

**Lyon County, MN**



Lyon County

504 Fairgrounds Road • Marshall, MN 56258



# BRIDGE INSPECTION AND LOAD RATING Report

For  
Bridge No. L5994

Lyon County, Minnesota  
State 4 over BNSF RR

.....  
Rating Analysis of Local  
Bridges  
MnDOT Contract No. 01890  
*WSB Project No. 02172-000*

*I hereby certify that this report was prepared by me  
or under my direct supervision and that I am a duly  
Licensed Professional Engineer under the laws of the  
State of Minnesota.*

March 10, 2014

Ashley Slominski, PE

Date

License No. 50489



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## LOAD RATING SUMMARY

Bridge No.: L5994

Current Load Ratings and Postings:	
Inventory Rating	HS 20.2
Operating Rating	HS 28.6
Load Posting	None
Recommended Load Ratings & Postings:	
Inventory Rating	HS 14.4
Operating Rating	HS 20.7
Recommended Load Posting	MnDOT Sign R12-5 28 Tons – Single Unit Truck (Type M3 & SHV's) 40 Tons – Truck & Trailer Combination (Type M3S2 & M3-3)

The recommended load ratings and postings stated reflect the current condition of the bridge superstructure.

Load Rating Notes and Assumptions:
<ul style="list-style-type: none"> <li>▶ Recommended load rating and posting is based on condition of bridge superstructure</li> <li>▶ Superstructure was calculated using Virtis (v6.3)</li> <li>▶ Curbs, rails and wearing surface loads are distributed equally to each beam</li> <li>▶ Allowable stress: <math>f = 1.6\text{ksi}</math> (no bridge plans available)</li> <li>▶ 2in deep wearing course</li> </ul>

**FORM RC-CL**  
Revised Jan. 2012

**MnDOT BRIDGE RATING AND LOAD POSTING REPORT**  
**FOR COUNTY AND LOCAL AGENCIES**

**Bridge Location and Description**

Hwy. No. STATE 4 Over  Under  BNSF RR **Bridge No.** L5994  
 Year Built 1972 Year Remodeled NA Replaces Br. NA  
 Type 701 County LYON Ref. Pt. \_\_\_\_\_  
 Description FIVE-SPAN NAIL-LAM TIMBER BEAM BRIDGE WITH MAIN STEEL SPAN. NO SKEW. 22.4' ROADWAY WIDTH. 27.6'-21.1'-36.5'-21.1'-27.6' SPANS. 2" BITUMINOUS OVERLAY WEAR SURFACE. TIMBER CURBS, SCUPPERS, POSTS AND RAILS.  
 Location 0.6 MI NW OF JCT TH 23

**Data for Basis of Report** (Check all that apply)

- Bridge Inventory File
- Previous Bridge Rating and Load Posting Report
- Bridge Plans
  - New  Overlay
  - Repair/Reconstruction
  - Other Dead Load Modifications
- Bridge Inspected by ASHLEY SLOMINSKI Date 11-08-13
  - Damaged Component
  - Deteriorated Component

**NBI Condition Ratings**

Deck 8  
 Superstructure 7  
 Substructure 7  
 ADTT 15

Types of Analysis:

- Manual  Computer\*  BARS  Virtis, V.6.3  Other\*

**Method of Rating** (Check appropriate box)

- Load Factor (LF)  Assigned Load Ratings
- Allowable Stress (AS)
- Load & Resistance Factor (LRFR)
- Load Testing
- No Rating Computations performed

Design Load UNKNOWN

Design Method UNKNOWN

**Summary of Rating and Load Posting Analysis**

Load Posting		Required <input checked="" type="checkbox"/>		Not Required <input type="checkbox"/>		Bridge Rating	
Sign		TONS		Inventory		Operating	
R12-1A	<input type="checkbox"/>			HS <input checked="" type="checkbox"/>	14.4	HS <input checked="" type="checkbox"/>	20.7
R12-5a	<input type="checkbox"/>			RF <input type="checkbox"/>		RF <input type="checkbox"/>	
R12-5	<input checked="" type="checkbox"/>	28 M3	40 M3S2				
R12-X11	<input type="checkbox"/>		45				

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Signature: *Ashley Sломinski* Date: 3/10/14

(Typed or Printed) Name: ASHLEY SLOMINSKI License No. 50489

(Typed or Printed) Employed by ( Agency/ Firm): WSB & ASSOCIATES, INC.

My signature below indicates that I have read and fully agreed with the load rating report.

Program Administrator's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

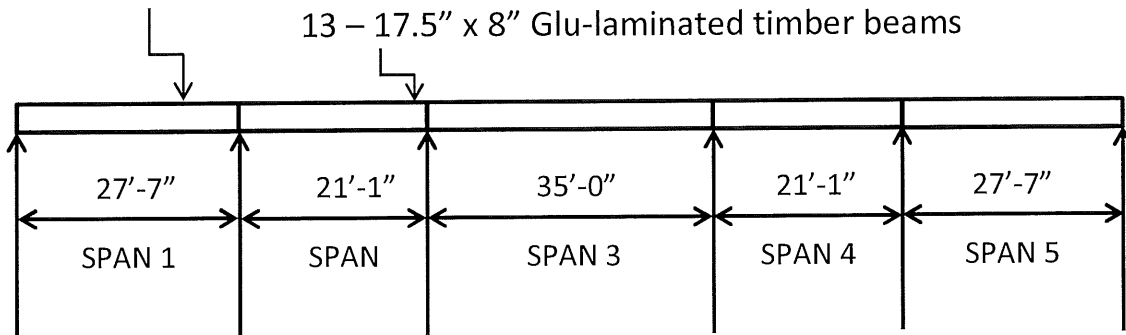
BRIDGE RATING DETAILS

Bridge Type 701  
 Rating Method ASR  
 Roadway Width 22.4'  
 Curved       Tapered  
 Beam Spacing 2.0'  
 Live Load Distribution Factor  
     Single 0.44      Multiple 0.50  
 Finite/Grid Element Analysis

Bridge No. L5994  
 Design Load: UNKNOWN  
 Inventory Rating: 14.4  
 Operating Rating: 20.7  
 Rated KLY      Checked AMS  
 Date 02/27/14  
 Sheet 2 of 2

