BRIDGE RATING

Prepared for

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

WESTFIELD

US ROUTE 202/STATE ROUTE 10 (SB)
NORTH ELM STREET

OVER

WESTFIELD RIVER

BRIDGE NO. W-25-010 (0V8)

STRUCTURE NO. W25010-0V8-DOT-NBI

DATE OF INSPECTION: JULY 2014
DATE OF RATING: JULY 2016

PREPARED BY

COMMONWEALTH OF MASSACHUSETTS
JOHN M. ENNIS
STRUCTURAL
No. 41191
REGISTERED PROFESSIONAL ENGINEER

7-25-16

STV Incorporated
One Financial Center, 3rd Floor
Boston, Massachusetts 02211

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Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

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SUMMARY OF BRIDGE RATING

TOWN/CITY: WESTFIELD

BRIDGE NO: W-25-010 (OV8)

CARRIES: US202/ST10/ELM STREET

OVER: WESTFIELD RIVER

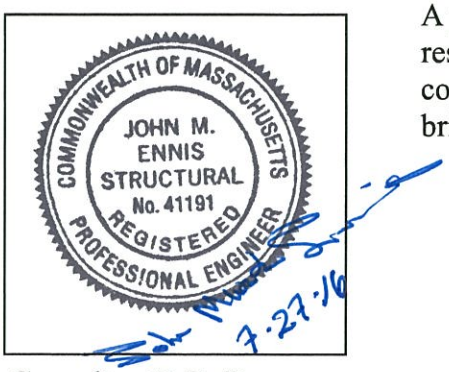
STRUCTURE NO.: W25010-0V8-DOT-NBI

BIN NO.: 0V8

RATING (TONS)

Allowable Stress Ratings for Load Posting Purposes Load Ratings in English Tons		
VEHICLE TYPE	**INVENTORY**	**OPERATING**
H20	31.3	52.6
TYPE 3	37.5	64.6
TYPE 3S2	59.0	85.8
HS20	41.5	71.5

MS18 Load Factor Ratings in Metric Tons Provided in Compliance with the December 1995 FHWA NBIS Coding Guide			
INVENTORY		**OPERATING**	
Item 66	**MS Equivalent**	**Item 64**	**MS Equivalent**
35.3	MS 19.7	48.1	MS 26.7



Consultant P.E. Stamp

A posting recommendation has been made based on the results of this rating report. This recommendation is contained in the "Memorandum to the NBIS File" for this bridge, dated _____.

_____

Director of Bridges and Structures Date

BREAKDOWN OF BRIDGE RATING

TOWN/CITY: WESTFIELD

BRIDGE NO: W-25-010 (0V8)

CARRIES: US202/ST10/ELM STREET

OVER: WESTFIELD RIVER

STRUCTURE NO.: W25010-0V8-DOT-NBI

BIN NO.: 0V8

BRIDGE COMPONENT	INVENTORY RATING (ENGLISH TONS)				OPERATING RATING (ENGLISH TONS)			
	H20	TYPE 3	TYPE 3S2	HS20	H20	TYPE 3	TYPE 3S2	HS20
Deck Slab	34.8	62.5	98.6	62.7	53.3	95.5	150.9	95.9
Exterior Stringer	36.9	52.2	81.5	66.3	56.1	79.3	124.0	100.9
Interior Stringer	33.4	47.5	74.0	60.2	**52.6**	74.6	116.4	92.8
End Floorbeam	47.5	61.7	94.6	67.5	71.2	92.4	141.7	101.1
Intermediate Floorbeam	**31.3**	**37.5**	**59.0**	**41.5**	53.9	**64.6**	101.6	**71.5**
Truss*	49.0	52.7	64.1	54.4	62.7	68.9	**85.8**	73.9

*Controlling truss member is U3-L4 for all trucks in inventory and operating, except for vehicle type 3S2, for which member U5-L6 controls the inventory rating. See page 5 for breakdown of truss element rating.

BREAKDOWN OF BRIDGE RATING

TOWN/CITY: WESTFIELD

BRIDGE NO: W-25-010 (0V8)

CARRIES: US202/ST10/ELM STREET

OVER: WESTFIELD RIVER

STRUCTURE NO.: W25010-0V8-DOT-NBI

BIN NO.: 0V8

BRIDGE COMPONENT	INVENTORY RATING (ENGLISH TONS)				OPERATING RATING (ENGLISH TONS)			
	H20	TYPE 3	TYPE 3S2	HS20	H20	TYPE 3	TYPE 3S2	HS20
Member L0-L2	56.5	58.7	64.8	59.6	80.6	88.2	103.6	96.9
Member L2-L4	75.3	78.7	86.6	80.3	98.1	107.6	125.8	118.5
Member L4-L6	82.9	87.0	96.4	88.9	104.7	114.0	132.2	123.4
Member L6-L8	179.5	180.6	185.7	181.4	170.1	184.4	208.6	204.9
Member U1-U3	125.3	131.4	144.5	133.9	180.7	189.5	208.4	193.2
Member U3-U5	124.4	78.8	87.3	80.6	160.5	110.0	124.2	115.3
Member U5-U7	952.2	370.1	380.5	371.7	1315.7	511.4	525.8	513.7
Member U7-U8	123.1	212.0	218.1	213.0	210.5	345.7	373.7	366.1
Member U1-L0	314.2	128.3	141.8	130.4	221.7	138.3	162.4	152.0
Member U1-L2	183.2	82.9	93.3	84.5	185.8	111.7	131.2	120.5
Member U3-L2	111.1	124.4	172.9	130.8	152.7	171.2	238.0	180.5
Member U3-L4	**49.0**	**52.7**	64.4	**54.4**	**62.7**	**68.9**	**85.8**	**73.9**
Member U5-L4	79.2	115.1	138.3	85.0	105.1	115.1	138.3	125.8
Member U5-L6	55.9	58.0	**64.1**	59.0	68.6	75.1	88.6	83.0
Member U7-L6	67.7	69.5	75.0	70.4	93.2	102.3	119.8	114.3
Member U7-L8	249.1	254.2	268.2	256.4	216.8	238.1	276.3	267.4
Typical Vertical	171.8	67.1	105.5	74.2	274.4	107.1	168.4	118.5

* Bold/shading indicates controlling truss member
** Truss Operating Rating include pedestrian loads

BREAKDOWN OF BRIDGE RATING CONTINUED

TOWN/CITY: WESTFIELD BRIDGE NO: W-25-010 (0V8)

CARRIES: US202/ST10/ELM STREET OVER: WESTFIELD RIVER

STRUCTURE NO.: W25010-0V8-DOT-NBI BIN NO.: 0V8

BRIDGE COMPONENT	INVENTORY RATING BY LOAD FACTOR METHOD (METRIC TONS)		OPERATING RATING BY LOAD FACTOR METHOD (METRIC TONS)	
	MS18	MS (EQUIV)	MS18	MS (EQUIV)
Deck Slab	62.0	MS 34.5	103.5	MS 57.5
Exterior Stringer	56.1	MS 31.2	93.7	MS 52.1
Interior Stringer	52.8	MS 29.4	88.2	MS 49.1
End Floorbeam	49.5	MS 27.6	82.8	MS 46.0
Intermediate Floorbeam	**35.3**	**MS 19.7**	59.1	MS 32.9
Truss*	53.1	MS 29.5	89.1	MS 49.5
Gusset Plates**	36.1	MS 20.1	**48.1**	**MS 26.7**

* Controlling truss members are U3 – U5 and L2-L4 for both inventory and operating rating. See page 7 for breakdown of truss element.
** Controlling gusset plate U7 for both inventory and operating rating. See page 8 for breakdown of gusset plate rating.

BREAKDOWN OF BRIDGE RATING CONTINUED

TOWN/CITY: WESTFIELD BRIDGE NO: W-25-010 (0V8)

CARRIES: US202/ST10/ELM STREET OVER: WESTFIELD RIVER

STRUCTURE NO.: W25010-0V8-DOT-NBI BIN NO.: 0V8

BRIDGE COMPONENT	INVENTORY RATING BY LOAD FACTOR METHOD (METRIC TONS)		OPERATING RATING BY LOAD FACTOR METHOD (METRIC TONS)	
	MS18	MS (EQUIV)	MS18	MS (EQUIV)
Member L0-L2	76.1	MS 42.3	127.3	MS 70.7
Member L2-L4	53.5	MS 29.7	**89.1**	**MS 49.5**
Member L4-L6	87.2	MS 48.4	145.5	MS 80.8
Member L6-L8	187.6	MS 104.2	313.0	MS 173.9
Member U1-U3	85.5	MS 47.5	142.9	MS 79.4
Member U3-U5	**53.1**	**MS 29.5**	**89.1**	**MS 49.5**
Member U5-U7	193.8	MS 107.6	323.4	MS 179.6
Member U7-U8	132.2	MS 73.4	220.6	MS 122.6
Member U1-L0	93.3	MS 51.8	156.2	MS 86.8
Member U1-L2	85.5	MS 47.5	142.9	MS 79.4
Member U3-L2	94.3	MS 52.4	157.1	MS 87.3
Member U3-L4	94.3	MS 52.4	157.8	MS 87.7
Member U5-L4	53.8	MS 29.9	89.7	MS 49.9
Member U5-L6	110.8	MS 61.6	184.7	MS 102.6
Member U7-L6	56.4	MS 31.3	94.3	MS 52.4
Member U7-L8	123.8	MS 68.8	207.0	MS 115.0
Typical Vertical	61.2	MS 34.0	102.1	MS 56.7

BREAKDOWN OF BRIDGE RATING CONTINUED

TOWN/CITY: WESTFIELD BRIDGE NO: W-25-010 (0V8)

CARRIES: US202/ST10/ELM STREET OVER: WESTFIELD RIVER

STRUCTURE NO.: W25010-0V8-DOT-NBI BIN NO.: 0V8

BRIDGE COMPONENT	INVENTORY RATING BY LOAD FACTOR METHOD (METRIC TONS)		OPERATING RATING BY LOAD FACTOR METHOD (METRIC TONS)	
	MS18	MS (EQUIV)	MS18	MS (EQUIV)
Gusset Plate @ L0	39.8	MS 22.1	55.0	MS 30.5
Gusset Plate @ L2	123.6	MS 68.7	179.1	MS 99.5
Gusset Plate @ L3	142.1	MS 78.9	215.9	MS 120.0
Gusset Plate @ L4	153.7	MS 85.4	215.9	MS 120.0
Gusset Plate @ L6	131.0	MS 72.8	186.0	MS 103.4
Gusset Plate @ L8	89.8	MS 49.9	119.7	MS 66.5
Gusset Plate @ U1	41.4	MS 22.9	69.1	MS 38.4
Gusset Plate @ U3	48.5	MS 26.9	67.6	MS 37.6
Gusset Plate @ U5	46.7	MS 25.9	63.8	MS 35.4
Gusset Plate @ U7	**36.1**	**MS 20.1**	**48.1**	**MS 26.7**

BREAKDOWN OF BRIDGE RATING CONTINUED

TOWN/CITY: WESTFIELD

BRIDGE NO: W-25-010 (0V8)

CARRIES: US202/ST10/ELM STREET

OVER: WESTFIELD RIVER

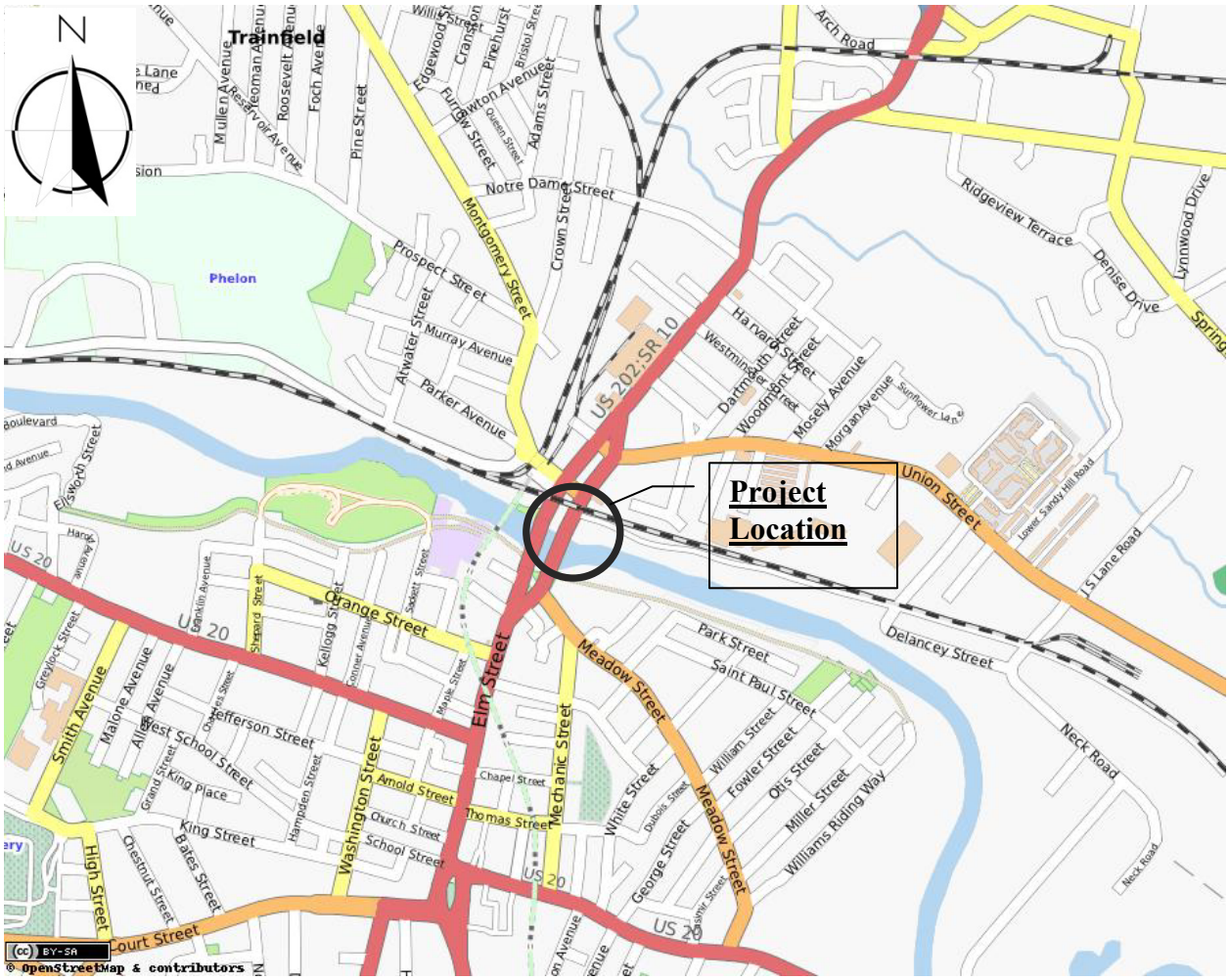
STRUCTURE NO.: W25010-0V8-DOT-NBI

BIN NO.: 0V8

BRIDGE ELEMENT	OPERATING RATING BY ASD METHOD	OPERATING RATING BY LOAD FACTOR METHOD
	SNOW REMOVAL EQUIPMENT	SNOW REMOVAL EQUIPMENT
SIDEWALK SLAB	8.8	6.6
SIDEWALK STRINGER	28.1	42.7
SIDEWALK BRACKET	99.5	135.7

LOCATION MAP

WESTFIELD US 202/SR 10 UNION AVENUE WESTFIELD RIVER BRIDGE NO. W-25-052



DESCRIPTION OF BRIDGE

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

Date of Construction:	1938, Rebuilt 2011
Original Design Loading:	HS-20
Posted Limit:	None
Bridge Type:	Two span continuous steel truss bridge with concrete deck supported by floor beams and stringers
Skew:	0°
Spans:	184 ft each, 368 ft total
Width of Bridge Deck:	68'-8", out to out
Roadway Width:	40'-0", curb to curb
Roadway Surface:	Hot mix asphalt
Curbs:	Concrete safety curbs under S3-TL4 railings
Sideway/Walkway/Median:	10 ft wide side walk on both sides outside of trusses
Bridge Railing:	S3-TL4 modified rail along roadway, steel pedestrian railing along both sides of sidewalk
Approach Railing:	Guardrail both sides
Superstructure:	2 span continuous Warren through trusses supporting floor beams, longitudinal stringers, and concrete deck
Modifications to Original Superstructure:	Gusset plates replaced at lower chord panel points, trusses reinforced where necessary, floor beams and deck replaced
Utilities:	10" Ø gas pipe, 12" Ø water pipe &18 telecom conduits
Substructure:	Masonry abutments and pier on steel sheet piling cofferdam.
Modifications to Original Substructure:	New retaining wall at east side of north abutment

RATING ANALYSIS ASSUMPTIONS AND CRITERIA

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

The structure was recently reconstructed and current inspection reports indicate that the structure is in good condition. The bridge substructure was not considered critical for rating purposes.

No section losses were applied to the floor beams, stringers, deck, or sidewalk stringers or brackets. All truss members were assumed to have 5% section loss. Appendix C shows that using the 5% section loss properties is more conservative than using individual repairs at panel points.

The steel truss chords and diagonals consist of built-up channel sections, ranging from 12" to 18" deep, connected by lacing bars. Truss members consist of both silicon and carbon steel. Bottom chord members L2L3, L3L4, top chord members U1U2, U2U3, U3U4, U4U5, U7U8, diagonal members U1L0, U3L4, U5L4, U5L6, U7L6, U7L8 and vertical members U1L1, U3L3, U5L5, U7L7, are silicon steel.

Based on the review of the bridge construction plans and the MassDOT inspection reports, the following stresses were used for rating purposes:

Structural Steel:

Existing members:
Typical Truss Members:
Fy = 33,000 psi
0.55Fy = 18,150 psi (Inventory allowable stress)
0.75Fy = 24,750 psi (Operating allowable stress)

Silicon Steel Truss members:
Fy = 45,000 psi
0.55Fy = 24,750 psi (Inventory allowable stress)
0.75Fy = 33,750 psi (Operating allowable stress)

New members: Fy = 50,000 psi
0.55Fy = 27,500 psi (Inventory allowable stress)
0.75Fy = 37,500 psi (Operating allowable stress)

Existing Gusset plates: Fy = 33,000 psi
Fu = 60,000 psi

New Gusset plates: Fy = 50,000 psi
Fu = 65,000 psi

RATING ANALYSIS ASSUMPTIONS AND CRITERIA CONTINUED

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

Existing Rivets: ϕF = 21,000 psi
Fu = 60,000 psi

New Bolts: ϕF = 35,000 psi
Fu = 120,000 psi

Cast-in-Place Concrete Deck and Sidewalk Deck:

f'c = 5000 psi
F_c = 2000 psi (Inventory allowable stress)
F_c = 3000 psi (Operating allowable stress)

Reinforcing Steel:

Fy = 60,000 psi
F_s = 24,000 psi (Inventory allowable stress)
F_s = 36,000 psi (Operating allowable stress)

The rating was performed using the load rating software AASHTOWare™ Virtis for the roadway stringers, floor beams, and truss members.

The assumptions used in rating the individual steel beams are as follows:

1. Superimposed wearing surface loads are distributed evenly to all roadway stringers
2. A wheel line was placed 2 feet away from the face of curb (on both sides)
3. The utilities, gas and water pipes, were modeled as distributed force on the corresponding sidewalk bracket.
4. The calculations were performed using the computer analysis program Virtis, Staad.pro, Microsoft Excel spreadsheets and hand calculations.

The inventory and operating capacity of the bridge was rated in accordance with the provisions of Chapter 7, Bridge Load Ratings, of the MHD Bridge Manual, the Second Edition of the "The Manual for Bridge Evaluation" (MBE) and all its interims up to date along with the 2002 edition of the "Standard Specification of Highway Bridges", both published by AASHTO, with section 6.7.2 "Rating Live Load" of the MCEB amended as stated in item (2) of rating assumptions.

RATING ANALYSIS ASSUMPTIONS AND CRITERIA CONTINUED

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

The live loads used for this rating are standard AASHTO "HS20" truck, "H20" truck load, and the Type 3 and Type 3S2 vehicles as shown in figure 7.7 of the MassDOT Bridge Manual. Where applicable, additional pedestrian loads were found using Bentley's Staad.pro and included in the operating rating of the truss members and gusset plates.

For both inventory and operating analysis, the live load distribution factor used for steel beams and trusses is that indicated in the 2002 edition of the "Standard Specifications for Highway Bridges" under part C, "Distribution of Loads". Where two or more methods of determining the distribution of live and dead loads are valid, the method that produces a higher rating shall govern in accordance with Section 7.2.4.6 of the MHD Bridge Manual.

The bridge was rated as two continuous through trusses with floor beams and stringers supporting a concrete deck, assuming a pin connection at the middle and roller supports on either end.

In rating this bridge, a model was developed using Virtis 6.3. Calculations were performed using Microsoft Excel. Hand calculations were performed for truss members, gusset plates, roadway deck, sidewalk deck, sidewalk stringers, and sidewalk brackets.

Gusset plate ratings were done according to the 2010 AASHTO Manual for Bridge Evaluation and its 2011-2015 interims. Ratings were done according to section B for load factor method. Though top chords of gusset plates show lower rating values when compared to the bridge's lower chords, it is important to note that the top chord splices do not consider top chord bracing gussets outside of the limits of the truss gusset plates and could provide additional capacity.

Sidewalk analysis follows the 2013 MassDOT LRFD Bridge Manual, for non-mountable sidewalks live-load analysis consists of 4-ton; 2-axle standard snow removal vehicle. Per section 7.2.3.5 only the operating rating is provided.

EVALUATION OF RATING AND RECOMMENDATIONS

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

The structure rates adequately and is in good condition. The intermediate floor beams controlled the inventory ratings for all vehicles with 31.3, 37.5, 59.0 and 41.5 ton ratings, for types H20, Type 3, Type 3S2 and HS20 respectively. The same floor beam also controlled the operating rating for vehicles Type 3 and HS20 with 64.6 and 71.5 ton ratings, respectively. The interior stringer controlled the operating rating for vehicle type H20 with 52.6 rating tons. Truss member U3-L4 controlled operating rating for Type 3S2 vehicle, with a rating of 85.8 tons.

The intermediate floor beam controlled the LFD inventory rating with a value of 35.3 metric tons. Gusset plate U7 controlled the LFD operating rating with a rating value of 48.1 metric tons.

This report contains the additional gusset plate rating based on the latest revisions of the bridge manual. Rating of gusset plates shows that the bridge is in good condition. STV recommends that routine inspection and maintenance to be performed on at regular intervals.

AVAILABLE PLANS

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)

The following plans were available for use to STV in rating the bridge:

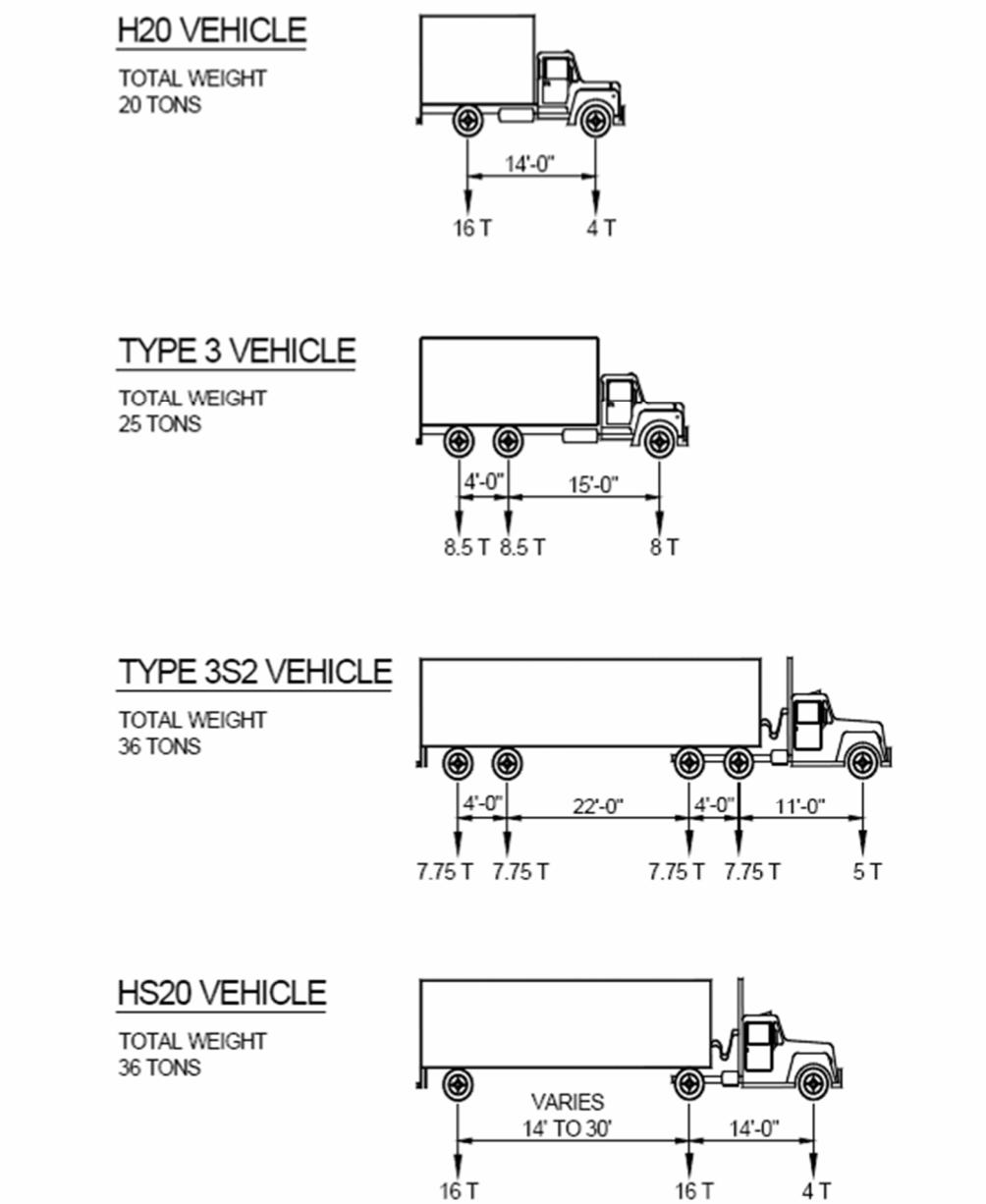
The Commonwealth of Massachusetts Highway Department
Transportation Improvements Project
Great River Bridge Project
Over the Great River
Westfield
Federal Aid Project No. BR-001S(300)
Project File No. 600933
PS&E Submission
July 2006
With amendments through 2011

Original Construction Drawings
September 1938
P.W.A. Project No.: Mass. 1467-F
Board of Public Works
Westfield, Massachusetts
Great River Bridge
Contract Drawings
Sheets No. 1 through 11 of 11

Additional Record Plans
March, 29th 1939
Sheets 12 & 14

TRUCK LOADINGS

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (0V8)



Appendix A – Inspection Reports

Report Date: April 29, 2016 THE GREAT RIVER BR.

State Information

BDEPT#= W25010 Agency Br.No.
Town= Westfield L.O. MHD
B.I.N= 0V8 AASHTO= 072.0
RANK= 3889 H.I.= 49.4 % FHWA Select List= Y

Identification

(8) Structure Number	W250100V8DOTNBI
(5) Inventory Route	121002023
(2) State Highway Department District	02
(3) County Code 013 (4) Place code	76030
(6) Features Intersected	**WATER WESTFIELD RIVER**
(7) Facility Carried	**US202 ST10/ELM SB**
(9) Location	JCT MEADOW ST.
(11) Kilometerpoint	0016.592
(12) Base Highway Network	Y
(13) LRS Inventory Route & Subroute	000000000000
(16) Latitude	42 DEG 07 MIN 44.05 SEC
(17) Longitude	72 DEG 44 MIN 46.40 SEC
(98) Border Bridge State Code	Share %
(99) Border Bridge Structure No.	#

Structure Type and Material

(43) Structure Type Main: Steel Code 310
Truss - Thru Jointless bridge type: Not applicable
(44) Structure Type Appr:
Other Code 000
(45) Number of spans in main unit 002
(46) Number of approach spans 0000
(107) Deck Structure Type - Concrete Cast-in-Place Code 1
(108) Wearing Surface / Protective System:
A) Type of wearing surface - Bituminous Code 6
B) Type of membrane - Unknown Code 8
C) Type of deck protection - Epoxy Coated Reinforcing Code 1

Age and Service

(27) Year Built 1938
(106) Year Reconstructed 2011
(42) Type of Service: On - Highway-Ped
Under - Waterway Code 55
(28) Lanes: On Structure 03 Under structure 00
(29) Average Daily Traffic 016950
(30) Year of ADT 2014 (109) Truck ADT 05 %
(19) Bypass, detour length 006 KM

Geometric Data

(48) Length of maximum span 0056.1 M
(49) Structure Length 00114.3 M
(50) Curb or sidewalk: Left 03.0 M Right 03.0 M
(51) Bridge Roadway Width Curb to Curb 012.2 M
(52) Deck Width Out to Out 013.2 M
(32) Approach Roadway Width (w/shoulders) 012.2 M
(33) Bridge Median - No median Code 0
(34) Skew 00 DEG (35) Structure Flared N
(10) Inventory Route MIN Vert Clear 04.88 M
(47) Inventory Route Total Horiz Clear 12.2 M
(53) Min Vert Clear Over Bridge Rdwy 04.88 M
(54) Min Vert Underclear ref N 00.00 M
(55) Min Lat Underclear RT ref N 00.0 M
(56) Min Lat Underclear LT 00.0 M

Navigation Data

(38) Navigation Control - No navigation control on waterway Code 0
(111) Pier Protection Code
(39) Navigation Vertical Clearance 000.0 M
(116) Vert-lift Bridge Nav Min Vert Clear M
(40) Navigation Horizontal Clearance 0000.0 M

Classification

		Code
(112) NBIS Bridge Length		Y
(104) Highway System		Y
(26) Functional Class -	Urban Arterial	14
(100) Defense Highway		0
(101) Parallel Structure		N
(102) Direction of Traffic -	2-way traffic	2
(103) Temporary Structure		N
(105) Federal Lands Highways		0
(110) Designated National Network		N
(20) Toll -	On free road	3
(21) Maintain -	State Highway Agency	01
(22) Owner -	State Highway Agency	01
(37) Historical Significance	potentially eligible	P

Condition

	Code
(58) Deck	8
(59) Superstructure	7
(60) Substructure	6
(61) Channel & Channel Protection	6
(62) Culverts	N

Load Rating and Posting

		Code
(31) Design Load -	HS 20=MS 18	5
(63) Operating Rating Method -	No rating analysis performed	5
(64) Operating Rating		44.1
(65) Inventory Rating Method -	No rating analysis performed	5
(66) Inventory Rating		32.4
(70) Bridge Posting		5
(41) Structure -	Open	A

Appraisal

	Code
(67) Structural Evaluation	6
(68) Deck Geometry	4
(69) Underclearances, vert. and horiz.	N
(71) Waterway adequacy	8
(72) Approach Roadway Alignment	7
(36) Traffic Safety Features	1 1 0 1
(113) Scour Critical Bridges	3

Inspections

(90) Inspection Date 07/25/14 (91) Frequency 24 MO
(92) Critical Feature Inspection: (93) CFI DATE

(A) Fracture Critical Detail	Y	24	MO A)	07/25/14
(B) Underwater Inspection	N	00	MO B)	00/00/00
(C) Other Special Inspection	N	00	MO C)	07/02/09
(*) Other Inspection (Critical Repair)	N	00	MO *)	02/27/07
(*) Closed Bridge	N	00	MO *)	01/27/11
(*) UW Special Inspection	N	00	MO *)	00/00/00
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 00/00/00	H20	Type 3	Type 3S2	Type HS
Operating	27.0	34.0	49.0	49.0
Inventory	20.0	25.0	36.0	36.0

Field Posting

Status DESIGN Posting Date 07/19/12

	2 Axle	3 Axle	5 Axle
Actual			
Recommended			

Missing Signs N

Misc.

Bridge Name THE GREAT RIVER BR.
N Anti-missile fence N Acrow Panel N Jointless Bridge
Freeze/Thaw

Accessibility (Needed/Used)

Y / Y	Liftbucket	N / N	Rigging	Y / Y	Other
N / N	Ladder	N / N	Staging	TRACKER	
N / N	Boat	Y / Y	Traffic Control		
P / N	Wader	N / N	RR Flagperson	Inspection Hours:	062
N / N	Inspector 50	Y / Y	Police		

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

STRUCTURES INSPECTION FIELD REPORT

ROUTINE INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
02	0V8	W-25-010

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	41-STATUS	90-ROUTINE INSP. DATE
WESTFIELD	W25010-0V8-DOT-NBI	016.592	A:OPEN	JUL 25, 2014

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	YR REHAB'D (NON 106)
US202 ST10/ELM SB	THE GREAT RIVER BR.	1938	2011	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER
WATER WESTFIELD RIVER	Urban Arterial	W. A. Drosehn

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER	PROJ MGR
310 : Steel Truss - Thru	State Highway Agency	State Highway Agency	B. D'Artista	HNTB Corporation

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	Varied	29°C	A. KIRIAKIDIS, S. ST HILAIRE

ITEM 58 — DECK: 8

		DEF
1.Wearing surface	8	-
2.Deck Condition	8	-
3.Stay in place forms	7	-
4.Curbs	7	-
5.Median	N	-
6.Sidewalks	8	-
7.Parapets	N	-
8.Railing	8	-
9.Anti Missile Fence	N	-
10.Drainage System	N	-
11.Lighting Standards	7	M-A
12.Utilities	5	S-P
13.Deck Joints	7	-
14.	N	-
15.	N	-
16.	N	-

CURB REVEAL (In millimeters)	E	W
	389	381

APPROACHES

		DEF
a. Appr. pavement condition	8	-
b. Appr. Roadway Settlement	8	-
c. Appr. Sidewalk Settlement	7	-
d.	N	-

OVERHEAD SIGNS (Attached to bridge) (Y/N): N

		DEF
a. Condition of Welds	N	-
b. Condition of Bolts	N	-
c. Condition of Signs	N	-

ITEM 59 — SUPERSTRUCTURE: 7

			DEF
1.Stringers		8	-
2.Floorbeams		8	-
3.Floor System Bracing		N	-
4.Girders or Beams		N	-
5.Trusses - General		7	-
a. Upper Chords	8		-
b. Lower Chords	7		-
c. Web Members	7		-
d. Lateral Bracing	6		-
e. Sway Bracings	7		-
f. Portals	6		-
g. End Posts	7		-
6.Pin & Hangers		N	-
7.Conn Plt's, Gussets & Angles		7	-
8.Cover Plates		N	-
9.Bearing Devices		6	-
10.Diaphragms/Cross Frames		N	-
11.Rivets & Bolts		6	M-A
12.Welds		7	-
13.Member Alignment		8	-
14.Paint/Coating		7	-
15.		N	-

Year Painted	2011

COLLISION DAMAGE: *Please explain*
None ( ) Minor (X) Moderate ( ) Severe ( )

LOAD DEFLECTION: *Please explain*
None ( ) Minor ( ) Moderate (X) Severe ( )

LOAD VIBRATION: *Please explain*
None ( ) Minor ( ) Moderate (X) Severe ( )

Any Fracture Critical Member: (Y/N) Y

Any Cracks: (Y/N) N

ITEM 60 — SUBSTRUCTURE: 6

	Dive	Cur		DEF
1. Abutments			6	
a. Pedestals	N	N		-
b. Bridge Seats	N	7		-
c. Backwalls	N	7		-
d. Breastwalls	N	6		-
e. Wingwalls	N	7		-
f. Slope Paving/Rip-Rap	N	6		-
g. Pointing	N	6		-
h. Footings	N	6		S-P
i. Piles	N	N		-
j. Scour	N	6		S-P
k. Settlement	N	7		-
l.	N	N		-
m.	N	N		-
2. Piers or Bents			7	
a. Pedestals	N	N		-
b. Caps	N	7		-
c. Columns	N	N		-
d. Stems/Webs/Pierwalls	N	7		-
e. Pointing	N	7		-
f. Footing	N	H		-
g. Piles	N	N		-
h. Scour	N	7		-
i. Settlement	N	7		-
j. Steel Sheeting	N	H		-
k.	N	N		-
3. Pile Bents			N	
a. Pile Caps	N	N		-
b. Piles	N	N		-
c. Diagonal Bracing	N	N		-
d. Horizontal Bracing	N	N		-
e. Fasteners	N	N		-

UNDERMINING (Y/N) If YES please explain: Y

COLLISION DAMAGE:
None (X) Minor ( ) Moderate ( ) Severe ( )

SCOUR: *Please explain*
None ( ) Minor (X) Moderate ( ) Severe ( )

I-60 (Dive Report): N *I-60 (This Report):* 6

93B-U/W (DIVE) Insp 00/00/00

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	0V8	W-25-010	W25010-0V8-DOT-NBI	JUL 25, 2014

ITEM 61 — CHANNEL & CHANNEL PROTECTION: 6

	Dive	Cur	DEF
1.Channel Scour	N	6	-
2.Embankment Erosion	N	7	-
3.Debris	N	6	-
4.Vegetation	N	6	-
5.Utilities	N	N	-
6.Rip-Rap/Slope Protection	N	6	-
7.Aggradation	N	6	-
8.Fender System	N	N	-

STREAM FLOW VELOCITY:
Tidal ( ) High ( ) Moderate (X) Low ( ) None ( )

ITEM 61 (Dive Report): N ITEM 61 (This Report): 6

93b-U/W INSP. DATE: 00/00/00

ITEM 36 — TRAFFIC SAFETY

	36	COND	DEF
A. Bridge Railing	1	7	-
B. Transitions	1	8	-
C. Approach Guardrail	0	8	-
D. Approach Guardrail Ends	1	8	-

WEIGHT POSTING

Not Applicable X

	H	3	3S2	Single
Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 00/00/00 EJDMT Date: 00/00/00

Signs In Place (Y=Yes,N=No, NR=NotRequired) Legibility/ Visibility	At bridge N	At bridge S	Other Advance N	Other Advance S

CLEARANCE POSTING

Not Applicable X

	E ft	E in	W ft	W in	meter
Actual Field Measurement	15	9	14	9	4.49
Posted Clearance		0		0	

Signs In Place (Y=Yes,N=No, NR=Not Required) Legibility/ Visibility	At bridge E	At bridge W	Advance E	Advance W

ACCESSIBILITY (Y/N/P)

	Needed	Used
Lift Bucket	Y	Y
Ladder	N	N
Boat	N	N
Waders	P	N
Inspector 50	N	N
Rigging	N	N
Staging	N	N
Traffic Control	Y	Y
RR Flagger	N	N
Police	Y	Y
Other:		
TRACKER	Y	Y

TOTAL HOURS 62

PLANS (Y/N): Y

(V.C.R.) (Y/N): N

TAPE#: _____

List of field tests performed:
Visual, Hands-On

RATING

Rating Report (Y/N): N

Date: 00/00/00

Inspection data at time of existing rating
I 58: - I 59: - I 60: - Date : 00/00/00

(To be filled out by DBIE)
Request for Rating or Rerating (Y/N): N

If YES please give priority:
HIGH ( ) MEDIUM ( ) LOW ( )

REASON: _____

CONDITION RATING GUIDE (For Items 58, 59, 60 and 61)

	CODE	CONDITION	DEFECTS
	N	NOT APPLICABLE	
G	9	EXCELLENT	Excellent condition.
G	8	VERY GOOD	No problem noted.
G	7	GOOD	Some minor problems.
F	6	SATISFACTORY	Structural elements show some minor deterioration.
F	5	FAIR	All primary structural elements are sound but may have minor section loss, cracking, spalling or scour.
P	4	POOR	Advance section loss, deterioration, spalling or scour.
P	3	SERIOUS	Loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
C	2	CRITICAL	Advance deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
C	1	"IMMINENT" FAILURE	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stablility. Bridge is closed to traffic but corrective action may put it back in light service.
	0	FAILED	Out of service - beyond corrective action.

DEFICIENCY REPORTING GUIDE

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.

S= Severe/Major Deficiency - Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroded rebars, Considerable settlement, Considerable scouring or undermining, Moderate to extensive corrosion to structural steel with measurable loss of section, etc.

C-S= Critical Structural Deficiency - A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency - A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Loose concrete hanging down over traffic or pedestrians, A hole in a sidewalk that may cause injuries to pedestrians, Missing section of bridge railing, etc.

URGENCY OF REPAIR:

I = Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her].

A = ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) upon receipt of the Inspection Report].

P = Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available].

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

BRIDGE ORIENTATION

Bridge W-25-010(0V8) is a two span structure that carries US Route 202 (State Route 10/Elm Street) southbound over the Westfield River in the City of Westfield. This structure is comprised of two Warren style continuous steel through trusses. The truss chords, diagonals and end posts are comprised of built-up riveted steel box sections. The truss verticals consist of built-up riveted steel I-shape sections. The floor system is comprised of rolled steel floorbeams and rolled steel stringers, which support a reinforced concrete deck with stay-in-place forms. The concrete filled steel grid deck sidewalks and the utilities are supported by the steel floorbeam cantilevers.

The substructure consists of two abutments (south and north) and one pier. The abutments are comprised of a mortared masonry block breastwall with reinforced concrete bridge seat and backwall, and mortared masonry block wingwalls. The pier consists of a mortared masonry block pierwall with a reinforced concrete cap.

This bridge is orientated south to north. The trusses are designated as west or east. The panel points and floorbeams of each span are numbered 0 to 8 starting from the abutment. Floorbeam 8 is located directly over the pier and is shared by both spans. The roadway stringers are numbered 1 to 9 from west to east. The west sidewalk stringers are designated A to C and the east sidewalk stringers D to F, from west to east. The nomenclature used for this report corresponds to the original design plans and the previous inspection reports.

GENERAL REMARKS

Inspection Access and Traffic Control:

An amphibious lift bucket truck (Harcon Bridge Tracker) was utilized to access the truss lower chords, floor system and substructure. A bucket truck with traffic control was utilized to access the truss upper chords, web members and bracings. An alternating single lane traffic closure occurred during the hours of 9:00am to 4:00pm.

Safety Warning:

The telecommunication conduits under the east sidewalk between sidewalk stringers D and E appear to be Transite, which contains asbestos. There are isolated locations of frayed conduits and numerous locations of broken conduits. Necessary safety precautions should be taken when inspecting in the vicinity of frayed or broken Transite conduits. Refer to Item 58.12 for additional comments.

Vertical Clearance:

The limiting vertical clearance was measured to be 14'-9 1/2" at the abandoned sign support attached to the span 1 south portal **(see photo 1)**. The lowest vertical clearance to a truss member was measured to be 15'-9" at midspan of the horizontal member of the span 1 north portal.

There are no vertical clearance signs for this bridge as the vertical clearance for the railroad bridge to the north controls for this portion of US Route 202 southbound.

ITEM 58 - DECK

Item 58.2 - Deck Condition

The underside of deck is hidden due to stay-in-place forms between the stringers and the galvanized steel bent plates for the deck overhangs. The condition coding of Item 58.2 is interpolated from the condition of Items 58.1 and 58.3.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Item 58.3 - Stay in place forms
There are isolated locations of minor dents/bends in the underside of the stay-in-place forms. The stay-in-place forms between stringers 4 through 6 of floorbeam bay 1 in span 2 exhibit a 10" long (two ribs) by up to 1 1/4" downward bend with slight rotation **(see photo 2)**. A similar condition occurs between stringers 3 and 4 of floorbeam bay 1 in span 1.

There are numerous locations of up to 2" long by 1 1/2" wide torched holes in the stay-in-place forms at the electrical conduit supports along sidewalk stringers C and D **(see photo 3)**. Most of these locations appear to have flashing installed.

Isolated joints of the deck overhang galvanized steel bent plates exhibit efflorescence and stalactites.

Item 58.4 - Curbs
The concrete curbs exhibit numerous hairline vertical cracks with moisture, particularly at rail posts.

Item 58.6 - Sidewalks
The sidewalks consist of a concrete filled steel grid deck. There are isolated locations where the top of grid deck bars are exposed.

Item 58.8 - Railing
Pedestrian railings are present along each sidewalk fascia and adjacent to the exterior face of each truss. The pedestrian railings consist of two steel pipe rails with pickets.

Refer to Item 36a for traffic railing comments.

Item 58.11 - Lighting Standards
The pedestrian luminaire attached to vertical U5L5 of the east truss in span 1 is not fully tightened at the threaded insert and can be moved by hand.

The roadway luminaire attached to vertical U3L3 of the west truss in span 2 is not fully tightened at the threaded insert and can be moved by hand **(see photo 4)**. This luminaire is above the right lane.

The police detail officer stated that most of the luminaires were not illuminated during nighttime hours. The bridge accent floodlights attached to vertical U5L5 of the west truss in both spans were illuminated during daytime hours.

Item 58.12 - Utilities
The PVC electrical conduit along stringer D in floorbeam bay 4 of span 1 is broken over a 3'-0" length with exposed wires **(see photo 5)**.

There are numerous locations where the threaded rods for the conduit supports are in contact with the floorbeam cantilever top flange **(see photo 6)**. One conduit support threaded rod at the floorbeam 3 east cantilever of span 1 has two backed off nuts **(see photo 6)**.

East Sidewalk Telecommunication Conduits:
The telecommunication conduits under the east sidewalk between sidewalk stringers D and E appear to be Transite, which contains asbestos. There are two locations where the transite conduits are fraying **(see photo 7)**. There are numerous locations where the transite conduits are broken and exposing wires. The most notable locations of broken transite conduits are:

- Span 2, Floorbeam Bay 1 at Floorbeam 0: 8 locations of broken conduit with exposed wires **(see photo 8)**.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Item 58.12 - Utilities (Cont'd)

- Span 2, Floorbeam Bay 4 at Midspan: 5 locations of broken conduit with exposed wires.
- Span 2, Floorbeam Bay 5 at Floorbeam 4: 5 locations of broken conduit with exposed wires.

Necessary safety precautions should be taken when inspecting in the vicinity of frayed or broken Transite conduits.

Item 58.13 - Deck Joints
The abutment deck joints have sand filling the expansion gap above the joint seal **(see photo 9)**. The joint armor of the north abutment deck joint exhibits minor plow damage throughout. There is an 18" long by 3/4" wide bend of the north joint armor of the north abutment deck joint within the center lane due to plow damage **(see photo 9)**.

The concrete encasement around the abutment deck joint transverse steel supports exhibit numerous full perimeter hairline cracks. The concrete encasement around the north abutment deck joint transverse steel support at stringer 4 has a 7" long by 3" high by 6 3/4" deep spall/void exposing the steel support.

APPROACHES

Approaches c - Appr. Sidewalk Settlement
There is a 1/32" wide longitudinal crack extending the majority of the length of both sidewalks of the north approach. Most joints of the north approach granite curbs are missing mortar.

ITEM 59 - SUPERSTRUCTURE

Item 59.5 - Trusses - General
Item 59.5.b - Lower Chords
The majority of the lower chord is in good condition and governs the overall condition coding of Item 59.5.b. The portion of the original lower chords within the gusset plates is in fair condition and exhibits section loss beyond the flange repair plates **(see photos 10 and 11)**. The bottom flanges exhibit up to 1/8" section loss by full width of both channels or up to 1/4" section loss by full width of one channel. There is typically minor section loss of the top flange of one channel and to the webs. West truss lower chord L4L5 in span 1 and east truss lower chord L2L3 in span 2 exhibit the most severe condition of the lower chord within the gusset plates **(see sketch 1 and photos 10 & 11)**. All section loss is painted over and shows no signs of active corrosion.

Numerous lower chords have top and bottom flange repair plates which terminate with edge distances of up to 10" to the first bolt, particularly in span 2 **(see photo 12)**. This excessive edge distance allows for the potential of future impacted rust.

Refer to Item 59.11 for additional comments.

Item 59.5.c - Web Members
The flanges of the vertical web members exhibit isolated locations of 1/8" deep pitting by 3" wide of one outstanding leg or 1/16" deep pitting by 3" wide of both outstanding legs. These areas of pitting are around vacant drilled holes for the original bridge railing or luminaires. All pitting is painted over and shows no signs of active corrosion.

Isolated vertical or diagonal web members exhibit 1/16" section loss along the lower chord gusset plate. This loss is painted over and shows no signs of active corrosion.

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REMARKS

Item 59.5.d - Lateral Bracing
Most lower lateral bracings exhibit a minor downward bend and rotation. The most severe condition occurs at the end bays where the lower lateral bracing has a 1 1/2" downward bend, minor rotation and moderate deflection and vibration under heavy live loading **(see photo 13)**.

Refer to Item 59.11 for additional comments.

Item 59.5.e - Sway Bracings
There is a 2 1/2" high by full width by 18" long bend of the bottom flange of the panel point 3 sway bracing in span 2 **(see photo 14)**. There is a 1" high by 2" wide by 8" long bend of the bottom flange of the panel point 5 sway bracing in span 2.

Item 59.5.f - Portals
The horizontal member of the span 1 portal bracing near the pier is bent 1" downward and has a 1" high by 3" wide by 18" long bend of the bottom flange due to collision damage over the left and center lanes **(see photo 15)**.

The span 2 portal bracing near the pier exhibits the following collision damage:
- Horizontal Member: Two locations of a 5/8" high by 2" wide by 11" long bends of the top and bottom flanges.
- Diagonal Member, East Truss to Midspan of Horizontal Member: 2" high by full width by 10" long bend of the bottom flange **(see photo 16)**.

Item 59.5.g - End Posts
The end posts bottom flange batten plates at the sidewalk exhibit 1/16" painted over loss extending most of the plate width. Refer to Item 59.11 for additional comments.

Item 59.7 - Conn Plt's, Gussets & Angles
Panel point U1 gusset plates in both spans exhibit 1/8" section loss of the interior face along the upper chord and web members **(see photo 17)**. This section loss extends up to 3/4" high by 14" long. The east gusset plate for panel points U1 and U5 of the west truss in span 1 exhibit 1/16" section loss by 2 1/2" around isolated rivets. All gusset plate section loss is painted over and shows no signs of active corrosion.

Refer to Item 59.12 for additional comments.

Item 59.9 - Bearing Devices
All elastomeric bearings at the abutments and pier exhibit 3/16" to 3/8" bulging over a height of 2 1/2" between the steel laminates **(see photos 18 and 19)**.

Both truss bearings at the pier have only two of the six anchor rods with a nut **(see photo 19)**.

Item 59.11 - Rivets & Bolts
There is a missing bolt for the floorbeam 4 connection to the east truss in span 2 **(see photo 20)**. There is a missing nut for the lower lateral bracing connection to the east end of floorbeam 1 in span 2 **(see photo 21)**. The east truss end post L0U1 of span 2 has two cut off rivet heads for the top plate at panel point L0 **(see photo 22)**.

Lower chord L0L1 of both trusses in span 1 exhibit missing/not installed bolts:
- West Truss, Lower Chord L0L1 at Panel Point L0: Four missing bolts connecting bottom flange plates north of bearing **(see photo 23)**. Two missing bolts connecting bottom flange plates at bearing.

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REMARKS

Item 59.11 - Rivets & Bolts (Cont'd)

- East Truss, Lower Chord L0L1 at Panel Point L1: One missing bolt and one bolt missing a nut for the connection of the bottom flange plates **(see photo 24)**.

Isolated lower chord rivets exhibit 20% head loss **(see photo 10)**. East truss lower chord L7L8 at panel point L8 of span 1 has three of four bolts loose for the connection to the bearing **(see photo 25)**.

Item 59.12 - Welds
This bridge is a riveted structure. However, tack and/or intermittent welds are present on most upper chord interior (roadway side) gusset plates at the additional plate and/or at the sway and upper lateral bracing connection **(see photo 26)**. Some of the welds are present along the edges of the gusset plate. These welds appear to have originated from the initial erection of the trusses.

Item 59.14 - Paint/Coating
The bottom flanges of the upper chords and end posts exhibit scattered small areas of paint system failure **(see photo 27)**.

SuperStructure Collision Notes
The portal bracing at the pier for each span exhibits minor collision damage (see photos 15 and 16). Refer to Item 59.5.f for additional comments.

SuperStructure Load Deflection Notes
The lower lateral bracing in the end bays exhibit moderate deflection under heavy live loading.

SuperStructure Load Vibration Notes
The lower lateral bracing in the end bays exhibit moderate vibration under heavy live loading.

ITEM 60 - SUBSTRUCTURE

Item 60.1 - Abutments
Item 60.1.b - Bridge Seats
The south abutment bridge seat exhibits isolated hairline vertical cracks on the fascia that extend across the seat and are aligned with backwall cracks.

Item 60.1.c - Backwalls
Both abutment backwalls exhibit numerous hairline vertical cracks with efflorescence and/or moisture.

Item 60.1.d - Breastwalls
There are scattered areas of moderate efflorescence from the masonry joints of the lower half of the north abutment. Refer to Item 60.1.g for additional comments.

The east end of the north abutment breastwall has isolated areas of minor undermining due to heavy scaling of the footing **(see sketch 2 and photos 28 & 29)**. Refer to Item 60.1.h for additional comments.

Item 60.1.e - Wingwalls
There is heavy efflorescence from the masonry joints of the northwest wingwall **(see photo 30)**.

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WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Item 60.1.f - Slope Paving/Rip-Rap
There is stone/masonry block rip-rap slope protection in front of the northwest and southwest (upstream) wingwalls. Isolated stones/blocks have displaced **(see photo 30)**. There is heavy vegetation growth from the joints of the northwest wingwall slope protection **(see photo 30)**.

Item 60.1.g - Pointing
There is minor mortar loss of the masonry joint between the top of the south abutment breastwall and bridge seat at both ends. The masonry joints of the bottom two courses of the north abutment breastwall exhibit moderate mortar loss with up to 10" deep penetrations **(see photo 31)**.

Item 60.1.h - Footings
The east end of the north abutment footing exhibits heavy concrete scaling due to scour **(see sketch 2 and photos 28 & 29)**. The scaling extends up to full width/length by full height of the footing. There are isolated areas where the masonry block breastwall has minor undermining.

The top of the north abutment footing exhibits up to full width/length by 7" high spalling/scaling at the west end **(see photo 31)**.

Item 60.1.j - Scour
Refer to Items 60.1.d, 60.1.h and 61.7 for comments.

Item 60.2 - Piers or Bents
Item 60.2.b - Caps
There is minor debris accumulation on top of the pier cap at both ends.

Item 60.2.d - Stems/Webs/Pierwalls
There are isolated areas of minor efflorescence from the masonry joints of the pierwall. The lower 5' of the west face of the pierwall exhibits heavy efflorescence from the masonry joints **(see photo 32)**. Refer to Item 60.2.f for additional comments.

One masonry block of the second course from the top of the north face of the pierwall has a 1/16" wide vertical crack by full block height **(see photo 33)**.

Item 60.2.e - Pointing
Isolated vertical masonry joints exhibit minor mortar loss with up to 4" deep penetrations **(see photo 33)**.

Item 60.2.j - Steel Sheeting
Refer to Item 61.6 for comments.

SubStructure Undermining Notes
Refer to Items 60.1.d and 60.1.h for comments.

SubStructure Scour Notes
Refer to Items 60.1.d, 60.1.h and 61.7 for comments.

ITEM 61 - CHANNEL AND CHANNEL PROTECTION

Item 61.1 - Channel Scour
There appears to be moderate to heavy channel scour at the northwest end of span 1 adjacent to the pier rip-rap as seen from above the water **(see photo 34)**.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Item 61.3 - Debris
A large fallen tree was present at the west end of the pier **(see photo 32)** and the east end of the north abutment. There are small fallen trees at the east end of the pier and the upstream (west) aggradation island.

Item 61.4 - Vegetation
There is heavy vegetation on the upstream (west) aggradation island **(see photo 35)**. Refer to Item 61.7 for additional comments.

Item 61.6 - Rip-Rap/Slope Protection
There is moderate vegetation growth from the rip-rap surrounding the pier **(see photo 32)**. Isolated rip-rap has displaced on the north side of the pier exposing the top of the steel sheeting cofferdam.

Refer to Item 60.1.f for additional comments.

Item 61.7 - Aggradation
An island has formed upstream (west) of the bridge due to aggradation **(see photo 35)**. This island redirects the natural flow of the river and potentially facilitates in the channel scour adjacent to the west end of the pier.

Large aggradation deposits have formed downstream (east) of this bridge beyond the waterfall. These aggradation deposits are adjacent to the substructure of bridge W-25-052(AEN), which carries US Route 202 northbound. Refer to the latest Routine Inspection Report of bridge W-25-052(AEN) for additional comments.

TRAFFIC SAFETY

Item 36a - Bridge Railing
There is a modified S3-TL4 bridge railing adjacent to each truss. The bridge railings exhibit areas of minor plow scrapes/paint loss to the top rail.

Item 36c - Approach Guardrail
There is thrie beam approach guardrail for the north (leading) approach only. There is only southbound traffic across the bridge.

The north approach guardrails only extend a portion of the approach due to a pedestrian crosswalk and decorative flower pots **(see photo 36)**.

Item 36d - Approach Guardrail Ends
he thrie beam north approach guardrail ends consist of terminal end sections.

Sketch / Photo Log
Sketch 1 : Span 1, West Truss, Lower Chord L4L5 at L4.
Sketch 2 : Partial Plan of North Abutment at East End.
Photo 1 : South Portal, Span 1, Looking North - Abandoned sign support protrudes below the portal and governs the vertical clearance.
Photo 2 : Stay-In-Place Forms between Stringers 4 through 6, Floorbeam Bay 1, Span 2 - Downward bend with slight rotation.
Photo 3 : Stay-In-Place Forms at Stringer C, Floorbeam Bay 1, Span 1 - Torched hole at the electrical conduit support.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Sketch / Photo Log (Cont'd)

Photo 4 : Roadway Luminaire attached to Vertical U3L3, West Truss, Span 2, Looking North - Luminaire not fully tightened.
Photo 5 : Electrical Conduit along Stringer D, Floorbeam Bay 4, Span 1 - Broken with exposed wires.
Photo 6 : Conduit Support at Floorbeam 3 East Cantilever, Span 1 - Threaded rods in contact w/ floorbeam cant. top flange & 2 backed off nuts.
Photo 7 : Telecommunication Conduits at Floorbeam 4 East Cantilever, Span 2, Looking North - Frayed.
Photo 8 : Telecommunication Conduits at Floorbeam 0 East Cantilever, Span 2, Lkg North - Multiple broken conduits w/ exposed wires.
Photo 9 : North Abutment Deck Joint, Looking West - Filled with sand and minor plow damage.
Photo 10 : Lower Chord L4L5 at Panel Point L4, West Truss, Span 1, Lkg South - Flange loss beyond repair plates. Note rivet head loss.
Photo 11 : Lower Chord L2L3 at Panel Point L2, East Truss, Span 2, Looking North - Flange section loss beyond repair plates.
Photo 12 : Lower Chord L7L8 near Panel Point L8, E. Truss, Span 2, Lkg W. - Bot. flange repair plates w/ excessive edge distance to first bolt.
Photo 13 : Lower Lateral Bracing, Floorbeam Bay 1, Span 1, Looking West - Downward bend and rotation.
Photo 14 : Sway Bracing at Panel Point 3, Span 2, Looking Northwest - Bend in bottom flange.
Photo 15 : Portal at Pier, Horizontal Member over Left & Center lanes, Span 1, Lkg W. - Member & bottom flange bent due to collision damage.
Photo 16 : Portal at Pier, Diagonal Member btwn East Truss & Midspan, Span 2, Lkg West - Bottom flange bent due to collision damage.
Photo 17 : Gusset Plate U1, West Truss, West Plate, East Face, Span 2 - Section loss along diagonal web member.
Photo 18 : West Truss Bearing at South Abutment, North Face, Looking Southwest - Bulging of elastomeric pad.
Photo 19 : East Truss Bearing at Pier, South Face - Bulging of elastomeric pad and missing anchor bolt nuts.
Photo 20 : Floorbeam 4 Connection to East Truss, Span 2, Looking East - Missing bolt.
Photo 21 : Lower Lateral Bracing Connection to East End of Floorbeam 1, Span 2, Looking West - Missing nut.
Photo 22 : End Post L0U1 at Panel Point L0, East Truss, Span 2, Looking South - Two cut off rivet heads.
Photo 23 : Lower Chord L0L1 at Panel Point L0, West Truss, Span 1, Looking South - Missing/not installed bolts.
Photo 24 : Lower Chord L0L1 at Panel Point L1, East Truss, Span 1, Looking South - One missing bolt and one bolt missing a nut.
Photo 25 : Lower Chord L7L8 at Panel Point L8, East Truss, Span 1, Looking North - Three of four bolts loose for the connection to the bearing.
Photo 26 : Gusset Plate U5, E. Truss, W. Plate, W. Face, Span 2, Lkg SE - Welds at the additional plate & sway/upper lateral bracing conn.
Photo 27 : Upper Chord U1U2, East Truss, Span 1, Looking South - Areas of paint system failure.
Photo 28 : North Abut. Breastwall & Footing, E. End, W. Face - Heavy scaling of footing due to scour & minor undermining of breastwall.
Photo 29 : North Abut. Breastwall and Footing, E. End, S. Face - Heavy scaling of footing due to scour & minor undermining of breastwall.
Photo 30 : Northwest Wingwall, Looking North - Efflorescence from masonry joints. Note slope protection with displaced blocks and vegetation.
Photo 31 : North Abutment Breastwall near West End, Looking Northwest - Masonry joints with mortar loss. Note footing with spalling/scaling.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Sketch / Photo Log (Cont'd)

Photo 32 : Pierwall, West Face, Looking North - Efflorescence from the masonry joints. Note fallen tree and vegetation from rip-rap.

Photo 33 : Pierwall at Center, North Face - Full block height vertical crack and masonry joints with mortar loss.

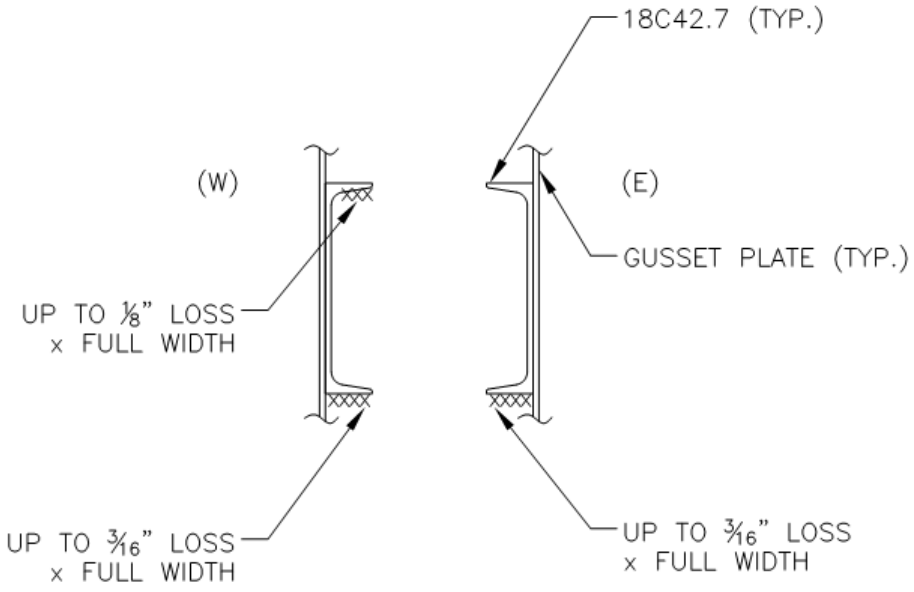
Photo 34 : Channel at Northwest End, Span 1, Looking East - Apparent channel scour.

Photo 35 : Channel, Upstream (West) End, Looking West - Island formed due to aggradation. Note vegetation on island.

Photo 36 : North Approach, Lkg South - Guardrails only extend a portion of the approach due to a pedestrian crosswalk & flower pots.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

SKETCHES



AS-BUILT PROPERTIES (18C42.7):
d = 18.000"
bf = 3.950"
tf = 0.625" AVERAGE
tw = 0.450"

NOTES:
1. THIS SECTION IS TAKEN BEYOND THE FLANGE REPAIR PLATES.
2. ADJACENT RIVETS WITH UP TO 20% HEAD LOSS.
3. ALL SECTION LOSS IS PAINTED OVER AND SHOWS NO SIGN OF ACTIVE CORROSION.
4. SPAN 2, EAST TRUSS, LOWER CHORD L2L3 AT L3: SIMILAR LESS SEVERE CONDITION.

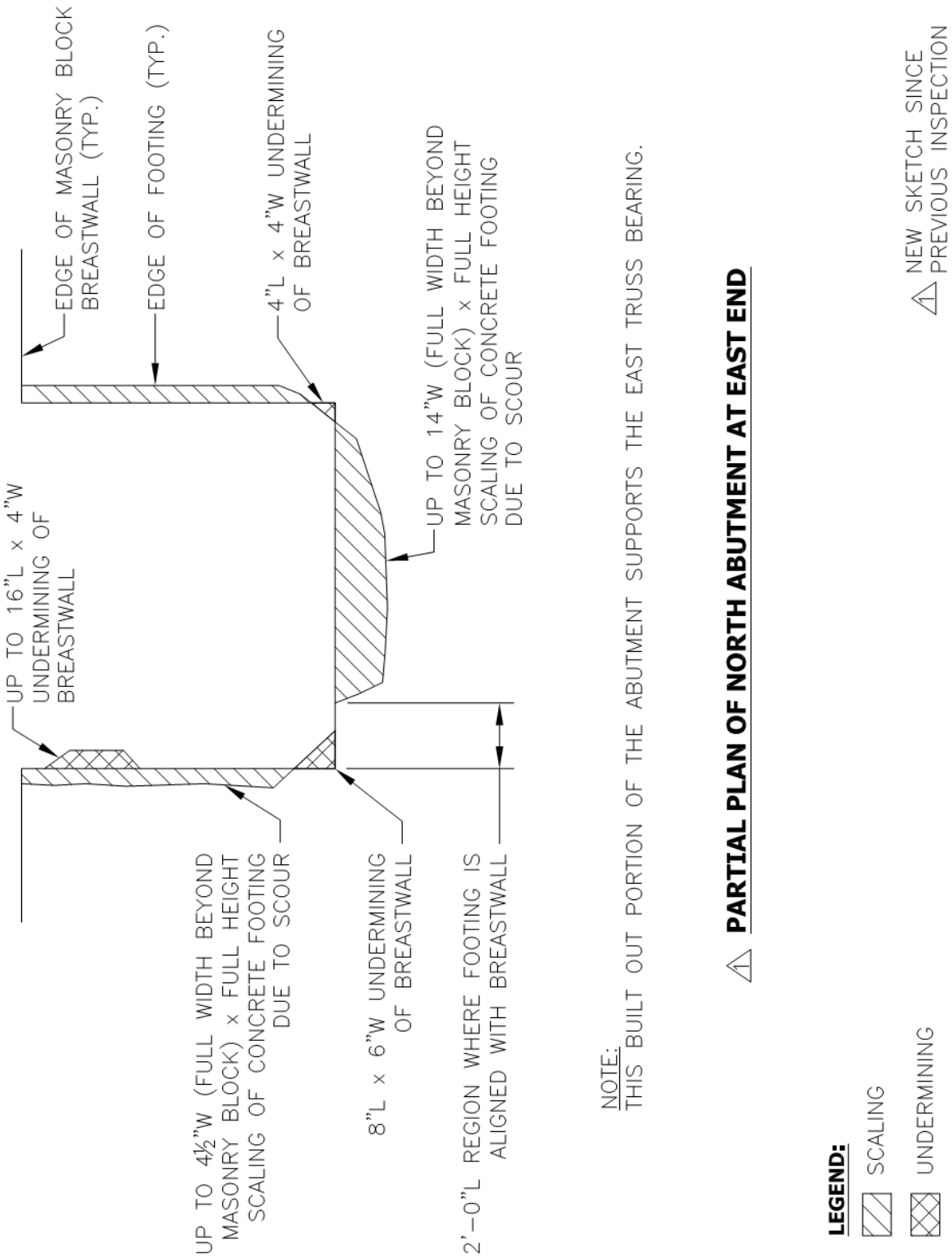
△1 SPAN 1, WEST TRUSS, LOWER CHORD L4L5 AT L4

△1 NEW SKETCH SINCE PREVIOUS INSPECTION

Sketch 1: Span 1, West Truss, Lower Chord L4L5 at L4.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

SKETCHES



Sketch 2: Partial Plan of North Abutment at East End.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 1: **South Portal, Span 1, Looking North - Abandoned sign support protrudes below the portal and governs the vertical clearance.**

Photo 2: **Stay-In-Place Forms between Stringers 4 through 6, Floorbeam Bay 1, Span 2 - Downward bend with slight rotation.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 3: **Stay-In-Place Forms at Stringer C, Floorbeam Bay 1, Span 1 - Torched hole at the electrical conduit support.**

Photo 4: **Roadway Luminaire attached to Vertical U3L3, West Truss, Span 2, Looking North - Luminaire not fully tightened.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 5: **Electrical Conduit along Stringer D, Floorbeam Bay 4, Span 1 - Broken with exposed wires.**

Photo 6: **Conduit Support at Floorbeam 3 East Cantilever, Span 1 - Threaded rods in contact w/ floorbeam cant. top flange & 2 backed off nuts.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 7: **Telecommunication Conduits at Floorbeam 4 East Cantilever, Span 2, Looking North - Frayed.**

Photo 8: **Telecommunication Conduits at Floorbeam 0 East Cantilever, Span 2, Lkg North - Multiple broken conduits w/ exposed wires.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 9: **North Abutment Deck Joint, Looking West - Filled with sand and minor plow damage.**

Photo 10: **Lower Chord L4L5 at Panel Point L4, West Truss, Span 1, Lkg South - Flange loss beyond repair plates. Note rivet head loss.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

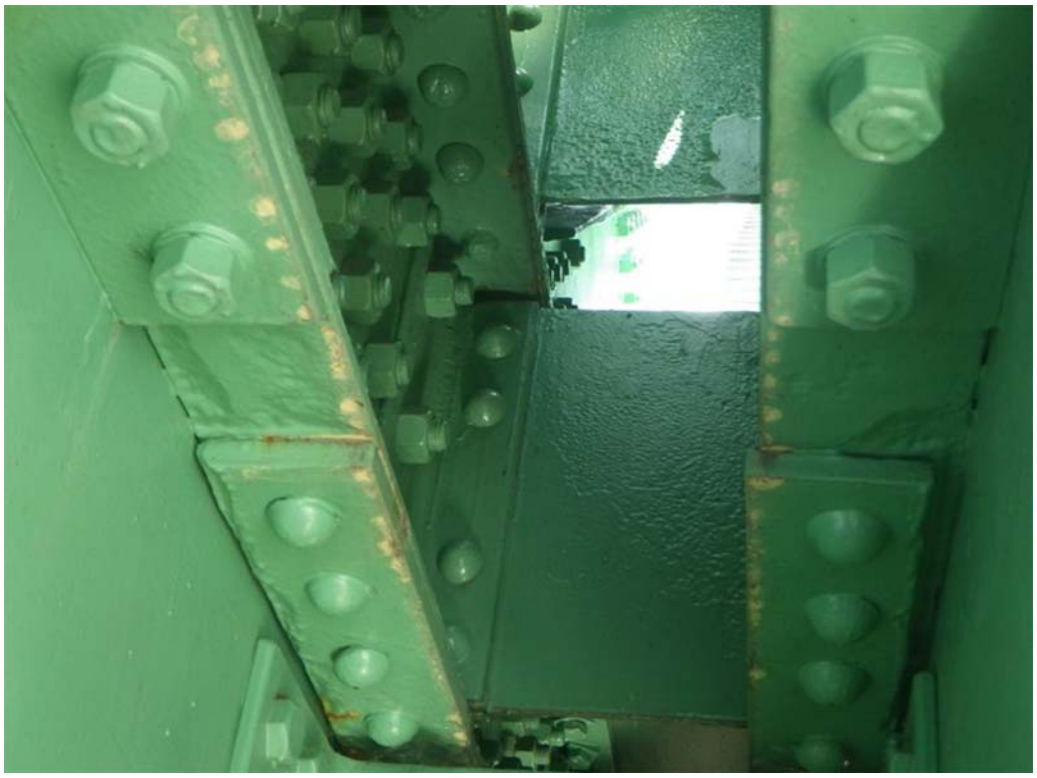


Photo 11: **Lower Chord L2L3 at Panel Point L2, East Truss, Span 2, Looking North - Flange section loss beyond repair plates.**

Photo 12: **Lower Chord L7L8 near Panel Point L8, E. Truss, Span 2, Lkg W. - Bot. flange repair plates w/ excessive edge distance to first bolt.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 13: **Lower Lateral Bracing, Floorbeam Bay 1, Span 1, Looking West - Downward bend and rotation.**

Photo 14: **Sway Bracing at Panel Point 3, Span 2, Looking Northwest - Bend in bottom flange.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 15: **Portal at Pier, Horizontal Member over Left & Center lanes, Span 1, Lkg W. - Member & bottom flange bent due to collision damage.**

Photo 16: **Portal at Pier, Diagonal Member btwn East Truss & Midspan, Span 2, Lkg West - Bottom flange bent due to collision damage.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 17: **Gusset Plate U1, West Truss, West Plate, East Face, Span 2 - Section loss along diagonal web member.**

Photo 18: **West Truss Bearing at South Abutment, North Face, Looking Southwest - Bulging of elastomeric pad.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 19: **East Truss Bearing at Pier, South Face - Bulging of elastomeric pad and missing anchor bolt nuts.**

Photo 20: **Floorbeam 4 Connection to East Truss, Span 2, Looking East - Missing bolt.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 21: **Lower Lateral Bracing Connection to East End of Floorbeam 1, Span 2, Looking West - Missing nut.**

Photo 22: **End Post L0U1 at Panel Point L0, East Truss, Span 2, Looking South - Two cut off rivet heads.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 23: **Lower Chord L0L1 at Panel Point L0, West Truss, Span 1, Looking South - Missing/not installed bolts.**

Photo 24: **Lower Chord L0L1 at Panel Point L1, East Truss, Span 1, Looking South - One missing bolt and one bolt missing a nut.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

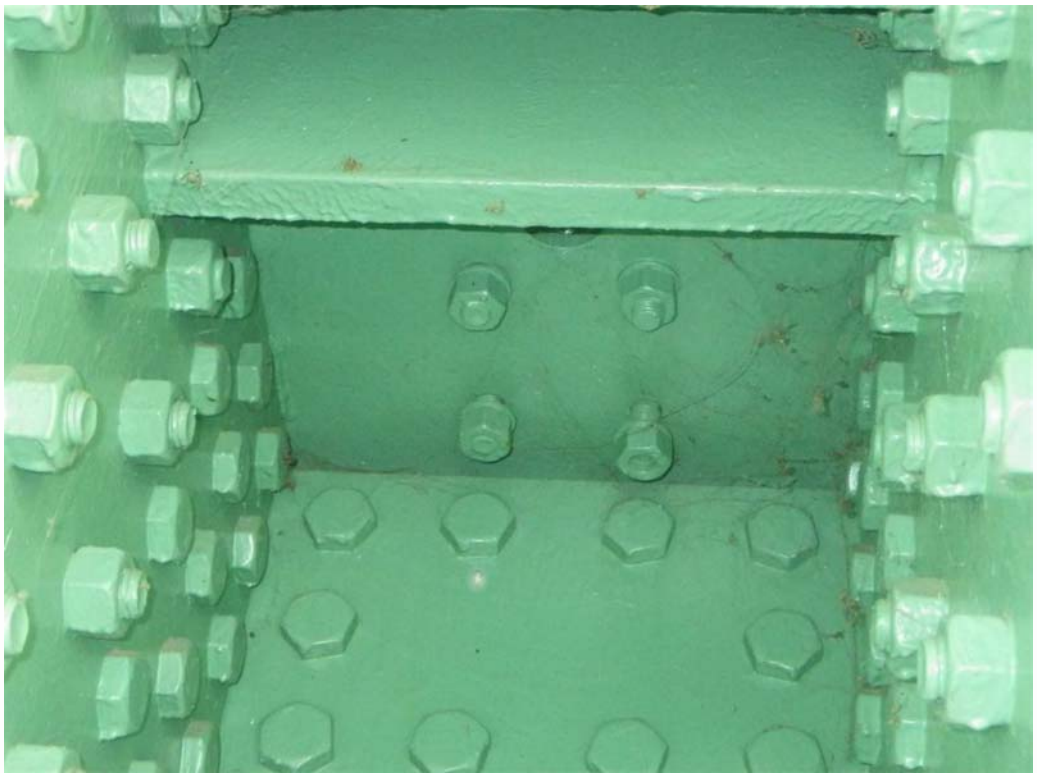


Photo 25: **Lower Chord L7L8 at Panel Point L8, East Truss, Span 1, Looking North - Three of four bolts loose for the connection to the bearing.**

Photo 26: **Gusset Plate U5, E. Truss, W. Plate, W. Face, Span 2, Lkg SE - Welds at the additional plate & sway/upper lateral bracing conn.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 27: **Upper Chord U1U2, East Truss, Span 1, Looking South - Areas of paint system failure.**

Photo 28: **North Abut. Breastwall & Footing, E. End, W. Face - Heavy scaling of footing due to scour & minor undermining of breastwall.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 29: **North Abut. Breastwall and Footing, E. End, S. Face - Heavy scaling of footing due to scour & minor undermining of breastwall.**

Photo 30: **Northwest Wingwall, Looking North - Efflorescence from masonry joints. Note slope protection with displaced blocks and vegetation.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 31: **North Abutment Breastwall near West End, Looking Northwest - Masonry joints with mortar loss. Note footing with spalling/scaling.**

Photo 32: **Pierwall, West Face, Looking North - Efflorescence from the masonry joints. Note fallen tree and vegetation from rip-rap.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 33: **Pierwall at Center, North Face - Full block height vertical crack and masonry joints with mortar loss.**

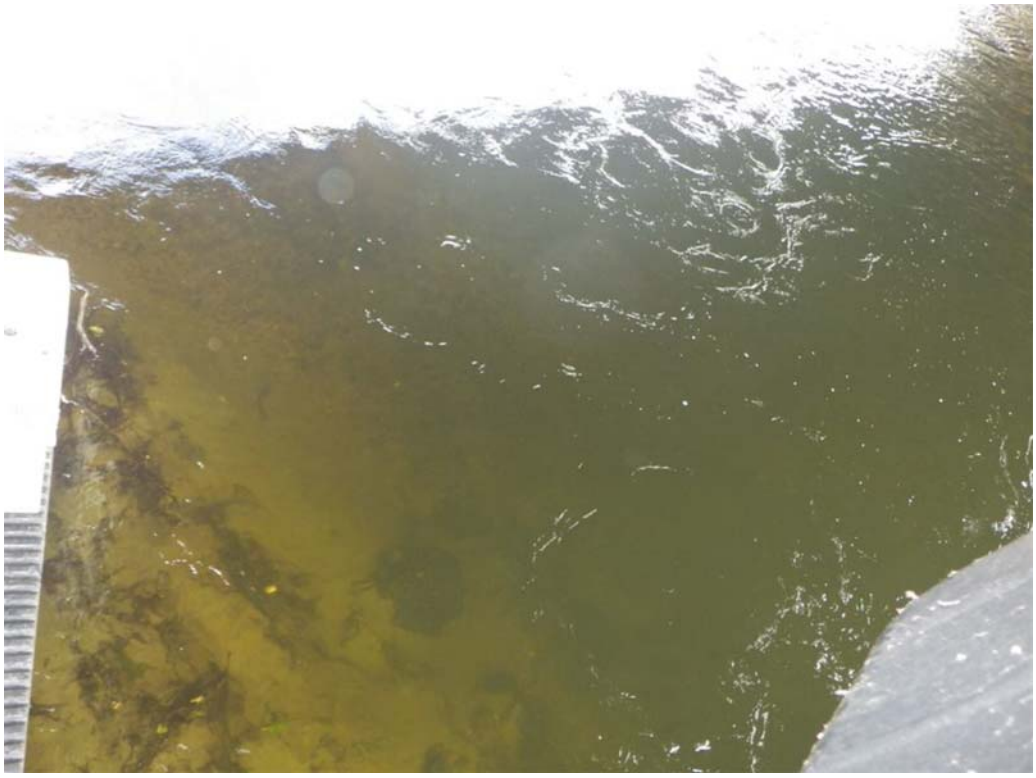


Photo 34: **Channel at Northwest End, Span 1, Looking East - Apparent channel scour.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 35: **Channel, Upstream (West) End, Looking West - Island formed due to aggradation. Note vegetation on island.**

Photo 36: **North Approach, Lkg South - Guardrails only extend a portion of the approach due to a pedestrian crosswalk & flower pots.**

Report Date: April 29, 2016 THE GREAT RIVER BR.

State Information

BDEPT#= W25010 Agency Br.No.
Town= Westfield L.O. MHD
B.I.N= 0V8 AASHTO= 072.0
RANK= 3889 H.I.= 49.4 % FHWA Select List= Y

Identification

(8) Structure Number	W250100V8DOTNBI
(5) Inventory Route	121002023
(2) State Highway Department District	02
(3) County Code 013 (4) Place code	76030
(6) Features Intersected	**WATER WESTFIELD RIVER**
(7) Facility Carried	**US202 ST10/ELM SB**
(9) Location	JCT MEADOW ST.
(11) Kilometerpoint	0016.592
(12) Base Highway Network	Y
(13) LRS Inventory Route & Subroute	000000000000
(16) Latitude	42 DEG 07 MIN 44.05 SEC
(17) Longitude	72 DEG 44 MIN 46.40 SEC
(98) Border Bridge State Code	Share %
(99) Border Bridge Structure No.	#

Structure Type and Material

(43) Structure Type Main: Steel Code 310
Truss - Thru Jointless bridge type: Not applicable
(44) Structure Type Appr:
Other Code 000
(45) Number of spans in main unit 002
(46) Number of approach spans 0000
(107) Deck Structure Type - Concrete Cast-in-Place Code 1
(108) Wearing Surface / Protective System:
A) Type of wearing surface - Bituminous Code 6
B) Type of membrane - Unknown Code 8
C) Type of deck protection - Epoxy Coated Reinforcing Code 1

Age and Service

(27) Year Built 1938
(106) Year Reconstructed 2011
(42) Type of Service: On - Highway-Ped
Under - Waterway Code 55
(28) Lanes: On Structure 03 Under structure 00
(29) Average Daily Traffic 016950
(30) Year of ADT 2014 (109) Truck ADT 05 %
(19) Bypass, detour length 006 KM

Geometric Data

(48) Length of maximum span 0056.1 M
(49) Structure Length 00114.3 M
(50) Curb or sidewalk: Left 03.0 M Right 03.0 M
(51) Bridge Roadway Width Curb to Curb 012.2 M
(52) Deck Width Out to Out 013.2 M
(32) Approach Roadway Width (w/shoulders) 012.2 M
(33) Bridge Median - No median Code 0
(34) Skew 00 DEG (35) Structure Flared N
(10) Inventory Route MIN Vert Clear 04.88 M
(47) Inventory Route Total Horiz Clear 12.2 M
(53) Min Vert Clear Over Bridge Rdwy 04.88 M
(54) Min Vert Underclear ref N 00.00 M
(55) Min Lat Underclear RT ref N 00.0 M
(56) Min Lat Underclear LT 00.0 M

Navigation Data

(38) Navigation Control - No navigation control on waterway Code 0
(111) Pier Protection Code
(39) Navigation Vertical Clearance 000.0 M
(116) Vert-lift Bridge Nav Min Vert Clear M
(40) Navigation Horizontal Clearance 0000.0 M

Classification

		Code
(112) NBIS Bridge Length		Y
(104) Highway System		Y
(26) Functional Class -	Urban Arterial	14
(100) Defense Highway		0
(101) Parallel Structure		N
(102) Direction of Traffic -	2-way traffic	2
(103) Temporary Structure		N
(105) Federal Lands Highways		0
(110) Designated National Network		N
(20) Toll -	On free road	3
(21) Maintain -	State Highway Agency	01
(22) Owner -	State Highway Agency	01
(37) Historical Significance	potentially eligible	P

Condition

	Code
(58) Deck	8
(59) Superstructure	7
(60) Substructure	6
(61) Channel & Channel Protection	6
(62) Culverts	N

Load Rating and Posting

		Code
(31) Design Load -	HS 20=MS 18	5
(63) Operating Rating Method -	No rating analysis performed	5
(64) Operating Rating		44.1
(65) Inventory Rating Method -	No rating analysis performed	5
(66) Inventory Rating		32.4
(70) Bridge Posting		5
(41) Structure -	Open	A

Appraisal

	Code
(67) Structural Evaluation	6
(68) Deck Geometry	4
(69) Underclearances, vert. and horiz.	N
(71) Waterway adequacy	8
(72) Approach Roadway Alignment	7
(36) Traffic Safety Features	1 1 0 1
(113) Scour Critical Bridges	3

Inspections

(90) Inspection Date 07/25/14 (91) Frequency 24 MO
(92) Critical Feature Inspection: (93) CFI DATE

(A) Fracture Critical Detail	Y	24	MO A)	07/25/14
(B) Underwater Inspection	N	00	MO B)	00/00/00
(C) Other Special Inspection	N	00	MO C)	07/02/09
(*) Other Inspection (Critical Repair)	N	00	MO *)	02/27/07
(*) Closed Bridge	N	00	MO *)	01/27/11
(*) UW Special Inspection	N	00	MO *)	00/00/00
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 00/00/00	H20	Type 3	Type 3S2	Type HS
Operating	27.0	34.0	49.0	49.0
Inventory	20.0	25.0	36.0	36.0

Field Posting

Status DESIGN Posting Date 07/19/12

	2 Axle	3 Axle	5 Axle
Actual			
Recommended			

Missing Signs N

Misc.

Bridge Name THE GREAT RIVER BR.
N Anti-missile fence N Acrow Panel N Jointless Bridge
Freeze/Thaw

Accessibility (Needed/Used)

Y / Y	Liftbucket	N / N	Rigging	Y / Y	Other
N / N	Ladder	N / N	Staging	TRACKER	
N / N	Boat	Y / Y	Traffic Control		
P / N	Wader	N / N	RR Flagperson	Inspection Hours:	062
N / N	Inspector 50	Y / Y	Police		

Report Date: February 25, 2013 THE GREAT RIVER BR.

