bu} = 3.3 ksi
 f_l = 0.04 ksi
DW = $f_{bu} + \frac{1}{2}f_l$ = 3.3 ksi

f_{bu} = 5.4 ksi
 f_l = 0.72 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 = 1.78 (Inv)
RF = 2.30 (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: 6/24/2015

Date: 6/24/2015

Girder: 7-2

Location: Pier 4

Section: 11

Shear Rating Factors:

Web (Stiffened - Interior Panels):

(LRFD 6.10.9.1):

Dead Load = DC =	444	k
WS Load = DW =	82	k
P =	0	
Live Load = LL =	235	k
Impact =	133%	

Live Load = LL + IM = 312.6 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 = 2.51 (Inv)

RF = 3.26 (Op)



Computations

Project: Br # 1558 - 2015 Maine Load Ratings
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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 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 = -23274 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -4405 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -7160 k-ft
 Lateral Live Load Moment = 78 k-ft
 Impact = 133%

Dead Load = DC = 19.8 ksi
 WS Load = DW = 3.7 ksi
 P = 0
 Live Load = LL + IM = 8.4 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 19.7 ksi
 fl = 0.08 ksi

DC = ff + fl/2 = 19.8 ksi

ff = 3.7 ksi
 fl = 0.04 ksi

DW = ff + fl/2 = 3.7 ksi

ff = 6.1 ksi
 fl = 0.72 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 = 2.20 (Inv)
 RF = 2.86 (Op)

Top Flange:

Service Flexural Requirements (LRFD 6.10.4.2.2-3)

Dead Load Moment = -23274 k-ft
 Lateral Dead Load Moment = 9 k-ft

Wearing Surface Moment = -4405 k-ft
 Lat. Wearing Surface Moment = 4 k-ft

Live Load Moment = -7160 k-ft
 Lateral Live Load Moment = 78 k-ft
 Impact = 133%

Dead Load = DC = 17.5 ksi
 WS Load = DW = 3.3 ksi
 P = 0
 Live Load = LL + IM = 7.6 ksi
 Capacity = 0.95RhFyf = C = 47.5 ksi

ff = 17.4 ksi
 fl = 0.08 ksi

DC = ff + fl/2 = 17.5 ksi

ff = 3.3 ksi
 fl = 0.04 ksi

DW = ff + fl/2 = 3.3 ksi

ff = 5.4 ksi
 fl = 0.72 ksi

LL + IM = ff + fl/2 = 7.6 ksi (Impact Added Here)

RF = 2.70 (Inv)
 RF = 3.50 (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

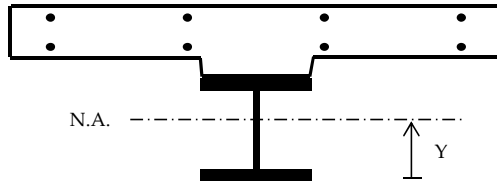
Project #: 55060.00
 Sheet:
 Date: 6/24/2015
 Date: 6/24/2015

Girder: 7-2

Location: Pier 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: 6/24/2015
 Date: 6/24/2015

Girder: 7-2 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

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 =	36	in	λf =	9.000
tfc =	2	in	λpf =	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

φfφcφsFnc = 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

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

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/tw =	126.9
D =	111	in	1.12√Ek/fyw =	75.0
do =	150	in	1.4√Ek/fyw =	93.8
			C =	0.44

k = 7.7 in
 Vp = 2816.6 k
 Vn = 2052.7 k

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

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

φvφcφsVn = 2052.7 k

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

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

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