2" Bituminous WC atop 4" thick nail laminated timber deck

13 - 17.5" x 8" Glu-laminated timber beams



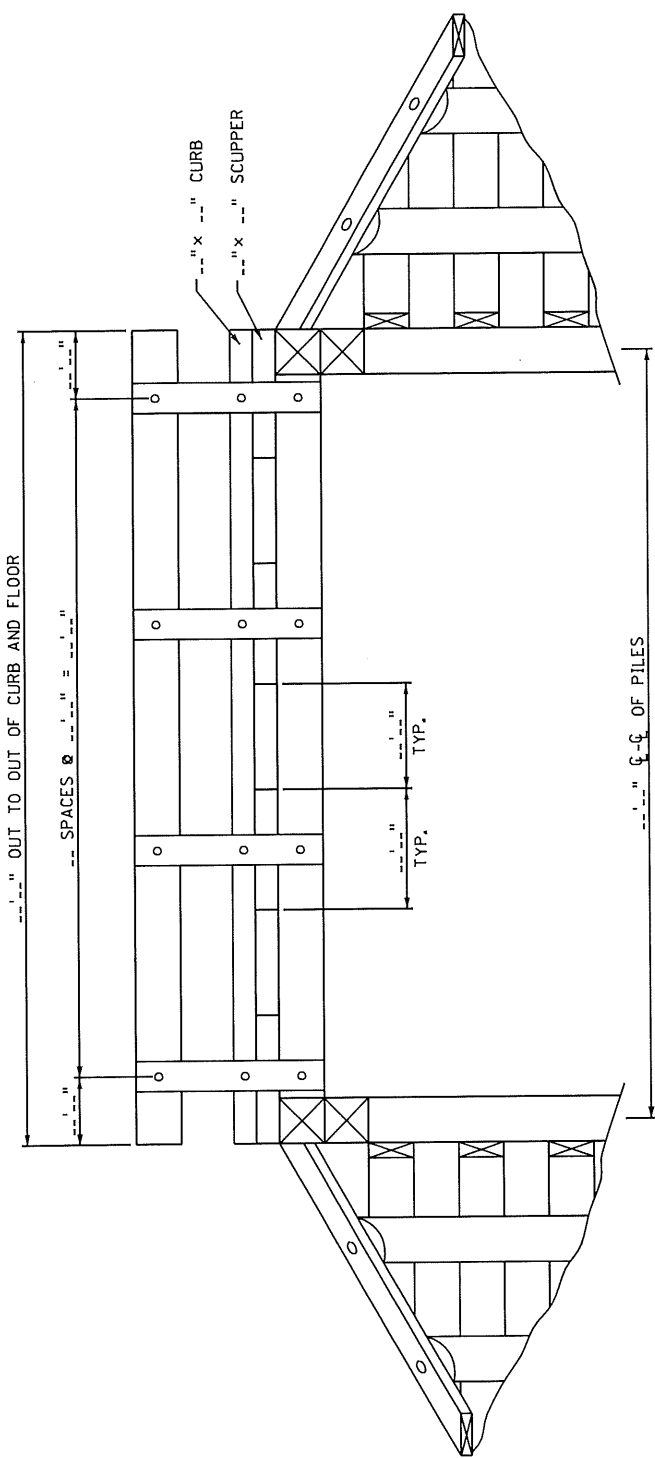
**BEAM ELEVATION <sup>2</sup>**

Show span lengths, structure/beam depths.

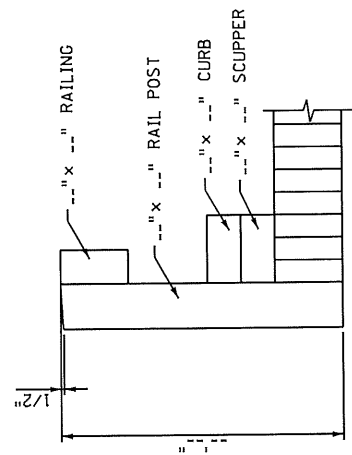
Truck	Rating Factor	Span/ Pier	Location	Limit State <sup>1</sup>	Notes/Comments
HS 20 Inventory	0.724	1	0.6	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH
HS 20 Operating	1.035	1	0.6	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH
Post, M3	1.177	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH
Post, M3S2	1.251	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH
Post, M3S3	1.156	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH
Type SU4	1.047	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH 1.047*27T=28T GOVERNS
Type SU5	0.954	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH 0.954*31T=29T
Type SU6	0.877	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH 0.877*34.75T=30T
Type SU7	0.855	1	0.5	SERVICE MOMENT	12IN INTERIOR TRIB WIDTH 0.855*38.75T=33T

<sup>1</sup> Choose from: service or ultimate; shear or moment

<sup>2</sup> Elevation may be on back or another sheet if it won't fit here.

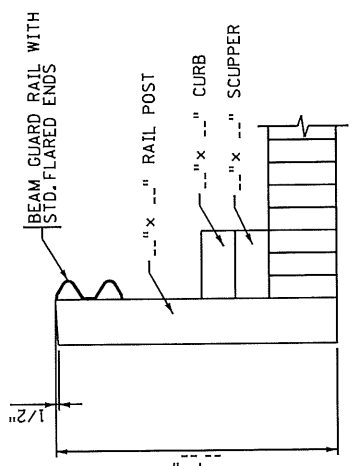


**GENERAL ELEVATION**



**SECTION THUR CURB AT RAIL POST**

TIMBER GUARDRAIL



**SECTION THUR CURB AT RAIL POST**

STEEL GUARDRAIL

**BRIDGE DATA:**

NUMBER OF SPANS: \_\_\_\_\_  
 SPAN LENGTH: \_\_\_\_\_  
 TIMBER DECK DEPTH: \_\_\_\_\_  
 OVERLAY: \_\_\_\_\_  
 DECK WIDTH: \_\_\_\_\_  
 ROADWAY WIDTH: \_\_\_\_\_



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 INFRASTRUCTURE | ENGINEERING | PLANNING | CONSTRUCTION

**BRIDGE MEASUREMENTS**

INSPECTOR: \_\_\_\_\_  
 DATE: \_\_\_\_\_  
 BRIDGE NO. \_\_\_\_\_

# Rating Results Summary Report

Name: 701  
Struct-Def: Single Span Glu-Lam

Bridge ID: L5994  
Member: G1

NBI: L5994  
Member Alt: G1

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HS 20-44	Axle Load	ASD	Inventory	94.72	2.631	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
HS 20-44	Axle Load	ASD	Operating	128.32	3.565	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
HS 20-44	Lane	ASD	Inventory	126.44	3.512	0.00	1 - ( 0.0)	Shear - Maximum	As Requested	As Requested
HS 20-44	Lane	ASD	Operating	171.29	4.758	0.00	1 - ( 0.0)	Shear - Maximum	As Requested	As Requested
M3	Axle Load	ASD	Operating	107.92	4.497	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
M3S2	Axle Load	ASD	Operating	191.65	4.791	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
M3S3	Axle Load	ASD	Operating	194.09	4.852	0.00	1 - ( 0.0)	Shear - Maximum	As Requested	As Requested
MINDot.SU4	Axle Load	ASD	Operating	110.26	4.084	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
MINDot.SU5	Axle Load	ASD	Operating	121.10	3.907	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
MINDot.SU6	Axle Load	ASD	Operating	135.83	3.909	27.60	1 - (100.0)	Shear - Minimum	As Requested	As Requested
MINDot.SU7	Axle Load	ASD	Operating	151.47	3.909	0.00	1 - ( 0.0)	Shear - Maximum	As Requested	As Requested

# Rating Results Summary Report

Name: 701  
Struct-Def: Single Span Glu-Lam

Bridge ID: L5994  
Member: G2

NBI: L5994  
Member Alt: G2

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span (%)	Limit State	Impact	Lane
HS 20-44	Axle Load	ASD	Inventory	28.87	0.802	16.56	1 - (60.0)	Flexure - Maximum	As Requested	As Requested
HS 20-44	Axle Load	ASD	Operating	41.07	1.141	16.56	1 - (60.0)	Flexure - Maximum	As Requested	As Requested
HS 20-44	Lane	ASD	Inventory	37.71	1.048	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
HS 20-44	Lane	ASD	Operating	53.84	1.496	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
M3	Axle Load	ASD	Operating	31.17	1.299	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
M3S2	Axle Load	ASD	Operating	55.21	1.380	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
M3S3	Axle Load	ASD	Operating	51.02	1.275	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
MNDot.SU4	Axle Load	ASD	Operating	31.18	1.155	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
MNDot.SU5	Axle Load	ASD	Operating	32.64	1.053	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
MNDot.SU6	Axle Load	ASD	Operating	33.62	0.967	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested
MNDot.SU7	Axle Load	ASD	Operating	36.57	0.944	13.80	1 - (50.0)	Flexure - Maximum	As Requested	As Requested

# Rating Results Summary Report

Name: 701  
Struct-Def: Single Span Glu-Lam

Bridge ID: L5994  
Member: G3

NBI: L5994  
Member Alt: G3

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span, (%)	Limit State	Impact	Lane
HS 20-44	Axle Load	ASD	Inventory	26.07	0.724	16.56	1 - ( 60.0)	Flexure - Maximum	As Requested	As Requested
HS 20-44	Axle Load	ASD	Inventory	37.24	1.035	16.56	1 - ( 60.0)	Flexure - Maximum	As Requested	As Requested
HS 20-44	Lane	ASD	Inventory	34.03	0.945	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
HS 20-44	Lane	ASD	Operating	48.80	1.356	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
M3	Axle Load	ASD	Operating	28.25	1.177	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
M3S2	Axle Load	ASD	Operating	50.05	1.251	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
M3S3	Axle Load	ASD	Operating	46.24	1.156	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
MNDot SU4	Axle Load	ASD	Operating	28.26	1.047	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
MNDot SU5	Axle Load	ASD	Operating	29.58	0.954	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
MNDot SU6	Axle Load	ASD	Operating	30.47	0.877	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested
MNDot SU7	Axle Load	ASD	Operating	33.15	0.855	13.80	1 - ( 50.0)	Flexure - Maximum	As Requested	As Requested