State Information

BDEPT#= W25010 Agency Br.No.
Town= Westfield L.O. MHD
B.I.N= 0V8 AASHTO= 009.0
RANK= 20 H.I.= 49.4 % FHWA Select List= Y

Identification

(8) Structure Number	W250100V8DOTNBI
(5) Inventory Route	121002020
(2) State Highway Department District	02
(3) County Code 013 (4) Place code	76030
(6) Features Intersected	WATER WESTFIELD RIVER
(7) Facility Carried	US202 /ST10/ELM ST
(9) Location	JCT MEADOW ST.
(11) Kilometerpoint	0016.592
(12) Base Highway Network	Y
(13) LRS Inventory Route & Subroute	000000000000
(16) Latitude	42 DEG 07 MIN 43.35 SEC
(17) Longitude	72 DEG 44 MIN 48.08 SEC
(98) Border Bridge State Code	Share %
(99) Border Bridge Structure No. #	

Structure Type and Material

(43) Structure Type Main: Steel Code 310
Truss - Thru Jointless bridge type: Not applicable
(44) Structure Type Appr:
Other Code 000
(45) Number of spans in main unit 002
(46) Number of approach spans 0000
(107) Deck Structure Type - Concrete Cast-in-Place Code 1
(108) Wearing Surface / Protective System:
A) Type of wearing surface - Bituminous Code 6
B) Type of membrane - Unknown Code 8
C) Type of deck protection - None Code 0

Age and Service

(27) Year Built 1938
(106) Year Reconstructed 0000
(42) Type of Service: On - Highway-Ped
Under - Waterway Code 55
(28) Lanes: On Structure 03 Under structure 00
(29) Average Daily Traffic 033900
(30) Year of ADT 2007 (109) Truck ADT 05 %
(19) Bypass, detour length 006 KM

Geometric Data

(48) Length of maximum span 0056.1 M
(49) Structure Length 00114.3 M
(50) Curb or sidewalk: Left 01.7 M Right 01.7 M
(51) Bridge Roadway Width Curb to Curb 012.2 M
(52) Deck Width Out to Out 018.2 M
(32) Approach Roadway Width (w/shoulders) 012.2 M
(33) Bridge Median - No median Code 0
(34) Skew 00 DEG (35) Structure Flared N
(10) Inventory Route MIN Vert Clear 04.88 M
(47) Inventory Route Total Horiz Clear 12.2 M
(53) Min Vert Clear Over Bridge Rdwy 04.88 M
(54) Min Vert Underclear ref N 00.00 M
(55) Min Lat Underclear RT ref N 00.0 M
(56) Min Lat Underclear LT 00.0 M

Navigation Data

38) Navigation Control - No navigation control on waterway Code 0
111) Pier Protection Code
39) Navigation Vertical Clearance 000.0 M
116) Vert-lift Bridge Nav Min Vert Clear M
40) Navigation Horizontal Clearance 0000.0 M

Classification

		Code
(112) NBIS Bridge Length		Y
(104) Highway System		Y
(26) Functional Class -	Urban Arterial	14
(100) Defense Highway		0
(101) Parallel Structure		N
(102) Direction of Traffic -	2-way traffic	2
(103) Temporary Structure		N
(105) Federal Lands Highways		0
(110) Designated National Network		N
(20) Toll -	On free road	3
(21) Maintain -	State Highway Agency	01
(22) Owner -	State Highway Agency	01
(37) Historical Significance	potentially eligible	P

Condition

	Code
(58) Deck	8
(59) Superstructure	7
(60) Substructure	7
(61) Channel & Channel Protection	4
(62) Culverts	N

Load Rating and Posting

		Code
(31) Design Load -	H 20=M 18	4
(63) Operating Rating Method -	Allowable Stress (AS)	2
(64) Operating Rating		00.0
(65) Inventory Rating Method -	Allowable Stress (AS)	2
(66) Inventory Rating		00.0
(70) Bridge Posting		0
(41) Structure -	Open	A

Appraisal

	Code
(67) Structural Evaluation	2
(68) Deck Geometry	4
(69) Underclearances, vert. and horiz.	N
(71) Waterway adequacy	8
(72) Approach Roadway Alignment	7
(36) Traffic Safety Features	1 1 0 1
(113) Scour Critical Bridges	3

Inspections

(90) Inspection Date 07/19/12 (91) Frequency 24 MO
(92) Critical Feature Inspection:

				(93) CFI DATE
(A) Fracture Critical Detail	Y	24	MO A)	07/19/12
(B) Underwater Inspection	Y	00	MO B)	04/07/10
(C) Other Special Inspection	N	00	MO C)	07/02/09
(*) Other Inspection (Critical Repair)	N	00	MO *)	02/27/07
(*) Closed Bridge	N	00	MO *)	01/27/11
(*) UW Special Inspection	Y	00	MO *)	04/07/10
(*) Damage Inspection			MO *)	00/00/00

Rating Loads

Report Date 01/01/95	H20	Type 3	Type 3S2	Type HS
Operating	21.0	37.0	59.0	0.0
Inventory	14.0	26.0	34.0	0.0

Field Posting

Status CLOSED Posting Date 05/08/95

	2 Axle	3 Axle	5 Axle
Actual			
Recommended			

Missing Signs N

Misc.

Bridge Name THE GREAT RIVER BR.
N Anti-missile fence N Acrow Panel N Jointless Bridge
Freeze/Thaw

Accessibility (Needed/Used)

Y / Y	Liftbucket	N / N	Rigging	N / Y Other
N / N	Ladder	Y / N	Staging	WATERLIFT
N / N	Boat	Y / N	Traffic Control	
P / N	Wader	N / N	RR Flagperson	Inspection Hours: 075
N / N	Inspector 50	Y / N	Police	

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION

STRUCTURES INSPECTION FIELD REPORT

FRACTURE CRITICAL INSPECTION

2-DIST	B.I.N.	BR. DEPT. NO.
02	0V8	W-25-010

CITY/TOWN	8.-STRUCTURE NO.	11-Kilo. POINT	90-ROUTINE INSP. DATE	93a - F.C. INSP. DATE
WESTFIELD	W25010-0V8-DOT-NBI	016.592	Jul 25, 2014	Jul 25, 2014

07-FACILITY CARRIED	MEMORIAL NAME/LOCAL NAME	27-YR BUILT	106-YR REBUILT	*YR REHAB'D (NON 106)
US202 ST10/ELM SB	THE GREAT RIVER BR.	1938	2011	0000

06-FEATURES INTERSECTED	26-FUNCTIONAL CLASS	DIST. BRIDGE INSPECTION ENGINEER
WATER WESTFIELD RIVER	Urban Arterial	W. A. Drosehn

43-STRUCTURE TYPE	22-OWNER	21-MAINTAINER	TEAM LEADER	PROJ MGR
310 : Steel Truss - Thru	State Highway Agency	State Highway Agency	B. D'Artista	HNTB Corporation

107-DECK TYPE	WEATHER	TEMP. (air)	TEAM MEMBERS
1 : Concrete Cast-in-Place	Varied	29°C	A. KIRIAKIDIS, S. ST HILAIRE

WEIGHT POSTING *Not Applicable* X

Actual Posting	N	N	N	N
Recommended Posting	N	N	N	N

Waived Date: 00/00/00 EJDMT Date: 00/00/00

Signs In Place (Y=Yes,N=No, NR=Not Required)
Legibility/ Visibility

At bridge N	At bridge S	Advance N	Advance S

PLANS (Y/N): Y

(V.C.R.) (Y/N): N

TAPE#:

RATING

Rating Report (Y/N): N Date: ----

Request for Rating or Rerating (Y/N): N

If YES please give priority: HIGH ( ) MEDIUM ( ) LOW ( )

REASON:

Inspection data at time of existing rating

I 58: - I 59: - I 60: - I 62: Date : 00/00/00

FRACTURE CRITICAL MEMBER(S):

	MEMBER	CRACK (Y/N):	WELD'S CONDITION (0-9)	LOCATION OF CORROSION, SECTION LOSS (%), CRACKS, COLLISION DAMAGE, STRESS CONCENTRATION, ETC.	CONDITION PREVIOUS (0-9)	CONDITION PRESENT (0-9)	INV. RATING OF MEMBER FROM RATING ANALYSIS	Deficiencies
A	Item 59.2 - Floorbeams	N	N		8	8	Not Rated	-
B	Item 59.5 - Trusses - General	N	N		7	7	Not Rated	-
C	Item 59.5.a - Upper Chords	N	N		8	8	Not Rated	-
D	Item 59.5.b - Lower Chords	N	N	See remarks in comments section.	7	7	Not Rated	-
E	Item 59.5.c - Web Members	N	N	See remarks in comments section.	7	7	Not Rated	-

List of field tests performed:
Visual, Hands-On.

	I-59	I-60
(Overall Previous Condition)	7	7
(Overall Current Condition)	7	6

DEFICIENCY: A defect in a structure that requires corrective action.

CATEGORIES OF DEFICIENCIES:

M= Minor Deficiency - Deficiencies which are minor in nature, generally do not impact the structural integrity of the bridge and could easily be repaired. Examples include but are not limited to: Spalled concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.

S= Severe/Major Deficiency - Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but are not limited to: Moderate to major deterioration in concrete, Exposed and corroded rebars, Considerable settlement, Considerable scouring or undermining, Moderate to extensive corrosion to structural steel with measurable loss of section, etc.

C-S= Critical Structural Deficiency - A deficiency in a structural element of a bridge that poses an extreme unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity of the bridge.

C-H= Critical Hazard Deficiency - A deficiency in a component or element of a bridge that poses an extreme hazard or unsafe condition to the public, but does not impair the structural integrity of the bridge. Examples include but are not limited to: Loose concrete hanging down over traffic or pedestrians, A hole in a sidewalk that may cause injuries to pedestrians, Missing section of bridge railing, etc.

URGENCY OF REPAIR:

I = Immediate- [Inspector(s) immediately contact District Bridge Inspection Engineer (DBIE) to report the Deficiency and to receive further instruction from him/her].

A = ASAP- [Action/Repair should be initiated by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) upon receipt of the Inspection Report].

P = Prioritize- [Shall be prioritized by District Maintenance Engineer or the Responsible Party (if not a State owned bridge) and repairs made when funds and/or manpower is available].

X=UNKNOWN N=NOT APPLICABLE H=HIDDEN/INACCESSIBLE R=REMOVED

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

BRIDGE ORIENTATION

Bridge W-25-010(0V8) is a two span structure that carries US Route 202 (State Route 10/Elm Street) southbound over the Westfield River in the City of Westfield. This structure is comprised of two Warren style continuous steel through trusses. The truss chords, diagonals and end posts are comprised of built-up riveted steel box sections. The truss verticals consist of built-up riveted steel I-shape sections. The floor system is comprised of rolled steel floorbeams and rolled steel stringers, which support a reinforced concrete deck with stay-in-place forms. The concrete filled steel grid deck sidewalks and the utilities are supported by the steel floorbeam cantilevers.

The substructure consists of two abutments (south and north) and one pier. The abutments are comprised of a mortared masonry block breastwall with reinforced concrete bridge seat and backwall, and mortared masonry block wingwalls. The pier consists of a mortared masonry block pierwall with a reinforced concrete cap.

This bridge is orientated south to north. The trusses are designated as west or east. The panel points and floorbeams of each span are numbered 0 to 8 starting from the abutment. Floorbeam 8 is located directly over the pier and is shared by both spans. The roadway stringers are numbered 1 to 9 from west to east. The west sidewalk stringers are designated A to C and the east sidewalk stringers D to F, from west to east. The nomenclature used for this report corresponds to the original design plans and the previous inspection reports.

GENERAL REMARKS

Inspection Access and Traffic Control:

An amphibious lift bucket truck (Harcon Bridge Tracker) was utilized to access the truss lower chords, floor system and substructure. A bucket truck with traffic control was utilized to access the truss upper chords, web members and bracings. An alternating single lane traffic closure occurred during the hours of 9:00am to 4:00pm.

Safety Warning:

The telecommunication conduits under the east sidewalk between sidewalk stringers D and E appear to be Transite, which contains asbestos. There are isolated locations of frayed conduits and numerous locations of broken conduits. Necessary safety precautions should be taken when inspecting in the vicinity of frayed or broken Transite conduits.

ITEM 59 - SUPERSTRUCTURE

Item 59.5 - Trusses - General

Item 59.5.b - Lower Chords

The majority of the lower chord is in good condition and governs the overall condition coding of Item 59.5.b. The portion of the original lower chords within the gusset plates is in fair condition and exhibits section loss beyond the flange repair plates **(see photos 1 and 2)**. The bottom flanges exhibit up to 1/8" section loss by full width of both channels or up to 1/4" section loss by full width of one channel. There is typically minor section loss of the top flange of one channel and to the webs. West truss lower chord L4L5 in span 1 and east truss lower chord L2L3 in span 2 exhibit the most severe condition of the lower chord within the gusset plates **(see sketch 1 and photos 1 & 2)**. All section loss is painted over and shows no signs of active corrosion.

Numerous lower chords have top and bottom flange repair plates which terminate with edge distances of up to 10" to the first bolt, particularly in span 2 **(see photos 3 and 4)**. This excessive edge distance allows for the potential of future impacted rust.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

REMARKS

Item 59.5.c - Web Members

Isolated diagonal web members exhibit 1/16" section loss along the lower chord gusset plate. This loss is painted over and shows no signs of active corrosion.

Sketch / Photo Log

Sketch 1 : Span 1, West Truss, Lower Chord L4L5 at L4.

Photo 1 : Lower Chord L4L5 at Panel Point L4, West Truss, Span 1, Looking South - Flange section loss beyond repair plates.

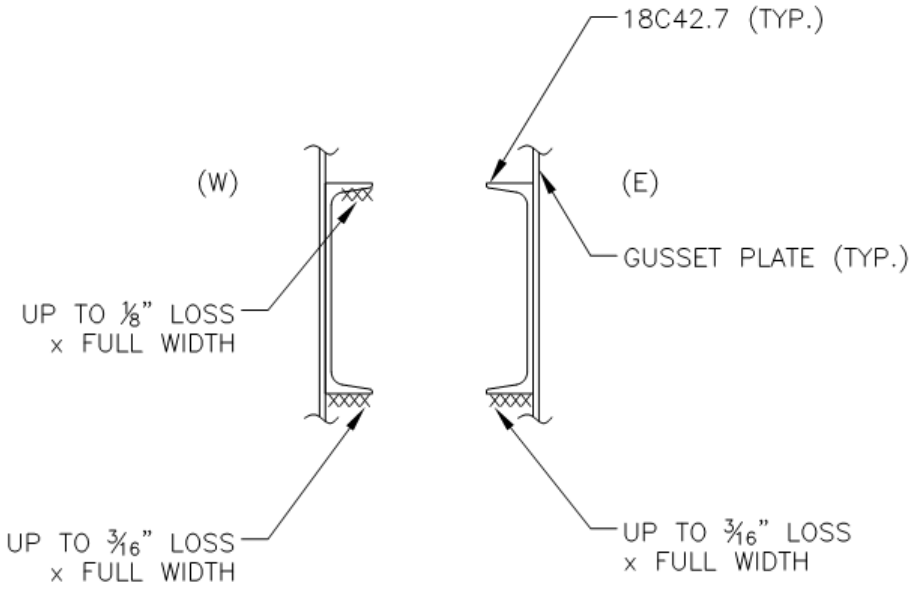
Photo 2 : Lower Chord L2L3 at Panel Point L2, East Truss, Span 2, Looking North - Flange section loss beyond repair plates.

Photo 3 : Lower Chord L6L7 near Panel Point L6, W. Truss, Span 1, Lkg E. - Bot. flange repair plates w/ excessive edge distance to first bolt.

Photo 4 : Lower Chord L7L8 near Panel Point L8, E. Truss, Span 2, Lkg W. - Bot. flange repair plates with excessive edge distance to first bolt.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

SKETCHES



AS–BUILT PROPERTIES (18C42.7):
d = 18.000"
bf = 3.950"
tf = 0.625" AVERAGE
tw = 0.450"

NOTES:
1. THIS SECTION IS TAKEN BEYOND THE FLANGE REPAIR PLATES.
2. ADJACENT RIVETS WITH UP TO 20% HEAD LOSS.
3. ALL SECTION LOSS IS PAINTED OVER AND SHOWS NO SIGN OF ACTIVE CORROSION.
4. SPAN 2, EAST TRUSS, LOWER CHORD L2L3 AT L3: SIMILAR LESS SEVERE CONDITION.

△1 SPAN 1, WEST TRUSS, LOWER CHORD L4L5 AT L4

△1 NEW SKETCH SINCE PREVIOUS INSPECTION

Sketch 1: Span 1, West Truss, Lower Chord L4L5 at L4.

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 1: **Lower Chord L4L5 at Panel Point L4, West Truss, Span 1, Looking South - Flange section loss beyond repair plates.**

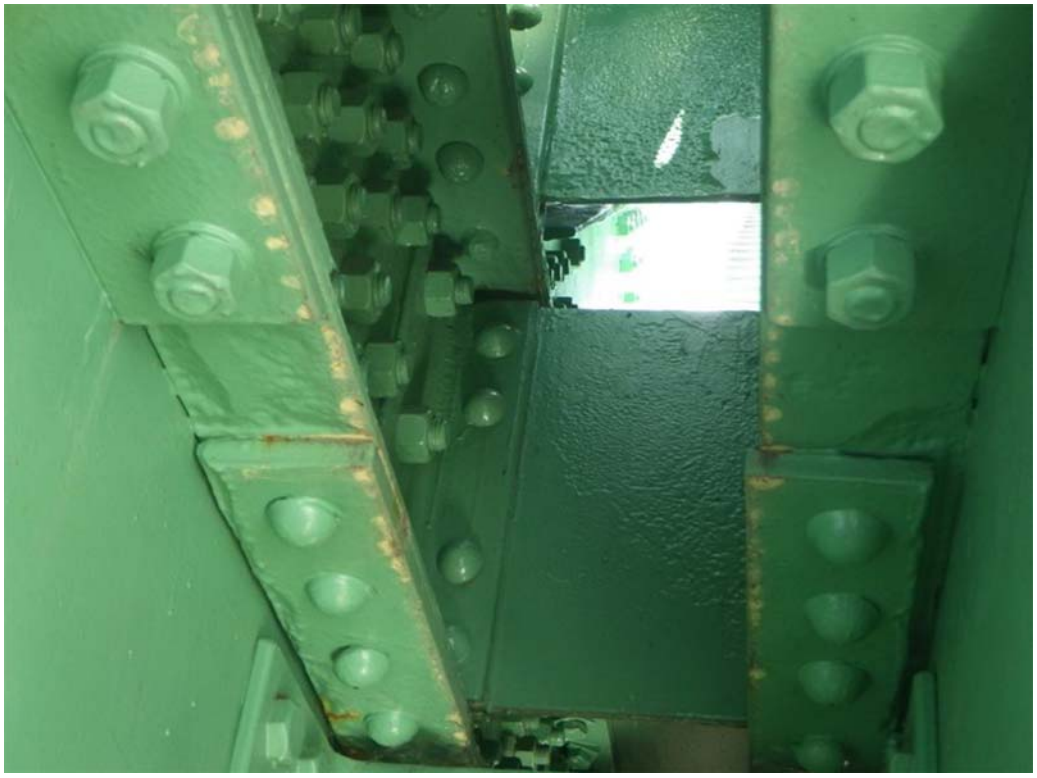


Photo 2: **Lower Chord L2L3 at Panel Point L2, East Truss, Span 2, Looking North - Flange section loss beyond repair plates.**

CITY/TOWN	B.I.N.	BR. DEPT. NO.	8.-STRUCTURE NO.	INSPECTION DATE
WESTFIELD	**0V8**	**W-25-010**	**W25010-0V8-DOT-NBI**	**JUL 25, 2014**

PHOTOS

Photo 3: **Lower Chord L6L7 near Panel Point L6, W. Truss, Span 1, Lkg E. - Bot. flange repair plates w/ excessive edge distance to first bolt.**

Photo 4: **Lower Chord L7L8 near Panel Point L8, E. Truss, Span 2, Lkg W. - Bot. flange repair plates with excessive edge distance to first bolt.**

Appendix B – Photographs

PHOTO LOG

Westfield US202/ST10/Elm St over Westfield River Bridge No. W-25-010 (08V)

PHOTO NUMBER	PHOTO DESCRIPTION
1	West Elevation
2	East Elevation
3	Bridge Looking South
4	North Approach
5	Bridge Looking North
6	South Approach
7	Typical Sidewalk and Handrails
8	Typical Gusset Plate Connection
9	Truss Cross Bracing
10	Truss Member with Repair Plate
11	South Abutment and Steel Sidewalk Framing
12	Pier and Underside Steel Framing

Photo No. 1 West Elevation

Photo No. 2 East Elevation

Photo No. 3 Bridge Looking South

Photo No. 4 North Approach

Photo No. 5 Bridge Looking North

Photo No. 6 South Approach

Photo No. 7 Typical Sidewalk and Handrails

Photo No. 8 Typical Gusset Plate Connection

Photo No. 5 Truss Cross Bracing

Photo No. 6 Truss Member with Repair Plate

Photo No. 7 South Abutment and Steel Sidewalk Framing

Photo No. 82 Pier and Underside Steel Framing

Appendix C – Computations

STATEMENT OF CONCURRENCE

I hereby state that I have checked the methods, assumptions, load distributions and all calculations for this rating report completed for Bridge No. W-25-010. By signing below, I confirm that I agree with all methods, assumptions, load distributions, and calculations contained in this rating report.

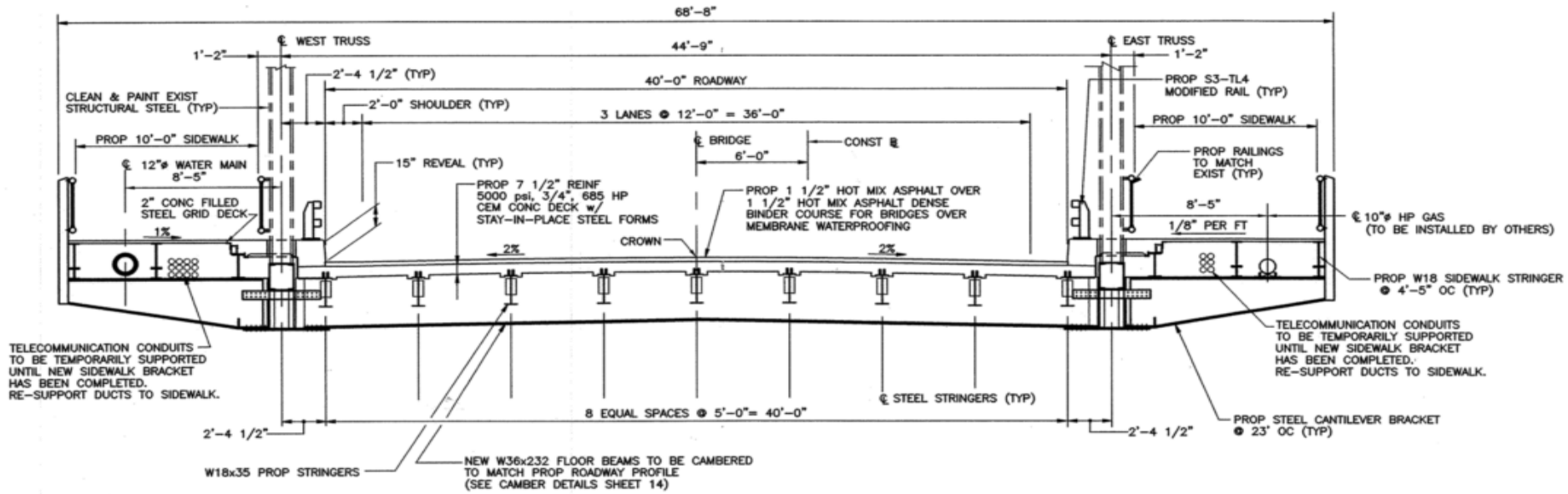
Signature: John Mark Ennis

Printed Name: JOHN MARK ENNIS

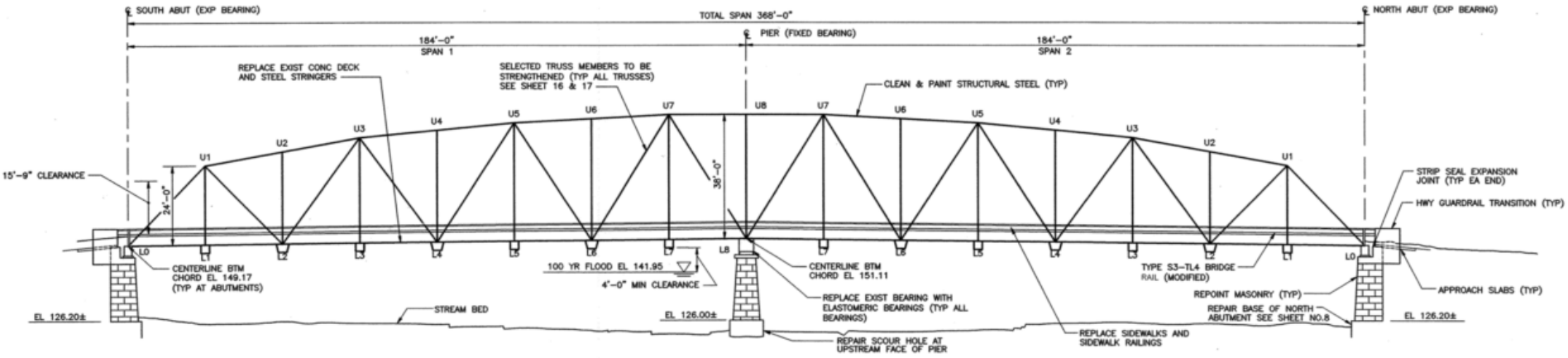
COMPUTATIONS INDEX

GENERAL SKETCHES C-4
DECK RATING C-8
SIDEWALK DECK, STRINGERS & BRACKET RATING C-14
STRINGERS & FLOOR BEAM RATING SUMMARY TABLES C-38
TRUSS RATING C-44
GUSSET PLATES RATING C-113

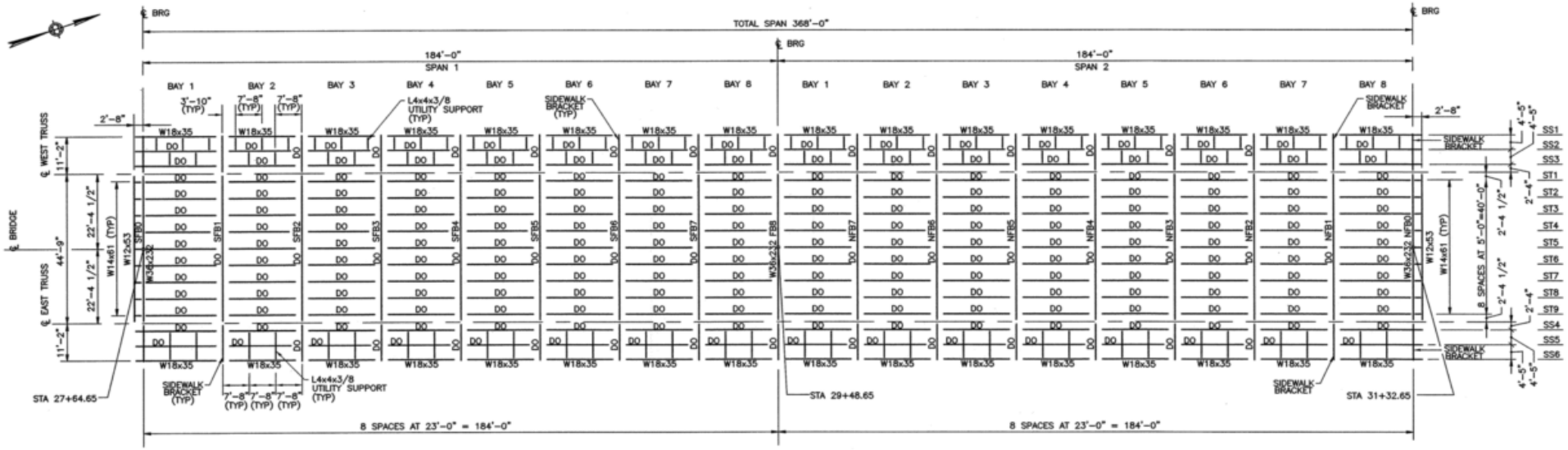
GENERAL SKETCHES



PROPOSED TYPICAL BRIDGE CROSS SECTION



ELEVATION



FRAMING PLAN

EXISTING TRUSS MEMBERS

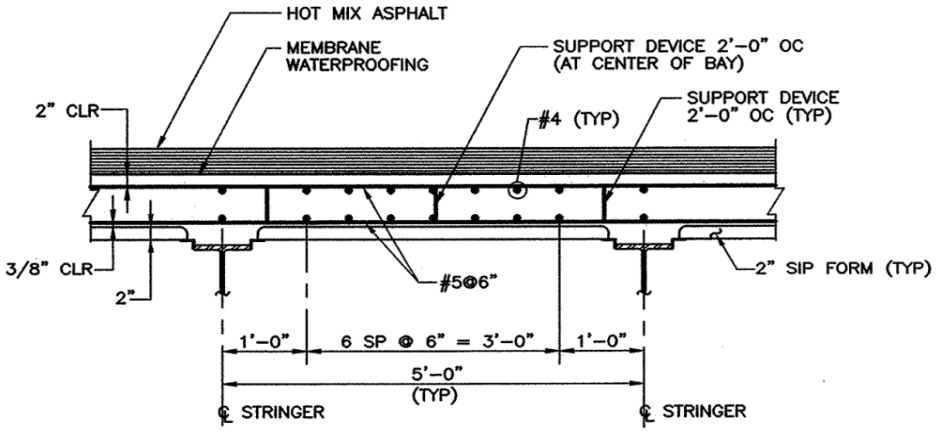
MEMBERS	SECTIONS	ASSEMBLY
$L_0 - L_2$	2–18" [S] @ 45.8 #	
$L_2 - L_4$	2–18" [S] @ 51.9 #	
$L_4 - L_6$	2–18" [S] @ 42.7 #	
*$L_6 - L_8$	2–18" [S] @ 42.7 #	
*$U_1 - U_3$	2–18" [S] @ 42.7 # COVER PLATE 16"x3/8"	
$U_3 - U_5$	2–18" [S] @ 42.7 # COVER PLATE 16"x3/8"	
$U_5 - U_7$	2–18" [S] @ 42.7 # COVER PLATE 16"x3/8"	
$U_7 - U_8$	2–18" [S] @ 42.7 # COVER PLATE 16"x3/8" 2–PLATES 15"x3/8"	
*$U_1 - L_0$	2–18" [S] @ 51.9 # COVER PLATE 16"x3/8"	
$U_1 - L_2$	2–15" [S] @ 33.9 #	
$U_3 - L_2$	2–12" [S] @ 25.0 #	
*$U_3 - L_4$	2–12" [S] @ 30.0 #	
$U_5 - L_4$	2–12" [S] @ 35.0 #	
*$U_5 - L_6$	2–15" [S] @ 40.0 # 2–PLATES 12"x1/2"	
$U_7 - L_6$	2–18" [S] @ 58.0 #	
*$U_7 - L_8$	2–18" [S] @ 58.0 # COVER PLATE 16"x3/8" 2–PLATES 15"x9/16"	
U_1-L_1 U_3-L_3 U_5-L_5 U_7-L_7	4 L –5"x3 1/2"x3/8"	
U_2-L_2 U_4-L_4 U_6-L_6 U_8-L_8	4 L –5"x3 1/2"x3/8"	

* MEMBERS REQUIRING ADDITIONAL REINFORCING.
SEE SHEETS 16 & 17 FOR REINFORCEMENT DETAILS.

DECK RATING

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Deck	AJL	NKN		SHT # 1
		5/28/2013	6/8/2016		

Concrete Slab Rating



Thickness(t) =	7.5	in			See Drawings, Sheets 24 & 25
Bottom Cover (Bc) =	1.375	in			(1/2 from 2" SIP form and 3/8"cl), Sheet 25
Top Cover (Tc) =	2	in			
Effective Span Length(S)=	4.75	ft			[1 Part II] 7.1.2
Bottom Bar Size	5		Top Bar Size	5	See Drawings, Sheet 25
Bottom Bar Spacing	6	in	Top Bar Spacing	6 in	

Concrete:

f'c=	5.0	ksi			[2] Table 6B.6.2.4.1-1
Inventory fc =	2.0	ksi	MBE 6.6.2.4	n=	6
Operating fc =	3.0	ksi			

Reinforcing: [2] Table 6B.6.2.3-1

fy =	60	ksi
Inventory fs =	24	ksi
Operating fs =	36	ksi

HMA Wearing Surface

Thickness =	3	in			
DW=	0.035	kip/ft^2	Wwearing=	0.14	kip/ft3
DC=	0.094	kip/ft^2	Wc=	0.15	kip/ft^3

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Deck	AJL	NKN		SHT # 2
		5/28/2013	6/8/2016		

Moment Capacity

Positive Moment:

Bottom Bars

Bar #	5	
Bar dia.	0.625	in
Bar Area	0.307	in^2
spacing =	6	in
As =	0.614	in^2
d =	5.81	in
d' =	2.31	in
s =	4.75	ft

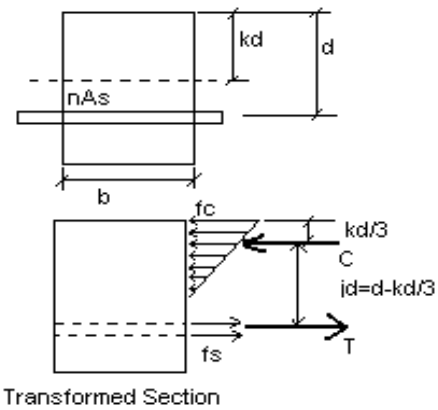
Top Bars

Bar #	5	
Bar dia.	0.625	in
Bar Area	0.307	in^2
spacing =	6	in
As' =	0.614	in^2
d =	5.19	in
d' =	1.69	in
s =	4.75	ft

$$\rho := \frac{A_s}{b \cdot d}$$ ρ= 0.00880

$$k := \sqrt{2\rho \cdot n + (\rho \cdot n)^2} - \rho \cdot n$$ k= 0.276

$$j := 1 - \frac{k}{3}$$ j= 0.908



CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Deck	AJL	NKN		SHT # 3
		5/28/2013	6/8/2016		

Check Concrete Stress : $fc = \frac{fs}{n} * \frac{k}{1 - k}$

					Allowable
Inventory	fc=	1.528 ksi	<	2 ksi
Operating	fc=	2.292 ksi	<	3 ksi

STEEL CONTROLS

Steel Moment Capacity: $M_{cap}=f_s*A_s*J*d$ *Note: All moments are taken per ft width of slab*

Inventory	M_{cap}=	6.48	kip*ft
Operating	M_{cap}=	9.71	kip*ft

Dead Load Moment: $M_{DL}=continuity*wl^2/8$

number of spans =	8	
continuity=	0.8	
w=	0.129	kip/ft^2
M_{DL}=	0.363	kip*ft

Impact Factor: I= 0.3 $I = \frac{50}{S+125} \leq 0.30$ [2] 6B.7.4.

For ASD, A1 = A2 = 1.0

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Deck	AJL	NKN		SHT # 4
		5/28/2013	6/8/2016		

Live Load Moment:

[1] 7.2.4.10

H20 and HS20 P= 16 kips *per wheel*

E=0.063S+4.65; Span >7'		M_{LL}= 0.2(P/E)S	M_{LL}=	3.54 kip*ft
	E= 4.29	OR M_{LL}= ((S+2)/32)P*.8	M_{LL}=	2.70 kip*ft
E=0.36S+2.58; Span ≤7'		Use lower M to produce higher rating		[1] 7.2.4.6

Type 3 P= 8.5 kips *per wheel*

E=0.063S+4.65; Span >7'				
	E= 4.29	M_{LL}= 0.2(P/E)S	M_{LL}=	1.88 kip*ft
E=0.36S+2.58; Span ≤7'				

Type 3S2 P= 7.75 kips *per wheel*

E=0.063S+4.65; Span >7'				
	E= 4.29	M_{LL}= 0.2(P/E)S	M_{LL}=	1.72 kip*ft
E=0.36S+2.58; Span ≤7'				

ASD Rating

$$RF = \frac{C - A_1 D}{A_2 L (I + 1)} \qquad RT=(RF)W$$

W		Inventory RF	Operating RF
H20	20 kips	1.742	2.664
HS20	36 kips	1.742	2.664
Type 3	25 kips	2.498	3.821
Type 3S2	36 kips	2.740	4.191

Inventory				Operating		
H20	34.8	tons		H20	53.3	tons
HS20	62.7	tons		HS20	95.9	tons
Type 3	62.5	tons		Type 3	95.5	tons
Type 3S2	98.6	tons		Type 3S2	150.9	tons

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Deck	AJL	NKN		SHT # 5
		5/28/2013	6/8/2016		

Metric LFD Deck Rating

Steel Moment Capacity $\Phi Mn = \Phi A_s * f_y * \left(d - \frac{a}{2}\right)$ $T = A_s * f_y$

$C = T$

T= 36.82 kips $C = 0.85 * f'c * b * a$

C= 36.82 kips

a= 0.722 in

ΦMn= 15.05 kip*ft

Dead Load Moment (from above)

M_{DL}= 0.363 kip*ft

Live Load Moment (for HS20 from above)

M_{LL}= 2.70 kip*ft

Rating Factor

$$RF = \frac{C - A_1 D}{A_2 L (I + 1)}$$

	A1	A2
Inventory	1.3	2.17
Operating	1.3	1.3

[2] 6B.5.3

C= Capacity of the member

D= Dead Load Effect on the member

L= Live Load Effect on the member

I= The Impact factor to be used with the live load [2] 6B.7.4

Inventory RF= 1.914

Operating RF= 3.195 Using MS18 (metric equivalent) = 32.4 tons

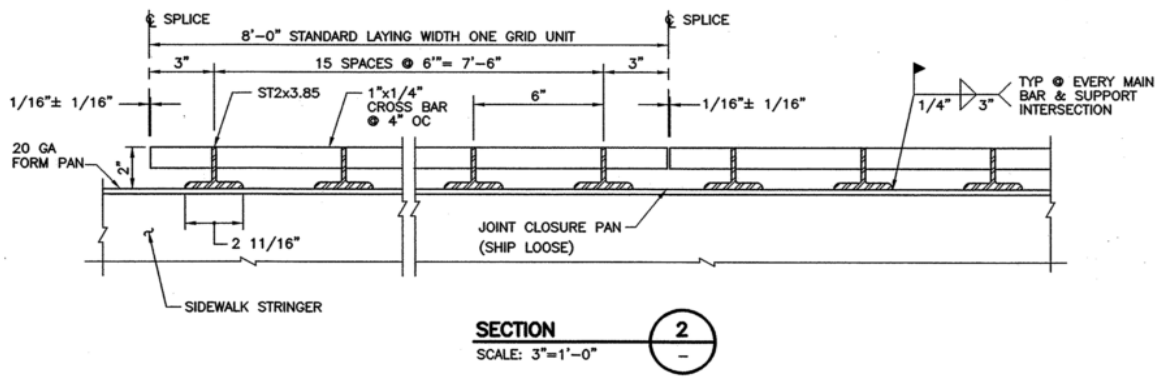
Inventory			Operating	
Item 66	MS Equivalent		Item 64	MS Equivalent
62.0	MS 34.5		103.5	MS 57.5

References: [1] MassDOT BRIDGE MANUAL, 2007
[2] AASHTO Manual for Bridge Evaluation, First Edition, 2008

SIDEWALK DECK, STRINGERS & BRACKET RATING

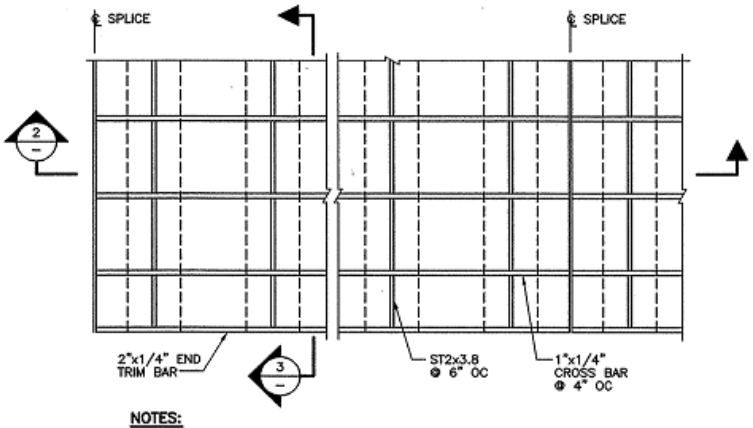
CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Sidewalk Deck	AJL	NKN		SHT # 1
		5/28/13	6/8/2016		

Concrete Filled Metal Grid Deck Rating



Thickness(t) =	2 in			
Effective Span Length(S)=	4.11 ft			
Concrete:				
f'c=	5.0 ksi			[2] Table 6B.6.2.4.1-1
Inventory fc =	2.0 ksi	MBE 6.6.2.4	n=	6
Operating fc =	3.0 ksi			
Grid Steel:				[2] Table 6B.6.2.3-1
fy =	50 ksi			
Inventory fs =	20 ksi			
Operating fs =	32.5 ksi			

ρc=	0.15 kip/ft^3
ρs=	0.49 kip/ft^3
Wc=	0.025 kip/ft^2
Ws=	0.010 kip/ft^2
DC=	0.035 kip/ft^2



NOTES:
1. FILL DECK WITH 5,000 PSI, 3/8", 710 HP CEMENT CONCRETE.
2. ALL STEEL TO BE IN ACCORDANCE WITH ASTM A-588.

TYPICAL GRID REINFORCED SIDEWALK PLAN

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Sidewalk Deck	AJL	NKN		SHT # 2
		5/28/13	6/8/16		

Section Properties

All values given for a 1 ft width of deck.

b= 12 in

Steel - Each ST2x3.85

A= 1.13 in^2
D= 2 in
tw= 0.193 in
bf= 2.663 in
tf= 0.293 in
Ix= 0.316 in^4
d= 0.448 in
S= 0.203 in3

For steel grid deck, use properties of two ST2x3.85 (spaced @ 6").
Ignore additional steel and concrete for rating.

A= 2.26
S.top= 0.406 in^3
S.btm= 1.411 in^3

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Rating for Sidewalk Deck	AJL	NKN		SHT # 3
		5/28/13	6/8/16		

Dead Load Moment: M_{DL}=continuity*$wl^2/8$

number of spans = 3
continuity= 1
w= 0.035 kip/ft^2
M_{DL}= 0.075 kip*ft

Live Load Moment:

Sidewalk deck is rated for special snow removal equipment with a total weight of 4 tons. See Staad.pro output for loads and LL moment.

M_{LL}= 0.464 kip-ft

Stresses:

	f.btm	f.top
M_{DL}/S=	0.634 ksi	2.204 ksi
M_{LL}/S=	3.947 ksi	13.71 ksi

Allowable Stress:

Steel Operating fs = 32.5 ksi

Rating:

$$RF = \frac{C - A_1 D}{A_2 L (I + 1)}$$

ASD	LFD
(Operating only)	
A1 = 1.0	A1 = 1.3
A2 = 1.0	A2 = 1.3

ASD Operating RF = 2.21 * 4 tons = 8.836 tons

LFD Operating RF = 1.66 * 4 tons = 6.649 tons

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 1
	SS1	5/28/13	6/8/2016		

Rating of Sidewalk Stringer SS1

1. Member and Material Properies

L=	23	ft	S=	4.417	ft
Section	W18x35		bf=	6	in
Ix-x=	510	in^4	tf=	0.425	in
Sx-x=	57.6	in^3	tw=	0.3	in
A=	10.3	in^2	T=	15.5	in
d=	17.7	in	Aw=	4.65	in^2
			Zx-x=	66.5	in3
fy=	50	ksi			
Inventory fy=	27.5	ksi	Inventory fv=	16.5	ksi
Operating fy=	37.5	ksi	Operating Fv=	22.5	ksi

Deck

t_s=	2	in	Assume section is noncomposite with 2" deck
b_{eff}=	29.5	in	
f_c'=	5	ksi	

Assume section is noncomposite with deck.

A=	10.3	in^2
y=	8.85	in
I=	510.00	in^4

$S_{bot,steel}$= 57.63 in^3

2. Loading

2.1. Dead Load

SW of stringer =	0.035	kip/ft
SW of Deck =	0.0615	kip/ft
SW steel grid=	0.0226	kip/ft
SIP forms=	0.000	kip/ft
Attachments=	0.0056	kip/ft
ΣW=	0.125	kip/ft
M=	8.25	kip-ft
V=	1.43	kip

Flexural Stresses Bottom of Steel

$$f_{DL}= \frac{M_{DL}}{Sx\text{-}x} = \frac{8.25*12}{57.6} = 1.718 \text{ ksi}$$

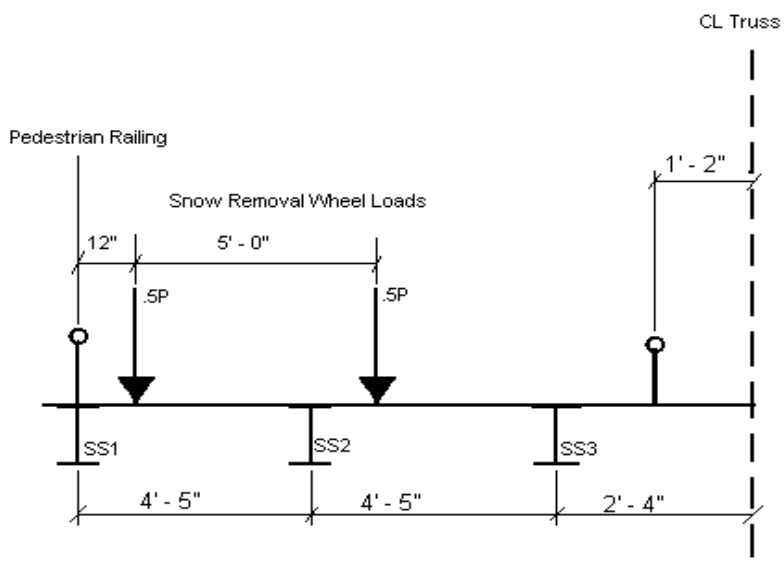
Shear Stress

$$f_{DL,shear}= V/A_w = 1.43/4.65 = 0.308 \text{ ksi}$$

2.2. Live Load

Impact - Impact does not have to be accounted for sidewalk walks - AASHTO 3.8.1.2

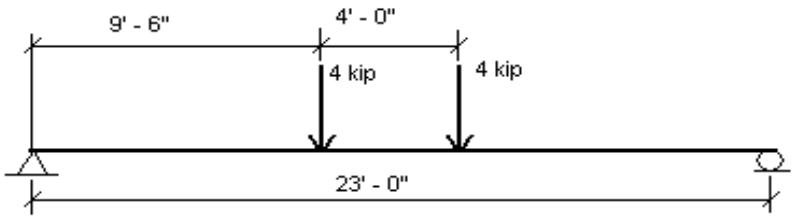
Distribution factor



DF= .5(41/53) = 0.387

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 3
	SS1	5/28/13	6/8/16		

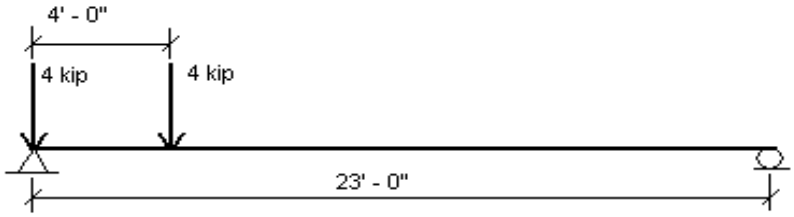
Max Moment



M= 4 k * 9.5 ft = 38 kip-ft

M_{LL}= M*DF = 14.70 kip-ft

Max Shear



V= 4+4*(19/23) = 7.304348 kip

V_{LL}= V*DF 2.83 kip

Flexural Stresses Bottom of Steel

$$f_{LL}=\frac{M_{LL}}{Sx\text{-}x} = \frac{14.70*12}{57.63} = 3.061 \text{ ksi}$$

Shear Stress

$$f_{LL,shear}= V_{LL}/A_w = 2.83/4.65 = 3.161 \text{ ksi}$$

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 4
	SS1	5/28/13	6/8/16		

3. ASD Rating Factor

General Rating Equation

$$RF = \frac{C-A_1D}{A_2L(1+I)}$$

For ASD Rating A1=A2= 1.00

According to AASHTO Standard Specification, 17th Edition 3.8.1.1
Impact should not be included for sidewalk loads

3.1. Operating Rating - Flexure

$$RF = \frac{37.5-1.406}{1*2.406*(1+0)} = 11.691$$

3.2. Operating Rating - Shear

$$RF = \frac{22.5-0.252}{1*3.161*(1+0)} = 7.021$$

4. ASD Rating

RT=(RF)T

4.1. Operating Rating - Flexure

RT= 11.69*4tons = 46.8 tons

4.2. Operating Rating - Shear

RT= 7.02*4tons = 28.1 tons

5. LFD Rating Factor

A1= 1.3
A2= 1.3 Operating

				Limit for 50ksi steel
Compression flange	b/t=	14.12	<	18.4
Web thickness	D/tw=	51.67	<	86

Section is compact.

Flexural capacity: C=Mu=FyZ C= 277.08 k-ft

Shear capacity:

k	5
6000sqrt(k)/sqrt(Fy)	60
7500sqrt(k)/sqrt(Fy)	75

C'= 1
Vp= 134.85 kip
C=Vu=C'Vp= 134.85 kip

5.1. Operating Rating - Flexure

$$RF = \frac{277.1-1.3*6.75}{1.3*14.70*(1+0)} = 13.940$$

5.2.

Operating Rating - Shear

$$RF = \frac{134.85-1.3*1.17}{1.3*2.83*(1+0)} = 36.208$$

6. LFD Rating

RT=(RF)T

6.1. Operating Rating - Flexure

RT= 13.94*4tons = 55.8 tons

6.2. Operating Rating - Shear

RT= 36.21*4tons = 144.8 tons

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 1
	SS2	5/28/13	6/8/2016		

Rating of Sidewalk Stringer SS2

1. Member and Material Properies

L=	23	ft	S=	4.417	ft
Section	W18x35		bf=	6	in
Ix-x=	510	in^4	tf=	0.425	in
Sx-x=	57.6	in^3	tw=	0.3	in
A=	10.3	in^2	T=	15.5	in
d=	17.7	in	Aw=	4.65	in^2
			Zx-x=	66.5	in3
fy=	50	ksi			
Inventory fy=	27.5	ksi	Inventory fv=	16.5	ksi
Operating fy=	37.5	ksi	Operating Fv=	22.5	ksi

Deck

t_s=	2	in
b_{eff}=	53	in
f_c'=	5	ksi

Assume section is noncomposite with deck.

A=	10.3	in^2
y=	8.85	in
I=	510.00	in^4

$S_{bot,steel}$= 57.63 in^3

2. Loading

2.1. Dead Load

SW of stringer =	0.035	kip/ft
SW of Deck =	0.110	kip/ft
SW steel grid=	0.0453	kip/ft
SIP forms=	0.000	kip/ft
Attachments=	0.0194	kip/ft
ΣW=	0.210	kip/ft
M=	13.89	kip-ft
V=	2.42	kip

Flexural Stresses Bottom of Steel

$$f_{DL}=\frac{M_{DL}}{Sx\text{-}x} = \frac{13.89*12}{57.6} = 2.894 \text{ ksi}$$

Shear Stress

$$f_{DL,shear}= V/A_w = 2.42/4.65 = 0.520 \text{ ksi}$$

2.2. Live Load

Impact - Impact does not have to be accounted for sidewalk walks - AASHTO 3.8.1.2

Distribution factor

DF= S/4.5= 0.981 AASHTO 3.23.2.3.1.5

M= 2 k * 9.5 ft = 19 kip-ft See SS1 diagram

M_{LL}= M*DF = 18.65 kip-ft

V= 2+2*(19/23) = 3.652174 kip See SS1 Diagram

V_{LL}= V*DF 3.58 kip

Flexural Stresses Bottom of Steel

$$f_{LL}=\frac{M_{LL}}{Sx\text{-}x} = \frac{18.65*12}{57.63} = 3.883 \text{ ksi}$$

Shear Stress

$$f_{LL,shear}= V_{LL}/A_w = 3.58/4.65 = 0.771 \text{ ksi}$$

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 3
	SS2	5/28/13	6/8/16		

3. ASD Rating Factor

General Rating Equation

$$RF = \frac{C-A_1D}{A_2L(1+I)}$$

For ASD Rating A1=A2= 1.00

According to AASHTO Standard Specification, 17th Edition 3.8.1.1
Impact should not be included for sidewalk loads

3.1. Operating Rating - Flexure

$$RF = \frac{37.5-2.271}{1*2.406*(1+0)} = 8.912$$

3.2. Operating Rating - Shear

$$RF = \frac{22.5-0.408}{1*0.631*(1+0)} = 28.514$$

4. ASD Rating

RT=(RF)T

4.1. Operating Rating - Flexure

RT= 8.91*4tons = 35.65 tons

4.2. Operating Rating - Shear

RT= 28.51*4tons = 114.1 tons

5. LFD Rating Factor

A1= 1.3
A2= 1.3 Operating

					Limit for 50ksi steel
Compression flange	b/t=	14.12	<	18.4	
Web thickness	D/tw=	51.67	<	86	
			Section is compact.		

Flexural capacity: C=Mu=FyZ C= 277.08 k-ft

Shear capacity:

			k	5
			6000sqrt(k)/sqrt(Fy)	60
C'=	1		7500sqrt(k)/sqrt(Fy)	75
Vp=	134.85	kip	C	
C=Vu=C'Vp=	134.85	kip	Vp	
			Vu	

5.1. Operating Rating - Flexure

$$RF = \frac{277.1-1.3*10.90}{1.3*15.26*(1+0)} = 10.685$$

5.2.

Operating Rating - Shear

$$RF = \frac{134.85-1.3*1.90}{1.3*2.93*(1+0)} = 28.264$$

6. LFD Rating

RT=(RF)T

6.1. Operating Rating - Flexure

RT= 10.68*4tons = 42.74 tons

6.2. Operating Rating - Shear

RT= 28.26*4tons = 113.1 tons

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 1
	SS3	5/28/13	6/8/2016		

Rating of Sidewalk Stringer SS3

1. Member and Material Properies

L=	23	ft	S=	4.417	ft
Section	W18x35		bf=	6	in
Ix-x=	510	in^4	tf=	0.425	in
Sx-x=	57.6	in^3	tw=	0.3	in
A=	10.3	in^2	T=	15.5	in
d=	17.7	in	Aw=	4.65	in^2
			Zx-x=	66.5	in3
fy=	50	ksi			
Inventory fy=	27.5	ksi	Inventory fv=	16.5	ksi
Operating fy=	37.5	ksi	Operating Fv=	22.5	ksi

	Deck	Grid	Reinforced	
t_s=	2	in	8	in
b_{eff}=	26.5	in	28	in
f_c'=	5	ksi		

Composite Section Properties

Short Term Composite Section n= 6.00

	A	y	A*y	d	$A*d^2$	I_0	
	in^2	in	in^3	in	in^4	in^4	
Deck							Assume 2" deck is
Deck	37.333333	21.700	810.13333	2.78	288.24	199.11	noncomposite
W18x35	10.3	8.85	91.155	10.07	1044.76	510	
Σ=	47.6	Σ=	901.3				
		y1=	18.92		I=	2042.11	in^4

$S_{top,conc}$= 2622.72 in^3
$S_{bot,steel}$= 107.93 in^3

Long Term Composite Section 3n= 18.00

	A	y	A*y	d	$A*d^2$	I_0	
	in^2	in	in^3	in	in^4	in^4	
Deck							Assume 2" deck is
Deck	12.44	21.700	270.0	2.78	96.08	66.37	noncomposite
W18x35	10.3	8.85	91.155	10.07	1044.76	510	
Σ=	22.7	Σ=	361.2				
		y1=	15.88		I=	1717.21	in^4

$S_{top,conc}$= 161.71 in^3
$S_{bot,steel}$= 108.13 in^3

2. Loading

2.1. Dead Load

SW of stringer =	0.035	kip/ft
SW of Deck =	0.289	kip/ft
SW steel grid=	0.0226	kip/ft
SIP forms=	0.0093333	kip/ft
Attachments=	0.0038	kip/ft
ΣW=	0.359	kip/ft
M_{DL}=	23.76	kip-ft
V_{DL}=	4.13	kip

Flexural Stresses Bottom of Steel

$$f_{DL,flexure} = \frac{M_{DL}}{Sx\text{-}x} = \frac{23.76*12}{57.6} = 4.950 \text{ ksi}$$

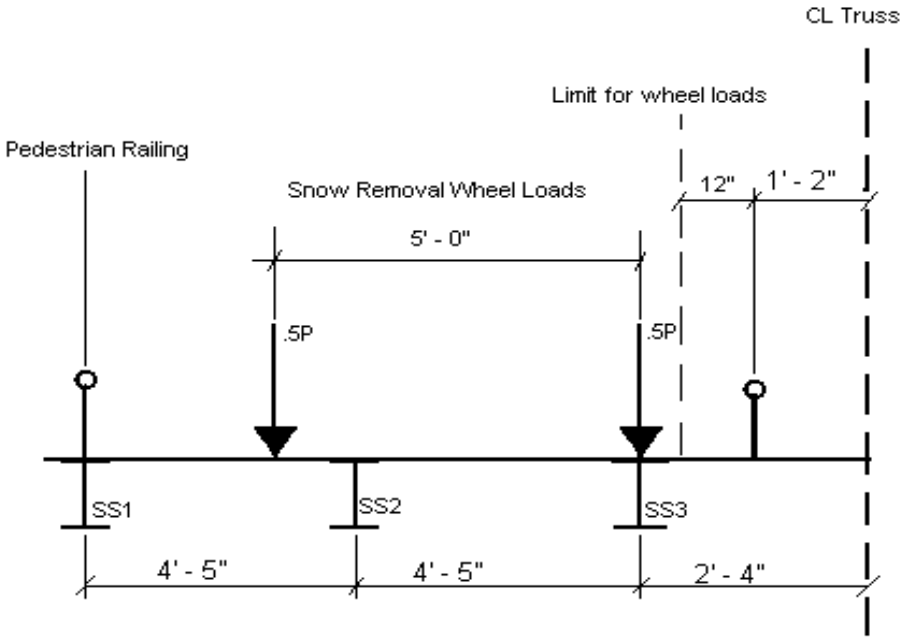
Shear Stress

$$f_{DL,shear} = V/A_w = 4.13/4.65 = 0.889 \text{ ksi}$$

2.2. Live Load

Impact - Impact does not have to be accounted for sidewalk walks - AASHTO 3.8.1.2

Distribution factor



DF= 0.5

M= 2 k * 9.5 ft = 19 kip-ft See SS1 diagram
M_{LL}= M*DF = 9.50 kip-ft

V= 2+2*(19/23) = 3.652 kip See SS1 diagram
V_{LL}= V*DF 1.83 kip

Flexural Stresses Bottom of Steel

$$f_{LL}=\frac{M_{LL}}{Sx\text{-}x} = \frac{9.50*12}{57.60} = 1.979 \text{ ksi}$$

Shear Stress

$$f_{LL,shear}= V_{LL}/A_w = 1.83/4.65 = 0.393 \text{ ksi}$$

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Stringer Rating	AJL	NKN		SHT # 4
	SS3	5/28/13	6/8/16		

3. ASD Rating Factor

General Rating Equation

$$RF = \frac{C - A_1 D}{A_2 L(1+I)}$$

For ASD Rating A1=A2= 1.00

According to AASHTO Standard Specification, 17th Edition 3.8.1.1
Impact should not be included for sidewalk loads

3.1. Operating Rating - Flexure

$$RF = \frac{37.5-4.638}{1*0.985*(1+0)} = 16.446$$

3.2. Operating Rating - Shear

$$RF = \frac{22.5-0.833}{1*0.393*(1+0)} = 55.032$$

4. ASD Rating

RT=(RF)T

4.1. Operating Rating - Flexure

RT= 16.45*4tons = 65.8 tons

4.2. Operating Rating - Shear

RT= 55.03*4tons = 220.1 tons

5. LFD Rating Factor

A1= 1.3
A2= 1.3 Operating

				Limit for 50ksi steel
Compression flange	b/t=	14.12	<	18.4
Web thickness	D/tw=	51.67	<	86

Section is compact.

Flexural capacity: C=Mu=FyZ C= 277.08 k-ft

Shear capacity:

		k	5
C'=	1	6000sqrt(k)/sqrt(Fy)	60
Vp=	134.85 kip	7500sqrt(k)/sqrt(Fy)	75
C=Vu=C'Vp=	134.85 kip		

5.1. Operating Rating - Flexure

$$RF = \frac{277.08-1.3*22.26}{1.3*9.50*(1+0)} = 19.935$$

5.2.

Operating Rating - Shear

$$RF = \frac{134.85-1.3*3.87}{1.3*1.83*(1+0)} = 54.542$$

6. LFD Rating

RT=(RF)T

6.1. Operating Rating - Flexure

RT= 19.93*4tons = 79.74 tons

6.2. Operating Rating - Shear

RT= 54.54*4tons = 218.2 tons

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Sidewalk Bracket Rating	AJL	NKN		SHT # 1
	Typical Sidewalk Bracket	5/28/13	6/8/2016		

Rating of Sidewalk Bracket

1. Member and Material Properies

L= 10.75 ft

fy= 50 ksi

Self weight of bracket

Top Flange

b= 1.000 ft

th= 3/4 in

Web (Conservatively use largest section load along entire section)

h= 35.00 in

th= 7/8 in

Bottom Flange

b= 1.000 ft

th= 3/4 in

Total area= 48.63 in^2

w= 0.1654601 klf

V= 1.779 kip

M= 9.5604896 k-ft

A1 24.3125 in2

a 24.255784 in

Z 589.71875 in3

2. Loading

2.1. Dead Load

Point load from SS1

Distance from end=	10.41667	ft	
R=	7.740	kips	(from 2 stringers)
M=	80.63	kip-ft	

Point load from SS2

Distance from end=	6	ft	
Stringer reaction=	3.8	kip	(from 2 stringers)
Additional load=	0.022	kip	(from W8x24x11")
Total R=	3.8	kip	
M=	22.932	k-ft	

Point load from SS3

Distance from end=	1.583333	ft	
Stringer reaction=	2.340	kip	(from 2 stringers)
Additional load=	0.022	kip	(from W8x24x11")
Total R=	2.4	kip	
M=	3.740	k-ft	

Pedestrian Rail

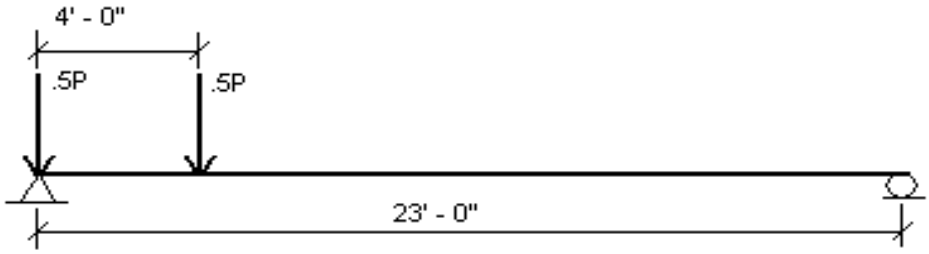
Distance from end=	10.75	ft	
R=	1.380	kips	*.060klf*23ft span*
M=	14.84	kip-ft	
V=	15.30	kip	total reaction from point loads

2.2. Utilities

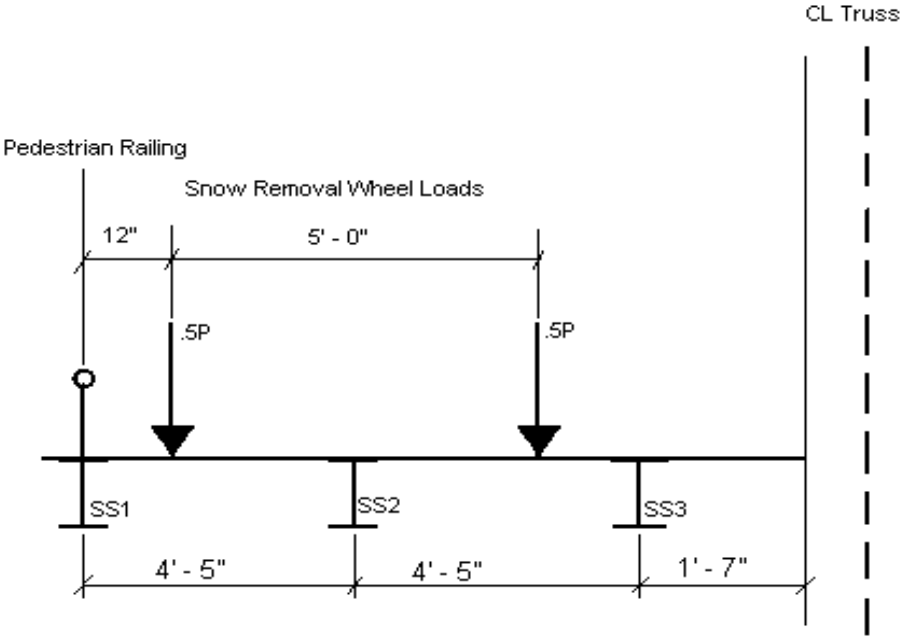
Note: Unit weight of 250 plf for utilities, see sheet 2 of 42.

w_{util}=	0.25	kip/ft	
L=	23	ft	
V=	5.75	kip	
D=	7.67	ft	(7'-7")
M=	44.08	kip-ft	
ΣM_{DL}=	175.78	kip-ft	
ΣV_{DL}=	22.83	kip	

2.3. Live Load



DF= .5+.5*19/23 0.913043



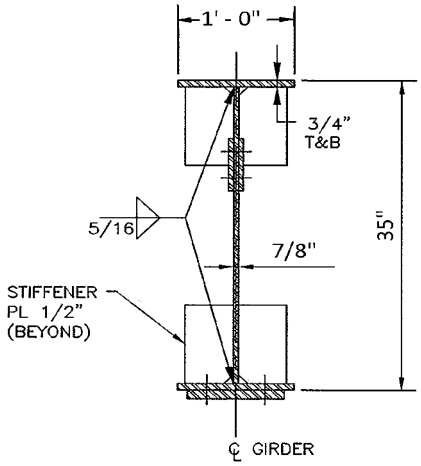
M_{LL}= (9'-5"+4'-5")*4kips*DF = 50.52 kip-ft

V_{LL}= V*DF 7.30 kip

3. Capacity

Determine Sidewalk Bracket Capacity

Section



Section Properties

	b	th
	in	in
Top Flange	12	3/4
Web	33.5	7/8
Bottom Flange	12	3/4

A= 47.3125 in^2
I= 8021.0 in^4
S= 458.34 in^3

fy= 50 ksi
Inventory flexure fy= 27.5 ksi
Operating flexure fy= 37.5 ksi
Inventory shear fv= 16.5 ksi
Operating shear fv= 22.5 ksi

Capacity of the section in flexure C=fy*S
Inventory = 1050.36 kip-ft
Operating = 1432.31 kip-ft

Capacity of the section in shear C=fv*Aw
Inventory = 483.66 kip
Operating = 659.53 kip

4. ASD Rating Factor

General Rating Equation

$$RF = \frac{C-A_1D}{A_2L(1+I)}$$

For ASD Rating A1=A2= 1.00

According to 3.8.1.1 Impact should not be included for sidewalk loads

4.1. Operating Rating Flexure

$$RF = \frac{489.67-1*166.96}{1*55.33*(1+0)} = 24.871$$

4.2. Operating Rating Shear

$$RF = \frac{659.53-1.0*22.83}{1*7.30*(1+0)} = 87.167$$

5. ASD Rating

RT=(RF)T

5.1. Operating Rating - Flexure

RT= 24.87*4tons = 99.5 tons

5.2. Operating Rating - Shear

RT= 87.17*4tons = 348.7 tons

6. LFD Rating Factor

A1= 1.3
A2= 1.3 Operating

				Limit for 50ksi steel
Compression flange	b/t=	16	<	18.4
Web thickness	D/tw=	40	<	86

Section is compact.

Flexural capcity: C=FyZ C= 2457.16 k-ft

Shear capacity:

k	5
6000sqrt(k)/sqrt(Fy)	60
7500sqrt(k)/sqrt(Fy)	75

C'= 1
Vp= 888.125 kip
C=Vu=C'Vp= 888.125 kip

6.1. Operating Rating - Flexure

$$RF = \frac{2457.16-1.3*166.96}{1.3*55.33*(1+0)} = 33.933$$

6.2.

Operating Rating - Shear

$$RF = \frac{888.125-1.3*21.68}{1.3*7.30*(1+0)} = 90.404$$

7. LFD Rating

RT=(RF)T

7.1. Operating Rating - Flexure

RT= 33.93*4tons = 135.7 tons

7.2. Operating Rating - Shear

RT= 90.40*4tons = 361.6 tons

STRINGERS & FLOOR BEAM RATING SUMMARY TABLES

Bay 1 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Bay 2 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
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HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Bay 3 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Bay 4 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Floorbeam Analysis Virtis Output

SFB0

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	50.05	74.98	2.503	3.749	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	90.1	134.97	2.503	3.749	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	47.53	71.2	2.377	3.56	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	67.51	101.13	1.875	2.809	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	61.71	92.44	2.468	3.698	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	94.57	141.67	2.627	3.935	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	73.51	122.77	2.042	3.41	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	55.08	91.99	1.53	2.555	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

SFB1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	26.98	46.48	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	48.56	83.66	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	31.27	53.87	1.563	2.694	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	41.49	71.49	1.153	1.986	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	37.51	64.62	1.5	2.585	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	58.99	101.62	1.638	2.823	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	46.01	76.84	1.278	2.134	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	39.32	65.66	1.092	1.824	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

SFB2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	26.98	46.48	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	48.56	83.66	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	31.27	53.87	1.563	2.694	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	41.49	71.49	1.153	1.986	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	37.51	64.62	1.5	2.585	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	58.99	101.62	1.638	2.823	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	46.01	76.84	1.278	2.134	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	39.32	65.66	1.092	1.824	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

TRUSS RATING

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 1
		5/28/13	6/8/2016		

Loading on Panel Points from Gusset Plates

East Truss - Gusset Plates, Doubler Plates, Repair Plates

	Gusset Pl. Width in	Gusset Pl. Thickness in	Repair Pl. Width in	Repair Pl. Height in	Repair Pl. Thickness in	Doubler Pl. Width in	Volume in3	Weight kips
L0S	42.5	0.50	92	16	0.75	30	6385.5	1.81
L1S	18	0.625	153	14.25	1.25	30	13818.75	3.92
L2S	65.75	0.625	158.75	16	1	30	18270.3125	5.18
L3S	21	0.625	120	14.25	1.625	30	14358.75	4.07
L4S	65.375	0.625	173.375	16	1	30	19165.5313	5.43
L5S	21	0.625	126	14.25	1	30	10425.75	2.96
L6S	70.875	0.75	151.875	16	1	30	19929.1875	5.65
L7S	22	0.625	55	14.25	1.25	0	6311.25	1.79
L8	81	0.5	174	16	1	30	19143	5.43
L7N	22	0.625	55	14.25	1.25	0	6311.25	1.79
L6N	70.875	0.75	157.875	16	1	30	20313.1875	5.76
L5N	21	0.625	114	14.25	1	30	9741.75	2.76
L4N	65.375	0.625	167.375	16	1	30	18781.5313	5.33
L3N	21	0.625	144	14.25	1.625	30	16581.75	4.70
L2N	65.75	0.625	176.75	16	1	30	19422.3125	5.51
L1N	18	0.625	117	14.25	1.25	30	11253.75	3.19
L0N	42.5	0.5	92	16	0.75	30	9073.5	2.57

	Weight kips
U1	0.32
U2	0.97
U3	0.32
U4	0.97
U5	0.32
U6	0.97
U7	0.32
U8	0.97

Assumptions:

All gusset plates assumed to be 7'-3" tall
All doubler plates assumed to be 1/2"x16"

Upper panel points take average of major/minor panel point lower gusset plates, assume symmetrical

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 2
		5/28/13	6/8/16		

Loading on Panel Points from Gusset Plates (Cont.)

West Truss - Gusset Plates, Doubler Plates, Repair Plates

	Gusset Pl. Width in	Gusset Pl. Thickness in	Repair Pl. Width in	Repair Pl. Height in	Repair Pl. Thickness in	Doubler Pl. Width in	Volume in3	Weight kips
L0S	42.5	0.50	86	16	0.75	30	6241.5	1.77
L1S	18	0.625	105	14.25	1.25	30	10398.75	2.95
L2S	65.74	0.625	170.75	16	1	30	19037.225	5.40
L3S	21	0.625	132	14.25	1.625	30	15470.25	4.39
L4S	65.375	0.625	167.375	16	1	30	18781.5313	5.33
L5S	21	0.625	102	14.25	1	30	9057.75	2.57
L6S	70.875	0.75	163.875	16	1	30	20697.1875	5.87
L7S	22	0.625	55	14.25	1.25	0	6311.25	1.79
L8	81	0.5	186	16	1	30	19911	5.65
L7N	22	0.625	55	14.25	1.25	0	6311.25	1.79
L6N	70.875	0.75	175.875	16	1	30	21465.1875	6.09
L5N	21	0.625	126	14.25	1	30	10425.75	2.96
L4N	65.375	0.625	155.375	16	1	30	18013.5313	5.11
L3N	21	0.625	126	14.25	1.625	30	14914.5	4.23
L2N	65.75	0.625	164.75	16	1	30	18654.3125	5.29
L1N	18	0.625	117	14.25	1.25	30	11253.75	3.19
L0N	42.5	0.5	98	16	0.75	30	9361.5	2.65

	Weight kips
U1	0.32
U2	0.97
U3	0.32
U4	0.97
U5	0.32
U6	0.97
U7	0.32
U8	0.97

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 3
		5/28/13	6/8/16		

Loading from Floor Beams

Deck

d_{deck}= 7.5 in
w_{deck}= 0.094 kip/ft^2

Stay-in-place (SIP) Forms

2"-16ga Galvanized Deck
w_{SIP}= 0.004 kip/ft^2

Haunch

t_{haumch}= 2 in
b_{haumch}= 8 in
w_{haunch}= 0.0167 kip/ft

Railing

Type S3-TL4
w 0.09 kip/ft

Curb

Area 1.5625 ft^2
w 0.234375 kip/ft

Wearing Surface

t_{WS}= 3 in
w_{WS}= 0.035 kip/ft^2 *140 pcf material*

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 4
		5/28/13	6/8/16		

Loading from Floor Beams (Cont.)

Stringers

Load on Exterior Stringer

Section	W18x35	
w_{SW}=	0.035	kip/ft
Spacing	5.00	ft
Overhang	2.38	ft

Load on Interior Stringer

Section	W18x35	
w_{SW}=	0.035	kip/ft
Spacing	5.00	ft

Loading

Deck	0.457	kip/ft
SIP	0.020	kip/ft
Haunch	0.02	kip/ft
Railing	0.09	kip/ft
Curb	0.234	kip/ft
Self Weight	0.035	kip/ft
Σ	0.853	kip/ft

Loading

Deck	0.469	kip/ft
SIP	0.020	kip/ft
Haunch	0.02	kip/ft
Railing		kip/ft
Curb		kip/ft
Self Weight	0.035	kip/ft
Σ	0.540	kip/ft

L= 23 ft span of stringers

R= 9.80 kips

R= 6.21 kips Reaction

Bracing of bottom chord

Section
L6x4x3/8

w= 0.0123 kip/ft

total length per bay 63.286057 ft

W Interior bay
0.78 kip

W Exterior bay
0.39 kip

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 5
		5/28/13	6/8/16		

Loading from Floor Beams (Cont.)

Stringers on End Floor Beam - Cantilever Stringers

Load on Exterior Stringer

Section	W14x61	
w_{SW}=	0.061	kip/ft
Spacing	5.00	ft
Overhang	2.375	ft

Load on Interior Stringer

Section	W14x61	
w_{SW}=	0.061	kip/ft
Spacing	5.00	ft

Loading

Deck	0.457	kip/ft
SIP	0.020	kip/ft
Haunch	0.02	kip/ft
Railing	0.09	kip/ft
Curb	0.234375	kip/ft
Self Weight	0.061	kip/ft
Σ	0.879	kip/ft

Loading

Deck	0.469	kip/ft
SIP	0.020	kip/ft
Haunch	0.02	kip/ft
Railing		kip/ft
Curb		kip/ft
Self Weight	0.061	kip/ft
Σ	0.566	kip/ft

Fascia Stringer(W12x53) 0.258 kips

Fascia Stringer (W12x53) 0.265 kips

L= 2.67 ft span of stringers

R= 2.60 kips

R= 1.78 kips Reaction

Floorbeams Reactions

Reactions from Dead Load (DC1)

Section	W36x232	
w_{SW}=	0.232	kip/ft
Span	44.75	ft
R=	5.19	kip/ft

Loading from Stringers

For End Floor Beam

R1= 40.37 kip

For Interior Floor Beam

R1= 63.11 kip

Loading from Bracing

For End Floor Beam

R1= 0.19 kip

For Interior Floor Beam

R1= 0.39 kip

Reaction from End Floor Beam to Truss

R= 45.76 kips

Reaction From Interior Floor Beam to truss

R= 68.69 kips

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN	AJL	SHT # 6
		5/28/13	6/8/16	6/9/2016	

Loading on sidewalk bracket

Sidewalk deck

2" steel grid deck

d_{deck}=	1	in	
w_{deck}=	0.013	kip/ft²	
$w_{Steel\ main}$=	0.0077	kip/ft²	ST 2x3.85 @ 6" o.c.
$w_{Steel\ crossbar}$=	0.0026	kip/ft²	1"x1/4" @ 4" o.c.
$w_{grid\ deck\ totalr}$=	0.023		

Reinforced section

d_{deck}=	10	in
w_{deck}=	0.125	kip/ft²

Stay-in-place (SIP) Forms

20 GA form pan

w_{SIP}=	0.002	kip/ft²

Haunch

t_{haumch}=	3	in	
b_{haumch}=	6.5	in	
w_{haunch}=	0.02	kip/ft	*Only on SS3*

Railing

Roadway side

w	0.06	kip/ft	(use the same loading, as in calculations the section of railing is the same as shown there)

Utilities

Unit weight of 250 plf for utilities. See sheet 2 of 42 (clip below).

w=	250	lb/ft	=	0.250	kip/ft
R	5.75	kips			

GENERAL NOTES:

A. DESIGN:

IN ACCORDANCE WITH THE 2002 SPECIFICATIONS OF THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO), INCLUDING LATEST INTERIMS FOR HS 20-44 LOADING.

1. DEAD LOADS:

UNIT WEIGHT OF MATERIALS: AASHTO 3.3.6

A. UTILITIES: 250 lb/LF EACH SIDEWALK BAY

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN	AJL	SHT # 7
		5/28/13	6/8/16	6/9/2016	

Loading on sidewalk bracket (Cont.)

Sidewalk Stringers

SS1&SS6

Section	W18X35
w_{SW}=	0.035 kip/ft
Trib. Width	2.21 ft

Loading	
Deck	0.05 kip/ft
SIP	0.004 kip/ft
Haunch	0. kip/ft
Railing	0.06 kip/ft
Selfweight	0.035 kip/ft
Σ	0.15 kip/ft
R=	1.72 kip

SS2&SS5

Section	W18X35
w_{SW}=	0.035 kip/ft
Trib. Width	4.42 ft

Loading	
Deck	0.1 kip/ft
SIP	0.009 kip/ft
Haunch	0. kip/ft
Railing	0. kip/ft
Selfweight	0.035 kip/ft
Σ	0.144 kip/ft
R=	1.66 kip

SS3&SS4

Section	W18X35
w_{SW}=	0.035 kip/ft
Trib. Width	4.54 ft
Grid Deck	2.21 ft
Reinforced	2.33 ft

Loading	
Deck	0.342 kip/ft
SIP	0.009 kip/ft
Haunch	0.02 kip/ft
Railing	0.06 kip/ft
Selfweight	0.035 kip/ft
Σ	0.466 kip/ft
R=	5.36 kip

Sidewalk Bracket

Web plate thickness	0.875	
A_{web}	15.62	ft^2
W_{web}	0.558	kips

Flange		
Section	7/8" x 12"	
L (top+btm)	21.5	ft
W_{flange}	0.768	kips

For the whole section

W	1.459	kips

Loading from stringers	17.487	kips
SW of Bracket	1.459	kips
Utilities	5.750	kips
(2) W8x24x11"	0.044	
Σ	24.740	kips

R for L0	13.09922	kips
R for L1 to L8	24.740	kips

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN	AJL	SHT # 8
		5/28/13	6/8/16	6/9/2016	

Wearing Surface Loading on Floorbeams

Reaction from Wearing Surface

For Exterior Floor Beam

w	0.035	kip/ft^2
roadway	40	ft
S	23	ft
Cantilever	2.67	ft
R	9.92	kips

For Interior Floor Beam

w	0.035	kip/ft^2
roadway	40	ft
S	23	ft
R	16.10	kips

Loading from Lateral Bracing

Loading on top chord

Portal Frame U1-L0

Diagonal Braces

n	8	pcs
L	14.142136	ft
Section	2-L3 1/2x3 1/2x5/16	
w	0.014	kip/ft
W	1.629174	

Top/Bottom Chord

n	2	pcs
L	44.75	ft
Section	2-L3 1/2x3 1/2x5/16	
w	0.014	kip/ft
W	1.29	

Verticals

n	3	pcs
L	10	ft
Section	2-L3 1/2x3 1/2x5/16	
w	0.014	kip/ft
W	0.432	

Top Chord

n	1	pcs
L	44.75	ft
Section	2-L5x3 1/2x5/16	
w	0.017	kip/ft
W	0.78	

$W_{Portal\ Frame}$	4.54	kips
R for U1	2.27	kips

(increase by 10%)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 9
		5/28/13	6/8/16		

Loading from Lateral Bracing (Cont.)

Inner Portal Frame U7-L8

Top/Bottom Chord

Section	2-L6x4x3/8	
w	0.025	kip/ft
L	44.75	ft
n	2	pcs
W	2.20	kips

Diagonal

Section	L5x3 1/2x5/16	
w	0.0087	kip/ft
L	31.112698	ft
n	4	pcs
W	1.0827219	kips

Vertical/Top Chord

Section	4-L5x3 1/2x5/16	
w	0.0348	kip/ft
L	66.75	ft
n	1	pcs
W	2.3229	kips

$W_{Portal\ Frame}$	6.17	kips	(increase by 10%)
R for U7	3.084	kips	

Diagonal Bracing

Section

2-L4x3 1/2x5/16

w	15.4	lb/ft
$L_{per\ Bay}$	63.2861	ft
R for U1, U7	0.244	kips
R forU2 toU6	0.487	kips

Horizontal Bracing

Section

4-L5x3 1/2x5/16

w	34.8	lb/ft
$L_{per\ Bay}$	44.75	ft
R for U1, U7	0.000	kips
R forU2 toU6	0.77865	kips

Longitudinal Bracing

Section

2-L3 1/2x3 1/2x5/16

w	14.4	lb/ft
$L_{per\ Bay}$	23	ft
R for U2,U3,U5,	0.083	kips
U1,U4,U8	0.000	kips

Summary

U1	2.51	kips
U2	1.35	kips
U3	1.35	kips
U4	1.27	kips
U5	1.35	kips
U6	1.35	kips
U7	3.33	kips
U8	0.00	kips

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN	AJL	SHT # 10
		5/28/13	6/8/16	6/9/2016	

Summary of Loads on Panel Points

Note: All loads are in kips.

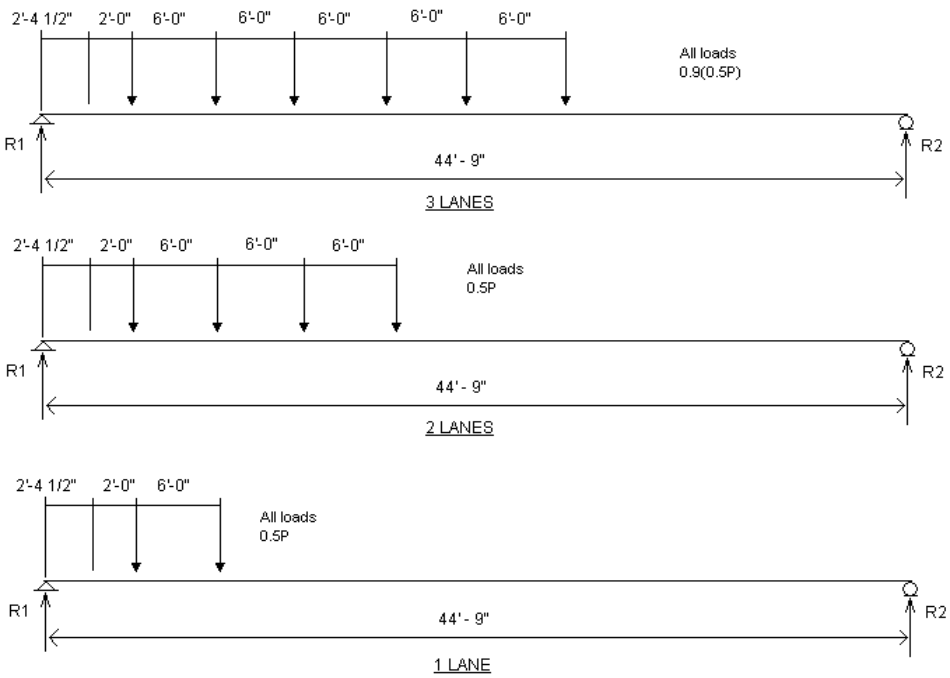
	Gusset Plates East	Gusset Plates West	Sidewalk Bracket	Floor Beams	Wearing Surface
L0S	1.81	1.77	13.099	45.76	9.92
L1S	3.92	2.95	24.740	68.69	16.10
L2S	5.18	5.40	24.740	68.69	16.10
L3S	4.07	4.39	24.740	68.69	16.10
L4S	5.43	5.33	24.740	68.69	16.10
L5S	2.96	2.57	24.740	68.69	16.10
L6S	5.65	5.87	24.740	68.69	16.10
L7S	1.79	1.79	24.740	68.69	16.10
L8	5.43	5.65	24.740	68.69	16.10
L7N	1.79	1.79	24.740	68.69	16.10
L6N	5.76	6.09	24.740	68.69	16.10
L5N	2.76	2.96	24.740	68.69	16.10
L4N	5.33	5.11	24.740	68.69	16.10
L3N	4.70	4.23	24.740	68.69	16.10
L2N	5.51	5.29	24.740	68.69	16.10
L1N	3.19	3.19	24.740	68.69	16.10
L0N	2.57	2.65	13.099	68.69	9.92

* Note: Floor beams and wearing surface loads automatically calculated in Virtis

	Gusset Plates	Bracing
U1	0.32	2.51
U2	0.97	1.35
U3	0.32	1.35
U4	0.97	1.27
U5	0.32	1.35
U6	0.97	1.35
U7	0.32	3.33
U8	0.97	0.00

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	4014943
SUBJECT	Loading on Truss	AJL	NKN		SHT # 11
		5/28/13	6/8/16		

Determine Distribution Factors for the Truss



3 lanes

DF = (0.9*0.5)*(10.375+16.375+22.375+28.375+34.375+40.375)/44.75

DF= 1.531

2 lanes

DF = (0.5)*(22.375+28.375+34.375+40.375)/44.75

DF= 1.402

For Virtis Analysis use DF = 1.531 for multiple lane analysis

1 lane

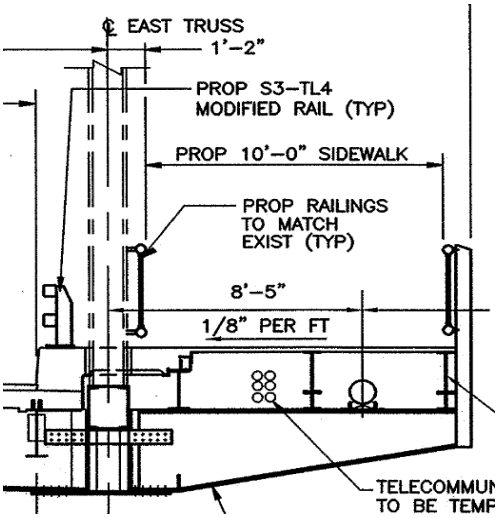
DF = (0.5)*(34.375+40.375)/44.75

DF= 0.835

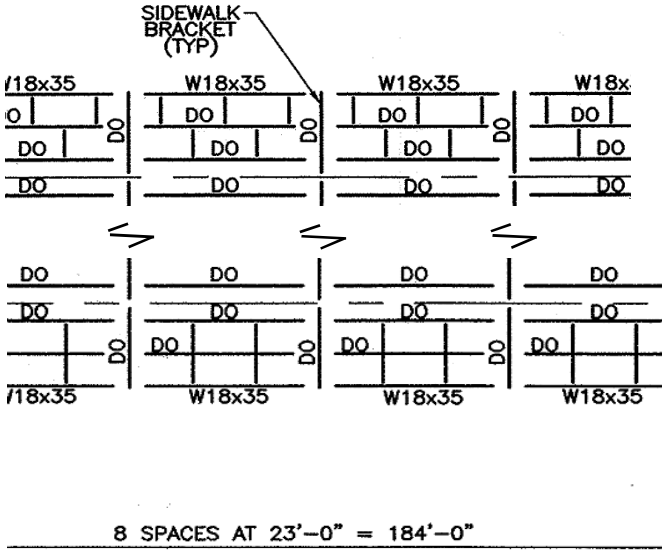
For Virtis Analysis use DF = 0.835 for single lane analysis

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Pedestrian Load on Truss	AJL	NKN		SHT # 1
		5/28/13	6/8/2016		

Pedestrian load on truss panel points



Typical Section @ Sidewalk



Partial Framing Plan

	W	B	A	$w_{pedestrian}$	$W_{pedestrian}$
	ft	ft	ft^2	kip/ft^2	kips
L0	10	14.167	141.67	0.042	5.90
L1	10	23	230	0.042	9.59
L2	10	23	230	0.042	9.59
L3	10	23	230	0.042	9.59
L4	10	23	230	0.042	9.59
L5	10	23	230	0.042	9.59
L6	10	23	230	0.042	9.59
L7	10	23	230	0.042	9.59
L8	10	23	230	0.042	9.59

W average span of the bracket
B distance between panel points
A tributary area of sidewalk per panel point

W=	10	ft	sidewalk width
L=	184	ft	truss length
P=	41.67	lb/ft^2	

P=(30+3,000/L)((55-W)/50)*

AASHTO Standard Specifications, 17th Ed, 3-3

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Pedestrian Load on Truss	AJL	NKN		SHT # 2
		5/28/13	6/8/16		

Summary of Staad Results: Pedestrian load on truss panel points

	Pedestrian Load (kip)
L0-L2	23.24
L2-L4	31.88
L4-L6	16.71
L6-L8	-18.52
U1-U3	-32.67
U3-U5	-27.27
U5-U7	-1.81
U7-U8	43.37
U1-L0	-33.59
U1-L2	12.89
U3-L2	0.48
U3-L4	-8.09
U5-L4	19.42
U5-L6	-27.69
U7-L6	39.25
U7-L8	-48.00
U1-L1	9.28

Positive: Tension
Negative: Compression

Along the bottom chord truss members of W-25-010, significant section loss was found near the panel points. Consequently, repair plates were designed and installed on both the inside and outside of the webs of all lower chord channel members at the gusset plate locations.