# Rating Results Summary Report

Name: 701  
Struct-Def: Steel Center Span

Bridge ID: L5994  
Member: G1

NBI: L5994  
Member Alt: G1

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span, (%)	Limit State	Impact	Lane
HS 20-44	Lane	LFD	Inventory	259.71	7.214	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Operating	433.72	12.048	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Inventory	183.53	5.098	21.90	1 - (60.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Operating	306.49	8.514	21.90	1 - (60.0)	Design Flexure - Steel	As Requested	As Requested
M3	Axle Load	LFD	Operating	244.72	10.197	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
M3S2	Axle Load	LFD	Operating	441.30	11.033	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
M3S3	Axle Load	LFD	Operating	429.50	10.738	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
MN1Dot SU4	Axle Load	LFD	Operating	245.57	9.095	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
MN1Dot SU5	Axle Load	LFD	Operating	268.68	8.667	21.90	1 - (60.0)	Design Flexure - Steel	As Requested	As Requested
MN1Dot SU6	Axle Load	LFD	Operating	272.11	7.831	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
MN1Dot SU7	Axle Load	LFD	Operating	286.26	7.387	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested

# Rating Results Summary Report

Name: 701  
Struct-Def: Steel Center Span

Bridge ID: L5994  
Member: G2

NBI: L5994  
Member Alt: G2

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span, (%)	Limit State	Impact	Lane
HS 20-44	Lane	LFD	Inventory	48.70	1.353	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Operating	81.32	2.259	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Inventory	34.41	0.956	21.90	1 - (60.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Operating	57.47	1.596	21.90	1 - (60.0)	Design Flexure - Steel	As Requested	As Requested
M3	Axle Load	LFD	Operating	45.88	1.912	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
M3S2	Axle Load	LFD	Operating	82.74	2.069	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
M3S3	Axle Load	LFD	Operating	80.53	2.013	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU4	Axle Load	LFD	Operating	46.04	1.705	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU5	Axle Load	LFD	Operating	50.38	1.625	21.90	1 - (60.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU6	Axle Load	LFD	Operating	51.02	1.468	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU7	Axle Load	LFD	Operating	53.67	1.385	18.25	1 - (50.0)	Design Flexure - Steel	As Requested	As Requested

# Rating Results Summary Report

Name: 701  
 Struct-Def: Steel Center Span

Bridge ID: L5994  
 Member: G3

NBI: L5994  
 Member Alt: G3

Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span, (%)	Limit State	Impact	Lane
HS 20-44	Lane	LFD	Inventory	48.70	1.353	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Lane	LFD	Operating	81.32	2.259	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Inventory	34.41	0.956	21.90	1 - ( 60.0)	Design Flexure - Steel	As Requested	As Requested
HS 20-44	Axle Load	LFD	Operating	57.47	1.596	21.90	1 - ( 60.0)	Design Flexure - Steel	As Requested	As Requested
M3	Axle Load	LFD	Operating	45.88	1.912	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
M3S2	Axle Load	LFD	Operating	82.74	2.069	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
M3S3	Axle Load	LFD	Operating	80.53	2.013	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU4	Axle Load	LFD	Operating	46.04	1.705	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU5	Axle Load	LFD	Operating	50.38	1.625	21.90	1 - ( 60.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU6	Axle Load	LFD	Operating	51.02	1.468	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested
MNDot SU7	Axle Load	LFD	Operating	53.67	1.385	18.25	1 - ( 50.0)	Design Flexure - Steel	As Requested	As Requested

Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
 Checked AMS  
 Back Check AMS  
 Corrected KLY  
 Verified AMS

Date 2/27/14  
 Date 3/9/14  
 Date 3/9/14  
 Date 3/10/14  
 Date 3/10/14

**TIMBER BEAM SPAN ALLOWABLE STRESS MOMENT RATING    END SPAN**

Bridge Number: L5994

**Beam Properties:**

Beam Width: w := 8in

Beam Height: h := 18in

Number of Beams:  $N_w := 13$

Beam Spacing:  $S_w := 2.0ft$

Skew: Skew := 0deg

Span Length:  $L_{span} := 27.6ft$

**Deck Properties:**

Deck Thickness: t := 4in

**Distribution Factors:**

Distribution Factor for Multilane Loading:

$$DF_{Multi} := \frac{S}{4.0 \cdot ft} = 0.500$$

Distribution Factor for Singlelane Loading:

$$DF_{Single} := \frac{S}{4.55 \cdot ft} = 0.44$$

**Material Properties (MnDOT Standard Unit Weights from Table 3.3.1):**

Bituminous Wearing Course:  $\gamma_{wc} := 0.150kcf$

Gravel Wearing Course:  $\gamma_{gwc} := 0.120kcf$

Timber:  $\gamma_{timber} := 0.05kcf$

**DEAD LOADS:**

Determine the Dead Loads applied to the bridge:

**Wear Course:**

$d_{wc} := 2.0in$       Depth of Bituminous Wear Course

$d_{gwc} := 0in$       Depth of Gravel Wear Course

$w_{roadway} := 22.4ft$       Roadway Width

$w_{deck} := 24.0ft$       Deck Width

**Weight of Wear Course:**

$$W_{WC} := \gamma_{wc} \cdot d_{wc} \cdot S + \gamma_{gwc} \cdot d_{gwc} \cdot S = 50 \frac{lb}{ft}$$

$$W_{WC} = 0.05 \frac{kip}{ft}$$

**Beam Weight:**

Weight of Beam:

$$W_{Beam} := \gamma_{timber} \cdot w \cdot h = 50 \frac{lb}{ft}$$

Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
 Checked AMS  
 Back Check AMS  
 Corrected KLY  
 Verified AMS

Date 2/27/14  
 Date 3/9/14  
 Date 3/9/14  
 Date 3/10/14  
 Date 3/10/14

**Deck Weight:**

Weight of Deck:

$$W_{Deck} := \gamma_{timber} \cdot t \cdot S = 33.333 \frac{lb}{ft}$$

**Diaphragm Weight:**

Weight of Cross Bracing

Width of Cross Bracing:  $d_w := 2in$

Depth of Cross Bracing:  $d_d := 4in$

Length of Cross Bracing:  $d_l := 2.475ft$

$$W_{Diaphragm} := (\gamma_{timber} \cdot d_w \cdot d_d \cdot d_l) 2 = 0.0137 \cdot kip \quad N_{diap} := 1$$

**Timber Curbs, Rail, or Utilities:**

Distance between Rail Posts  $Space_{RP} := 6.25ft$

**Top Rail:**

wood:  $TopR_W := 3in$   $TopR_D := 8in$

$$TopR_A := TopR_W \cdot TopR_D \cdot Space_{RP} = 1800 \cdot in^3$$

steel:  $W_{12guage} := 0.64 \frac{lb}{in \cdot ft}$   $SteelGuard_D := 0in$

$$TopR_{DCSteel} := W_{12guage} \cdot SteelGuard_D = 0$$

**Bottom Rail:**

wood:  $BotR_W := 4in$   $BotR_D := 8in$

$$BotR_A := BotR_W \cdot BotR_D \cdot Space_{RP} = 2400 \cdot in^3$$

**Post:**

$Post_W := 8in$   $Post_D := 8in$   $Post_L := 5.5ft$

$$Post_A := Post_W \cdot Post_D \cdot Post_L = 4224 \cdot in^3$$

**Rail Post Block**

$PostBk_W := 0in$   $PostBk_D := 0in$   $PostBk_L := 0ft$

$$PostBk_A := PostBk_W \cdot PostBk_D \cdot PostBk_L = 0 \cdot in^3$$

**Curb:**

$Curb_W := 8in$   $Curb_D := 6in$

$$Curb_A := Curb_W \cdot Curb_D \cdot Space_{RP} = 3600 \cdot in^3$$

**Scupper Block:**

$ScupB_W := 8in$   $ScupB_D := 6in$   $ScupB_L := 6.25ft$

$$ScupB_A := ScupB_W \cdot ScupB_D \cdot ScupB_L = 3600 \cdot in^3$$

Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
 Checked AMS  
 Back Check AMS  
 Corrected KLY  
 Verified AMS