The mid-lengths of the members, between the panel points, had no significant section loss noted during inspection, so there are no additional plates added in these areas. A nominal section loss of 5% is assumed to account for any minor losses along the unreinforced member lengths.

Original sections with minimal section loss in the middle and deteriorated sections with repair plates at the ends, the more conservative section properties, are used along the entire member. The following calculations use chord member L4-L6 to show that the original section is significantly more conservative. Original sections with 5% section loss will be used for all bottom chord members.

The loading on the rehabilitated members is more complicated than a new design because dead loads present during construction caused stress in the original deteriorated section before the repair plates were added. Once the repair plates were in place, loads from reconstruction of the deck, floorbeams, stringers, and sidewalk could act on the entire repaired section, along with live loads. To account for the difference between construction loads and final loads, two separate dead load conditions are included in a rating analysis. Assume 10% of the total dead load is present during construction and acts on the member with significant section loss. The other 90% of the dead load and 100% of the live load acts on the repaired section. Stresses from both conditions are combined to create one dead load effect for the rating factor equation.

The loading on the original section with minimal section loss is straightforward because the section is unchanged between construction loading and final loading, so 100% of the dead load and 100% of the live load act on the member.

As shown in the following calculations, the capacity of the sections with 5% loss control for the bottom chord members over the sections with more loss with repair plates. The rating uses the 5% loss section properties for all members.

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	Original Section Properties	9/10/14	6/8/16		

SECTION PROPERTIES

TRUSS MEMBER **L4-L6**

2 channels MC 18 x 42.70

Ix = **554.00** in^4

Iy = **14.40** in^4

h = b - 2bf

A = **12.60** in^2

d= **18.00** in

b_f = **3.95** in

t_w = **0.45** in

x''' = **0.88** in

width b = **16.25** in

$d + t_3 + t_4$ = 18.00 in

$b_3 = b_4$ = **0.00** in

t_3 = **0.00** in

t_4 = **0.00** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b in	t in	A in^2	y in	Ay in^3	a in	Aa^2 in^4	I_0 in^4
MC18	1	-	-	12.60	9.00	113.4	0.00	0.0	554.0
MC18	2	-	-	12.60	9.00	113.4	0.00	0.0	554.0
	S			**25.20**		226.8		0	1108

A = **25.20** in^2

y' = **9.00** in

y'' = **9.00** in

I_x = **1108** in^4

r_x = **6.63** in

$S_{x\ bot}$ = **123** in^3

Section Properties about y-y Axis

	b in	t in	A in^2	x in	Ax in^3	a in	Aa^2 in^4	I_0 in^4
1	-	-	12.60	-	-	7.25	661.9	14.4
2	-	-	12.60	-	-	7.25	661.9	14.4
S			**25.20**				1324	29

A = **25.20** in^2

x' = **8.13** in

x'' = **8.13** in

I_y = **1353** in^4

r_y = **7.33** in

S_y = **166** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 2
	L4-L6	9/10/14	6/8/16		

TRUSS MEMBER **L4-L6**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

Length: Lu = **23.00** feet

Rows of Bolts: n = **5.00**

Moment of Inertia (X-Axis): **1108** in^4

Moment of Inertia (Y-Axis): **1353** in^4

Radius of Gyration (X-Axis): **6.63** in

Radius of Gyration (Y-Axis): **7.33** in

*Anet = Agross - 2n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 25.20 in^2 (gross)

Net Area: A_{net} = **20.70** in^2 (net)

Use Gross Area = **24.48** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.821 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 444.312 kips

P_{oper}= 605.88 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 621 kips

P_{oper}= 832.14 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

KL/r (X-Axis): **42** < Cc

KL/r (Y-Axis): **38** < Cc

AASHTO 10.7.1

KL/r min = 38 (K=1) KL/r < 120

Inventory Capacity

If KL/r ≤ C_c, F_a = 17.23 ksi

If KL/r > C_c, F_a = 77.92 ksi

Fa= 17.23 ksi

Pa= 434.11 kips

F_a = Fy/F.S.[1 - (KL/r)^2 Fy/4pi^2E]

F_a = 135000740/ (KL/r)^2

Operating Capacity

If KL/r ≤ C_c, F_a = 23.40 ksi

If KL/r > C_c, F_a = 118.64 ksi

Fa= 23.40 ksi

Pa= 589.61 kips

F_a = Fy/F.S.[1 - (KL/r)^2 Fy/4pi^2E]

F_a = 168363840/ (KL/r)^2

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	5% Section Loss Properties	9/10/14	6/8/16		

Assume 5% section loss to original member. Assume loss in web thickness, resulting in 5% loss in Ix, and .95^3 remaining for Iy.

SECTION PROPERTIES **TRUSS MEMBER** **L4-L6**

						width b =	**16.25**	in
	2 channels MC 18 x	**42.70**	A =	**11.97**	in^2	$d + t_3 + t_4$ =	18.00	in
Ix =	**451.24**	in^4	d=	**18.00**	in	$b_3 = b_4$ =	**0.00**	in
Iy =	**11.73**	in^4	b_f =	**3.95**	in	t_3 =	**0.00**	in
			t_w =	**0.45**	in	t_4 =	**0.00**	in
h = b - 2bf			x''' =	**0.88**	in	y' - d/2 = **e** =	0.00	in

$A = S(b_n t_n)$ *$I = S I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	0.00	0.0	451.2
MC18	2	-	-	11.97	9.00	107.7	0.00	0.0	451.2
	S			**23.94**		215.5		0	902

A =	**23.94**	in^2	**y' =**	**9.00**	in	I_x =	**902**	in^4
			y'' =	**9.00**	in			
r_x =	**6.14**	in				$S_{x\ bot}$ =	**100**	in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	11.97	-	-	7.25	628.8	11.7
2	-	-	11.97	-	-	7.25	628.8	11.7
S			**23.94**				1258	23

A =	**23.94**	in^2	**x' =**	**8.13**	in	I_y =	**1281**	in^4
			x'' =	**8.13**	in			
r_y =	**7.32**	in				S_y =	**158**	in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 2
	L4-L6	9/10/14	6/8/16		

TRUSS MEMBER **L4-L6**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

Length: Lu = **23.00** feet

Rows of Bolts: n = **5.00**

Moment of Inertia (X-Axis): **902** in^4

Moment of Inertia (Y-Axis): **1281** in^4

Radius of Gyration (X-Axis): **6.14** in

Radius of Gyration (Y-Axis): **7.32** in

*Anet = Agross - 2n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 23.94 in^2 (gross)

Net Area: A_{net} = **19.44** in^2 (net)

Use Gross Area = **23.031** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.812 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 418.0127 kips

P_{oper}= 570.0173 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 583.2 kips

P_{oper}= 781.488 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

KL/r (X-Axis): **45** < Cc

KL/r (Y-Axis): **38** < Cc

AASHTO 10.7.1

KL/r min = 38 (K=1) KL/r < 120

Inventory Capacity

If KL/r ≤ C_c, F_a = 14.66 ksi

If KL/r > C_c, F_a = 66.81 ksi

Fa= 14.66 ksi

Pa= 350.95 kips

F_a = Fy/F.S.[1 - (KL/r)^2 Fy/4pi^2E]

F_a = 135000740/ (KL/r)^2

Operating Capacity

If KL/r ≤ C_c, F_a = 18.28 ksi

If KL/r > C_c, F_a = 118.27 ksi

Fa= 18.28 ksi

Pa= 437.65 kips

F_a = Fy/F.S.[1 - (KL/r)^2 Fy/4pi^2E]

F_a = 168363840/ (KL/r)^2

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	70% Section Loss Properties	9/10/14	6/8/16		

Assume 70% total section loss, with 30%^4 remaining for Ix and Iy.

SECTION PROPERTIES

2 channels MC 18 x 42.70

Ix = **4.49** in^4

Iy = **0.12** in^4

h = b - 2bf

A = **3.78** in^2

d= **18.00** in

b_f = **3.95** in

t_w = **0.07** in

x''' = **0.88** in

TRUSS MEMBER **L4-L6**

width b = **16.25** in

$d + t_3 + t_4$ = 18.00 in

$b_3 = b_4$ = **0.00** in

t_3 = **0.00** in

t_4 = **0.00** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	3.78	9.00	34.0	0.00	0.0	4.5
MC18	2	-	-	3.78	9.00	34.0	0.00	0.0	4.5
	S			**7.56**		68.0		0	9

A = **7.56** in^2

y' = 9.00 in

y'' = 9.00 in

I_x = **9** in^4

r_x = **1.09** in

$S_{x\ bot}$ = **1** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	3.78	-	-	7.25	198.6	0.1
2	-	-	3.78	-	-	7.25	198.6	0.1
S			**7.56**				397	0

A = **7.56** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **397** in^4

r_y = **7.25** in

S_y = **49** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 2
	L4-L6	9/10/14	6/8/16		

TRUSS MEMBER **L4-L6**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.07 inches

Length: Lu = **23.00** feet

Rows of Bolts: n = **5.00**

Moment of Inertia (X-Axis): **9** in^4

Moment of Inertia (Y-Axis): **397** in^4

Radius of Gyration (X-Axis): **1.09** in

Radius of Gyration (Y-Axis): **7.25** in

*Anet = Agross - 2n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 7.56 in^2 (gross)

Net Area: A_{net} = **6.89** in^2 (net)

Use Gross Area = **7.56** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.911 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 137.214 kips

P_{oper}= 187.11 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 206.55 kips

P_{oper}= 276.777 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

KL/r (X-Axis): **253** < Cc

KL/r (Y-Axis): **38** < Cc

AASHTO 10.7.1

KL/r min = 38 (K=1) KL/r < 120

Inventory Capacity

If KL/r ≤ C_c, F_a = -15.40 ksi

If KL/r > C_c, F_a = 2.10 ksi

Fa= 2.10 ksi

Pa= 15.91 kips

F_a = Fy/F.S.[1 - (KL/r)^2 Fy/4pi^2E]

F_a = 135000740/ (KL/r)^2

Operating Capacity

If KL/r ≤ C_c, F_a = -20.92 ksi

If KL/r > C_c, F_a = 116.18 ksi

Fa= 116.18 ksi

Pa= 878.30 kips

F_a = Fy/F.S.[1 - (KL/r)^2 Fy/4pi^2E]

F_a = 168363840/ (KL/r)^2

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	70% Section Loss with Repair Plates	9/10/14	6/8/16		

Assume 70% total section loss, with 30% Iy remaining and 30% ^3 remaining for Ix.

SECTION PROPERTIES

2 channels MC 18 x 42.70

Ix = 14.96 in^4

Iy = 4.32 in^4

A = 3.78 in^2

d= 18.00 in

b_f = 3.95 in

t_w = 0.07 in

x''' = 0.88 in

TRUSS MEMBER **L4-L6**

width b = 16.25 in

$d + t_3 + t_4$ = 18.00 in

$b_3 = b_4$ = 0.00 in

t_3 = 0.00 in

t_4 = 0.00 in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b in	t in	A in^2	y in	Ay in^3	a in	Aa^2 in^4	I_0 in^4
MC18	1	-	-	3.78	9.00	34.0	0.00	0.0	15.0
MC18	2	-	-	3.78	9.00	34.0	0.00	0.0	15.0
Repair	3	12.0	1.00	12.00	9.00	108.0	0.00	0.0	144
Repair	4	12.0	1.00	12.00	9.00	108.0	0.00	0.0	144
Flange	5	2.75	0.50	1.38	17.13	23.5	8.13	90.8	0.028646
Flange	6	2.75	0.50	1.38	17.13	23.5	8.13	90.8	0.028646
Flange	7	2.75	0.50	1.38	0.88	1.2	-8.13	90.8	0.028646
Flange	8	2.75	0.50	1.38	0.88	1.2	-8.13	90.8	0.028646
	SUM			**37.06**		333.5		363	318

A = **37.06** in^2

y' = 9.00 in

y'' = 9.00 in

I_x = **681** in^4

r_x = **4.29** in

$S_{x\ bot}$ = **76** in^3

Section Properties about y-y Axis

		b in	t in	A in^2	x in	Ax in^3	a in	Aa^2 in^4	I_0 in^4
MC18	1	-	-	3.78	-	-	7.25	198.6	4.3
MC18	2	-	-	3.78	-	-	7.25	198.6	4.3
Repair	3	12.0	1.00	12.00	-	-	7.625	697.7	1
Repair	4	12.0	1.00	12.00	-	-	7.625	697.7	1
Flange	5	2.75	0.50	1.38	-	-	6.3	54.6	0.866536
Flange	6	2.75	0.50	1.38	-	-	6.3	54.6	0.866536
Flange	7	2.75	0.50	1.38	-	-	6.3	54.6	0.866536
Flange	8	2.75	0.50	1.38	-	-	6.3	54.6	0.866536
	SUM			**37.06**				2011	14

A = **37.06** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **2025** in^4

r_y = **7.39** in

S_y = **249** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 2
	L4-L6	9/10/14	6/8/16		

TRUSS MEMBER **L4-L6**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.07 inches

Length: Lu = **23.00** feet

Number of Bolts: n = **12.00**

Moment of Inertia (X-Axis): **681** in^4

Moment of Inertia (Y-Axis): **2025** in^4

Radius of Gyration (X-Axis): **4.29** in

Radius of Gyration (Y-Axis): **7.39** in

*Anet = Agross - 2n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 37.06 in^2 (gross)

Net Area: A_{net} = **25.06** in^2 (net)

Use Gross Area = **30.619** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.676 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 555.7349 kips

P_{oper}= 757.8203 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 751.8 kips

P_{oper}= 1007.412 kips

Note: The repairs are located at the ends of the members, so they do no influnce the compressive capacity of the member.

CLIENT	MassDOT		**STV Incorporated**		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating, L4-L6 Comparison	AJL	NKN		SHT # 1
	Summary of Section properties	9/10/14	6/8/16		

Summary of L4-L6 Section Properties			
	Original Section	5% Section Loss	70% SL + Repairs
A	25.20 in^2	23.94 in^2	37.06 in^2
Ix	1108 in^4	902 in^4	681 in^4
Sx	123 in^3	100 in^3	76 in^3
rx	6.63 in	6.14 in	4.29 in
Iy	1353 in^4	1281 in^4	2025 in^4
Sy	166 in^3	158 in^3	249 in^3
ry	7.33 in	7.32 in	7.39 in

CLIENT	MassDOT		**STV Incorporated**		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	Comparing Sections	9/10/14	6/8/16		

Use section properties of middle of beam (5% section loss) to the end (70% SL with repairs)

	5% Section Loss	70% SL	+Repairs	**Total repair**
A=	**23.94**	7.56	37.06	**37.06**

Tensile Capacity

Fa.inv =	**18.15** ksi	18.15	18.15	**18.15**
Fa.oper =	**24.75** ksi	24.75	24.75	**24.75**

Say 100 kip unit DL, 100 kip unit LL

Stresses

		10/A1	*90/A2*	
DL Stress =	**4.1771** ksi	1.3228	2.4285	**3.7512** ksi
LL Stress =	**4.1771** ksi		2.6983	**2.6983** ksi

Tensile Rating Factor

RF.inv =	**3.35**	**5.34**
RF.oper =	**4.93**	**7.78**

The original section properties with minimal section loss produce much lower rating factors. The 5% section loss member will be used conservatively throughout the rating for all bottom chord members.

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	L0-L2 with 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **L0-L2**

					width b =	16.25	in
2 channels MC 18 x	45.80	A =	12.83	in^2	$d + t_3 + t_4$ =	18.00	in
Ix =	470.78	in^4	d=	18.00	in	$b_3 = b_4$ =	0.00	in
Iy =	12.30	in^4	b_f =	4.00	in	t_3 =	0.00	in
			t_w =	0.50	in	t_4 =	0.00	in
h = b - 2bf			x''' =	0.87	in	y' - d/2 = **e** =	0.00	in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	12.83	9.00	115.4	0.00	0.0	470.8
MC18	2	-	-	12.83	9.00	115.4	0.00	0.0	470.8
	S			**25.65**		230.9		0	942

A =	**25.65**	in^2	**y' =**	**9.00**	in	I_x =	**942**	in^4
			y'' =	**9.00**	in			
r_x =	**6.059**	in				$S_{x\ bot}$ =	**105**	in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	12.83	-	-	7.26	675.8	12.3
2	-	-	12.83	-	-	7.26	675.8	12.3
S			**25.65**				1352	25

A =	**25.65**	in^2	**x' =**	**8.13**	in	I_y =	**1376**	in^4
			x'' =	**8.13**	in			
r_y =	**7.32**	in				S_y =	**169**	in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	L0-L2 with 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **L0-L2**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.50 inches

Length: Lu = **23.00** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **942** in^4

Moment of Inertia (Y-Axis): **1376** in^4

Radius of Gyration (X-Axis): **6.06** in

Radius of Gyration (Y-Axis): **7.32** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 25.65 in^2 (gross)

Net Area: A_{net} = **20.65** in^2 (net)

Use Gross Area = **24.4975** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.805 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 444.63 kips

P_{oper}= 606.31 kips

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 619.5 kips

P_{oper}= 830.13 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

KL/r (X-Axis): **46** < Cc

KL/r (Y-Axis): **38** < Cc

AASHTO 10.7.1 KL/r < 120

KL/r min = 38 (K=1)

Inventory Capacity

If KL/r ≤ C_c, F_a = 14.64 ksi $F_a = 15570 - .45*(KL/r)^2$

If KL/r > C_c, F_a = 65.06 ksi $F_a = 135008740/(KL/r)^2$

Fa= 14.64 ksi

Pa= 375.42 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 18.25 ksi $F_a = 19410 - .56*(KL/r)^2$

If KL/r > C_c, F_a = 81.13 ksi $F_a = 168363840/(KL/r)^2$

Fa= 18.25 ksi

Pa= 468.06 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	L2-L4 with 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **L2-L4**

2 channels MC 18 x 49.31

Ix = 510.70 in^4

Iy = 13.36 in^4

h = b - 2bf

A = 14.54 in^2

d= 18.00 in

b_f = 4.10 in

t_w = 0.60 in

x''' = 0.86 in

width b = 16.25 in

$d + t_3 + t_4$ = 18.00 in

$b_3 = b_4$ = 0.00 in

t_3 = 0.00 in

t_4 = 0.00 in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	14.54	9.00	130.8	0.00	0.0	510.7
MC18	2	-	-	14.54	9.00	130.8	0.00	0.0	510.7
	S			**29.07**		261.6		0	1021

A = **29.07** in^2

y' = 9.00 in

y'' = 9.00 in

I_x = **1021** in^4

r_x = **5.93** in

$S_{x\ bot}$ = **113** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	14.54	-	-	7.27	767.6	13.4
2	-	-	14.54	-	-	7.27	767.6	13.4
S			**29.07**				1535	27

A = **29.07** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **1562** in^4

r_y = **7.33** in

S_y = **192** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	L2-L4 with 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **L0-L2**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.60 inches

Length: Lu = **23.00** feet

Length: Lu = **23.00** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1021** in^4

Moment of Inertia (Y-Axis): **1562** in^4

Radius of Gyration (X-Axis): **5.93** in

Radius of Gyration (Y-Axis): **7.33** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 29.07 in^2 (gross)

Net Area: A_{net} = **23.07** in^2 (net)

Use Gross Area = **27.4305** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.794 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi fu= 70 ksi

Inventory fy= 24.75 ksi (0.55Fy) Inventory fu= 35 ksi (0.50Fu)

Operating fy= 33.75 ksi (0.75Fy) Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 678.9049 kips

P_{oper}= 925.7794 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 807.45 kips

P_{oper}= 1081.983 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **47** < Cc

KL/r min = 38 (K=1)

KL/r (Y-Axis): **38** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 19.43 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 62.27 ksi $F_a = 135008740/(KL/r)^2$

Fa= 19.43 ksi

Pa= 564.84 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 24.22 ksi $F_a = 26{,}470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 77.66 ksi $F_a = 168363840/(KL/r)^2$

Fa= 24.22 ksi

Pa= 703.94 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	L4-L6 with 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **L4-L6**

width b = **16.25** in

2 channels MC 18 x 40.57

Ix = **451.24** in^4

Iy = **11.73** in^4

h = b - 2bf

A = **11.97** in^2

d= **18.00** in

b_f = **3.95** in

t_w = **0.45** in

x''' = **0.88** in

$d + t_3 + t_4$ = 18.00 in

$b_3 = b_4$ = **0.00** in

t_3 = **0.00** in

t_4 = **0.00** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n t_n)$ *$I = S I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	0.00	0.0	451.2
MC18	2	-	-	11.97	9.00	107.7	0.00	0.0	451.2
	S			**23.94**		215.5		0	902

A = **23.94** in^2

y' = 9.00 in

y'' = 9.00 in

I_x = **902** in^4

r_x = **6.14** in

$S_{x\ bot}$ = **100** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	11.97	-	-	7.25	628.8	11.7
2	-	-	11.97	-	-	7.25	628.8	11.7
S			**23.94**				1258	23

A = **23.94** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **1281** in^4

r_y = **7.32** in

S_y = **158** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	L4-L6 with 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **L4-L6**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

Length: Lu = **23.00** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **902** in^4

Moment of Inertia (Y-Axis): **1281** in^4

Radius of Gyration (X-Axis): **6.14** in

Radius of Gyration (Y-Axis): **7.32** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 23.94 in^2 (gross)

Net Area: A_{net} = **19.44** in^2 (net)

Use Gross Area = **23.031** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.812 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi fu= 60 ksi

Inventory fy= 18.15 ksi (0.55Fy) Inventory fu= 30 ksi (0.50Fu)

Operating fy= 24.75 ksi (0.75Fy) Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 418.0127 kips

P_{oper}= 570.0173 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 583.2 kips

P_{oper}= 781.488 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

KL/r (X-Axis): **45** < Cc

KL/r (Y-Axis): **38** < Cc

AASHTO 10.7.1

KL/r min = 38

KL/r < (K=1) 120

Inventory Capacity

If KL/r ≤ C_c, F_a = 14.66 ksi $F_a = 15570 - .45*(KL/r)^2$

If KL/r > C_c, F_a = 66.81 ksi $F_a = 135008740/(KL/r)^2$

Fa= 14.66 ksi

Pa= 350.98 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 18.28 ksi $F_a = 19410 - .56*(KL/r)^2$

If KL/r > C_c, F_a = 83.32 ksi $F_a = 168363840/(KL/r)^2$

Fa= 18.28 ksi

Pa= 437.58 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	L6-L8 with 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **L6-L8**

2 channels MC 18 x 40.57

Ix = 451.24 in^4

Iy = 11.73 in^4

h = b - 2bf

A = 11.97 in^2

d= 18.00 in

b_f = 3.95 in

t_w = 0.45 in

x''' = 0.88 in

width b = 16.25 in

$d + t_3 + t_4$ = 19.00 in

$b_3 = b_4$ = 16.00 in

t_3 = 0.50 in

t_4 = 0.50 in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	0.00	0.0	451.2
MC18	2	-	-	11.97	9.00	107.7	0.00	0.0	451.2
	3	16.00	0.50	8.00	9.00	72.0	0.00	0.0	170.7
	4	16.00	0.50	8.00	9.00	72.0	0.00	0.0	170.7
	S			**39.94**		359.5		0	1244

A = **39.94** in^2 **y' = 9.00** in I_x = **1244** in^4

r_x = **5.58** in $S_{x\ bot}$ = **138** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	11.97	-	-	7.25	628.8	11.7
2	-	-	11.97	-	-	7.25	628.8	11.7
3	16.00	0.50	8.00	-0.25	-2.0	-8.38	561.1	0.2
4	16.00	0.50	8.00	16.50	132.0	8.38	561.1	0.2
S			**39.94**				2380	24

A = **39.94** in^2 **x' = 8.13** in I_y = **2404** in^4

r_y = **7.76** in S_y = **296** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	L6-L8 with 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **L6-L8**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

Length: Lu = **23.00** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1244** in^4

Moment of Inertia (Y-Axis): **2404** in^4

Radius of Gyration (X-Axis): **5.58** in

Radius of Gyration (Y-Axis): **7.76** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 39.94 in^2 (gross)

Net Area: A_{net} = **35.44** in^2 (net)

Use Gross Area = **39.94** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.887 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 724.911 kips

P_{oper}= 988.515 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 1063.2 kips

P_{oper}= 1424.688 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

AASHTO 10.7.1

KL/r < 120

KL/r (X-Axis): **49** < Cc

KL/r min = 36 (K=1)

KL/r (Y-Axis): **36** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 14.47 ksi $F_a = 15570 - .45*(KL/r)^2$

If KL/r > C_c, F_a = 55.19 ksi $F_a = 135008740/(KL/r)^2$

Fa= 14.47 ksi

Pa= 577.90 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 18.04 ksi $F_a = 19410 - .56*(KL/r)^2$

If KL/r > C_c, F_a = 68.83 ksi $F_a = 168363840/(KL/r)^2$

Fa= 18.04 ksi

Pa= 720.53 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U1-U3 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U1-U3**

2 channels MC 18 x 42.70

Ix = 451.24 in^4

Iy = 11.73 in^4

h = b - 2bf

A = 11.97 in^2

d= 18.00 in

b_f = 3.95 in

t_w = 0.45 in

x''' = 0.88 in

width b = 16.25 in

$d + t_3 + t_4$ = 18.88 in

$b_3 = b_4$ = b5 = 16.00 in

t_3 = 0.38 in

t_4 = t5 = 0.50 in

y' - d/2 = **e** = 1.20 in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	-1.20	17.2	451.2
MC18	2	-	-	11.97	9.00	107.7	-1.20	17.2	451.2
	3	16.00	0.38	6.00	18.19	109.1	7.99	382.8	0.1
	4	16.00	0.50	8.00	9.00	72.0	-1.20	11.5	170.7
	5	16.00	0.50	8.00	9.00	72.0	-1.20	11.5	170.7
	S			**45.94**		468.6		440	1244

A = **45.94** in^2 **y' = 10.20** in I_x = **1684** in^4

r_x = **6.05** in $S_{x\ bot}$ = **165** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	11.97	-	-	7.25	628.8	11.7
2	-	-	11.97	-	-	7.25	628.8	11.7
3	16.00	0.38	6.00	-	-	0.00	0.0	128.0
4	16.00	0.50	8.00	-	-	8.38	561.1	0.2
5	16.00	0.50	8.00	-	-	8.38	561.1	0.2
S			**45.94**				2380	152

A = **45.94** in^2 **x' = 8.13** in I_y = **2532** in^4

x'' = 8.13 in

r_y = **7.42** in S_y = **312** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U1-U3 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U1-U3**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

$$L_u = \sqrt{a^2 + b^2} =$$

a = **23.00** ft

b = **4.00** ft

Length: Lu = **23.35** feet

Number of Bolts: n = **10**

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Moment of Inertia (X-Axis): **1684** in^4

Moment of Inertia (Y-Axis): **2532** in^4

Radius of Gyration (X-Axis): **6.05** in

Radius of Gyration (Y-Axis): **7.42** in

Gross Area: A_{gross} = 45.94 in^2 (gross)

Net Area: A_{net} = **41.44** in^2 (net)

Use Gross Area = **45.94** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.902 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi

Inventory fy= 24.75 ksi (0.55Fy)

Operating fy= 33.75 ksi (0.75Fy)

fu= 70 ksi

Inventory fu= 35 ksi (0.50Fu)

Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y * A_{gross}$)

P_{inv}= 1137.0 kips

P_{oper}= 1550.5 kips

Fracture at Net Section ($P=F_u * A_{net}$)

P_{inv}= 1450.4 kips

P_{oper}= 2154.586 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1

KL/r < 120

KL/r (X-Axis): **46** < Cc

KL/r (Y-Axis): **38** < Cc

KL/r min = 38 (K=1)

Inventory Capacity

If KL/r ≤ C_c, F_a = 19.45 ksi

If KL/r > C_c, F_a = 63.07 ksi

Fa= 19.45 ksi

Pa= 893.68 kips

F_a = 21230 - .83(KL/r)^2*

F_a = 135008740/ (KL/r)^2

Operating Capacity

If KL/r ≤ C_c, F_a = 24.24 ksi

If KL/r > C_c, F_a = 78.65 ksi

Fa= 24.24 ksi

Pa= 1113.8 kips

F_a = 26,470 - 1.04(KL/r)^2*

F_a = 168363840/ (KL/r)^2

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U3-U5 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U3-U5**

2 channels MC 18 x 42.70

Ix = **451.24** in^4

Iy = **11.73** in^4

h = b - 2bf

A = **11.97** in^2

d= **18.00** in

b_f = **3.95** in

t_w = **0.45** in

x''' = **0.88** in

width b = **16.25** in

$d + t_3 + t_4$ = 18.38 in

$b_3 = b_4$ = **16.00** in

t_3 = **0.38** in

t_4 = **0.00** in

y' - d/2 = **e** = 1.84 in

$A = S(b_n t_n)$ *$I = S I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	-1.84	40.6	451.2
MC18	2	-	-	11.97	9.00	107.7	-1.84	40.6	451.2
	3	16.00	0.38	6.00	18.19	109.1	7.35	323.8	0.1
	S			**29.94**		324.6		405	903

A = **29.94** in^2

y' = **10.84** in

y'' = **7.53** in

I_x = **1308** in^4

r_x = **6.61** in

$S_{x\ bot}$ = **121** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	11.97	-	-	7.25	628.8	11.7
2	-	-	11.97	-	-	7.25	628.8	11.7
3	16.00	0.38	6.00	-	-	0.00	0.0	128.0
S			**29.94**				1258	151

A = **29.94** in^2

x' = **8.13** in

x'' = **8.13** in

I_y = **1409** in^4

r_y = **6.86** in

S_y = **173** in^3

	MassDOT		STV Incorporated		
	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U3-U5 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U3-U5**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

a = **23.00** ft

b = **2.00** ft

Length: Lu = **23.09** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1308** in^4

Moment of Inertia (Y-Axis): **1409** in^4

Radius of Gyration (X-Axis): **6.61** in

Radius of Gyration (Y-Axis): **6.86** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 29.94 in^2 (gross)

Net Area: A_{net} = **25.44** in^2 (net)

Use Gross Area = **29.931** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.850 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi

Inventory fy= 24.75 ksi (0.55Fy)

Operating fy= 33.75 ksi (0.75Fy)

fu= 70 ksi

Inventory fu= 35 ksi (0.50Fu)

Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 740.7923 kips

P_{oper}= 1010.171 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 890.4 kips

P_{oper}= 1193.136 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **42** < Cc

KL/r min = 40 (K=1)

KL/r (Y-Axis): **40** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 19.77 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 76.82 ksi $F_a = 135008740/(KL/r)^2$

Fa= 19.77 ksi

Pa= 591.95 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 24.64 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 95.80 ksi $F_a = 168363840/(KL/r)^2$

Fa= 24.64 ksi

Pa= 737.79 kips

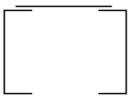
CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U5-U7 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U5-U7**

2 channels MC 18 x 42.70

Ix = **451.24** in^4

Iy = **11.73** in^4



h = b - 2bf

A = **11.97** in^2

d= **18.00** in

b_f = **3.95** in

t_w = **0.45** in

x''' = **0.88** in

width b = **16.25** in

$d + t_3 + t_4$ = 18.38 in

$b_3 = b_4$ = **16.00** in

t_3 = **0.38** in

t_4 = **0.00** in

Access hole h = 10.00 in

y' - d/2 = **e** = 1.84 in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	-1.84	40.6	451.2
MC18	2	-	-	11.97	9.00	107.7	-1.84	40.6	451.2
	3	16.00	0.38	6.00	18.19	109.1	7.35	323.8	0.1
	S			**29.94**		324.6		405	903

A = **29.94** in^2

y' = **10.84** in

y'' = **7.53** in

I_x = **1308** in^4

r_x = **6.61** in

$S_{x\ bot}$ = **121** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	11.97	-	-	7.25	628.8	11.7
2	-	-	11.97	-	-	7.25	628.8	11.7
3	16.00	0.38	6.00	-	-	0.00	0.0	128.0
S			**29.94**				1258	151

A = **29.94** in^2

x' = **8.13** in

x'' = **8.13** in

I_y = **1409** in^4

r_y = **6.86** in

S_y = **173** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U5-U7 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U5-U7**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

a = **23.00** ft

b = **1.00** ft

Length: Lu = **23.02** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1308** in^4

Moment of Inertia (Y-Axis): **1409** in^4

Radius of Gyration (X-Axis): **6.61** in

Radius of Gyration (Y-Axis): **6.86** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 29.94 in^2 (gross)

Net Area: A_{net} = **25.44** in^2 (net)

Use Gross Area = **29.931** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.850 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 543.2477 kips

P_{oper}= 740.7923 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 763.2 kips

P_{oper}= 1022.688 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **42** < Cc

KL/r min = 40 (K=1)

KL/r (Y-Axis): **40** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 14.78 ksi $F_a = 15570 - .45*(KL/r)^2$

If KL/r > C_c, F_a = 77.25 ksi $F_a = 135008740/(KL/r)^2$

Fa= 14.78 ksi

Pa= 442.62 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 18.43 ksi $F_a = 19410 - .56*(KL/r)^2$

If KL/r > C_c, F_a = 96.34 ksi $F_a = 168363840/(KL/r)^2$

Fa= 18.43 ksi

Pa= 551.83 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U7-U8 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U7-U8**

2 channels MC 18 x 42.70

Ix = 451.24 in^4

Iy = 11.73 in^4

h = b - 2bf

A = 11.97 in^2

d= 18.00 in

b_f = 3.95 in

t_w = 0.45 in

x''' = 0.877 in

width b = 16.25 in

b_3 = 16.00 in

t_3 = 0.375 in

t4 = t5 = 15.00 in

b4 = b5 = 0.3750 in

y' - d/2 = **e** = 1.34 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	9.00	107.7	-1.34	21.4	451.2
MC18	2	-	-	11.97	9.00	107.7	-1.34	21.4	451.2
Top PL	3	16.00	0.38	6.00	18.19	109.1	7.85	369.7	0.1
Side PL	4	0.38	15.00	5.63	9.00	50.6	-1.34	10.1	105.5
Side PL	5	0.38	15.00	5.63	9.00	50.6	-1.34	10.1	105.5
	S			**41.19**		425.8		433	1113

A = **41.19** in^2 **y' =** **10.34** in I_x = **1546** in^4

r_x = **6.13** in $S_{x\ bot}$ = **150** in^3

Section Properties about y-y Axis

		b	t	A	x	Ax	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	11.97	-	-	7.25	628.8	11.7
MC18	2	-	-	11.97	-	-	7.25	628.8	11.7
Top PL	3	16.00	0.38	6.00	-	-	0.00	0.0	128.0
Side PL	4	0.38	15.00	5.63	-	-	16.06	1451.3	0.1
Side PL	5	0.38	15.00	5.63	-	-	16.06	1451.3	0.1
	S			**41.19**				4160	152

A = **41.19** in^2 **x' =** **8.13** in I_y = **4312** in^4

r_y = **10.23** in S_y = **531** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U7-U8 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U7-U8**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.45 inches

a = **23.00** ft

b = **0.00** ft

Length: Lu = **23.00** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1546** in^4

Moment of Inertia (Y-Axis): **4312** in^4

Radius of Gyration (X-Axis): **6.13** in

Radius of Gyration (Y-Axis): **10.23** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 41.19 in^2 (gross)

Net Area: A_{net} = **36.69** in^2 (net)

Use Gross Area = **41.19** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.891 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi

Inventory fy= 24.75 ksi (0.55Fy)

Operating fy= 33.75 ksi (0.75Fy)

fu= 70 ksi

Inventory fu= 35 ksi (0.50Fu)

Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 1019.453 kips

P_{oper}= 1390.163 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 1284.15 kips

P_{oper}= 1720.761 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1

KL/r < 120

KL/r (X-Axis): **45** < Cc

KL/r min = 27 (K=1)

KL/r (Y-Axis): **27** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 19.55 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 66.53 ksi $F_a = 135008740/(KL/r)^2$

Fa= 19.55 ksi

Pa= 805.09 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 24.36 ksi $F_a = 26{,}470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 82.97 ksi $F_a = 168363840/(KL/r)^2$

Fa= 24.36 ksi

Pa= 1003.4 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U1-L0 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U1-L0**

2 channels MC 18 x 51.90

Ix = **510.7** in^4

Iy = **13.4** in^4

h = b - 2bf

A = **14.54** in^2

d= **18.00** in

b_f = **4.10** in

t_w = **0.60** in

x''' = **0.86** in

width b = **16.25** in

$d + t_3 + t_4$ = 18.88 in

b_3 = **16.00** in

t_3 = **0.38** in

t_4 = t5 = **0.50** in

b4 = b5 = **17.00** in

y' - d/2 = **e** = 1.06 in

$A = S(b_n\ t_n)$ *$I = S I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

x-x Axis		b	t	A	y	Ay	a	Aa^2	I_{0X}
MC18	1	-	-	14.54	9.00	130.8	-1.06	16.3	510.7
MC18	2	-	-	14.54	9.00	130.8	-1.06	16.3	510.7
Top PL	3	16.00	0.38	6.00	18.19	109.1	8.13	396.5	0.1
Side PL	4	17.00	0.50	8.50	9.00	76.5	-1.06	9.5	204.7
Side PL	5	17.00	0.50	8.50	9.00	76.5	-1.06	9.5	204.7
	S			**52.07**		523.8		448	1431

A = **52.07** in^2

y' = **10.06** in

y'' = **8.32** in

I_x = **1879** in^4

r_x = **6.01** in

$S_{x\ bot}$ = **187** in^3

y-y Axis		b	t	A	x	Ax	a	Aa^2	I_{0Y}
MC18	1	-	-	14.54	-	-	7.27	767.6	13.4
MC18	2	-	-	14.54	-	-	7.27	767.6	13.4
Top PL	3	16.00	0.38	6.00	-	-	0.00	0.0	128.0
Side PL	4	0.00	1878.98	0.00	939.49	0.0	929.43	0.0	0.0
Side PL	5	1878.98	0.00	0.00	10.06	0.0	0.00	0.0	0.0
	S			**35.07**				1535	155

A = **35.07** in^2

x' = **8.13** in

x'' = **8.13** in

I_y = **1690** in^4

r_y = **6.94** in

S_y = **208** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U1-L0 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U1-L0**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.60 inches

a = **23.00** ft

b = **24.00** ft

Length: Lu = **33.24** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1879** in^4

Moment of Inertia (Y-Axis): **1690** in^4

Radius of Gyration (X-Axis): **6.01** in

Radius of Gyration (Y-Axis): **6.94** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 52.07 in^2 (gross)

Net Area: A_{net} = **46.07** in^2 (net)

Use Gross Area = **52.07** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.885 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi

Inventory fy= 24.75 ksi (0.55Fy)

Operating fy= 33.75 ksi (0.75Fy)

fu= 70 ksi

Inventory fu= 35 ksi (0.50Fu)

Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 1288.733 kips

P_{oper}= 1757.363 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 1612.45 kips

P_{oper}= 2160.683 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **66** < Cc

KL/r (Y-Axis): **57** < Cc

KL/r min = 57 (K=1)

Inventory Capacity

If KL/r ≤ C_c, F_a = 17.57 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 30.62 ksi $F_a = 135008740/(KL/r)^2$

Fa= 17.57 ksi

Pa= 914.88 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 21.88 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 38.18 ksi $F_a = 168363840/(KL/r)^2$

Fa= 21.88 ksi

Pa= 1139.51 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U1-L2 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U1-L2**

2 channels C 15 x 33.9

Ix = **256.57** in^4

Iy = **6.62** in^4

h = b - 2bf

A = **9.46** in^2

d= **15.00** in

b_f = **3.40** in

t_w = **0.40** in

x''' = **0.79** in

width b = **16.25** in

$d + t_3 + t_4$ = 15.00 in

$b_3 = b_4$ = **0.00** in

t_3 = **0.00** in

t_4 = **0.00** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
C15	1	-	-	9.46	7.50	71.0	0.00	0.0	256.6
C15	2	-	-	9.46	7.50	71.0	0.00	0.0	256.6
	S			**18.92**		141.9		0	513

A = **18.92** in^2

y' = 7.50 in

y'' = 7.50 in

I_x = **513** in^4

r_x = **5.21** in

$S_{x\,bot}$ = **68** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	9.46	-	-	7.34	509.5	6.6
2	-	-	9.46	-	-	7.34	509.5	6.6
S			**18.92**				1019	13

A = **18.92** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **1032** in^4

r_y = **7.39** in

S_y = **127** in^3

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U1-L2 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U1-L2**

Width = 16.25 inches

Depth: d = 15.00 inches

Thickness: t_1 = 0.40 inches

a = **23.00** ft

b = **24.00** ft

Length: Lu = **33.24** feet

Number of Bolts: n = **8**

Moment of Inertia (X-Axis): **513** in^4

Moment of Inertia (Y-Axis): **1032** in^4

Radius of Gyration (X-Axis): **5.21** in

Radius of Gyration (Y-Axis): **7.39** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 18.92 in^2 (gross)

Net Area: A_{net} = **15.72** in^2 (net)

Use Gross Area = **18.5626** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.831 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 65 ksi

Inventory fu= 32.5 ksi (0.50Fu)

Operating fu= 43.55 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 336.9112 kips

P_{oper}= 459.4244 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 511.03 kips

P_{oper}= 684.7802 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **77** < Cc

KL/r min = 54 (K=1)

KL/r (Y-Axis): **54** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 12.93 ksi $F_a = 15570 - .45*(KL/r)^2$

If KL/r > C_c, F_a = 23.01 ksi $F_a = 135008740/(KL/r)^2$

Fa= 12.93 ksi

Pa= 244.67 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 16.12 ksi $F_a = 19410 - .56*(KL/r)^2$

If KL/r > C_c, F_a = 28.69 ksi $F_a = 168363840/(KL/r)^2$

Fa= 16.12 ksi

Pa= 305.13 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U3-L2 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U3-L2**

width b = **16.25** in

2 channels C 12 x 25

Ix = **117.29** in^4

Iy = **3.64** in^4

h = b - 2bf

A = **6.98** in^2

d= **12.00** in

b_f = **3.05** in

t_w = **0.39** in

x''' = **0.67** in

$d + t_3 + t_4$ = 12.00 in

$b_3 = b_4$ = **0.00** in

t_3 = **0.00** in

t_4 = **0.00** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
C12	1	-	-	6.98	6.00	41.9	0.00	0.0	117.3
C12	2	-	-	6.98	6.00	41.9	0.00	0.0	117.3
	S			**13.97**		83.8		0	235

A = **13.97** in^2

y' = 6.00 in

y'' = 6.00 in

I_x = **235** in^4

r_x = **4.10** in

$S_{x\ bot}$ = **39** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	6.98	-	-	7.45	387.7	3.6
2	-	-	6.98	-	-	7.45	387.7	3.6
S			**13.97**				775	7

A = **13.97** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **783** in^4

r_y = **7.49** in

S_y = **96** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U3-L2 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U3-L2**

Width = 16.25 in

Depth: d = 12.00 in

Thickness: t_1 = 0.39 in

a = **23.00** ft

b = **32.00** ft

Length: Lu = **39.41** ft

Number of Bolts: n = **6**

Moment of Inertia (X-Axis): **235** in^4

Moment of Inertia (Y-Axis): **783** in^4

Radius of Gyration (X-Axis): **4.10** in

Radius of Gyration (Y-Axis): **7.49** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 13.97 in^2 (gross)

Net Area: A_{net} = **11.64** in^2 (net)

Use Gross Area = **13.73775** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.834 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 249.3402 kips

P_{oper}= 340.0093 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 349.29 kips

P_{oper}= 468.0486 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

KL/r (X-Axis): **115** < Cc

KL/r (Y-Axis): **63** < Cc

AASHTO 10.7.1

KL/r min = 63

KL/r < 120

(K=1)

Inventory Capacity

If KL/r ≤ C_c, F_a = 9.58 ksi

If KL/r > C_c, F_a = 10.14 ksi

Fa= 9.58 ksi

Pa= 133.77 kips

$F_a = 15570 - .45*(KL/r)^2$

$F_a = 135008740/(KL/r)^2$

Operating Capacity

If KL/r ≤ C_c, F_a = 11.95 ksi

If KL/r > C_c, F_a = 12.65 ksi

Fa= 11.95 ksi

Pa= 166.94 kips

$F_a = 19410 - .56*(KL/r)^2$

$F_a = 168363840/(KL/r)^2$

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U3-L4 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U3-L4**

2 channels C 12 x 30

Ix = **131.95** in^4

Iy = **4.19** in^4

h = b - 2bf

A = **8.38** in^2

d= **12.00** in

b_f = **3.17** in

t_w = **0.51** in

x''' = **0.67** in

width b = **16.25** in

$d + t_3 + t_4$ = 13.00 in

$b_3 = b_4$ = **11.00** in

t_3 = **0.50** in

t_4 = **0.50** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
C12	1	-	-	8.38	6.00	50.3	0.00	0.0	132.0
C12	2	-	-	8.38	6.00	50.3	0.00	0.0	132.0
	3	11.00	0.50	5.50	6.00	33.0	0.00	0.0	55.5
	4	11.00	0.50	5.50	6.00	33.0	0.00	0.0	55.5
	S			**27.76**		166.5		0	375

A = **27.76** in^2

y' = **6.00** in

y'' = **6.50** in

I_x = **375** in^4

r_x = **3.67** in

$S_{x\ bot}$ = **62** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	8.38	-	-	7.45	465.2	4.2
2	-	-	8.38	-	-	7.45	465.2	4.2
3	11.00	0.50	5.50	-	-	8.38	385.8	0.1
4	11.00	0.50	5.50	-	-	8.38	385.8	0.1
S			**27.76**				1702	9

A = **27.76** in^2

x' = **8.13** in

x'' = **8.13** in

I_y = **1711** in^4

r_y = **7.85** in

S_y = **211** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U3-L4 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U3-L4**

Width = 16.25 inches

Depth: d = 12.00 inches

Thickness: t_1 = 0.51 inches

a = **23.00** ft

b = **32.00** ft

Length: Lu = **39.41** feet

Number of Bolts: n = **6**

Moment of Inertia (X-Axis): **375** in^4

Moment of Inertia (Y-Axis): **1711** in^4

Radius of Gyration (X-Axis): **3.67** in

Radius of Gyration (Y-Axis): **7.85** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 27.76 in^2 (gross)

Net Area: A_{net} = **24.70** in^2 (net)

Use Gross Area = **27.76** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.890 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi fu= 70 ksi

Inventory fy= 24.75 ksi (0.55Fy) Inventory fu= 35 ksi (0.50Fu)

Operating fy= 33.75 ksi (0.75Fy) Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 687.0105 kips

P_{oper}= 936.8325 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 864.43 kips

P_{oper}= 1158.3362 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

KL/r (X-Axis): **129** > Cc KL/r min = 60 (K=1)

KL/r (Y-Axis): **60** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 7.48 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 8.15 ksi $F_a = 135008740/(KL/r)^2$

Fa= 8.15 ksi

Pa= 226.28 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 9.25 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 10.17 ksi $F_a = 168363840/(KL/r)^2$

Fa= 10.17 ksi

Pa= 282.18 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U5-L4 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U5-L4**

2 channels MC 12 x 35

Ix = **175.93** in^4

Iy = **10.34** in^4

h = b - 2bf

A = **9.79** in^2

d= **12.00** in

b_f = **3.77** in

t_w = **0.47** in

x''' = **1.05** in

width b = **16.25** in

$d + t_3 + t_4$ = 12.00 in

$b_3 = b_4$ = **0.00** in

t_3 = **0.00** in

t_4 = **0.00** in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I/y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC12	1	-	-	9.79	6.00	58.7	0.00	0.0	175.9
MC12	2	-	-	9.79	6.00	58.7	0.00	0.0	175.9
	S			**19.57**		117.4		0	352

A = **19.57** in^2

y' = 6.00 in

y'' = 6.00 in

I_x = **352** in^4

r_x = **4.24** in

$S_{x\ bot}$ = **59** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	9.79	-	-	7.08	489.8	10.3
2	-	-	9.79	-	-	7.08	489.8	10.3
S			**19.57**				980	21

A = **19.57** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **1000** in^4

r_y = **7.15** in

S_y = **123** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U5-L4 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U5-L4**

Width = 16.25 inches

Depth: d = 12.00 inches

Thickness: t_1 = 0.47 inches

a = **23.00** ft

b = **36.00** ft

Length: Lu = **42.72** feet

Number of Bolts: n = **6**

Moment of Inertia (X-Axis): **352** in^4

Moment of Inertia (Y-Axis): **1000** in^4

Radius of Gyration (X-Axis): **4.24** in

Radius of Gyration (Y-Axis): **7.15** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 19.57 in^2 (gross)

Net Area: A_{net} = **16.77** in^2 (net)

Use Gross Area = **19.57** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.857 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi fu= 70 ksi

Inventory fy= 24.75 ksi (0.55Fy) Inventory fu= 35 ksi (0.50Fu)

Operating fy= 33.75 ksi (0.75Fy) Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 484.3575 kips

P_{oper}= 660.4875 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 586.88 kips

P_{oper}= 786.4192 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **121** > Cc

KL/r min = 72 (K=1)

KL/r (Y-Axis): **72** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 9.10 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 9.24 ksi $F_a = 135008740/(KL/r)^2$

Fa= 9.24 ksi

Pa= 180.77 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 11.27 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 11.52 ksi $F_a = 168363840/(KL/r)^2$

Fa= 11.52 ksi

Pa= 225.42 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U5-L6 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U5-L6**

width b = **16.25** in

2 channels C 15 x 40.00

A = **11.21** in^2

Ix = **284.26** in^4

d= **15.00** in

Iy = **7.52** in^4

b_f = **3.52** in

t_w = **0.52** in

x''' = **0.777** in

h = b - 2bf

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$

$d + t_3 + t_4$ = 16.25 in

$b_3 = b_4$ = **12.00** in

t_3 = t4 = **0.50** in

t_5 = t6 = **0.75** in

b5 = b6 = **14.00** in

y' - d/2 = **e** = 0.00 in

Section Properties about x-x Axis $r = (I/A)^{1/2}$ $S = I / y$

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
C15	1	-	-	11.21	7.50	84.1	0.00	0.0	284.3
C15	2	-	-	11.21	7.50	84.1	0.00	0.0	284.3
Side PL	3	12.00	0.50	6.00	7.50	45.0	0.00	0.0	72.0
Side PL	4	12.00	0.50	6.00	7.50	45.0	0.00	0.0	72.0
Side PL	5	14.00	0.75	10.50	7.50	78.8	0.00	0.0	171.5
Side PL	6	14.00	0.75	10.50	7.50	78.8	0.00	0.0	171.5
	S			**55.42**		415.7		0	1056

A = **55.42** in^2 **y' = 7.50** in I_x = **1056** in^4

y'' = 8.00 in

r_x = **4.36** in $S_{x\ bot}$ = **141** in^3

Section Properties about y-y Axis

		b	t	A	x	Ax	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
C15	1	-	-	11.21	-	-	7.35	605.3	7.5
C15	2	-	-	11.21	-	-	7.35	605.3	7.5
Side PL	3	12.00	0.50	6.00	-	-	7.36	0.0	0.125
Side PL	4	12.00	0.50	6.00	-	-	7.36	0.0	0.125
Side PL	5	14.00	0.75	10.50	-	-	8.50	758.6	0.5
Side PL	6	14.00	0.75	10.50	-	-		0.0	0.5
	S			**55.42**				1969	16

A = **55.42** in^2 **x' = 8.13** in I_y = **1985** in^4

x'' = 8.13 in

r_y = **5.99** in S_y = **244** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U5-L6 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U5-L6**

Width = 16.25 inches

Depth: d = 15.00 inches

Thickness: t_1 = 0.52 inches

a = **23.00** ft

b = **36.00** ft

Length: Lu = **42.72** feet

Number of Bolts: n = **8**

Moment of Inertia (X-Axis): **1056** in^4

Moment of Inertia (Y-Axis): **1985** in^4

Radius of Gyration (X-Axis): **4.36** in

Radius of Gyration (Y-Axis): **5.99** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 55.42 in^2 (gross)

Net Area: A_{net} = **51.26** in^2 (net)

Use Gross Area = **55.42** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.925 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi fu= 70 ksi

Inventory fy= 24.75 ksi (0.55Fy) Inventory fu= 35 ksi (0.50Fu)

Operating fy= 33.75 ksi (0.75Fy) Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 1371.645 kips

P_{oper}= 1870.425 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 1794.1 kips

P_{oper}= 2404.094 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **117** > Cc

KL/r min = 86 (K=1)

KL/r (Y-Axis): **86** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 9.78 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 9.78 ksi $F_a = 135008740/(KL/r)^2$

Fa= 9.78 ksi

Pa= 542.26 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 12.12 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 12.20 ksi $F_a = 168363840/(KL/r)^2$

Fa= 12.20 ksi

Pa= 676.23 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U7-L6 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U7-L6**

2 channels MC 18 x 58.00

Ix = 550.61 in^4

Iy = 14.50 in^4

h = b - 2bf

A = 16.25 in^2

d= 18.00 in

b_f = 4.20 in

t_w = 0.70 in

x''' = 0.86 in

width b = 16.25 in

$d + t_3 + t_4$ = 18.00 in

$b_3 = b_4$ = 0.00 in

t_3 = 0.00 in

t_4 = 0.00 in

y' - d/2 = **e** = 0.00 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ $r = (I/A)^{1/2}$ $S = I / y$

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	16.25	9.00	146.2	0.00	0.0	550.6
MC18	2	-	-	16.25	9.00	146.2	0.00	0.0	550.6
	S			**32.49**		292.4		0	1101

A = **32.49** in^2

y' = 9.00 in

y'' = 9.00 in

I_x = **1101** in^4

r_x = **5.82** in

$S_{x\ bot}$ = **122** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	16.25	-	-	7.26	856.9	14.5
2	-	-	16.25	-	-	7.26	856.9	14.5
S			**32.49**				1714	29

A = **32.49** in^2

x' = 8.13 in

x'' = 8.13 in

I_y = **1743** in^4

r_y = **7.32** in

S_y = **215** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U7-L6 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U7-L6**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.70 inches

a = **23.00** ft

b = **38.00** ft

Length: Lu = **44.42** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **1101** in^4

Moment of Inertia (Y-Axis): **1743** in^4

Radius of Gyration (X-Axis): **5.82** in

Radius of Gyration (Y-Axis): **7.32** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 32.49 in^2 (gross)

Net Area: A_{net} = **25.49** in^2 (net)

Use Gross Area = **30.3635** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.785 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi

Inventory fy= 24.75 ksi (0.55Fy)

Operating fy= 33.75 ksi (0.75Fy)

fu= 70 ksi

Inventory fu= 35 ksi (0.50Fu)

Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 751.4966 kips

P_{oper}= 1024.768 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 892.15 kips

P_{oper}= 1195.481 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **92** < Cc

KL/r (Y-Axis): **73** < Cc

KL/r min = 73 (K=1)

Inventory Capacity

If KL/r ≤ C_c, F_a = 14.27 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 16.11 ksi $F_a = 135008740/(KL/r)^2$

Fa= 14.27 ksi

Pa= 463.72 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 17.75 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 20.09 ksi $F_a = 168363840/(KL/r)^2$

Fa= 17.75 ksi

Pa= 576.77 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U7-L8 w/ 5% Section Loss	9/10/14	6/8/16		

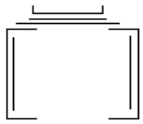
SECTION PROPERTIES **TRUSS MEMBER** **U7-L8**

2 channels MC 18 x 58.00

Ix = 550.61 in^4

Iy = 14.50 in^4

h = b - 2bf



A = 16.25 in^2

d= 18.00 in

b_f = 4.20 in

t_w = 0.70 in

x''' = 0.862 in

width b = 16.25 in

b_3 = 16.00 in

t_3 = 0.375 in

t4 = t5 = 15.00 in

b4 = b5 = 0.5625 in

b6= 9.00 in

t6= 1.25 in

$A = S(b_n\ t_n)$ $I = S\,I_0 + Ay^2$ y' - d/2 = **e** = 4.16 in

Section Properties about x-x Axis $r = (I/A)^{1/2}$ $S = I / y$

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	16.25	9.00	146.2	-4.16	280.9	550.6
MC18	2	-	-	16.25	9.00	146.2	-4.16	280.9	550.6
Top PL	3	16.00	0.38	6.00	18.19	109.1	5.03	151.8	0.1
Side PL	4	0.56	15.00	8.44	9.00	75.9	-4.16	145.9	158.2
Side PL	5	0.56	15.00	8.44	9.00	75.9	-4.16	145.9	158.2
Top PL	6	9.00	1.25	11.25	19.00	213.8	5.84	383.9	1.5
MC13x50	7	-	-	14.70	20.60	302.8	7.44	813.9	16.5
	S			**81.32**		1070.0		2203	1436

A = **81.32** in^2 **y' = 13.16** in I_x = **3639** in^4

r_x = **6.69** in $S_{x\ bot}$ = **277** in^3

Section Properties about y-y Axis

		b	t	A	x	Ax	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
MC18	1	-	-	16.25	-	-	7.26	856.9	14.5
MC18	2	-	-	16.25	-	-	7.26	856.9	14.5
Top PL	3	16.00	0.38	6.00	-	-	0.00	0.0	128.0
Side PL	4	0.56	15.00	8.44	-	-	15.97	2151.6	0.2
Side PL	5	0.56	15.00	8.44	-	-	15.97	2151.6	0.2
Top PL	6	9.00	1.25	11.25	-	-	0.00	0.0	75.9
MC13x50	7	-	-	14.70	-	-	0.00	0.0	314.0
	S			**81.32**				6017	547

A = **81.32** in^2 **x' = 8.13** in I_y = **6564** in^4

r_y = **8.98** in S_y = **808** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U7-L8 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U7-L8**

Width = 16.25 inches

Depth: d = 18.00 inches

Thickness: t_1 = 0.70 inches

a = **23.00** ft

b = **0.00** ft

Length: Lu = **23.00** feet

Number of Bolts: n = **10**

Moment of Inertia (X-Axis): **3639** in^4

Moment of Inertia (Y-Axis): **6564** in^4

Radius of Gyration (X-Axis): **6.69** in

Radius of Gyration (Y-Axis): **8.98** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = **81.32** in^2 (gross)

Net Area: A_{net} = **74.32** in^2 (net)

Use Gross Area = **81.315** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.914 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi

Inventory fy= 24.75 ksi (0.55Fy)

Operating fy= 33.75 ksi (0.75Fy)

fu= 70 ksi

Inventory fu= 35 ksi (0.50Fu)

Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 2012.546 kips

P_{oper}= 2744.381 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 2601.025 kips

P_{oper}= 3485.3735 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **41** < Cc

KL/r min = 31 (K=1)

KL/r (Y-Axis): **31** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 19.82 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 79.31 ksi $F_a = 135008740/(KL/r)^2$

Fa= 19.82 ksi

Pa= 1611.4 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 24.70 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 98.90 ksi $F_a = 168363840/(KL/r)^2$

Fa= 24.70 ksi

Pa= 2008.4 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U1-L1 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U1-L1**

Use also for U3-L3, U5-L5 & U7-L7

4 angles L5x3 1/2x 0.375

Ix = **6.34** in^4

Iy = **2.59** in^4

A = **2.90** in^2

d= **5.00** in

b_f = **3.50** in

y'''= **1.61** in

x''' = **0.86** in

width b = **16.25** in

2* d + t1= 10.00 in

$b_3 = b_4$ = **0.00** in

t_1 = **0.00** in

y' - d/2 = **e** = 2.50 in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
L5x3 1/2	1	-	-	2.90	6.61	19.2	1.61	7.5	6.3
L5x3 1/2	2	-	-	2.90	3.39	9.8	-1.61	7.5	6.3
L5x3 1/2	3	-	-	2.90	6.61	19.2	1.61	7.5	6.3
L5x3 1/2	4	-	-	2.90	3.39	9.8	-1.61	7.5	6.3
	S			**11.59**		58.0		30	25

A = **11.59** in^2 **y' = 5.00** in I_x = **55** in^4

y'' = 5.00 in

r_x = **2.19** in $S_{x\ bot}$ = **11** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	2.90	-	-	7.26	152.9	2.6
2	-	-	2.90	-	-	7.26	152.9	2.6
3	-	-	2.90	-	-	7.26	152.9	2.6
4	-	-	2.90	-	-	7.26	152.9	2.59
S			**11.59**				612	10

A = **11.59** in^2 **x' = 8.13** in I_y = **622** in^4

x'' = 8.13 in

r_y = **7.33** in S_y = **77** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U1-L1 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U1-L1**

Width = 16.25 inches

Depth: d = 5.00 inches

Thickness: t_1 = 0.375 inches

a = **0.00** ft

b = **24.00** ft

Length: Lu = **24.00** feet

Number of Bolts: n = **4**

Moment of Inertia (X-Axis): **55** in^4

Moment of Inertia (Y-Axis): **622** in^4

Radius of Gyration (X-Axis): **2.19** in

Radius of Gyration (Y-Axis): **7.33** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 11.59 in^2 (gross)

Net Area: A_{net} = **10.09** in^2 (net)

Use Gross Area = **11.59** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.871 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 45 ksi fu= 70 ksi

Inventory fy= 24.75 ksi (0.55Fy) Inventory fu= 35 ksi (0.50Fu)

Operating fy= 33.75 ksi (0.75Fy) Operating fu= 46.9 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 286.8525 kips

P_{oper}= 391.1625 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 353.15 kips

P_{oper}= 473.221 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 112.8

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **132** > Cc

KL/r min = 39 (K=1)

KL/r (Y-Axis): **39** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 6.82 ksi $F_a = 21230 - .83*(KL/r)^2$

If KL/r > C_c, F_a = 7.78 ksi $F_a = 135008740/(KL/r)^2$

Fa= 7.78 ksi

Pa= 90.16 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 8.42 ksi $F_a = 26,470 - 1.04*(KL/r)^2$

If KL/r > C_c, F_a = 9.70 ksi $F_a = 168363840/(KL/r)^2$

Fa= 9.70 ksi

Pa= 112.4 kips

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 1
	U2-L2 w/ 5% Section Loss	9/10/14	6/8/16		

SECTION PROPERTIES **TRUSS MEMBER** **U2-L2**

Use also for U4-L4, & U6-L6

width b = **16.25** in

4 angles L5x3 1/2x 0.375

A = **2.90** in^2

2* d + t1= 10.00 in

Ix = **6.34** in^4

d= **5.00** in

$b_3 = b_4$ = **0.00** in

Iy = **2.59** in^4

b_f = **3.50** in

t_1 = **0.00** in

y'''= **1.61** in

x''' = **0.86** in

y' - d/2 = **e** = 2.50 in

$A = S(b_n\ t_n)$ *$I = S\,I_0 + Ay^2$* *$r = (I/A)^{1/2}$* *$S = I / y$*

Section Properties about x-x Axis

		b	t	A	y	Ay	a	Aa^2	I_0
		in	in	in^2	in	in^3	in	in^4	in^4
L5x3 1/2	1	-	-	2.90	6.61	19.2	1.61	7.5	6.3
L5x3 1/2	2	-	-	2.90	3.39	9.8	-1.61	7.5	6.3
L5x3 1/2	3	-	-	2.90	6.61	19.2	1.61	7.5	6.3
L5x3 1/2	4	-	-	2.90	3.39	9.8	-1.61	7.5	6.3
	S			**11.59**		58.0		30	25

A = **11.59** in^2 **y' = 5.00** in I_x = **55** in^4

y'' = 5.00 in

r_x = **2.19** in $S_{x\ bot}$ = **11** in^3

Section Properties about y-y Axis

	b	t	A	x	Ax	a	Aa^2	I_0
	in	in	in^2	in	in^3	in	in^4	in^4
1	-	-	2.90	-	-	7.26	152.9	2.6
2	-	-	2.90	-	-	7.26	152.9	2.6
3	-	-	2.90	-	-	7.26	152.9	2.6
4	-	-	2.90	-	-	7.26	152.9	2.59
S			**11.59**				612	10

A = **11.59** in^2 **x' = 8.13** in I_y = **622** in^4

x'' = 8.13 in

r_y = **7.33** in S_y = **77** in^3

CLIENT	MassDOT		STV Incorporated		
PROJECT	Westfield Great River Bridge W25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating - Section Properties	AJL	NKN		SHT # 2
	U2-L2 w/ 5% Section Loss	9/10/14	6/8/16		

TRUSS MEMBER **U2-L2**

Width = 16.25 inches

Depth: d = 5.00 inches

Thickness: t_1 = 0.375 inches

a = **0.00** ft

b = **24.00** ft

Length: Lu = **24.00** feet

Number of Bolts: n = **4**

Moment of Inertia (X-Axis): **55** in^4

Moment of Inertia (Y-Axis): **622** in^4

Radius of Gyration (X-Axis): **2.19** in

Radius of Gyration (Y-Axis): **7.33** in

*Anet = Agross - n *(1.0") * t_1*

(AASHTO 10.16.14.6)

Gross Area: A_{gross} = 11.59 in^2 (gross)

Net Area: A_{net} = **10.09** in^2 (net)

Use Gross Area = **11.59** in^2 (gross)

Tension Capacity A_{net} / A_{gross} = 0.871 > 0.85 ? AASHTO MBE Table 6B.6.2.1-1

fy= 33 ksi

Inventory fy= 18.15 ksi (0.55Fy)

Operating fy= 24.75 ksi (0.75Fy)

fu= 60 ksi

Inventory fu= 30 ksi (0.50Fu)

Operating fu= 40.2 ksi (0.67Fu)

Yielding Over Gross Area ($P=F_y*A_{gross}$)

P_{inv}= 210.3585 kips

P_{oper}= 286.8525 kips

Fracture at Net Section ($P=F_u*A_{net}$)

P_{inv}= 302.7 kips

P_{oper}= 405.618 kips

Compression Capacity

AASHTO Table 10.32.1A

C_c= 131.7

AASHTO 10.7.1 KL/r < 120

KL/r (X-Axis): **132** > Cc

KL/r min = 39 (K=1)

KL/r (Y-Axis): **39** < Cc

Inventory Capacity

If KL/r ≤ C_c, F_a = 7.76 ksi $F_a = 15570 - .45*(KL/r)^2$

If KL/r > C_c, F_a = 7.78 ksi $F_a = 135008740/(KL/r)^2$

Fa= 7.78 ksi

Pa= 90.16 kips

Operating Capacity

If KL/r ≤ C_c, F_a = 9.69 ksi $F_a = 19410 - .56*(KL/r)^2$

If KL/r > C_c, F_a = 9.70 ksi $F_a = 168363840/(KL/r)^2$

Fa= 9.70 ksi

Pa= 112.43 kips

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 5/28/13	NKN 6/8/2016		SHT # 1

Virtis calculates rating factors for truss members in LFD only. Use element forces from Virtis to calculate ASD rating factors

	DL	H20		DF	I	H20	
	kips	kips	kips			kips	kips
L0-L2	285.94	-4.06	31.60	1.53	0.16	-7.22	56.21
L2-L4	380.23	-9.14	44.62	1.53	0.16	-16.26	79.37
L4-L6	173.22	-13.54	33.21	1.53	0.16	-24.08	59.07
L6-L8	-291.37	-17.95	11.43	1.53	0.16	-31.93	20.33
U1-U3	-396.05	-44.67	7.07	1.53	0.16	-79.46	12.58
U3-U5	-313.45	-41.63	11.51	1.53	0.16	-74.05	20.47
U5-U7	25.83	-23.44	15.82	1.53	0.16	-41.69	28.14
U7-U8	634.88	0.00	20.52	1.53	0.16	0.00	36.50
U1-L0	-413.26	-45.67	5.87	1.53	0.16	-81.23	10.44
U1-L2	150.69	-12.40	26.50	1.53	0.16	-22.06	47.14
U3-L2	17.07	-18.20	23.51	1.53	0.16	-32.37	41.82
U3-L4	-116.45	-25.18	14.36	1.53	0.16	-44.79	25.54
U5-L4	258.28	-9.29	32.11	1.53	0.16	-16.52	57.12
U5-L6	-369.66	-34.72	6.11	1.53	0.16	-61.76	10.87
U7-L6	512.87	-2.54	39.66	1.53	0.16	-4.52	70.54
U7-L8	-663.40	-42.79	0.00	1.53	0.16	-76.11	0.00
U1-L1	112.19	0.00	35.13	1.53	0.16	0.00	62.49

From Virtis LL+I (and DF included)

	DL	HS20		DF	I	HS20	
	kips	kips				kips	kips
L0-L2	285.94	-7.23	53.85	1.53	0.16	-12.86	95.78
L2-L4	380.23	-16.27	75.27	1.53	0.16	-28.94	133.89
L4-L6	173.22	-24.11	55.71	1.53	0.16	-42.89	99.09
L6-L8	-291.37	-31.97	16.69	1.53	0.16	-56.87	29.69
U1-U3	-396.05	-75.19	12.58	1.53	0.16	-133.74	22.38
U3-U5	-313.45	-69.95	20.50	1.53	0.16	-124.42	36.46
U5-U7	25.83	-38.04	28.17	1.53	0.16	-67.66	50.11
U7-U8	634.88	0.00	36.54	1.53	0.16	0.00	64.99
U1-L0	-413.26	-77.83	10.45	1.53	0.16	-138.44	18.59
U1-L2	150.69	-15.72	44.61	1.53	0.16	-27.96	79.35
U3-L2	17.07	-30.31	35.94	1.53	0.16	-53.91	63.93
U3-L4	-116.45	-40.87	23.42	1.53	0.16	-72.70	41.66
U5-L4	258.28	-14.82	53.80	1.53	0.16	-26.36	95.70
U5-L6	-369.66	-59.22	9.17	1.53	0.16	-105.34	16.31
U7-L6	512.87	-3.13	68.61	1.53	0.16	-5.57	122.04
U7-L8	-663.40	-74.82	0.00	1.53	0.16	-133.08	0.00
U1-L1	112.19	0.00	47.65	1.53	0.16	0.00	84.76

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 5/28/13	NKN 6/8/16		SHT # 2

	DL	Type 3		DF	I	Type 3	
	kips	kips	kips			kips	kips
L0-L2	285.94	-5.05	38.01	1.53	0.16	-8.98	67.61
L2-L4	380.23	-11.35	53.35	1.53	0.16	-20.19	94.90
L4-L6	173.22	-16.82	39.54	1.53	0.16	-29.92	70.33
L6-L8	-291.37	-22.30	12.40	1.53	0.16	-39.67	22.06
U1-U3	-396.05	-53.24	8.78	1.53	0.16	-94.70	15.62
U3-U5	-313.45	-49.67	14.30	1.53	0.16	-88.35	25.44
U5-U7	25.83	-27.28	19.65	1.53	0.16	-48.52	34.95
U7-U8	634.88	0.00	25.49	1.53	0.16	0.00	45.34
U1-L0	-413.26	-54.93	7.29	1.53	0.16	-97.71	12.97
U1-L2	150.69	-11.94	31.59	1.53	0.16	-21.24	56.19
U3-L2	17.07	-21.54	26.25	1.53	0.16	-38.31	46.69
U3-L4	-116.45	-29.28	16.74	1.53	0.16	-52.08	29.78
U5-L4	258.28	-10.66	38.18	1.53	0.16	-18.96	67.91
U5-L6	-369.66	-41.79	6.72	1.53	0.16	-74.33	11.95
U7-L6	512.87	-2.44	48.23	1.53	0.16	-4.34	85.79
U7-L8	-663.40	-52.42	0.00	1.53	0.16	-93.24	0.00
U1-L1	112.19	0.00	36.61	1.53	0.16	0.00	65.12

	DL	Type 3S2		DF	I	Type 3S2	
	kips	kips	kips			kips	kips
L0-L2	285.94	-7.06	49.55	1.53	0.16	-12.56	88.14
L2-L4	380.23	-15.89	69.83	1.53	0.16	-28.26	124.21
L4-L6	173.22	-23.55	51.37	1.53	0.16	-41.89	91.37
L6-L8	-291.37	-31.23	12.61	1.53	0.16	-55.55	22.43
U1-U3	-396.05	-69.69	12.29	1.53	0.16	-123.96	21.86
U3-U5	-313.45	-64.59	20.02	1.53	0.16	-114.89	35.61
U5-U7	25.83	-33.78	27.52	1.53	0.16	-60.09	48.95
U7-U8	634.88	0.00	35.69	1.53	0.16	0.00	63.48
U1-L0	-413.26	-71.61	10.21	1.53	0.16	-127.38	18.16
U1-L2	150.69	-9.99	40.39	1.53	0.16	-17.77	71.84
U3-L2	17.07	-26.91	27.19	1.53	0.16	-47.87	48.36
U3-L4	-116.45	-34.54	20.21	1.53	0.16	-61.44	35.95
U5-L4	258.28	-12.23	47.96	1.53	0.16	-21.75	85.31
U5-L6	-369.66	-54.47	6.77	1.53	0.16	-96.89	12.04
U7-L6	512.87	-1.31	64.43	1.53	0.16	-2.33	114.60
U7-L8	-663.40	-71.54	0.00	1.53	0.16	-127.25	0.00
U1-L1	112.19	0.00	33.52	1.53	0.16	0.00	59.62

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 5/28/13	NKN 6/8/16		SHT # 3

RATING SUMMARY FOR H20 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 20 tons

		LL+IMPACT			ALLOWABLE FORCE		R.F.	RATING
MEMBERS	DL FORCE	COMPR.	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-7.22	56.21	IR	375.42	444.63	2.82	56.47
		-7.22	79.45	OR	468.06	606.31	4.03	80.65
L2-L4	380.23	-16.26	79.37	IR	564.84	678.90	3.76	75.26
		-16.26	111.25	OR	703.94	925.78	4.90	98.08
L4-L6	173.22	-24.08	59.07	IR	350.98	418.01	4.14	82.88
		-24.08	75.78	OR	437.58	570.02	5.24	104.72
L6-L8	-291.37	-31.93	20.33	IR	577.90	724.91	8.97	179.48
		-50.45	20.33	OR	720.53	988.52	8.51	170.14
U1-U3	-396.05	-79.46	12.58	IR	893.68	1137.02	6.26	125.26
		-79.46	25.47	OR	1113.75	1550.48	9.03	180.65
U3-U5	-313.45	-44.79	25.54	IR	591.95	740.79	6.22	124.36
		-52.87	25.54	OR	737.79	1010.17	8.03	160.51
U5-U7	25.83	-61.76	10.87	IR	442.62	543.25	47.61	952.18
		-89.44	10.87	OR	551.83	740.79	65.79	1315.71
U7-U8	634.88	0.00	62.49	IR	805.09	1019.45	6.15	123.09
		0.00	71.77	OR	1003.37	1390.16	10.52	210.48
DIAGONAL								
U1-L0	-413.26	-31.93	20.33	IR	914.88	1288.73	15.71	314.21
		-65.52	20.33	OR	1139.51	1757.36	11.08	221.70
U1-L2	150.69	-31.93	20.33	IR	244.67	336.91	9.16	183.19
		-31.93	33.22	OR	305.13	459.42	9.29	185.84
U3-L2	17.07	-32.37	41.82	IR	133.77	249.34	5.55	111.09
		-32.37	42.30	OR	166.94	340.01	7.64	152.70
U3-L4	-116.45	-44.79	25.54	IR	226.28	687.01	2.45	49.04
		-52.87	25.54	OR	282.18	936.83	3.13	62.69
U5-L4	258.28	-16.52	57.12	IR	180.77	484.36	3.96	79.17
		-16.52	76.53	OR	225.42	660.49	5.26	105.11
U5-L6	-369.66	-61.76	10.87	IR	542.26	1371.65	2.79	55.89
		-89.44	10.87	OR	676.23	1870.43	3.43	68.55
U7-L6	512.87	-4.52	70.54	IR	463.72	751.50	3.38	67.65
		-4.52	109.80	OR	576.77	1024.77	4.66	93.24
U7-L8	-663.4	-76.11	0.00	IR	1611.43	2012.55	12.46	249.11
		-124.11	0.00	OR	2008.45	2744.38	10.84	216.75
VERTICAL								
U1-L1	112.19	-31.93	20.33	IR	90.16	286.85	8.59	171.82
		-65.52	20.33	OR	112.43	391.16	13.72	274.43

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 5/28/13	NKN 6/8/16		SHT # 4

RATING SUMMARY FOR HS20 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 36 tons

		LL+IMPACT		ALLOWABLE FORCE			R.F.	RATING
MEMBERS	DL FORCE	COMPRESSIO	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-12.86	95.78	IR	375.42	444.63	1.66	59.64
		-12.86	119.02	OR	468.06	606.31	2.69	96.90
L2-L4	380.23	-28.94	133.89	IR	564.84	678.90	2.23	80.31
		-28.94	165.77	OR	703.94	925.78	3.29	118.48
L4-L6	173.22	-42.89	99.09	IR	350.98	418.01	2.47	88.93
		-42.89	115.80	OR	437.58	570.02	3.43	123.35
L6-L8	-291.37	-56.87	29.69	IR	577.90	724.91	5.04	181.39
		-75.39	29.69	OR	720.53	988.52	5.69	204.94
U1-U3	-396.05	-133.74	22.38	IR	893.68	1137.02	3.72	133.95
		-133.74	35.27	OR	1113.75	1550.48	5.37	193.19
U3-U5	-313.45	-124.42	36.46	IR	591.95	740.79	2.24	80.58
		-132.51	36.46	OR	737.79	1010.17	3.20	115.29
U5-U7	25.83	-67.66	50.11	IR	442.62	543.25	10.33	371.75
		-95.35	50.11	OR	551.83	740.79	14.27	513.67
U7-U8	634.88	0.00	64.99	IR	805.09	1019.45	5.92	213.01
		0.00	74.27	OR	1003.37	1390.16	10.17	366.08
DIAGONAL								
U1-L0	-413.26	-138.44	18.59	IR	914.88	1288.73	3.62	130.44
		-172.03	18.59	OR	1139.51	1757.36	4.22	151.98
U1-L2	150.69	-27.96	79.35	IR	244.67	336.91	2.35	84.49
		-27.96	92.24	OR	305.13	459.42	3.35	120.49
U3-L2	17.07	-53.91	63.93	IR	133.77	249.34	3.63	130.80
		-53.91	64.41	OR	166.94	340.01	5.01	180.51
U3-L4	-116.45	-72.70	41.66	IR	226.28	687.01	1.51	54.39
		-80.78	41.66	OR	282.18	936.83	2.05	73.86
U5-L4	258.28	-26.36	95.70	IR	180.77	484.36	2.36	85.05
		-26.36	115.11	OR	225.42	660.49	3.49	125.79
U5-L6	-369.66	-105.34	16.31	IR	542.26	1371.65	1.64	58.99
		-133.02	16.31	OR	676.23	1870.43	2.30	82.97
U7-L6	512.87	-5.57	122.04	IR	463.72	751.50	1.96	70.39
		-5.57	161.29	OR	576.77	1024.77	3.17	114.26
U7-L8	-663.4	-133.08	0.00	IR	1611.43	2012.55	7.12	256.45
		-181.08	0.00	OR	2008.45	2744.38	7.43	267.40
VERTICAL								
U1-L1	112.19	0.00	84.76	IR	90.16	286.85	2.06	74.19
		-33.59	84.76	OR	112.43	391.16	3.29	118.49

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 5/28/13	NKN 6/8/16		SHT # 5

RATING SUMMARY FOR TYPE 3 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 25 tons

		LL+IMPACT		ALLOWABLE FORCE			R.F.	RATING
MEMBERS	DL FORCE	COMPRESSIO	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-8.98	67.61	IR	375.42	444.63	2.35	58.68
		-8.98	90.85	OR	468.06	606.31	3.53	88.16
L2-L4	380.23	-20.19	94.90	IR	564.84	678.90	3.15	78.69
		-20.19	126.78	OR	703.94	925.78	4.30	107.58
L4-L6	173.22	-29.92	70.33	IR	350.98	418.01	3.48	87.01
		-29.92	87.04	OR	437.58	570.02	4.56	113.97
L6-L8	-291.37	-39.67	22.06	IR	577.90	724.91	7.22	180.59
		-58.19	22.06	OR	720.53	988.52	7.38	184.39
U1-U3	-396.05	-94.70	15.62	IR	893.68	1137.02	5.25	131.37
		-94.70	28.51	OR	1113.75	1550.48	7.58	189.47
U3-U5	-313.45	-88.35	25.44	IR	591.95	740.79	3.15	78.81
		-96.43	25.44	OR	737.79	1010.17	4.40	110.01
U5-U7	25.83	-48.52	34.95	IR	442.62	543.25	14.80	370.09
		-76.21	34.95	OR	551.83	740.79	20.46	511.39
U7-U8	634.88	0.00	45.34	IR	805.09	1019.45	8.48	212.05
		0.00	54.62	OR	1003.37	1390.16	13.83	345.71
DIAGONAL								
U1-L0	-413.26	-97.71	12.97	IR	914.88	1288.73	5.13	128.35
		-131.29	12.97	OR	1139.51	1757.36	5.53	138.29
U1-L2	150.69	-21.24	56.19	IR	244.67	336.91	3.31	82.85
		-21.24	69.08	OR	305.13	459.42	4.47	111.72
U3-L2	17.07	-38.31	46.69	IR	133.77	249.34	4.97	124.36
		-38.31	47.17	OR	166.94	340.01	6.85	171.16
U3-L4	-116.45	-52.08	29.78	IR	226.28	687.01	2.11	52.72
		-60.17	29.78	OR	282.18	936.83	2.75	68.87
U5-L4	258.28	-18.96	67.91	IR	180.77	484.36	3.33	83.22
		-18.96	87.33	OR	225.42	660.49	4.61	115.14
U5-L6	-369.66	-74.33	11.95	IR	542.26	1371.65	2.32	58.05
		-102.02	11.95	OR	676.23	1870.43	3.01	75.13
U7-L6	512.87	-4.34	85.79	IR	463.72	751.50	2.78	69.54
		-4.34	125.04	OR	576.77	1024.77	4.09	102.35
U7-L8	-663.4	-93.24	0.00	IR	1611.43	2012.55	10.17	254.19
		-141.24	0.00	OR	2008.45	2744.38	9.52	238.08
VERTICAL								
U1-L1	112.19	0.00	65.12	IR	90.16	286.85	2.68	67.05
		-33.59	65.12	OR	112.43	391.16	4.28	107.10

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 5/28/13	NKN 6/8/16		SHT # 6

RATING SUMMARY FOR TYPE 3S2 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 36 tons

		LL+IMPACT		ALLOWABLE FORCE			R.F.	RATING
MEMBERS	DL FORCE	COMPRESSIO	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-12.56	88.14	IR	375.42	444.63	1.80	64.82
		-12.56	111.38	OR	468.06	606.31	2.88	103.55
L2-L4	380.23	-28.26	124.21	IR	564.84	678.90	2.40	86.57
		-28.26	156.09	OR	703.94	925.78	3.50	125.82
L4-L6	173.22	-41.89	91.37	IR	350.98	418.01	2.68	96.45
		-41.89	108.08	OR	437.58	570.02	3.67	132.16
L6-L8	-291.37	-55.55	22.43	IR	577.90	724.91	5.16	185.69
		-74.07	22.43	OR	720.53	988.52	5.79	208.58
U1-U3	-396.05	-123.96	21.86	IR	893.68	1137.02	4.01	144.52
		-123.96	34.75	OR	1113.75	1550.48	5.79	208.43
U3-U5	-313.45	-114.89	35.61	IR	591.95	740.79	2.42	87.27
		-122.97	35.61	OR	737.79	1010.17	3.45	124.22
U5-U7	25.83	-60.09	48.95	IR	442.62	543.25	10.57	380.53
		-87.77	48.95	OR	551.83	740.79	14.61	525.81
U7-U8	634.88	0.00	63.48	IR	805.09	1019.45	6.06	218.08
		0.00	72.76	OR	1003.37	1390.16	10.38	373.69
DIAGONAL								
U1-L0	-413.26	-127.38	18.16	IR	914.88	1288.73	3.94	141.77
		-160.96	18.16	OR	1139.51	1757.36	4.51	162.43
U1-L2	150.69	-17.77	71.84	IR	244.67	336.91	2.59	93.31
		-17.77	84.74	OR	305.13	459.42	3.64	131.16
U3-L2	17.07	-47.87	48.36	IR	133.77	249.34	4.80	172.89
		-47.87	48.84	OR	166.94	340.01	6.61	238.03
U3-L4	-116.45	-61.44	35.95	IR	226.28	687.01	1.79	64.36
		-69.52	35.95	OR	282.18	936.83	2.38	85.82
U5-L4	258.28	-21.75	85.31	IR	180.77	484.36	2.65	95.40
		-21.75	104.72	OR	225.42	660.49	3.84	138.26
U5-L6	-369.66	-96.89	12.04	IR	542.26	1371.65	1.78	64.13
		-124.57	12.04	OR	676.23	1870.43	2.46	88.59
U7-L6	512.87	-2.33	114.60	IR	463.72	751.50	2.08	74.96
		-2.33	153.86	OR	576.77	1024.77	3.33	119.78
U7-L8	-663.4	-127.25	0.00	IR	1611.43	2012.55	7.45	268.20
		-175.25	0.00	OR	2008.45	2744.38	7.68	276.31
VERTICAL								
U1-L1	112.19	0.00	59.62	IR	90.16	286.85	2.93	105.46
		-33.59	59.62	OR	112.43	391.16	4.68	168.44

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	Summary Sheet	6/9/16	6/18/16		

Truss Element	INVENTORY RATING BY ALLOWABLE STRESS METHOD				OPERATING RATING BY ALLOWABLE STRESS METHOD			
	H20	TYPE 3	TYPE 3S2	HS20	H20	TYPE 3	TYPE 3S2	HS20
L0-L2	56.5	58.7	64.8	59.6	80.6	88.2	103.6	96.9
L2-L4	75.3	78.7	86.6	80.3	98.1	107.6	125.8	118.5
L4-L6	82.9	87.0	96.4	88.9	104.7	114.0	132.2	123.4
L6-L8	179.5	180.6	185.7	181.4	170.1	184.4	208.6	204.9
U1-U3	125.3	131.4	144.5	133.9	180.7	189.5	208.4	193.2
U3-U5	124.4	78.8	87.3	80.6	160.5	110.0	124.2	115.3
U5-U7	952.2	370.1	380.5	371.7	1315.7	511.4	525.8	513.7
U7-U8	123.1	212.0	218.1	213.0	210.5	345.7	373.7	366.1
U1-L0	314.2	128.3	141.8	130.4	221.7	138.3	162.4	152.0
U1-L2	183.2	82.9	93.3	84.5	185.8	111.7	131.2	120.5
U3-L2	111.1	124.4	172.9	130.8	152.7	171.2	238.0	180.5
U3-L4	**49.0**	**52.7**	64.4	**54.4**	**62.7**	**68.9**	**85.8**	**73.9**
U5-L4	79.2	115.1	138.3	85.0	105.1	115.1	138.3	125.8
U5-L6	55.9	58.0	**64.1**	59.0	68.6	75.1	88.6	83.0
U7-L6	67.7	69.5	75.0	70.4	93.2	102.3	119.8	114.3
U7-L8	249.1	254.2	268.2	256.4	216.8	238.1	276.3	267.4
VERTICAL	171.8	67.1	105.5	74.2	274.4	107.1	168.4	118.5

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	Converting LFD Virtis Rating to Metric	5/28/13	6/8/2016		

	RF from Virtis		Inventory		Operating	
	Inv	Opr	MS18	MS (Equiv)	MS18	MS (Equiv)
L0-L2	2.35	3.93	76.1	MS 42.3	127.3	MS 70.7
L2-L4	1.65	2.75	53.5	MS 29.7	89.1	MS 49.5
L4-L6	2.69	4.49	87.2	MS 48.4	145.5	MS 80.8
L6-L8	5.79	9.66	187.6	MS 104.2	313.0	MS 173.9
U1-U3	2.64	4.41	85.5	MS 47.5	142.9	MS 79.4
U3-U5	1.64	2.75	53.1	MS 29.5	89.1	MS 49.5
U5-U7	5.98	9.98	193.8	MS 107.6	323.4	MS 179.6
U7-U8	4.08	6.81	132.2	MS 73.4	220.6	MS 122.6
U1-L0	2.88	4.82	93.3	MS 51.8	156.2	MS 86.8
U1-L2	2.64	4.41	85.5	MS 47.5	142.9	MS 79.4
U3-L2	2.91	4.85	94.3	MS 52.4	157.1	MS 87.3
U3-L4	2.91	4.87	94.3	MS 52.4	157.8	MS 87.7
U5-L4	1.66	2.77	53.8	MS 29.9	89.7	MS 49.9
U5-L6	3.42	5.7	110.8	MS 61.6	184.7	MS 102.6
U7-L6	1.74	2.91	56.4	MS 31.3	94.3	MS 52.4
U7-L8	3.82	6.39	123.8	MS 68.8	207.0	MS 115.0
Vertical	1.89	3.15	61.2	MS 34.0	102.1	MS 56.7

GUSSET PLATES RATING

INDEX

Westfield Bridge No.W-25-010

L0 Gusset Plate Rating …….. C - 116

L2 Gusset Plate Rating …….. C – 124

L3 Gusset Plate Rating …….. C - 143

L4 Gusset Plate Rating …….. C - 148

L6 Gusset Plate Rating …….. C - 165

L8 Gusset Plate Rating …….. C – 182

U1 Gusset Plate Rating …….. C - 194

U3 Gusset Plate Rating …….. C - 208

U5 Gusset Plate Rating …….. C - 226

U7 Gusset Plate Rating …….. C - 250

The following assumptions were made for rating the gusset plates:

- Trusses are symmetric on both sides of the roadway as well as on both spans. Only one gusset plate for each major panel point is checked.