Date 2/27/14  
 Date 3/9/14  
 Date 3/9/14  
 Date 3/10/14  
 Date 3/10/14

**Miscellaneous Weights:**

$$\text{Utilities} := 0 \frac{\text{lb}}{\text{ft}}$$

**Total Weight of Rail Distributed over all beams:**

$$\text{Area}_{\text{Rail}} := \text{TopR}_A + \text{BotR}_A + \text{Post}_A + \text{PostBk}_A + \text{Curb}_A + \text{ScupB}_A = 9.042 \cdot \text{ft}^3$$

$$W_{\text{DC2}} := \gamma_{\text{timber}} \cdot \left( \frac{2 \cdot \text{Area}_{\text{Rail}}}{\text{Space}_{\text{RP}}} \right) + 2 \cdot \text{TopR}_{\text{DCSteel}} + \text{Utilities} = 144.667 \frac{\text{lb}}{\text{ft}} \quad \frac{W_{\text{DC2}}}{N} = 0.0111 \frac{\text{kip}}{\text{ft}}$$

$$W_{\text{Total}} := \frac{W_{\text{DC2}}}{N} + W_{\text{WC}} + W_{\text{Beam}} + W_{\text{Deck}} + \frac{W_{\text{Diaphragm}} \cdot N_{\text{diap}}}{L} = 144.96 \frac{\text{lb}}{\text{ft}}$$

**RATING ANALYSIS - INVENTORY AND OPERATING RATING-Interior Girder:**

**Moment:**

$$S_{\text{xx}} := \frac{w \cdot h^2}{6} = 432 \cdot \text{in}^3 \quad \text{Section Modulus}$$

$$f_b := 1.6 \cdot \text{ksi} \quad \text{No bridge plas available, use allowable stress of 1.6 ksi}$$

$$f_{\text{bOR}} := 1.33 \cdot f_b = 2.128 \cdot \text{ksi}$$

**Resisting Moment of Timber Beams:**

$$M_r := S \cdot f_b = 57.6 \cdot \text{kip} \cdot \text{ft} \quad \text{Inventory Rating}$$

$$M_{r\text{OR}} := S \cdot f_{\text{bOR}} = 76.608 \cdot \text{kip} \cdot \text{ft} \quad \text{Operating Rating}$$

**Dead Load Moment of Timber Beams:**

**Midspan :**

$$M_{\text{DL}} := \frac{[(W_{\text{Total}}) \cdot L^2]}{8} = 13.803 \cdot \text{kip} \cdot \text{ft}$$

**0.6\*L :**

$$M_{\text{DL}0.6} := \frac{[(W_{\text{Total}}) \cdot (0.6L) \cdot (L - 0.6 \cdot L)]}{2} = 13.251 \cdot \text{kip} \cdot \text{ft}$$

Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
Checked AMS  
Back Check AMS  
Corrected KLY  
Verified AMS

Date 2/27/14  
Date 3/9/14  
Date 3/9/14  
Date 3/10/14  
Date 3/10/14

**Moment available for Live Load per Wheel Line:**

Midspan :

0.6\*L:

$$M_{LL0.5} := \frac{(M_r - M_{DL})}{DF_{Multi}} = 87.594 \cdot \text{kip} \cdot \text{ft}$$

$$M_{LL0.6} := \frac{(M_r - M_{DL0.6})}{DF_{Multi}} = 88.698 \cdot \text{kip} \cdot \text{ft}$$

Inventory Rating

$$M_{LLOR0.5} := \frac{(M_{rOR} - M_{DL})}{DF_{Multi}} = 125.61 \cdot \text{kip} \cdot \text{ft}$$

$$M_{LLOR0.6} := \frac{(M_{rOR} - M_{DL0.6})}{DF_{Multi}} = 126.714 \cdot \text{kip} \cdot \text{ft}$$

Operating Rating

**Live Load Moment per Wheel Based off of Table C6B-1 taken from MBE V.2011:**

See Excel Spreadsheet C6B-1 and C6B-2.xlsx for interpolation results:

$$M_{HS20} := 123.0 \text{kip} \cdot \text{ft}$$

Inventory Rating:

$$IR := 20 \cdot \frac{M_{LL0.6}}{M_{HS20}} = 14.4$$

$$RF := \frac{IR}{20} = 0.721$$

Operating Rating:

$$OR := 20 \cdot \frac{M_{LLOR0.6}}{M_{HS20}} = 20.6$$

$$RF_{OR} := \frac{OR}{20} = 1.03$$

**RATING ANALYSIS - POSTING RATINGS-Interior Girder:**

$S = 432 \cdot \text{in}^3$  Section Modulus

$f_{bOR} = 2.128 \cdot \text{ksi}$  Allowable Stress

**Resisting Moment of Timber Beams:**

$M_{rOR} = 76.608 \cdot \text{kip} \cdot \text{ft}$

**Dead Load Moment of Timber Beams:**

$M_{DL} = 13.803 \cdot \text{kip} \cdot \text{ft}$

**Moment available for Live Load per Wheel Line:**

$$M_{LLPOST} := \frac{(M_{rOR} - M_{DL})}{DF_{Multi}} = 125.61 \cdot \text{kip} \cdot \text{ft}$$

0.6\*L:

$$M_{LLPOST0.6} := \frac{(M_{rOR} - M_{DL0.6})}{DF_{Multi}} = 126.714 \cdot \text{kip} \cdot \text{ft}$$

Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
 Checked AMS  
 Back Check AMS  
 Corrected KLY  
 Verified AMS

Date 2/27/14  
 Date 3/9/14  
 Date 3/9/14  
 Date 3/10/14  
 Date 3/10/14

**Live Load Moment per Wheel Based off of Table C6B-1 and C6B-2 taken from MBE V.2011:**

See Excel Spreadsheet C6B-1 and C6B-2.xlsx for interpolation results:

$$M_3 := 100.92 \text{ kip}\cdot\text{ft} \quad M_{SU4} := 120.8 \text{ kip}\cdot\text{ft} \quad M_{SU6} := 143.18 \text{ kip}\cdot\text{ft}$$

$$M_{3S2} := 98.66 \text{ kip}\cdot\text{ft} \quad M_{SU5} := 131.52 \text{ kip}\cdot\text{ft} \quad M_{SU7} := 143.18 \text{ kip}\cdot\text{ft}$$

$$M_{3S3} := 83.10 \text{ kip}\cdot\text{ft}$$

Type 3 Rating (Gross Weight = 24T):

$$OR_3 := 24 \cdot \frac{M_{LLPOST}}{M_3} = 29.9 \quad RF_3 := \frac{OR_3}{24} = 1.245$$

Type 3S2 Rating (Gross Weight = 40T):

$$OR_{3S2} := 40 \cdot \frac{M_{LLPOST}}{M_{3S2}} = 50.9 \quad RF_{3S2} := \frac{OR_{3S2}}{40} = 1.273$$

Type 3-3 Rating (Gross Weight = 40T):

$$OR_{3S3} := 40 \cdot \frac{M_{LLPOST}}{M_{3S3}} = 60.5 \quad RF_{3S3} := \frac{OR_{3S3}}{40} = 1.512$$

This value represents the AASHTO Trucks and not the MN Trucks. This is why they do not match the virtual ratings. They are used as a guide.