- Interior (roadway) and exterior gusset plates share loads evenly.

- Forces from members are distributed evenly to accompanying bolts unless otherwise noted.

- For the existing gusset plates, Fy = 33 ksi and Fu = 60 ksi are used.

- For the existing rivets, ϕF = 21 ksi and Fu = 60 ksi.

- The dead load and live load forces on the truss members come from Virtis, and the pedestrian load forces (used for Operating Rating) come from Staad.pro. The live load forces used are the larger of the maximum forces from truck or lane loads.

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	ARG	*WRG*		
	Gusset Plate Loading	4/28/16	6/1/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: L0**

Member Connection:	**L0-U1**	***C***	**Member Connection:**	**L0-L2**	***T***
Total Fasteners		66	Total Fasteners		108
Thickness of Channel Web (in)		0.6	Thickness of Channel Web (in)		0.5
Dead Load (kip)		413.3	Dead Load (kip)		285.94
Truck Live Load + Impact (kip)		161.7	Truck Live Load + Impact (kip)		100.39
Pedestrian Load (kip)		33.6	Pedestrian Load (kip)		23.24
Bolts on Gusset Plates		66	Bolts on Gusset Plates		108
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**206.65**	Dead Load Per Gusset Plate (kip)		**142.97**
LL+I Per Gusset Plate (kip)		**80.85**	LL+I Per Gusset Plate (kip)		**50.20**
Ped. Load Per Gusset Plate (kip)		**16.80**	Ped. Load Per Gusset Plate (kip)		**11.62**

Member Connection:	**-**	***0***	**Member Connection:**	**-**	***0***
Total Fasteners		0	Total Fasteners		0
Thickness of Channel Web (in)		0	Thickness of Channel Web (in)		0
Dead Load (kip)		0	Dead Load (kip)		0
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		0	Pedestrian Load (kip)		0
Bolts on Gusset Plates		0	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**0.00**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**0.00**

Member Connection:	**-**	***0***	**Member Connection:**	**-**	***0***
Total Fasteners		0	Total Fasteners		0
Thickness of Channel Web (in)		0	Thickness of Channel Web (in)		0
Dead Load (kip)		0	Dead Load (kip)		0
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		0	Pedestrian Load (kip)		0
Bolts on Gusset Plates		0	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**0.00**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**0.00**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	*ARG*	*WRG*		
L0S	Fasteners Bearing & Shear Capacity	4/28/2016	6/1/2016		2

2

Member Connection: **L0-U1**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.625	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.5	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	8	25		*Figure 1*
Diameter =	0.875	0.875	in	*Figure 1*
Area =	0.60	0.60	in^2	
Shear C =	168.4	316	kip	*Capacity for Total Fastener Group*
Bearing C =	472.50	1476.56	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	206.65	kip	**Pedestrian Loads are only*
LL+I Force =	80.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	16.80	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.23**	**>1, OK**
	RF_{opr} =	**1.70**	**>1, OK**
Bearing:	**RF_{inv} =**	**9.58**	**>1, OK**
	RF_{opr} =	**13.24**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	*ARG*	*WRG*		
L0S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/1/2016*		3

2

Member Connection: **L0-L2**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.5	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	3	in	*Figure 1*

Fasteners Information:

	Bolt	-		
				**Connection > 50"*
ϕF =	28	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	54	-		*Figure 1*
Diameter =	0.875	-	in	*Figure 1*
Area =	0.60	-	in^2	
Shear C =	909.2	0	kip	*Capacity for Total Fastener Group*
Bearing C =	2551.50	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	142.97	kip	**Pedestrian Loads are only*
LL+I Force =	50.20	kip	*included in Operating Ratings per*
*Pedestrian Force =	11.62	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**1.23**	**>1, OK**	**Shear:**	**RF_{inv} =**	**6.64**	**>1, OK**
	RF_{opr} =	**1.70**	**>1, OK**		**RF_{opr} =**	**9.00**	**>1, OK**
Bearing:	**RF_{inv} =**	**9.58**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**21.72**	**>1, OK**
	RF_{opr} =	**13.24**	**>1, OK**		**RF_{opr} =**	**29.44**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	*ARG*	*WRG*		
L0S	Axial Tension Capacity	4/28/2016	6/1/2016		4

1 0

Member Connection: **L0-L2**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	33	ksi	*Yield Stress*
Fu =	60	60	ksi	*Ultimate Stress*
Thickness =	0.625	0.5	in	*Figure 1*
Ae =	31.49	-	in^2	*Effective Area*
Block Shear Rupture C =	1453.80	1163.04	kip	*Block Shear Capacity*
Effective Gross Yielding C =	1039.09	-	kip	*Yielding Capacity*
Controlling C =	1039.1			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	133	12	50.38	in	*Figure 2*
# Bolts =	23	4	3		*Figure 2*
Bolts Diameter =	0.875	0.875	0.875	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	83.13	7.50	31.49	in^2	**Figure 4*
Gusset An =	69.65	5.16	29.73	in^2	
Member Ag =	66.50	6.00	25.19	in^2	
Member An =	55.72	4.13	23.78	in^2	

Member Loading Information:

DL Force =	142.97	kip	**Pedestrian Loads are only*
LL+I Force =	50.20	kip	*included in Operating Ratings per*
*Pedestrian Force =	11.62	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension: **RF_{inv} = 7.83** **>1, OK**

RF_{opr} = 10.62 **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	*ARG*	*WRG*		
L0S	Compression Capacity	4/28/2016	6/1/2016		5

Member Connection: **L0-U1**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	53.375	in	*Figure 4*
Whitmore Distance, Lc =	2.25	in	*Figure 4*
Thickness =	0.625	in	*Gusset Plate thickness*
A_s =	33.36	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	6.24		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**32.96**	**ksi**	
C =	**934.68**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	206.65	kip	**Pedestrian Loads are only*
LL+I Force =	80.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	16.80	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**3.80**	**>1, OK**
	RF_{opr} =	**5.25**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	*ARG*	*WRG*		
L0S	Shear Capacity: Rupture Resistance	4/28/2016	6/1/2016		6

Member Connection: **L0-L2**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	L0	-	-	-		
Fy =	33	0	0	0	ksi	*Yield Stress*
Fu =	60	0	0	0	ksi	*Ultimate Stress*
Thickness =	0.625	0	0	0	in	*Plate Thickness*
Shear Plane Length =	83.125	0	0	0	in	*Figure 3*
# Bolts =	12	0	0	0		*Figure 3*
Bolts Diameter =	0.875	0	0	0	in	*Figure 3*
# Rivets =	0	0	0	0		*Figure 3*
Rivet Diameter =	0	0	0	0	in	*Figure 3*
Gross Area, Ag =	51.95	0	0.00	0	in^2	
Net Area, An =	44.92	0	0.00	0	in^2	
Yield Resistance C =	875.06	0.0	0.0	0.0	kip	*Yield Capacity*
Rupture Resistance C =	1169.33	0.0	0.0	0.0	kip	*Rupture Capacity*
Controlling C =	875.1		0.0			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	L0-U1	206.65	80.85	16.80	46.60	141.99	55.55	11.54
	-	0.00	0.00	0.00	0.00	0	0	0
	-	0.00	0.00	0.00	0.00	0	0	0
SECTION B-B	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-	0.00	0.00	0.00	0.00	0	0	0
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B		Controlling	
Shear Rupture Rating:	**5.73**	**>1, OK**	**>1, OK**	**RF_{inv} =**	**5.73**	**>1, OK**
	7.92	**>1, OK**	**>1, OK**	**RF_{opr} =**	**7.92**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L0	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/28/2016	6/1/2016		7

Gusset Reference: **L0**

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	**1.23**	**44.20**	**1.70**	**61.09**
Axial Tension Capacity	7.83	282.00	10.62	382.23
Shear Capacity: Yield/Rupture	5.73	206.20	7.92	284.99
Partial Shear Capacity: Yield	N/A	N/A	N/A	N/A
Compression Capacity	3.80	136.67	5.25	188.88
Chord Splice	N/A	N/A	N/A	N/A
Gusset Rating:	**1.23**	**44.20**	**1.70**	**61.09**

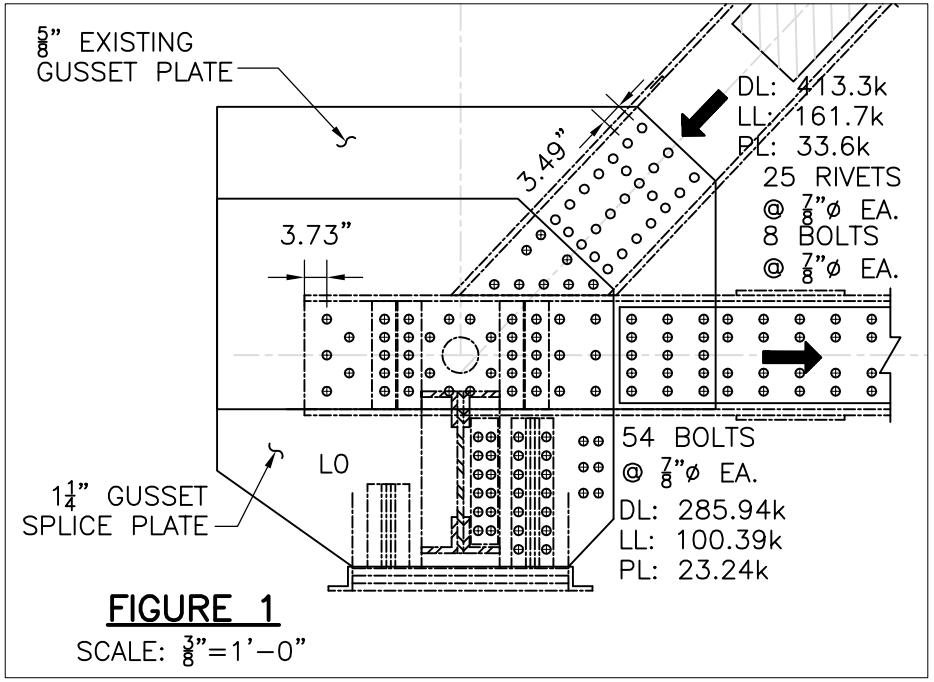


FIGURE 1

SCALE: 3/8"=1'-0"

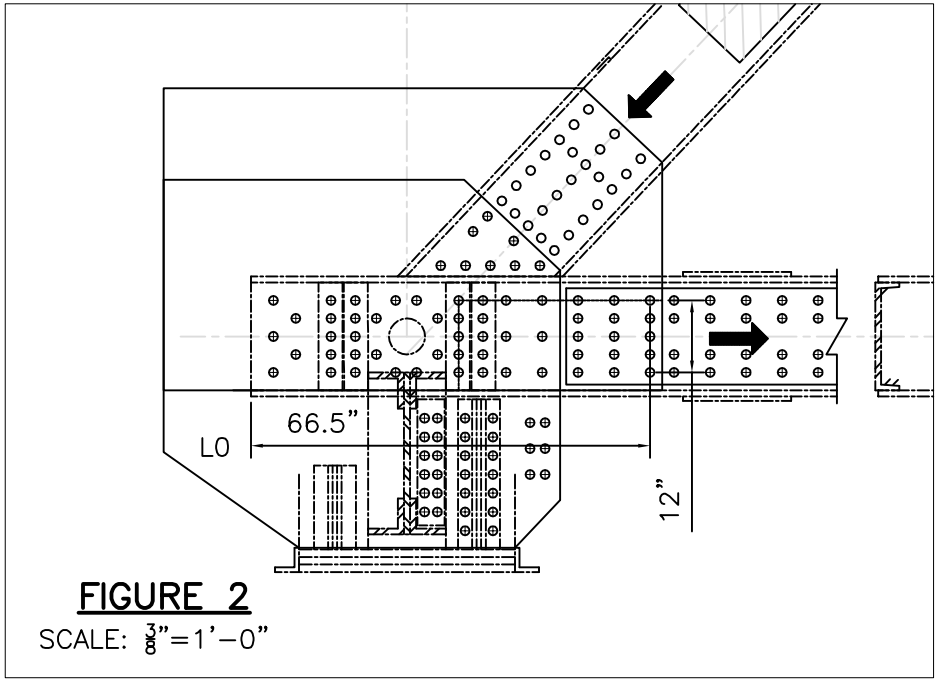


FIGURE 2

SCALE: 3/8"=1'-0"

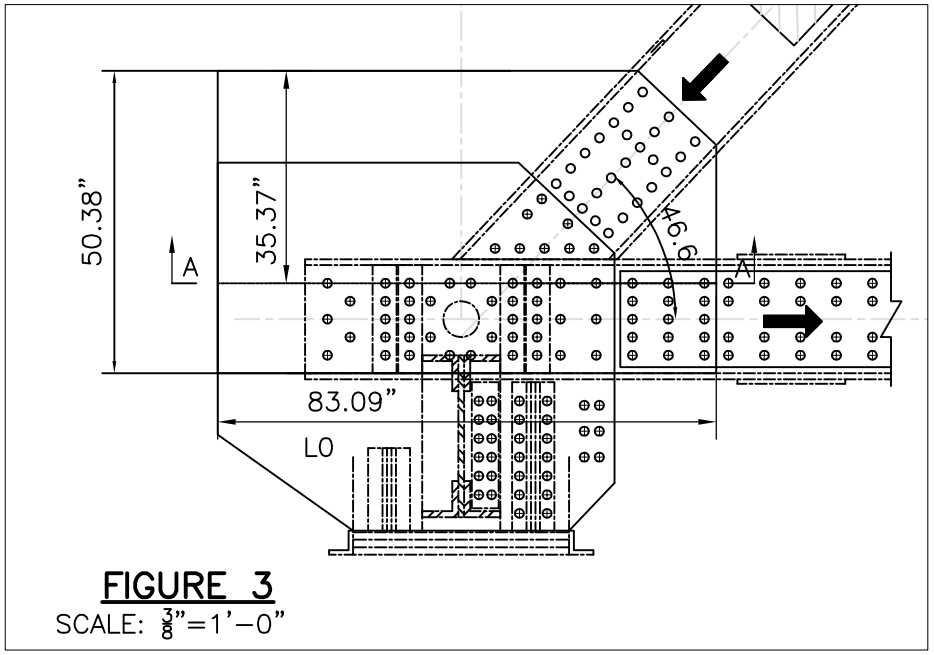


FIGURE 3

SCALE: 3/8"=1'-0"

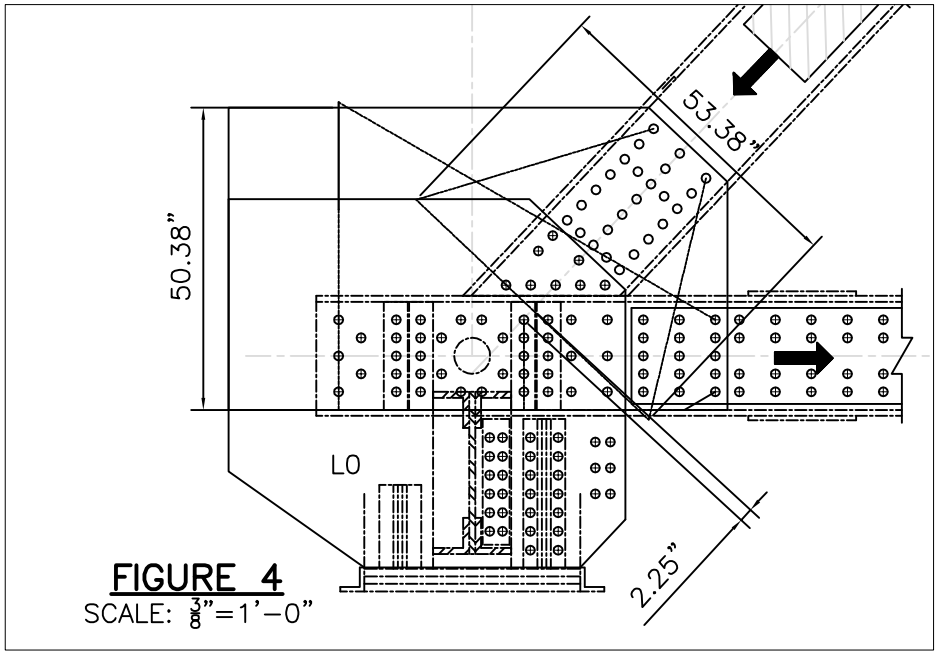


FIGURE 4

SCALE: 3/8"=1'-0"

Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

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STV 100 Years
STV Incorporated
One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: L0-A
Title: Gusset Plate L0 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	ARG	*WRG*		
	Gusset Plate Loading	4/28/16	6/1/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: L2**

Member Connection: L2-L0	***T***	**Member Connection: L2-U1**	***T***
Total Fasteners	76	Total Fasteners	36
Thickness of Channel Web (in)	0.5	Thickness of Channel Web (in)	0.4
Dead Load (kip)	285.9	Dead Load (kip)	150.7
Truck Live Load + Impact (kip)	100.4	Truck Live Load + Impact (kip)	84.84
Pedestrian Load (kip)	23.2	Pedestrian Load (kip)	12.9
Bolts on Gusset Plates	60	Bolts on Gusset Plates	36
Bolts on Additional Load Transferring Members	16	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**112.86**	Dead Load Per Gusset Plate (kip)	**75.35**
LL+I Per Gusset Plate (kip)	**39.63**	LL+I Per Gusset Plate (kip)	**42.42**
Ped. Load Per Gusset Plate (kip)	**9.16**	Ped. Load Per Gusset Plate (kip)	**6.45**
		**Alternative Load Case Exists on*	***L2-U1b***
Member Connection: L2-U2	***C***	**Member Connection: L2-U3**	***T***
Total Fasteners	20	Total Fasteners	24
Thickness of Channel Web (in)	0.375	Thickness of Channel Web (in)	0.387
Dead Load (kip)	6.84	Dead Load (kip)	17.1
Truck Live Load + Impact (kip)	0	Truck Live Load + Impact (kip)	63.9
Pedestrian Load (kip)	0	Pedestrian Load (kip)	0.48
Bolts on Gusset Plates	20	Bolts on Gusset Plates	24
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**3.42**	Dead Load Per Gusset Plate (kip)	**8.55**
LL+I Per Gusset Plate (kip)	**0.00**	LL+I Per Gusset Plate (kip)	**31.95**
Ped. Load Per Gusset Plate (kip)	**0.00**	Ped. Load Per Gusset Plate (kip)	**0.24**
Member Connection: L2-L4	***T***	**Member Connection: L2-U3b**	***C***
Total Fasteners	84	Total Fasteners	24
Thickness of Channel Web (in)	0.6	Thickness of Channel Web (in)	0.387
Dead Load (kip)	380.2	Dead Load (kip)	-17.1
Truck Live Load + Impact (kip)	148.1	Truck Live Load + Impact (kip)	55.7
Pedestrian Load (kip)	31.9	Pedestrian Load (kip)	-0.48
Bolts on Gusset Plates	68	Bolts on Gusset Plates	24
Bolts on Additional Load Transferring Members	16	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**153.89**	Dead Load Per Gusset Plate (kip)	**-8.55**
LL+I Per Gusset Plate (kip)	**59.95**	LL+I Per Gusset Plate (kip)	**27.85**
Ped. Load Per Gusset Plate (kip)	**12.91**	Ped. Load Per Gusset Plate (kip)	**-0.24**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Fasteners Bearing & Shear Capacity	4/28/2016	6/1/2016		2

5

Member Connection: **L2-L0**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.5	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.9375	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	30	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	824.7	0	kip	*Capacity for Total Fastener Group*
Bearing C =	1620.00	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	112.86	kip	**Pedestrian Loads are only*
LL+I Force =	39.63	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.16	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**7.88**	**>1, OK**
	RF_{opr} =	**10.69**	**>1, OK**
Bearing:	**RF_{inv} =**	**17.13**	**>1, OK**
	RF_{opr} =	**23.23**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/1/2016*		3

5

Member Connection: **L2-U1**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.4	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	18	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	494.8	0	kip	*Capacity for Total Fastener Group*
Bearing C =	777.60	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	75.35	kip	**Pedestrian Loads are only*
LL+I Force =	42.42	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.45	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**4.31**	**>1, OK**
	RF_{opr} =	**6.25**	**>1, OK**
Bearing:	**RF_{inv} =**	**7.38**	**>1, OK**
	RF_{opr} =	**10.70**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/1/2016*		4

5

Member Connection: **L2-U3**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.387	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	12	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	329.9	0	kip	*Capacity for Total Fastener Group*
Bearing C =	501.55	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	8.55	kip	**Pedestrian Loads are only*
LL+I Force =	31.95	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.24	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**4.60**	**>1, OK**
	RF_{opr} =	**7.62**	**>1, OK**
Bearing:	**RF_{inv} =**	**7.07**	**>1, OK**
	RF_{opr} =	**11.72**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/1/2016*		5

5

Member Connection: **L2-L4**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	65	ksi	*Ultimate Strength*
Thickness =	0.625	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	34	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	934.6	0	kip	*Capacity for Total Fastener Group*
Bearing C =	2486.25	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	153.89	kip	**Pedestrian Loads are only*
LL+I Force =	59.95	kip	*included in Operating Ratings per*
*Pedestrian Force =	12.91	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**5.65**	**>1, OK**
	RF_{opr} =	**7.76**	**>1, OK**
Bearing:	**RF_{inv} =**	**17.58**	**>1, OK**
	RF_{opr} =	**24.14**	**>1, OK**

5

Member Connection: **L2-U3b**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.387	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	12	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	329.9	0	kip	*Capacity for Total Fastener Group*
Bearing C =	501.55	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	-8.55	kip	**Pedestrian Loads are only*
LL+I Force =	27.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	-0.24	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**4.31**	**>1, OK**	**Shear:**	**RF_{inv} =**	**5.64**	**>1, OK**
	RF_{opr} =	**6.25**	**>1, OK**		**RF_{opr} =**	**9.50**	**>1, OK**
Bearing:	**RF_{inv} =**	**7.07**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**8.48**	**>1, OK**
	RF_{opr} =	**10.70**	**>1, OK**		**RF_{opr} =**	**14.28**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Axial Tension Capacity	4/28/2016	6/1/2016		7

4 0

Member Connection: **L2-L0**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	33	ksi	*Yield Stress*
Fu =	65	60	ksi	*Ultimate Stress*
Thickness =	0.625	0.5	in	*Figure 1*
Ae =	0.00	-	in^2	*Effective Area*
Block Shear Rupture C =	1288.28	736.54	kip	*Block Shear Capacity*
Effective Gross Yielding C =	0.00	-	kip	*Yielding Capacity*
Controlling C =	736.5			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	0		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	66.25	12	-	in	*Figure 2*
# Bolts =	12	4	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	41.41	7.50	0.00	in^2	**Figure 4*
Gusset An =	33.44	4.84	0.00	in^2	
Member Ag =	33.13	6.00	0.00	in^2	
Member An =	26.75	3.88	0.00	in^2	

Member Loading Information:

DL Force =	112.86	kip	**Pedestrian Loads are only*
LL+I Force =	39.63	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.16	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension: **RF_{inv} = 6.86 >1, OK**

RF_{opr} = 9.30 >1, OK

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Axial Tension Capacity	*4/28/2016*	*6/1/2016*		8

4 0

Member Connection: **L2-U1**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	33	ksi	*Yield Stress*
Fu =	65	60	ksi	*Ultimate Stress*
Thickness =	0.625	0.4	in	*Figure 1*
Ae =	19.60	-	in^2	*Effective Area*
Block Shear Rupture C =	938.26	449.14	kip	*Block Shear Capacity*
Effective Gross Yielding C =	980.00	-	kip	*Yielding Capacity*
Controlling C =	449.1			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	41	10	31.36	in	*Figure 2*
# Bolts =	9	1	4		*Figure 2*
Bolts Diameter =	1	1	1	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	25.63	6.25	19.60	in^2	**Figure 4*
Gusset An =	19.65	5.59	16.94	in^2	
Member Ag =	16.40	4.00	12.54	in^2	
Member An =	12.58	3.58	10.84	in^2	

Member Loading Information:

DL Force =	75.35	kip	**Pedestrian Loads are only*
LL+I Force =	42.42	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.45	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension: **RF_{inv} = 3.82** **>1, OK**

RF_{opr} = 5.53 **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Axial Tension Capacity	*4/28/2016*	*6/1/2016*		9

4 0

Member Connection: **L2-U3**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	33	ksi	*Yield Stress*
Fu =	65	60	ksi	*Ultimate Stress*
Thickness =	0.625	0.387	in	*Figure 1*
Ae =	13.74	-	in^2	*Effective Area*
Block Shear Rupture C =	662.44	298.93	kip	*Block Shear Capacity*
Effective Gross Yielding C =	686.92	-	kip	*Yielding Capacity*
Controlling C =	298.9			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	32	6	22.81	in	*Figure 2*
# Bolts =	7	1	4		*Figure 2*
Bolts Diameter =	1	1	1	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	20.00	3.75	14.26	in^2	**Figure 4*
Gusset An =	15.35	3.09	11.60	in^2	
Member Ag =	12.38	2.32	8.83	in^2	
Member An =	9.51	1.91	7.18	in^2	

Member Loading Information:

DL Force =	8.55	kip	**Pedestrian Loads are only*
LL+I Force =	31.95	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.24	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension: **RF_{inv} = 4.15** **>1, OK**

RF_{opr} = 6.88 **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Axial Tension Capacity	*4/28/2016*	*6/1/2016*		10

4 0

Member Connection: **L2-L4**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	45	ksi	*Yield Stress*
Fu =	65	70	ksi	*Ultimate Stress*
Thickness =	0.625	0.6	in	*Figure 1*
Ae =	0.00	-	in^2	*Effective Area*
Block Shear Rupture C =	1090.02	1035.40	kip	*Block Shear Capacity*
Effective Gross Yielding C =	0.00	-	kip	*Yielding Capacity*
Controlling C =	1035.4			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	0		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	57	12	-	in	*Figure 2*
# Bolts =	15	4	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	35.63	7.50	0.00	in^2	**Figure 4*
Gusset An =	25.66	4.84	0.00	in^2	
Member Ag =	34.20	7.20	0.00	in^2	
Member An =	24.64	4.65	0.00	in^2	

Member Loading Information:

DL Force =	153.89	kip	**Pedestrian Loads are only*
LL+I Force =	59.95	kip	*included in Operating Ratings per*
*Pedestrian Force =	12.91	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension:	**RF_{inv} =**	**6.42**	**>1, OK**
	RF_{opr} =	**8.82**	**>1, OK**
Controlling:	**RF_{inv} =**	**3.82**	**>1, OK**
	RF_{opr} =	**5.53**	**>1, OK**

Member Connection: **L2-U3b**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	50	ksi	*Yield Stress*
Whitmore Eff. Length =	22.81	in	*Figure 4*
Whitmore Distance, Lc =	14	in	*Figure 4*
Thickness =	0.625	in	*Gusset Plate thickness*
A_s =	14.26	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	38.80		
$\sqrt{(2\pi^2E/F_y)}$ =	107.00		
F_{cr} =	**46.71**	**ksi**	
C =	**566.06**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	-8.55	kip	**Pedestrian Loads are only*
LL+I Force =	27.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	-0.24	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**9.55**	**>1, OK**
	RF_{opr} =	**16.08**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Shear Capacity: Rupture Resistance	4/28/2016	6/1/2016		12

Member Connection: **L2-L0**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	L2	-	L2	-		
Fy =	50	0	50	0	ksi	*Yield Stress*
Fu =	65	0	65	0	ksi	*Ultimate Stress*
Thickness =	0.625	0	0.625	0	in	*Plate Thickness*
Shear Plane Length =	65.74	0	74.61	0	in	*Figure 3*
# Bolts =	14	0	13	0		*Figure 3*
Bolts Diameter =	1	0	1	0	in	*Figure 3*
# Rivets =	0	0	0	0		*Figure 3*
Rivet Diameter =	0	0	0	0	in	*Figure 3*
Gross Area, Ag =	41.09	0	46.63	0	in^2	
Net Area, An =	31.79	0	38.00	0	in^2	
Yield Resistance C =	1048.55	0.0	1190.0	0.0	kip	*Yield Capacity*
Rupture Resistance C =	896.48	0.0	1071.5	0.0	kip	*Rupture Capacity*
Controlling C =	896.5		1071.5			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	L2-U1	75.35	42.42	6.45	46.60	51.77	29.15	4.43
	L2-U3b	-8.55	27.85	-0.24	54.70	-4.94	16.09	-0.14
	-	0.00	0.00	0.00	0.00	0	0	0
SECTION B-B	L2-U1	75.35	42.42	6.45	46.60	54.75	30.82	4.69
	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**8.51**	**>1, OK**	**14.96**	**>1, OK**	**RF_{inv} =**	**8.51**	**>1, OK**
	12.98	**>1, OK**	**21.67**	**>1, OK**	**RF_{opr} =**	**12.98**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
L2S	Shear Capacity: Partial Shear Check	4/28/2016	6/1/2016		13

2

Member Connection: L2-U3b

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? No

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		L2	-	
Fy =	0	0	ksi	50	0	*Yield Stress*
Thickness =	0	0	in	0.625	0	*Plate Thickness*
Shear Plane Length =	0	0	in	30.61	0	*Figure 3*
# Bolts =	0	0		5.5	0	*Figure 3*
Bolts Diameter =	0	0	in	1	0	*Figure 3*
# Rivets =	0	0		0	0	*Figure 3*
Rivet Diameter =	0	0	in	0	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	19.131	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	488.2	0.0	*Yield Capacity*
Controlling C =	0.0			488.2		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	L2-U3b	-8.55	27.85	-0.24	54.70	-6.98	22.73	-0.20

	Horizontal	Vertical		Controlling	
Partial Shear Rating:	>1, OK	10.08	>1, OK	RF_{inv} = 10.08	>1, OK
	>1, OK	16.98	>1, OK	RF_{opr} = 16.98	>1, OK

2

Gusset Reference: L2

Reference

Chord Splice Resistance: $C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$ — *MBE (2014) L6B.2.6.6*

Net Capacity*: $C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$ — *MBE (2014) L6B.2.6.6*
**For Tensile Splices Only*

LFR rating factor: $RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$ — Inventory Rating

LFR rating factor: $RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$ — Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ_{cs} =	1			Resistance Factor

Gusset Properties:

Splice Type = *T*

Tensile Splice	*Yes*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.625	*in*	Gusset PL Height, H =	*74.61*	*in*
Chord Box Centroid Depth =	38	*in*	Lsplice =	*4*	*in*
Yield Stress, F_y =	50	*ksi*	Ultimate Stress, F_u =	*65*	*ksi*
F_{cr} check =	11.09	**<25, OK**	Critical Stess, F_{cr} =	*50*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.625	74.61	37.31	46.63	1739.58	21631.80	21631.66	0.14
Left	0.625	74.61	37.31	46.63	1739.58	21631.80	21631.66	0.14
Addtl PLs								
Top	8	0.5	47.57	4	190.28	417.1	0.1	417.0
Bottom	8	0.5	28.43	4	113.72	319.1	0.1	319.0
Right				0	0	0.0	0.0	0.0
Left				0	0	0.0	0.0	0.0
		Σ=	37.36	101.26	3783.16	43999.73		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/1/2016*		15

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top	2	0.9375	0.5	47.57	-0.938	-44.60	-144.21	-0.02	-144.19
Bottom	2	0.9375	0.5	28.43	-0.938	-26.65	-42.59	-0.02	-42.57
1	2	0.625	1.0625	7.15	-1.328	-9.50	-1042.73	-0.12	-1042.61
2	2	0.625	1.0625	12.65	-1.328	-16.80	-673.58	-0.12	-673.46
3	2	0.625	1.0625	18.4	-1.328	-24.44	-373.56	-0.12	-373.44
4**	2	0.625	8.25	25.65	-10.313	-264.52	-992.78	-58.49	-934.29
5	2	0.625	1.0625	32	-1.328	-42.50	-13.46	-0.12	-13.33
6	2	0.625	1.0625	38	-1.328	-50.47	-10.77	-0.12	-10.65
7	2	0.625	1.0625	44	-1.328	-58.44	-103.72	-0.12	-103.59
8	2	0.625	1.0625	50.61	-1.328	-67.22	-316.81	-0.12	-316.69
9	2	0.625	1.0625	55.62	-1.328	-73.87	-555.64	-0.12	-555.52
10	2	0.625	1.0625	60.61	-1.328	-80.50	-859.80	-0.12	-859.67
11	2	0.625	1.0625	65.61	-1.328	-87.14	-1230.90	-0.12	-1230.77
12	2	0.625	1.0625	72.11	-1.328	-95.77	-1812.60	-0.12	-1812.48
-	-	-	-	-	-	-	-	-	-
			Σ=	35.17	-26.80	-942.40	-8173.15	-59.90	-8113.25

*****Splice Hole***

Splice Properties: **C = 4783.91 kip** *Controlling Resistance*

A_g=	101.3	in^2	A_n=	74.5	in^2	*Plates areas*
y_g=	37.4	in	y_n=	38.1	in	*Area Centroid Height*
H - y_g=	37.25	in	H - y_n=	36.46	in	Ytop
I_g=	43999.7	in	I_n=	35826.6	in	*Area Moment of Inertia*
S_g=	1177.7	in^3	S_n=	939.1	in^3	*Plates Section Modulus*
e_p=	0.6	in	e_n=	0.1	in	*Distance between centroid*
C_{GROSS} =	**4799.01**	**kip**	**C_{NET} =**	**4783.91**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/1/2016*		16

Splice Forces:

Gusset Reference = L2

Left side:

	DL	LL	θ_L
L2-L0	285.90	100.40	0
L2-U1	150.7	84.84	46.6
-	0	0	0
$\gamma.\Sigma =$	506.28	344.36	

Right Side:

	DL	LL	θ_L
-	0	0	0
L2-U3	17.1	63.9	54.7
L2-L4	380.20	148.10	0
$\gamma.\Sigma =$	507.11	401.50	

	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**12.42**	**>1, OK**	**10.65**	**>1, OK**	**RF_{inv} =**	**10.65**	**>1, OK**
RF_{LFRopr} =	**20.73**	**>1, OK**	**17.78**	**>1, OK**	**RF_{opr} =**	**17.78**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L2	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/28/2016	6/1/2016		17

Gusset Reference: L2

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	4.31	155.20	6.25	224.87
Axial Tension Capacity	3.82	137.34	5.53	199.00
Shear Capacity: Yield/Rupture	8.51	306.42	12.98	467.16
Partial Shear Capacity: Yield	10.08	362.97	16.98	611.15
Compression Capacity	9.55	343.81	16.08	578.89
Chord Splice	10.65	383.47	17.78	640.10
Controlling Gusset Rating:	**3.82**	**137.34**	**5.53**	**199.00**

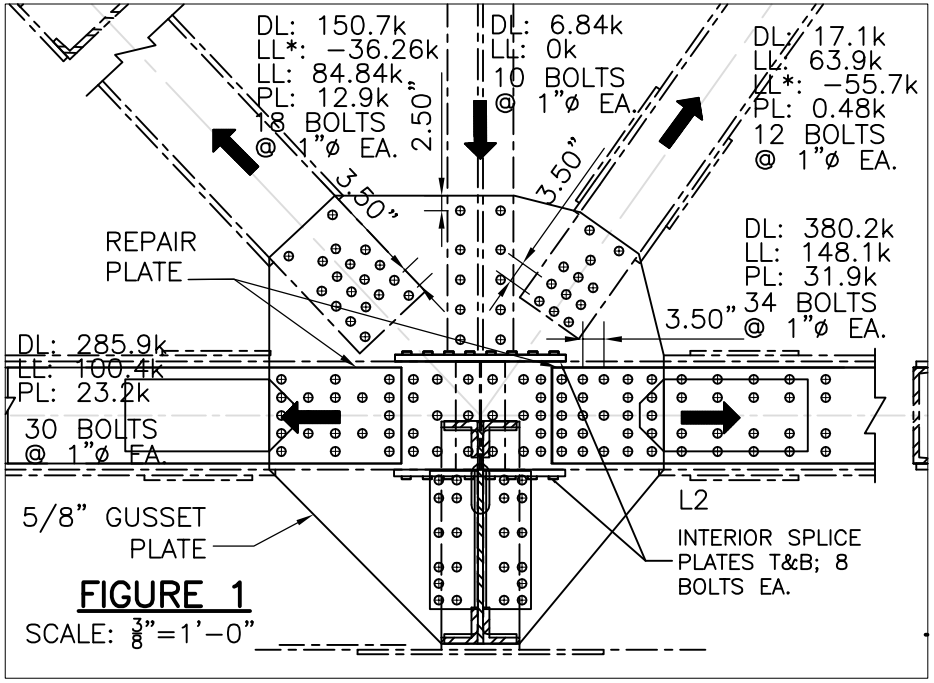

FIGURE 1
SCALE: $\frac{3}{8}$"=1'−0"

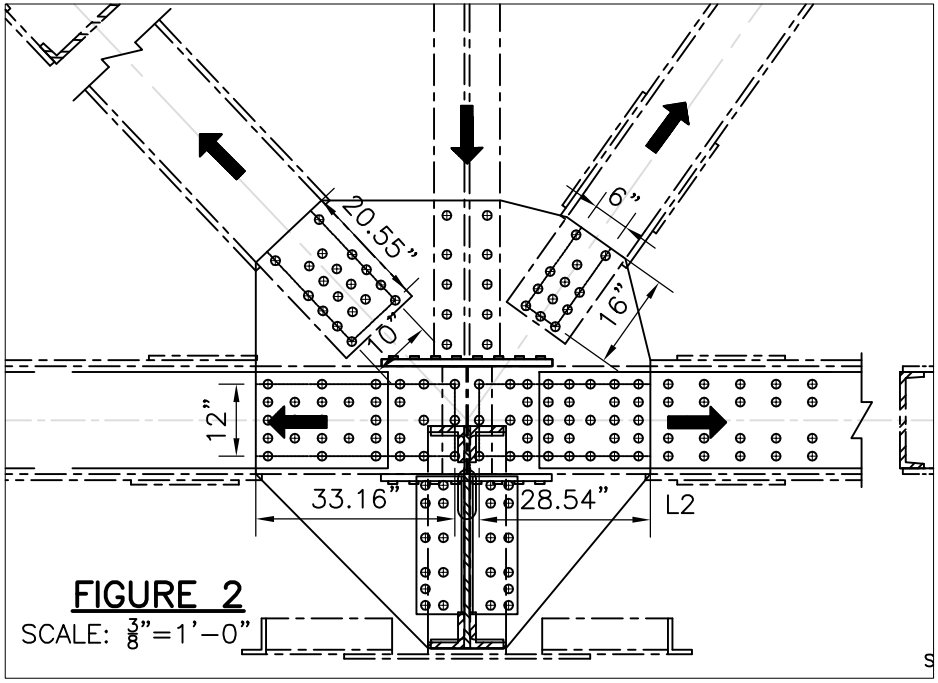

FIGURE 2
SCALE: $\frac{3}{8}$"=1'−0"

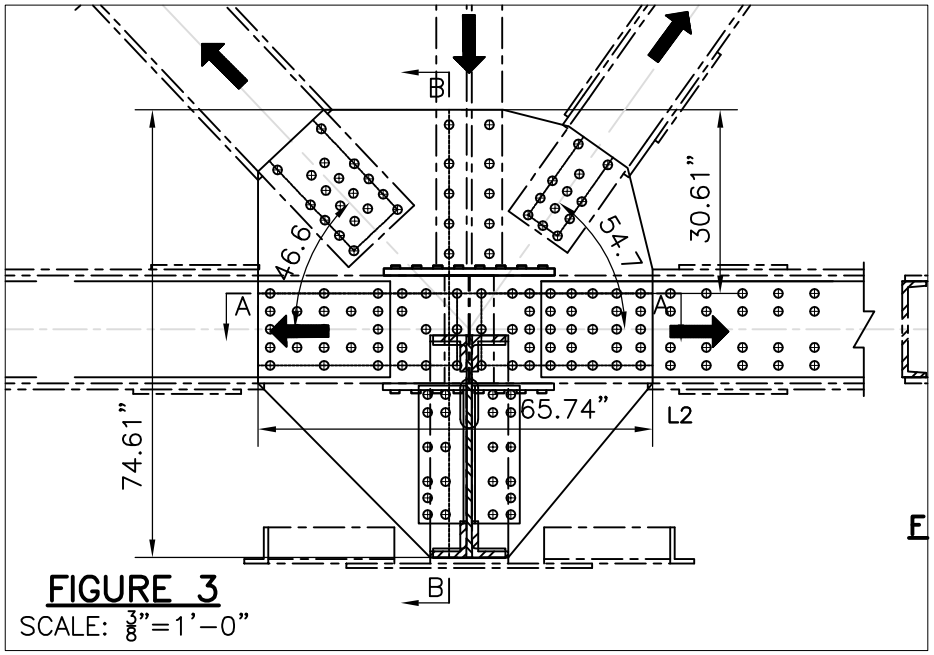

FIGURE 3
SCALE: $\frac{3}{8}$"=1'−0"

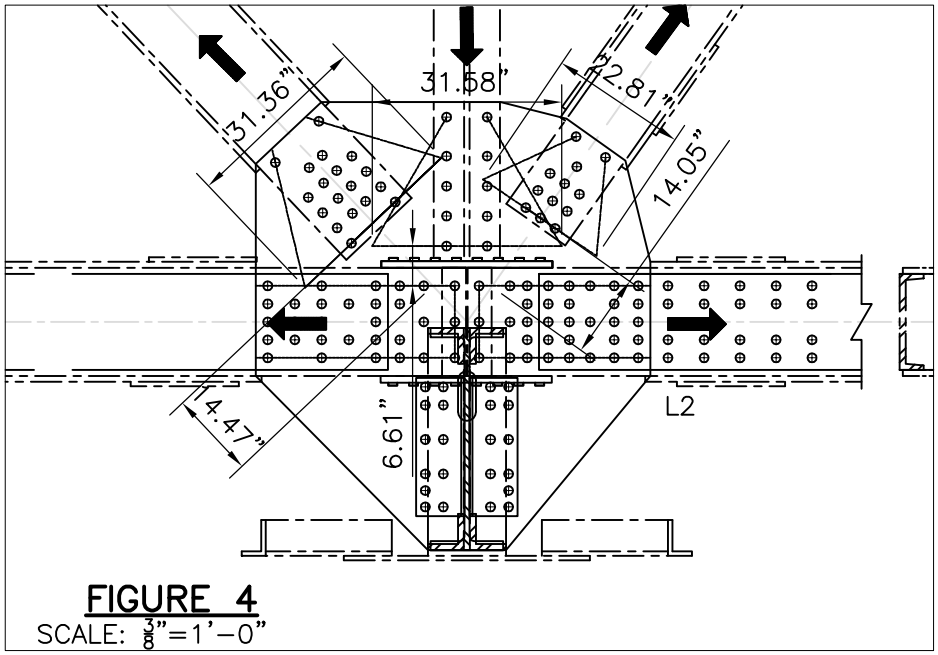

FIGURE 4
SCALE: $\frac{3}{8}$"=1'−0"

Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

BOLT ⊕
RIVET ○

STV 100 Years

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One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
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Project: WESTFIELD (W−25−010) GREAT RIVER BRIDGE		Drawing No.: L2−A
Title: Gusset Plate L2 Rating		Project No.: 401−3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

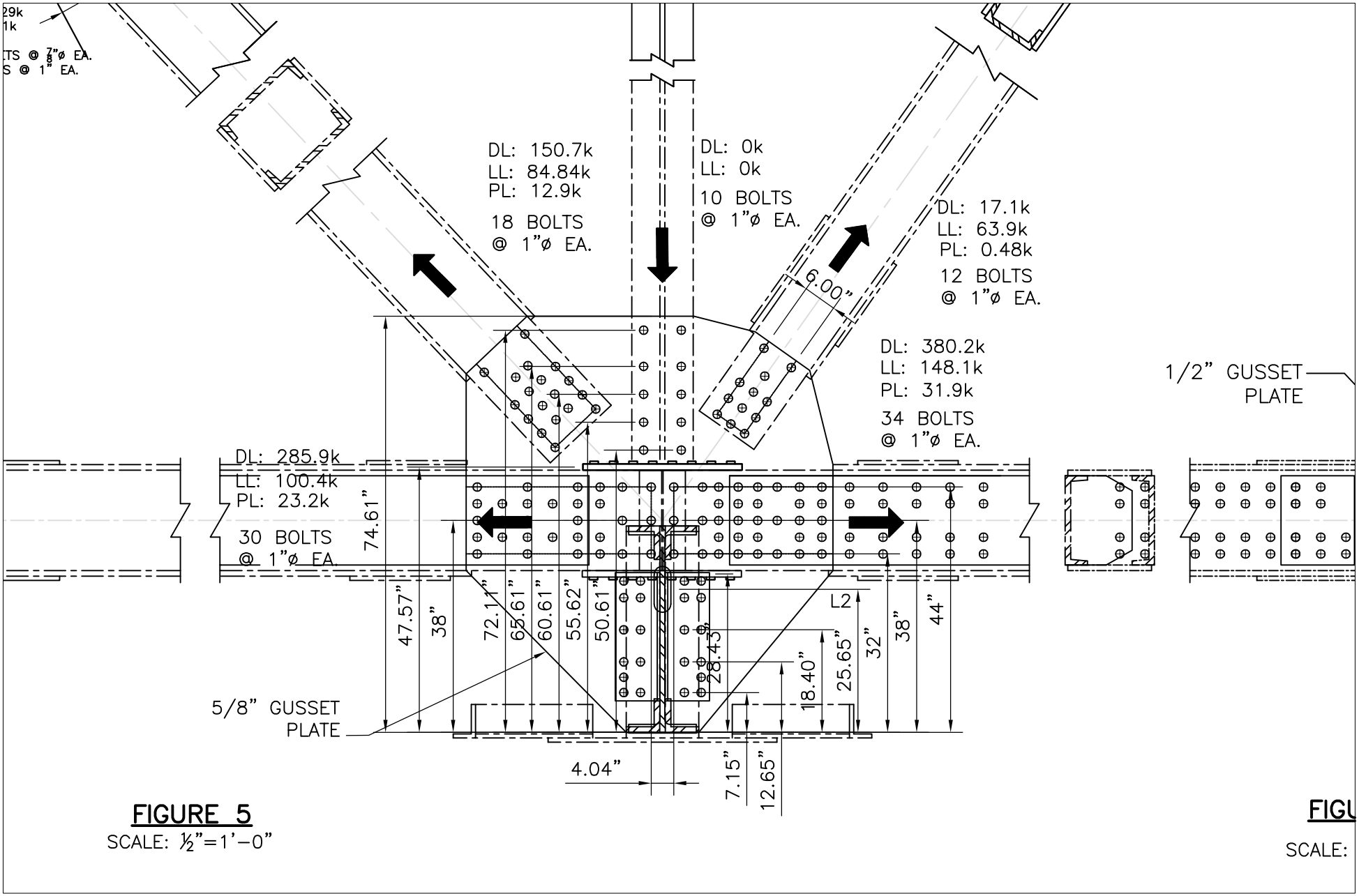

FIGURE 5

SCALE: ½"=1'–0"

FIGU

SCALE:

Figure 5: Gusset Plate & Chord Splice

LEGEND:

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Project: WESTFIELD (W–25–010) GREAT RIVER BRIDGE		Figure No.: L2–B
Title: Gusset Plate L2 Rating		Project No.: 401–3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L3	ARG	*WRG*		
	Gusset Plate Loading	4/29/16	6/1/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: L3**

Member Connection:	**L3-U3**	***T***	**Member Connection:**	**-**	***0***
Total Fasteners		40	Total Bolts		0
Thickness of Channel Web (in)		0.375	Thickness of Channel Web (in)		0
Dead Load (kip)		112.84	Dead Load (kip)		0
Truck Live Load + Impact (kip)		94.29	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		9.28	Pedestrian Load (kip)		0
Bolts on Gusset Plates		40	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**56.42**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**47.15**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**4.64**	Ped. Load Per Gusset Plate (kip)		**0.00**

Member Connection:	**-**	***0***	**Member Connection:**	**-**	***0***
Total Bolts		0	Total Bolts		0
Thickness of Channel Web (in)		0	Thickness of Channel Web (in)		0
Dead Load (kip)		0	Dead Load (kip)		0
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		0	Pedestrian Load (kip)		0
Bolts on Gusset Plates		0	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**0.00**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**0.00**

Member Connection:	**-**	***0***	**Member Connection:**	**-**	***0***
Total Bolts		0	Total Bolts		0
Thickness of Channel Web (in)		0	Thickness of Channel Web (in)		0
Dead Load (kip)		0	Dead Load (kip)		0
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		0	Pedestrian Load (kip)		0
Bolts on Gusset Plates		0	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**0.00**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**0.00**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L3	*ARG*	*WRG*		
L3S	Fasteners Bearing & Shear Capacity	4/29/2016	6/1/2016		2

Member Connection: **L3-U3**

		Reference
Shear Resistance:	$C := (\phi F)m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.938	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	20	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	549.8	0	kip	*Capacity for Total Fastener Group*
Bearing C =	945	0	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	56.42	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.64	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**4.66**	**>1, OK**
	RF_{opr} =	**7.08**	**>1, OK**
Bearing:	**RF_{inv} =**	**8.52**	**>1, OK**
	RF_{opr} =	**12.95**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L3	*ARG*	*WRG*		
L3S	Axial Tension Capacity	4/29/2016	6/1/2016		3

1 0

Member Connection: **L3-U3**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	45	ksi	
Fu =	65	70	ksi	
Thickness =	0.5	0.375	in	*Figure 1*
Ae =	10.44	-	in^2	
Block Shear Rupture C =	1033.28	731.85	kip	
Effective Gross Yielding C =	522.00	-	kip	
Controlling C =	522.0			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	78.75	4.5	20.88	in	*Figure 2*
# Bolts =	19	1	2		*Figure 2*
Bolts Diameter =	1	1	1	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	39.38	2.25	10.44	in^2	** Figure 4*
Gusset An =	29.28	1.72	9.38	in^2	
Member Ag =	29.53	1.69	7.83	in^2	
Member An =	21.96	1.29	7.03	in^2	

Member Loading Information:

DL Force =	56.42	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.64	kip	*Bridge Manual 7.2.4.7*

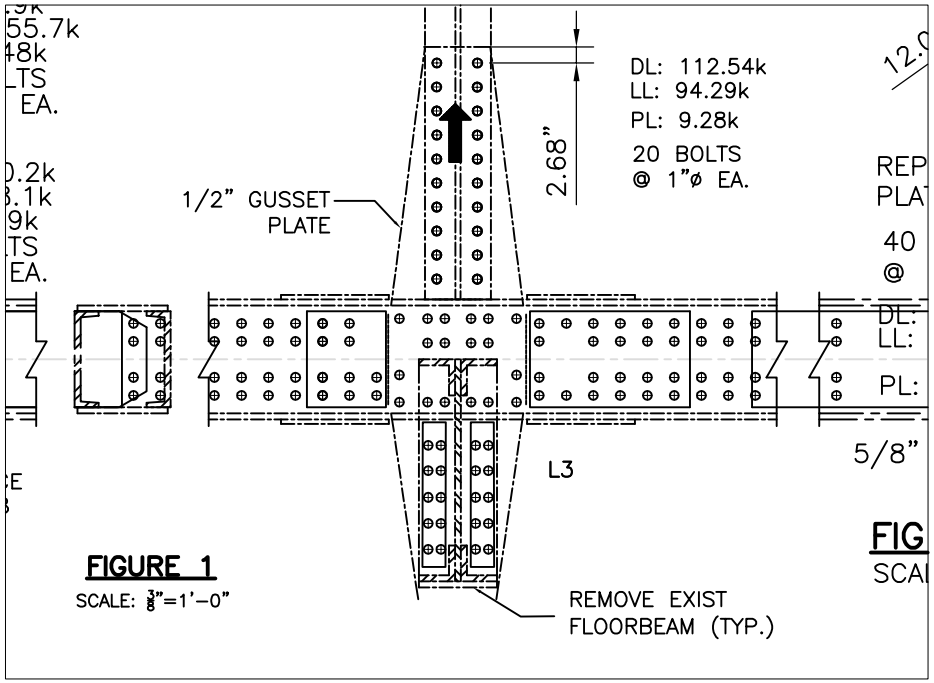
Additional Factors:

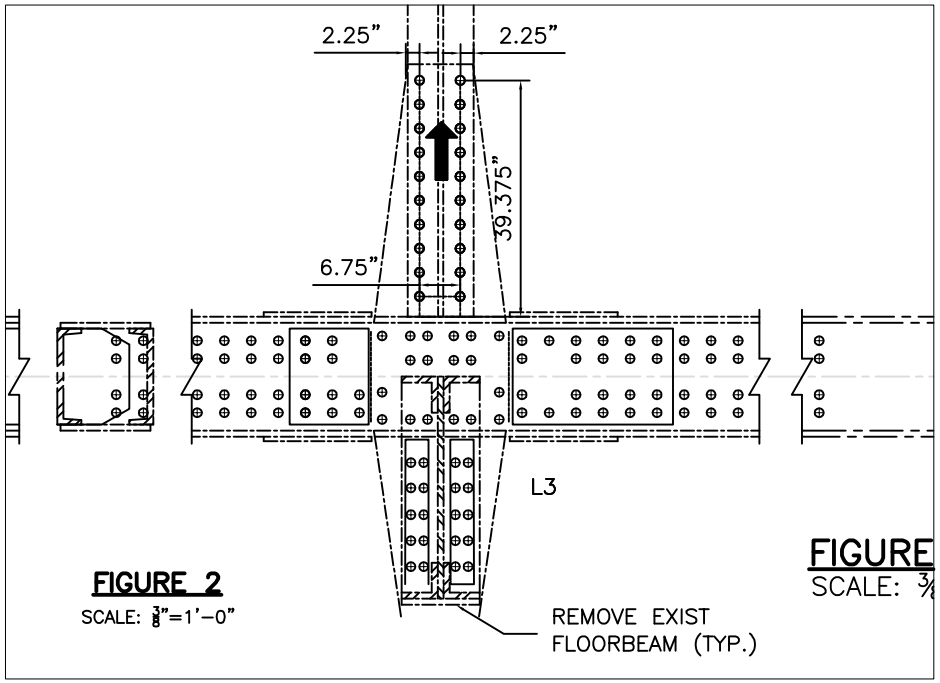
		Tension:	**RF_{inv} =**	**4.39**	**>1, OK**
Reduction Factor, Rp =	1		**RF_{opr} =**	**6.66**	**>1, OK**
β =	0.15				

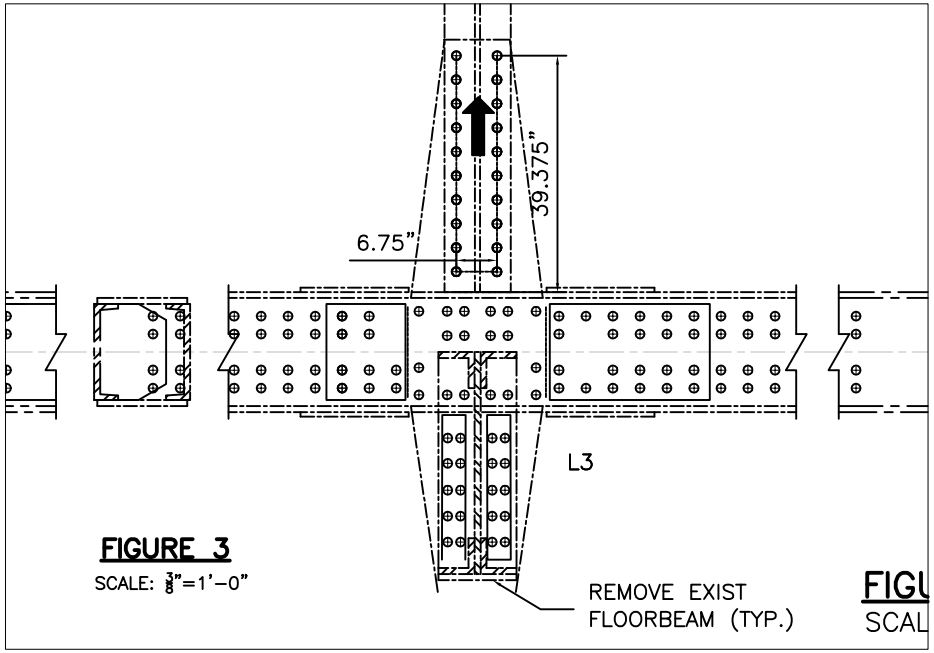
CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L3	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/29/2016	6/1/2016		4

Gusset Reference: L3-U3

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	4.66	167.65	7.08	254.77
Axial Tension Capacity	4.39	157.88	6.66	239.92
Shear Capacity: Yield/Rupture	N/A	N/A	N/A	N/A
Partial Shear Capacity: Yield	N/A	N/A	N/A	N/A
Compression Capacity	N/A	N/A	N/A	N/A
Chord Splice	N/A	N/A	N/A	N/A
Gusset Rating:	4.39	157.88	6.66	239.92







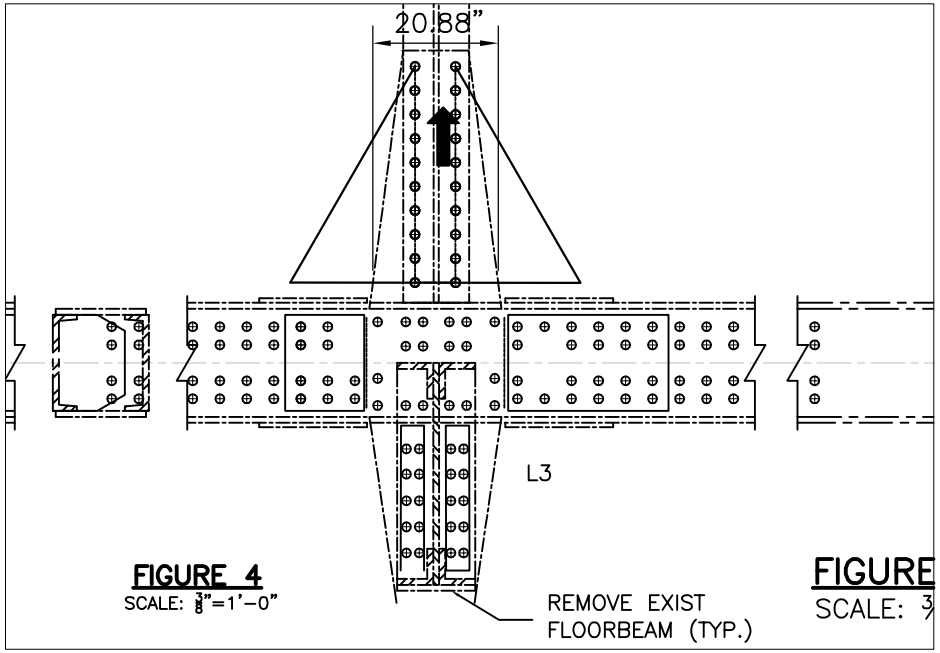


Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

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STV 100 Years
STV Incorporated
One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: L3-A
Title: Gusset Plate L3 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	ARG	*WRG*		
	Gusset Plate Loading	4/29/16	6/1/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: L4**

Member Connection:	**L4-L2**	***T***	**Member Connection:**	**L4-U3**	***C***
Total Fasteners		96	Total Fasteners		48
Thickness of Channel Web (in)		0.6	Thickness of Channel Web (in)		0.51
Dead Load (kip)		380.2	Dead Load (kip)		116.5
Truck Live Load + Impact (kip)		148.1	Truck Live Load + Impact (kip)		74.7
Pedestrian Load (kip)		31.9	Pedestrian Load (kip)		8.1
Bolts on Gusset Plates		80	Bolts on Gusset Plates		48
Bolts on Additional Load Transferring Members		16	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**158.42**	Dead Load Per Gusset Plate (kip)		**58.25**
LL+I Per Gusset Plate (kip)		**61.71**	LL+I Per Gusset Plate (kip)		**37.35**
Ped. Load Per Gusset Plate (kip)		**13.29**	Ped. Load Per Gusset Plate (kip)		**4.05**

Member Connection:	**L4-U4**	***C***	**Member Connection:**	**L4-U5**	***T***
Total Fasteners		24	Total Fasteners		78
Thickness of Channel Web (in)		0.375	Thickness of Channel Web (in)		0.465
Dead Load (kip)		5.63	Dead Load (kip)		258.3
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		103.2
Pedestrian Load (kip)		0	Pedestrian Load (kip)		19.4
Bolts on Gusset Plates		24	Bolts on Gusset Plates		78
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**2.82**	Dead Load Per Gusset Plate (kip)		**129.15**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**51.60**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**9.70**

Member Connection:	**L4-L6**	***T***	**Member Connection:**	**-**	***0***
Total Fasteners		72	Total Fasteners		0
Thickness of Channel Web (in)		0.45	Thickness of Channel Web (in)		0
Dead Load (kip)		173.2	Dead Load (kip)		0
Truck Live Load + Impact (kip)		108.6	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		16.7	Pedestrian Load (kip)		0
Bolts on Gusset Plates		56	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		16	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**67.36**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**42.23**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**6.49**	Ped. Load Per Gusset Plate (kip)		**0.00**

*(**b**) Denotes alternative Load Case*

Member Connection: **L4-L2**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	65	ksi	*Ultimate Strength*
Thickness =	0.625	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	40	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	1099.6	0	kip	*Capacity for Total Fastener Group*
Bearing C =	2925.00	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	158.42	kip	**Pedestrian Loads are only*
LL+I Force =	61.71	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.29	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**6.67**	**>1, OK**
	RF_{opr} =	**9.17**	**>1, OK**
Bearing:	**RF_{inv} =**	**20.31**	**>1, OK**
	RF_{opr} =	**27.89**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Fasteners Bearing & Shear Capacity	*4/29/2016*	*6/1/2016*		3

4

Member Connection: **L4-U3**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.51	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	24	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	659.7	0	kip	*Capacity for Total Fastener Group*
Bearing C =	1542.24	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	58.25	kip	**Pedestrian Loads are only*
LL+I Force =	37.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.05	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**7.21**	**>1, OK**
	RF_{opr} =	**10.85**	**>1, OK**
Bearing:	**RF_{inv} =**	**18.09**	**>1, OK**
	RF_{opr} =	**27.25**	**>1, OK**

Member Connection: **L4-U5**

		Reference
Shear Resistance:	$C := (\phi F)m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.465	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	39	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	1072.1	0	kip	*Capacity for Total Fastener Group*
Bearing C =	2285.01	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	129.15	kip	**Pedestrian Loads are only*
LL+I Force =	51.60	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.70	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**8.07**	**>1, OK**
	RF_{opr} =	**11.35**	**>1, OK**
Bearing:	**RF_{inv} =**	**18.91**	**>1, OK**
	RF_{opr} =	**26.57**	**>1, OK**

Member Connection: **L4-L6**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	28	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	769.7	0	kip	*Capacity for Total Fastener Group*
Bearing C =	1360.80	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	67.36	kip	**Pedestrian Loads are only*
LL+I Force =	42.23	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.49	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**6.67**	**>1, OK**	**Shear:**	**RF_{inv} =**	**7.44**	**>1, OK**
	RF_{opr} =	**9.17**	**>1, OK**		**RF_{opr} =**	**10.77**	**>1, OK**
Bearing:	**RF_{inv} =**	**13.89**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**13.89**	**>1, OK**
	RF_{opr} =	**20.10**	**>1, OK**		**RF_{opr} =**	**20.10**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Axial Tension Capacity	4/29/2016	6/1/2016		6

3 0

Member Connection: **L4-L2**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	45	ksi	*Yield Stress*
Fu =	65	70	ksi	*Ultimate Stress*
Thickness =	0.625	0.6	in	*Figure 1*
Ae =	0.00	-	in^2	*Effective Area*
Block Shear Rupture C =	1172.64	1062.02	kip	*Block Shear Capacity*
Effective Gross Yielding C =	0.00	-	kip	*Yielding Capacity*
Controlling C =	1062.0			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	0		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	59	12	-	in	*Figure 2*
# Bolts =	13	4	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	36.88	7.50	0.00	in^2	**Figure 4*
Gusset An =	28.24	4.84	0.00	in^2	
Member Ag =	35.40	7.20	0.00	in^2	
Member An =	27.11	4.65	0.00	in^2	

Member Loading Information:

DL Force =	158.42	kip	**Pedestrian Loads are only*
LL+I Force =	61.71	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.29	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension: **RF_{inv} = 6.39** **>1, OK**

RF_{opr} = 8.78 **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Axial Tension Capacity	*4/29/2016*	*6/1/2016*		7

3 0

Member Connection: **L4-U5**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	45	ksi	*Yield Stress*
Fu =	65	70	ksi	*Ultimate Stress*
Thickness =	0.625	0.465	in	*Figure 1*
Ae =	22.94	-	in^2	*Effective Area*
Block Shear Rupture C =	920.86	698.94	kip	*Block Shear Capacity*
Effective Gross Yielding C =	1147.19	-	kip	*Yielding Capacity*
Controlling C =	698.9			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	57.36	6	36.71	in	*Figure 2*
# Bolts =	17	2	3		*Figure 2*
Bolts Diameter =	1	1	1	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	35.85	3.75	22.94	in^2	**Figure 4*
Gusset An =	24.56	2.42	20.95	in^2	
Member Ag =	26.67	2.79	17.07	in^2	
Member An =	18.27	1.80	15.59	in^2	

Member Loading Information:

DL Force =	129.15	kip	**Pedestrian Loads are only*
LL+I Force =	51.60	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.70	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

		Tension:	**RF_{inv} =**	**4.74**	**>1, OK**
Reduction Factor, Rp =	1		**RF_{opr} =**	**6.66**	**>1, OK**
β =	0.15				

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Axial Tension Capacity	*4/29/2016*	*6/1/2016*		8

3 0

Member Connection: **L4-L6**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	33	ksi	*Yield Stress*
Fu =	65	60	ksi	*Ultimate Stress*
Thickness =	0.625	0.45	in	*Figure 1*
Ae =	0.00	-	in^2	*Effective Area*
Block Shear Rupture C =	1247.45	643.48	kip	*Block Shear Capacity*
Effective Gross Yielding C =	0.00	-	kip	*Yielding Capacity*
Controlling C =	643.5			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	0		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	63.6	12	-	in	*Figure 2*
# Bolts =	9	4	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	39.75	7.50	0.00	in^2	**Figure 4*
Gusset An =	33.77	4.84	0.00	in^2	
Member Ag =	28.62	5.40	0.00	in^2	
Member An =	24.32	3.49	0.00	in^2	

Member Loading Information:

DL Force =	67.36	kip	**Pedestrian Loads are only*
LL+I Force =	42.23	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.49	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension:	**RF_{inv} =**	**6.07**	**>1, OK**
	RF_{opr} =	**8.78**	**>1, OK**
Controlling:	**RF_{inv} =**	**4.74**	**>1, OK**
	RF_{opr} =	**6.66**	**>1, OK**

Member Connection: **L4-U3**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	50	ksi	*Yield Stress*
Whitmore Eff. Length =	26.69	in	*Figure 4*
Whitmore Distance, Lc =	14.16	in	*Figure 4*
Thickness =	0.625	in	*Gusset Plate thickness*
A_s =	16.68	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	39.24		
$\sqrt{(2\pi^2E/F_y)}$ =	107.00		
F_{cr} =	**46.64**	**ksi**	
C =	**661.28**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	58.25	kip	**Pedestrian Loads are only*
LL+I Force =	37.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.05	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**7.22**	**>1, OK**
	RF_{opr} =	**10.88**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Shear Capacity: Rupture Resistance	4/29/2016	6/1/2016		10

Member Connection: **L4-L2**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A			Plane B-B			
	L4	-		L4	-		
Fy =	50	0		50	0	ksi	*Yield Stress*
Fu =	65	0		65	0	ksi	*Ultimate Stress*
Thickness =	0.625	0		0.625	0	in	*Plate Thickness*
Shear Plane Length =	65.33	0		80.01	0	in	*Figure 3*
# Bolts =	12	0		16	0		*Figure 3*
Bolts Diameter =	1	0		1	0	in	*Figure 3*
# Rivets =	0	0	*	1	0		*Figure 3*
Rivet Diameter =	0	0	*	8.25	0	in	*Figure 3*
Gross Area, Ag =	40.83	0		50.01	0	in^2	**Splice Hole*
Net Area, An =	32.86	0		34.19	0	in^2	
Yield Resistance C =	1042.01	0.0		1276.2	0.0	kip	*Yield Capacity*
Rupture Resistance C =	926.71	0.0		964.0	0.0	kip	*Rupture Capacity*
Controlling C =	926.7			964.0			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	L4-U3	58.25	37.35	4.05	54.70	33.66	21.58	2.34
	L4-U5	129.15	51.60	9.70	57.60	69.20	27.65	5.20
	-	0.00	0.00	0.00	0.00	0	0	0
SECTION B-B	L4-U5	129.15	51.60	9.70	57.60	109.04	43.57	8.19
	-	0.00	0.00	0.00	0.00	0	0	0
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**7.42**	**>1, OK**	**8.70**	**>1, OK**	**RF_{inv} =**	**7.42**	**>1, OK**
	10.75	**>1, OK**	**12.22**	**>1, OK**	**RF_{opr} =**	**10.75**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Shear Capacity: Partial Shear Check	4/29/2016	6/1/2016		10

1

Member Connection: **L4-U3**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? No

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		L4	-	
Fy =	0	0	ksi	50	0	*Yield Stress*
Thickness =	0	0	in	0.625	0	*Plate Thickness*
Shear Plane Length =	0	0	in	35.17	0	*Figure 3*
# Bolts =	0	0		6	0	*Figure 3*
Bolts Diameter =	0	0	in	1	0	*Figure 3*
# Rivets =	0	0		0	0	*Figure 3*
Rivet Diameter =	0	0	in	0	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	21.981	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	561.0	0.0	*Yield Capacity*
Controlling C =	0.0			561.0		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	L4-U3	58.25	37.35	4.05	54.70	47.54	30.48	3.31

	Horizontal	Vertical			Controlling	
Partial Shear Rating:	>1, OK	7.55	>1, OK	RF_{inv} =	7.55	>1, OK
	>1, OK	11.36	>1, OK	RF_{opr} =	11.36	>1, OK

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
L4S	Chord Splice Resistance	4/29/2016	6/1/2016		11

1

Gusset Reference: L4

Reference

Chord Splice Resistance: $C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$ *MBE (2014) L6B.2.6.6*

Net Capacity*: $C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$ *MBE (2014) L6B.2.6.6*

**For Tensile Splices Only*

LFR rating factor: $RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$ Inventory Rating

LFR rating factor: $RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$ Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ_{cs} =	1			Resistance Factor

Gusset Properties:

Splice Type = *T*

Tensile Splice	*Yes*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.625	*in*	Gusset PL Height, H =	*79.125*	*in*
Chord Box Centroid Depth =	37	*in*	Lsplice =	*4*	*in*
Yield Stress, F_y =	50	*ksi*	Ultimate Stress, F_u =	*65*	*ksi*
F_{cr} check =	11.09	**<25, OK**	Critical Stess, F_{cr} =	*50*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.625	79.125	39.56	49.45	1956.49	25803.02	25801.20	1.82
Left	0.625	79.125	39.56	49.45	1956.49	25803.02	25801.20	1.82
Addtl PLs								
Top	8	0.5	46.625	4	186.5	210.6	0.1	210.5
Bottom	8	0.5	27.375	4	109.5	575.7	0.1	575.6
Right				0	0	0.0	0.0	0.0
Left				0	0	0.0	0.0	0.0
		Σ=	39.4	106.9	4209.0	52392.3		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
	Chord Splice Resistance	*4/29/2016*	*6/1/2016*		12

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h.y_{bar}$	Icg	Ig	$A.d^2$
Top	2	1.0625	0.5	46.63	-1.063	-49.54	-106.44	-0.02	-106.41
Bottom	2	1.0625	0.5	27.375	-1.063	-29.09	-90.78	-0.02	-90.76
1	2	0.625	1.0625	7.125	-1.328	-9.46	-1155.33	-0.12	-1155.20
2	2	0.625	1.0625	12.625	-1.328	-16.77	-764.64	-0.12	-764.51
3	2	0.625	1.0625	18.375	-1.328	-24.40	-442.10	-0.12	-441.98
4**	2	0.625	8.25	25.625	-10.313	-264.26	-1304.57	-58.49	-1246.07
5	2	0.625	1.0625	27.375	-1.328	-36.36	-113.57	-0.12	-113.45
6	2	0.625	1.0625	31	-1.328	-41.17	-42.03	-0.12	-41.91
7	2	0.625	1.0625	34	-1.328	-45.16	-9.22	-0.12	-9.10
8	2	0.625	1.0625	37	-1.328	-49.14	-0.32	-0.12	-0.19
9	2	0.625	1.0625	40	-1.328	-53.13	-15.32	-0.12	-15.20
10	2	0.625	1.0625	43.000	-1.328	-57.11	-54.23	-0.12	-54.11
11	2	0.625	1.0625	52.250	-1.328	-69.39	-324.69	-0.12	-324.57
12	2	0.625	1.0625	56.250	-1.328	-74.71	-512.04	-0.12	-511.91
13	2	0.625	1.0625	60.250	-1.328	-80.02	-741.89	-0.12	-741.76
14	2	0.625	1.0625	66.250	-1.328	-87.99	-1166.34	-0.12	-1166.22
15	2	0.625	1.0625	72.250	-1.328	-95.96	-1686.43	-0.12	-1686.30
16	2	0.625	1.0625	76.250	-1.328	-101.27	-2086.27	-0.12	-2086.15
			Σ=	36.62	-32.36	-1184.91	-10616.21	-60.41	-10555.80

*****Splice Hole***

Splice Properties: **C = 3851.39 kip** *Controlling Resistance*

A_g=	106.9	in^2	A_n=	74.5	in^2	*Plates areas*
y_g=	39.4	in	y_n=	40.6	in	*Area Centroid Height*
H - y_g=	39.75	in	H - y_n=	38.56	in	Ytop
I_g=	52392.3	in	I_n=	41776.1	in	*Area Moment of Inertia*
S_g=	1317.9	in^3	S_n=	1029.8	in^3	*Plates Section Modulus*
e_p=	2.4	in	e_n=	3.6	in	*Distance between centroid*
C_{GROSS} =	**4483.15**	**kip**	**C_{NET} =**	**3851.39**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
	Chord Splice Resistance	*4/29/2016*	*6/1/2016*		13

Splice Forces:

Gusset Reference = L4

Left side:

	DL	LL	θ_L
L4-L2	380.20	148.10	0
L4-U3	-116.5	-74.7	54.7
-	0	0	0
$\gamma.\Sigma =$	406.74	227.71	

Right Side:

	DL	LL	θ_L
-	0	0	0
L4-U5	258.3	103.2	57.6
L4-L6	173.20	108.60	0
$\gamma.\Sigma =$	405.09	355.66	

	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**15.13**	**>1, OK**	**9.69**	**>1, OK**	**RF_{inv} =**	**9.69**	**>1, OK**
RF_{LFRopr} =	**25.25**	**>1, OK**	**16.17**	**>1, OK**	**RF_{opr} =**	**16.17**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L4	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/29/2016	6/1/2016		14

Gusset Reference: L4

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	6.67	240.24	9.17	329.95
Axial Tension Capacity	**4.74**	**170.74**	**6.66**	**239.90**
Shear Capacity: Yield/Rupture	7.42	267.22	10.75	386.82
Partial Shear Capacity: Yield	7.55	271.66	11.36	409.10
Compression Capacity	7.22	260.09	10.88	391.67
Chord Splice	9.69	348.84	16.17	582.29
Gusset Rating:	**4.74**	**170.74**	**6.66**	**239.90**

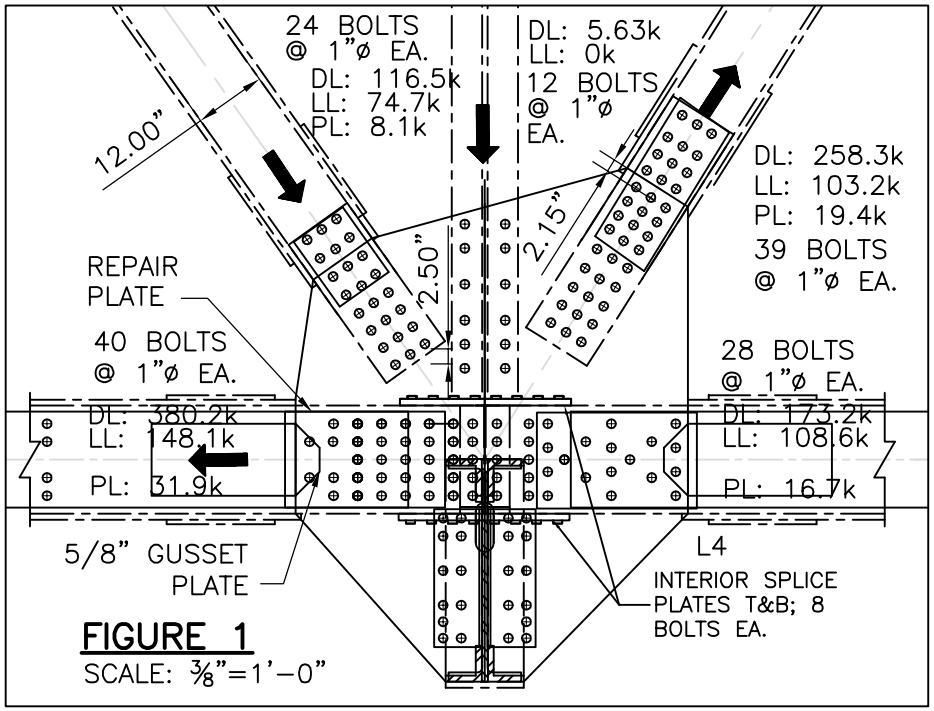

FIGURE 1
SCALE: ⅜"=1'-0"

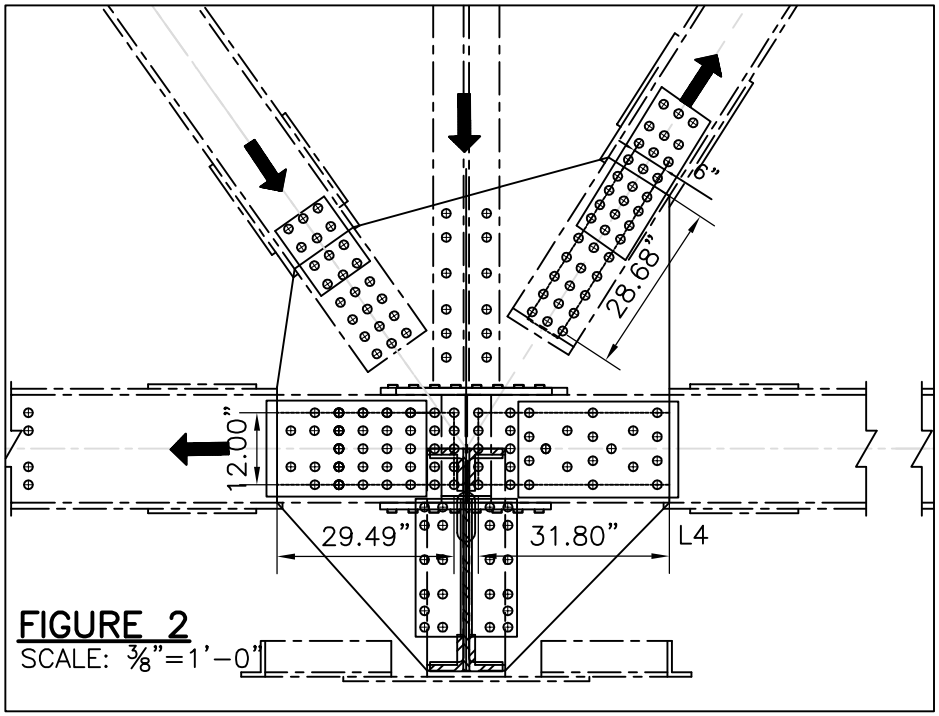

FIGURE 2
SCALE: ⅜"=1'-0"

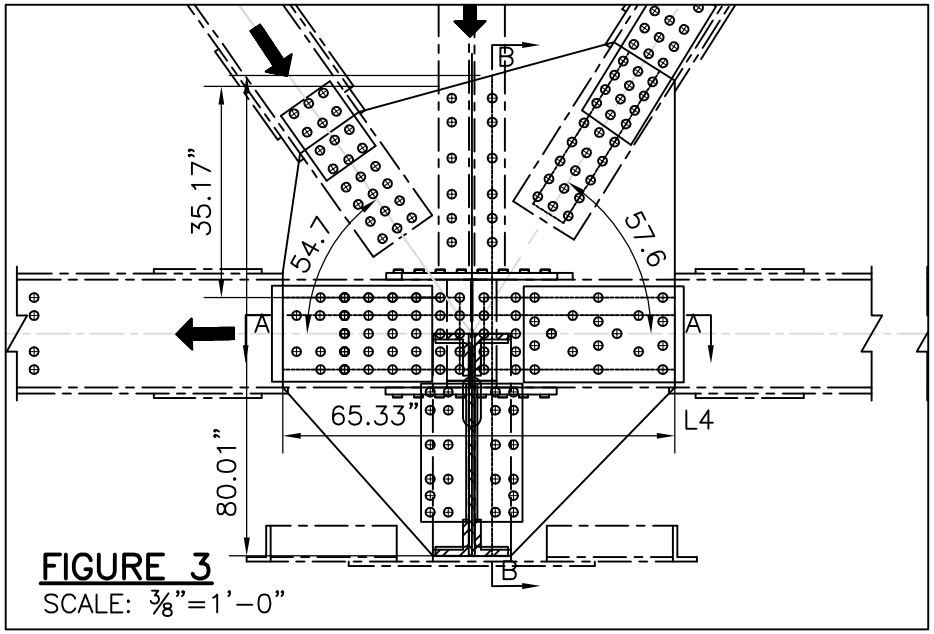

FIGURE 3
SCALE: ⅜"=1'-0"

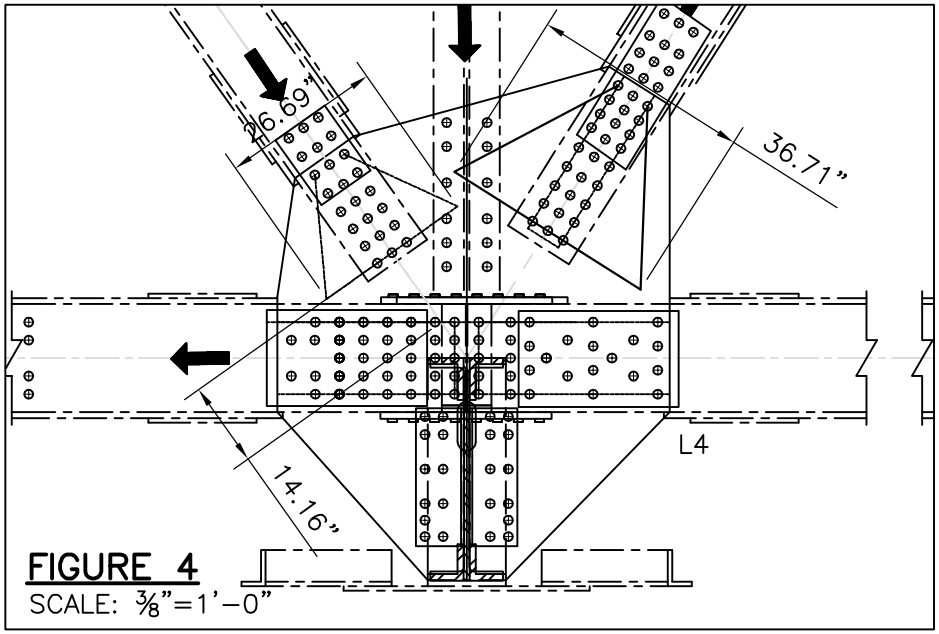

FIGURE 4
SCALE: ⅜"=1'-0"

Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

BOLT ⊕
RIVET ○

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STV Incorporated
One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: L4-A
Title: Gusset Plate L4 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

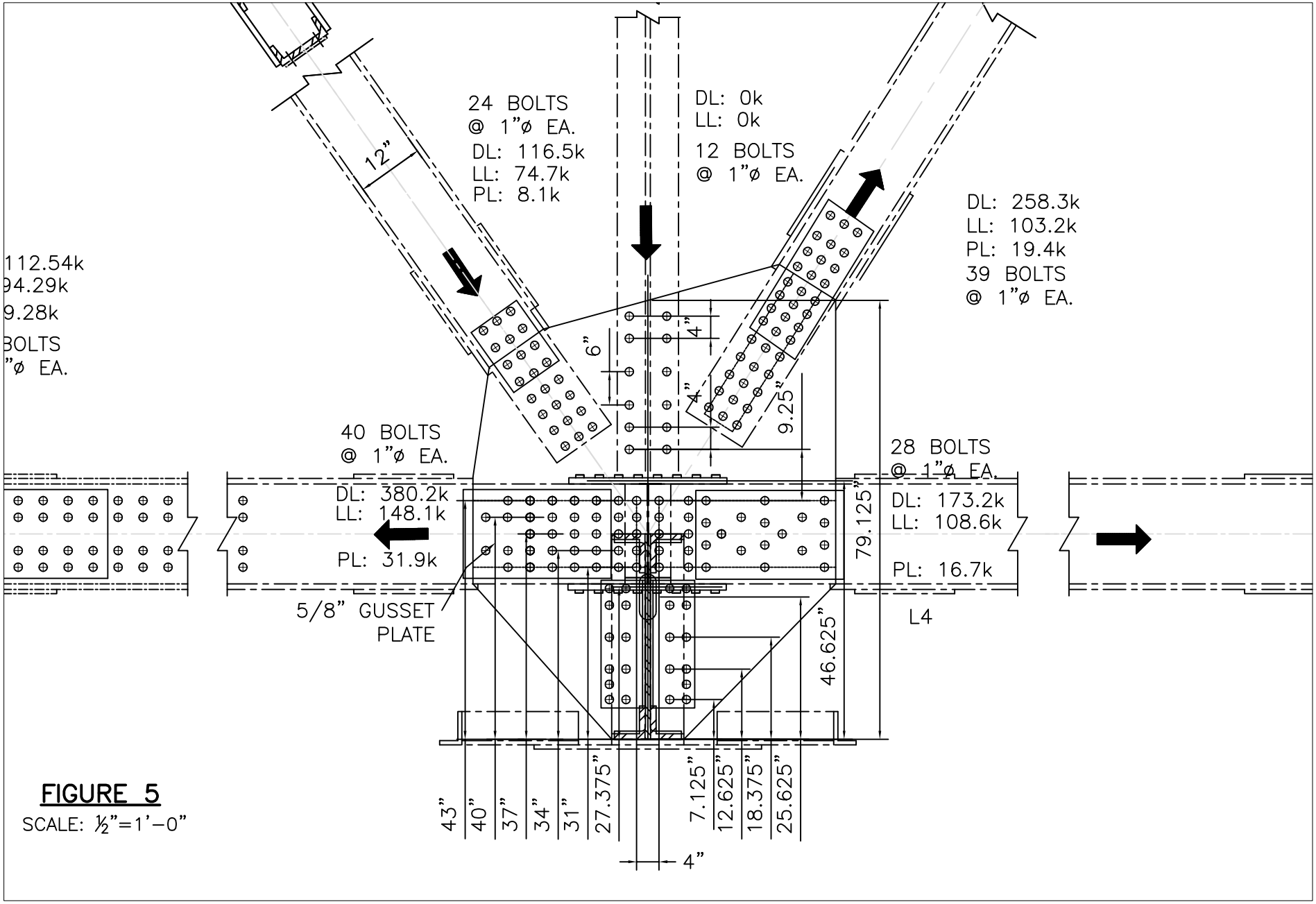

FIGURE 5

SCALE: ½"=1'-0"

Figure 5: Gusset Plate & Chord Splice

LEGEND:

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One Financial Center, 3rd Floor
Boston, MA 02111

Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: L4-B
Title: Gusset Plate L4 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	ARG	*WRG*		
	Gusset Plate Loading	4/29/16	6/1/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: L6**

Member Connection: L6-L4	***T***	**Member Connection: L6-U5**	***C***
Total Fasteners	72	Total Fasteners	76
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0.52
Dead Load (kip)	173.2	Dead Load (kip)	369.7
Truck Live Load + Impact (kip)	108.6	Truck Live Load + Impact (kip)	124.7
Pedestrian Load (kip)	16.7	Pedestrian Load (kip)	27.7
Bolts on Gusset Plates	56	Bolts on Gusset Plates	76
Bolts on Additional Load Transferring Members	16	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**67.36**	Dead Load Per Gusset Plate (kip)	**184.85**
LL+I Per Gusset Plate (kip)	**42.23**	LL+I Per Gusset Plate (kip)	**62.35**
Ped. Load Per Gusset Plate (kip)	**6.49**	Ped. Load Per Gusset Plate (kip)	**13.85**

Member Connection: L6-U6	***C***	**Member Connection: L6-U7**	***T***
Total Fasteners	32	Total Fasteners	80
Thickness of Channel Web (in)	0.375	Thickness of Channel Web (in)	0.7
Dead Load (kip)	5.78	Dead Load (kip)	512.9
Truck Live Load + Impact (kip)	0	Truck Live Load + Impact (kip)	156.3
Pedestrian Load (kip)	0	Pedestrian Load (kip)	39.3
Bolts on Gusset Plates	32	Bolts on Gusset Plates	80
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**2.89**	Dead Load Per Gusset Plate (kip)	**256.45**
LL+I Per Gusset Plate (kip)	**0.00**	LL+I Per Gusset Plate (kip)	**78.15**
Ped. Load Per Gusset Plate (kip)	**0.00**	Ped. Load Per Gusset Plate (kip)	**19.65**

Member Connection: L6-L8	***C***	**Member Connection: -**	***0***
Total Fasteners	68	Total Fasteners	0
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0
Dead Load (kip)	291.4	Dead Load (kip)	0
Truck Live Load + Impact (kip)	91.7	Truck Live Load + Impact (kip)	0
Pedestrian Load (kip)	18.5	Pedestrian Load (kip)	0
Bolts on Gusset Plates	52	Bolts on Gusset Plates	0
Bolts on Additional Load Transferring Members	16	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**111.42**	Dead Load Per Gusset Plate (kip)	**0.00**
LL+I Per Gusset Plate (kip)	**35.06**	LL+I Per Gusset Plate (kip)	**0.00**
Ped. Load Per Gusset Plate (kip)	**7.07**	Ped. Load Per Gusset Plate (kip)	**0.00**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
L6S	Fasteners Bearing & Shear Capacity	4/29/2016	6/1/2016		2

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Member Connection: **L6-L4**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	3.688	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	28	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	769.7	0	kip	*Capacity for Total Fastener Group*
Bearing C =	1360.80	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	67.36	kip	**Pedestrian Loads are only*
LL+I Force =	42.23	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.49	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**7.44**	**>1, OK**
	RF_{opr} =	**10.77**	**>1, OK**
Bearing:	**RF_{inv} =**	**13.89**	**>1, OK**
	RF_{opr} =	**20.10**	**>1, OK**

Member Connection: **L6-U5**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.52	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	38	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	1044.6	0	kip	*Capacity for Total Fastener Group*
Bearing C =	2489.76	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	184.85	kip	**Pedestrian Loads are only*
LL+I Force =	62.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.85	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**5.94**	**>1, OK**
	RF_{opr} =	**8.12**	**>1, OK**
Bearing:	**RF_{inv} =**	**16.63**	**>1, OK**
	RF_{opr} =	**22.71**	**>1, OK**

Member Connection: **L6-U7**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	65	ksi	*Ultimate Strength*
Thickness =	0.75	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	40	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	1099.6	0	kip	*Capacity for Total Fastener Group*
Bearing C =	3510.00	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	256.45	kip	**Pedestrian Loads are only*
LL+I Force =	78.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	19.65	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**4.52**	**>1, OK**
	RF_{opr} =	**6.03**	**>1, OK**
Bearing:	**RF_{inv} =**	**18.73**	**>1, OK**
	RF_{opr} =	**24.99**	**>1, OK**

Member Connection: **L6-L8**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	3.313	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	26	-		*Figure 1*
Diameter =	1	-	in	*Figure 1*
Area =	0.79	-	in^2	
Shear C =	714.7	0	kip	*Capacity for Total Fastener Group*
Bearing C =	1263.60	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	111.42	kip	**Pedestrian Loads are only*
LL+I Force =	35.06	kip	*included in Operating Ratings per*
*Pedestrian Force =	7.07	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**4.52**	**>1, OK**	**Shear:**	**RF_{inv} =**	**7.49**	**>1, OK**
	RF_{opr} =	**6.03**	**>1, OK**		**RF_{opr} =**	**10.40**	**>1, OK**
Bearing:	**RF_{inv} =**	**13.89**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**14.70**	**>1, OK**
	RF_{opr} =	**20.10**	**>1, OK**		**RF_{opr} =**	**20.42**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
L6S	Axial Tension Capacity	4/29/2016	6/1/2016		6

2 2

Member Connection: **L6-L4**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	33	ksi	*Yield Stress*
Fu =	65	60	ksi	*Ultimate Stress*
Thickness =	0.75	0.45	in	*Figure 1*
Ae =	32.20	-	in^2	*Effective Area*
Block Shear Rupture C =	1620.13	706.16	kip	*Block Shear Capacity*
Effective Gross Yielding C =	1610.16	-	kip	*Yielding Capacity*
Controlling C =	706.2			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	65.5	12	47.5	in	*Figure 2*
# Bolts =	13	2	11		*Figure 2*
Bolts Diameter =	1	1	1	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	49.13	9.00	35.63	in^2	**Figure 4*
Gusset An =	38.77	7.41	26.86	in^2	
Member Ag =	29.48	5.40	21.38	in^2	
Member An =	23.26	4.44	16.12	in^2	

Member Loading Information:

DL Force =	67.36	kip	**Pedestrian Loads are only*
LL+I Force =	42.23	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.49	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

		Tension:	**RF_{inv} =**	**6.75**	**>1, OK**
Reduction Factor, Rp =	1		**RF_{opr} =**	**9.77**	**>1, OK**
β =	0.15				

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
L6S	Axial Tension Capacity	*4/29/2016*	*6/1/2016*		7

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Member Connection: **L6-U7**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	50	45	ksi	*Yield Stress*
Fu =	65	70	ksi	*Ultimate Stress*
Thickness =	0.75	0.7	in	*Figure 1*
Ae =	36.56	-	in^2	*Effective Area*
Block Shear Rupture C =	1564.18	1404.40	kip	*Block Shear Capacity*
Effective Gross Yielding C =	1828.13	-	kip	*Yielding Capacity*
Controlling C =	1404.4			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	61.1	12	48.75	in	*Figure 2*
# Bolts =	14	1	5		*Figure 2*
Bolts Diameter =	1	1	1	in	*Figure 2*
# Rivets =	0	0	0		*Figure 2*
Rivet Diameter =	0	0	0	in	*Figure 2*
Gusset Ag =	45.83	9.00	36.56	in^2	**Figure 4*
Gusset An =	34.67	8.20	32.58	in^2	
Member Ag =	42.77	8.40	34.13	in^2	
Member An =	32.36	7.66	30.41	in^2	

Member Loading Information:

DL Force =	256.45	kip	**Pedestrian Loads are only*
LL+I Force =	78.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	19.65	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 1

β = 0.15

Tension:	**RF_{inv} =**	**6.32**	**>1, OK**
	RF_{opr} =	**8.42**	**>1, OK**
Controlling:	**RF_{inv} =**	**6.32**	**>1, OK**
	RF_{opr} =	**8.42**	**>1, OK**

Member Connection: **L6-U5**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	50	ksi	*Yield Stress*
Whitmore Eff. Length =	50.625	in	*Figure 4*
Whitmore Distance, Lc =	12.03	in	*Figure 4*
Thickness =	0.75	in	*Gusset Plate thickness*
A_s =	37.97	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	27.78		
$\sqrt{(2\pi^2E/F_y)}$ =	107.00		
F_{cr} =	**48.31**	**ksi**	
C =	**1559.28**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	184.85	kip	**Pedestrian Loads are only*
LL+I Force =	62.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.85	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**9.75**	**>1, OK**
	RF_{opr} =	**13.31**	**>1, OK**

Member Connection: **L6-L8**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	50	ksi	*Yield Stress*
Whitmore Eff. Length =	48.84	in	*Figure 4*
Whitmore Distance, Lc =	4.04	in	*Figure 4*
Thickness =	0.75	in	*Gusset Plate thickness*
A_s =	36.63	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	9.33		
$\sqrt{(2\pi^2E/F_y)}$ =	107.00		
F_{cr} =	**49.81**	**ksi**	
C =	**1550.86**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	111.42	kip	**Pedestrian Loads are only*
LL+I Force =	35.06	kip	*included in Operating Ratings per*
*Pedestrian Force =	7.07	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**18.48**	**>1, OK**
	RF_{opr} =	**25.67**	**>1, OK**
Controlling:	**RF_{inv} =**	**9.75**	**>1, OK**
	RF_{opr} =	**13.31**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
L6S	Shear Capacity: Rupture Resistance	4/29/2016	6/1/2016		10

Member Connection: **L6-L4**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	L6	-	L6	-		
Fy =	50	0	50	0	ksi	*Yield Stress*
Fu =	65	0	65	0	ksi	*Ultimate Stress*
Thickness =	0.75	0	0.75	0	in	*Plate Thickness*
Shear Plane Length =	70.71	0	88.375	0	in	*Figure 3*
# Bolts =	14	0	16	0		*Figure 3*
Bolts Diameter =	1	0	1	0	in	*Figure 3*
# Rivets =	0	0	0	0		*Figure 3*
Rivet Diameter =	0	0	0	0	in	*Figure 3*
Gross Area, Ag =	53.03	0	66.28	0	in^2	
Net Area, An =	41.88	0	53.53	0	in^2	
Yield Resistance C =	1353.39	0.0	1691.5	0.0	kip	*Yield Capacity*
Rupture Resistance C =	1180.89	0.0	1509.6	0.0	kip	*Rupture Capacity*
Controlling C =	1180.9		1509.6			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	L6-L4	86.60	54.30	8.35	0.00	86.60	54.30	8.35
	L6-L8	145.70	45.85	9.25	0.00	145.70	45.85	9.25
	-	0.00	0.00	0.00	0.00	0	0	0
SECTION B-B	L6-U7	256.45	78.15	19.65	58.90	219.59	66.92	16.83
	L6-L8	145.70	45.85	9.25	0.00	0	0	0
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**4.04**	**>1, OK**	**8.43**	**>1, OK**	**RF_{inv} =**	**4.04**	**>1, OK**
	5.74	**>1, OK**	**11.24**	**>1, OK**	**RF_{opr} =**	**5.74**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
L6S	Shear Capacity: Partial Shear Check	4/29/2016	6/1/2016		10

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Member Connection: **L6-U5**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? Yes

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		L6	-	
Fy =	0	0	ksi	50	0	*Yield Stress*
Thickness =	0	0	in	0.75	0	*Plate Thickness*
Shear Plane Length =	0	0	in	43.99	0	*Figure 3*
# Bolts =	0	0		8.5	0	*Figure 3*
Bolts Diameter =	0	0	in	1	0	*Figure 3*
# Rivets =	0	0		0	0	*Figure 3*
Rivet Diameter =	0	0	in	0	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	32.993	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	842.0	0.0	*Yield Capacity*
Controlling C =	0.0			842.0		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	L6-U5	184.85	62.35	13.85	57.60	156.07	52.64	11.69

	Horizontal	Vertical			Controlling	
Partial Shear Rating:	**>1, OK**	**5.59**	**>1, OK**	RF_{inv} =	**5.59**	**>1, OK**
	>1, OK	**7.64**	**>1, OK**	RF_{opr} =	**7.64**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
L6S	Chord Splice Resistance	4/29/2016	6/1/2016		11

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Gusset Reference: L6

Reference

Chord Splice Resistance: $C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$ — *MBE (2014) L6B.2.6.6*

Net Capacity*: $C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$ — *MBE (2014) L6B.2.6.6*
**For Tensile Splices Only*

LFR rating factor: $RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$ — Inventory Rating

LFR rating factor: $RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$ — Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ_{cs} =	1			Resistance Factor

Gusset Properties:

Splice Type = *B*

Tensile Splice?	*Yes*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.75	*in*	Gusset PL Height, H =	*88.22*	*in*
Chord Box Centroid Depth =	38	*in*	Lsplice =	*4.04*	*in*
Yield Stress, F_y =	50	*ksi*	Ultimate Stress, F_u =	*65*	*ksi*
F_{cr} check =	9.33	**<25, OK**	Critical Stess, F_{cr} =	*50*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.75	88.22	44.11	66.17	2918.54	42920.27	42912.24	8.03
Left	0.75	88.22	44.11	66.17	2918.54	42920.27	42912.24	8.03
Addtl PLs								
Top	8	0.5	47.57	4	190.28	58.1	0.1	58.0
Bottom	8	0.5	28.43	4	113.72	940.3	0.1	940.2
Right				0	0	0.0	0.0	0.0
Left				0	0	0.0	0.0	0.0
		Σ=	43.8	140.3	6141.1	86839.0		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
	Chord Splice Resistance	*4/29/2016*	*6/1/2016*		12

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top	2	0.9375	0.5	47.57	-0.938	-44.60	-33.24	-0.02	-33.22
Bottom	2	0.9375	0.5	28.43	-0.938	-26.65	-163.06	-0.02	-163.04
1	2	0.75	1.0625	8.15	-1.594	-12.99	-1785.27	-0.15	-1785.12
2	2	0.75	1.0625	13.65	-1.594	-21.75	-1246.75	-0.15	-1246.60
3	2	0.75	1.0625	19.4	-1.594	-30.92	-786.86	-0.15	-786.71
4**	2	0.75	8.25	26.65	-12.375	-329.79	-2842.53	-70.19	-2772.34
5	2	0.75	1.0625	32	-1.594	-51.00	-147.57	-0.15	-147.42
6	2	0.75	1.0625	38	-1.594	-60.56	-21.01	-0.15	-20.86
7	2	0.75	1.0625	44	-1.594	-70.13	-9.20	-0.15	-9.05
8	2	0.75	1.0625	50.99	-1.594	-81.27	-140.15	-0.15	-140.00
9	2	0.75	1.0625	55.99	-1.594	-89.23	-329.37	-0.15	-329.22
10	2	0.75	1.0625	60.99	-1.594	-97.20	-598.27	-0.15	-598.12
11	2	0.75	1.0625	65.99	-1.594	-105.17	-946.86	-0.15	-946.71
12	2	0.75	1.0625	70.99	-1.594	-113.14	-1375.14	-0.15	-1374.99
13	2	0.75	1.0625	76.99	-1.594	-122.70	-1994.27	-0.15	-1994.12
14	2	0.75	1.0625	80.99	-1.594	-129.08	-2470.77	-0.15	-2470.62
15	2	0.75	1.0625	84.99	-1.594	-135.45	-2998.27	-0.15	-2998.12
-	-	-	-	-	-	-	-	-	-
			Σ=	41.62	-36.56	-1521.64	-17888.57	-72.33	-17816.24

*****Splice Hole***

Splice Properties:

C = 4962.37 kip *Controlling Resistance*

A_g=	140.3	in^2	A_n=	103.8	in^2	*Plates areas*
y_g=	43.8	in	y_n=	44.5	in	*Area Centroid Height*
H - y_g=	44.46	in	H - y_n=	43.70	in	Ytop
I_g=	86839.0	in	I_n=	68950.4	in	*Area Moment of Inertia*
S_g=	1953.3	in^3	S_n=	1548.8	in^3	*Plates Section Modulus*
e_p=	5.8	in	e_n=	6.5	in	*Distance between centroid*
C_{GROSS} =	**4962.37**	**kip**	**C_{NET} =**	**4694.95**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
	Chord Splice Resistance	*4/29/2016*	*6/1/2016*		13

Splice Forces:

Gusset Reference = L6

Left side:

	DL	LL	θ_L
L6-L4	173.20	108.60	0
L6-U5	-369.7	-124.7	57.6
-	0	0	0
$\gamma.\Sigma =$	-32.36	90.67	

Right Side:

	DL	LL	θ_L
-	0	0	0
L6-U7	-512.9	-156.3	58.9
L6-L8	291.40	91.70	0
$\gamma.\Sigma =$	34.41	23.80	

	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**55.09**	**>1, OK**	**207.09**	**>1, OK**	**RF_{inv} =**	**55.09**	**>1, OK**
RF_{LFRopr} =	**91.96**	**>1, OK**	**345.69**	**>1, OK**	**RF_{opr} =**	**91.96**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L6	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/29/2016	6/1/2016		14

Gusset Reference: L6

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	4.52	162.64	6.03	216.94
Axial Tension Capacity	6.32	227.36	8.42	303.26
Shear Capacity: Yield/Rupture	4.04	145.59	5.74	206.70
Partial Shear Capacity: Yield	5.59	201.39	7.64	275.07
Compression Capacity	9.75	350.95	13.31	479.34
Chord Splice	55.09	1983.18	91.96	3310.38
Gusset Rating:	4.04	145.59	5.74	206.70

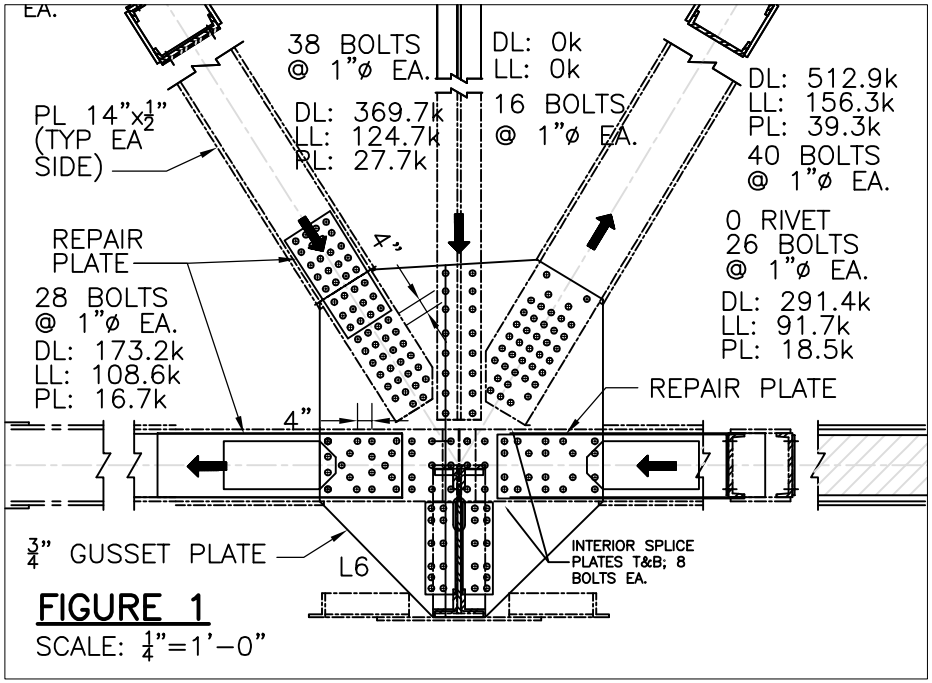

FIGURE 1
SCALE: 1/4"=1'-0"

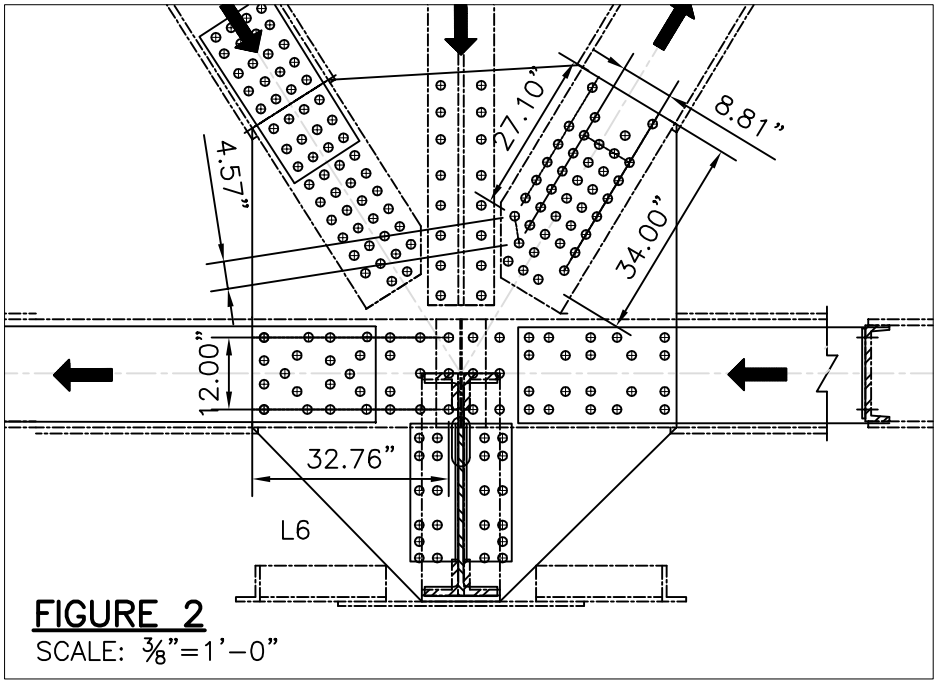

FIGURE 2
SCALE: 3/8"=1'-0"

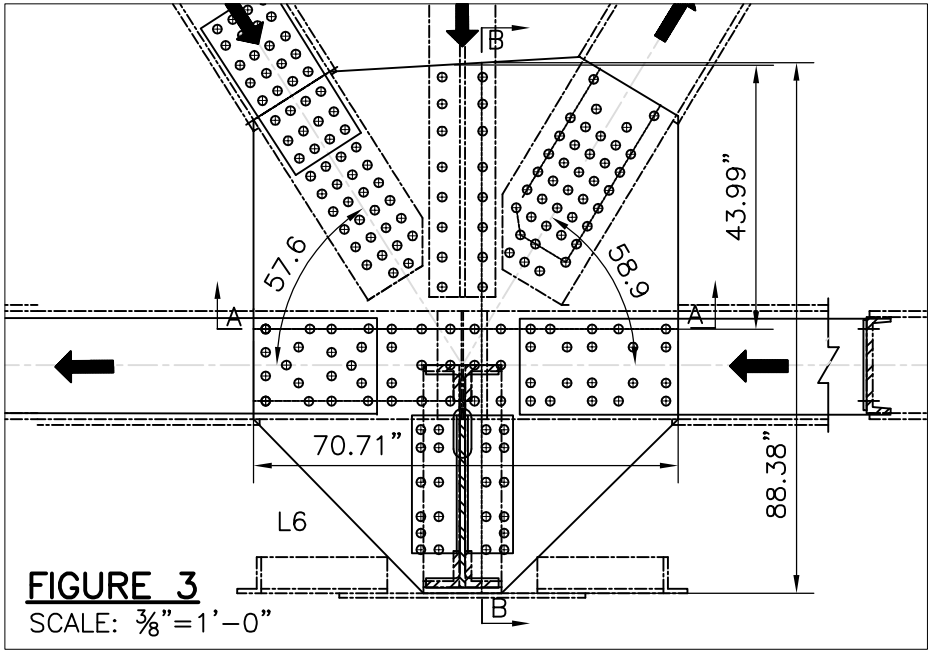

FIGURE 3
SCALE: 3/8"=1'-0"

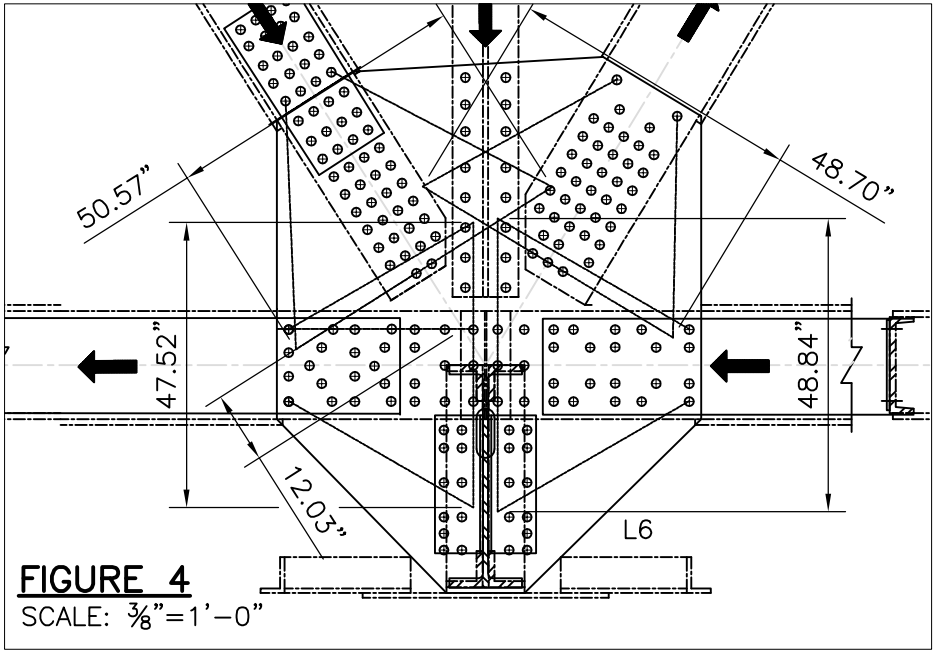

FIGURE 4
SCALE: 3/8"=1'-0"

Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

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STV 100 Years
STV Incorporated
One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: L6-A
Title: Gusset Plate L6 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

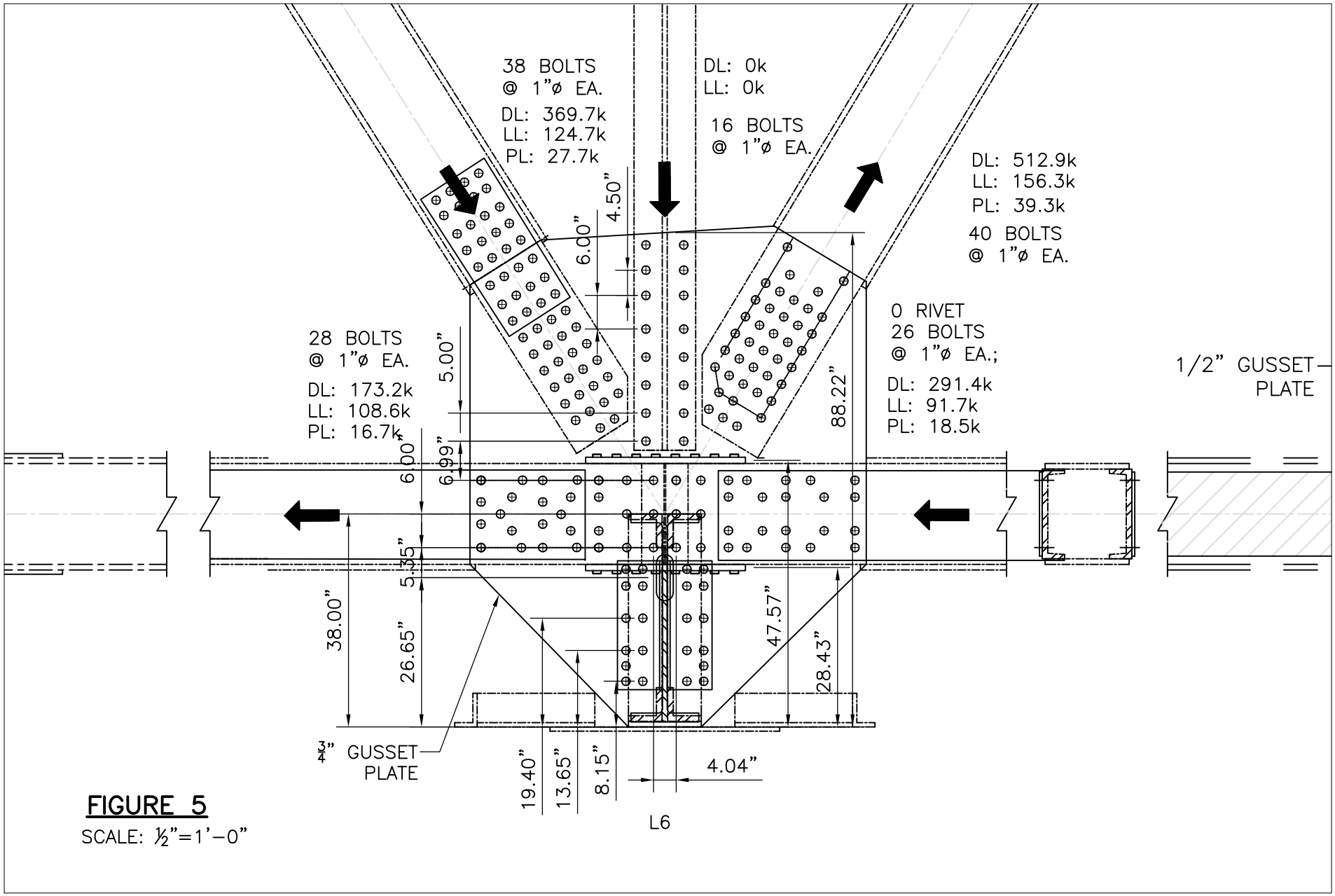

FIGURE 5

SCALE: ½"=1'-0"

Figure 5: Gusset Plate & Chord Splice

LEGEND:

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STV Incorporated
One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: L6-B
Title: Gusset Plate L6 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	ARG	*WRG*		
	Gusset Plate Loading	4/28/16	6/1/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: L8**

Member Connection:	**L8-L6**	***C***	**Member Connection:**	**L8-U7**	***C***
Total Fasteners		92	Total Fasteners		108
Thickness of Channel Web (in)		0.45	Thickness of Channel Web (in)		0.7
Dead Load (kip)		291.4	Dead Load (kip)		663.4
Truck Live Load + Impact (kip)		91.7	Truck Live Load + Impact (kip)		189.7
Pedestrian Load (kip)		18.5	Pedestrian Load (kip)		48
Bolts on Gusset Plates		92	Bolts on Gusset Plates		108
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**145.70**	Dead Load Per Gusset Plate (kip)		**331.70**
LL+I Per Gusset Plate (kip)		**45.85**	LL+I Per Gusset Plate (kip)		**94.85**
Ped. Load Per Gusset Plate (kip)		**9.25**	Ped. Load Per Gusset Plate (kip)		**24.00**

Member Connection:	**L8-U8**	***C***	**Member Connection:**	**-**	***0***
Total Fasteners		36	Total Fasteners		0
Thickness of Channel Web (in)		0.375	Thickness of Channel Web (in)		0
Dead Load (kip)		5.34	Dead Load (kip)		0
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		0	Pedestrian Load (kip)		0
Bolts on Gusset Plates		36	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**2.67**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**0.00**

Member Connection:	**-**	***0***	**Member Connection:**	**-**	***0***
Total Fasteners		0	Total Fasteners		0
Thickness of Channel Web (in)		0	Thickness of Channel Web (in)		0
Dead Load (kip)		0	Dead Load (kip)		0
Truck Live Load + Impact (kip)		0	Truck Live Load + Impact (kip)		0
Pedestrian Load (kip)		0	Pedestrian Load (kip)		0
Bolts on Gusset Plates		0	Bolts on Gusset Plates		0
Bolts on Additional Load Transferring Members		0	Bolts on Additional Load Transferring Members		0
Dead Load Per Gusset Plate (kip)		**0.00**	Dead Load Per Gusset Plate (kip)		**0.00**
LL+I Per Gusset Plate (kip)		**0.00**	LL+I Per Gusset Plate (kip)		**0.00**
Ped. Load Per Gusset Plate (kip)		**0.00**	Ped. Load Per Gusset Plate (kip)		**0.00**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
L8S	Fasteners Bearing & Shear Capacity	4/28/2016	6/1/2016		2

2

Member Connection: **L8-L6**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.5	in	*Figure 1*

Fasteners Information:

	Bolt	-		
ϕF =	35	-	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	46	-		*Figure 1*
Diameter =	0.875	-	in	*Figure 1*
Area =	0.60	-	in^2	
Shear C =	968.1	0	kip	*Capacity for Total Fastener Group*
Bearing C =	1956.15	0.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	145.70	kip	**Pedestrian Loads are only*
LL+I Force =	45.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.25	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**7.83**	**>1, OK**
	RF_{opr} =	**10.87**	**>1, OK**
Bearing:	**RF_{inv} =**	**17.76**	**>1, OK**
	RF_{opr} =	**24.66**	**>1, OK**

Member Connection: **L8-U7**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.7	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.5	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	38	16		*Figure 1*
Diameter =	0.875	0.875	in	*Figure 1*
Area =	0.60	0.60	in^2	
Shear C =	799.8	202	kip	*Capacity for Total Fastener Group*
Bearing C =	2932.65	1234.80	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	331.70	kip	**Pedestrian Loads are only*
LL+I Force =	94.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	24.00	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**2.77**	**>1, OK**	**Shear:**	**RF_{inv} =**	**2.77**	**>1, OK**
	RF_{opr} =	**3.69**	**>1, OK**		**RF_{opr} =**	**3.69**	**>1, OK**
Bearing:	**RF_{inv} =**	**17.76**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**18.15**	**>1, OK**
	RF_{opr} =	**24.18**	**>1, OK**		**RF_{opr} =**	**24.18**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
L8S	Compression Capacity	4/28/2016	6/1/2016		4

Member Connection: **L8-U7**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	57.16	in	*Figure 4*
Whitmore Distance, Lc =	15.39	in	*Figure 4*
Thickness =	1.5	in	*Gusset Plate thickness*
A_s =	85.74	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	17.77		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**32.70**	**ksi**	
C =	**2383.11**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	331.70	kip	**Pedestrian Loads are only*
LL+I Force =	94.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	24.00	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**9.48**	**>1, OK**
	RF_{opr} =	**12.63**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
L8S	Shear Capacity: Rupture Resistance	4/28/2016	6/1/2016		5

Member Connection: **L8-L6**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	L8	-	L8	-		
Fy =	33	0	33	0	ksi	*Yield Stress*
Fu =	60	0	60	0	ksi	*Ultimate Stress*
Thickness =	1.5	0	1.5	0	in	*Plate Thickness*
Shear Plane Length =	81	0	67.625	0	in	*Figure 3*
# Bolts =	18	0	8	0		*Figure 3*
Bolts Diameter =	1	0	1	0	in	*Figure 3*
# Rivets =	0	0	3	0		*Figure 3*
Rivet Diameter =	0	0	0.875	0	in	*Figure 3*
Gross Area, Ag =	121.50	0	101.44	0	in^2	
Net Area, An =	79.31	0	70.97	0	in^2	*Pin Hole Subtracted*
Yield Resistance C =	2046.45	0.0	1708.5	0.0	kip	*Yield Capacity*
Rupture Resistance C =	2064.54	0.0	1847.3	0.0	kip	*Rupture Capacity*
Controlling C =	2046.4		1708.5			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	L8-U7*	0.00	-121.42	0.00	0.00	0.00	-121.42	0.00
	-	0.00	0.00	0.00	0.00	0	0	0
	-	0.00	0.00	0.00	0.00	0	0	0
SECTION B-B	L8-U7	331.70	94.85	24.00	58.90	284.02	81.22	20.55
	L8-U8	2.67	0.00	0.00	90.00	2.67	0	0
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**7.77**	**>1, OK**	**7.58**	**>1, OK**	**RF_{inv} =**	**7.58**	**>1, OK**
	12.96	**>1, OK**	**10.10**	**>1, OK**	**RF_{opr} =**	**10.10**	**>1, OK**

*Net longitudinal forces are used due to gusset symmetry.

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
L8S	Shear Capacity: Partial Shear Check	4/28/2016	6/1/2016		6

1

Member Connection: **L8-U7**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? Yes

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		L8	-	
Fy =	0	0	ksi	33	0	*Yield Stress*
Thickness =	0	0	in	1.5	0	*Plate Thickness*
Shear Plane Length =	0	0	in	52.61	0	*Figure 3*
# Bolts =	0	0		6	0	*Figure 3*
Bolts Diameter =	0	0	in	0.875	0	*Figure 3*
# Rivets =	0	0		3	0	*Figure 3*
Rivet Diameter =	0	0	in	0.875	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	78.915	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	1329.2	0.0	*Yield Capacity*
Controlling C =	0.0			1329.2		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	L8-U7	331.70	94.85	24.00	58.90	284.02	81.22	20.55

	Horizontal	Vertical			Controlling	
Partial Shear Rating:	**>1, OK**	**5.45**	**>1, OK**	RF_{inv} =	**5.45**	**>1, OK**
	>1, OK	**7.26**	**>1, OK**	RF_{opr} =	**7.26**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
L8S	Chord Splice Resistance	4/28/2016	6/1/2016		7

1

Gusset Reference: L8

Reference

Chord Splice Resistance: $C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$ *MBE (2014) L6B.2.6.6*

Net Capacity*: $C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$ *MBE (2014) L6B.2.6.6*
**For Tensile Splices Only*

LFR rating factor: $RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$ Inventory Rating

LFR rating factor: $RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$ Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ_{cs} =	1			Resistance Factor

Gusset Properties:

Splice Type = *C*

Mill to Bear?	*No*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	1.5	*in*	Gusset PL Height, H =	*67.61*	*in*
Chord Box Centroid Depth =	9	*in*	Lsplice =	*6*	*in*
Yield Stress, F_y =	33	*ksi*	Ultimate Stress, F_u =	*60*	*ksi*
F_{cr} check =	6.93	**<25, OK**	Critical Stess, F_{cr} =	*33*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	1.5	67.61	33.81	101.42	3428.33	38631.61	38631.61	0.00
Left	1.5	67.61	33.81	101.42	3428.33	38631.61	38631.61	0.00
Addtl PLs								
Top				0	0	0.0	0.0	0.0
Bottom				0	0	0.0	0.0	0.0
Right				0	0	0.0	0.0	0.0
Left				0	0	0.0	0.0	0.0
		Σ=	33.805	202.83	6856.67	77263.22		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
	Chord Splice Resistance	4/28/2016	6/1/2016		8

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top									
Bottom									
1									
2									
3									
4**									
5	-								
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
			Σ=	-	0.00	0.00	0.00	0.00	0.00

Splice Properties: **C = 2090.83 kip** *Controlling Resistance*

A_g=	202.8	in^2	A_n=	-	in^2	*Plates areas*
y_g=	33.8	in	y_n=	-	in	*Area Centroid Height*
H - y_g=	33.81	in	H - y_n=	-	in	Ytop
I_g=	77263.2	in	I_n=	-	in	*Area Moment of Inertia*
S_g=	2285.6	in^3	S_n=	-	in^3	*Plates Section Modulus*
e_p=	24.8	in	e_n=	-	in	*Distance between centroid*
C_{GROSS} =	**2090.83**	**kip**	**C_{NET} =**	**-**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
	Chord Splice Resistance	4/28/2016	6/1/2016		9

Splice Forces:

Gusset Reference = L8

Left side:

	DL	LL	θ_L
L8-L6	291.40	91.70	0
L8-U7	663.4	189.7	58.9
-	0	0	0
$\gamma.\Sigma =$	824.29	411.62	

- Right Side:

	DL	LL	θ_L
-	0	0	0
-	0	0	0
-	0.00	0.00	0
$\gamma.\Sigma =$	0.00	0.00	

	Left Side		Right Side		Controlling	
RF_{LFRinv} =	**3.08**	**>1, OK**	**>1, OK**	RF_{inv} =	**3.08**	**>1, OK**
RF_{LFRopr} =	**5.14**	**>1, OK**	**>1, OK**	RF_{opr} =	**5.14**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: L8	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/28/2016	6/1/2016		10

Gusset Reference: L8

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	2.77	99.80	3.69	132.95
Axial Tension Capacity	N/A	N/A	N/A	N/A
Shear Capacity: Yield/Rupture	7.58	272.86	10.10	363.50
Partial Shear Capacity: Yield	5.45	196.09	7.26	261.22
Compression Capacity	9.48	341.40	12.63	454.80
Chord Splice	3.08	110.77	5.14	184.90
Gusset Rating:	2.77	99.80	3.69	132.95

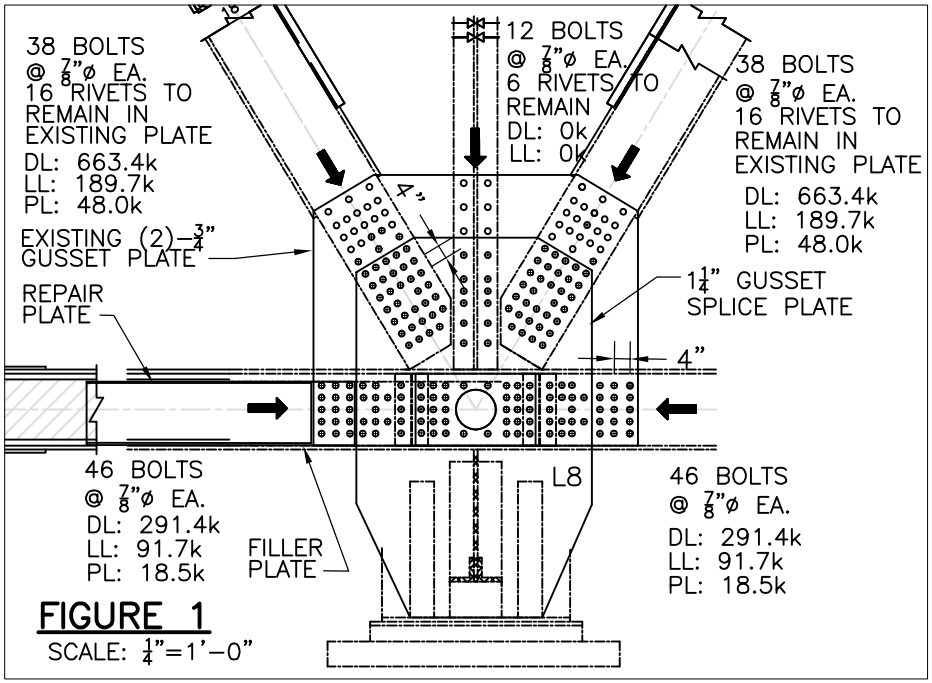

FIGURE 1
SCALE: 1/4"=1'-0"

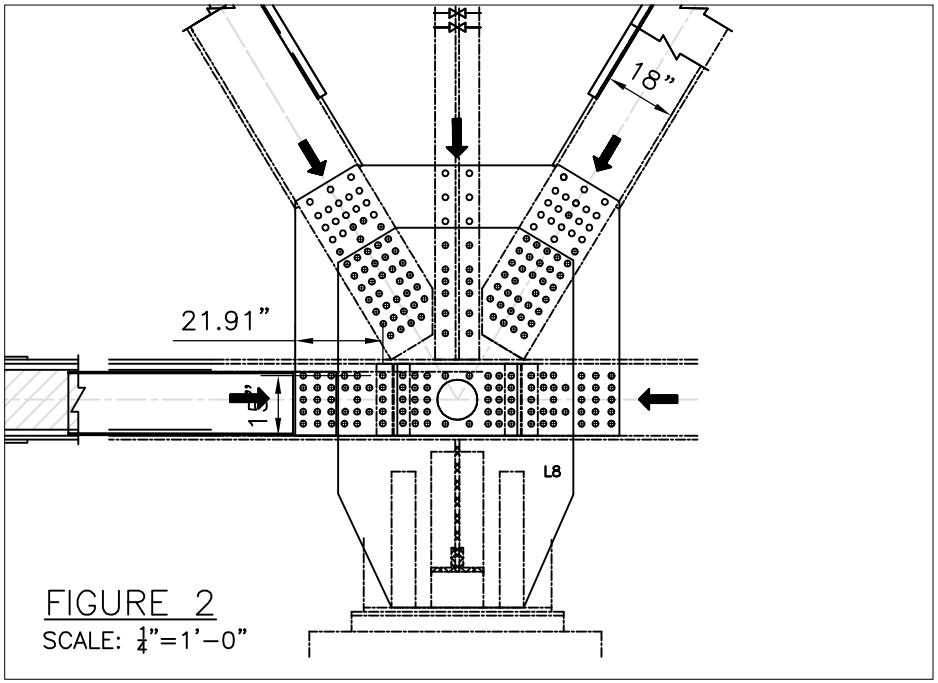

FIGURE 2
SCALE: 1/4"=1'-0"

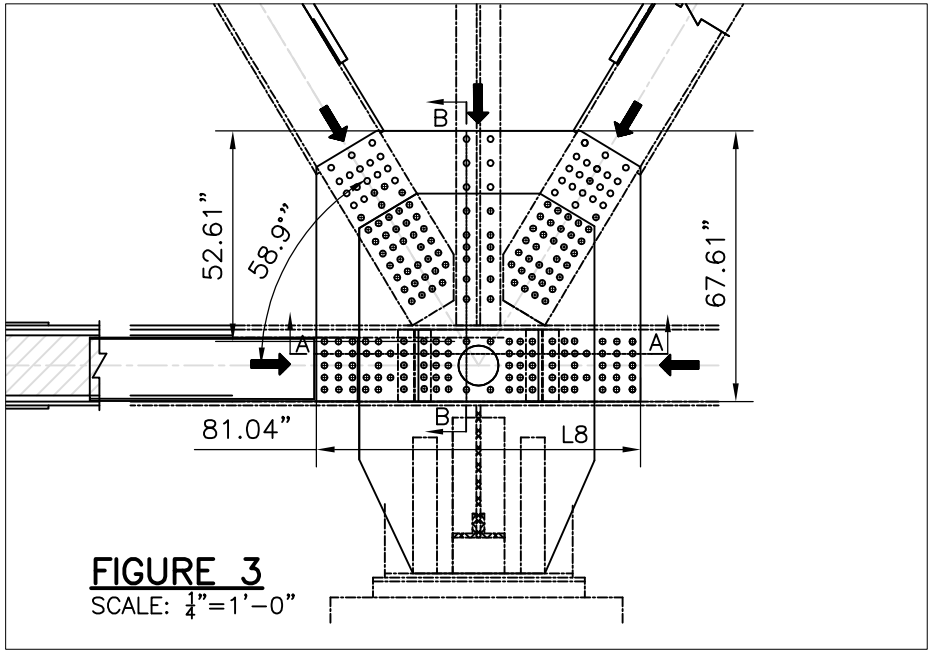

FIGURE 3
SCALE: 1/4"=1'-0"

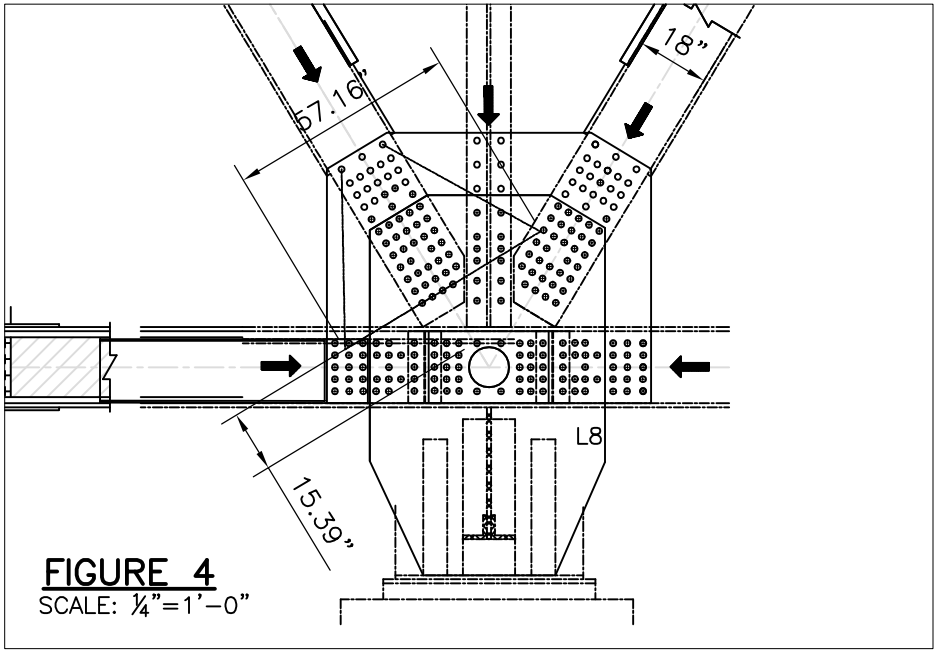

FIGURE 4
SCALE: 1/4"=1'-0"

Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

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STV Incorporated
One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: L8-A
Title: Gusset Plate L8 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

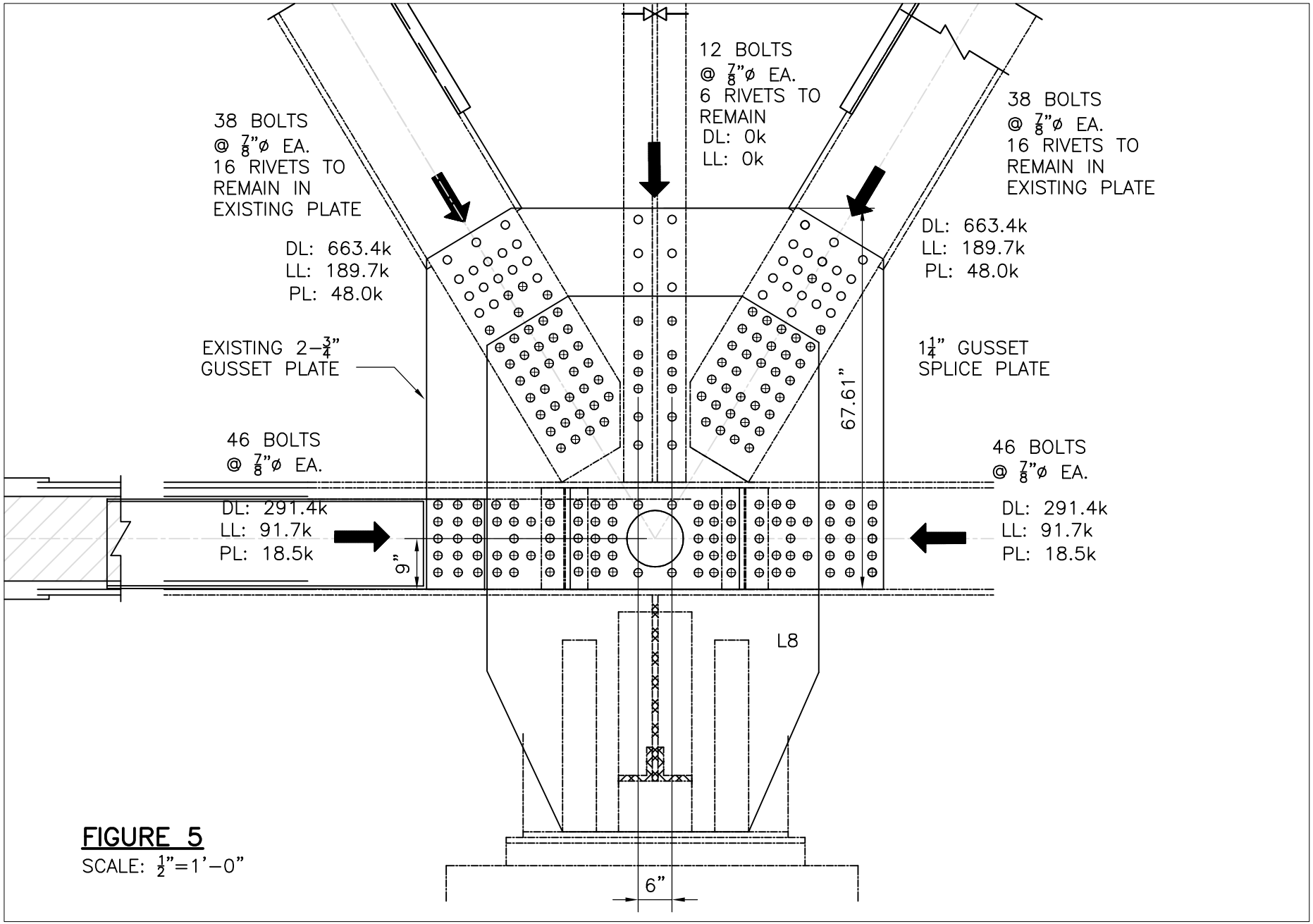

FIGURE 5

SCALE: 1/2"=1'-0"

Figure 5: Gusset Plate & Chord Splice

LEGEND:

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Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: L8-B
Title: Gusset Plate L8 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	ARG	*WRG*		
	Gusset Plate Loading	4/28/16	6/2/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: U1**

Member Connection: U1-L0	***C***	**Member Connection: U1-L1**	***T***
Total Fasteners	90	Total Fasteners	28
Thickness of Channel Web (in)	0.6	Thickness of Channel Web (in)	0.375
Dead Load (kip)	413.3	Dead Load (kip)	112.9
Truck Live Load + Impact (kip)	161.71	Truck Live Load + Impact (kip)	94.29
Pedestrian Load (kip)	33.6	Pedestrian Load (kip)	9.21
Bolts on Gusset Plates	70	Bolts on Gusset Plates	28
Bolts on Additional Load Transferring Members	20	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**160.73**	Dead Load Per Gusset Plate (kip)	**56.45**
LL+I Per Gusset Plate (kip)	**62.89**	LL+I Per Gusset Plate (kip)	**47.15**
Ped. Load Per Gusset Plate (kip)	**13.07**	Ped. Load Per Gusset Plate (kip)	**4.61**

Member Connection: U1-L2	***T***	**Member Connection: U1-U3**	***C***
Total Fasteners	36	Total Fasteners	60
Thickness of Channel Web (in)	0.4	Thickness of Channel Web (in)	0.45
Dead Load (kip)	150.7	Dead Load (kip)	396.05
Truck Live Load + Impact (kip)	84.84	Truck Live Load + Impact (kip)	144.06
Pedestrian Load (kip)	12.9	Pedestrian Load (kip)	32.7
Bolts on Gusset Plates	36	Bolts on Gusset Plates	60
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**75.35**	Dead Load Per Gusset Plate (kip)	**198.03**
LL+I Per Gusset Plate (kip)	**42.42**	LL+I Per Gusset Plate (kip)	**72.03**
Ped. Load Per Gusset Plate (kip)	**6.45**	Ped. Load Per Gusset Plate (kip)	**16.35**

Member Connection: U1-L2b	***C***	**Member Connection: -**	***0***
Total Fasteners	36	Total Fasteners	0
Thickness of Channel Web (in)	0.4	Thickness of Channel Web (in)	0
Dead Load (kip)	150.7	Dead Load (kip)	0
Truck Live Load + Impact (kip)	-36.26	Truck Live Load + Impact (kip)	0
Pedestrian Load (kip)	12.9	Pedestrian Load (kip)	0
Bolts on Gusset Plates	36	Bolts on Gusset Plates	0
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**75.35**	Dead Load Per Gusset Plate (kip)	**0.00**
LL+I Per Gusset Plate (kip)	**-18.13**	LL+I Per Gusset Plate (kip)	**0.00**
Ped. Load Per Gusset Plate (kip)	**6.45**	Ped. Load Per Gusset Plate (kip)	**0.00**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
U1S	Fasteners Bearing & Shear Capacity	4/28/2016	6/2/2016		2

5

Member Connection: **U1-L0**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.50	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	35		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	442	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	1240.31	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	160.73	kip	**Pedestrian Loads are only*
LL+I Force =	62.89	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.07	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.71**	**>1, OK**
	RF_{opr} =	**2.36**	**>1, OK**
Bearing:	**RF_{inv} =**	**7.56**	**>1, OK**
	RF_{opr} =	**10.45**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
U1S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/2/2016*		3

5

Member Connection: **U1-L1**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	4	10		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	110.0	126	kip	*Capacity for Total Fastener Group*
Bearing C =	162.00	354.38	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	56.45	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.61	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.59**	**>1, OK**
	RF_{opr} =	**2.42**	**>1, OK**
Bearing:	**RF_{inv} =**	**4.33**	**>1, OK**
	RF_{opr} =	**6.58**	**>1, OK**

5

Member Connection: **U1-L2**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	2	16		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	55.0	202	kip	*Capacity for Total Fastener Group*
Bearing C =	81.00	567.00	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	75.35	kip	**Pedestrian Loads are only*
LL+I Force =	42.42	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.45	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.73**	**>1, OK**
	RF_{opr} =	**2.50**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.98**	**>1, OK**
	RF_{opr} =	**8.66**	**>1, OK**

5

Member Connection: **U1-U3**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.19	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	10	20		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	274.9	253	kip	*Capacity for Total Fastener Group*
Bearing C =	405.00	708.75	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	198.03	kip	**Pedestrian Loads are only*
LL+I Force =	72.03	kip	*included in Operating Ratings per*
*Pedestrian Force =	16.35	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**1.59**	**>1, OK**	**Shear:**	**RF_{inv} =**	**1.73**	**>1, OK**
	RF_{opr} =	**2.35**	**>1, OK**		**RF_{opr} =**	**2.35**	**>1, OK**
Bearing:	**RF_{inv} =**	**4.33**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**5.48**	**>1, OK**
	RF_{opr} =	**6.58**	**>1, OK**		**RF_{opr} =**	**7.45**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
U1S	Axial Tension Capacity	4/28/2016	6/2/2016		6

2 2

Member Connection: **U1-L1**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70	ksi	*Ultimate Stress*
Thickness =	0.375	0.375	in	*Figure 1*
Ae =	11.96	-	in^2	*Effective Area*
Block Shear Rupture C =	369.58	484.69	kip	*Block Shear Capacity*
Effective Gross Yielding C =	394.52	-	kip	*Yielding Capacity*
Controlling C =	369.6			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	49.48	6.75	31.88	in	*Figure 2*
# Bolts =	4	1	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	9	0	3		*Figure 2*
Rivet Diameter =	0.875	0	0.875	in	*Figure 2*
Gusset Ag =	18.56	2.53	11.96	in^2	**Figure 4*
Gusset An =	13.80	2.13	10.90	in^2	
Member Ag =	18.56	2.53	11.96	in^2	
Member An =	13.80	2.13	10.90	in^2	

Member Loading Information:

DL Force =	56.45	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.61	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension: **RF_{inv} = 2.90** **>1, OK**

RF_{opr} = 4.40 **>1, OK**

2 2

Member Connection: **U1-L2**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	33	ksi	*Yield Stress*
Fu =	60	60	ksi	*Ultimate Stress*
Thickness =	0.375	0.4	in	*Figure 1*
Ae =	9.65	-	in^2	*Effective Area*
Block Shear Rupture C =	287.17	306.32	kip	*Block Shear Capacity*
Effective Gross Yielding C =	318.53	-	kip	*Yielding Capacity*
Controlling C =	287.2			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	34.08	9	25.74	in	*Figure 2*
# Bolts =	2	3	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	7	0	4		*Figure 2*
Rivet Diameter =	0.875	0	0.875	in	*Figure 2*
Gusset Ag =	12.78	3.38	9.65	in^2	**Figure 4*
Gusset An =	9.52	2.18	8.25	in^2	
Member Ag =	13.63	3.60	10.30	in^2	
Member An =	10.16	2.33	8.80	in^2	

Member Loading Information:

DL Force =	75.35	kip	**Pedestrian Loads are only*
LL+I Force =	42.42	kip	*included in Operating Ratings per*
*Pedestrian Force =	6.45	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension:	**RF_{inv} =**	**2.06**	**>1, OK**
	RF_{opr} =	**2.98**	**>1, OK**
Controlling:	**RF_{inv} =**	**2.06**	**>1, OK**
	RF_{opr} =	**2.98**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
U1S	Shear Capacity: Rupture Resistance	4/28/2016	6/2/2016		8

Member Connection: **U1-L0**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	-	-	U1	-		
Fy =	0	0	33	0	ksi	*Yield Stress*
Fu =	0	0	60	0	ksi	*Ultimate Stress*
Thickness =	0	0	0.375	0	in	*Plate Thickness*
Shear Plane Length =	0	0	47.17	0	in	*Figure 3*
# Bolts =	0	0	0	0		*Figure 3*
Bolts Diameter =	0	0	0	0	in	*Figure 3*
# Rivets =	0	0	9	0		*Figure 3*
Rivet Diameter =	0	0	0.875	0	in	*Figure 3*
Gross Area, Ag =	0.00	0	17.69	0	in^2	
Net Area, An =	0.00	0	14.52	0	in^2	
Yield Resistance C =	0.00	0.0	297.9	0.0	kip	*Yield Capacity*
Rupture Resistance C =	0.00	0.0	378.1	0.0	kip	*Rupture Capacity*
Controlling C =	0.0		297.9			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	U1-L1	56.45	47.15	4.61	0.00	56.45	47.15	4.61
	U1-L2	75.35	42.42	6.45	43.36	54.78	30.84	4.69
	U1-U3	198.03	72.03	16.35	79.95	34.56	12.57	2.85
SECTION B-B	U1-L2b	-75.35	18.13	-6.45	0.00	-75.35	18.13	-6.45
	U1-U3	198.03	72.03	16.35	56.69	108.75	39.56	8.98
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A	Plane B-B			Controlling	
Shear Rupture Rating:	**>1, OK**	**2.03**	**>1, OK**	**RF_{inv} =**	**2.03**	**>1, OK**
	>1, OK	**3.25**	**>1, OK**	**RF_{opr} =**	**3.25**	**>1, OK**

1

Gusset Reference: U1

Reference

Chord Splice Resistance: $C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$ — *MBE (2014) L6B.2.6.6*

Net Capacity*: $C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$ — *MBE (2014) L6B.2.6.6*
**For Tensile Splices Only*

LFR rating factor: $RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$ — Inventory Rating

LFR rating factor: $RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$ — Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr} =	1.3	*Factors as in Article 6A.6.3.*
φ_{cs} =	1			Resistance Factor

Gusset Properties:

Splice Type = *C*

Mill to Bear?	*No*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.375	*in*	Gusset PL Height, H =	*48.64*	*in*
Chord Box Centroid Depth =	9	*in*	Lsplice =	*4*	*in*
Yield Stress, F_y =	33	*ksi*	Ultimate Stress, F_u =	*60*	*ksi*
F_{cr} check =	18.48	**<25, OK**	Critical Stess, F_{cr} =	*33*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.375	48.64	24.32	18.24	443.60	4359.72	3596.09	763.63
Left	0.375	48.64	24.32	18.24	443.60	4359.72	3596.09	763.63
Addtl PLs								
Top	16	0.5	1.83	8	14.64	2053.2	0.2	2053.0
Bottom				0	0	0.0	0.0	0.0
Right	0.375	21	11	7.875	86.625	658.9	289.4	369.5
Left	0.375	21	11	7.875	86.625	658.9	289.4	369.5
		Σ=	17.85	60.23	1075.08	12090.40		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/2/2016*		10

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top									
Bottom									
1									
2									
3									
4**									
5	-								
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
			Σ=	-	0.00	0.00	0.00	0.00	0.00

NOTE: Top chord splices do not consider top chord bracing gussets outside of the limits of the truss gusset plates and could provide addition capacity.

Splice Properties: **C = 843.12 kip** *Controlling Resistance*

A_g=	60.2	in^2	A_n=	-	in^2	*Plates areas*
y_g=	17.8	in	y_n=	-	in	*Area Centroid Height*
H - y_g=	30.79	in	H - y_n=	-	in	Ytop
I_g=	12090.4	in	I_n=	-	in	*Area Moment of Inertia*
S_g=	392.7	in^3	S_n=	-	in^3	*Plates Section Modulus*
e_p=	8.8	in	e_n=	-	in	*Distance between centroid*
C_{GROSS} =	**843.12**	**kip**	**C_{NET} =**	**-**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/2/2016*		11

Splice Forces:

Gusset Reference = U1

Left side:

	DL	LL	θ_L
U1-L0	413.30	161.71	71.69
U1-L1	-112.9	-94.29	28.32
-	0	0	0
$\gamma.\Sigma =$	440.46	236.08	

Right Side:

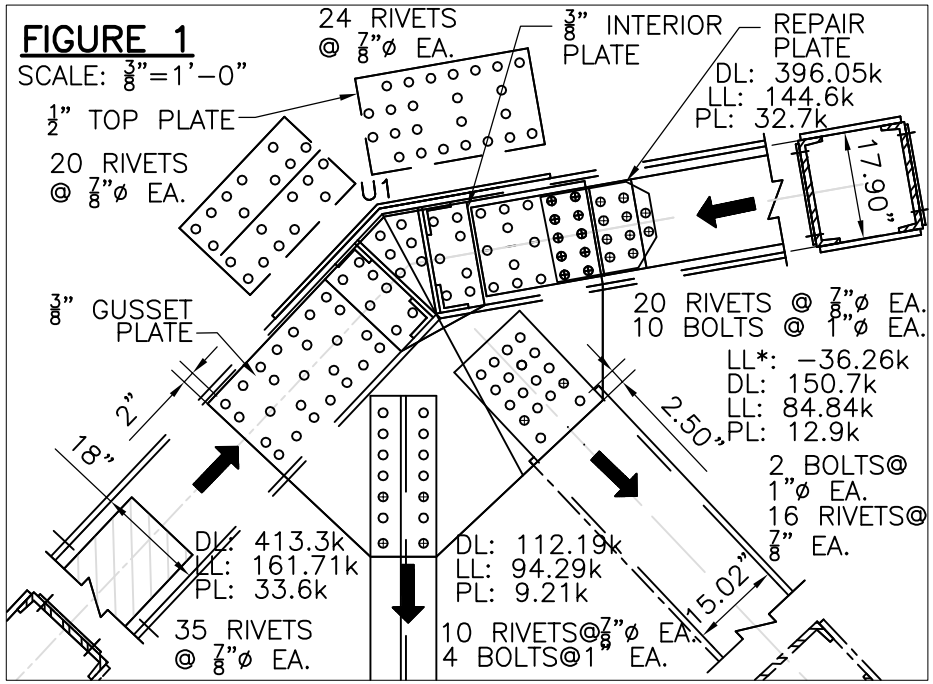
	DL	LL	θ_L
-	0	0	0
U1-L2b	-150.7	36.26	15.04
U1-U3	396.05	144.06	71.68
$\gamma.\Sigma =$	437.93	317.18	

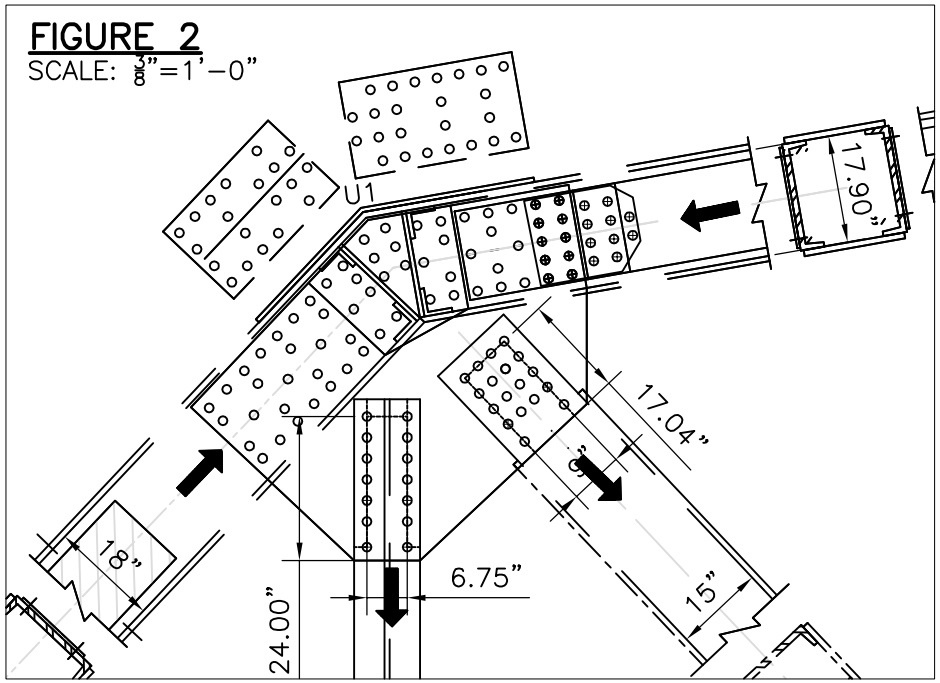
	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**1.71**	**>1, OK**	**1.28**	**>1, OK**	**RF_{inv} =**	**1.28**	**>1, OK**
RF_{LFRopr} =	**2.85**	**>1, OK**	**2.13**	**>1, OK**	**RF_{opr} =**	**2.13**	**>1, OK**

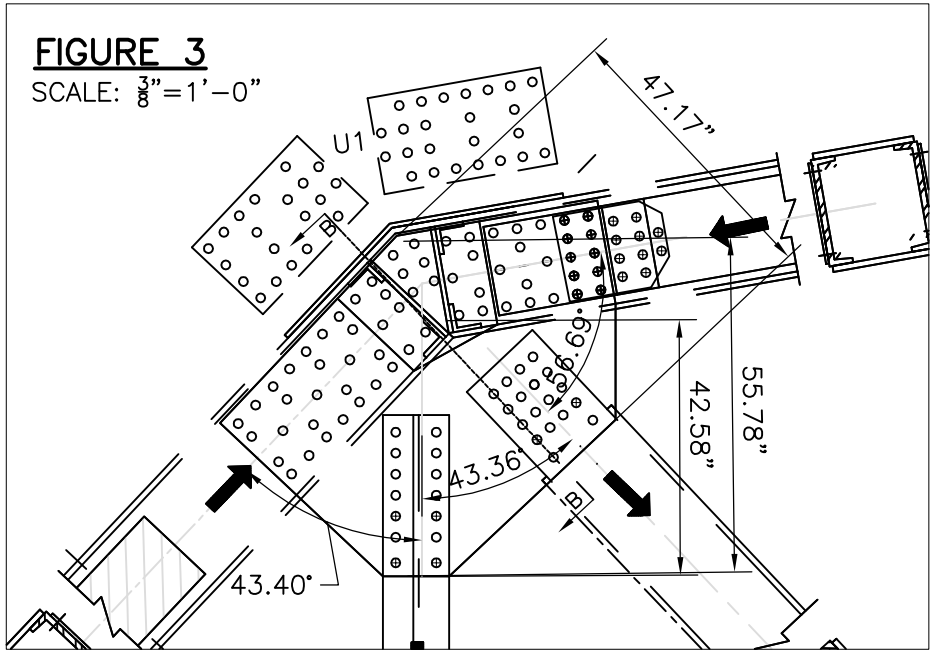
CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U1	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/28/2016	6/2/2016		12

Gusset Reference: U1

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	1.59	57.30	2.35	84.60
Axial Tension Capacity	2.06	74.00	2.98	107.22
Shear Capacity: Yield/Rupture	2.03	73.20	3.25	117.05
Partial Shear Capacity: Yield	N/A	N/A	N/A	N/A
Compression Capacity	N/A	N/A	N/A	N/A
Chord Splice	**1.28**	**45.99**	**2.13**	**76.77**
Gusset Rating:	1.28	45.99	2.13	76.77







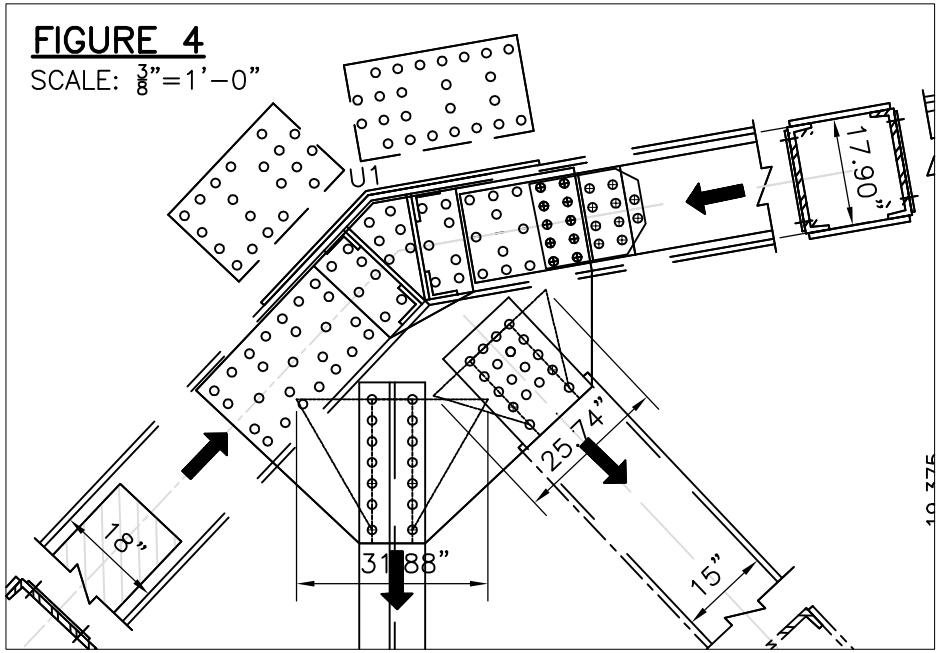


Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: U1-A
Title: Gusset Plate U1 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

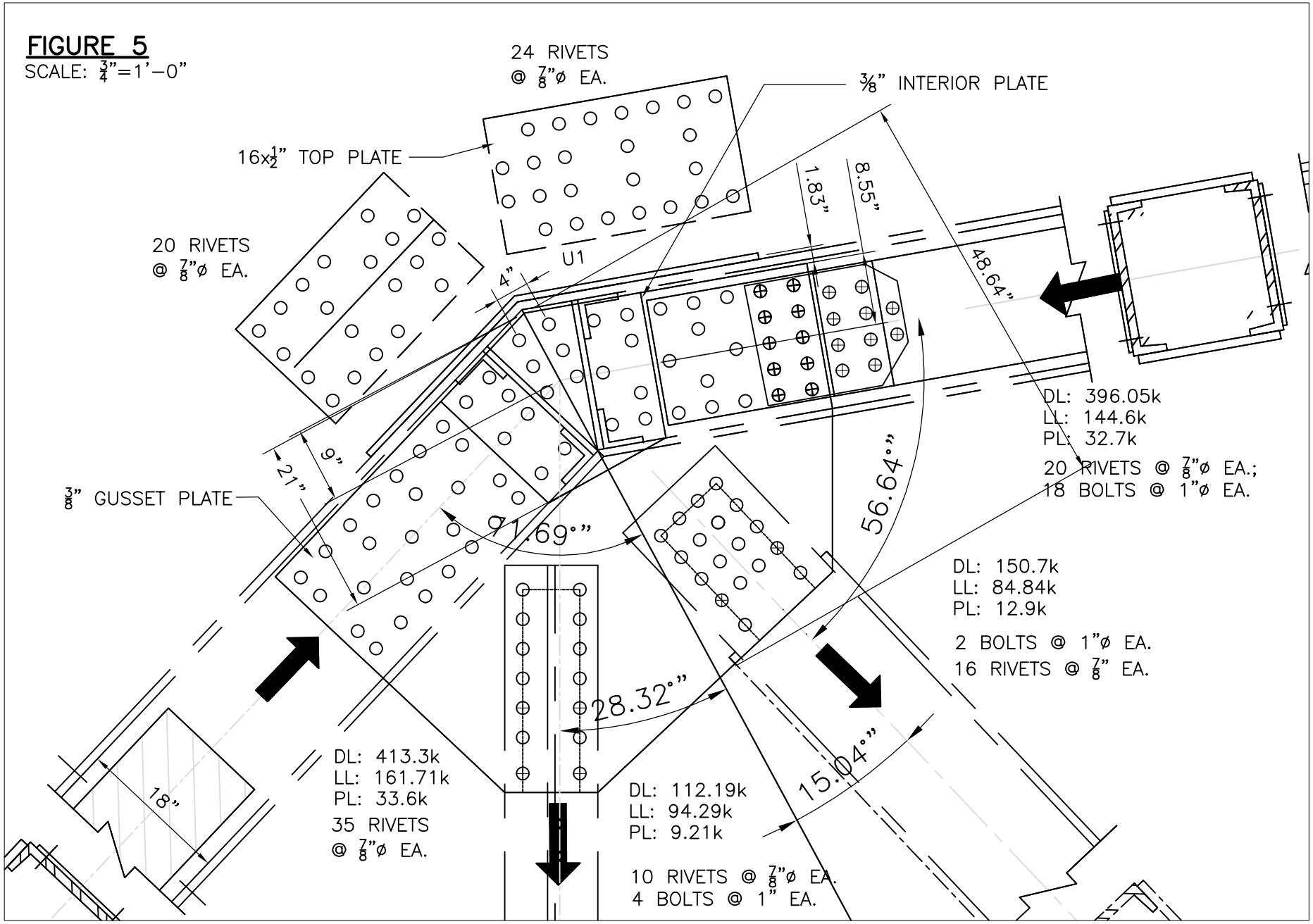

Figure 5: Gusset Plate & Chord Splice

LEGEND:

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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: U1-B
Title: Gusset Plate U1 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	ARG	*WRG*		
	Gusset Plate Loading	4/26/16	6/2/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: U3**

Member Connection: U3-U1	***C***	**Member Connection: U3-L2**	***T***
Total Fasteners	80	Total Fasteners	24
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0.39
Dead Load (kip)	396.05	Dead Load (kip)	17.1
Truck Live Load + Impact (kip)	144.6	Truck Live Load + Impact (kip)	63.9
Pedestrian Load (kip)	32.7	Pedestrian Load (kip)	0.48
Bolts on Gusset Plates	60	Bolts on Gusset Plates	24
Bolts on Additional Load Transferring Members	20	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**148.52**	Dead Load Per Gusset Plate (kip)	**8.55**
LL+I Per Gusset Plate (kip)	**54.23**	LL+I Per Gusset Plate (kip)	**31.95**
Ped. Load Per Gusset Plate (kip)	**12.26**	Ped. Load Per Gusset Plate (kip)	**0.24**

Member Connection: U3-L3	***T***	**Member Connection: U3-L4**	***C***
Total Fasteners	28	Total Fasteners	30
Thickness of Channel Web (in)	0.375	Thickness of Channel Web (in)	0.51
Dead Load (kip)	112.84	Dead Load (kip)	116.5
Truck Live Load + Impact (kip)	94.29	Truck Live Load + Impact (kip)	74.7
Pedestrian Load (kip)	9.28	Pedestrian Load (kip)	8.1
Bolts on Gusset Plates	28	Bolts on Gusset Plates	30
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**56.42**	Dead Load Per Gusset Plate (kip)	**58.25**
LL+I Per Gusset Plate (kip)	**47.15**	LL+I Per Gusset Plate (kip)	**37.35**
Ped. Load Per Gusset Plate (kip)	**4.64**	Ped. Load Per Gusset Plate (kip)	**4.05**

Member Connection: U3-U5	***C***	**Member Connection: U3-L2b**	***C***
Total Fasteners	68	Total Fasteners	24
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0.39
Dead Load (kip)	313.5	Dead Load (kip)	17.1
Truck Live Load + Impact (kip)	139	Truck Live Load + Impact (kip)	-55.7
Pedestrian Load (kip)	27.3	Pedestrian Load (kip)	0.48
Bolts on Gusset Plates	48	Bolts on Gusset Plates	24
Bolts on Additional Load Transferring Members	20	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**110.65**	Dead Load Per Gusset Plate (kip)	**8.55**
LL+I Per Gusset Plate (kip)	**49.06**	LL+I Per Gusset Plate (kip)	**-27.85**
Ped. Load Per Gusset Plate (kip)	**9.64**	Ped. Load Per Gusset Plate (kip)	**0.24**

*(**b)** Denotes alternative Load Case*

Member Connection: **U3-U1**

		Reference
Shear Resistance:	$C := (\phi F)m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	10	20		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	274.9	253	kip	*Capacity for Total Fastener Group*
Bearing C =	567.00	992.25	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	148.52	kip	**Pedestrian Loads are only*
LL+I Force =	54.23	kip	*included in Operating Ratings per*
*Pedestrian Force =	12.26	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**2.84**	**>1, OK**
	RF_{opr} =	**3.87**	**>1, OK**
Bearing:	**RF_{inv} =**	**11.61**	**>1, OK**
	RF_{opr} =	**15.81**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
U3S	Fasteners Bearing & Shear Capacity	*4/26/2016*	*6/2/2016*		3

6

Member Connection: **U3-L2**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.39	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.563	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	12		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	152	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	442.26	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	8.55	kip	**Pedestrian Loads are only*
LL+I Force =	31.95	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.24	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**2.03**	**>1, OK**
	RF_{opr} =	**3.36**	**>1, OK**
Bearing:	**RF_{inv} =**	**6.22**	**>1, OK**
	RF_{opr} =	**10.30**	**>1, OK**

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Member Connection: **U3-L3**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	4	10		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	110.0	126	kip	*Capacity for Total Fastener Group*
Bearing C =	189.00	413.44	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	56.42	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.64	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.59**	**>1, OK**
	RF_{opr} =	**2.42**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.17**	**>1, OK**
	RF_{opr} =	**7.86**	**>1, OK**

6

Member Connection: **U3-L4**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.51	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.38	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	6	9		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	164.9	114	kip	*Capacity for Total Fastener Group*
Bearing C =	385.56	506.05	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	58.25	kip	**Pedestrian Loads are only*
LL+I Force =	37.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.05	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**2.50**	**>1, OK**
	RF_{opr} =	**3.77**	**>1, OK**
Bearing:	**RF_{inv} =**	**10.07**	**>1, OK**
	RF_{opr} =	**15.16**	**>1, OK**

Member Connection: **U3-U5**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.813	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	24		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	303	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	1190.70	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	110.65	kip	**Pedestrian Loads are only included in Operating Ratings per Bridge Manual 7.2.4.7*
LL+I Force =	49.06	kip	
*Pedestrian Force =	9.64	kip	

Controlling:

Shear:	**RF_{inv} =**	**1.50**	**>1, OK**	**Shear:**	**RF_{inv} =**	**1.50**	**>1, OK**
	RF_{opr} =	**2.09**	**>1, OK**		**RF_{opr} =**	**2.09**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.17**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**9.83**	**>1, OK**
	RF_{opr} =	**7.86**	**>1, OK**		**RF_{opr} =**	**13.72**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
U3S	Axial Tension Capacity	4/26/2016	6/2/2016		8

2 2

Member Connection: **U3-L2**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	33	ksi	*Yield Stress*
Fu =	60	60		*Ultimate Stress*
Thickness =	0.75	0.39	in	*Figure 1*
Ae =	17.03	-	in^2	*Effective Area*
Block Shear Rupture C =	545.27	283.54	kip	*Block Shear Capacity*
Effective Gross Yielding C =	562.11	-	kip	*Yielding Capacity*
Controlling C =	283.5			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	33	6.25	23.01	in	*Figure 2*
# Bolts =	0	0	0		*Figure 2*
Bolts Diameter =	0	0	0	in	*Figure 2*
# Rivets =	9	1	4		*Figure 2*
Rivet Diameter =	0.875	0.875	0.875	in	*Figure 2*
Gusset Ag =	24.75	4.69	17.26	in^2	**Figure 4*
Gusset An =	18.42	3.98	14.45	in^2	
Member Ag =	12.87	2.44	8.97	in^2	
Member An =	9.58	2.07	7.51	in^2	