Type SU4 Rating (Gross Weight = 27T):

$$OR_{SU4} := 27 \cdot \frac{M_{LLPOST}}{M_{SU4}} = 28.1 \quad RF_{SU4} := \frac{OR_{SU4}}{27} = 1.04$$

Type SU5 Rating (Gross Weight = 31T):

$$OR_{SU5} := 31 \cdot \frac{M_{LLPOST}}{M_{SU5}} = 29.6 \quad RF_{SU5} := \frac{OR_{SU5}}{31} = 0.955$$

Type SU6 Rating (Gross Weight = 34.75T):

$$OR_{SU6} := 34.75 \cdot \frac{M_{LLPOST}}{M_{SU6}} = 30.5 \quad RF_{SU6} := \frac{OR_{SU6}}{34.75} = 0.877$$

Type SU7 Rating (Gross Weight = 38.75T):

$$OR_{SU7} := 38.75 \cdot \frac{M_{LLPOST}}{M_{SU7}} = 34 \quad RF_{SU7} := \frac{OR_{SU7}}{38.75} = 0.877$$



Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
 Checked AMS  
 Back Check AMS  
 Corrected KLY  
 Verified AMS

Date 2/27/14  
 Date 3/9/14  
 Date 3/9/14  
 Date 3/10/14  
 Date 3/10/14

## STEEL SIMPLE SPAN RATING INPUTS

Beam spacing:  $S := 2.0\text{ft}$       Deck Height:  $h := 4\text{in}$       Span Length:  $L := 36.5\text{ft}$

*Material Properties (MnDOT Standard Unit Weights from Table 3.3.1):*

Wearing Course:  $\gamma_{wcc} := 0.120\text{kcf}$        $\gamma_{bwc} := 0.150\text{kcf}$        $N := 12$       Number of Beams

**DEAD LOADS:**       $\gamma_{timber} := 0.05\text{kcf}$

Determine the Dead Loads applied to the bridge:

**Wear Course:**

$d_{BWC} := 2\text{in}$       Depth of Bit Wear Course

$d_{GWC} := 0\text{in}$       Depth of Gravel Wear Course

Average Weight of Wear Course:

$$W_{wcc} := \gamma_{bwc} \cdot d_{BWC} \cdot S + \gamma_{gwc} \cdot d_{GWC} \cdot S = 50 \frac{\text{lb}}{\text{ft}}$$

Project SHV Contract #3

Job Number 02172-000

Calcs For Load Rating Inputs



Originated KLY  
 Checked AMS  
 Back Check AMS  
 Corrected KLY  
 Verified AMS

Date 2/27/14  
 Date 3/9/14  
 Date 3/9/14  
 Date 3/10/14  
 Date 3/10/14

### Effective Flange Width:

$$\text{Overhang} := 12\text{in} = 1\text{ft}$$

$$t_{\text{seff}} := 6\text{in}$$

#### LFR:

Exterior Girder:

$$b_{\text{effLFRext}} := \min\left(0.25 \cdot L, \text{Overhang} + \frac{S}{2}, t_{\text{seff}} \cdot 12\right) = 24 \cdot \text{in}$$

AASHTO Standard Specification 10.38.3.1

$$b_{\text{effLFRext}} = 24 \cdot \text{in}$$

Interior Girder:

$$b_{\text{effLFRint}} := \min(0.25 \cdot L, S, t_{\text{seff}} \cdot 12) = 24 \cdot \text{in}$$

$$b_{\text{effLFRint}} = 24 \cdot \text{in}$$

#### LRFR:

AASHTO LRFD 4.6.2.6.1

Exterior Girder:

$$b_{\text{effLRFRext}} := \text{Overhang} + \frac{S}{2} = 24 \cdot \text{in}$$

$$b_{\text{effLRFRext}} = 24 \cdot \text{in}$$

Interior Girder:

$$b_{\text{effLRFRint}} := S = 24 \cdot \text{in}$$

$$b_{\text{effLRFRint}} = 24 \cdot \text{in}$$

### Live Load Distribution Factors:

#### Interior Bays

Distribution Factor Multiple Lanes:

$$DF_{\text{HS20}} := \frac{S}{5.5\text{ft}} = 0.364$$

Distribution Factor Single Lanes:

$$DF_{\text{Post}} := \frac{S}{7\text{ft}} = 0.286 \quad DF_{\text{Post}} = 0.286$$

Table C6B-1

WSB Associates

Span, ft/c/c	Live Load Moments in ft-kips per Wheel Line									
	Type of Loading (without Impact)					Type of Loading (with Impact)				
	H-15	HS-20	3	3S2	3-3	H-15	HS-20	3	3S2	3-3
5.0	15.0	20.0	10.6	9.7	10.0	19.5	26.0	13.8	12.6	13.0
6.0	18.0	24.0	12.8	11.6	12.0	23.4	31.2	16.6	15.1	15.6
7.0	21.0	28.0	15.2	13.8	14.0	27.3	36.4	19.7	18.0	18.2
8.0	24.0	32.0	19.1	17.4	16.0	31.2	41.6	24.9	22.7	20.8
9.0	27.0	36.0	23.1	21.1	19.1	35.1	46.8	30.1	27.4	24.8
10.0	30.0	40.0	27.2	24.8	22.4	39.0	52.0	35.4	32.2	29.1
11.0	33.0	44.0	31.3	28.5	25.8	42.9	57.2	40.7	37.1	33.5
12.0	36.0	48.0	35.4	32.2	29.2	46.8	62.4	46.0	42.0	37.9
13.0	39.0	52.0	39.6	36.1	32.6	50.7	67.6	51.4	46.9	42.3
14.0	42.0	56.0	43.7	39.9	36.0	54.6	72.8	56.8	51.8	46.8
15.0	45.0	60.0	47.9	43.7	39.4	58.5	78.0	62.2	56.8	51.3
16.0	48.0	64.0	52.1	47.5	42.9	62.4	83.2	67.7	61.7	55.7
17.0	51.0	68.0	56.3	51.3	46.3	66.3	88.4	73.1	66.7	60.2
18.0	54.0	72.0	60.4	55.1	49.8	70.2	93.6	78.6	71.6	64.7
19.0	57.0	76.0	64.6	58.9	53.2	74.1	98.8	84.0	76.6	69.2
20.0	60.0	80.0	68.9	62.8	56.7	78.0	104.0	89.5	81.6	73.7
21.0	63.0	84.0	73.1	66.6	60.2	81.9	109.2	95.0	86.6	78.2
22.0	66.0	88.0	77.3	70.5	63.6	85.8	114.4	100.5	91.6	82.7
23.0	69.0	92.0	81.5	75.2	67.1	89.7	119.6	105.9	97.7	87.2
24.0	72.0	96.3	85.7	80.3	70.6	93.6	125.2	111.4	104.4	91.8
25.0	75.0	103.7	89.9	85.4	74.1	97.5	134.8	116.9	111.0	96.3
26.0	78.0	111.1	94.2	90.5	77.5	101.4	144.4	122.4	117.7	100.8
27.0	81.3	118.5	98.4	95.6	81.0	105.7	154.1	127.9	124.3	105.3
28.0	85.1	126.0	102.6	100.7	84.5	110.6	163.8	133.4	131.0	109.8
29.0	88.8	133.5	106.8	105.9	88.0	115.4	173.6	138.9	137.6	114.4
30.0	92.5	141.0	112.9	111.0	91.5	120.2	183.3	146.8	144.3	118.9
32.0	99.8	156.2	125.3	121.2	101.5	130.0	203.1	162.9	157.6	132.0
34.0	107.4	171.8	137.6	131.5	112.3	139.6	223.3	178.9	170.9	146.0
36.0	114.8	189.4	150.0	141.7	123.1	149.2	246.2	195.0	184.2	160.1
38.0	122.3	207.1	162.4	151.9	134.0	159.0	269.2	211.1	197.5	174.1
40.0	129.7	224.9	174.8	162.2	144.8	168.6	292.4	227.3	210.8	188.3
42.0	137.2	242.7	187.2	172.4	155.7	178.3	315.3	243.3	224.0	202.3
44.0	144.7	260.4	199.7	182.7	166.6	187.5	337.5	258.7	236.7	215.8
46.0	152.1	278.3	212.1	192.9	177.4	196.6	359.6	274.1	249.3	229.3
48.0	159.6	296.1	224.5	203.2	188.3	205.7	381.7	289.4	261.9	242.8
50.0	167.1	314.0	237.0	220.8	199.3	214.8	403.8	304.7	283.9	256.2
52.0	174.6	331.8	249.4	238.4	214.3	223.9	425.5	319.9	305.8	274.8
54.0	182.0	349.7	261.8	256.1	231.3	232.8	447.3	335.0	327.6	295.9
56.0	189.5	367.6	274.3	273.8	248.3	241.8	469.1	350.1	349.4	316.9
58.0	198.8	385.4	286.8	291.4	265.3	253.1	490.6	365.1	371.1	337.7
60.0	209.2*	403.3	299.2	309.2	282.3	265.8*	512.2	380.1	392.7	358.5
70.0	265.1*	492.8	361.5	398.0	372.2	333.1*	619.0	454.2	500.1	467.6
80.0	327.*	582.4	423.9	487.1	471.9	406.8*	724.5	527.3	605.9	587.0
90.0	394.9*	672.2	486.3	576.4	571.7	486.7*	828.8	599.4	710.5	704.6
100.0	468.8*	762.0	548.7	665.9	671.5	572.9*	931.2	670.7	813.9	820.7
120.0	634.5*	941.6	673.6	845.1	871.3	764.*	1133.7	811.1	1017.5	1049.1
140.0	824.2*	1121.4	798.5	1024.5	1071.1	979.8*	1333.3	949.2	1217.8	1273.2
160.0	1038.*	1384.0	923.5	1204.1	1270.9	1220.1*	1626.2	1085.5	1415.3	1493.9
180.0	1275.8*	1701.0	1048.4	1383.7	1470.8	1484.9*	1980.0	1222.3	1610.6	1712.0
200.0	1537.5*	2050.0	1173.4	1563.5	1670.8	1774.*	2365.7	1353.9	1804.0	1927.8
250.0	2296.9*	3062.5	1485.8	2013.0	2170.6	2603.1*	3469.8	1683.9	2281.4	2460.0
300.0	3206.2*	4275.0	1798.2	2462.6	2670.5	3583.5*	4779.4	2009.8	2752.4	2984.7