Member Loading Information:

DL Force =	8.55	kip	**Pedestrian Loads are only*
LL+I Force =	31.95	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.24	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

		Tension:	**RF_{inv} =**	**3.93**	**>1, OK**
Reduction Factor, Rp =	0.9		**RF_{opr} =**	**6.51**	**>1, OK**
β =	0.15				

2 2

Member Connection: **U3-L3**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70		*Ultimate Stress*
Thickness =	0.75	0.375	in	*Figure 1*
Ae =	23.69	-	in^2	*Effective Area*
Block Shear Rupture C =	625.86	415.92	kip	*Block Shear Capacity*
Effective Gross Yielding C =	781.61	-	kip	*Yielding Capacity*
Controlling C =	415.9			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	47	4.25	31.58	in	*Figure 2*
# Bolts =	4	1	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	9	0	3		*Figure 2*
Rivet Diameter =	0.875	0	0.875	in	*Figure 2*
Gusset Ag =	35.25	3.19	23.69	in^2	**Figure 4*
Gusset An =	25.73	2.39	21.58	in^2	
Member Ag =	17.63	1.59	11.84	in^2	
Member An =	12.87	1.20	10.79	in^2	

Member Loading Information:

DL Force =	56.42	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.64	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension:	**RF_{inv} =**	**3.35**	**>1, OK**
	RF_{opr} =	**5.09**	**>1, OK**
Controlling:	**RF_{inv} =**	**3.35**	**>1, OK**
	RF_{opr} =	**5.09**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
U3S	Compression Capacity	4/26/2016	6/2/2016		10

Member Connection: **U3-L4**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	22.52	in	*Figure 4*
Whitmore Distance, Lc =	11.53	in	*Figure 4*
Thickness =	0.75	in	*Gusset Plate thickness*
A_s =	16.89	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	26.63		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**32.33**	**ksi**	
C =	**464.08**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	58.25	kip	**Pedestrian Loads are only*
LL+I Force =	37.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.05	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**4.79**	**>1, OK**
	RF_{opr} =	**7.22**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
U3S	Shear Capacity: Rupture Resistance	4/26/2016	6/2/2016		11

Member Connection: **U3-U1**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	U3	-	U3	-		
Fy =	33	0	33	0	ksi	*Yield Stress*
Fu =	60	0	60	0	ksi	*Ultimate Stress*
Thickness =	0.75	0	0.75	0	in	*Plate Thickness*
Shear Plane Length =	56.67	0	48.56	0	in	*Figure 3*
# Bolts =	2	0	2	0		*Figure 3*
Bolts Diameter =	1	0	1	0	in	*Figure 3*
# Rivets =	13	0	10	0		*Figure 3*
Rivet Diameter =	0.875	0	0.875	0	in	*Figure 3*
Gross Area, Ag =	42.50	0	36.42	0	in^2	
Net Area, An =	31.77	0	27.80	0	in^2	
Yield Resistance C =	715.88	0.0	613.4	0.0	kip	*Yield Capacity*
Rupture Resistance C =	826.94	0.0	723.5	0.0	kip	*Rupture Capacity*
Controlling C =	715.9		613.4			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	U3-L2	8.55	31.95	0.24	47.24	5.80	21.69	0.16
	U3-L3	56.42	47.15	4.64	82.55	7.32	6.11	0.60
	U3-L4	58.25	37.35	4.05	62.14	27.22	17.45	1.89
SECTION B-B	U3-U5	110.65	49.06	9.64	95.04	110.22	48.87	9.60
	U3-L4	58.25	37.35	4.05	35.31	33.67	21.59	2.34
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**6.76**	**>1, OK**	**2.79**	**>1, OK**	**RF_{inv} =**	**2.79**	**>1, OK**
	10.65	**>1, OK**	**3.98**	**>1, OK**	**RF_{opr} =**	**3.98**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
U3S	Shear Capacity: Partial Shear Check	4/26/2016	6/2/2016		12

2

Member Connection: **U3-L2b**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? No

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	U3	-		-	-	
Fy =	33	0	ksi	0	0	*Yield Stress*
Thickness =	0.75	0	in	0	0	*Plate Thickness*
Shear Plane Length =	28.68	0	in	0	0	*Figure 3*
# Bolts =	2	0		0	0	*Figure 3*
Bolts Diameter =	1	0	in	0	0	*Figure 3*
# Rivets =	6	0		0	0	*Figure 3*
Rivet Diameter =	0.875	0	in	0	0	*Figure 3*
Gross Area, Ag =	21.51	0	in^2	0.000	0	*Gross Area*
Yield Resistance C =	362.3	0.0	kip	0.0	0.0	*Yield Capacity*
Controlling C =	362.3			0.0		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	U3-L2b	-8.55	27.85	-0.24	35.30	-6.98	22.73	-0.20
VERT	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Horizontal		Vertical		Controlling	
Partial Shear Rating:	**7.53**	**>1, OK**	**>1, OK**	RF_{inv} =	**7.53**	**>1, OK**
	12.68	**>1, OK**	**>1, OK**	RF_{opr} =	**12.68**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
U3S	Shear Capacity: Partial Shear Check	4/26/2016	6/2/2016		13

2

Member Connection: **U3-L4**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? No

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		U3	-	
Fy =	0	0	ksi	33	0	*Yield Stress*
Thickness =	0	0	in	0.75	0	*Plate Thickness*
Shear Plane Length =	0	0	in	31.68	0	*Figure 3*
# Bolts =	0	0		2	0	*Figure 3*
Bolts Diameter =	0	0	in	1	0	*Figure 3*
# Rivets =	0	0		5	0	*Figure 3*
Rivet Diameter =	0	0	in	0.875	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	23.760	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	400.2	0.0	*Yield Capacity*
Controlling C =	0.0			400.2		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	U3-L4	58.25	37.35	4.05	35.31	33.67	21.59	2.34

	Horizontal	Vertical			Controlling	
Partial Shear Rating:	>1, OK	7.61	>1, OK	RF_{inv} =	7.61	>1, OK
	>1, OK	11.46	>1, OK	RF_{opr} =	11.46	>1, OK

2

Gusset Reference: U3

Reference

Chord Splice Resistance: $C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$ *MBE (2014) L6B.2.6.6*

Net Capacity*: $C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$ *MBE (2014) L6B.2.6.6*
**For Tensile Splices Only*

LFR rating factor: $RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$ Inventory Rating

LFR rating factor: $RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$ Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ_{cs} =	1			Resistance Factor

Gusset Properties:

Splice Type = *C*

Mill to Bear?	*No*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.75	*in*	Gusset PL Height, H =	*46.63*	*in*
Chord Box Centroid Depth =	8.625	*in*	Lsplice =	*5.625*	*in*
Yield Stress, F_y =	33	*ksi*	Ultimate Stress, F_u =	*60*	*ksi*
F_{cr} check =	12.99	**<25, OK**	Critical Stess, F_{cr} =	*33*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.75	46.63	23.31	34.97	815.21	6694.83	6334.85	359.98
Left	0.75	46.63	23.31	34.97	815.21	6694.83	6334.85	359.98
Addtl PLs								
Top	16.25	0.625	-1.99	10.16	-20.2109	4958.1	0.3	4957.7
Bottom								
Right				0	0	0.0	0.0	0.0
Left				0	0	0.0	0.0	0.0
		Σ=	20.10	80.09	1610.21	18347.73		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
	Chord Splice Resistance	*4/26/2016*	*6/2/2016*		15

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top									
Bottom									
1									
2									
3									
4**									
5	-								
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
			Σ=	-	0.00	0.00	0.00	0.00	0.00

Splice Properties: **C = 1134.88 kip** *Controlling Resistance*

A_g=	80.1	in^2	A_n=	-	in^2	*Plates areas*
y_g=	20.1	in	y_n=	-	in	*Area Centroid Height*
H - y_g=	26.52	in	H - y_n=	-	in	Ytop
I_g=	18347.7	in	I_n=	-	in	*Area Moment of Inertia*
S_g=	691.8	in^3	S_n=	-	in^3	*Plates Section Modulus*
e_p=	11.5	in	e_n=	-	in	*Distance between centroid*
C_{GROSS} =	**1134.88**	**kip**	**C_{NET} =**	**-**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
	Chord Splice Resistance	*4/26/2016*	*6/2/2016*		16

Splice Forces:

Gusset Reference = U3

Left side:

	DL	LL	θ_L
U3-U1	396.05	144.60	87.52
U3-L2	-17.1	-63.9	42.84
-	0	0	0
$\gamma.\Sigma =$	499.27	219.20	

Right Side:

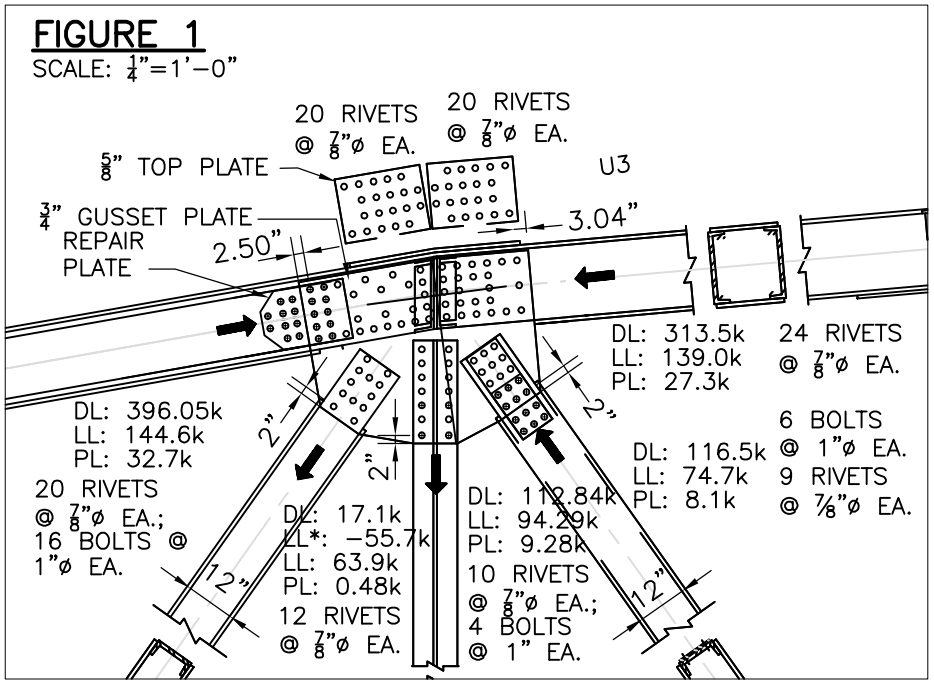
	DL	LL	θ_L
-	0	0	0
U3-L4	116.5	74.7	27.78
U3-U5	313.50	139.00	87.51
$\gamma.\Sigma =$	477.75	376.90	

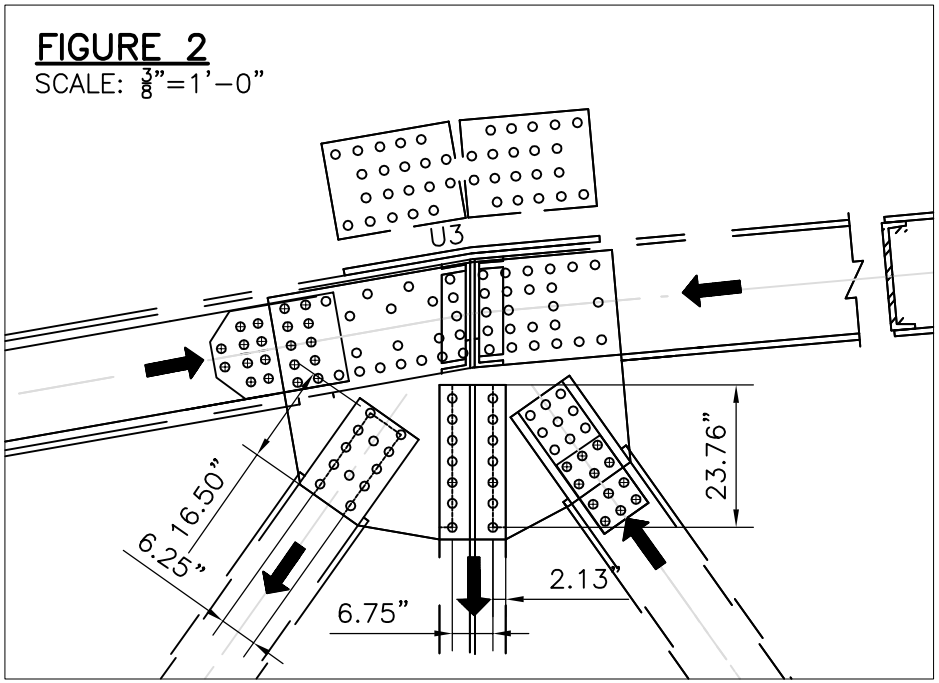
	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**2.90**	**>1, OK**	**1.74**	**>1, OK**	**RF_{inv} =**	**1.74**	**>1, OK**
RF_{LFRopr} =	**4.84**	**>1, OK**	**2.91**	**>1, OK**	**RF_{opr} =**	**2.91**	**>1, OK**

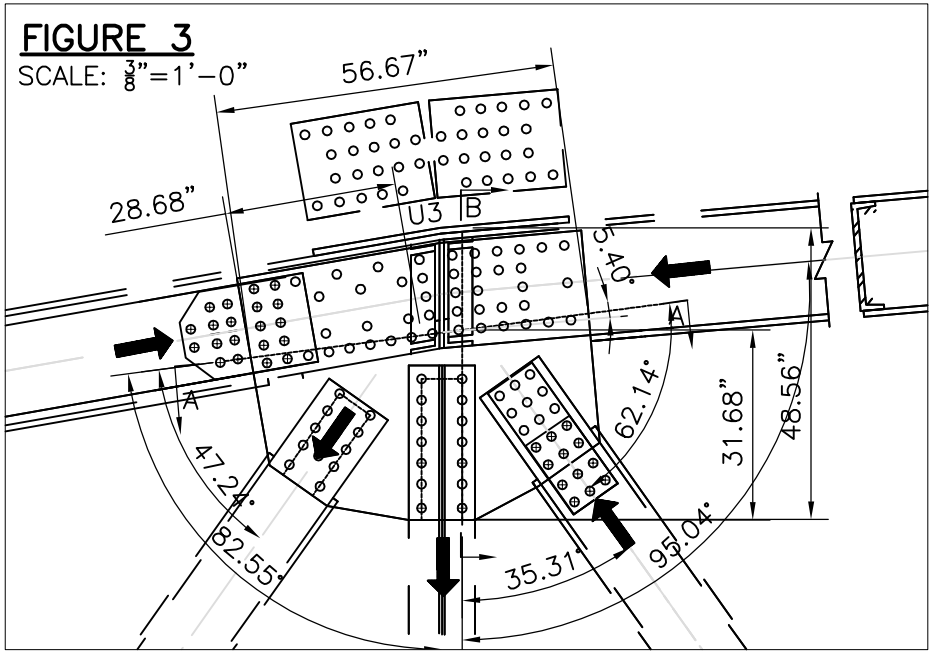
CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U3	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/26/2016	6/2/2016		17

Gusset Reference: U3

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	**1.50**	**53.84**	**2.09**	**75.12**
Axial Tension Capacity	3.35	120.55	5.09	183.19
Shear Capacity: Yield/Rupture	2.79	100.39	3.98	143.30
Partial Shear Capacity: Yield	7.53	271.06	11.46	412.48
Compression Capacity	4.79	172.50	7.22	259.77
Chord Splice	1.74	62.77	2.91	104.77
Gusset Rating:	**1.50**	**53.84**	**2.09**	**75.12**







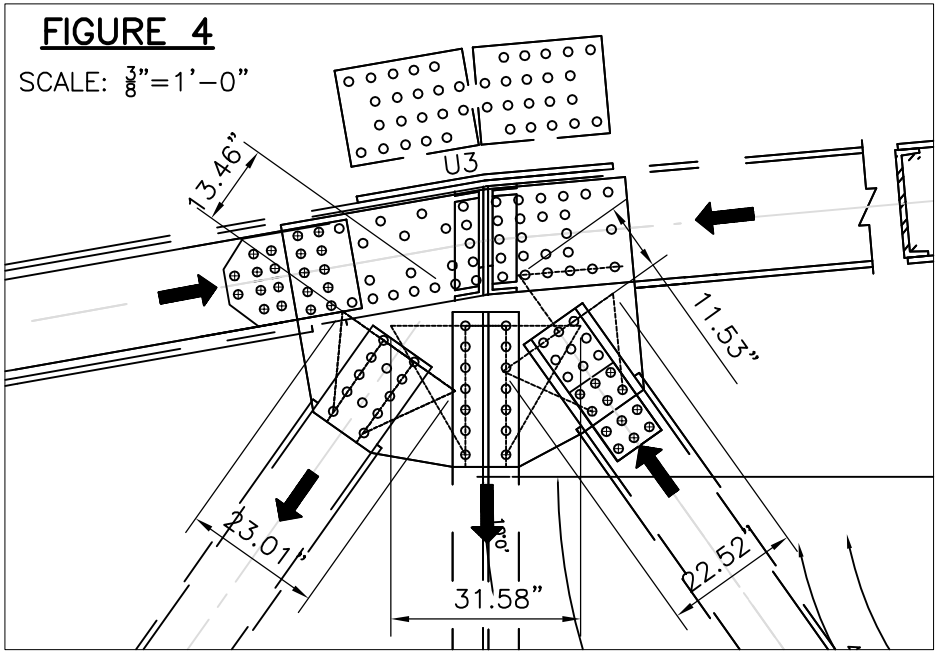


Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

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One Financial Center, 3rd Floor
Boston, MA 02111
Tel: (617) 482-7298
Fax: (617) 482-1837
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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: U3-A
Title: Gusset Plate U3 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

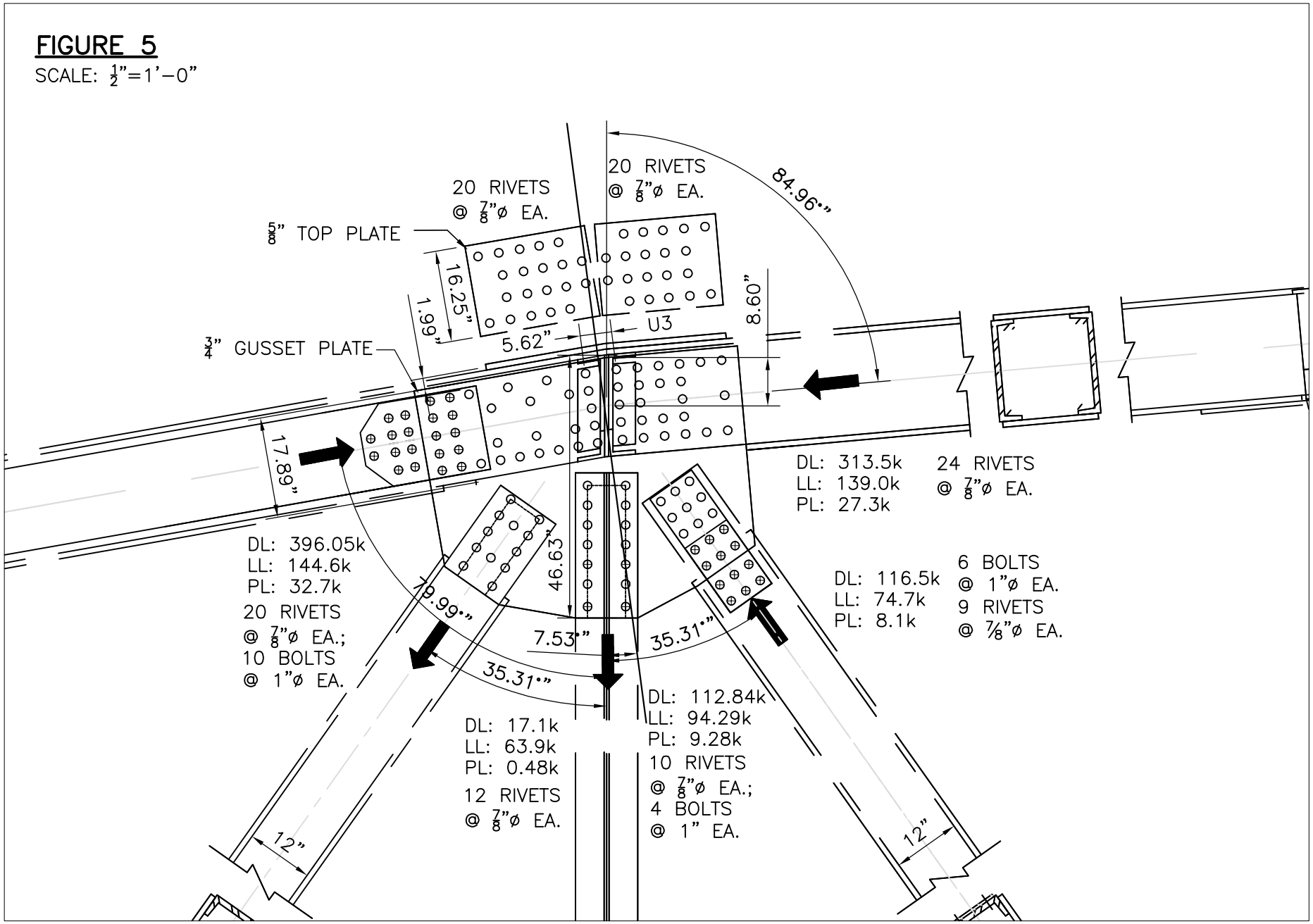

Figure 5: Gusset Plate & Chord Splice

LEGEND:

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One Financial Center, 3rd Floor
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Tel: (617) 482-7298
Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: U3-B
Title: Gusset Plate U3 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	ARG	*WRG*		
	Gusset Plate Loading	4/28/16	6/3/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: U5**

Member Connection: U5-U3	***C***	**Member Connection: U5-L4**	***T***
Total Fasteners	80	Total Bolts	46
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0.465
Dead Load (kip)	313.5	Dead Load (kip)	258.3
Truck Live Load + Impact (kip)	139	Truck Live Load + Impact (kip)	103.2
Pedestrian Load (kip)	27.3	Pedestrian Load (kip)	19.4
Bolts on Gusset Plates	48	Bolts on Gusset Plates	46
Bolts on Additional Load Transferring Members	32	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**94.05**	Dead Load Per Gusset Plate (kip)	**129.15**
LL+I Per Gusset Plate (kip)	**41.70**	LL+I Per Gusset Plate (kip)	**51.60**
Ped. Load Per Gusset Plate (kip)	**8.19**	Ped. Load Per Gusset Plate (kip)	**9.70**

Member Connection: U5-L5	***T***	**Member Connection: U5-L6**	***C***
Total Bolts	28	Total Bolts	76
Thickness of Channel Web (in)	0.375	Thickness of Channel Web (in)	0.52
Dead Load (kip)	111.4	Dead Load (kip)	369.7
Truck Live Load + Impact (kip)	94.29	Truck Live Load + Impact (kip)	124.7
Pedestrian Load (kip)	9.2	Pedestrian Load (kip)	27.7
Bolts on Gusset Plates	28	Bolts on Gusset Plates	76
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**55.70**	Dead Load Per Gusset Plate (kip)	**184.85**
LL+I Per Gusset Plate (kip)	**47.15**	LL+I Per Gusset Plate (kip)	**62.35**
Ped. Load Per Gusset Plate (kip)	**4.60**	Ped. Load Per Gusset Plate (kip)	**13.85**

Member Connection: U5-U7	***T***	**Member Connection: U5-U7b**	***C***
Total Bolts	76	Total Bolts	76
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0.45
Dead Load (kip)	25.8	Dead Load (kip)	25.8
Truck Live Load + Impact (kip)	64.54	Truck Live Load + Impact (kip)	-67.67
Pedestrian Load (kip)	1.8	Pedestrian Load (kip)	1.8
Bolts on Gusset Plates	44	Bolts on Gusset Plates	44
Bolts on Additional Load Transferring Members	32	Bolts on Additional Load Transferring Members	32
Dead Load Per Gusset Plate (kip)	**7.47**	Dead Load Per Gusset Plate (kip)	**7.47**
LL+I Per Gusset Plate (kip)	**18.68**	LL+I Per Gusset Plate (kip)	**-19.59**
Ped. Load Per Gusset Plate (kip)	**0.52**	Ped. Load Per Gusset Plate (kip)	**0.52**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Fasteners Bearing & Shear Capacity	4/28/2016	6/3/2016		2

6

Member Connection: **U5-U3**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.813	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	24		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	303	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	1190.70	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	94.05	kip	**Pedestrian Loads are only*
LL+I Force =	41.70	kip	*included in Operating Ratings per*
*Pedestrian Force =	8.19	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**2.00**	**>1, OK**
	RF_{opr} =	**2.79**	**>1, OK**
Bearing:	**RF_{inv} =**	**11.81**	**>1, OK**
	RF_{opr} =	**16.47**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/3/2016*		3

6

Member Connection: **U5-L4**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.4375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	5	18		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	137.4	227	kip	*Capacity for Total Fastener Group*
Bearing C =	236.25	744.19	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	129.15	kip	**Pedestrian Loads are only*
LL+I Force =	51.60	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.70	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.76**	**>1, OK**
	RF_{opr} =	**2.47**	**>1, OK**
Bearing:	**RF_{inv} =**	**7.26**	**>1, OK**
	RF_{opr} =	**10.20**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/3/2016*		4

6

Member Connection: **U5-L5**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	3.313	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	4	10		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	110.0	126	kip	*Capacity for Total Fastener Group*
Bearing C =	189.00	413.44	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	55.70	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.60	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.60**	**>1, OK**
	RF_{opr} =	**2.44**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.18**	**>1, OK**
	RF_{opr} =	**7.88**	**>1, OK**

6

Member Connection: **U5-L6**

Reference

Shear Resistance: $C := (\phi F) m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.4375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	26	12		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	714.7	152	kip	*Capacity for Total Fastener Group*
Bearing C =	1228.50	496.13	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	184.85	kip	**Pedestrian Loads are only*
LL+I Force =	62.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.85	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**4.63**	**>1, OK**
	RF_{opr} =	**6.32**	**>1, OK**
Bearing:	**RF_{inv} =**	**10.97**	**>1, OK**
	RF_{opr} =	**14.98**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Fasteners Bearing & Shear Capacity	*4/28/2016*	*6/3/2016*		6

6

Member Connection: **U5-U7**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.563	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	22		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	278	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	935.55	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	7.47	kip	**Pedestrian Loads are only*
LL+I Force =	18.68	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.52	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**1.60**	**>1, OK**	**Shear:**	**RF_{inv} =**	**6.61**	**>1, OK**
	RF_{opr} =	**2.44**	**>1, OK**		**RF_{opr} =**	**10.74**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.18**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**22.84**	**>1, OK**
	RF_{opr} =	**7.88**	**>1, OK**		**RF_{opr} =**	**37.09**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Axial Tension Capacity	4/28/2016	6/3/2016		7

3 3

Member Connection: **U5-L4**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70	ksi	*Ultimate Stress*
Thickness =	0.4375	0.465	in	*Figure 1*
Ae =	15.26	-	in^2	*Effective Area*
Block Shear Rupture C =	425.55	599.43	kip	*Block Shear Capacity*
Effective Gross Yielding C =	503.44	-	kip	*Yielding Capacity*
Controlling C =	425.6			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	53.5	6	34.87	in	*Figure 2*
# Bolts =	4	0	0		*Figure 2*
Bolts Diameter =	1	0	0	in	*Figure 2*
# Rivets =	11	2	5		*Figure 2*
Rivet Diameter =	0.875	0.875	0.875	in	*Figure 2*
Gusset Ag =	23.41	2.63	15.26	in^2	**Figure 4*
Gusset An =	17.04	1.80	13.20	in^2	
Member Ag =	24.88	2.79	16.21	in^2	
Member An =	18.11	1.92	14.03	in^2	

Member Loading Information:

DL Force =	129.15	kip	**Pedestrian Loads are only*
LL+I Force =	51.60	kip	*included in Operating Ratings per*
*Pedestrian Force =	9.70	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension: RF_{inv} = **2.30** **>1, OK**

RF_{opr} = **3.23** **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Axial Tension Capacity	*4/28/2016*	*6/3/2016*		8

3 3

Member Connection: **U5-L5**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70		*Ultimate Stress*
Thickness =	0.4375	0.375	in	*Figure 1*
Ae =	17.98	-	in^2	*Effective Area*
Block Shear Rupture C =	519.39	587.79	kip	*Block Shear Capacity*
Effective Gross Yielding C =	593.38	-	kip	*Yielding Capacity*
Controlling C =	519.4			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	63.25	6.75	41.1	in	*Figure 2*
# Bolts =	4	1	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	9	0	2		*Figure 2*
Rivet Diameter =	0.875	0	0.875	in	*Figure 2*
Gusset Ag =	27.67	2.95	17.98	in^2	**Figure 4*
Gusset An =	22.12	2.49	17.16	in^2	
Member Ag =	23.72	2.53	15.41	in^2	
Member An =	18.96	2.13	14.71	in^2	

Member Loading Information:

DL Force =	55.70	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.60	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension: **RF_{inv} = 4.37 >1, OK**

RF_{opr} = 6.64 >1, OK

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Axial Tension Capacity	*4/28/2016*	*6/3/2016*		9

3 3

Member Connection: **U5-U7**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	33	ksi	*Yield Stress*
Fu =	60	60		*Ultimate Stress*
Thickness** =	0.8125	0.45	in	*Figure 1*
Ae =	13.35	-	in^2	*Effective Area*
Block Shear Rupture C =	647.09	358.39	kip	*Block Shear Capacity*
Effective Gross Yielding C =	440.71	-	kip	*Yielding Capacity*
Controlling C =	358.4			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	30	12	30.62	in	*Figure 2*
# Bolts =	0	0	0		*Figure 2*
Bolts Diameter =	0	0	0	in	*Figure 2*
# Rivets =	4.5	4.5	5		*Figure 2*
Rivet Diameter =	0.875	0.875	0.875	in	*Figure 2*
Gusset Ag =	24.38	9.75	13.40	in^2	**Figure 4*
Gusset An =	20.95	6.32	11.35	in^2	***Additional 3/8" PL on Gusset*
Member Ag =	13.50	5.40	13.78	in^2	*is used for Block Shear Only*
Member An =	11.60	3.50	11.67	in^2	

Member Loading Information:

DL Force =	7.47	kip	**Pedestrian Loads are only*
LL+I Force =	18.68	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.52	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

		Tension:	**RF_{inv} =**	**8.60**	**>1, OK**
Reduction Factor, Rp =	0.9		**RF_{opr} =**	**13.97**	**>1, OK**
β =	0.15	**Controlling:**	**RF_{inv} =**	**2.30**	**>1, OK**
			RF_{opr} =	**3.23**	**>1, OK**

Member Connection: **U5-U3**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	31.74	in	*Figure 4*
Whitmore Distance, Lc =	6	in	*Figure 4*
Thickness =	0.8125	in	*Gusset Plate thickness*
A_s =	25.79	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	12.79		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**32.84**	**ksi**	
C =	**719.96**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	94.05	kip	**Pedestrian Loads are only*
LL+I Force =	41.70	kip	*included in Operating Ratings per*
*Pedestrian Force =	8.19	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**6.61**	**>1, OK**
	RF_{opr} =	**9.22**	**>1, OK**

Member Connection: **U5-L6**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	42.44	in	*Figure 4*
Whitmore Distance, Lc =	15.25	in	*Figure 4*
Thickness =	0.4375	in	*Gusset Plate thickness*
A_s =	18.57	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	60.37		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**29.53**	**ksi**	
C =	**466.10**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	184.85	kip	**Pedestrian Loads are only*
LL+I Force =	62.35	kip	*included in Operating Ratings per*
*Pedestrian Force =	13.85	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**1.67**	**>1, OK**
	RF_{opr} =	**2.28**	**>1, OK**

Member Connection: **U5-U7b**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	30.62	in	*Figure 4*
Whitmore Distance, Lc =	6	in	*Figure 4*
Thickness =	0.8125	in	*Gusset Plate thickness*
A_s =	24.88	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	12.79		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**32.84**	**ksi**	
C =	**694.56**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	-7.47	kip	**Pedestrian Loads are only*
LL+I Force =	19.59	kip	*included in Operating Ratings per*
*Pedestrian Force =	-0.52	kip	*Bridge Manual 7.2.4.7*

Controlling:

RF_{inv} =	**1.67**	**>1, OK**	**Compression Rating:**	**RF_{inv} =**	**16.57**	**>1, OK**
RF_{opr} =	**2.28**	**>1, OK**		**RF_{opr} =**	**28.41**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Shear Capacity: Partial Shear Check	4/28/2016	6/3/2016		13

1

Member Connection: U5-L6

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? Yes

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		U5	-	
Fy =	0	0	ksi	33	0	*Yield Stress*
Thickness =	0	0	in	0.4375	0	*Plate Thickness*
Shear Plane Length =	0	0	in	38.38	0	*Figure 3*
# Bolts =	0	0		2	0	*Figure 3*
Bolts Diameter =	0	0	in	1	0	*Figure 3*
# Rivets =	0	0		5	0	*Figure 3*
Rivet Diameter =	0	0	in	0.875	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	16.791	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	282.8	0.0	*Yield Capacity*
Controlling C =	0.0			282.8		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	U5-L6	184.85	62.35	13.85	60.15	160.33	54.08	12.01

	Horizontal	Vertical			Controlling	
Partial Shear Rating:	>1, OK	0.63	<1, NG	RF_{inv} =	0.63	<1, NG
	>1, OK	0.87	<1, NG	RF_{opr} =	0.87	<1, NG

**Partial Shear rating is superseded based on the refined analysis.

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Shear Capacity: Rupture Resistance	4/28/2016	6/3/2016		#REF!

Member Connection: **U5-U3**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	U5	-	U5	-		
Fy =	33	0	33	33	ksi	*Yield Stress*
Fu =	60	0	60	60	ksi	*Ultimate Stress*
Thickness =	0.4375	0	0.4375	0.375	in	*Plate Thickness*
Shear Plane Length =	67.11	0	52.92	18	in	*Figure 3*
# Bolts =	0	0	2	0		*Figure 3*
Bolts Diameter =	0	0	1	0	in	*Figure 3*
# Rivets =	12	0	10	0		*Figure 3*
Rivet Diameter =	0.875	0	0.875	0	in	*Figure 3*
Gross Area, Ag =	29.36	0	23.15	6.75	in^2	
Net Area, An =	24.44	0	18.12	6.75	in^2	
Yield Resistance C =	494.53	0.0	390.0	113.7	kip	*Yield Capacity*
Rupture Resistance C =	636.15	0.0	471.7	175.7	kip	*Rupture Capacity*
Controlling C =	494.5		503.7			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	U5-L4	129.15	51.60	9.70	53.59	76.66	30.63	5.76
	U5-L5	55.70	47.15	4.60	85.96	3.92	3.32	0.32
	U5-L6	184.85	62.35	13.85	60.15	92.01	31.03	6.89
SECTION B-B	U3-U5	110.65	49.06	9.64	84.96	-9.72	-4.31	-0.85
	L4-U5	129.15	51.60	9.70	32.37	109.08	43.58	8.19
	U5-L5	55.70	47.15	4.60	0.00	55.7	47.145	4.6

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**1.92**	**>1, OK**	**1.61**	**>1, OK**	**RF_{inv} =**	**1.61**	**>1, OK**
	2.67	**>1, OK**	**2.36**	**>1, OK**	**RF_{opr} =**	**2.36**	**>1, OK**

Member Connection: **U5-L6**

Reference

Per MBE 2014, section 6.A.6.12.6.11, a refined analysis can be employed to determine the nominal resistance of a gusset-plate connection. These checks supersede partial shear check.

MBE (2014) 6A.6.12.6.11

Basic Corner Check:

MBE (2014) Fig. C6A.6.12.6.11-1

**For dimensions used below see Figure U5_C*

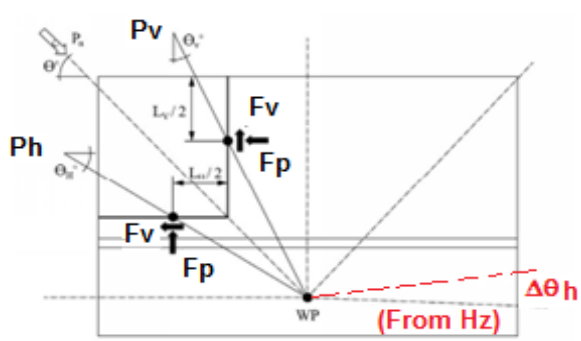


Figure C6A.6.12.6.11-1—Basic Corner Check

Based on Force equilibrium in x & y on the plate:

$$\Sigma F_y := P_{sin}(\theta) + (P_v \cdot \sin(\theta_v) + P_h \cdot \sin(\theta_h - \Delta\theta_h)) = 0 \qquad \text{(I)}$$

$$\Sigma F_x := P_{cos}(\theta) + (P_v \cdot \cos(\theta_v) + P_h \cdot \cos(\theta_h - \Delta\theta_h)) = 0 \qquad \text{(II)}$$

Working on equation (II) gives us (III):

$$P_h = \frac{-[P_{cos}(\theta) + P_v \cdot (\cos(\theta_v))]}{(\cos(\theta_h - \Delta\theta_h))} \qquad \text{(III)}$$

Inputing (III) into (I) yields (IV):

$$P_{sin}(\theta) + \left[P_v \cdot \sin(\theta_v) + \left[\frac{-[P_{cos}(\theta) + P_v \cdot (\cos(\theta_v))]}{(\cos(\theta_h - \Delta\theta_h))}\right] \cdot \sin(\theta_h - \Delta\theta_h)\right] = 0$$

Solving equation (IV) yields the force breakdown below:

Force Breakdown:

P.sin	Pvsin	-Pv.cos	-P.cos
0.845	0.992	-0.050	-0.215

Based on Section Equilibrium Dimensions on Figure U5-C

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
0	Shear: Basic Corner Check & Truncated Whitmore	*4/28/2016*	*6/3/2016*		15

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ =	0.9			Resistance Factor
Fy =	33	ksi		*Plate Yield Strength*

Δθh = 2.520 deg from horizontal

Member U5-L6 Forces: *Total forces below are split / gusset for both vert & hz planes*

DL, kip =	369.7	**θ =**	57.63	deg
LL, kip =	124.7			
PL, kip =	27.7			

	DL	LLinv	LLopr
Fp, kip =	99.0	33.4	40.8
Fv, kip =	156.1	52.7	64.4

Vertical Plane: Vector through midpoint of vertical partial shear plane (Pv)

P_{VDL}, kip =	-123.4	**θv =**	82.89	deg
P_{VLLv}, kip =	-41.6	**L, in =**	38.38	
P_{VLL+PL}, kip =	-50.9	**t, in =**	0.4375	

	DL	LLinv	LLopr
Fp, kip =	-15.3	-5.2	-6.3
Fv, kip =	-122.5	-41.3	-50.5

Horizontal Plane: Vector through midpoint of horizontal partial shear plane (Ph)

P_{HDL}, kip =	-90.2	**θh =**	24.42	deg
P_{HLLv}, kip =	-30.4	**L, in =**	29.33	
P_{HLL+PL}, kip =	-37.2	**t, in =**	0.4375	

	DL	LLinv	LLopr
Fp, kip =	-82.1	-27.7	-33.9
Fv, kip =	-37.3	-12.6	-15.4

Force Equilibrium Check:

Axial -	ΣFp =	0.0	0.0	0.0
Shear -	ΣFv =	0.0	0.0	0.0

von Misses Equation: $\sigma_v = \sqrt{\sigma_1^2 - \sigma_1\sigma_2 + \sigma_2^2}$ *Principal Plane Stress Eqn*

	Vertical Plane			Horizontal Plane		
	DL	LLinv	LLopr	DL	LLinv	LLopr
Shear Stress, ksi =	7.29	2.46	3.01	6.40	2.16	2.64
Compression, ksi =	0.91	0.31	0.38	2.91	0.98	1.20
von Misses, ksi =	6.88	2.32	2.84	5.55	1.87	2.29

	Vertical		Horizontal			Controlling	
Inventory Rating:	**4.12**	**>1, OK**	**5.53**	**>1, OK**	**RF_{inv} =**	**4.12**	**>1, OK**
Operating Rating:	**5.62**	**>1, OK**	**7.56**	**>1, OK**	**RF_{opr} =**	**5.62**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
6	Shear: Basic Corner Check & Truncated Whitmore	*4/28/2016*	*6/3/2016*		16

Member Connection: **U5-L6**

Reference

Per MBE 2014, section 6.A.6.12.6.11, a refined analysis can be employed to determine the nominal resistance of a gusset-plate connection. The truncated whitmore is done as follow:

MBE (2014) 6A.6.12.6.11

Gusset & Member Information:

φ_{cg} = 1.00 *Resistance factor for compression*

E = 29000.00 ksi *Modulus of Elasticity*

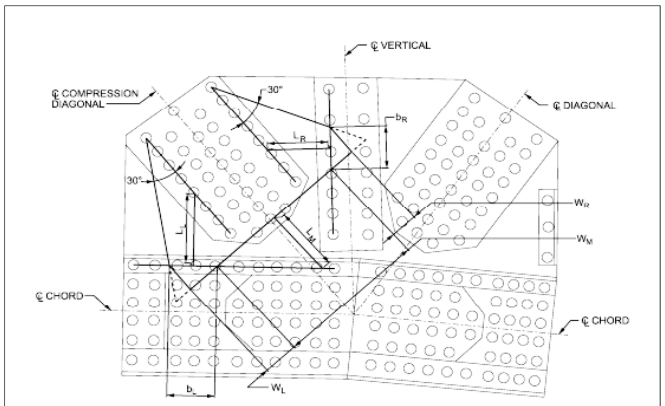


Figure C6A.12.6.11-2—Truncated Whitmore Section

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

	Left	Mid	Right		
Whitmore Eff. Length =	5.16	32.9	0	in	*Figure 7*
Whitmore Distance, L =	11.39	12.41	0	in	*Figure 7*
Thickness =	0.4375	0.4375	0.4375	in	*Gusset Plate thickness*
A_s =	2.26	14.39	0.00	in^2	*Area of Whitmore section*
K =	0.5	0.5	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	45.09	49.13	0.00		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71	131.71	131.71		
F_{cr} =	**31.07**	**30.70**	**33.00**	**ksi**	
C =	**59.61**	**375.65**	**0.00**	**kip**	
Σ C =		**435.26**			*Member Compressive Capacity*

Member Loading Information:

**Pedestrian Loads are only included in Operating Ratings per Bridge Manual 7.2.4.7*

DL Force =	184.85	kip
LL+I Force =	62.35	kip
*Pedestrian Force =	13.85	kip

Inventory Rating:	**RF_{inv} =**	**1.44**	**>1, OK**
Operating Rating:	**RF_{opr} =**	**1.97**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
U5S	Shear Capacity: Rupture Resistance	4/28/2016	6/3/2016		17

Member Connection: **U5-U3**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014) Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014) Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	U5	-	U5	-		
Fy =	33	0	33	33	ksi	*Yield Stress*
Fu =	60	0	60	60	ksi	*Ultimate Stress*
Thickness =	0.4375	0	0.4375	0.375	in	*Plate Thickness*
Shear Plane Length =	67.11	0	52.92	18	in	*Figure 3*
# Bolts =	0	0	2	0		*Figure 3*
Bolts Diameter =	0	0	1	0	in	*Figure 3*
# Rivets =	12	0	10	0		*Figure 3*
Rivet Diameter =	0.875	0	0.875	0	in	*Figure 3*
Gross Area, Ag =	29.36	0	23.15	6.75	in^2	
Net Area, An =	24.44	0	18.12	6.75	in^2	
Yield Resistance C =	494.53	0.0	390.0	113.7	kip	*Yield Capacity*
Rupture Resistance C =	636.15	0.0	471.7	175.7	kip	*Rupture Capacity*
Controlling C =	494.5		503.7			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	U5-L4	129.15	51.60	9.70	53.59	76.66	30.63	5.76
	U5-L5	55.70	47.15	4.60	85.96	3.92	3.32	0.32
	U5-L6	184.85	62.35	13.85	60.15	92.01	31.03	6.89
SECTION B-B	U3-U5	110.65	49.06	9.64	84.96	-9.72	-4.31	-0.85
	L4-U5	129.15	51.60	9.70	32.37	109.08	43.58	8.19
	U5-L5	55.70	47.15	4.60	0.00	55.7	47.145	4.6

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**1.92**	**>1, OK**	**1.61**	**>1, OK**	**RF_{inv} =**	**1.61**	**>1, OK**
	2.67	**>1, OK**	**2.36**	**>1, OK**	**RF_{opr} =**	**2.36**	**>1, OK**

Gusset Reference: U5

		Reference
Chord Splice Resistance:	$C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$	*MBE (2014) L6B.2.6.6*
Net Capacity*:	$C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$	*MBE (2014) L6B.2.6.6* **For Tensile Splices Only*
LFR rating factor:	$RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$	Inventory Rating
LFR rating factor:	$RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$	Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17		*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3		*Factors as in Article 6A.6.3.*
φ_{cs} =	1				Resistance Factor

Gusset Properties:

Splice Type = *B*

Mill to Bear?	*No*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.8125	*in*	Gusset PL Height, H =	*52.875*	*in*
Chord Box Centroid Depth =	9	*in*	Lsplice =	*6.125*	*in*
Yield Stress, F_y =	33	*ksi*	Ultimate Stress, F_u =	*60*	*ksi*
F_{cr} check =	13.06	**<25, OK**	Critical Stess, F_{cr} =	*33*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.4375	52.875	26.44	23.13	611.57	6683.95	5389.49	1294.46
Left	0.4375	52.875	26.44	23.13	611.57	6683.95	5389.49	1294.46
Addtl PLs								
Top	16	0.625	-1.875	10	-18.75	4340.1	0.3	4339.7
Bottom	8	0.4375	18	3.5	63	3.3	0.1	3.2
Right	0.375	18	9	6.75	60.75	851.5	182.3	669.2
Left	0.375	18	9	6.75	60.75	851.5	182.3	669.2
		Σ=	18.96	73.27	1388.90	19414.137		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/3/2016*		19

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top									
Bottom									
1									
2									
3									
4**									
5	-								
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
			Σ=	-	0.00	0.00	0.00	0.00	0.00

Splice Properties: **C = 1062.99 kip** *Controlling Resistance*

A_g=	73.3	in^2	A_n=	-	in^2	*Plates areas*
y_g=	19.0	in	y_n=	-	in	*Area Centroid Height*
H - y_g=	33.92	in	H - y_n=	-	in	Ytop
I_g=	19414.1	in	I_n=	-	in	*Area Moment of Inertia*
S_g=	572.4	in^3	S_n=	-	in^3	*Plates Section Modulus*
e_p=	10.0	in	e_n=	-	in	*Distance between centroid*
C_{GROSS} =	**1062.99**	**kip**	**C_{NET} =**	**-**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/3/2016*		20

Splice Forces:

Gusset Reference = U5

Left side:

	DL	LL	θ_L
U5-U3	313.50	139.00	84.96
U5-L4	-258.3	-103.2	32.37
-	0	0	0
$\gamma.\Sigma =$	226.20	180.57	

Right Side:

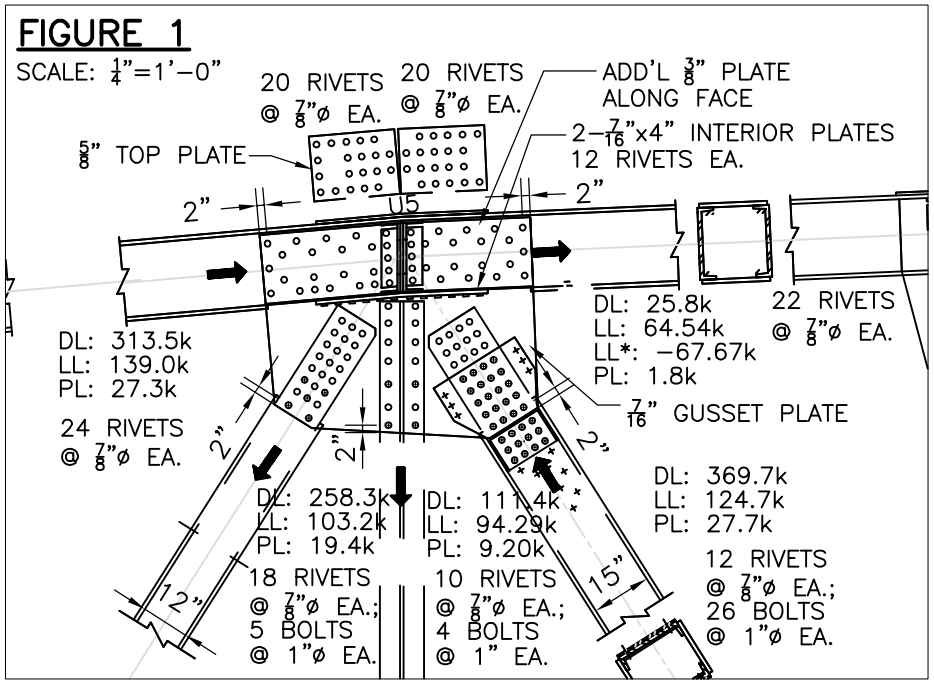
	DL	LL	θ_L
-	0	0	0
U5-L6	369.7	124.7	32.37
U5-U7	-25.80	-64.54	92.47
$\gamma.\Sigma =$	407.37	234.59	

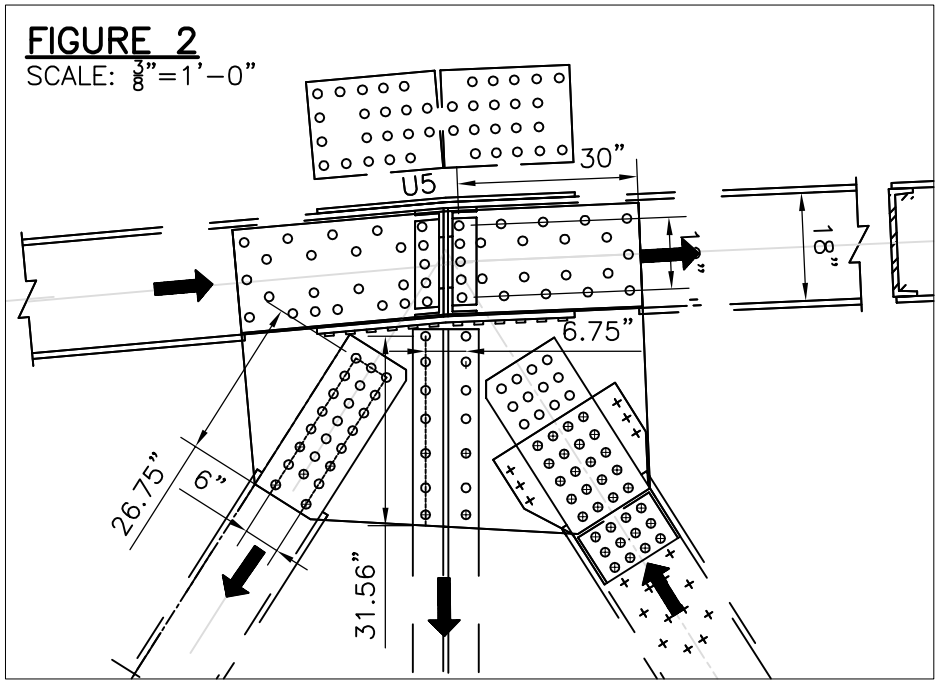
	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**4.63**	**>1, OK**	**2.79**	**>1, OK**	**RF_{inv} =**	**2.79**	**>1, OK**
RF_{LFRopr} =	**7.74**	**>1, OK**	**4.67**	**>1, OK**	**RF_{opr} =**	**4.67**	**>1, OK**

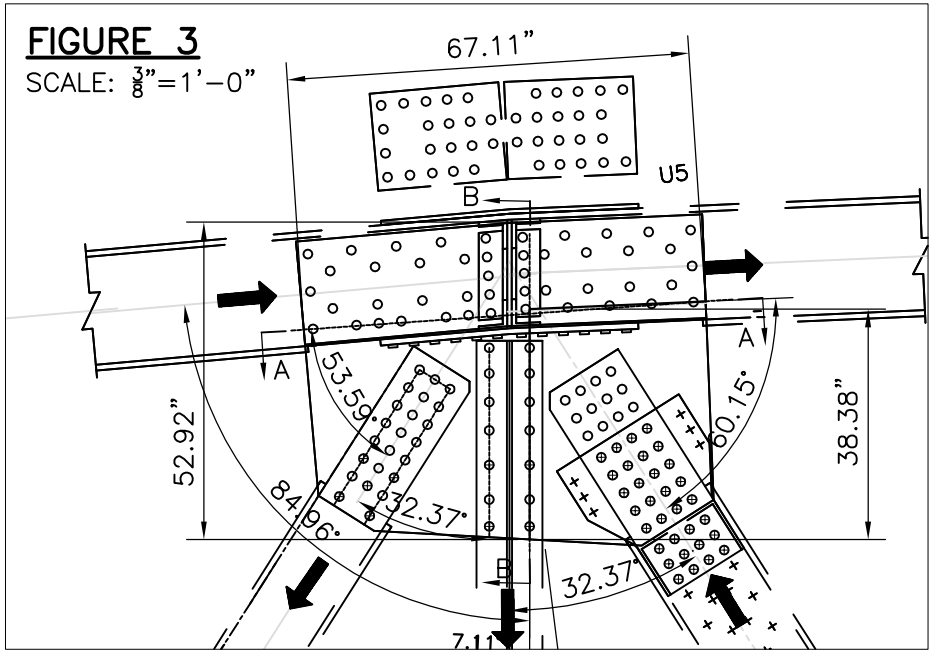
CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U5	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/28/2016	6/3/2016		21

Gusset Reference: U5

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	1.60	57.65	2.44	87.67
Axial Tension Capacity	2.30	82.84	3.23	116.40
Shear Capacity: Yield/Rupture	1.61	57.99	2.36	85.04
Partial Shear Capacity: Yield	**1.44**	**51.87**	**1.97**	**70.85**
Compression Capacity	1.67	60.08	2.28	82.06
Chord Splice	2.79	100.61	4.67	167.94
Gusset Rating:	**1.44**	**51.87**	**1.97**	**70.85**







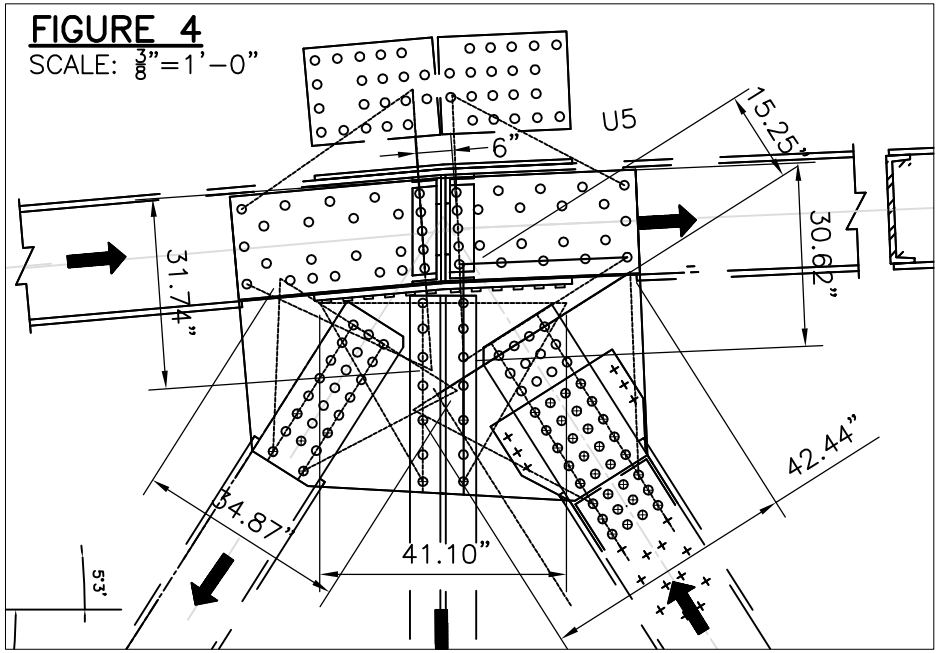


Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

BOLT ⊕
RIVET ○

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Fax: (617) 482-1837
www.stvinc.com/

Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: U5-A
Title: Gusset Plate U5 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

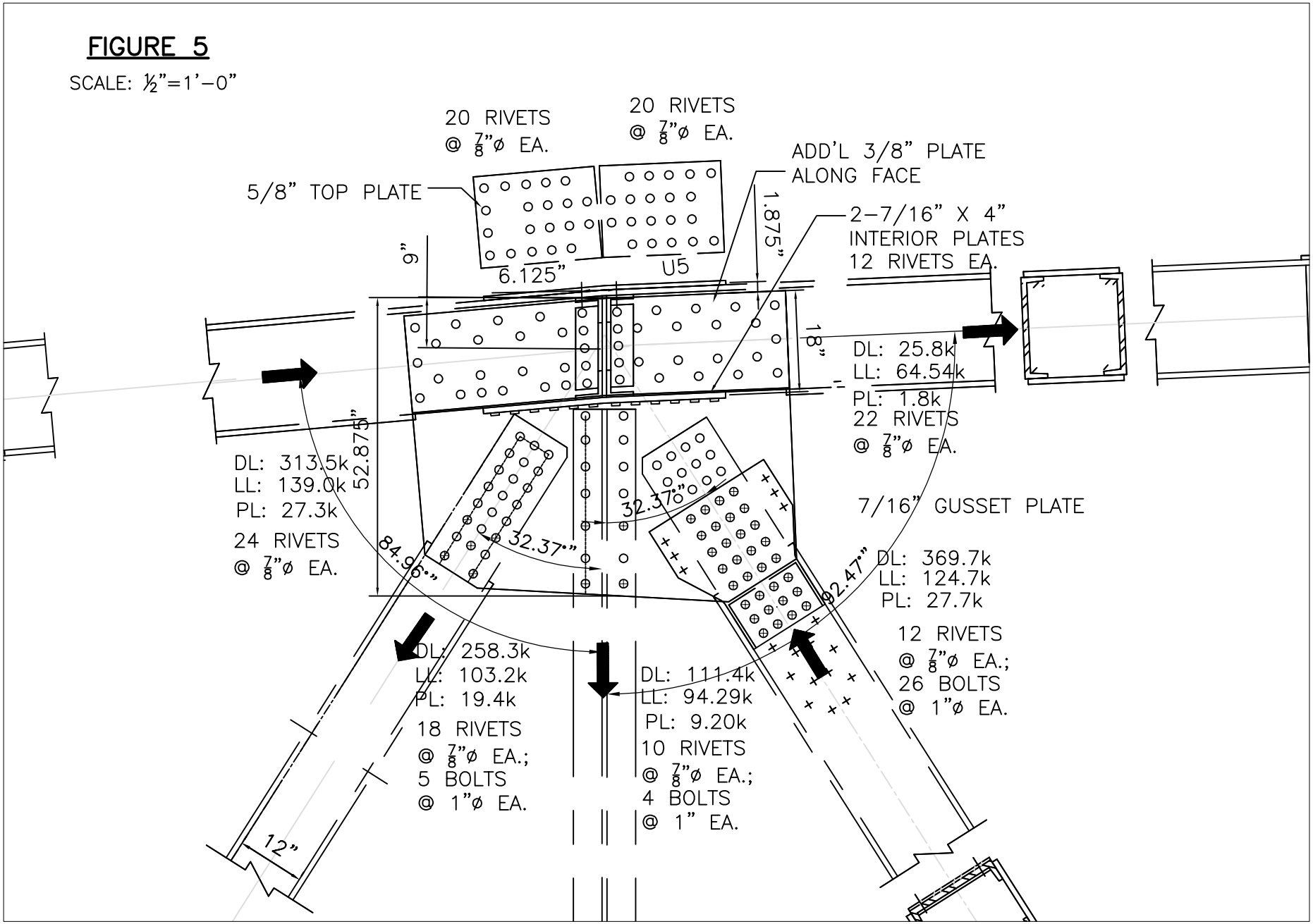

Figure 5: Gusset Plate & Chord Splice

LEGEND:

BOLT ⊕

RIVET ○

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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: U5-B
Title: Gusset Plate U5 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

FIGURE 6

SCALE: ½"=1'–0"

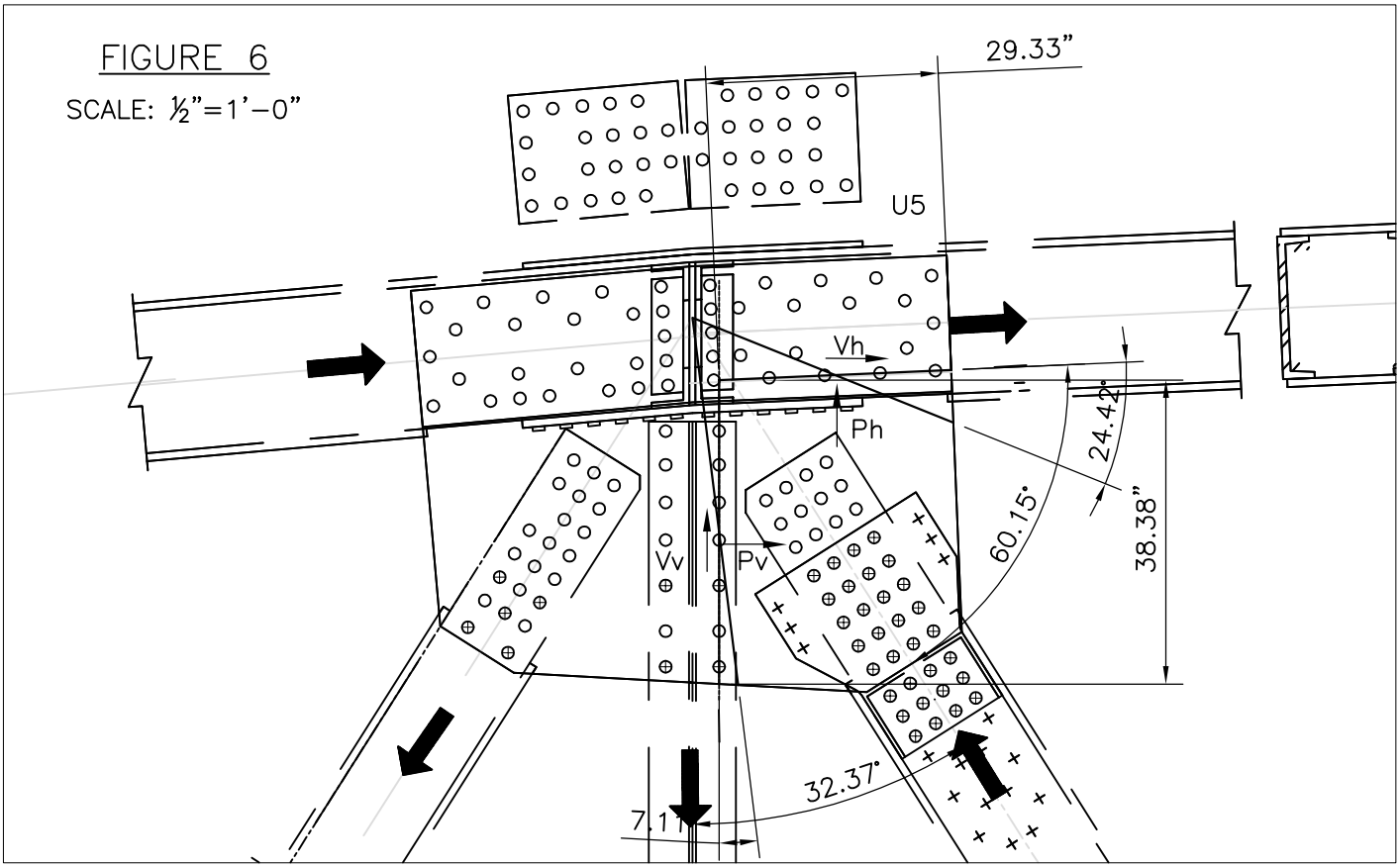
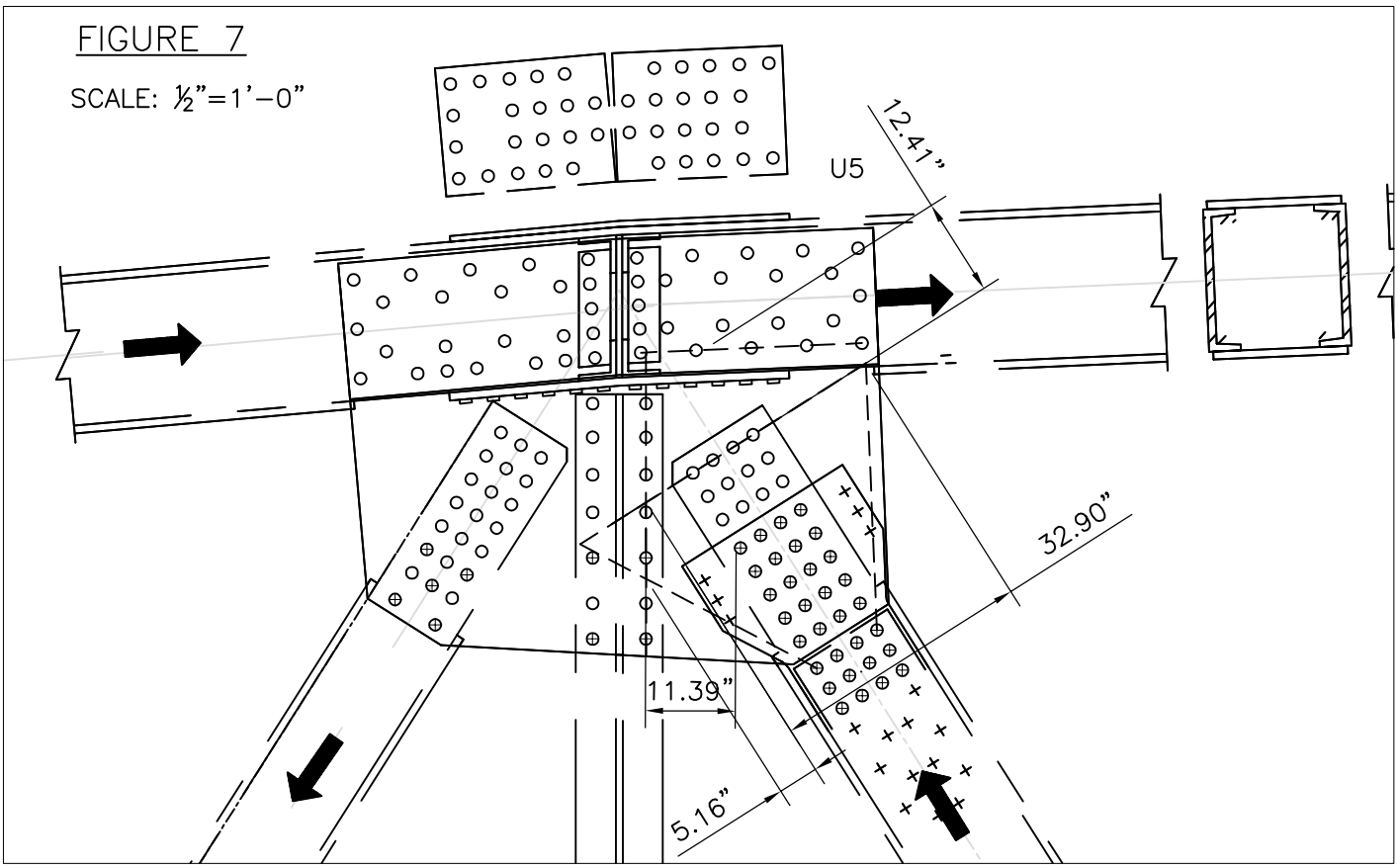


FIGURE 7

SCALE: ½"=1'–0"



REFINED ANALYSIS DIMENSIONS:

Figure 6: Basic Corner Check

Figure 7: Truncated Whitmore Check

LEGEND:

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Boston, MA 02111

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Project: WESTFIELD (W–25–010) GREAT RIVER BRIDGE		Figure No.: U5–C
Title: Gusset Plate U5 Rating		Project No.: 401–3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	ARG	*WRG*		
	Gusset Plate Loading	4/28/16	6/3/2016		SHT # 1

Gusset Plate Loading **Gusset Plate: U7**

Member Connection: U7-U5	***T***	**Member Connection: U7-L6**	***T***
Total Fasteners	94	Total Fasteners	80
Thickness of Channel Web (in)	0.45	Thickness of Channel Web (in)	0.7
Dead Load (kip)	25.8	Dead Load (kip)	512.9
Truck Live Load + Impact (kip)	64.5	Truck Live Load + Impact (kip)	156.3
Pedestrian Load (kip)	1.8	Pedestrian Load (kip)	39.3
Bolts on Gusset Plates	62	Bolts on Gusset Plates	80
Bolts on Additional Load Transferring Members	32	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**8.51**	Dead Load Per Gusset Plate (kip)	**256.45**
LL+I Per Gusset Plate (kip)	**21.27**	LL+I Per Gusset Plate (kip)	**78.15**
Ped. Load Per Gusset Plate (kip)	**0.59**	Ped. Load Per Gusset Plate (kip)	**19.65**

Member Connection: U7-L7	***T***	**Member Connection: U7-L8**	***C***
Total Fasteners	30	Total Fasteners	108
Thickness of Channel Web (in)	0.375	Thickness of Channel Web (in)	0.7
Dead Load (kip)	111.6	Dead Load (kip)	663.4
Truck Live Load + Impact (kip)	94.3	Truck Live Load + Impact (kip)	189.7
Pedestrian Load (kip)	8.3	Pedestrian Load (kip)	48
Bolts on Gusset Plates	30	Bolts on Gusset Plates	108
Bolts on Additional Load Transferring Members	0	Bolts on Additional Load Transferring Members	0
Dead Load Per Gusset Plate (kip)	**55.80**	Dead Load Per Gusset Plate (kip)	**331.70**
LL+I Per Gusset Plate (kip)	**47.15**	LL+I Per Gusset Plate (kip)	**94.85**
Ped. Load Per Gusset Plate (kip)	**4.15**	Ped. Load Per Gusset Plate (kip)	**24.00**

Member Connection: U7-U8	***T***	**Member Connection: U7-U5b**	***C***
Total Fasteners	100	Total Fasteners	94
Thickness of Channel Web (in)	0.7	Thickness of Channel Web (in)	0.45
Dead Load (kip)	634.9	Dead Load (kip)	25.8
Truck Live Load + Impact (kip)	167.4	Truck Live Load + Impact (kip)	-67.67
Pedestrian Load (kip)	43.4	Pedestrian Load (kip)	1.8
Bolts on Gusset Plates	68	Bolts on Gusset Plates	62
Bolts on Additional Load Transferring Members	32	Bolts on Additional Load Transferring Members	32
Dead Load Per Gusset Plate (kip)	**215.87**	Dead Load Per Gusset Plate (kip)	**8.51**
LL+I Per Gusset Plate (kip)	**56.92**	LL+I Per Gusset Plate (kip)	**-22.32**
Ped. Load Per Gusset Plate (kip)	**14.76**	Ped. Load Per Gusset Plate (kip)	**0.59**

*(**b**) Denotes alternative Load Case*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Fasteners Bearing & Shear Capacity	4/28/2016	6/3/2016		2

6

Member Connection: **U7-U5**

		Reference
Shear Resistance:	$C := (\phi F)m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.45	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.563	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	31		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	391	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	1318.28	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	8.51	kip	**Pedestrian Loads are only*
LL+I Force =	21.27	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.59	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**8.24**	**>1, OK**
	RF_{opr} =	**13.38**	**>1, OK**
Bearing:	**RF_{inv} =**	**28.32**	**>1, OK**
	RF_{opr} =	**45.99**	**>1, OK**

Member Connection: **U7-L6**

		Reference
Shear Resistance:	$C := (\phi F)m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.5625	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	10	30		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	274.9	379	kip	*Capacity for Total Fastener Group*
Bearing C =	607.50	1594.69	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	256.45	kip	**Pedestrian Loads are only*
LL+I Force =	78.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	19.65	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.89**	**>1, OK**
	RF_{opr} =	**2.52**	**>1, OK**
Bearing:	**RF_{inv} =**	**11.02**	**>1, OK**
	RF_{opr} =	**14.70**	**>1, OK**

6

Member Connection: **U7-L7**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	70	ksi	*Ultimate Strength*
Thickness =	0.375	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.938	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	4	11		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	110.0	139	kip	*Capacity for Total Fastener Group*
Bearing C =	189.00	454.78	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	55.80	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.15	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.72**	**>1, OK**
	RF_{opr} =	**2.64**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.58**	**>1, OK**
	RF_{opr} =	**8.57**	**>1, OK**

Member Connection: **U7-L8**

Reference

Shear Resistance: $C := (\phi F)m \cdot A$ — *MBE (2014) Eqn. L6B.2.6.1-1*

Bearing Resistance: $C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$ — *MBE (2014) Eqn. 10-166b*

Inventory Rating Factor: $RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$

Operating Rating Factor: $RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.5625	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	Bolt	Rivet		
ϕF =	35	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	9	45		*Figure 1*
Diameter =	1	0.875	in	*Figure 1*
Area =	0.79	0.60	in^2	
Shear C =	247.4	568	kip	*Capacity for Total Fastener Group*
Bearing C =	546.75	2392.03	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	331.70	kip	**Pedestrian Loads are only*
LL+I Force =	94.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	24.00	kip	*Bridge Manual 7.2.4.7*

Shear:	**RF_{inv} =**	**1.87**	**>1, OK**
	RF_{opr} =	**2.49**	**>1, OK**
Bearing:	**RF_{inv} =**	**12.18**	**>1, OK**
	RF_{opr} =	**16.23**	**>1, OK**

6

Member Connection: **U7-U8**

		Reference
Shear Resistance:	$C := (\phi F) m \cdot A$	*MBE (2014) Eqn. L6B.2.6.1-1*
Bearing Resistance:	$C := 0.9 \cdot L_c \cdot t \cdot F_u \le 1.8 \cdot d \cdot t \cdot F_u$	*MBE (2014) Eqn. 10-166b*
Inventory Rating Factor:	$RF_{inv} := \frac{(C - 1.3 \cdot P_{DL})}{2.17 \cdot P_{LL}}$	
Operating Rating Factor:	$RF_{opr} := \frac{(C - 1.3 \cdot P_{DL})}{1.3 \cdot P_{LL}}$	

Gusset & Member Information:

F_u=	60	ksi	*Ultimate Strength*
Thickness =	0.5625	in	*Controlling Member Thickness*
Shear Plane, m =	1		*Figure 1*
Holes clear distance, Lc =	2.44	in	*Figure 1*

Fasteners Information:

	-	Rivet		
ϕF =	-	21	ksi	*MBE (2014) Table. L6B.2.6.1-1*
Qty =	-	34		*Figure 1*
Diameter =	-	0.875	in	*Figure 1*
Area =	-	0.60	in^2	
Shear C =	0.0	429	kip	*Capacity for Total Fastener Group*
Bearing C =	0.00	1807.31	kip	Capacity for Total Fastener Group

Member Loading Information:

DL Force =	215.87	kip	**Pedestrian Loads are only*
LL+I Force =	56.92	kip	*included in Operating Ratings per*
*Pedestrian Force =	14.76	kip	*Bridge Manual 7.2.4.7*

Controlling:

Shear:	**RF_{inv} =**	**1.20**	**>1, OK**	**Shear:**	**RF_{inv} =**	**1.20**	**>1, OK**
	RF_{opr} =	**1.60**	**>1, OK**		**RF_{opr} =**	**1.60**	**>1, OK**
Bearing:	**RF_{inv} =**	**5.58**	**>1, OK**	**Bearing:**	**RF_{inv} =**	**12.36**	**>1, OK**
	RF_{opr} =	**8.57**	**>1, OK**		**RF_{opr} =**	**16.39**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Axial Tension Capacity	4/28/2016	6/3/2016		7

4 0

Member Connection: U7-U5

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	33	ksi	*Yield Stress*
Fu =	60	60	ksi	*Ultimate Stress*
Thickness =	0.5625	0.45	in	*Figure 1*
Ae =	16.43	-	in^2	*Effective Area*
Block Shear Rupture C =	539.60	431.68	kip	*Block Shear Capacity*
Effective Gross Yielding C =	542.05	-	kip	*Yielding Capacity*
Controlling C =	431.7			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	31.75	14.99	31.86	in	*Figure 2*
# Bolts =	0	0	7		*Figure 2*
Bolts Diameter =	0	0	1	in	*Figure 2*
# Rivets =	5.5	4.5	0		*Figure 2*
Rivet Diameter =	0.875	0.875	0	in	*Figure 2*
Gusset Ag =	17.86	8.43	17.92	in^2	**Figure 4*
Gusset An =	14.96	6.06	13.74	in^2	
Member Ag =	14.29	6.75	14.34	in^2	
Member An =	11.97	4.85	10.99	in^2	

Member Loading Information:

DL Force =	8.51	kip	**Pedestrian Loads are only*
LL+I Force =	21.27	kip	*included in Operating Ratings per*
*Pedestrian Force =	0.59	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension: **RF_{inv} = 9.11** **>1, OK**

RF_{opr} = 14.80 **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Axial Tension Capacity	*4/28/2016*	*6/3/2016*		8

4 0

Member Connection: **U7-L6**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70	ksi	*Ultimate Stress*
Thickness =	0.5625	0.7	in	*Figure 1*
Ae =	26.61	-	in^2	*Effective Area*
Block Shear Rupture C =	633.33	1035.59	kip	*Block Shear Capacity*
Effective Gross Yielding C =	878.19	-	kip	*Yielding Capacity*
Controlling C =	633.3			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	57.5	9	47.31	in	*Figure 2*
# Bolts =	4	0	0		*Figure 2*
Bolts Diameter =	1	0	0	in	*Figure 2*
# Rivets =	12	3	7		*Figure 2*
Rivet Diameter =	0.875	0.875	0.875	in	*Figure 2*
Gusset Ag =	32.34	5.06	26.61	in^2	**Figure 4*
Gusset An =	23.63	3.48	22.92	in^2	
Member Ag =	40.25	6.30	33.12	in^2	
Member An =	29.40	4.33	28.52	in^2	

Member Loading Information:

DL Force =	256.45	kip	**Pedestrian Loads are only*
LL+I Force =	78.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	19.65	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension: **RF_{inv} = 1.77** **>1, OK**

RF_{opr} = 2.36 **>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Axial Tension Capacity	*4/28/2016*	*6/3/2016*		9

4 0

Member Connection: **U7-L7**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70	ksi	*Ultimate Stress*
Thickness =	0.5625	0.375	in	*Figure 1*
Ae =	26.70	-	in^2	*Effective Area*
Block Shear Rupture C =	718.82	641.82	kip	*Block Shear Capacity*
Effective Gross Yielding C =	880.98	-	kip	*Yielding Capacity*
Controlling C =	641.8			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	1		*Resistance Factor, $\varphi_{bs\ and\ y}$*
Plane Length =	76.5	4.5	47.46	in	*Figure 2*
# Bolts =	4	1	0		*Figure 2*
Bolts Diameter =	1	1	0	in	*Figure 2*
# Rivets =	11	0	3		*Figure 2*
Rivet Diameter =	0.875	0	0.875	in	*Figure 2*
Gusset Ag =	43.03	2.53	26.70	in^2	**Figure 4*
Gusset An =	34.84	1.93	25.11	in^2	
Member Ag =	28.69	1.69	17.80	in^2	
Member An =	23.23	1.29	16.74	in^2	

Member Loading Information:

DL Force =	55.80	kip	**Pedestrian Loads are only*
LL+I Force =	47.15	kip	*included in Operating Ratings per*
*Pedestrian Force =	4.15	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

		Tension:	**RF_{inv} =**	**5.56**	**>1, OK**
Reduction Factor, Rp =	0.9		**RF_{opr} =**	**8.54**	**>1, OK**
β =	0.15				

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Axial Tension Capacity	*4/28/2016*	*6/3/2016*		10

4 0

Member Connection: **U7-U8**

Reference

Block Shear Resistance: If $F_u \cdot A_{vn} \le F_y \cdot A_{vg}$ *MBE (2014) Eqn. L6B.2.6.1-1*

Then: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_u \cdot A_{vn} + F_u \cdot A_{tn})$ Else: $C := R_p \cdot \varphi_{bs} \cdot (0.58 \cdot F_y \cdot A_{vg} + F_u \cdot A_{tn})$

Effective Gross Yielding: $C := A_e \cdot F_y \cdot \varphi_y$ With: $A_e = A_n + \beta \cdot A_g \le A_g$ Eqn. L6B.2.6.5-1

Members Information:

	Gusset	Member		
Fy =	33	45	ksi	*Yield Stress*
Fu =	60	70	ksi	*Ultimate Stress*
Thickness =	0.5625	0.7	in	*Figure 1*
Ae =	0.00	-	in^2	*Effective Area*
Block Shear Rupture C =	600.87	945.55	kip	*Block Shear Capacity*
Effective Gross Yielding C =	0.00	-	kip	*Yielding Capacity*
Controlling C =	600.9			*Controlling Tension Capacity*

Shear, Tension & Whitmore Planes Information:

	Shear	Tension	Whitmore*		
Resistance Factor =	0.85	0.85	0		*Resistance Factor,* $\varphi_{bs\ and\ y}$
Plane Length =	36.25	14.99	-	in	*Figure 2*
# Bolts =	0	0	0		*Figure 2*
Bolts Diameter =	0	0	0	in	*Figure 2*
# Rivets =	5.5	3.5	0		*Figure 2*
Rivet Diameter =	0.875	0.875	0	in	*Figure 2*
Gusset Ag =	20.39	8.43	0.00	in^2	**Figure 4*
Gusset An =	17.49	6.59	0.00	in^2	
Member Ag =	25.38	10.49	0.00	in^2	
Member An =	21.77	8.20	0.00	in^2	

Member Loading Information:

DL Force =	215.87	kip	**Pedestrian Loads are only*
LL+I Force =	56.92	kip	*included in Operating Ratings per*
*Pedestrian Force =	14.76	kip	*Bridge Manual 7.2.4.7*

Additional Factors:

Reduction Factor, Rp = 0.9

β = 0.15

Tension:	**RF_{inv} =**	**2.59**	**>1, OK**
	RF_{opr} =	**3.44**	**>1, OK**
Controlling:	**RF_{inv} =**	**1.77**	**>1, OK**
	RF_{opr} =	**2.36**	**>1, OK**

Member Connection: **U7-L8**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	52.41	in	*Figure 4*
Whitmore Distance, Lc =	14	in	*Figure 4*
Thickness =	0.5625	in	*Gusset Plate thickness*
A_s =	29.48	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	43.11		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**31.23**	**ksi**	
C =	**782.64**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	331.70	kip	**Pedestrian Loads are only*
LL+I Force =	94.85	kip	*included in Operating Ratings per*
*Pedestrian Force =	24.00	kip	*Bridge Manual 7.2.4.7*

Compression Rating:	**RF_{inv} =**	**1.71**	**>1, OK**
	RF_{opr} =	**2.27**	**>1, OK**

Member Connection: **U7-U5b**

Reference

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

MBE (2014) L6B.2.6.4-1

If: $\frac{KL_c\sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Gusset & Member Information:

φ_{cg} =	1.00		*Resistance factor for compression*
E =	29000.00	ksi	*Modulus of Elasticity*
F_y =	33	ksi	*Yield Stress*
Whitmore Eff. Length =	31.86	in	*Figure 4*
Whitmore Distance, Lc =	5.75	in	*Figure 4*
Thickness =	0.5625	in	*Gusset Plate thickness*
A_s =	17.92	in^2	*Area of Whitmore section*

Effective Length Factor, K =	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	17.71		
$\sqrt{(2\pi^2E/F_y)}$ =	131.71		
F_{cr} =	**32.70**	**ksi**	
C =	**498.15**	**kip**	*Member Compressive Capacity*

Member Loading Information:

DL Force =	-8.51	kip	**Pedestrian Loads are only*
LL+I Force =	22.32	kip	*included in Operating Ratings per*
*Pedestrian Force =	-0.59	kip	*Bridge Manual 7.2.4.7*

Controlling:

RF_{inv} =	**1.71**	**>1, OK**	**Compression Rating:**	**RF_{inv} =**	**10.51**	**>1, OK**
RF_{opr} =	**2.27**	**>1, OK**		**RF_{opr} =**	**18.03**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Shear Capacity: Rupture Resistance	4/28/2016	6/3/2016		13

Member Connection: **U7-U5**

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$ *MBE (2014 Eqn. L6B.2.6.3-1*

Rupture Resistance: $C_{...} := \varphi_{vu} \cdot (0.58 \cdot F_u \cdot A_n)$ *MBE (2014 Eqn. L6B.2.6.3-2*

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

φ_{vu} = 0.85 *Shear Rupture Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Plane A-A		Plane B-B			
	U7	-	U7	-		
Fy =	33	0	33	0	ksi	*Yield Stress*
Fu =	60	0	60	0	ksi	*Ultimate Stress*
Thickness =	0.5625	0	0.5625	0	in	*Plate Thickness*
Shear Plane Length =	73.75	0	60.25	0	in	*Figure 3*
# Bolts =	0	0	2	0		*Figure 3*
Bolts Diameter =	0	0	1	0	in	*Figure 3*
# Rivets =	13	0	9	0		*Figure 3*
Rivet Diameter =	0.875	0	0.875	0	in	*Figure 3*
Gross Area, Ag =	41.48	0	33.89	0	in^2	
Net Area, An =	34.63	0	27.95	0	in^2	
Yield Resistance C =	698.73	0.0	570.8	0.0	kip	*Yield Capacity*
Rupture Resistance C =	901.40	0.0	727.5	0.0	kip	*Rupture Capacity*
Controlling C =	698.7		570.8			*Controlling Capacity*

						Shear Loading		
	Member	DL	LL+I	PL	Angle	DL_V	LL_V	PL_V
SECTION A-A	U7-L6	256.45	78.15	19.65	57.90	136.28	41.53	10.44
	U7-L8	331.70	94.85	24.00	59.90	166.35	47.57	12.04
	U7-L7	55.80	47.15	4.15	89.00	0.97	0.82	0.07
SECTION B-B	U7-L8	331.70	94.85	24.00	58.90	284.02	81.22	20.55
	-	0.00	0.00	0.00	0.00	0	0	0
	-	0.00	0.00	0.00	0.00	0	0	0

	Plane A-A		Plane B-B			Controlling	
Shear Rupture Rating:	**1.56**	**>1, OK**	**1.14**	**>1, OK**	**RF_{inv} =**	**1.14**	**>1, OK**
	2.08	**>1, OK**	**1.52**	**>1, OK**	**RF_{opr} =**	**1.52**	**>1, OK**

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
U7S	Shear Capacity: Partial Shear Check	4/28/2016	6/3/2016		14

1

Member Connection: U7-L8

Reference

Yield Resistance: $C_{..} := \varphi_{vy} \cdot (0.58 \cdot F_y \cdot A_g \cdot \Omega)$

MBE (2014) Eqn. L6B.2.6.3-1

Chamfered End? Yes

Different Framing Angles? Yes

φ_{vy} = 1.00 *Shear Yielding Resistance Factor*

Ω = 0.88 *Shear reduction factor*

	Horizontal Plane C-C			Vertical Plane C-C		
	-	-		U7	-	
Fy =	0	0	ksi	33	0	*Yield Stress*
Thickness =	0	0	in	0.5625	0	*Plate Thickness*
Shear Plane Length =	0	0	in	45.125	0	*Figure 3*
# Bolts =	0	0		2	0	*Figure 3*
Bolts Diameter =	0	0	in	1	0	*Figure 3*
# Rivets =	0	0		6	0	*Figure 3*
Rivet Diameter =	0	0	in	0.875	0	*Figure 3*
Gross Area, Ag =	0	0	in^2	25.383	0	*Gross Area*
Yield Resistance C =	0.0	0.0	kip	427.5	0.0	*Yield Capacity*
Controlling C =	0.0			427.5		*Controlling Capacity*

Member Loading:

	Member	DL	LL+I	PL	Angle	Shear Loading DL_V	LL_V	PL_V
HZ	-	0.00	0.00	0.00	0.00	0	0	0
VERT	U7-L8	331.70	94.85	24.00	58.90	284.02	81.22	20.55

	Horizontal	Vertical			Controlling	
Partial Shear Rating:	>1, OK	0.33	<1, NG	RF_{inv} =	0.33	<1, NG
	>1, OK	0.44	<1, NG	RF_{opr} =	0.44	<1, NG

**Partial Shear rating is superseded based on the refined analysis.

Member Connection: **U7-L8**

Reference

Per MBE 2014, section 6.A.6.12.6.11, a refined analysis can be employed to determine the nominal resistance of a gusset-plate connection. These checks supersede partial shear check.

MBE (2014) 6A.6.12.6.11

Basic Corner Check:

MBE (2014) Fig. C6A.6.12.6.11-1

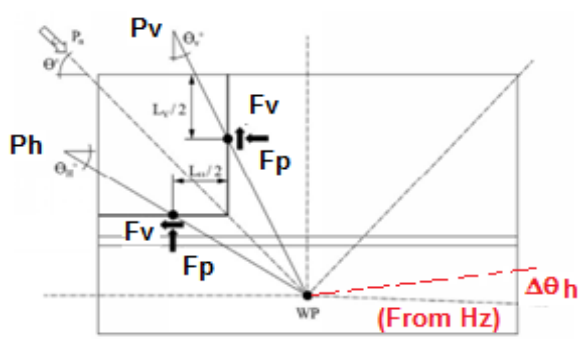


Figure C6A.6.12.6.11-1—Basic Corner Check

**For dimensions used below see Figure U7_C*

In this case, $\Delta\theta h = 0$

Based on Force equilibrium in x & y on the plate:

$$\Sigma F_y := P_{sin}(\theta) + (P_v \cdot \sin(\theta_v) + P_h \cdot \sin(\theta_h - \Delta\theta_h)) = 0 \qquad \text{(I)}$$

$$\Sigma F_x := P_{cos}(\theta) + (P_v \cdot \cos(\theta_v) + P_h \cdot \cos(\theta_h - \Delta\theta_h)) = 0 \qquad \text{(II)}$$

Working on equation (II) gives us (III):

$$P_h = \frac{-[P_{cos}(\theta) + P_v \cdot (\cos(\theta_v))]}{(\cos(\theta_h - \Delta\theta_h))} \qquad \text{(III)}$$

Inputing (III) into (I) yields (IV):

$$P_{sin}(\theta) + \left[P_v \cdot \sin(\theta_v) + \left[\frac{-[P_{cos}(\theta) + P_v \cdot (\cos(\theta_v))]}{(\cos(\theta_h - \Delta\theta_h))}\right] \cdot \sin(\theta_h - \Delta\theta_h)\right] = 0$$

Solving equation (IV) yields the force breakdown below:

Force Breakdown:

P.sin	Pvsin	-Pv.cos	-P.cos
0.856	0.994	-0.042	-0.196

Based on Section Equilibrium Dimensions on Figure U7-C

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
6	Shear: Basic Corner Check & Truncated Whitmore	*4/28/2016*	*6/3/2016*		16

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17	*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3	*Factors as in Article 6A.6.3.*
φ =	0.9			Resistance Factor
Fy =	33	ksi		*Plate Yield Strength*

Member U7-L8 Forces: *Total forces below are split / gusset for both vert & hz planes*

DL, kip =	663.4	**θ =**	58.89	deg
LL, kip =	189.7			
PL, kip =	48			

	DL	LLinv	LLopr
Fp, kip =	171.4	49.0	61.4
Fv, kip =	284.0	81.2	101.8

Vertical Plane: Vector through midpoint of vertical partial shear plane (Pv)

Pv, kip =	-230.2	**θv =**	83.6	deg
LLv, kip =	-65.8	**L, in =**	45.14	
LL+PL, kip =	-82.5	**t, in =**	0.375	

	DL	LLinv	LLopr
Fp, kip =	-25.7	-7.3	-9.2
Fv, kip =	-228.7	-65.4	-82.0

Horizontal Plane: Vector through midpoint of horizontal partial shear plane (Ph)

Ph, kip =	-155.9	**θh =**	20.77	deg
LLh, kip =	-44.6	**L, in =**	35.72	
LL+PL, kip =	-55.8	**t, in =**	0.375	

	DL	LLinv	LLopr
Fp, kip =	-145.7	-41.7	-52.2
Fv, kip =	-55.3	-15.8	-19.8

Force Equilibrium Check:

Axial -	ΣFp =	0.0	0.0	0.0
Shear -	ΣFv =	0.0	0.0	0.0

von Misses Equation: $\sigma_v = \sqrt{\sigma_1^2 - \sigma_1\sigma_2 + \sigma_2^2}$ *Principal Plane Stress Eqn*

	Vertical Plane			Horizontal Plane		
	DL	LLinv	LLopr	DL	LLinv	LLinv
Shear Stress, ksi =	13.51	3.86	4.84	10.88	3.11	3.90
Compression, ksi =	1.52	0.43	0.54	4.13	1.18	1.48
von Misses, ksi =	12.82	3.67	4.59	9.51	2.72	3.41

	Vertical		Horizontal			Controlling	
Inventory Rating:	**1.64**	**>1, OK**	**2.94**	**>1, OK**	**RF_{inv} =**	**1.64**	**>1, OK**
oprating Rating:	**2.18**	**>1, OK**	**3.91**	**>1, OK**	**RF_{opr} =**	**2.18**	**>1, OK**

Member Connection: **U7-L8**

Reference

Per MBE 2014, section 6.A.6.12.6.11, a refined analysis can be employed to determine the nominal resistance of a gusset-plate connection.

MBE (2014) 6A.6.12.6.11

Gusset & Member Information:

φ_{cg} = 1.00 *Resistance factor for compression*

E = 29000.00 ksi *Modulus of Elasticity*

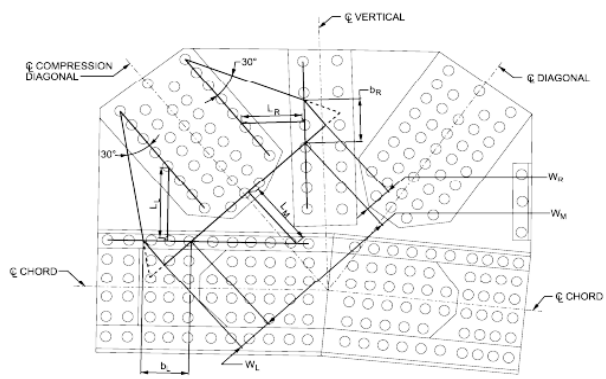


Figure C6A.12.6.11-2—Truncated Whitmore Section

Compressive Capacity: $C_{..} := \varphi_{cg} \cdot (0.85 \cdot A_s \cdot F_{cr})$

If: $\frac{KL_c \sqrt{12}}{t} \le \sqrt{2\pi^2 \cdot \frac{E}{Fy}}$

Else: $F_{...cr} := \frac{(\pi^2 \cdot E)}{\left[12 \cdot \left(\frac{KL_c}{t}\right)^2\right]}$

Then: $F_{.cr} := F_y \cdot \left[1 - \frac{(Fy \cdot 12)}{(4\pi^2 \cdot E)} \cdot \left(\frac{KL_c}{t}\right)^2\right]$

	Left	Mid	Right		
Whitmore Eff. Length =	8.2	33.33	2.26	in	*Figure 7*
Whitmore Distance, L =	10.16	10.05	35.48	in	*Figure 7*
Thickness =	0.5625	0.5625	0.5625	in	*Gusset Plate thickness*
A_s =	4.61	18.75	1.27	in^2	*Area of Whitmore section*
K =	0.5	0.5	0.5		*MBE (2014)*
$(KL_c)\sqrt{12}/t$ =	31.28	30.95	109.25		
$\sqrt{(2\pi^2 E/F_y)}$ =	131.71	131.71	131.71		
F_{cr} =	**32.07**	**32.09**	**21.65**	**ksi**	
C =	**125.73**	**511.37**	**23.39**	**kip**	
Σ C =		**660.49**			*Member Compressive Capacity*

Member Loading Information:

**Pedestrian Loads are only included in oprating Ratings per Bridge Manual 7.2.4.7*

DL Force =	331.70	kip
LL+I Force =	94.85	kip
*Pedestrian Force =	24.00	kip

Inventory Rating:	**RF_{inv} =**	**1.11**	**>1, OK**
oprating Rating:	**RF_{opr} =**	**1.48**	**>1, OK**

1

Gusset Reference: U7

		Reference
Chord Splice Resistance:	$C := \varphi_{cs} \cdot F_y \cdot \left(\frac{S_g \cdot A_g}{S_g + e_p \cdot A_g} \right)$	*MBE (2014) L6B.2.6.6*
Net Capacity*:	$C := \varphi_{cs} \cdot F_u \cdot \left(\frac{S_n \cdot A_n}{S_n + e_p \cdot A_n} \right)$	*MBE (2014) L6B.2.6.6* **For Tensile Splices Only*
LFR rating factor:	$RF_{LRFinv} := \frac{(C - \gamma_{DL} \cdot P_{DL})}{\gamma_{LL} \cdot P_{LL}}$	Inventory Rating
LFR rating factor:	$RF_{LRFopr} := RF_{LRFinv} \cdot \frac{\gamma_{LLinv}}{\gamma_{LLopr}}$	Operating Rating

Resistance Factors:

γ_{DL} =	1.3	γ_{LLinv} =	2.17		*Factors as in Article 6A.6.3.*
γ_{LL} =	2.17	γ_{LLopr}=	1.3		*Factors as in Article 6A.6.3.*
φ_{cs} =	1				Resistance Factor

Gusset Properties:

Splice Type = *T*

Tensile Splice?	*Yes*		Load Factor =	1	
Modulus of Elasticity, E=	29000	*ksi*	Effec. Col. Length, K =	*0.5*	
Gusset Thickness, t =	0.5625	*in*	Gusset PL Height, H =	*60.125*	*in*
Chord Box Centroid Depth =	9	*in*	Lsplice =	*5.75*	*in*
Yield Stress, F_y =	33	*ksi*	Ultimate Stress, F_u =	*60*	*ksi*
F_{cr} check =	17.71	**<25, OK**	Critical Stess, F_{cr} =	*33*	*ksi*

Gross Splice Section Properties:

	Thickness	Height	y_{bar} [1]	A_g	$A_g \cdot y_{bar}$	Icg	Ig	$A.d^2$
Gusset PL	in	in	in	in^2	in^3	in^4	in^4	in^4
Right	0.5625	60.125	30.06	33.82	1016.72	10740.32	10188.41	551.91
Left	0.5625	60.125	30.06	33.82	1016.72	10740.32	10188.41	551.91
Addtl PLs								
Top	16	0.625	1.375	10	13.75	6075.5	0.3	6075.2
Bottom	8	0.4375	18.375	3.5	64.3125	204.8	0.1	204.7
Right				0	0	0.0	0.0	0.0
Left				0	0	0.0	0.0	0.0
		Σ=	26.02	81.14	2111.51	27760.9		

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/3/2016*		19

***Net Splice Section Properties:** **Applies to Tensile Chords Only*

Plates	n_{areas}	Thickness	Height	y_{bar}^2	A_h	$A_h \cdot y_{bar}$	Icg	Ig	$A.d^2$
Top									
Bottom									
1	2	0.5625	0.9375	3.125	-1.055	-3.30	-709.44	-0.08	-709.36
2	2	0.5625	0.9375	6	-1.055	-6.33	-560.88	-0.08	-560.80
3	2	0.5625	0.9375	9	-1.055	-9.49	-424.45	-0.08	-424.37
4	2	0.5625	0.9375	15	-1.055	-15.82	-208.55	-0.08	-208.47
5	2	0.5625	0.9375	21.875	-1.055	-23.07	-54.51	-0.08	-54.43
6	2	0.5625	0.9375	25.875	-1.055	-27.29	-10.77	-0.08	-10.69
7	2	0.5625	0.9375	30.625	-1.055	-32.30	-2.66	-0.08	-2.59
8	2	0.5625	0.9375	35.375	-1.055	-37.31	-42.15	-0.08	-42.07
9	2	0.5625	0.9375	40.875	-1.055	-43.11	-147.33	-0.08	-147.25
10	2	0.5625	1.0625	46.625	-1.195	-55.73	-368.94	-0.11	-368.83
11	2	0.5625	0.9375	51.125	-1.055	-53.92	-513.61	-0.08	-513.53
12	2	0.5625	1.0625	57.125	-1.195	-68.28	-941.65	-0.11	-941.54
13									
14									
15									
16									
			Σ=	29.059	-12.94	-375.95	-3984.93	-1.00	-3983.93

Splice Properties: **C = 992.91 kip** *Controlling Resistance*

A_g=	81.1	in^2	A_n=	68.2	in^2	*Plates areas*
y_g=	26.0	in	y_n=	25.4	in	*Area Centroid Height*
H - y_g=	34.10	in	H - y_n=	34.68	in	Ytop
I_g=	27760.9	in	I_n=	23776.0	in	*Area Moment of Inertia*
S_g=	814.1	in^3	S_n=	685.6	in^3	*Plates Section Modulus*
e_p=	17.0	in	e_n=	16.4	in	*Distance between centroid*
C_{GROSS} =	**992.91**	**kip**	**C_{NET} =**	**1552.37**	**kip**	*Resistance*

CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
	Chord Splice Resistance	*4/28/2016*	*6/3/2016*		20

Splice Forces:

Gusset Reference = U7

Left side:

	DL	LL	θ_L
U7-U5	25.80	64.50	2.1
U7-L6	512.9	156.3	58.9
-	0	0	0
$\gamma.\Sigma =$	377.93	315.06	

Right Side:

	DL	LL	θ_L
-	0	0	0
U7-L8	-663.4	-189.7	58.9
U7-U8	634.90	167.40	0
$\gamma.\Sigma =$	379.90	150.63	

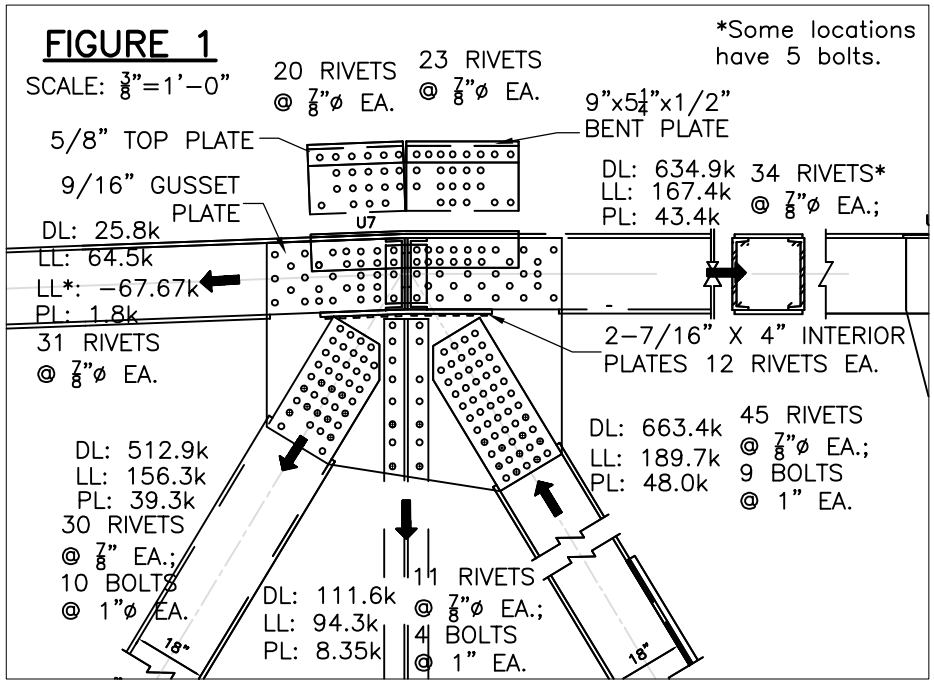
	Left Side		Right Side			Controlling	
RF_{LFRinv} =	**1.95**	**>1, OK**	**4.07**	**>1, OK**	**RF_{inv} =**	**1.95**	**>1, OK**
RF_{LFRopr} =	**3.26**	**>1, OK**	**6.79**	**>1, OK**	**RF_{opr} =**	**3.26**	**>1, OK**

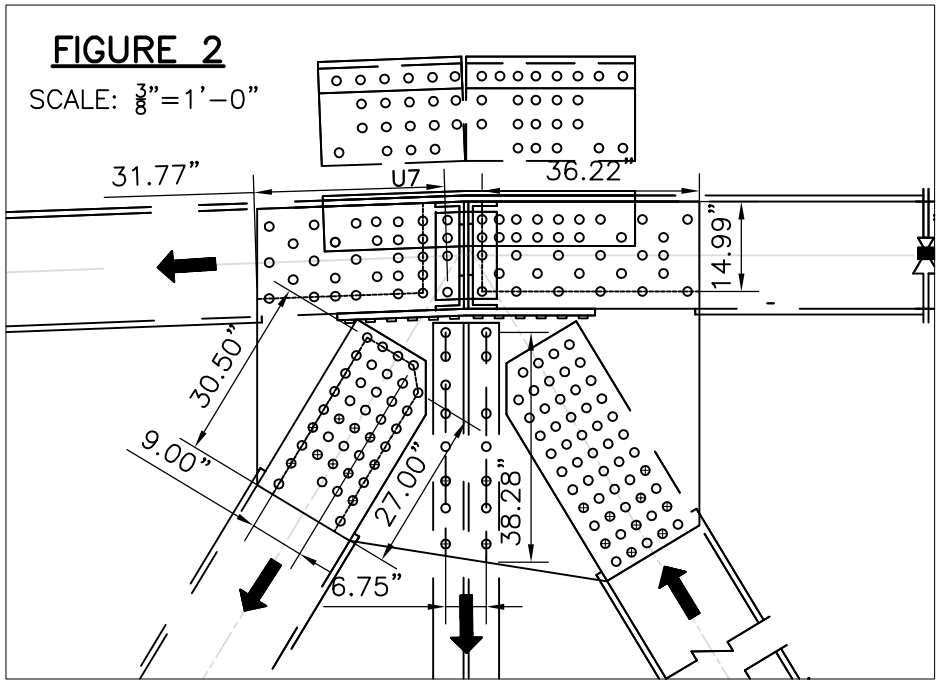
CLIENT	MassDOT	STV INCORPORATED			
PROJECT	Westfield Great River Bridge	MADE	CHK.	REV.	401-3391
SUBJECT	W-25-010 Gusset Plate Rating: U7	*ARG*	*WRG*		
	Gusset Plate Rating Summary	4/28/2016	6/3/2016		21

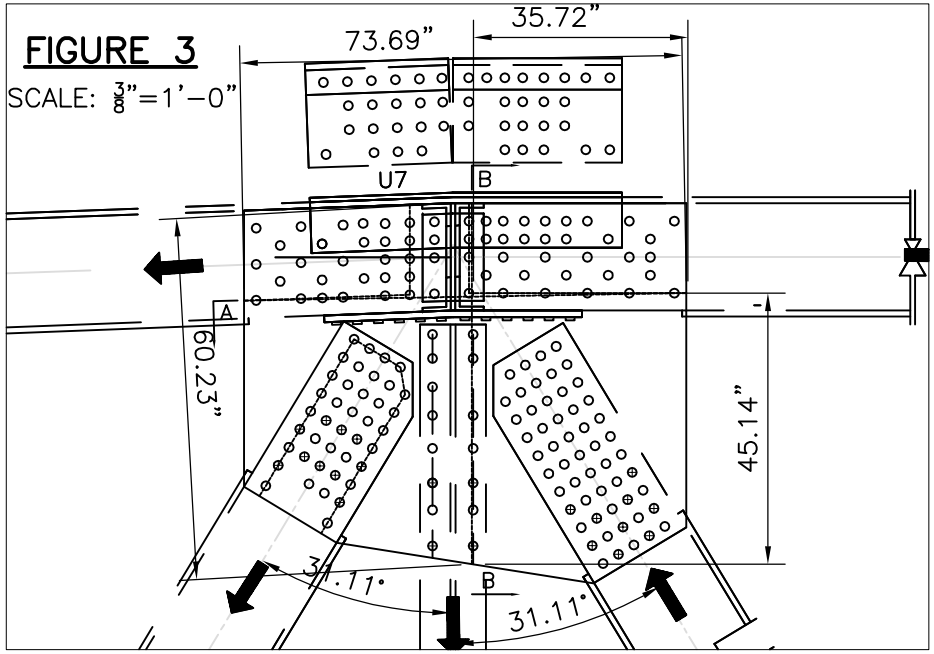
Gusset Reference: U7

	Inventory		Operating	
	Rating Factor	Rating (Tons)	Rating Factor	Rating (Tons)
Bearing and Shear Capacity: Bolts	1.20	43.35	1.60	57.46
Axial Tension Capacity	1.77	63.67	2.36	84.93
Shear Capacity: Yield/Rupture	1.14	41.18	1.52	54.86
Partial Shear Capacity: Yield	**1.11**	**40.10**	**1.48**	**53.42**
Compression Capacity	1.71	61.47	2.27	81.88
Chord Splice	1.95	70.27	3.26	117.30
Gusset Rating:	**1.11**	**40.10**	**1.48**	**53.42**

**Partial Shear rating is superseded based on the refined analysis.







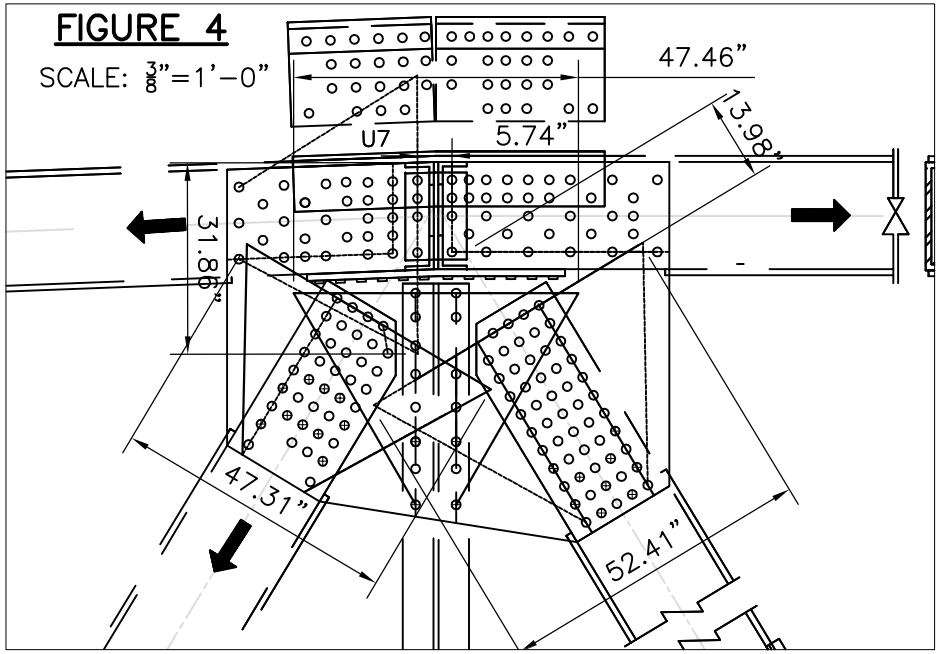


Figure 1: Loads and Fasteners Information
Figure 2: Block Shear & Tension Planes
Figure 3: Shear Rupture Planes Information
Figure 4: Tension & Compression Whitmore Planes

LEGEND:

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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Drawing No.: U7-A
Title: Gusset Plate U7 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

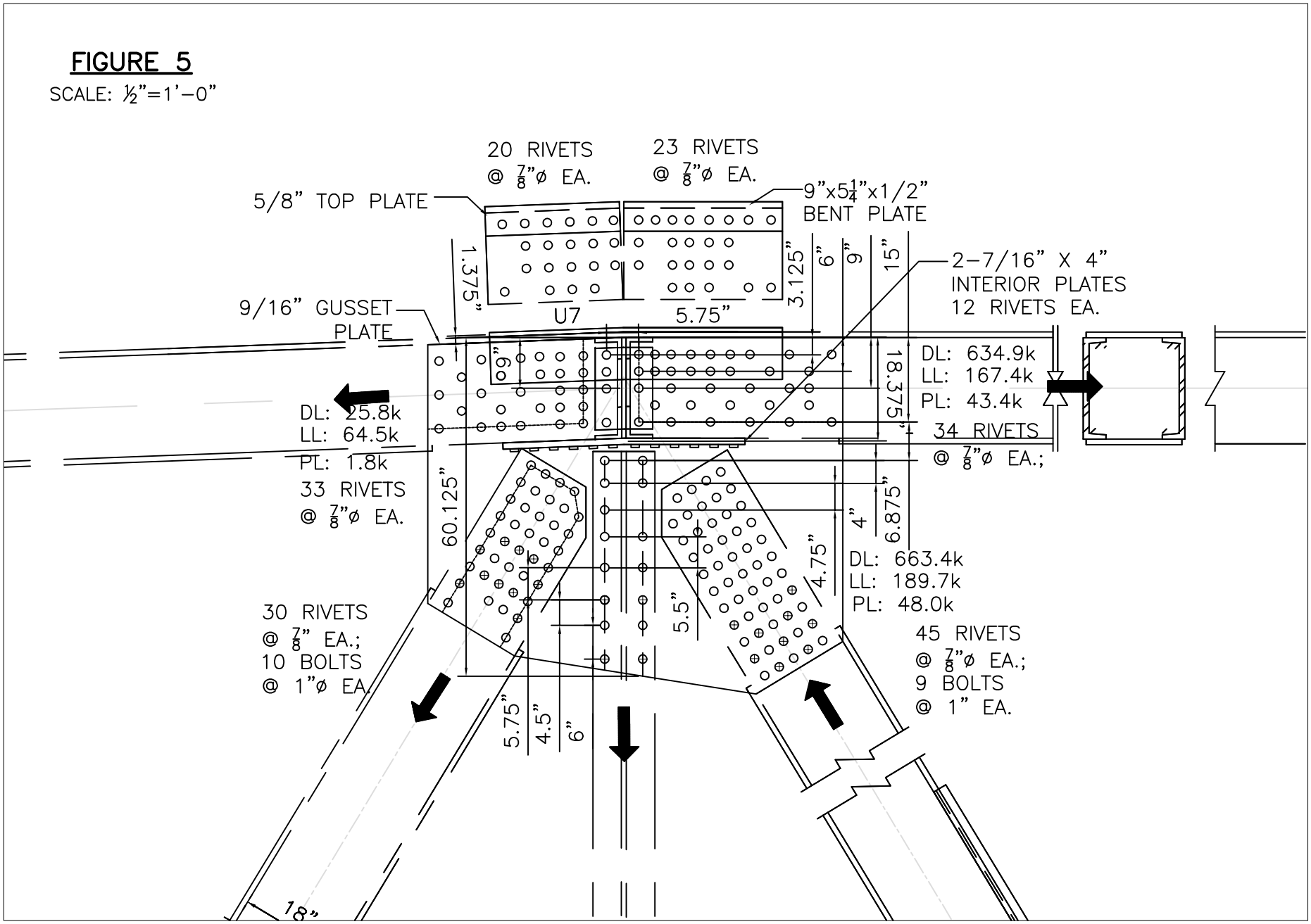

Figure 5: Gusset Plate & Chord Splice

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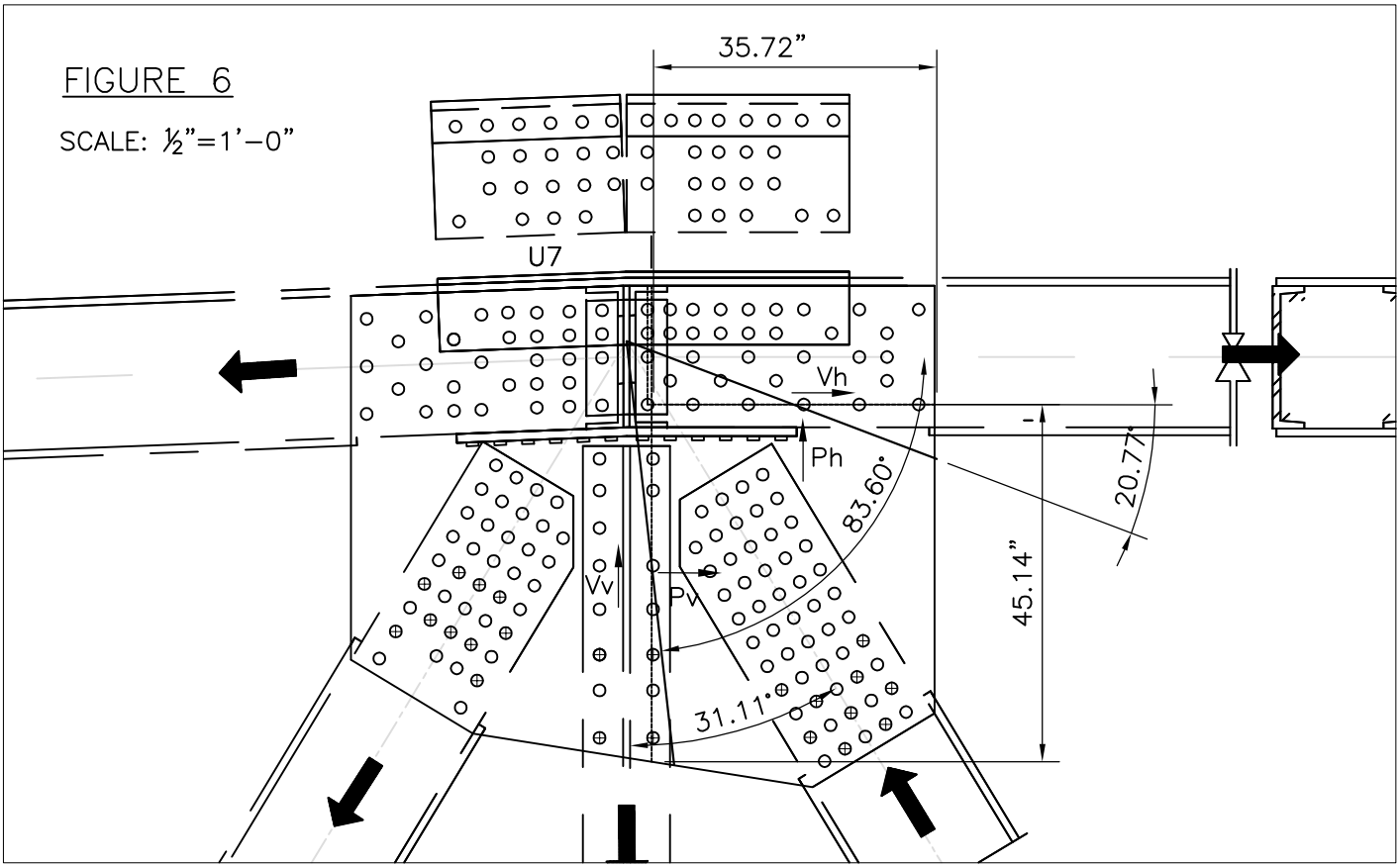
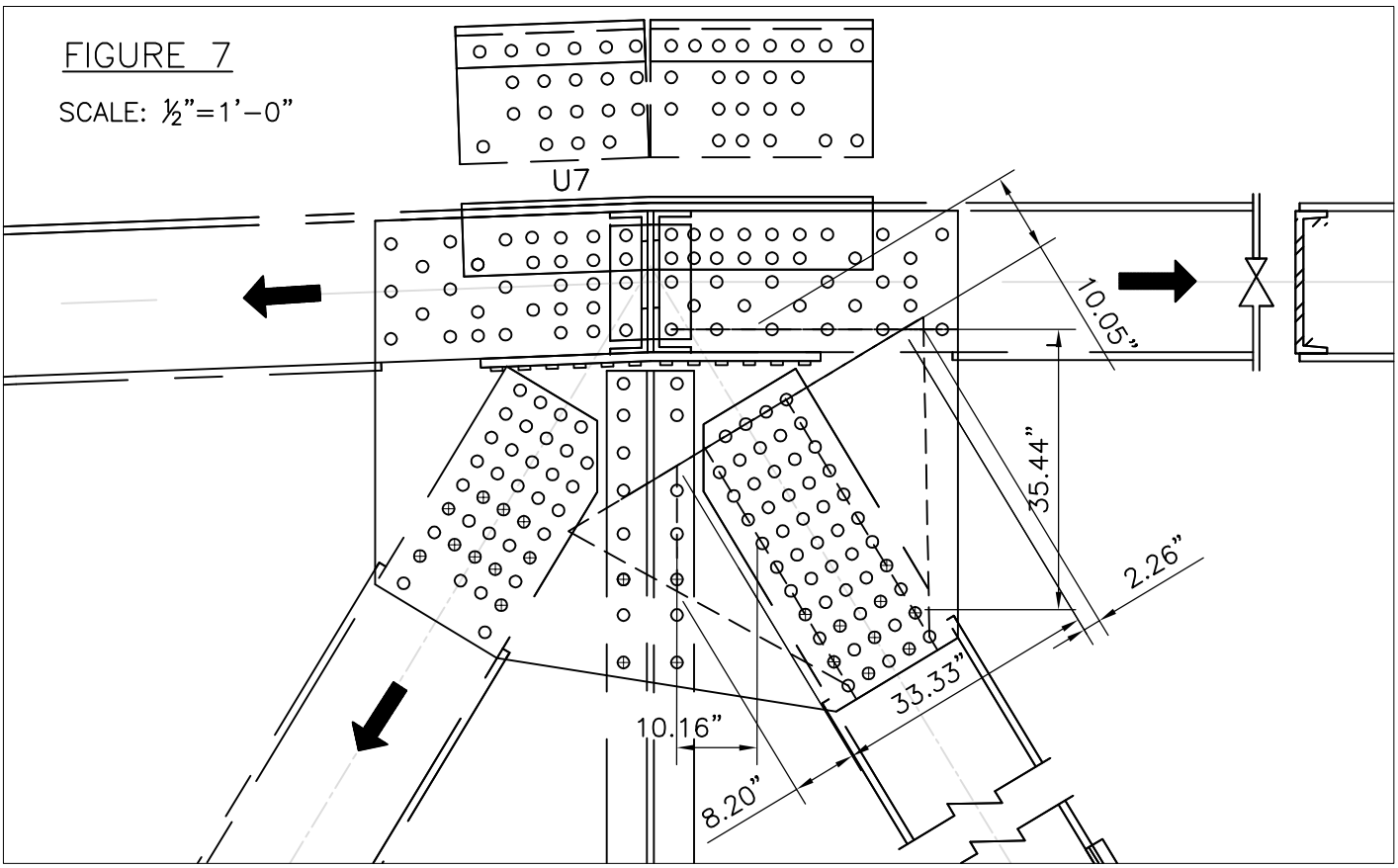
Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: U7-B
Title: Gusset Plate U7 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted





REFINED ANALYSIS DIMENSIONS:

Figure 6: Basic Corner Check
Figure 7: Truncated Whitmore Check

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Project: WESTFIELD (W-25-010) GREAT RIVER BRIDGE		Figure No.: U7-C
Title: Gusset Plate U7 Rating		Project No.: 401-3391
Drawn By: ARG	Date: 04/22/2016	Scale: As Noted

Appendix D – Computer Input and Output

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Westfield Bridge No.W-25-010

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STAAD.PRO MODELS & RESULTS D-51

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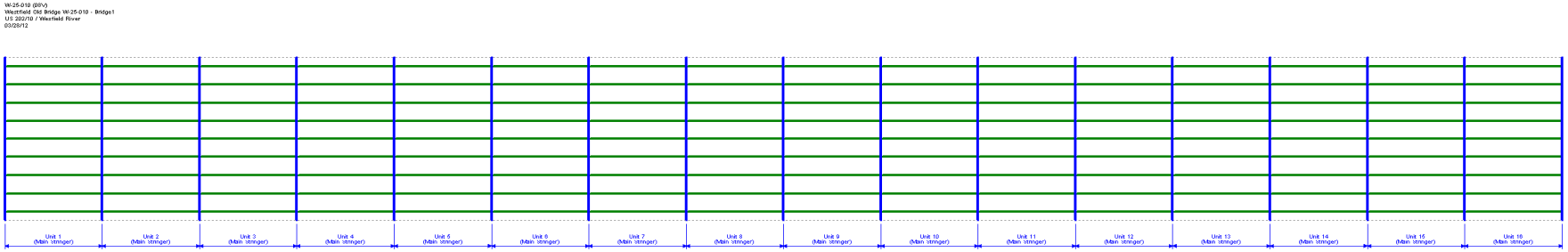
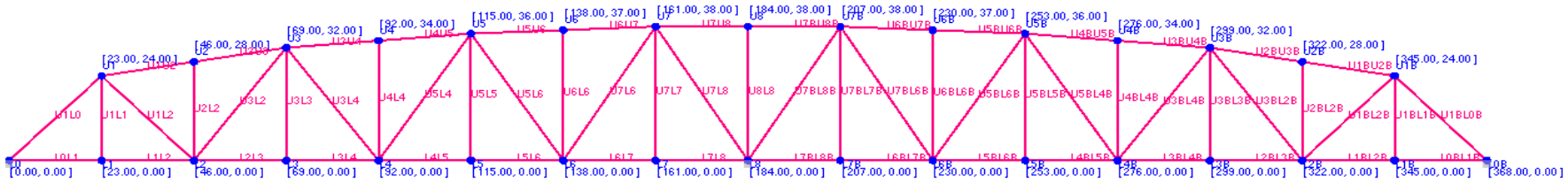
Virtis Schematics

Framing plan:

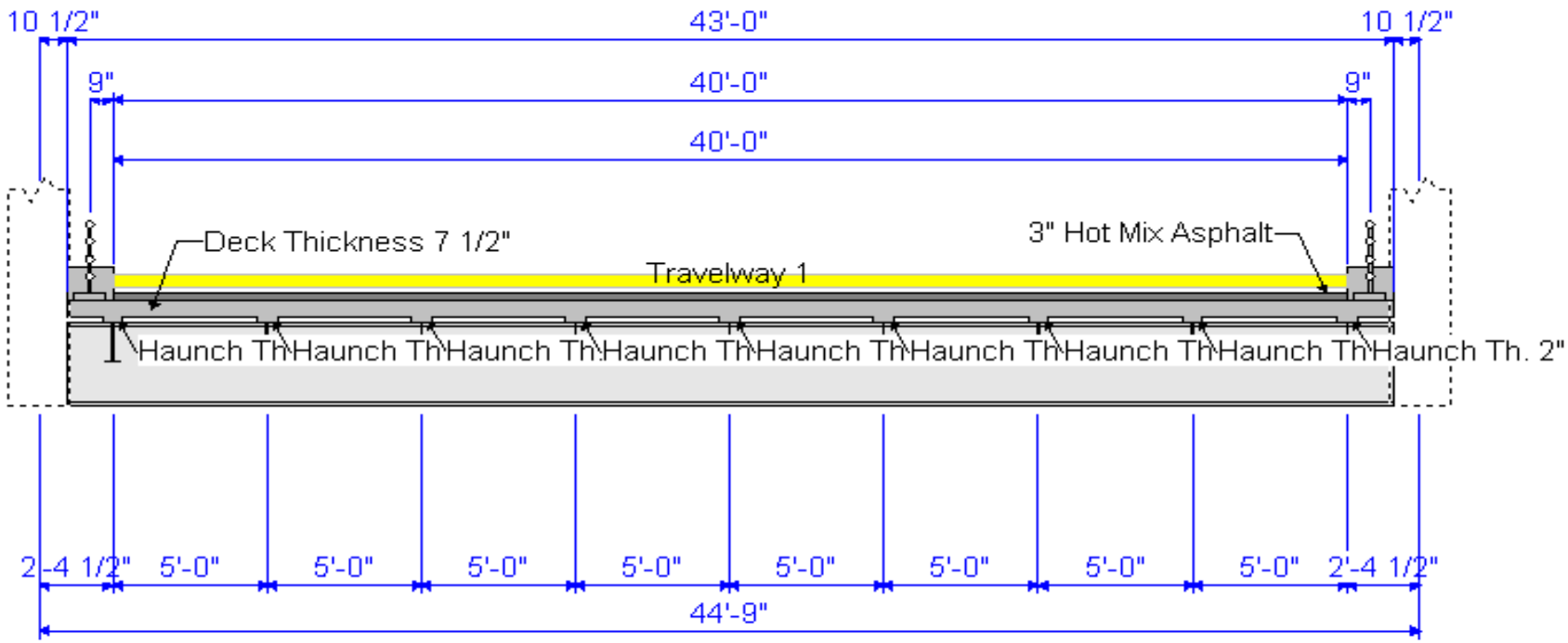


Truss:



Typical Section:

W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1
US 202/10 / Wesfield River
03/29/12



Notes:
* The truss members are not drawn to scale.

Stringer Ratings

Bay 1 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Bay 2 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Bay 3 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Bay 4 Stringers

Stringer 1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	46.49	70.72	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	83.69	127.3	2.325	3.536	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	36.85	56.05	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	66.32	100.89	1.842	2.802	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	52.23	79.34	2.089	3.174	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	81.49	123.96	2.264	3.443	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	78.74	131.5	2.187	3.653	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	62.4	104.21	1.733	2.895	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringer 3

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	42.2	66.43	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	75.96	119.57	2.11	3.321	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	33.44	52.64	1.672	2.632	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	60.2	92.78	1.672	2.577	11.5	1 - (50.0)	23	1 - (100.0)	Design Flexure - Steel	Design Shear - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	47.48	74.58	1.899	2.983	10.35	1 - (45.0)	10.35	1 - (45.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	73.96	116.43	2.055	3.234	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	74.11	123.76	2.059	3.438	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	58.73	98.08	1.631	2.725	11.5	1 - (50.0)	11.5	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Floor beam Ratings

Floorbeam Analysis Virtis Output

SFB0

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	50.05	74.98	2.503	3.749	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	90.1	134.97	2.503	3.749	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	47.53	71.2	2.377	3.56	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	67.51	101.13	1.875	2.809	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	61.71	92.44	2.468	3.698	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	94.57	141.67	2.627	3.935	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	73.51	122.77	2.042	3.41	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	55.08	91.99	1.53	2.555	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

SFB1

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	26.98	46.48	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	48.56	83.66	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	31.27	53.87	1.563	2.694	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	41.49	71.49	1.153	1.986	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	37.51	64.62	1.5	2.585	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	58.99	101.62	1.638	2.823	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	46.01	76.84	1.278	2.134	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	39.32	65.66	1.092	1.824	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

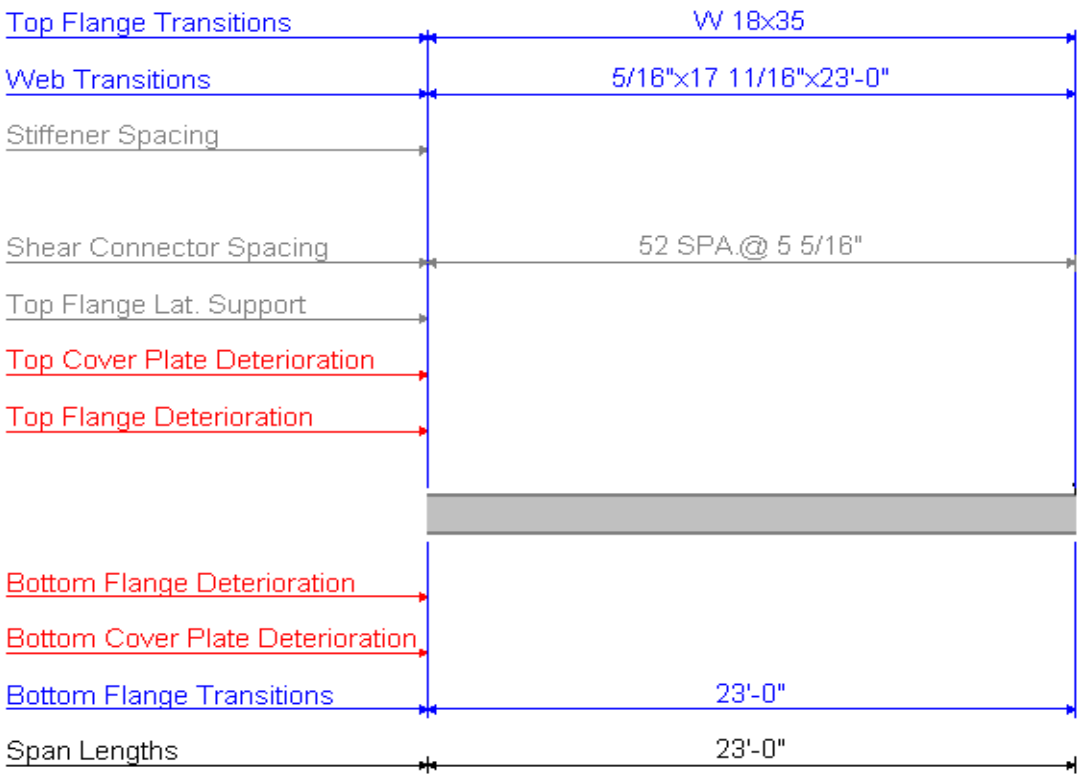
SFB2

Live Load	Live Load Type	Rating Method		Inventory Load Rating (Ton)	Operating Load Rating (Ton)	Inventory Rating Factor	Operating Rating Factor	Inventory Location (ft)	Inventory Location Span - (%)	Operating Location (ft)	Operating Location Span - (%)	Inventory Limit State	Operating Limit State	Impact	Lane
H 20-44	Lane	ASD	Success	26.98	46.48	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	ASD	Success	48.56	83.66	1.349	2.324	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
H 20-44	Axle Load	ASD	Success	31.27	53.87	1.563	2.694	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	ASD	Success	41.49	71.49	1.153	1.986	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3	Axle Load	ASD	Success	37.51	64.62	1.5	2.585	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
Type 3S2	Axle Load	ASD	Success	58.99	101.62	1.638	2.823	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Success	46.01	76.84	1.278	2.134	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Success	39.32	65.66	1.092	1.824	22.38	1 - (50.0)	22.38	1 - (50.0)	Design Flexure - Steel	Design Flexure - Steel	As Requested	As Requested

Stringers Schematics

Bay 1, Stringer 1

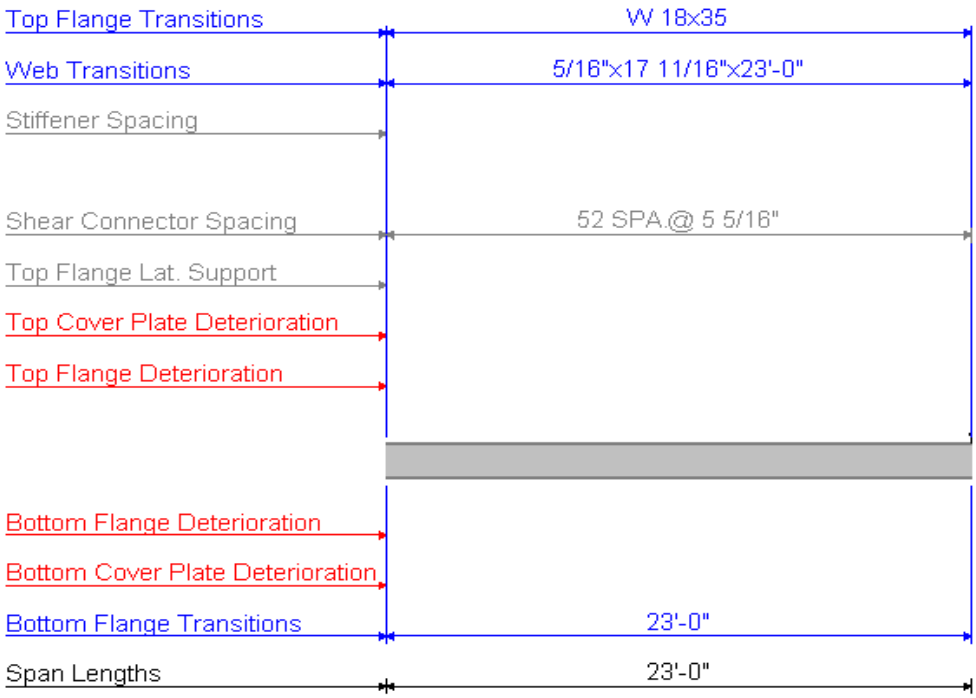
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - Unit1 Stringer1
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.
* X denotes cross frame locations.

Bay 1, Stringer 2

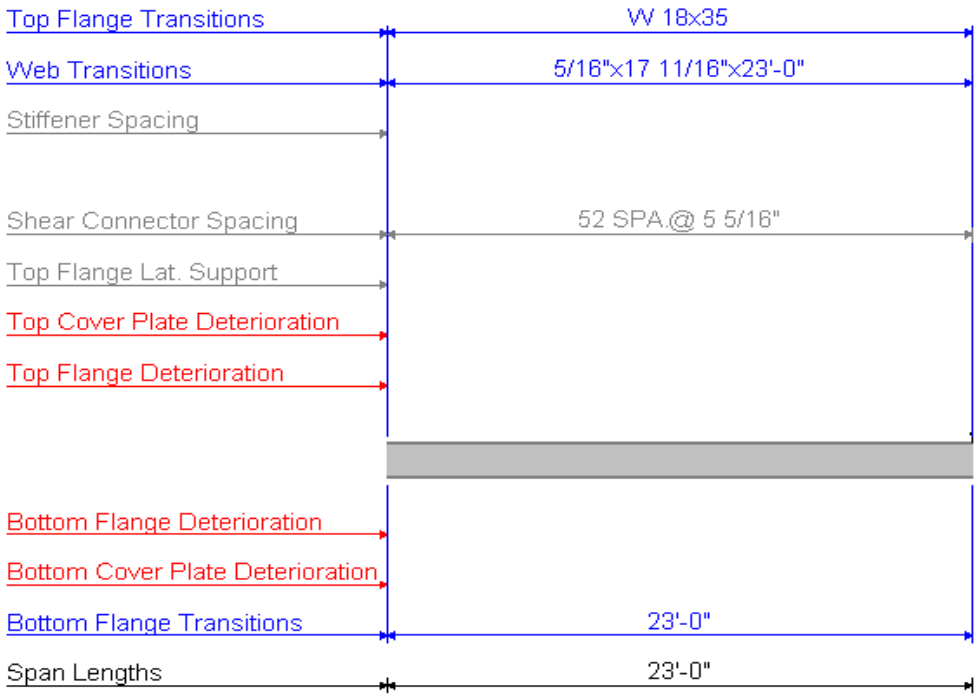
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - Unit1 Stringer2
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.
* X denotes cross frame locations.

Bay 1, Stringer 3

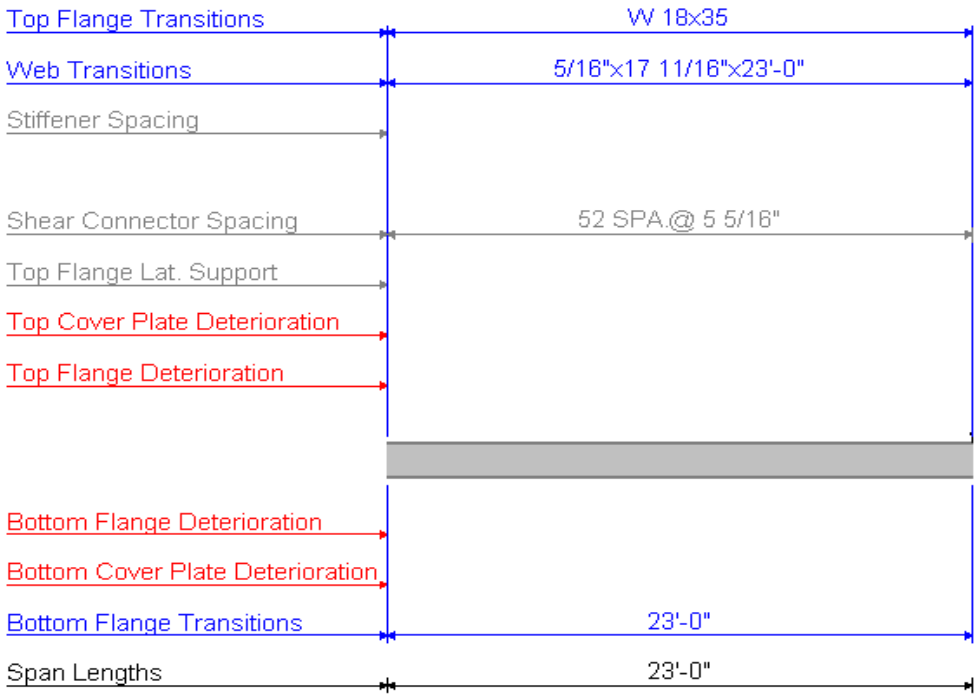
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - Unit1 Stringer3
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.
* X denotes cross frame locations.

Bay 2, Stringer 1

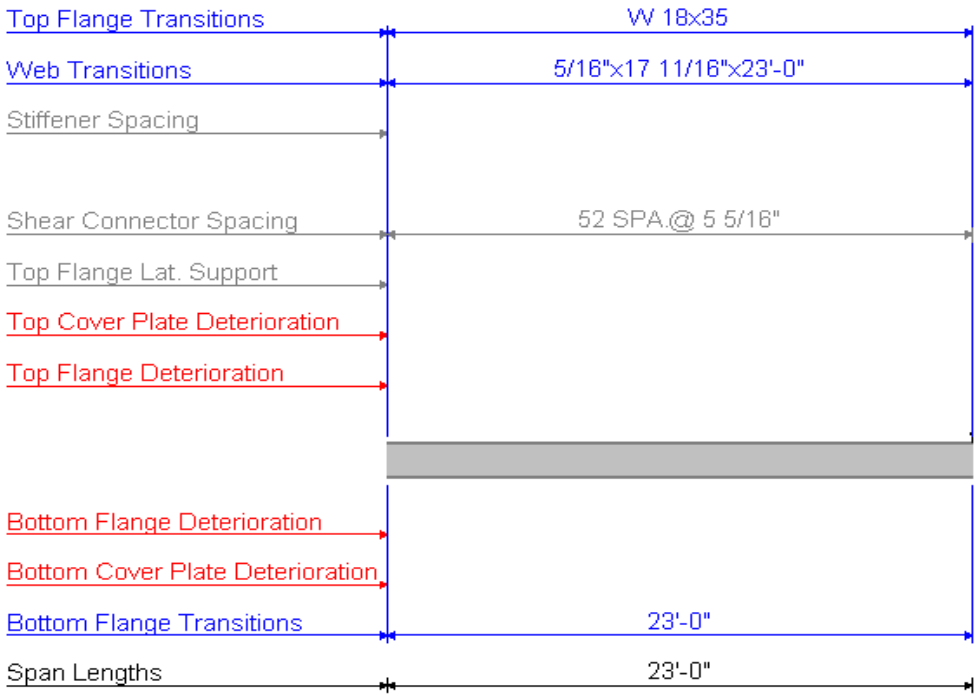
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - Unit2 Stringer1
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.
* X denotes cross frame locations.

Bay 2, Stringer 2

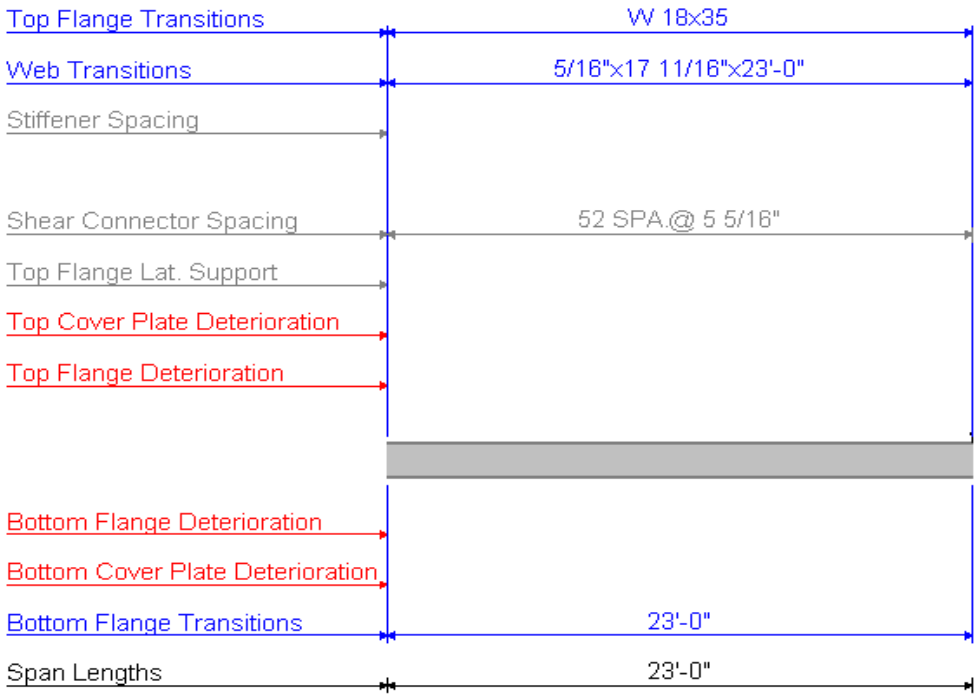
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - Unit2 Stringer2
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.
* X denotes cross frame locations.

Bay 2, Stringer 3

W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - Unit2 Stringer3
US 202/10 / Wesfield River
04/19/12

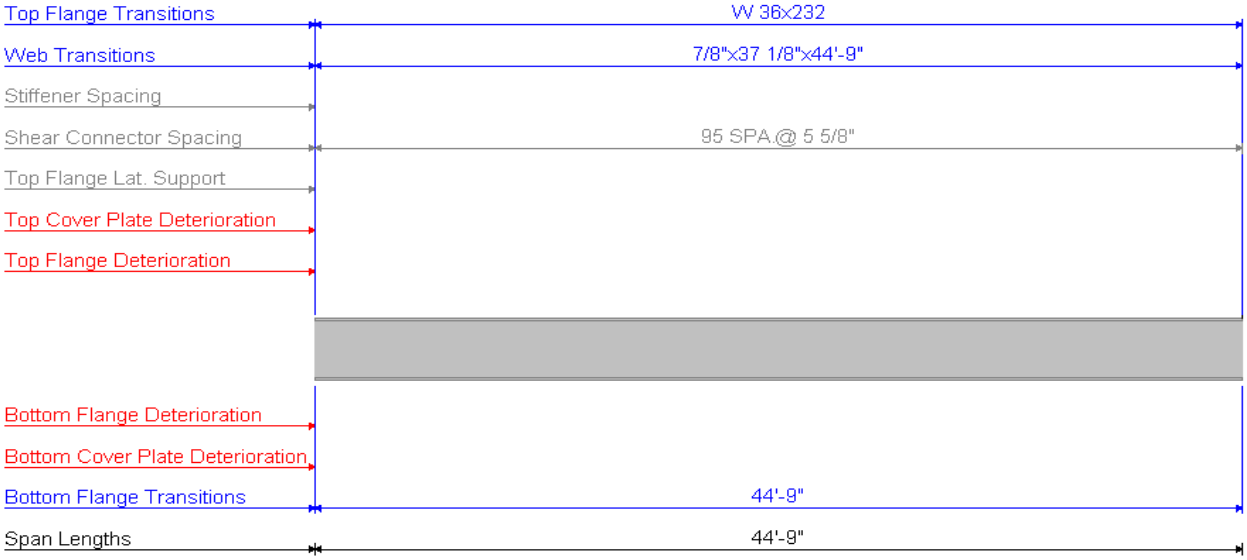


Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.
* X denotes cross frame locations.

Floor beams Schematics

End Floorbeam, SFB0

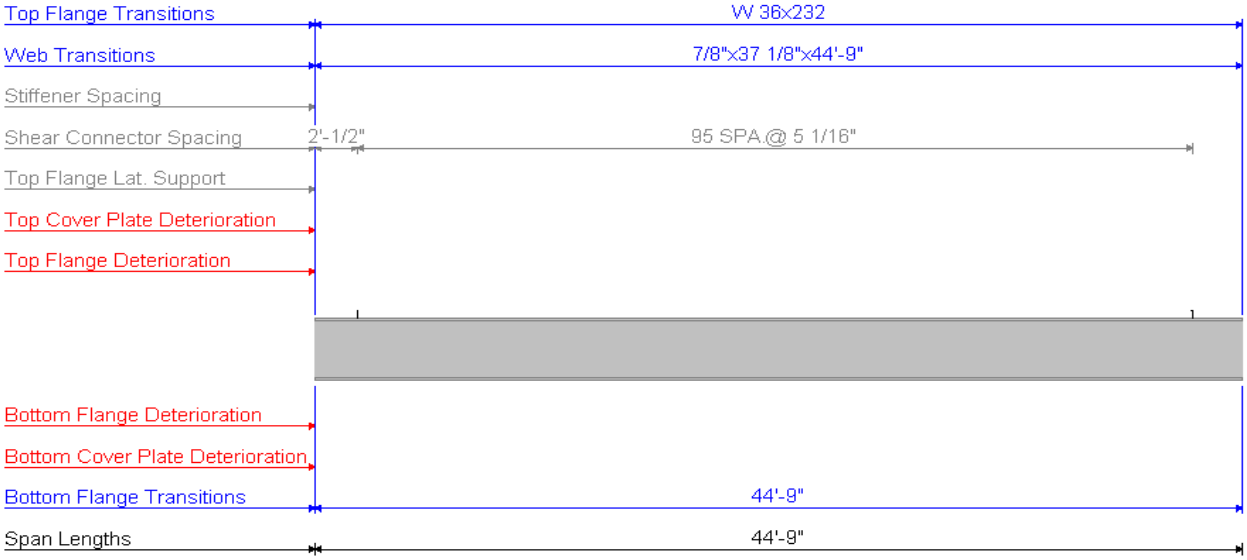
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - SFB0
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.

Intermediate Floorbeam, SFB1

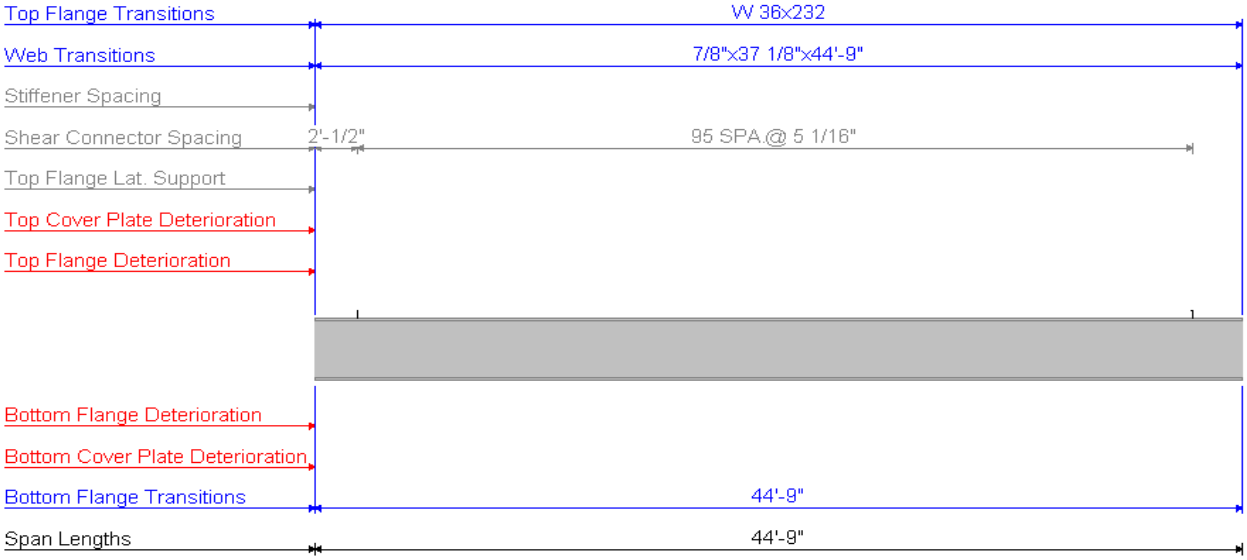
W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - SFB1
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.

Intermediate Floorbeam, SFB2

W-25-010 (08V)
Westfield Old Bridge W-25-010 - Bridge1 - SFB2
US 202/10 / Wesfield River
04/19/12



Notes:
* All flange length dimensions are horiz. (length along flange may differ).
* Transverse stiffener pairs shown in red.
* Single transverse stiffener shown in blue.
* Bearing stiffeners shown in green.
* Dimensioning starts and ends at CL bearings.

Truss Ratings

ASD Rating Summary

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	Summary Sheet	9/8/14	6/8/16		

Truss Element	INVENTORY RATING BY ALLOWABLE STRESS METHOD				OPERATING RATING BY ALLOWABLE STRESS METHOD			
	H20	TYPE 3	TYPE 3S2	HS20	H20	TYPE 3	TYPE 3S2	HS20
L0-L2	56.5	58.7	64.8	59.6	80.6	88.2	103.6	96.9
L2-L4	75.3	78.7	86.6	80.3	98.1	107.6	125.8	118.5
L4-L6	82.9	87.0	96.4	88.9	104.7	114.0	132.2	123.4
L6-L8	179.5	180.6	185.7	181.4	170.1	184.4	208.6	204.9
U1-U3	125.3	131.4	144.5	133.9	180.7	189.5	208.4	193.2
U3-U5	124.4	78.8	87.3	80.6	160.5	110.0	124.2	115.3
U5-U7	952.2	370.1	380.5	371.7	1315.7	511.4	525.8	513.7
U7-U8	123.1	212.0	218.1	213.0	210.5	345.7	373.7	366.1
U1-L0	314.2	128.3	141.8	130.4	221.7	138.3	162.4	152.0
U1-L2	183.2	82.9	93.3	84.5	185.8	111.7	131.2	120.5
U3-L2	111.1	124.4	172.9	130.8	152.7	171.2	238.0	180.5
U3-L4	**49.0**	**52.7**	64.4	**54.4**	**62.7**	**68.9**	**85.8**	**73.9**
U5-L4	79.2	115.1	138.3	85.0	105.1	115.1	138.3	125.8
U5-L6	55.9	58.0	**64.1**	59.0	68.6	75.1	88.6	83.0
U7-L6	67.7	69.5	75.0	70.4	93.2	102.3	119.8	114.3
U7-L8	249.1	254.2	268.2	256.4	216.8	238.1	276.3	267.4
VERTICAL	171.8	67.1	105.5	74.2	274.4	107.1	168.4	118.5

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 9/8/14	NKN 6/8/16		SHT # 1

	DL	H20		DF	I	H20	
	kips	kips	kips			kips	kips
L0-L2	285.94	-4.06	31.60	1.53	0.16	-7.22	56.21
L2-L4	380.23	-9.14	44.62	1.53	0.16	-16.26	79.37
L4-L6	173.22	-13.54	33.21	1.53	0.16	-24.08	59.07
L6-L8	-291.37	-17.95	11.43	1.53	0.16	-31.93	20.33
U1-U3	-396.05	-44.67	7.07	1.53	0.16	-79.46	12.58
U3-U5	-313.45	-41.63	11.51	1.53	0.16	-74.05	20.47
U5-U7	25.83	-23.44	15.82	1.53	0.16	-41.69	28.14
U7-U8	634.88	0.00	20.52	1.53	0.16	0.00	36.50
U1-L0	-413.26	-45.67	5.87	1.53	0.16	-81.23	10.44
U1-L2	150.69	-12.40	26.50	1.53	0.16	-22.06	47.14
U3-L2	17.07	-18.20	23.51	1.53	0.16	-32.37	41.82
U3-L4	-116.45	-25.18	14.36	1.53	0.16	-44.79	25.54
U5-L4	258.28	-9.29	32.11	1.53	0.16	-16.52	57.12
U5-L6	-369.66	-34.72	6.11	1.53	0.16	-61.76	10.87
U7-L6	512.87	-2.54	39.66	1.53	0.16	-4.52	70.54
U7-L8	-663.40	-42.79	0.00	1.53	0.16	-76.11	0.00
U1-L1	112.19	0.00	35.13	1.53	0.16	0.00	62.49

From Virtis LL+I (and DF included)

	DL	HS20		DF	I	HS20	
	kips	kips				kips	kips
L0-L2	285.94	-7.23	53.85	1.53	0.16	-12.86	95.78
L2-L4	380.23	-16.27	75.27	1.53	0.16	-28.94	133.89
L4-L6	173.22	-24.11	55.71	1.53	0.16	-42.89	99.09
L6-L8	-291.37	-31.97	16.69	1.53	0.16	-56.87	29.69
U1-U3	-396.05	-75.19	12.58	1.53	0.16	-133.74	22.38
U3-U5	-313.45	-69.95	20.50	1.53	0.16	-124.42	36.46
U5-U7	25.83	-38.04	28.17	1.53	0.16	-67.66	50.11
U7-U8	634.88	0.00	36.54	1.53	0.16	0.00	64.99
U1-L0	-413.26	-77.83	10.45	1.53	0.16	-138.44	18.59
U1-L2	150.69	-15.72	44.61	1.53	0.16	-27.96	79.35
U3-L2	17.07	-30.31	35.94	1.53	0.16	-53.91	63.93
U3-L4	-116.45	-40.87	23.42	1.53	0.16	-72.70	41.66
U5-L4	258.28	-14.82	53.80	1.53	0.16	-26.36	95.70
U5-L6	-369.66	-59.22	9.17	1.53	0.16	-105.34	16.31
U7-L6	512.87	-3.13	68.61	1.53	0.16	-5.57	122.04
U7-L8	-663.40	-74.82	0.00	1.53	0.16	-133.08	0.00
U1-L1	112.19	0.00	47.65	1.53	0.16	0.00	84.76

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 9/8/14	NKN 6/8/16		SHT # 2

	DL	Type 3		DF	I	Type 3	
	kips	kips	kips			kips	kips
L0-L2	285.94	-5.05	38.01	1.53	0.16	-8.98	67.61
L2-L4	380.23	-11.35	53.35	1.53	0.16	-20.19	94.90
L4-L6	173.22	-16.82	39.54	1.53	0.16	-29.92	70.33
L6-L8	-291.37	-22.30	12.40	1.53	0.16	-39.67	22.06
U1-U3	-396.05	-53.24	8.78	1.53	0.16	-94.70	15.62
U3-U5	-313.45	-49.67	14.30	1.53	0.16	-88.35	25.44
U5-U7	25.83	-27.28	19.65	1.53	0.16	-48.52	34.95
U7-U8	634.88	0.00	25.49	1.53	0.16	0.00	45.34
U1-L0	-413.26	-54.93	7.29	1.53	0.16	-97.71	12.97
U1-L2	150.69	-11.94	31.59	1.53	0.16	-21.24	56.19
U3-L2	17.07	-21.54	26.25	1.53	0.16	-38.31	46.69
U3-L4	-116.45	-29.28	16.74	1.53	0.16	-52.08	29.78
U5-L4	258.28	-10.66	38.18	1.53	0.16	-18.96	67.91
U5-L6	-369.66	-41.79	6.72	1.53	0.16	-74.33	11.95
U7-L6	512.87	-2.44	48.23	1.53	0.16	-4.34	85.79
U7-L8	-663.40	-52.42	0.00	1.53	0.16	-93.24	0.00
U1-L1	112.19	0.00	36.61	1.53	0.16	0.00	65.12

	DL	Type 3S2		DF	I	Type 3S2	
	kips	kips	kips			kips	kips
L0-L2	285.94	-7.06	49.55	1.53	0.16	-12.56	88.14
L2-L4	380.23	-15.89	69.83	1.53	0.16	-28.26	124.21
L4-L6	173.22	-23.55	51.37	1.53	0.16	-41.89	91.37
L6-L8	-291.37	-31.23	12.61	1.53	0.16	-55.55	22.43
U1-U3	-396.05	-69.69	12.29	1.53	0.16	-123.96	21.86
U3-U5	-313.45	-64.59	20.02	1.53	0.16	-114.89	35.61
U5-U7	25.83	-33.78	27.52	1.53	0.16	-60.09	48.95
U7-U8	634.88	0.00	35.69	1.53	0.16	0.00	63.48
U1-L0	-413.26	-71.61	10.21	1.53	0.16	-127.38	18.16
U1-L2	150.69	-9.99	40.39	1.53	0.16	-17.77	71.84
U3-L2	17.07	-26.91	27.19	1.53	0.16	-47.87	48.36
U3-L4	-116.45	-34.54	20.21	1.53	0.16	-61.44	35.95
U5-L4	258.28	-12.23	47.96	1.53	0.16	-21.75	85.31
U5-L6	-369.66	-54.47	6.77	1.53	0.16	-96.89	12.04
U7-L6	512.87	-1.31	64.43	1.53	0.16	-2.33	114.60
U7-L8	-663.40	-71.54	0.00	1.53	0.16	-127.25	0.00
U1-L1	112.19	0.00	33.52	1.53	0.16	0.00	59.62

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 9/8/14	NKN 6/8/16		SHT # 3

RATING SUMMARY FOR H20 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 20 tons

		LL+IMPACT			ALLOWABLE FORCE		R.F.	RATING
MEMBERS	DL FORCE	COMPR.	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-7.22	56.21	IR	375.42	444.63	2.82	56.47
		-7.22	79.45	OR	468.06	606.31	4.03	80.65
L2-L4	380.23	-16.26	79.37	IR	564.84	678.90	3.76	75.26
		-16.26	111.25	OR	703.94	925.78	4.90	98.08
L4-L6	173.22	-24.08	59.07	IR	350.98	418.01	4.14	82.88
		-24.08	75.78	OR	437.58	570.02	5.24	104.72
L6-L8	-291.37	-31.93	20.33	IR	577.90	724.91	8.97	179.48
		-50.45	20.33	OR	720.53	988.52	8.51	170.14
U1-U3	-396.05	-79.46	12.58	IR	893.68	1137.02	6.26	125.26
		-79.46	25.47	OR	1113.75	1550.48	9.03	180.65
U3-U5	-313.45	-44.79	25.54	IR	591.95	740.79	6.22	124.36
		-52.87	25.54	OR	737.79	1010.17	8.03	160.51
U5-U7	25.83	-61.76	10.87	IR	442.62	543.25	47.61	952.18
		-89.44	10.87	OR	551.83	740.79	65.79	1315.71
U7-U8	634.88	0.00	62.49	IR	805.09	1019.45	6.15	123.09
		0.00	71.77	OR	1003.37	1390.16	10.52	210.48
DIAGONAL								
U1-L0	-413.26	-31.93	20.33	IR	914.88	1288.73	15.71	314.21
		-65.52	20.33	OR	1139.51	1757.36	11.08	221.70
U1-L2	150.69	-31.93	20.33	IR	244.67	336.91	9.16	183.19
		-31.93	33.22	OR	305.13	459.42	9.29	185.84
U3-L2	17.07	-32.37	41.82	IR	133.77	249.34	5.55	111.09
		-32.37	42.30	OR	166.94	340.01	7.64	152.70
U3-L4	-116.45	-44.79	25.54	IR	226.28	687.01	2.45	49.04
		-52.87	25.54	OR	282.18	936.83	3.13	62.69
U5-L4	258.28	-16.52	57.12	IR	180.77	484.36	3.96	79.17
		-16.52	76.53	OR	225.42	660.49	5.26	105.11
U5-L6	-369.66	-61.76	10.87	IR	542.26	1371.65	2.79	55.89
		-89.44	10.87	OR	676.23	1870.43	3.43	68.55
U7-L6	512.87	-4.52	70.54	IR	463.72	751.50	3.38	67.65
		-4.52	109.80	OR	576.77	1024.77	4.66	93.24
U7-L8	-663.4	-76.11	0.00	IR	1611.43	2012.55	12.46	249.11
		-124.11	0.00	OR	2008.45	2744.38	10.84	216.75
VERTICAL								
U1-L1	112.19	-31.93	20.33	IR	90.16	286.85	8.59	171.82
		-65.52	20.33	OR	112.43	391.16	13.72	274.43

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 9/8/14	NKN 6/8/16		SHT # 4

RATING SUMMARY FOR HS20 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 36 tons

		LL+IMPACT		ALLOWABLE FORCE			R.F.	RATING
MEMBERS	DL FORCE	COMPRESSIO	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-12.86	95.78	IR	375.42	444.63	1.66	59.64
		-12.86	119.02	OR	468.06	606.31	2.69	96.90
L2-L4	380.23	-28.94	133.89	IR	564.84	678.90	2.23	80.31
		-28.94	165.77	OR	703.94	925.78	3.29	118.48
L4-L6	173.22	-42.89	99.09	IR	350.98	418.01	2.47	88.93
		-42.89	115.80	OR	437.58	570.02	3.43	123.35
L6-L8	-291.37	-56.87	29.69	IR	577.90	724.91	5.04	181.39
		-75.39	29.69	OR	720.53	988.52	5.69	204.94
U1-U3	-396.05	-133.74	22.38	IR	893.68	1137.02	3.72	133.95
		-133.74	35.27	OR	1113.75	1550.48	5.37	193.19
U3-U5	-313.45	-124.42	36.46	IR	591.95	740.79	2.24	80.58
		-132.51	36.46	OR	737.79	1010.17	3.20	115.29
U5-U7	25.83	-67.66	50.11	IR	442.62	543.25	10.33	371.75
		-95.35	50.11	OR	551.83	740.79	14.27	513.67
U7-U8	634.88	0.00	64.99	IR	805.09	1019.45	5.92	213.01
		0.00	74.27	OR	1003.37	1390.16	10.17	366.08
DIAGONAL								
U1-L0	-413.26	-138.44	18.59	IR	914.88	1288.73	3.62	130.44
		-172.03	18.59	OR	1139.51	1757.36	4.22	151.98
U1-L2	150.69	-27.96	79.35	IR	244.67	336.91	2.35	84.49
		-27.96	92.24	OR	305.13	459.42	3.35	120.49
U3-L2	17.07	-53.91	63.93	IR	133.77	249.34	3.63	130.80
		-53.91	64.41	OR	166.94	340.01	5.01	180.51
U3-L4	-116.45	-72.70	41.66	IR	226.28	687.01	1.51	54.39
		-80.78	41.66	OR	282.18	936.83	2.05	73.86
U5-L4	258.28	-26.36	95.70	IR	180.77	484.36	2.36	85.05
		-26.36	115.11	OR	225.42	660.49	3.49	125.79
U5-L6	-369.66	-105.34	16.31	IR	542.26	1371.65	1.64	58.99
		-133.02	16.31	OR	676.23	1870.43	2.30	82.97
U7-L6	512.87	-5.57	122.04	IR	463.72	751.50	1.96	70.39
		-5.57	161.29	OR	576.77	1024.77	3.17	114.26
U7-L8	-663.4	-133.08	0.00	IR	1611.43	2012.55	7.12	256.45
		-181.08	0.00	OR	2008.45	2744.38	7.43	267.40
VERTICAL								
U1-L1	112.19	0.00	84.76	IR	90.16	286.85	2.06	74.19
		-33.59	84.76	OR	112.43	391.16	3.29	118.49

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 9/8/14	NKN 6/8/16		SHT # 5

RATING SUMMARY FOR TYPE 3 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 25 tons

		LL+IMPACT		ALLOWABLE FORCE			R.F.	RATING
MEMBERS	DL FORCE	COMPRESSIO	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-8.98	67.61	IR	375.42	444.63	2.35	58.68
		-8.98	90.85	OR	468.06	606.31	3.53	88.16
L2-L4	380.23	-20.19	94.90	IR	564.84	678.90	3.15	78.69
		-20.19	126.78	OR	703.94	925.78	4.30	107.58
L4-L6	173.22	-29.92	70.33	IR	350.98	418.01	3.48	87.01
		-29.92	87.04	OR	437.58	570.02	4.56	113.97
L6-L8	-291.37	-39.67	22.06	IR	577.90	724.91	7.22	180.59
		-58.19	22.06	OR	720.53	988.52	7.38	184.39
U1-U3	-396.05	-94.70	15.62	IR	893.68	1137.02	5.25	131.37
		-94.70	28.51	OR	1113.75	1550.48	7.58	189.47
U3-U5	-313.45	-88.35	25.44	IR	591.95	740.79	3.15	78.81
		-96.43	25.44	OR	737.79	1010.17	4.40	110.01
U5-U7	25.83	-48.52	34.95	IR	442.62	543.25	14.80	370.09
		-76.21	34.95	OR	551.83	740.79	20.46	511.39
U7-U8	634.88	0.00	45.34	IR	805.09	1019.45	8.48	212.05
		0.00	54.62	OR	1003.37	1390.16	13.83	345.71
DIAGONAL								
U1-L0	-413.26	-97.71	12.97	IR	914.88	1288.73	5.13	128.35
		-131.29	12.97	OR	1139.51	1757.36	5.53	138.29
U1-L2	150.69	-21.24	56.19	IR	244.67	336.91	3.31	82.85
		-21.24	69.08	OR	305.13	459.42	4.47	111.72
U3-L2	17.07	-38.31	46.69	IR	133.77	249.34	4.97	124.36
		-38.31	47.17	OR	166.94	340.01	6.85	171.16
U3-L4	-116.45	-52.08	29.78	IR	226.28	687.01	2.11	52.72
		-60.17	29.78	OR	282.18	936.83	2.75	68.87
U5-L4	258.28	-18.96	67.91	IR	180.77	484.36	3.33	83.22
		-18.96	87.33	OR	225.42	660.49	4.61	115.14
U5-L6	-369.66	-74.33	11.95	IR	542.26	1371.65	2.32	58.05
		-102.02	11.95	OR	676.23	1870.43	3.01	75.13
U7-L6	512.87	-4.34	85.79	IR	463.72	751.50	2.78	69.54
		-4.34	125.04	OR	576.77	1024.77	4.09	102.35
U7-L8	-663.4	-93.24	0.00	IR	1611.43	2012.55	10.17	254.19
		-141.24	0.00	OR	2008.45	2744.38	9.52	238.08
VERTICAL								
U1-L1	112.19	0.00	65.12	IR	90.16	286.85	2.68	67.05
		-33.59	65.12	OR	112.43	391.16	4.28	107.10

(Pedestrian Loading added for Operating Rating)

CLIENT	MassDOT	STV Incorporated			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating Summary Sheets	AJL 9/8/14	NKN 6/8/16		SHT # 6

RATING SUMMARY FOR TYPE 3S2 TRUCK

$$RF = \frac{C-A_1D}{A_2L(1+I)} \qquad I = \frac{50.00}{L+125} = \frac{50.00}{184+125} = 0.162$$

P= 36 tons

		LL+IMPACT		ALLOWABLE FORCE			R.F.	RATING
MEMBERS	DL FORCE	COMPRESSIO	TENSION		COMPRESSION	TENSION		(tons)
CHORDS								
L0-L2	285.94	-12.56	88.14	IR	375.42	444.63	1.80	64.82
		-12.56	111.38	OR	468.06	606.31	2.88	103.55
L2-L4	380.23	-28.26	124.21	IR	564.84	678.90	2.40	86.57
		-28.26	156.09	OR	703.94	925.78	3.50	125.82
L4-L6	173.22	-41.89	91.37	IR	350.98	418.01	2.68	96.45
		-41.89	108.08	OR	437.58	570.02	3.67	132.16
L6-L8	-291.37	-55.55	22.43	IR	577.90	724.91	5.16	185.69
		-74.07	22.43	OR	720.53	988.52	5.79	208.58
U1-U3	-396.05	-123.96	21.86	IR	893.68	1137.02	4.01	144.52
		-123.96	34.75	OR	1113.75	1550.48	5.79	208.43
U3-U5	-313.45	-114.89	35.61	IR	591.95	740.79	2.42	87.27
		-122.97	35.61	OR	737.79	1010.17	3.45	124.22
U5-U7	25.83	-60.09	48.95	IR	442.62	543.25	10.57	380.53
		-87.77	48.95	OR	551.83	740.79	14.61	525.81
U7-U8	634.88	0.00	63.48	IR	805.09	1019.45	6.06	218.08
		0.00	72.76	OR	1003.37	1390.16	10.38	373.69
DIAGONAL								
U1-L0	-413.26	-127.38	18.16	IR	914.88	1288.73	3.94	141.77
		-160.96	18.16	OR	1139.51	1757.36	4.51	162.43
U1-L2	150.69	-17.77	71.84	IR	244.67	336.91	2.59	93.31
		-17.77	84.74	OR	305.13	459.42	3.64	131.16
U3-L2	17.07	-47.87	48.36	IR	133.77	249.34	4.80	172.89
		-47.87	48.84	OR	166.94	340.01	6.61	238.03
U3-L4	-116.45	-61.44	35.95	IR	226.28	687.01	1.79	64.36
		-69.52	35.95	OR	282.18	936.83	2.38	85.82
U5-L4	258.28	-21.75	85.31	IR	180.77	484.36	2.65	95.40
		-21.75	104.72	OR	225.42	660.49	3.84	138.26
U5-L6	-369.66	-96.89	12.04	IR	542.26	1371.65	1.78	64.13
		-124.57	12.04	OR	676.23	1870.43	2.46	88.59
U7-L6	512.87	-2.33	114.60	IR	463.72	751.50	2.08	74.96
		-2.33	153.86	OR	576.77	1024.77	3.33	119.78
U7-L8	-663.4	-127.25	0.00	IR	1611.43	2012.55	7.45	268.20
		-175.25	0.00	OR	2008.45	2744.38	7.68	276.31
VERTICAL								
U1-L1	112.19	0.00	59.62	IR	90.16	286.85	2.93	105.46
		-33.59	59.62	OR	112.43	391.16	4.68	168.44

(Pedestrian Loading added for Operating Rating)

LFD Rating Summary

CLIENT	MassDOT	**STV Incorporated**			
PROJECT	Westfield Great River Bridge W-25-010	MADE	CHK.	REV.	4014943
SUBJECT	Truss Rating	AJL	NKN		SHT # 1
	Converting Virtis Rating to Metric	9/10/14	6/8/16		

	RF from Virtis		Inventory		Operating	
	Inv	Opr	MS18	MS (Equiv)	MS18	MS (Equiv)
L0-L2	2.35	3.93	76.1	MS 42.3	127.3	MS 70.7
L2-L4	1.65	2.75	53.5	MS 29.7	89.1	MS 49.5
L4-L6	2.69	4.49	87.2	MS 48.4	145.5	MS 80.8
L6-L8	5.79	9.66	187.6	MS 104.2	313.0	MS 173.9
U1-U3	2.64	4.41	85.5	MS 47.5	142.9	MS 79.4
U3-U5	1.64	2.75	53.1	MS 29.5	89.1	MS 49.5
U5-U7	5.98	9.98	193.8	MS 107.6	323.4	MS 179.6
U7-U8	4.08	6.81	132.2	MS 73.4	220.6	MS 122.6
U1-L0	2.88	4.82	93.3	MS 51.8	156.2	MS 86.8
U1-L2	2.64	4.41	85.5	MS 47.5	142.9	MS 79.4
U3-L2	2.91	4.85	94.3	MS 52.4	157.1	MS 87.3
U3-L4	2.91	4.87	94.3	MS 52.4	157.8	MS 87.7
U5-L4	1.66	2.77	53.8	MS 29.9	89.7	MS 49.9
U5-L6	3.42	5.7	110.8	MS 61.6	184.7	MS 102.6
U7-L6	1.74	2.91	56.4	MS 31.3	94.3	MS 52.4
U7-L8	3.82	6.39	123.8	MS 68.8	207.0	MS 115.0
Vertical	1.89	3.15	61.2	MS 34.0	102.1	MS 56.7