\* Based on standard lane loading. All other values are based on standard truck loading.

HS-20
Interpolation Value
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 118.5
Y2 = 123.00 Interpolated Value
Y3 = 126.0

Type 3
Interpolation Value
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 98.4
Y2 = 100.92 Interpolated Value
Y3 = 102.6

Type 3S2
Interpolation Value
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 95.6
Y2 = 98.66 Interpolated Value
Y3 = 100.7

Type 3-3
Interpolation Value
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 81.0
Y2 = 83.10 Interpolated Value
Y3 = 84.5

Table C6B-2

WSB Associates

Span ft c/c	Live Load Moments in ft-kip per Wheel Line													
	Type of Loading (without Impact)							Type of Loading (with Impact)						
	HS-20	NRL	SU4	SU5	SU6	SU7	HS-20	NRL	SU4	sus	SU6	SU7		
5.0	20.0	10.6	10.6	10.6	10.6	10.6	26.0	13.8	13.8	13.8	13.8	13.8		
6.0	24.0	12.8	12.8	12.8	12.8	12.8	31.2	16.6	16.6	16.6	16.6	16.6		
7.0	28.0	15.2	15.2	15.2	15.2	15.2	36.4	19.8	19.8	19.8	19.8	19.8		
8.0	32.0	19.1	19.1	19.1	19.1	19.1	41.6	24.8	24.8	24.8	24.8	24.8		
9.0	36.0	23.1	23.1	23.1	23.1	23.1	46.8	30.0	30.0	30.0	30.0	30.0		
10.0	40.0	27.9	27.9	27.9	27.9	27.9	52.0	36.3	36.3	36.3	36.3	36.3		
11.0	44.0	33.1	33.1	33.1	33.1	33.1	57.2	43.0	43.0	43.0	43.0	43.0		
12.0	48.0	38.3	38.3	38.3	38.3	38.3	62.4	49.8	49.8	49.8	49.8	49.8		
13.0	52.0	43.5	43.5	43.5	43.5	43.5	67.6	56.6	56.6	56.6	56.6	56.6		
14.0	56.0	48.8	48.8	48.8	48.8	48.8	72.8	63.4	63.4	63.4	63.4	63.4		
15.0	60.0	54.4	54.0	54.0	54.4	54.4	78.0	70.7	70.2	70.2	70.7	70.7		
16.0	64.0	60.6	59.2	59.2	60.6	60.6	83.2	78.8	77.0	77.0	78.8	78.8		
17.0	68.0	66.7	64.5	65.3	66.7	66.7	88.4	86.7	83.9	84.9	86.7	86.7		
18.0	72.0	73.6	69.7	71.5	73.6	73.6	93.6	95.1	90.6	93.0	95.1	95.1		
19.0	76.0	80.8	74.9	77.8	80.8	80.8	98.8	105.0	97.4	101.1	105.0	105.0		
20.0	80.0	88.1	80.2	84.0	88.1	88.1	104.0	114.5	104.3	109.2	114.5	114.5		
21.0	84.0	95.3	85.4	90.3	95.3	95.3	109.2	123.9	111.0	117.4	123.9	123.9		
22.0	88.0	102.6	90.7	96.5	102.6	102.6	114.4	133.4	117.9	125.5	133.4	133.4		
23.0	92.0	110.2	95.9	102.8	109.8	110.2	119.6	143.3	124.7	133.6	142.7	143.3		
24.0	96.3	118.4	101.2	109.0	117.1	118.4	125.2	153.9	131.6	141.7	152.2	153.9		
25.0	103.7	126.6	106.4	115.3	124.3	126.6	134.8	164.5	138.3	149.9	161.6	164.5		
26.0	111.1	135.5	111.6	121.5	131.6	134.8	144.4	176.2	145.1	158.0	171.1	175.2		
27.0	118.5	144.8	116.9	127.8	138.8	143.0	154.1	188.2	152.0	166.1	180.4	185.9		
28.0	126.0	154.0	123.4	134.0	146.1	151.2	163.8	200.2	160.4	174.2	189.9	196.6		
29.0	133.5	163.3	130.1	140.3	153.3	159.4	173.6	212.3	169.1	182.4	199.3	207.2		
30.0	141.0	172.5	136.8	146.5	160.6	167.6	183.3	224.3	177.8	190.5	208.7	217.9		
32.0	156.2	191.0	150.2	159.0	175.1	184.0	203.1	248.3	195.3	206.7	227.6	239.2		
34.0	171.8	209.5	163.6	172.0	189.6	200.5	223.3	272.4	212.7	223.6	246.5	260.7		
36.0	189.4	228.9	177.1	187.3	205.4	216.9	246.2	297.6	230.2	243.5	267.0	282.0		
38.0	207.1	248.8	190.5	202.7	222.7	235.6	269.2	323.4	247.7	263.5	289.5	306.3		
40.0	224.9	268.8	204.0	218.0	240.0	255.0	292.4	349.4	265.1	283.4	312.0	331.5		
42.0	242.7	288.8	217.4	233.4	257.3	274.3	315.4	375.3	282.5	303.3	334.3	356.4		
44.0	260.4	308.7	230.9	248.7	274.7	293.7	337.4	400.0	299.2	322.3	356.0	380.6		
46.0	278.3	328.7	244.3	264.1	292.0	313.1	359.7	424.8	315.7	341.3	377.4	404.6		
48.0	296.1	348.7	257.8	279.5	309.3	332.4	381.7	449.5	332.3	360.3	398.7	428.5		
50.0	314.0	368.7	271.3	294.9	326.6	351.8	403.7	474.0	348.8	379.2	419.9	452.3		
52.0	331.8	388.6	284.8	310.3	344.0	371.2	425.5	498.4	365.3	398.0	441.2	476.1		
54.0	349.7	408.6	298.2	325.7	361.3	390.5	447.4	522.7	381.5	416.7	462.2	499.6		
56.0	367.6	428.6	311.7	341.1	378.7	409.9	469.1	547.0	397.8	435.3	483.3	523.1		
58.0	385.4	448.6	325.2	356.6	396.0	429.3	490.7	571.2	414.1	454.0	504.2	546.6		
60.0	403.3	468.5	338.7	372.0	413.3	448.7	512.2	595.1	430.2	472.5	525.0	569.9		
70.0	492.8	568.5	406.1	449.2	500.1	545.5	619.2	714.2	510.2	564.4	628.3	685.4		
80.0	582.5	668.4	473.5	526.5	586.9	642.4	724.5	831.4	589.0	654.9	730.0	799.0		
90.0	672.2	768.4	540.9	603.8	673.7	739.2	828.5	947.0	666.7	744.2	830.4	911.1		
100.0	762.0	868.3	608.4	681.2	760.5	836.1	931.3	1061.3	743.6	832.6	929.5	1021.9		
120.0	941.6	1068.3	743.3	836.0	934.2	1029.8	1133.8	1286.3	895.0	1006.6	1124.8	1240.0		
140.0	1121.4	1268.2	878.3	990.9	1107.9	1223.6	1333.0	1501.5	1044.0	1177.8	1316.9	1454.4		
160.0	1384.*	1468.2	1013.2	1145.8	1281.6	1417.3	1626.8*	1725.8	1191.0	1346.8	1506.4	1665.9		
180.0	1701.*	1668.2	1148.2	1300.7	1455.3	1611.1	1979.9*	1941.7	1336.4	1513.9	1693.9	1875.2		
200.0	2050.*	1868.2	1283.2	1455.6	1629.0	1804.8	2365.4*	2155.6	1480.6	1679.5	1879.6	2082.5		
250.0	3062.5*	2368.1	1620.7	1843.0	2063.3	2289.2	3470.8*	2683.8	1836.8	2088.7	2338.4	2594.4		
300.0	4275.*	2868.1	1958.1	2230.4	2497.7	2773.5	4777.9*	3205.5	2188.5	2492.8	2791.5	3099.8		

\* Based on standard loading. All other values based on standard truck loading.