Bridge ID NBI
Bridge : Bridge Alt
StructDef Member :
User :
Date : Thursday, April 19, 2012
10:18:48
File : RatingResults.XML
Module

Load Factor Rating Summary

Live Load	Live Load Type	Inv Element	Inv RF	Inv Capacity (Ton)	Opr Element	Opr RF	Opr Capacity (Ton)	Impact	Lane
H 20-44	Design Truck	U3NL3N	2.56	51.19	U3NL3N	4.275	85.49	As Requested	As Requested
H 20-44	Design Lane	U7L6	1.361	27.23	U7L6	2.273	45.47	As Requested	As Requested
H 20-44	Design Truck	U3NL3N	4.693	93.86	U3NL3N	7.838	156.75	With Impact	Single Lane
H 20-44	Design Lane	U7L6	2.496	49.92	U7L6	4.168	83.36	With Impact	Single Lane
H 20-44	Design Truck	U3NL3N	2.56	51.19	U3NL3N	4.275	85.49	With Impact	Multi-Lane
H 20-44	Design Lane	U7L6	1.361	27.23	U7L6	2.273	45.47	With Impact	Multi-Lane
H 20-44	Design Truck	U4NU5N	5.885	117.71	U4NU5N	9.828	196.57	Without Impact	Single Lane
H 20-44	Design Lane	U7L6	2.9	58	U7L6	4.843	96.85	Without Impact	Single Lane
H 20-44	Design Truck	U4NU5N	3.21	64.2	U4NU5N	5.36	107.21	Without Impact	Multi-Lane
H 20-44	Design Lane	U7L6	1.582	31.63	U7L6	2.641	52.82	Without Impact	Multi-Lane
HS 20-44	Design Truck	U4NU5N	1.644	59.19	U4NU5N	2.746	98.84	As Requested	As Requested
HS 20-44	Design Lane	U7L6	1.361	49.01	U7L6	2.273	81.84	As Requested	As Requested
HS 20-44	Design Truck	U4NU5N	3.015	108.52	U4NU5N	5.034	181.23	With Impact	Single Lane
HS 20-44	Design Lane	U7L6	2.496	89.85	U7L6	4.168	150.06	With Impact	Single Lane
HS 20-44	Design Truck	U4NU5N	1.644	59.19	U4NU5N	2.746	98.84	With Impact	Multi-Lane
HS 20-44	Design Lane	U7L6	1.361	49.01	U7L6	2.273	81.84	With Impact	Multi-Lane
HS 20-44	Design Truck	U4NU5N	3.502	126.08	U4NU5N	5.849	210.56	Impact	Single Lane
HS 20-44	Design Lane	U7L6	2.9	104.39	U7L6	4.843	174.34	Impact	Single Lane
HS 20-44	Design Truck	U4NU5N	1.91	68.77	U4NU5N	3.19	114.84	Impact	Multi-Lane
HS 20-44	Design Lane	U7L6	1.582	56.94	U7L6	2.641	95.08	Impact	Multi-Lane
Type 3	Design Truck	U4NU5N	2.315	57.88	U4NU5N	3.867	96.66	As Requested	As Requested
Type 3	Design Truck	U4NU5N	4.245	106.13	U4NU5N	7.089	177.24	With Impact	Single Lane
Type 3	Design Truck	U4NU5N	2.315	57.88	U4NU5N	3.867	96.66	With Impact	Multi-Lane
Type 3	Design Truck	U4NU5N	4.932	123.3	U4NU5N	8.237	205.92	Without Impact	Single Lane
Type 3	Design Truck	U4NU5N	2.69	67.25	U4NU5N	4.492	112.31	Without Impact	Multi-Lane
Type 3S2	Design Truck	L3NL4N	1.777	63.97	L3NL4N	2.968	106.83	As Requested	As Requested
Type 3S2	Design Truck	L3NL4N	3.258	117.3	L3NL4N	5.441	195.89	With Impact	Single Lane
Type 3S2	Design Truck	L3NL4N	1.777	63.97	L3NL4N	2.968	106.83	With Impact	Multi-Lane
Type 3S2	Design Truck	L3NL4N	3.785	136.28	L3NL4N	6.322	227.58	Without Impact	Single Lane
Type 3S2	Design Truck	L3NL4N	2.065	74.32	L3NL4N	3.448	124.12	Without Impact	Multi-Lane

Bridge ID :W-25-010(08V)
Bridge : Westfield Old Bridge W-25-010
StructDef : Bridge1
User : Virtis
Date : Thursday, April 19, 2012 15:41:10
File : RatingResults.XML
Module Version : 1.1

NBI Structure ID :W2501008V
Bridge Alt :
Member : East Truss

Load Factor Rating Summary

Live Load	Live Load Type	Inv Element	Inv RF	Inv Capacity (Ton)	Opr Element	Opr RF	Opr Capacity (Ton)	Impact	Lane
HS 20-44	Design Truck	U4NU5N	1.644	59.19	U4NU5N	2.746	98.84	As Requested	As Requested
HS 20-44	Design Lane	U7L6	1.361	49.01	U7L6	2.273	81.84	As Requested	As Requested
HS 20-44	Design Truck	U4NU5N	3.015	108.52	U4NU5N	5.034	181.23	With Impact	Single Lane
HS 20-44	Design Lane	U7L6	2.496	89.85	U7L6	4.168	150.06	With Impact	Single Lane
HS 20-44	Design Truck	U4NU5N	1.644	59.19	U4NU5N	2.746	98.84	With Impact	Multi-Lane
HS 20-44	Design Lane	U7L6	1.361	49.01	U7L6	2.273	81.84	With Impact	Multi-Lane
HS 20-44	Design Truck	U4NU5N	3.502	126.08	U4NU5N	5.849	210.56	Without Impact	Single Lane
HS 20-44	Design Lane	U7L6	2.9	104.39	U7L6	4.843	174.34	Without Impact	Single Lane
HS 20-44	Design Truck	U4NU5N	1.91	68.77	U4NU5N	3.19	114.84	Without Impact	Multi-Lane
HS 20-44	Design Lane	U7L6	1.582	56.94	U7L6	2.641	95.08	Without Impact	Multi-Lane

Virtis Truss Input

```
Truss "East Truss"
Unit
Force kips
Length ft
Properties in
DefaultSysUnitType US
DefaultStructSteel "33 ksi"
DefaultEndConnection
Riveted
MaterialType
Steel1 = "33 ksi"
Steel2 = "Weightless Grade 50"

SectionType
Ch1 = "MC 18x58"
Ch2 = "MC 18x51.9"
Ch3 = "MC 18x45.8"
Ch4 = "MC 18x42.7"
Ch5 = "C 15x40"
Ch6 = "C 15x33.9"
Ch7 = "MC 12x35"
Ch8 = "C 12x30"
Ch9 = "C 12x25"
Ch10 = "C 10x25"
Ang1 =  "L 5x3.5x0.375"

MemberCrossSection
ChannelBox =  L0-L2
Channels Ch3 Inward 16.25
Connection Riveted 0.0
Lacing Both

ChannelBox =  L2-L4
Channels Ch2 Inward 16.25
Connection Riveted 0.0
Lacing Both

ChannelBox =  U1-L0
TopFlangePlate
16.0 0.375
LeftWebPlate
17.0 0.5
RightWebPlate
17.0 0.5
Channels Ch2 Inward 16.25
Connection Bolted 0.0
Lacing Bottom

ChannelBox =  L4-L6
Channels Ch4 Inward 16.25
Connection Riveted 0.0
Lacing Both

ChannelBox =  L6-L8
LeftWebPlate
16.0 0.5
RightWebPlate
16.0 0.5
Channels Ch4 Inward 16.25
Connection Bolted 0.0
Lacing Both

ChannelBox =  U1-U3
TopFlangePlate
16.0 0.375
LeftWebPlate
16.0 0.5
RightWebPlate
16.0 0.5
Channels Ch4 Inward 16.25
Connection Bolted 0.0
Lacing Bottom

ChannelBox =  U3-U5
TopFlangePlate
16.0 0.375
Channels Ch4 Inward 16.25
Connection Riveted 0.0
Lacing Bottom

ChannelBox =  U5-U7
TopFlangePlate
16.0 0.375
Channels Ch4 Inward 16.25
Connection Riveted 0.0
Lacing Bottom

ChannelBox =  U7-U8
TopFlangePlate
16.0 0.375
LeftWebPlate
15.0 0.375
RightWebPlate
15.0 0.375
Channels Ch4 Inward 16.25
Connection Riveted 0.0
Lacing Bottom

ChannelBox =  U1-L2
Channels Ch6 Inward 16.25
Connection Riveted 0.0
Lacing Both

ChannelBox =  U3-L2
Channels Ch9 Inward 16.25
Connection Riveted 0.0
Lacing Both
```

```
ChannelBox =  U3-L4
LeftWebPlate
11.0 0.5
RightWebPlate
11.0 0.5
Channels Ch8 Inward 16.25
Connection Bolted 0.0
Lacing Both

ChannelBox =  U5-L4
Channels Ch7 Inward 16.25
Connection Riveted 0.0
Lacing Both

ChannelBox =  U5-L6
LeftWebPlate
12.0 0.5
14.0 0.75
RightWebPlate
12.0 0.5
14.0 0.75
Channels Ch5 Inward 16.25
Connection Bolted 0.0
Lacing Both

ChannelBox =  U7-L6
Channels Ch1 Inward 16.25
Connection Riveted 0.0
Lacing Both

ChannelBox =  U7-L8
TopFlangePlate
16.0 0.375
9.0 1.25
13.0 0.787
LeftWebPlate
15.0 0.5625
RightWebPlate
15.0 0.5625
Channels Ch1 Inward 16.25
Connection Bolted 0.0
Lacing Bottom

Builtup =  Verticals
TopFlangePlate
8.0 0.25
BottomFlangePlate
8.0 0.25
TopAngles Ang1 Horizontal
BottomAngles Ang1 Horizontal
BackToBack 16.25
Lacing Web


PanelPoint
U1 Upper 23 24
U2 Upper 46 28
U3 Upper 69 32
U4 Upper 92 34
U5 Upper 115 36
U6 Upper 138 37
U7 Upper 161 38
U8 Upper 184 38

L0 Lower 0 0
L1 Lower 23 0
L2 Lower 46 0
L3 Lower 69 0
L4 Lower 92 0
L5 Lower 115 0
L6 Lower 138 0
L7 Lower 161 0
L8 Lower 184 0

U1N Upper 345 24
U2N Upper 322 28
U3N Upper 299 32
U4N Upper 276 34
U5N Upper 253 36
U6N Upper 230 37
U7N Upper 207 38


L0N Lower 368 0
L1N Lower 345 0
L2N Lower 322 0
L3N Lower 299 0
L4N Lower 276 0
L5N Lower 253 0
L6N Lower 230 0
L7N Lower 207 0


Member
L0L1 L0 L1 L0-L2
L1L2 L1 L2 L0-L2

L2L3 L2 L3 L2-L4
L3L4 L3 L4 L2-L4

L4L5 L4 L5 L4-L6
L5L6 L5 L6 L4-L6

L6L7 L6 L7 L6-L8
L7L8 L7 L8 L6-L8

U1U2 U1 U2 U1-U3
U2U3 U2 U3 U1-U3
```

```
U3U4 U3 U4 U3-U5
U4U5 U4 U5 U3-U5

U5U6 U5 U6 U5-U7
U6U7 U6 U7 U5-U7

U7U8 U7 U8 U7-U8

U1L0 U1 L0 U1-L0
U1L2 U1 L2 U1-L2
U3L2 U3 L2 U3-L2
U3L4 U3 L4 U3-L4
U5L4 U5 L4 U5-L4
U5L6 U5 L6 U5-L6
U7L6 U7 L6 U7-L6
U7L8 U7 L8 U7-L8
U1L1 U1 L1 Verticals
U3L3 U3 L3 Verticals
U5L5 U5 L5 Verticals
U7L7 U7 L7 Verticals
U2L2 U2 L2 Verticals
U4L4 U4 L4 Verticals
U6L6 U6 L6 Verticals
U8L8 U8 L8 Verticals

L0NL1N L0N L1N L0-L2
L1NL2N L1N L2N L0-L2

L2NL3N L2N L3N L2-L4
L3NL4N L3N L4N L2-L4

L4NL5N L4N L5N L4-L6
L5NL6N L5N L6N L4-L6

L6NL7N L6N L7N L6-L8
L7NL8N L7N L8 L6-L8

U1NU2N U1N U2N U1-U3
U2NU3N U2N U3N U1-U3

U3NU4N U3N U4N U3-U5
U4NU5N U4N U5N U3-U5

U5NU6N U5N U6N U5-U7
U6NU7N U6N U7N U5-U7

U7NU8N U7N U8 U7-U8

U1NL0N U1N L0N U1-L0
U1NL2N U1N L2N U1-L2
U3NL2N U3N L2N U3-L2
U3NL4N U3N L4N U3-L4
U5NL4N U5N L4N U5-L4
U5NL6N U5N L6N U5-L6
U7NL6N U7N L6N U7-L6
U7NL8N U7N L8 U7-L8
U1NL1N U1N L1N Verticals
U3NL3N U3N L3N Verticals
U5NL5N U5N L5N Verticals
U7NL7N U7N L7N Verticals
U2NL2N U2N L2N Verticals
U4NL4N U4N L4N Verticals
U6NL6N U6N L6N Verticals


Support
L0 Roller
L8 Pinned
L0N Roller


PanelPointLoad
L0 DC 0.0 -1.81            //Gusset plates
L1 DC 0.0 -3.92
L2 DC 0.0 -5.18
L3 DC 0.0 -4.07
L4 DC 0.0 -5.43
L5 DC 0.0 -2.96
L6 DC 0.0 -5.65
L7 DC 0.0 -1.79
L8 DC 0.0 -5.43
L0N DC 0.0 -1.79
L1N DC 0.0 -5.76
L2N DC 0.0 -2.76
L3N DC 0.0 -5.33
L4N DC 0.0 -4.70
L5N DC 0.0 -5.51
L6N DC 0.0 -3.19
L7N DC 0.0 -2.57
L0 DC 0.0 -13.381            //Sidewalk loads
L1 DC 0.0 -25.303
L2 DC 0.0 -25.303
L3 DC 0.0 -25.303
L4 DC 0.0 -25.303
L5 DC 0.0 -25.303
L6 DC 0.0 -25.303
L7 DC 0.0 -25.303
L8 DC 0.0 -25.303
L0 DC 0.0 -13.381
L1N DC 0.0 -25.303
L2N DC 0.0 -25.303
L3N DC 0.0 -25.303
L4N DC 0.0 -25.303
L5N DC 0.0 -25.303
L6N DC 0.0 -25.303
L7N DC 0.0 -25.303
```

```
U1 DC 0.0 -0.32            //Top chord gusset plates
U2 DC 0.0 -0.97
U3 DC 0.0 -0.32
U4 DC 0.0 -0.97
U5 DC 0.0 -0.32
U6 DC 0.0 -0.97
U7 DC 0.0 -0.32
U8 DC 0.0 -0.97
U1N DC 0.0 -0.32
U2N DC 0.0 -0.97
U3N DC 0.0 -0.32
U4N DC 0.0 -0.97
U5N DC 0.0 -0.32
U6N DC 0.0 -0.97
U7N DC 0.0 -0.32
U1 DC 0.0 -2.51             //Top chord bracing
U2 DC 0.0 -1.35
U3 DC 0.0 -1.35
U4 DC 0.0 -1.27
U5 DC 0.0 -1.35
U6 DC 0.0 -1.35
U7 DC 0.0 -3.33
U8 DC 0.0 -0
U1N DC 0.0 -2.51
U2N DC 0.0 -1.35
U3N DC 0.0 -1.35
U4N DC 0.0 -1.27
U5N DC 0.0 -1.35
U6N DC 0.0 -1.35
U7N DC 0.0 -3.33


LLDistribution
OneLane 0.835 1.0
MultiLane 1.531 1.0
//0.9 multiplier used for 3 lanes

MemberOfInterest
L0L1
Deterioration
Channels
Left Web 5 0 L0 0 23
Right Web 5 0 L0 0 23
L1L2
Deterioration
Channels
Left Web 5 0 L1 0 23
Right Web 5 0 L1 0 23
L2L3
Deterioration
Channels
Left Web 5 0 L2 0 23
Right Web 5 0 L2 0 23
L3L4
Deterioration
Channels
Left Web 5 0 L3 0 23
Right Web 5 0 L3 0 23
L4L5
Deterioration
Channels
Left Web 5 0 L4 0 23
Right Web 5 0 L4 0 23
L5L6
Deterioration
Channels
Left Web 5 0 L5 0 23
Right Web 5 0 L5 0 23
L6L7
Deterioration
Channels
Left Web 5 0 L6 0 23
Right Web 5 0 L6 0 23
L7L8
Deterioration
Channels
Left Web 5 0 L7 0 23
Right Web 5 0 L7 0 23
L0NL1N
Deterioration
Channels
Left Web 5 0 L0 0 23
Right Web 5 0 L0 0 23
L1NL2N
Deterioration
Channels
Left Web 5 0 L1 0 23
Right Web 5 0 L1 0 23
L2NL3N
Deterioration
Channels
Left Web 5 0 L2 0 23
Right Web 5 0 L2 0 23
L3NL4N
Deterioration
Channels
Left Web 5 0 L3 0 23
Right Web 5 0 L3 0 23
L4NL5N
Deterioration
Channels
Left Web 5 0 L4 0 23
Right Web 5 0 L4 0 23
L5NL6N
Deterioration
Channels
Left Web 5 0 L5 0 23
Right Web 5 0 L5 0 23
```

L6NL7N
Deterioration
Channels
Left Web 5 0 L6 0 23
Right Web 5 0 L6 0 23
L7NL8N
Deterioration
Channels
Left Web 5 0 L7 0 23
Right Web 5 0 L7 0 23

Maximum Panel Forces

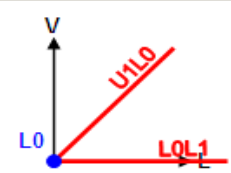
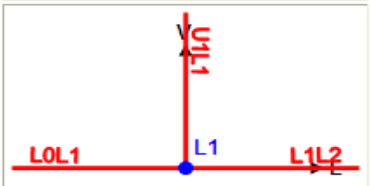
Truss Panel Point Maximum Forces

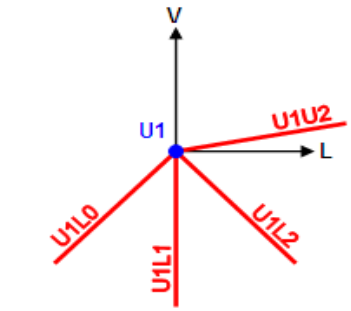
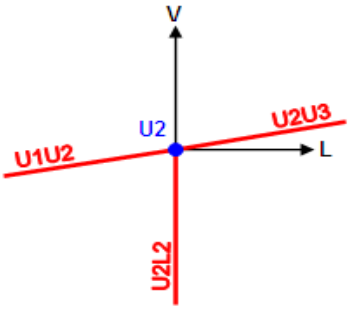
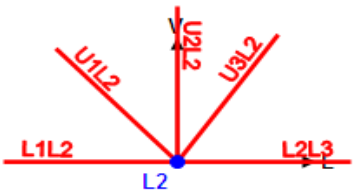
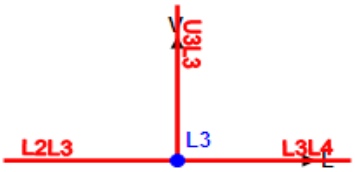
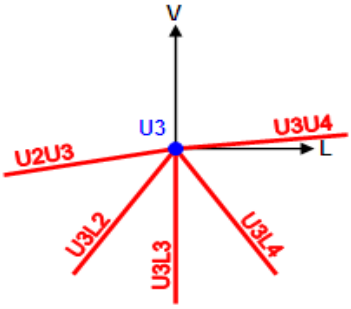
Bridge Name:	Westfield Old Bridge W-25-010
NBI Structure ID:	W2501008V
Bridge ID:	W-25-010 (08V)
Analyzed By:	Virtis
Analyze Date:	Friday, April 20, 2012 08:28:41
Analysis Engine:	AASHTO Truss LFR Engine Version 6.3.1.3001
Report By:	virtis
Report Date:	Friday, April 20, 2012 08:28:46
Report Stylesheet:	C:\Documents and Settings\All Users\Application Data\AASHTOWARE\VirtisOpis63\Xsl Files\TrussPanelPointMaxForces.xslt
Superstructure Definition Name:	Bridge1
Truss Name:	East Truss

Note:
Theta is measured from the positive longitudinal axis in counterclockwise direction.
Impact and distribution factors are included in live load forces.
Positive member force indicates member in tension. Negative member force indicates member in compression
Positive net force indicates force is acting in positive direction. Negative net force indicates force is acting in negative direction
LL Codes:
(T) Truck load controls
(L) Lane load controls

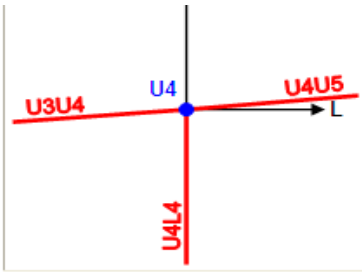
Live Load: **HS 20-44 (Design Truck and Design Lane)**

As Requested Impact:	With Impact
As Request Lane:	Multi-Lane
LL Scale Factor:	1

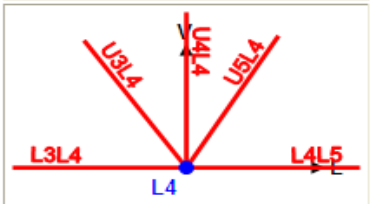
Panel Point (ft)	Member	Theta (Degrees)	DL Force (kip)	LL Force (kip) Compression	LL Force (kip) Tension	
L0 [0.00, 0.00]	L0L1	0.00	285.94	-16.57 (L)	100.39 (L)	
	U1L0	46.22	-413.26	-161.71 (L)	26.04 (L)	
	Net Longitudinal Force:		-0.00	128.45		
	Net Vertical Force:		298.37	116.75		
L1 [23.00, 0.00]	L0L1	180.00	285.94	-16.57 (L)	100.39 (L)	
	L1L2	0.00	285.94	-16.57 (L)	100.39 (L)	
	U1L1	90.00	112.19		94.29 (T)	
	Net Longitudinal Force:		0.00	116.96		

	Net Vertical Force:		-112.19	-94.29		
U1 [23.00, 24.00]	U1U2	9.87	-396.05	-144.59 (L)	28.83 (L)	
	U1L0	226.22	-413.26	-161.71 (L)	26.04 (L)	
	U1L2	313.78	150.69	-36.26 (L)	84.84 (L)	
	U1L1	270.00	112.19		94.29 (T)	
	Net Longitudinal Force:		-0.00	-198.99		
	Net Vertical Force:		-9.52	199.12		
U2 [46.00, 28.00]	U1U2	189.87	-396.05	-144.59 (L)	28.83 (L)	
	U2U3	9.87	-396.05	-144.59 (L)	28.83 (L)	
	U2L2	270.00	-6.84			
	Net Longitudinal Force:		-0.00	-170.86		
	Net Vertical Force:		-6.84	29.71		
L2 [46.00, 0.00]	L1L2	180.00	285.94	-16.57 (L)	100.39 (L)	
	L2L3	0.00	380.23	-37.28 (L)	148.08 (L)	
	U1L2	133.78	150.69	-36.26 (L)	84.84 (L)	
	U3L2	54.29	17.07	-55.70 (T)	63.93 (T)	
	U2L2	90.00	-6.84			
	Net Longitudinal Force:		0.00	228.87		
	Net Vertical Force:		-115.81	-113.16		
L3 [69.00, 0.00]	L2L3	180.00	380.23	-37.28 (L)	148.08 (L)	
	L3L4	0.00	380.23	-37.28 (L)	148.08 (L)	
	U3L3	90.00	112.84		94.29 (T)	
	Net Longitudinal Force:		0.00	185.35		
	Net Vertical Force:		-112.84	-94.29		
U3 [69.00, 32.00]	U2U3	189.87	-396.05	-144.59 (L)	28.83 (L)	
	U3U4	4.97	-313.45	-139.04 (L)	46.96 (L)	
	U3L2	234.29	17.07	-55.70 (T)	63.93 (T)	
	U3L4	305.71	-116.45	-74.72 (L)	43.82 (T)	
	U3L3	270.00	112.84		94.29 (T)	
	Net Longitudinal Force:		-0.00	247.84		
	Net Vertical Force:		-8.56	198.76		
	U3U4	184.97	-313.45	-139.04 (L)	46.96 (L)	V

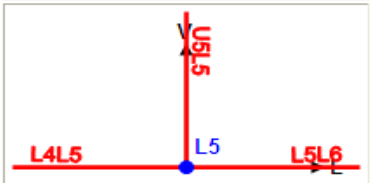
U4 [92.00, 34.00]	U4U5	4.97	-313.45	-139.04 (L)	46.96 (L)
	U4L4	270.00	-5.63		
	Net Longitudinal Force:		-0.00	-185.29	
	Net Vertical Force:		-5.63	16.11	



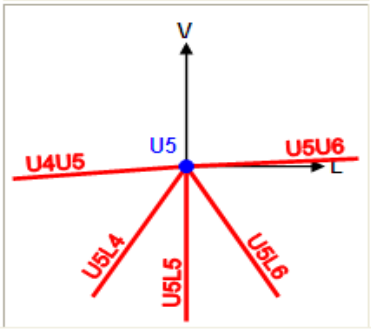
L4 [92.00, 0.00]	L3L4	180.00	380.23	-37.28 (L)	148.08 (L)
	L4L5	0.00	173.22	-55.23 (L)	108.59 (L)
	U3L4	125.71	-116.45	-74.72 (L)	43.82 (T)
	U5L4	57.43	258.28	-28.37 (T)	103.16 (L)
	U4L4	90.00	-5.63		
	Net Longitudinal Force:		-0.00	-245.01	
	Net Vertical Force:		-117.46	-122.51	



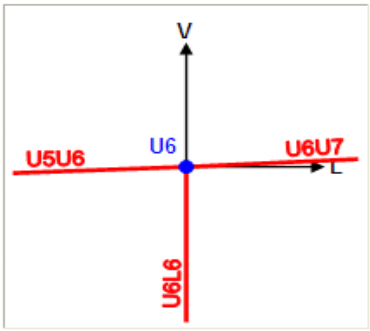
L5 [115.00, 0.00]	L4L5	180.00	173.22	-55.23 (L)	108.59 (L)
	L5L6	0.00	173.22	-55.23 (L)	108.59 (L)
	U5L5	90.00	111.42		94.29 (T)
	Net Longitudinal Force:		0.00	163.81	
	Net Vertical Force:		-111.42	-94.29	



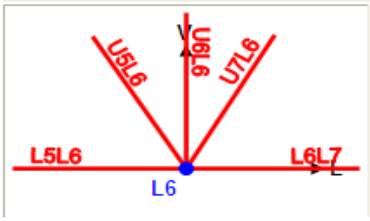
U5 [115.00, 36.00]	U4U5	184.97	-313.45	-139.04 (L)	46.96 (L)
	U5U6	2.49	25.83	-67.67 (T)	64.54 (L)
	U5L4	237.43	258.28	-28.37 (T)	103.16 (L)
	U5L6	302.57	-369.66	-124.69 (L)	18.07 (T)
	U5L5	270.00	111.42		94.29 (T)
	Net Longitudinal Force:		0.00	237.05	
	Net Vertical Force:		-10.72	203.45	



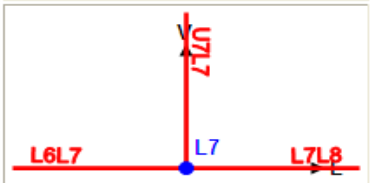
U6 [138.00, 37.00]	U5U6	182.49	25.83	-67.67 (T)	64.54 (L)
	U6U7	2.49	25.83	-67.67 (T)	64.54 (L)
	U6L6	270.00	-5.78		
	Net Longitudinal Force:		-0.00	132.08	
	Net Vertical Force:		-5.78	5.74	

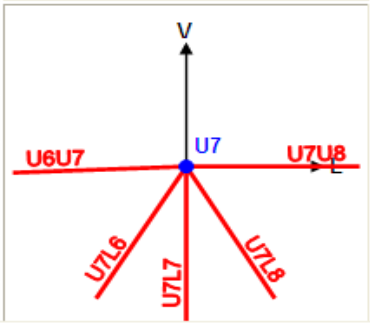


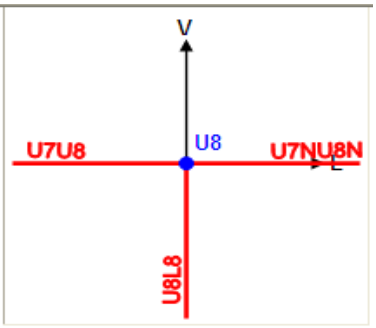
L6 [138.00, 0.00]	L5L6	180.00	173.22	-55.23 (L)	108.59 (L)
	L6L7	0.00	-291.37	-91.74 (L)	29.68 (T)
	U5L6	122.57	-369.66	-124.69 (L)	18.07 (T)
	U7L6	58.82	512.87	-6.23 (T)	156.28 (L)
	U6L6	90.00	-5.78		

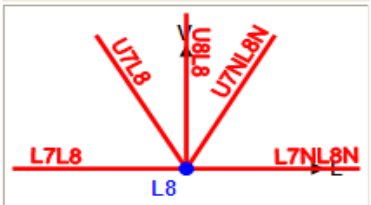


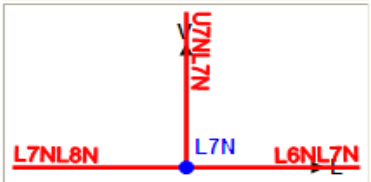
	Net Longitudinal Force:		-0.00	-232.97	
	Net Vertical Force:		-121.46	-148.93	
L7 [161.00, 0.00]	L6L7	180.00	-291.37	-91.74 (L)	29.68 (T)
	L7L8	0.00	-291.37	-91.74 (L)	29.68 (T)
	U7L7	90.00	111.56		94.29 (T)
	Net Longitudinal Force:		0.00	121.42	
	Net Vertical Force:		-111.56	-94.29	
U7 [161.00, 38.00]	U6U7	182.49	25.83	-67.67 (T)	64.54 (L)
	U7U8	0.00	634.88		167.42 (L)
	U7L6	238.82	512.87	-6.23 (T)	156.28 (L)
	U7L8	301.18	-663.40	-189.65 (L)	
	U7L7	270.00	111.56		94.29 (T)
	Net Longitudinal Force:		0.00	-140.05	
	Net Vertical Force:		-16.10	-76.22	
U8 [184.00, 38.00]	U7U8	180.00	634.88		167.42 (L)
	U8L8	270.00	-5.34		
	U7NU8N	0.00	634.88		167.42 (L)
	Net Longitudinal Force:		0.00	0.00	
	Net Vertical Force:		-5.34	0.00	
L8 [184.00, 0.00]	L7L8	180.00	-291.37	-91.74 (L)	29.68 (T)
	U7L8	121.18	-663.40	-189.65 (L)	
	U8L8	90.00	-5.34		
	L7NL8N	0.00	-291.27	-91.74 (L)	29.68 (T)
	U7NL8N	58.82	-663.60	-189.65 (L)	
	Net Longitudinal Force:		-0.00	-121.42	
	Net Vertical Force:		1140.59	324.49	
L7N [207.00, 0.00]	L6NL7N	0.00	-291.27	-91.74 (L)	29.68 (T)
	L7NL8N	180.00	-291.27	-91.74 (L)	29.68 (T)
	U7NL7N	90.00	112.34		94.29 (T)
	Net Longitudinal Force:		0.00	-121.42	
	Net Vertical Force:		-112.34	-94.29	
	U6NU7N	357.51	26.11	-67.67 (T)	64.54 (L)



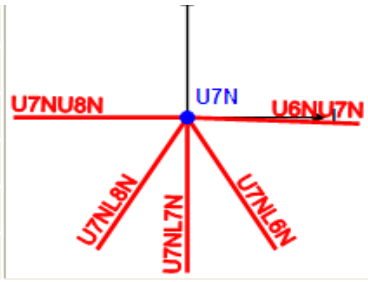




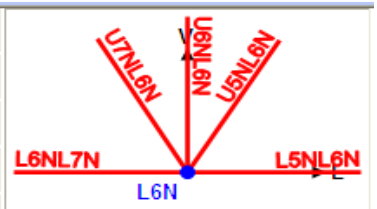




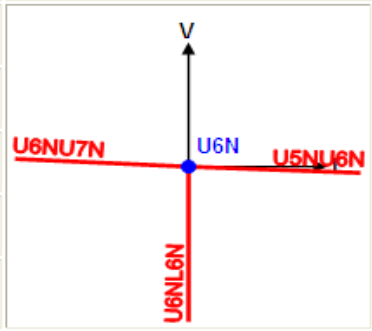
U7N [207.00, 38.00]	U7NU8N	180.00	634.88		167.42 (L)
	U7NL6N	301.18	512.14	-6.23 (T)	156.28 (L)
	U7NL8N	238.82	-663.60	-189.65 (L)	
	U7NL7N	270.00	112.34		94.29 (T)
	Net Longitudinal Force:		-0.00	140.05	
	Net Vertical Force:		-16.10	-76.22	



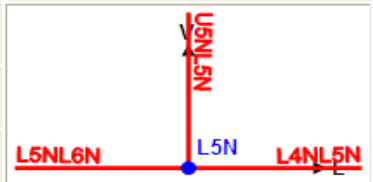
L6N [230.00, 0.00]	L5NL6N	0.00	174.11	-55.23 (L)	108.59 (L)
	L6NL7N	180.00	-291.27	-91.74 (L)	29.68 (T)
	U5NL6N	57.43	-371.84	-124.69 (L)	18.07 (T)
	U7NL6N	121.18	512.14	-6.23 (T)	156.28 (L)
	U6NL6N	90.00	-5.78		
	Net Longitudinal Force:		0.00	232.97	
	Net Vertical Force:		-119.00	-148.93	



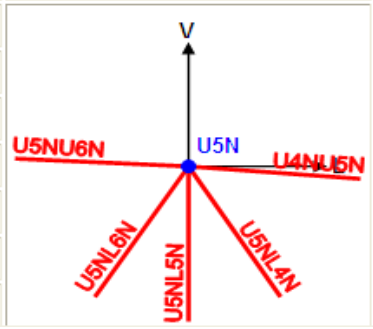
U6N [230.00, 37.00]	U5NU6N	357.51	26.11	-67.67 (T)	64.54 (L)
	U6NU7N	177.51	26.11	-67.67 (T)	64.54 (L)
	U6NL6N	270.00	-5.78		
	Net Longitudinal Force:		-0.00	132.08	
	Net Vertical Force:		-5.78	-5.74	



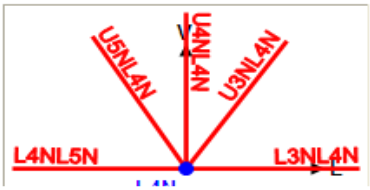
L5N [253.00, 0.00]	L4NL5N	0.00	174.11	-55.23 (L)	108.59 (L)
	L5NL6N	180.00	174.11	-55.23 (L)	108.59 (L)
	U5NL5N	90.00	113.97		94.29 (T)
	Net Longitudinal Force:		0.00	-163.81	
	Net Vertical Force:		-113.97	-94.29	

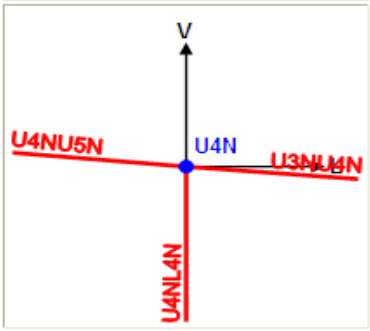
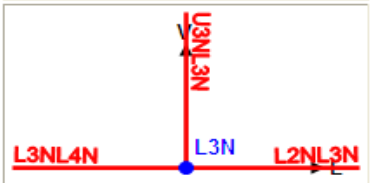
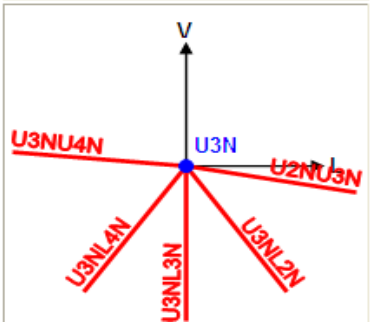
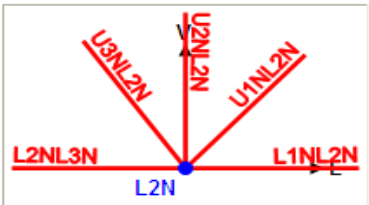
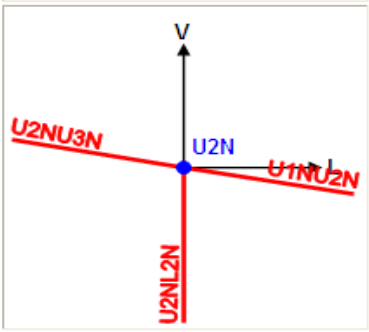


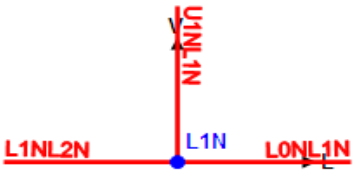
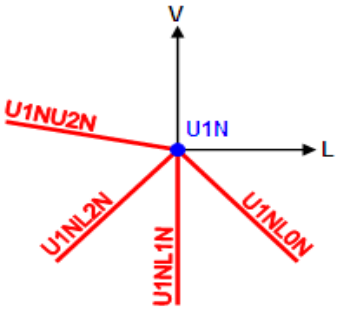
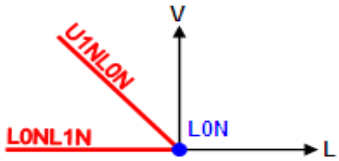
U5N [253.00, 36.00]	U4NU5N	355.03	-313.91	-139.04 (L)	46.96 (L)
	U5NU6N	177.51	26.11	-67.67 (T)	64.54 (L)
	U5NL4N	302.57	257.49	-28.37 (T)	103.16 (L)
	U5NL6N	237.43	-371.84	-124.69 (L)	18.07 (T)
	U5NL5N	270.00	113.97		94.29 (T)
	Net Longitudinal Force:		-0.00	-237.05	
	Net Vertical Force:		-10.72	203.45	



L4N	L3NL4N	0.00	380.74	-37.28 (L)	148.08 (L)
	L4NL5N	180.00	174.11	-55.23 (L)	108.59 (L)
	U3NL4N	54.29	-116.53	-74.72 (L)	43.82 (T)
	U5NL4N	122.57	257.49	-28.37 (T)	103.16 (L)



[276.00, 0.00]	U4NL4N	90.00	-5.63			L4N
	Net Longitudinal Force:		0.00	245.01		
	Net Vertical Force:		-116.73	-122.51		
U4N [276.00, 34.00]	U3NU4N	355.03	-313.91	-139.04 (L)	46.96 (L)	
	U4NU5N	175.03	-313.91	-139.04 (L)	46.96 (L)	
	U4NL4N	270.00	-5.63			
	Net Longitudinal Force:		0.00	-185.29		
	Net Vertical Force:		-5.63	-16.11		
L3N [299.00, 0.00]	L2NL3N	0.00	380.74	-37.28 (L)	148.08 (L)	
	L3NL4N	180.00	380.74	-37.28 (L)	148.08 (L)	
	U3NL3N	90.00	114.10		94.29 (T)	
	Net Longitudinal Force:		0.00	-185.35		
	Net Vertical Force:		-114.10	-94.29		
U3N [299.00, 32.00]	U2NU3N	350.13	-395.61	-144.59 (L)	28.83 (L)	
	U3NU4N	175.03	-313.91	-139.04 (L)	46.96 (L)	
	U3NL2N	305.71	15.46	-55.70 (T)	63.93 (T)	
	U3NL4N	234.29	-116.53	-74.72 (L)	43.82 (T)	
	U3NL3N	270.00	114.10		94.29 (T)	
	Net Longitudinal Force:		-0.00	-247.84		
	Net Vertical Force:		-8.56	198.76		
L2N [322.00, 0.00]	L1NL2N	0.00	286.57	-16.57 (L)	100.39 (L)	
	L2NL3N	180.00	380.74	-37.28 (L)	148.08 (L)	
	U1NL2N	46.22	149.15	-36.26 (L)	84.84 (L)	
	U3NL2N	125.71	15.46	-55.70 (T)	63.93 (T)	
	U2NL2N	90.00	-6.84			
	Net Longitudinal Force:		0.00	-228.87		
	Net Vertical Force:		-113.39	-113.16		
U2N [322.00, 28.00]	U1NU2N	350.13	-395.61	-144.59 (L)	28.83 (L)	
	U2NU3N	170.13	-395.61	-144.59 (L)	28.83 (L)	
	U2NL2N	270.00	-6.84			
	Net Longitudinal Force:		-0.00	170.86		
	Net Vertical Force:		-6.84	-29.71		

L1N [345.00, 0.00]	L0NL1N	0.00	286.57	-16.57 (L)	100.39 (L)	
	L1NL2N	180.00	286.57	-16.57 (L)	100.39 (L)	
	U1NL1N	90.00	114.03		94.29 (T)	
	Net Longitudinal Force:		-0.00	-116.96		
	Net Vertical Force:		-114.03	-94.29		
U1N [345.00, 24.00]	U1NU2N	170.13	-395.61	-144.59 (L)	28.83 (L)	
	U1NL0N	313.78	-414.17	-161.71 (L)	26.04 (L)	
	U1NL2N	226.22	149.15	-36.26 (L)	84.84 (L)	
	U1NL1N	270.00	114.03		94.29 (T)	
	Net Longitudinal Force:		0.00	198.99		
	Net Vertical Force:		-9.52	199.12		
L0N [368.00, 0.00]	L0NL1N	180.00	286.57	-16.57 (L)	100.39 (L)	
	U1NL0N	133.78	-414.17	-161.71 (L)	26.04 (L)	
	Net Longitudinal Force:		-0.00	-128.45		
	Net Vertical Force:		299.02	116.75		

STAAD.PRO MODELS & RESULTS

SIDEWALK DECK

Job Information

	Engineer	Checked	Approved
Name:			
Date:	06-Jun-12		

Structure Type	SPACE FRAME

Number of Nodes	4557	Highest Node	4993
Number of Plates	4416	Highest Plate	4892

Number of Basic Load Cases	1
Number of Combination Load Cases	0

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

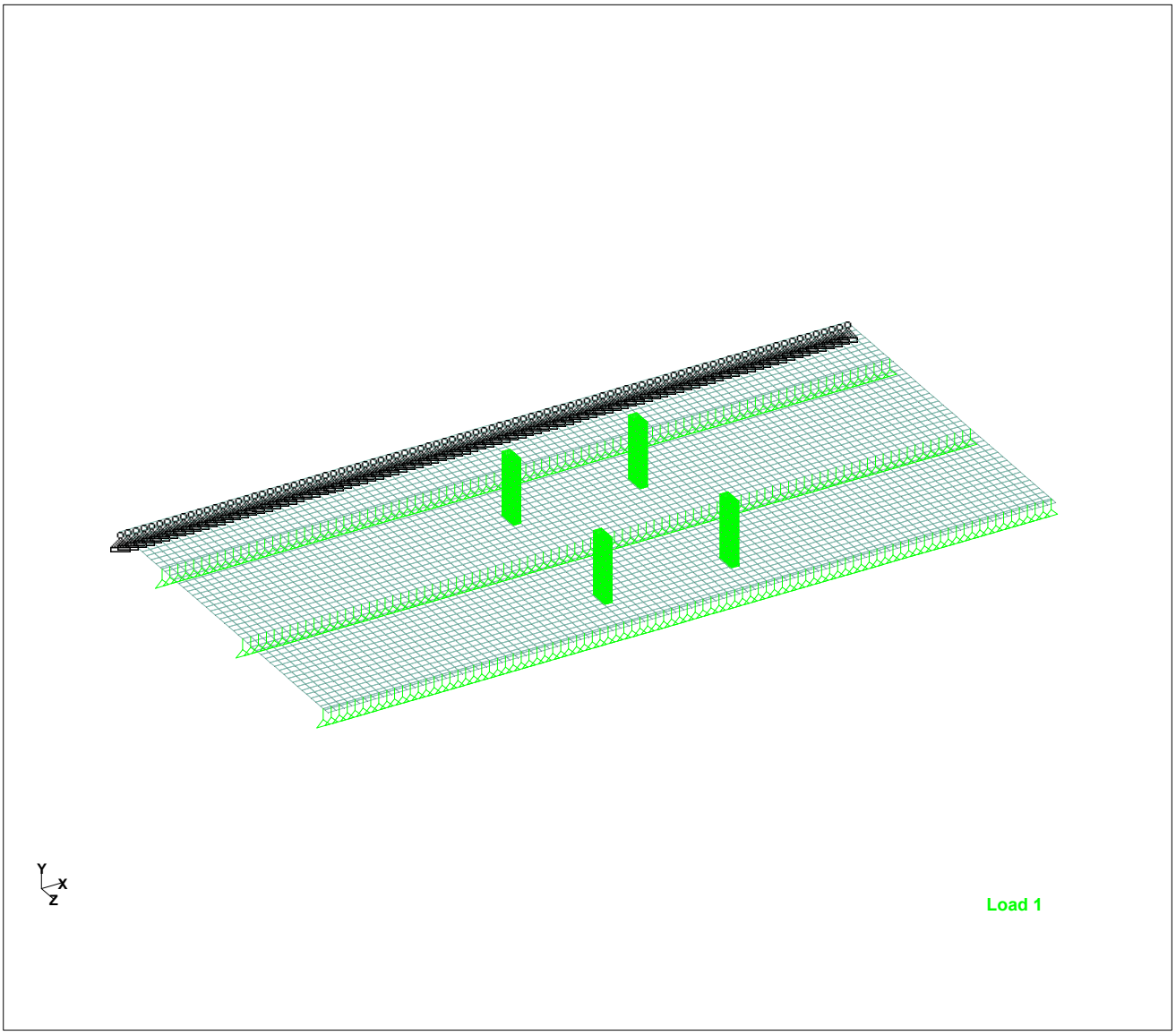
Type	L/C	Name
Primary	1	SNOW REMOVAL TRUCK

Materials

Mat	Name	E (kip/in^2)	ν	Density (kip/in^3)	α (/°F)
1	STEEL	29E+3	0.300	0.000	6.5E -6
2	STAINLESSSTEEL	28E+3	0.300	0.000	9.9E -6
3	ALUMINUM	10E+3	0.330	0.000	12.8E -6
4	CONCRETE	3.15E+3	0.170	0.000	5E -6

Basic Load Cases

Number	Name
1	SNOW REMOVAL TRUCK



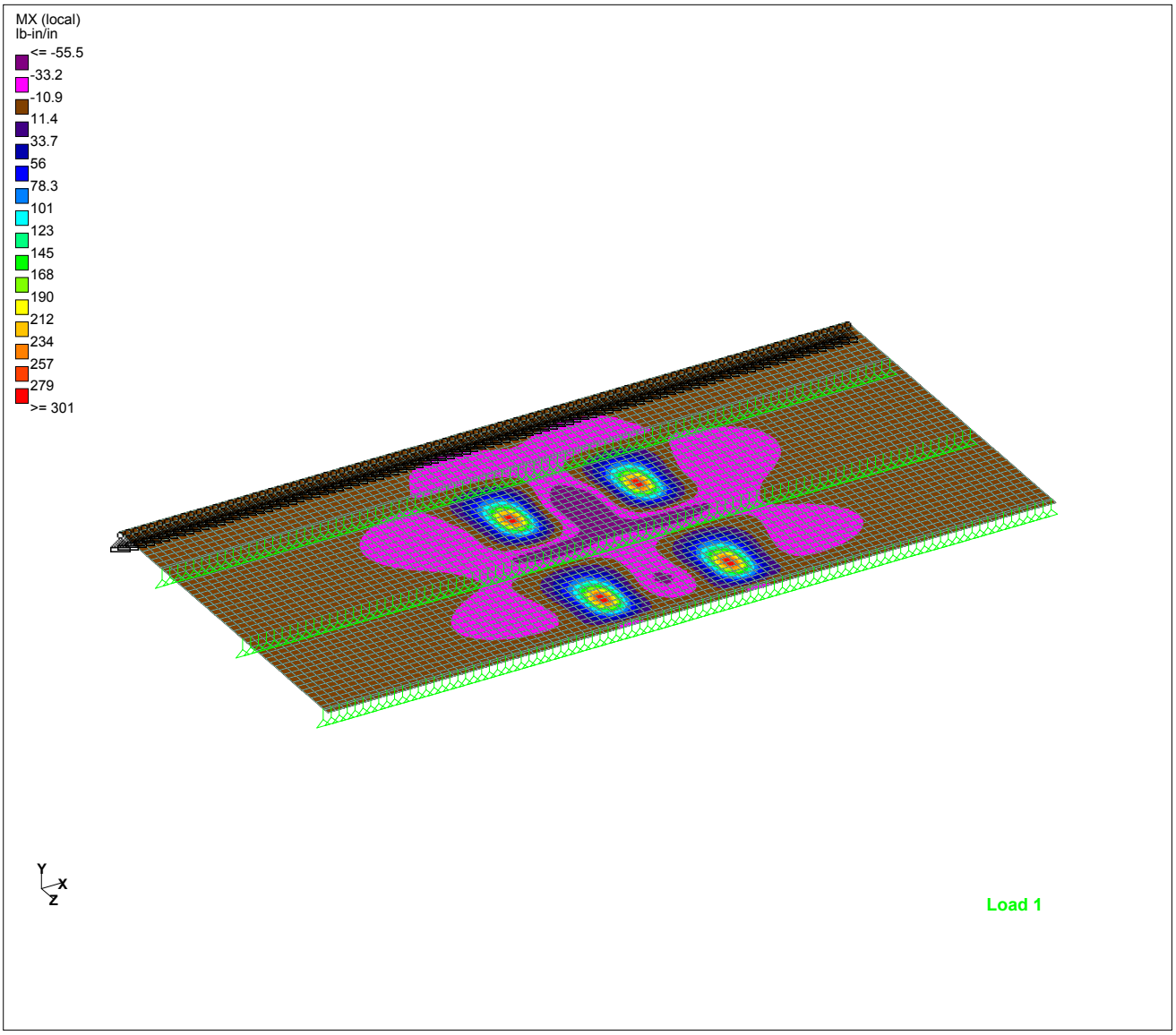
Whole Structure

Plate Centre Stress Summary

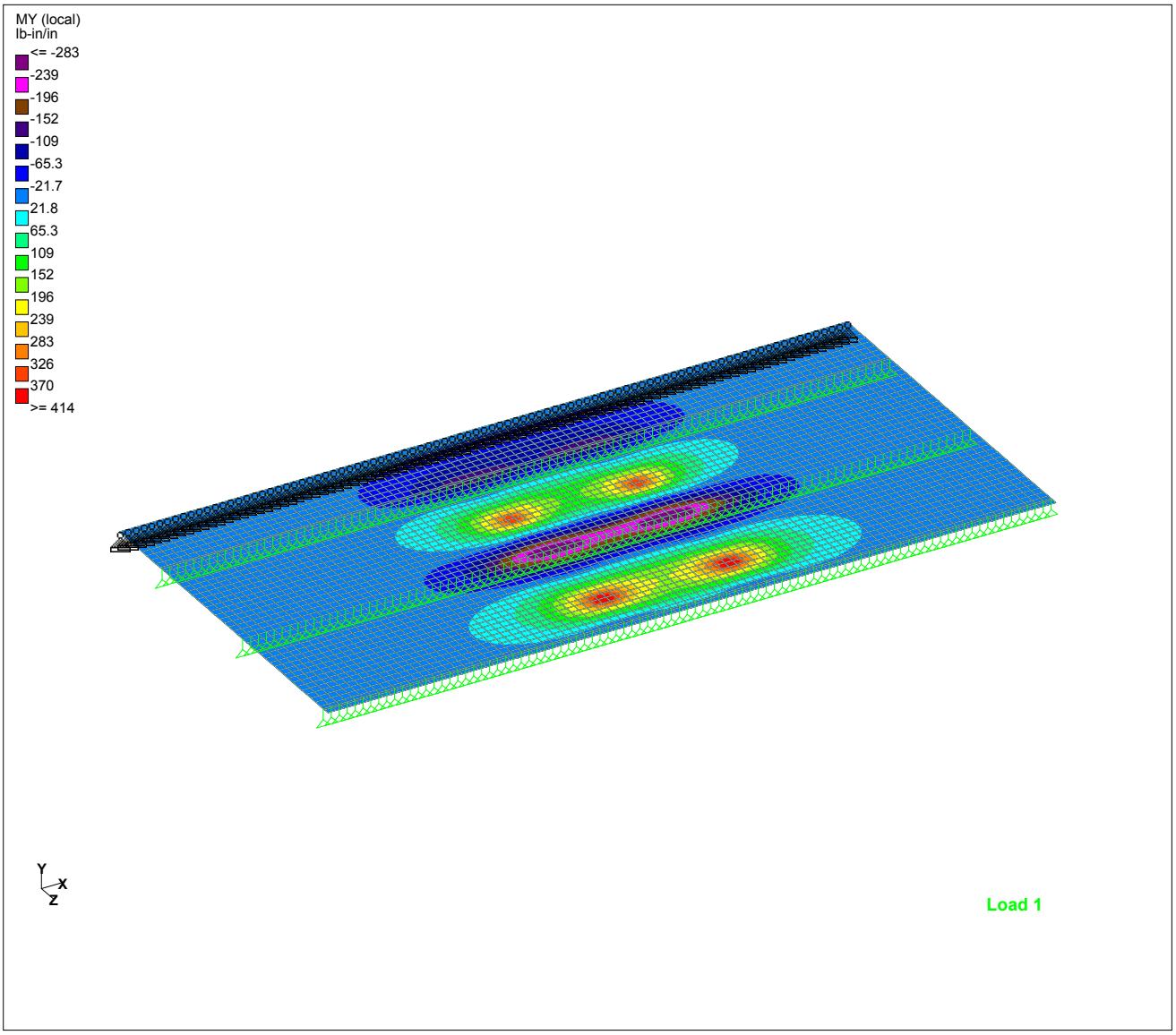
			Shear		Membrane			Bending		
	Plate	L/C	Qx (psi)	Qy (psi)	Sx (psi)	Sy (psi)	Sxy (psi)	Mx (lb-in/in)	My (lb-in/in)	Mxy (lb-in/in)
Max Qx	4138	1:SNOW REM(	**38.263**	-5.184	0.000	0.000	0.000	256.268	422.496	18.387
Min Qx	4156	1:SNOW REM(	**-38.263**	-5.184	0.000	0.000	0.000	256.267	422.497	-18.387
Max Qy	3955	1:SNOW REM(	-0.362	**32.655**	0.000	0.000	0.000	257.507	310.616	1.206
Min Qy	2255	1:SNOW REM(	0.046	**-37.659**	0.000	0.000	0.000	289.532	310.376	-8.656
Max Sx	101	1:SNOW REM(	0.001	0.012	**0.000**	0.000	0.000	0.006	0.030	0.013
Min Sx	101	1:SNOW REM(	0.001	0.012	**0.000**	0.000	0.000	0.006	0.030	0.013
Max Sy	101	1:SNOW REM(	0.001	0.012	0.000	**0.000**	0.000	0.006	0.030	0.013
Min Sy	101	1:SNOW REM(	0.001	0.012	0.000	**0.000**	0.000	0.006	0.030	0.013
Max Sxy	101	1:SNOW REM(	0.001	0.012	0.000	0.000	**0.000**	0.006	0.030	0.013
Min Sxy	101	1:SNOW REM(	0.001	0.012	0.000	0.000	**0.000**	0.006	0.030	0.013
Max Mx	4139	1:SNOW REM(	0.415	-6.693	0.000	0.000	0.000	**339.492**	463.668	7.322
Min Mx	2247	1:SNOW REM(	-0.000	-4.953	0.000	0.000	0.000	**-62.950**	128.092	-0.000
Max My	4155	1:SNOW REM(	-0.415	-6.693	0.000	0.000	0.000	339.492	**463.668**	-7.322
Min My	2954	1:SNOW REM(	-0.723	12.666	0.000	0.000	0.000	-55.805	**-321.935**	3.750
Max Mxy	4535	1:SNOW REM(	1.412	-9.327	0.000	0.000	0.000	10.817	59.929	**100.042**
Min Mxy	4559	1:SNOW REM(	-1.412	-9.327	0.000	0.000	0.000	10.816	59.929	**-100.041**

Plate Centre Principal Stress Summary

			Principal		Von Mis		Tresca	
	Plate	L/C	Top (psi)	Bottom (psi)	Top (psi)	Bottom (psi)	Top (psi)	Bottom (psi)
Max (t)	4155	1:SNOW REM(	**696.148**	-508.593	623.885	623.885	696.148	696.148
Max (b)	4139	1:SNOW REM(	696.147	**-508.593**	623.885	623.885	696.147	696.147
Max VM (t)	4155	1:SNOW REM(	696.148	-508.593	**623.885**	623.885	696.148	696.148
Max VM (b)	4155	1:SNOW REM(	696.148	-508.593	623.885	**623.885**	696.148	696.148
Tresca (t)	4155	1:SNOW REM(	696.148	-508.593	623.885	623.885	**696.148**	696.148
Tresca (b)	4155	1:SNOW REM(	696.148	-508.593	623.885	623.885	696.148	**696.148**



Whole Structure



Whole Structure

PEDESTRIAN LOAD ON TRUSS

Job Information

	Engineer	Checked	Approved
Name:			
Date:	5-Apr-12		

Structure Type	SPACE FRAME

Number of Nodes	32	Highest Node	215
Number of Elements	61	Highest Beam	415

Number of Basic Load Cases	1
Number of Combination Load Cases	0

Included in this printout are data for:

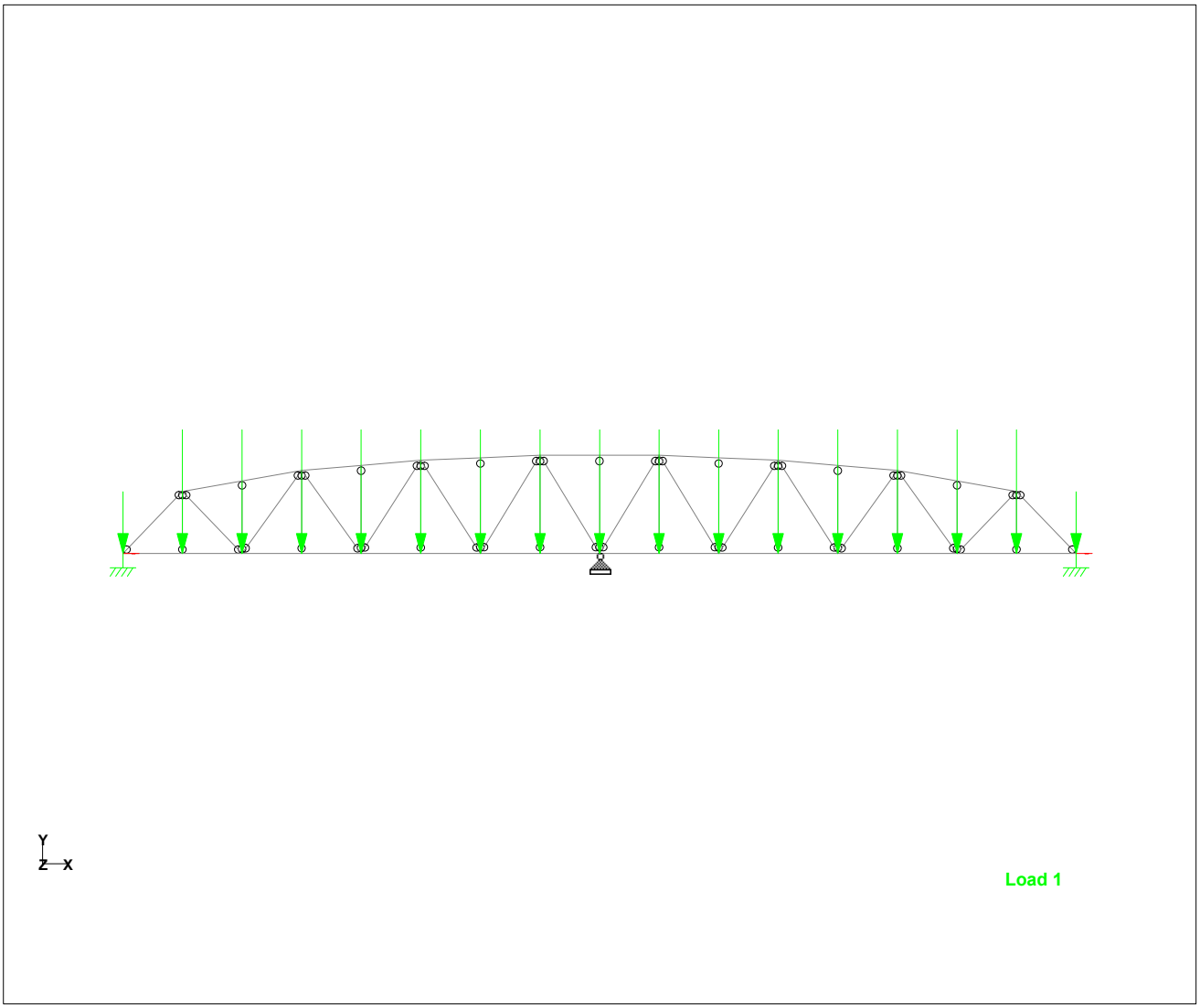
All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	PEDESTRIAN LOAD

Basic Load Cases

Number	Name
1	PEDESTRIAN LOAD



Whole Structure Loads 0.200608kip:1ft 1 PEDESTRIAN LOAD

Beam End Forces

Sign convention is as the action of the joint on the beam.

			Axial	Shear		Torsion	Bending	
Beam	Node	L/C	Fx (kip)	Fy (kip)	Fz (kip)	Mx (kip-in)	My (kip-in)	Mz (kip-in)
100	100	1:PEDESTRIAI	-23.240	0.200	0.000	0.000	0.000	0.000
	101	1:PEDESTRIAI	23.240	-0.200	0.000	0.000	0.000	55.100
101	101	1:PEDESTRIAI	-23.240	-0.179	0.000	0.000	0.000	-55.100
	102	1:PEDESTRIAI	23.240	0.179	0.000	0.000	0.000	5.765
102	102	1:PEDESTRIAI	-31.882	0.145	0.000	0.000	0.000	-5.765
	103	1:PEDESTRIAI	31.882	-0.145	0.000	0.000	0.000	45.758
103	103	1:PEDESTRIAI	-31.882	-0.167	0.000	0.000	0.000	-45.758
	104	1:PEDESTRIAI	31.882	0.167	0.000	0.000	0.000	-0.215
104	104	1:PEDESTRIAI	-16.710	0.154	0.000	0.000	0.000	0.215
	105	1:PEDESTRIAI	16.710	-0.154	0.000	0.000	0.000	42.258
105	105	1:PEDESTRIAI	-16.710	-0.236	0.000	0.000	0.000	-42.258
	106	1:PEDESTRIAI	16.710	0.236	0.000	0.000	0.000	-22.756
106	106	1:PEDESTRIAI	18.520	0.317	0.000	0.000	0.000	22.756
	107	1:PEDESTRIAI	-18.520	-0.317	0.000	0.000	0.000	64.812
107	107	1:PEDESTRIAI	18.520	-0.925	0.000	0.000	0.000	-64.812
	108	1:PEDESTRIAI	-18.520	0.925	0.000	0.000	0.000	-190.622
108	108	1:PEDESTRIAI	18.520	0.925	0.000	0.000	0.000	190.622
	109	1:PEDESTRIAI	-18.520	-0.925	0.000	0.000	0.000	64.812
109	109	1:PEDESTRIAI	18.520	-0.317	0.000	0.000	0.000	-64.812
	110	1:PEDESTRIAI	-18.520	0.317	0.000	0.000	0.000	-22.756
110	110	1:PEDESTRIAI	-16.710	0.236	0.000	0.000	0.000	22.756
	111	1:PEDESTRIAI	16.710	-0.236	0.000	0.000	0.000	42.258
111	111	1:PEDESTRIAI	-16.710	-0.154	0.000	0.000	0.000	-42.258
	112	1:PEDESTRIAI	16.710	0.154	0.000	0.000	0.000	-0.215
112	112	1:PEDESTRIAI	-31.882	0.167	0.000	0.000	0.000	0.215
	113	1:PEDESTRIAI	31.882	-0.167	0.000	0.000	0.000	45.758
113	113	1:PEDESTRIAI	-31.882	-0.145	0.000	0.000	0.000	-45.758
	114	1:PEDESTRIAI	31.882	0.145	0.000	0.000	0.000	5.765
114	114	1:PEDESTRIAI	-23.240	0.179	0.000	0.000	0.000	-5.765
	115	1:PEDESTRIAI	23.240	-0.179	0.000	0.000	0.000	55.100
115	115	1:PEDESTRIAI	-23.240	-0.200	0.000	0.000	0.000	-55.100
	116	1:PEDESTRIAI	23.240	0.200	0.000	0.000	0.000	-0.000
201	201	1:PEDESTRIAI	32.667	0.134	0.000	0.000	0.000	-0.000
	202	1:PEDESTRIAI	-32.667	-0.134	0.000	0.000	0.000	37.581
202	202	1:PEDESTRIAI	32.630	-0.079	0.000	0.000	0.000	-37.581
	203	1:PEDESTRIAI	-32.630	0.079	0.000	0.000	0.000	15.335
203	203	1:PEDESTRIAI	27.270	0.049	0.000	0.000	0.000	-15.335
	204	1:PEDESTRIAI	-27.270	-0.049	0.000	0.000	0.000	28.971
204	204	1:PEDESTRIAI	27.260	-0.064	0.000	0.000	0.000	-28.971
	205	1:PEDESTRIAI	-27.260	0.064	0.000	0.000	0.000	11.150
205	205	1:PEDESTRIAI	1.805	-0.013	0.000	0.000	0.000	-11.150
	206	1:PEDESTRIAI	-1.805	0.013	0.000	0.000	0.000	7.600
206	206	1:PEDESTRIAI	1.810	0.094	0.000	0.000	0.000	-7.600

Beam End Forces Cont...

			Axial	Shear		Torsion	Bending	
Beam	Node	L/C	Fx (kip)	Fy (kip)	Fz (kip)	Mx (kip-in)	My (kip-in)	Mz (kip-in)
	207	1:PEDESTRIAI	-1.810	-0.094	0.000	0.000	0.000	33.492
207	207	1:PEDESTRIAI	-43.373	-0.695	0.000	0.000	0.000	-33.492
	208	1:PEDESTRIAI	43.373	0.695	0.000	0.000	0.000	-158.244
208	208	1:PEDESTRIAI	-43.373	0.695	0.000	0.000	0.000	158.244
	209	1:PEDESTRIAI	43.373	-0.695	0.000	0.000	0.000	33.492
209	209	1:PEDESTRIAI	1.810	-0.094	0.000	0.000	0.000	-33.492
	210	1:PEDESTRIAI	-1.810	0.094	0.000	0.000	0.000	7.600
210	210	1:PEDESTRIAI	1.805	0.013	0.000	0.000	0.000	-7.600
	211	1:PEDESTRIAI	-1.805	-0.013	0.000	0.000	0.000	11.150
211	211	1:PEDESTRIAI	27.260	0.064	0.000	0.000	0.000	-11.150
	212	1:PEDESTRIAI	-27.260	-0.064	0.000	0.000	0.000	28.971
212	212	1:PEDESTRIAI	27.270	-0.049	0.000	0.000	0.000	-28.971
	213	1:PEDESTRIAI	-27.270	0.049	0.000	0.000	0.000	15.335
213	213	1:PEDESTRIAI	32.630	0.079	0.000	0.000	0.000	-15.335
	214	1:PEDESTRIAI	-32.630	-0.079	0.000	0.000	0.000	37.581
214	214	1:PEDESTRIAI	32.667	-0.134	0.000	0.000	0.000	-37.581
	215	1:PEDESTRIAI	-32.667	0.134	0.000	0.000	0.000	-0.000
301	101	1:PEDESTRIAI	-9.212	0.000	0.000	0.000	0.000	0.000
	201	1:PEDESTRIAI	9.212	-0.000	0.000	0.000	0.000	0.000
302	102	1:PEDESTRIAI	-0.217	0.000	0.000	0.000	0.000	0.000
	202	1:PEDESTRIAI	0.217	-0.000	0.000	0.000	0.000	0.000
303	103	1:PEDESTRIAI	-9.279	0.000	0.000	0.000	0.000	0.000
	203	1:PEDESTRIAI	9.279	-0.000	0.000	0.000	0.000	0.000
304	104	1:PEDESTRIAI	-0.114	0.000	0.000	0.000	0.000	0.000
	204	1:PEDESTRIAI	0.114	-0.000	0.000	0.000	0.000	0.000
305	105	1:PEDESTRIAI	-9.201	-0.000	0.000	0.000	0.000	0.000
	205	1:PEDESTRIAI	9.201	0.000	0.000	0.000	0.000	0.000
306	106	1:PEDESTRIAI	0.107	0.000	0.000	0.000	0.000	0.000
	206	1:PEDESTRIAI	-0.107	-0.000	0.000	0.000	0.000	0.000
307	107	1:PEDESTRIAI	-8.347	0.000	0.000	0.000	0.000	0.000
	207	1:PEDESTRIAI	8.347	-0.000	0.000	0.000	0.000	0.000
308	108	1:PEDESTRIAI	1.389	0.000	0.000	0.000	0.000	0.000
	208	1:PEDESTRIAI	-1.389	-0.000	0.000	0.000	0.000	0.000
309	109	1:PEDESTRIAI	-8.347	-0.000	0.000	0.000	0.000	0.000
	209	1:PEDESTRIAI	8.347	0.000	0.000	0.000	0.000	0.000
310	110	1:PEDESTRIAI	0.107	-0.000	0.000	0.000	0.000	0.000
	210	1:PEDESTRIAI	-0.107	0.000	0.000	0.000	0.000	0.000
311	111	1:PEDESTRIAI	-9.201	0.000	0.000	0.000	0.000	0.000
	211	1:PEDESTRIAI	9.201	-0.000	0.000	0.000	0.000	0.000
312	112	1:PEDESTRIAI	-0.114	-0.000	0.000	0.000	0.000	0.000
	212	1:PEDESTRIAI	0.114	0.000	0.000	0.000	0.000	0.000
313	113	1:PEDESTRIAI	-9.279	-0.000	0.000	0.000	0.000	0.000
	213	1:PEDESTRIAI	9.279	0.000	0.000	0.000	0.000	0.000
314	114	1:PEDESTRIAI	-0.217	-0.000	0.000	0.000	0.000	0.000

Beam End Forces Cont...

			Axial	Shear		Torsion	Bending	
Beam	Node	L/C	Fx (kip)	Fy (kip)	Fz (kip)	Mx (kip-in)	My (kip-in)	Mz (kip-in)
	214	1:PEDESTRIAI	0.217	0.000	0.000	0.000	0.000	0.000
315	115	1:PEDESTRIAI	-9.212	-0.000	0.000	0.000	0.000	0.000
	215	1:PEDESTRIAI	9.212	0.000	0.000	0.000	0.000	0.000
400	100	1:PEDESTRIAI	33.588	0.000	0.000	0.000	0.000	0.000
	201	1:PEDESTRIAI	-33.588	0.000	0.000	0.000	0.000	0.000
401	201	1:PEDESTRIAI	-12.894	0.000	0.000	0.000	0.000	0.000
	102	1:PEDESTRIAI	12.894	0.000	0.000	0.000	0.000	0.000
402	102	1:PEDESTRIAI	-0.478	0.000	0.000	0.000	0.000	0.000
	203	1:PEDESTRIAI	0.478	-0.000	0.000	0.000	0.000	0.000
403	203	1:PEDESTRIAI	8.085	0.000	0.000	0.000	0.000	0.000
	104	1:PEDESTRIAI	-8.085	-0.000	0.000	0.000	0.000	0.000
404	104	1:PEDESTRIAI	-19.416	-0.000	0.000	0.000	0.000	0.000
	205	1:PEDESTRIAI	19.416	0.000	0.000	0.000	0.000	0.000
405	205	1:PEDESTRIAI	27.685	-0.000	0.000	0.000	0.000	0.000
	106	1:PEDESTRIAI	-27.685	0.000	0.000	0.000	0.000	0.000
406	106	1:PEDESTRIAI	-39.252	-0.000	0.000	0.000	0.000	0.000
	207	1:PEDESTRIAI	39.252	0.000	0.000	0.000	0.000	0.000
407	207	1:PEDESTRIAI	47.996	-0.000	0.000	0.000	0.000	0.000
	108	1:PEDESTRIAI	-47.996	0.000	0.000	0.000	0.000	0.000
408	108	1:PEDESTRIAI	47.996	0.000	0.000	0.000	0.000	0.000
	209	1:PEDESTRIAI	-47.996	-0.000	0.000	0.000	0.000	0.000
409	209	1:PEDESTRIAI	-39.252	0.000	0.000	0.000	0.000	0.000
	110	1:PEDESTRIAI	39.252	-0.000	0.000	0.000	0.000	0.000
410	110	1:PEDESTRIAI	27.685	0.000	0.000	0.000	0.000	0.000
	211	1:PEDESTRIAI	-27.685	-0.000	0.000	0.000	0.000	0.000
411	211	1:PEDESTRIAI	-19.416	0.000	0.000	0.000	0.000	0.000
	112	1:PEDESTRIAI	19.416	-0.000	0.000	0.000	0.000	0.000
412	112	1:PEDESTRIAI	8.085	-0.000	0.000	0.000	0.000	0.000
	213	1:PEDESTRIAI	-8.085	0.000	0.000	0.000	0.000	0.000
413	213	1:PEDESTRIAI	-0.478	-0.000	0.000	0.000	0.000	0.000
	114	1:PEDESTRIAI	0.478	0.000	0.000	0.000	0.000	0.000
414	114	1:PEDESTRIAI	-12.894	0.000	0.000	0.000	0.000	0.000
	215	1:PEDESTRIAI	12.894	0.000	0.000	0.000	0.000	0.000
415	215	1:PEDESTRIAI	33.588	0.000	0.000	0.000	0.000	0.000
	116	1:PEDESTRIAI	-33.588	0.000	0.000	0.000	0.000	0.000

Appendix E – Old Rating Report Reference

BRIDGE RATING

prepared for

MASSACHUSETTS HIGHWAY DEPARTMENT

WESTFIELD

North Elm Street over Westfield River

W-25-10 (08V)

020-251-034-101

COMMONWEALTH OF MASSACHUSETTS
CARL L. GOLDKNOPF
STRUCTURAL
No. 31968
REGISTERED PROFESSIONAL ENGINEER

Carl L. Goldknopf
1/10/95

October, 1994
Date of Inspection

January, 1995
Date of Rating

Submitted by:
STV GROUP
ENGINEERS AND PLANNERS
230 Congress Street, Boston Massachusetts 02110

BRIDGE EVALUATION RATING

Town-City	Location	Bridge No.	Maintenance No.
WESTFIELD	North Elm Street over Westfield River	W-25-10 (08V)	020-251-034-101

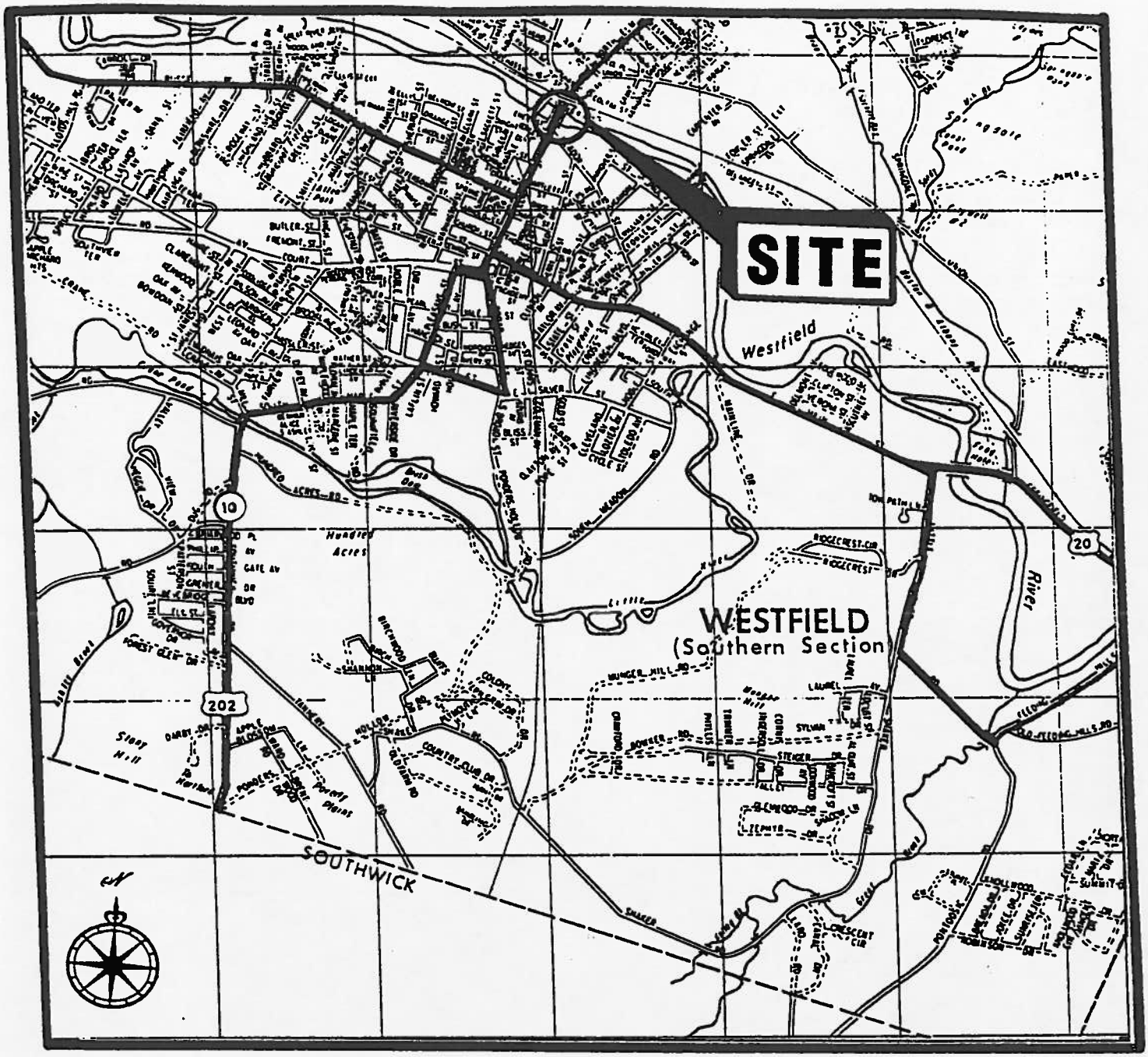
VEHICLE TYPE	INVENTORY RATING	OPERATING RATING	RECOMMENDED POSTING*
H-20	14.8	21.1	
3	26.5	37.8	
3S2	34.3	59.6	
HS-20	26.7	38.0	

RATINGS AND RECOMMENDED POSTING TONS
NOTES:

* TO BE FILLED IN BY BRIDGE ENGINEER; CONSULTANT ENGINEER'S STAMP DOES NOT APPLY TO POSTING.

COMMONWEALTH OF MASSACHUSETTS
CARL L. GOLDKNOPF
STRUCTURAL
No. 31968
REGISTERED PROFESSIONAL ENGINEER

Carl 1/10/95



LOCATION MAP

DESCRIPTION OF BRIDGE

WESTFIELD **NORTH ELM STREET OVER WESTFIELD RIVER** **W-25-10 (08V)**

The structure, built in 1938, is a two span continuous Warren through truss bridge. The structure consists of riveted steel trusses which support steel floor beams and stringers beneath a reinforced concrete deck. The two spans are symmetrical, each with a length of 184 feet (center-center of bearings) for a total bridge length of 368 feet. The bridge structure provides a 40'-0" wide roadway that carries two lanes of traffic south and one lane of traffic north on North Elm Street over the Westfield River. A 5 foot wide cantilever-supported sidewalk extends off of both the east and west trusses. The superstructure was found to be in fair condition at the time of this inspection.

The bridge deck consists of a 7 1/4" thick reinforced concrete deck covered by a 2" thick bituminous concrete wearing surface. The roadway is lined on both sides by concrete curbs. The roadway surface was in fair condition with longitudinal and transverse cracking present. The reinforced concrete sidewalk slabs are 6" thick and were also found to be in fair condition at the time of this inspection. No wearing surface exists on the sidewalk slabs. The underside of all three concrete slabs were found to be in poor condition. Transverse cracking, efflouresence and light to heavy spalling was found throughout.

Support for the deck is provided by nine 21WF59 steel stringers, except in the exterior panels which have 18WF64 steel stringers, spaced at 5'0" on center. All stringers were in fair condition with light to moderate rust throughout and light section loss in limited areas. See section "Rating Analysis Assumptions and Criteria" for description of loss assumptions.

The steel stringers are supported by 17 built-up steel floorbeams consisting of a web plate, back to back double angles for the top and bottom flanges, and top and bottom cover platés. The 15 interior floorbeams have a 36"x7/16" web plate with 6x6x13/16" angles. The 2 end floorbeams have a 27"x7/16" web plate with 6x6x3/4" angles. Two steel 13"x3/4" cover plates exist on

the top and bottom of the floorbeams. The floor beams were found to be in fair to good condition with light to moderate rust throughout.

The steel truss chords and diagonals consist of built-up channel sections, ranging from 12" to 18" deep, connected by lacing bars. The steel truss vertical members consist of 5x3-1/2x3/8" back to back double angles connected by lacing bars. They vary in height from 24' to 38' at the pier. Truss members consist of both silicon and carbon steel. Bottom chord members L2L3, L3L4, top chord members U1U2,U2U3,U3U4,U4U5,U7U8, diagonal members U1L0, U3L4, U5L4, U5L6, U7L6, U7L8 and vertical members U1L1, U3L3, U5L5, U7L7, are silicon steel. The trusses have sixteen panels spaced at 23' center to center of panel points. All truss members were found to be in good condition with light rust and paint scaling throughout.

Lateral bracing for the truss consists of angles connected at top and bottom truss panel points. All lateral bracing were found to be in fair condition with light to moderate rust present.

Support for the sidewalk deck is provided by built-up steel longitudinal stringers. These consist of a 27"x5/8" web plate and 5x3-1/2x3/8" single angles on the top and bottom. Cantilever brackets spaced at 23' provide support for the stringers. The brackets consist of steel web plates and top and bottom double angles. Both the stringers and brackets were found to be in fair condition with light to moderate rust throughout and light section loss in limited areas on the stringers.

Utilities are carried by the sidewalk on the east and west side. Twelve 4" diameter electric conduits and a 10-inch diameter water main are under the west sidewalk and six 4" diameter telephone conduits and a 12-inch diameter gas line are carried by the east sidewalk.

DESCRIPTION OF BRIDGE

WESTFIELD **NORTH ELM STREET OVER WESTFIELD RIVER** **W-25-10 (08V)**

A total of six bearings exist on the bridge, two at each abutment and center pier. Bearings at each abutment are nested roller expansion type, while fixed plate bearings exist at the pier. The bearings were found in fair condition with light to moderate rust and heavy debris surrounding them.

The abutments consist of two granite block faced concrete piers fronting the original gravity-type abutments. The original abutments are also stone faced concrete structures and are built integrally with the retaining walls that support the approaches of the bridge. The retaining wall on the south end of the bridge is part of a longer retaining wall that extends to the east that was built to function as a dike wall. The bridge center pier also consists of stone faced concrete. This center pier was widened on each side to accommodate the existing bridge. From our visual inspection, the abutment and wingwall systems appear to be in good structural condition and able to support the required loads.

RATING ANALYSIS ASSUMPTIONS AND CRITERIA

WESTFIELD **NORTH ELM STREET OVER WESTFIELD RIVER** **W-25-10 (08V)**

The October, 1994 inspections completed by STV group were the main basis for the rating of this bridge. An MHD Structures Inspection Field Report dated October 11, 1994 was also available. The STV inspection concurrs with the conditions noted in the MHD inspection report. STV made use of staging during the inspection in order to more accurately determine the condition of the underside of the bridge. The condition assumptions and rating criteria that were used in this report, based on this inspection, are described below.

Member:	Concrete Deck	50% loss of bottom rebars
	Stringers	5% section loss
	Floor Beams	5% section loss
	Truss members	5% loss

The inventory and operating capacity of the bridge was rated in accordance with the provisions of the 1989 edition of the *Manual for the Maintenance Inspection of Bridges* and the "Interim Specifications" 1984 through 1990, both published by the American Association of State Highway and Transportation Officials (AASHTO), with section 5.2.2, "Live Loads," amended as follows:

1. The outside wheel of any vehicle shall be considered as applied at a distance of not less than 2 feet from the face of any curb.
2. The spacing, center to center, of adjacent wheels of passing vehicles shall be taken as 4 feet.

The live loads used in rating will be the standard AASHTO "H20 and HS20" loading and the Type 3 and Type 3S2 units shown in Plate II of the above referenced AASHTO Manual. For both inventory and operating analysis, the live load distribution factor used was that indicated in the *Standard Specifications for Highway Bridges*, also published by AASHTO (1992), under Part C, "Distribution of Loads."

The bridge, built in 1938, was assumed to have a yield strength of 33,000 psi, for carbon steel and 45,000 psi for silicon steel. Allowable axial tensile stresses of 18,000 psi (inventory) and 24,500 (operating) were assumed for carbon steel. For silicon steel allowable axial tensile stresses of 24,500 psi (inventory) and 33,000 psi (operating) were assumed. Various allowable compressive stresses were used, reduced in accordance with Tables 5.4.2A & B of the AASHTO *Manual for Maintenance Inspection of Bridges*.

The reinforced concrete deck was assumed to have a compressive strength (f'c) equal to 3,000 psi (inventory). The reinforcing steel was assumed to have an inventory stress (fs) equal to 18,000 psi and an operating stress of 25,000 psi.

EVALUATION OF RATING AND RECOMMENDATIONS

WESTFIELD **NORTH ELM STREET OVER WESTFIELD RIVER** **W-25-10 (08V)**

The bridge rating breakdown sheet, found at the begining of this report, indicates that the reinforced concrete deck is the critical rating component, receiving H20 inventory and operating ratings of **14.8 and 21.1 tons** respectively.

Considering that the concrete deck rated below statutory limits and the present condition of the deck is poor, we recommend that the deck be replaced. We also recommend that general maintenance and inspection of the structure continue at regular intervals.

It should also be noted that two discrepancies exist between this rating and the previous rating completed in January, 1982. First, the previous rating was done with a 4-1/2" thick wearing surface on the concrete deck. The October, 1994 inspections found a 2" thick wearing surface on the concrete deck. The second is that the previous rating did not assume any losses when rating the concrete deck while this rating report did, as discussed earlier.

AVAILABLE PLANS

WESTFIELD | **NORTH ELM STREET OVER WESTFIELD RIVER** | **W-25-10 (0V8)**

The following plans were made available to STV Group for their use in determining the live load capacity of this bridge.

Board of Public Works
Westfield, Massachusetts
Great River Bridge
September, 1938

Prepared by: Fay, Spofford & Thorndike, Engineers, Boston, Massachusetts

P.W.A Project No. Mass. 1467-F