<b>SU4</b>
<u>Interpolation Value</u>
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 116.9
<b>Y2 = 120.80 Interpolated Value</b>
Y3 = 123.4

<b>SU5</b>
<u>Interpolation Value</u>
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 127.8
<b>Y2 = 131.52 Interpolated Value</b>
Y3 = 134.0

<b>SU6</b>
<u>Interpolation Value</u>
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 138.8
<b>Y2 = 143.18 Interpolated Value</b>
Y3 = 146.1

<b>SU7</b>
<u>Interpolation Value</u>
X1 = 27
X2 = Span Length 27.6 ft
X3 = 28
Y1 = 143.0
<b>Y2 = 147.92 Interpolated Value</b>
Y3 = 151.2

## Mn/DOT Structure Inventory Report

Bridge ID: L5994

STATE 4 over BNSF RR

Date: 01/10/2013

+ GENERAL +	+ ROADWAY +	+ INSPECTION +
Agency Br. No. S2	Bridge Match ID (TIS) 1	Deficient Status F.O.
District 8 Maint. Area	Roadway O/U Key 1-ON	Sufficiency Rating 78.9
County 42 - LYON	Route Sys/Nbr SPRK 4	Last Inspection Date 11-02-2011
City	Roadway Name or Description	Inspection Frequency 24
Township LYONS	SPRK 4	Inspector Name DNR
Desc. Loc. 0.6 MI NW OF JCT TH 23	Roadway Function MAINLINE	Structure R-POSTED - OTHER CAP
Sect., Twp., Range 05 - 110NN - 42W	Roadway Type 2 WAY TRAF	+ NBI CONDITION RATINGS +
Latitude 44d 21m 36.13s	Control Section (TH Only)	Deck 8
Longitude 95d 55m 32.26s	Ref. Point (TH Only)	Superstructure 7
Custodian COUNTY	Date Opened to Traffic	Substructure 7
Owner STATE FOREST	Detour Length 4 mi.	Channel N
Inspection By DNR	Lanes 2 Lanes ON Bridge	Culvert N
BMU Agreement	ADT (YEAR) 150 (1993)	+ NBI APPRAISAL RATINGS +
Year Built 1972	HCA DT	Structure Evaluation 7
Year Fed Rehab	Functional Class. RURAL LOCAL	Deck Geometry 4
Year Remodeled	+ RDWY DIMENSIONS +	Underclearances 6
Temp	If Divided NB-EB SB-WB	Waterway Adequacy N
Plan Avail. NO PLAN	Roadway Width 22.4 ft	Approach Alignment 3
+ STRUCTURE +	Vertical Clearance	+ SAFETY FEATURES +
Service On HIGHWAY	Max. Vert. Clear.	Bridge Railing 0-SUBSTANDARD
Service Under RAILROAD	Horizontal Clear.	GR Transition 0-SUBSTANDARD
Main Span Type TIMB BEAM SPAN	Lateral Clr. - Lt/Rt	Appr. Guardrail 1-MEETS STANDARDS
Main Span Detail	Appr. Surface Width 26.0 ft	GR Termini N-NOT REQUIRED
Appr. Span Type	Roadway Width 22.4 ft	+ IN DEPTH INSP. +
Appr. Span Detail	Median Width	Frac. Critical
Skew	+ MISC. BRIDGE DATA +	Underwater
Culvert Type	Structure Flared NO	Pinned Asbly.
Barrel Length	Parallel Structure NONE	Spec. Feat.
Number of Spans	Field Conn. ID	+ WATERWAY +
MAIN: 5 APPR: 0 TOTAL: 5	Cantilever ID	Drainage Area
Main Span Length 35.0 ft	Foundations	Waterway Opening
Structure Length 132.4 ft	Abut. TIMBER - PILE BENT	Navigation Control NOT APPL
Deck Width 24.0 ft	Pier TIMBER - PILE BENT	Pier Protection
Deck Material TIMBER	Historic Status NOT ELIGIBLE	Nav. Vert./Horz. Clr.
Wear Surf Type BITUMINOUS	On - Off System OFF	Nav. Vert. Lift Bridge Clear.
Wear Surf Install Year	+ PAINT +	MN Scour Code A-NON WATERWAY
Wear Course/Fill Depth 0.13 ft	Year Painted Pct. Unsound	Scour Evaluation Year
Deck Membrane NONE	Painted Area	+ CAPACITY RATINGS +
Deck Protect. N/A	Primer Type	Design Load UNKN
Deck Install Year	Finish Type	Operating Rating HS 28.60
Structure Area 3,178 sq ft	+ BRIDGE SIGNS +	Inventory Rating HS 20.20
Roadway Area 2,971 sq ft	Posted Load NOT REQUIRED	Posting
Sidewalk Width - L/R	Traffic SPEED LIMIT	Rating Date 06-01-1976
Curb Height - L/R	Horizontal NOT REQUIRED	Mn/DOT Permit Codes
Rail Codes - L/R 38 38	Vertical NOT APPLICABLE	A: N B: N C: N

### Mn/DOT BRIDGE INSPECTION REPORT

Inspected by: DNR

**BRIDGE L5994 STATE 4 OVER BNSF RR**

**INSP. DATE: 11-02-2011**

County: LYON	Location: 0.6 MI NW OF JCT TH 23	Length: 132.4 ft
City:	Route: SPRK 4 Ref. Pt.:	Deck Width: 24.0 ft
Township: LYONS	Control Section: Maint. Area:	Rdwy. Area / Pct. Unsnd: 2,971 sq ft
Section: 05 Township: 110NN Range: 42W	Local Agency Bridge Nbr: S2	Paint Area/ Pct. Unsnd:
Span Type: TIMB BEAM SPAN		Culvert N/A
NBI Deck: 8 Super: 7 Sub: 7 Chan: N Culv: N		
Open, Posted, Closed: OTHER LD CAP RES		
Appraisal Ratings - Approach: 3 Waterway: N	MN Scour Code: A-NON WATERWAY	Def. Stat: F.O. Suff. Rate: 78.9
Required Bridge Signs - Load Posting: NOT REQUIRED Traffic: SPEED LIMIT		
Horizontal: NOT REQUIRED Vertical: NOT APPLICABLE		

**STRUCTURE UNIT: 0**

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
32	TIMBER DECK-BIT O/L	2	11-02-2011	3,175 SF	3,175	0	0	0	N/A
			10-28-2009	3,175 SF	3,175	0	0	0	N/A
Notes: [2011-THERE ARE 11 MINOR TRANSVERSE CRACKS IN THE OVERLAY OF THE MAIN SPAN									
2009- A new asphalt overlay was constructed in 2008. There are 5 minor transverse cracks in the overlay over the main span.]									
320	CONC APPR SLAB-BITOL	2	11-02-2011	2 EA	2	0	0	0	N/A
			10-28-2009	2 EA	2	0	0	0	N/A
Notes: [East end new in 2005.]									
332	TIMBER RAILING	2	11-02-2011	262 LF	236	26	0	N/A	N/A
			10-28-2009	262 LF	236	26	0	N/A	N/A
Notes: [< none >]									
107	PAINTED STEEL GIRDER	2	11-02-2011	420 LF	416	4	0	0	0
			10-28-2009	420 LF	417	3	0	0	0
Notes: [8. SPAN 3 HAS 12 STEEL GIRDERS (GRAY PAINT WITH ORANGE PRIMER). BOTTOM FLANGE OF GIRDERS AT EAST END OF SPAN HAVE VERY MINOR RUSTING.									
111	TIMBER GIRDER	2	11-02-2011	1,296 LF	907	363	26	0	N/A
			10-28-2009	1,296 LF	909	364	26	0	N/A
Notes: [11. SPAN 1 HAS 13 GIRDERS: LEFT FASCIA GIRDER HAS 1/4" SURFACE CHECK ALONG MIDDLE OF BEAM. RIGHT FASCIA GIRDER HAS 1/2" SURFACE CHECK. GIRDER NO 2 HAS MINOR DETERIORATION (BIRD NESTS), IS SLIGHTLY TWISTED AND HAS 1/4" SURFACE CHECK RUNNING ENTIRE LENGTH AT MIDDLE OF GIRDER. GIRDERS NO 5,6,8 AND 11 HAVE 1/4" TO 3/8" SURFACE CKECK RUNNING ENTIRE LENGTH AT MIDDLE OF GIRDER. CHECK DEPTHS AT GIRDER NO. 5 IS 2-1/4" . ENDS OF 2 GIRDERS AT PIER NO. 1 HAVE A 1/4" TO 1/2" END CHECKS.									
SPAN 2: GIRDERS NO 4 AND 8 HAVE 1/4" TO 3/8" WIDE X 2" DEEP SURFACE CHECKS RUNNING ENTIRE LENGHT (POTENTIAL FOR SHEAR CRACKS). GIRDER NO. 5 HAS 1/4" SURFACE CHECK RUNNING ENTIRE LENGTH AT MIDDLE OF BEAM. AT PIER NO. 1 GIRDER HAS 1/4" DIAGONAL CRACK 2" INTO BEAM. AT PIER NO. 2 GIRDER NO. 4 HAS 1/4" SPLIT THRU CHECK.									
SPAN 3: AT PIER NO. 3 THE END OF GIRDERS HAVE 1/4" END CHECKS. GIRDER NO. 6 AT PIER HAS MINOR TWIST AND 1/4" HEART CHECK. GIRDER NO. 5 AT PIER HAS 1/4" TO 3/8" X 2" DEEP SPLIT THRU CHECK FOR APPROX. 2 FEET.									
SPAN 4: (DID NOT INSPECT WITH SNOOPER BUCKET) GIRDER NO'S 3,4,5,10, AND 11 HAVE 1/4" SURFACE CHECK ENTIRE LENGTH. GIRDER NO. 8 HAS 1/4"-3/8" END CHECK.									
SPAN 5: FASCIA BEAMS HAVE 1/4" - 3/8" END CHECK. GIRDER NO.11 AND 12 HAVE 1/4" SURFACE CHECK FOR ENTIRE LENGTH. GIRDER NO. 5 AT PIER 4 HAS 3"X 4-1/2" +/- WEDGE TO MIDDLE OF BEAM CRACKED LOOSE. ENDS OF GIRDERS AT PIER NO. 4 HAVE MINOR CHECKING, ONE HAS 3/8" END CHECK.									

## Mn/DOT BRIDGE INSPECTION REPORT

Inspected by: DNR

BRIDGE L5994

STATE 4 OVER BNSF RR

INSP. DATE: 11-02-2011

## STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
206	TIMBER COLUMN	2	11-02-2011 10-28-2009	38 EA 38 EA	30 29	8 9	0 0	1 0	N/A N/A
Notes:  59. PIER NO. 2 - PILING NO 3,4, AND 5, HAVE GREEN ALGAE GROWING AT GROUNDLINE. PILING NO 4 HAS 1/4" END CHECK FOR APPROX. 1 FOOT AT TOP OF PILING. ALL THE PILING HAVE MINOR SURFACE CHECKS.									
PIER NO. 3 -2011 - PILE 2 (SECOND FROM THE SOUTH) IS ROTTED AT THE GROUNDLINE. ALL PILING HAVE MINOR SURFACE CHECKS. PILING NO. 6 HAS 1/4" SURFACE CHECKS ENTIRE LENGTH.									
PIER NO. 4 - PILING NO'S 2,3, AND 6 HAVE 1/4" TO 3/8" SURFACE CHECKS ENTIRE LENGTH. ALL PILING HAVE MINOR SURFACE CHECKING.									
216	TIMBER ABUTMENT	2	11-02-2011 10-28-2009	49 LF 49 LF	49 46	0 3	0 0	0 0	N/A N/A
Notes:  < none >									
235	TIMBER CAP	2	11-02-2011 10-28-2009	144 LF 144 LF	65 66	58 59	22 23	0 0	N/A N/A
Notes:  42. PIER CAP NO. 1 - RIGHT SIDE HAS 1/4" - 3/8" END CHECK WITH MINOR DETERIORATION AT END OF PIER CAP.									
PIER CAP NO. 2 - LEFT END OF CAP IS CHECKED WITH MOSS GROWING. HAIRLINE SURFACE CHECK RUNNING ENTIRE LENGTH OF CAP FOR 2-1/2 FEET. BOTTOM OF PIER CAP HAS NARROW TO HAIRLINE CRACK FOLLOWING BOLT LINE WITH DISCOLORATION.									
PIER CAP NO.3 HAS HAIRLINE TO 1/4" SURFACE CHECKS RUNNING ENTIRE LENGTH OF CAP. RIGHT END HAS 3/8" END CHECK FOR APPROX. 1 FOOT.									
PIER CAP NO.4 AT BOTTOM HAS 1/4" TO 3/8" CRACK AT BOLT LINE FOR ENTIRE LENGTH (NO SIGNS OF ROT), EXCEPT BETWEEN PILING NO. 1 AND 2 IT IS HAIRLINE. LEFT END OF CAP HAS MINOR END CHECKING.									
964	CRITICAL FINDING	2	11-02-2011 10-28-2009	1 EA 1 EA	1 1	0 0	N/A N/A	N/A N/A	N/A N/A
Notes:  2011 NO CRITICAL FINDINGS NOTED									
981	SIGNING	2	11-02-2011 10-28-2009	1 EA 1 EA	0 1	0 0	1 0	0 0	0 0
Notes:  2011 - NE DELINEATOR SHOULD BE REATTACHED TO THE END POST									
Signs Required: Traffic Control Horizontal delineators are in place.]									
982	GUARDRAIL	1	11-02-2011 10-28-2009	1 EA 1 EA	1 1	0 0	0 0	N/A N/A	N/A N/A
Notes:  Galvanized steel w-rail on sw and nw corner. cable railing off of se and ne corner.									
984	DRAINAGE	2	11-02-2011 10-28-2009	1 EA 1 EA	1 1	0 0	0 0	N/A N/A	N/A N/A
Notes:  < none >									
985	SLOPES	2	11-02-2011 10-28-2009	1 EA 1 EA	0 0	1 1	0 0	N/A N/A	N/A N/A
Notes:  Concrete slope protection in good condition.									

### Mn/DOT BRIDGE INSPECTION REPORT

Inspected by: DNR

**BRIDGE L5994**

**STATE 4 OVER BNSF RR**

**INSP. DATE: 11-02-2011**

STRUCTURE UNIT: 0

ELEM NBR	ELEMENT NAME	ENV	INSP. DATE	QUANTITY	QTY CS 1	QTY CS 2	QTY CS 3	QTY CS 4	QTY CS 5
986	CURB & SIDEWALK	2	11-02-2011	1 EA	0	1	0	N/A	N/A
			10-28-2009	1 EA	0	1	0	N/A	N/A

Notes: |Minor damage to timber curb.|

General Notes: 2011 - RE-ATTACH SE HORIZONTAL DELINEATOR

Seal cracks in asphalt overlay routinely with a hot poured bituminous sealant.

Inspector's Signature

Reviewer's Signature / Date