

	Project Name:	FOREST LAKE VEHICULAR BRIDGE	By:	NBE
	Project No.:	521715	Date:	3/2/2021
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LOAD RATING CALCULATIONS
FOR
FOREST LAKE VEHICULAR BRIDGE
ELITE PROPERTIES OF AMERICA, INC.
100' LONG X 30' WIDE Modular
FOUTNAIN, CO
BIG R BRIDGE JOB NO. 521715

Load Rating Specifications: THE MANUAL FOR BRIDGE EVALUATION, THIRD EDITION, 2018 BY AASHTO (MBE)

Design Specifications: AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH EDITION, 2017 (ABDS)

Structural Materials: Structural Steel: ASTM A 709 Grade 50W Weathering Steel



3-2-21

March 2, 2021



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Design Vehicle Load Rating Factors	Interior Girder				Exterior Girder			
	Strength I		Service II		Strength I		Service II	
	Inv RF	Opr RF	Inv RF	Opr RF	Inv RF	Opr RF	Inv RF	Opr RF
HL-93 Flexure	1.45	1.87	1.26	1.64	1.08	1.40	1.08	1.40
HL-93 Shear	4.21	5.45	N/A	N/A	5.43	7.04	N/A	N/A

AASHTO Legal Loads, Interior Girder Load Rating Factors		Flexure w/ IM				Flexure w/o IM			
		Strength I		Service II		Strength I		Service II	
		RF	Tons	RF	Tons	RF	Tons	RF	Tons
Routine Commercial Traffic (C)	Type 3	3.57	89.31	2.31	57.72	4.75	118.79	3.07	76.77
	Type 3S2	2.95	106.19	1.91	68.63	3.92	141.23	2.54	91.28
	Type 3-3	2.93	117.16	1.89	75.72	3.90	155.83	2.52	100.71
Specialized Hauling Vehicles (H)	NRL	2.26	90.32	1.46	58.37	3.00	120.12	1.94	77.64
	SU4	3.22	86.97	2.08	56.21	4.28	115.68	2.77	74.76
	SU5	2.88	89.21	1.86	57.66	3.83	118.65	2.47	76.68
	SU6	2.58	89.58	1.67	57.89	3.43	119.14	2.22	77.00
	SU7	2.35	90.87	1.52	58.73	3.12	120.86	2.02	78.11

AASHTO Legal Loads, Exterior Girder Load Rating Factors		Flexure w/ IM				Flexure w/o IM			
		Strength I		Service II		Strength I		Service II	
		RF	Tons	RF	Tons	RF	Tons	RF	Tons
Routine Commercial Traffic (C)	Type 3	2.67	66.73	1.98	49.46	3.55	88.75	2.63	65.78
	Type 3S2	2.20	79.34	1.63	58.80	2.93	105.52	2.17	78.21
	Type 3-3	2.19	87.53	1.62	64.88	2.91	116.42	2.16	86.29
Specialized Hauling Vehicles (H)	NRL	1.69	67.48	1.25	50.01	2.24	89.75	1.66	66.52
	SU4	2.41	64.98	1.78	48.16	3.20	86.42	2.37	64.06
	SU5	2.15	66.65	1.59	49.40	2.86	88.65	2.12	65.70
	SU6	1.93	66.92	1.43	49.60	2.56	89.01	1.90	65.97
	SU7	1.75	67.89	1.30	50.32	2.33	90.30	1.73	66.93



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Load Ratings per The Manual For Bridge Evaluation,
Third Edition, 2018 by AASHTO

Reference

$$RF = (C - (\gamma_{DC})(DC) - (\gamma_{DW})(DW)) / ((\gamma_{LL})(LL + IM))$$

6A.4.2.1

C = $\phi_c \phi_s \phi_R R_n$ for Strength Limit State

$$\phi_c = 1$$

Tbl 6A.4.2.3-1

C = f_R for Service Limit State

$$\phi_s = 1$$

Tbl 6A.4.2.4-1

$$\phi_f = 1$$

$$ADTT = 172$$

$$\phi_v = 1$$

Load Factors	γ_{DC}	γ_{DW}	Design Load		Legal Load (C)	Legal Load (H)
			Inventory	Operating		
			γ_{LL}	γ_{LL}	γ_{LL}	γ_{LL}
Strength I	1.25	1.5	1.75	1.35	1.3	1.3
Strength II	1.25	1.5	X	X	X	X
Service II	1	1	1.3	1	1.3	1.3

Tbl 6A.4.2.2-1

Tbl 6A.4.4.2.3a-1

Tbl 6A.4.4.2.3b-1

Tbl 6A.4.5.4.2a-1

C: Routine Commercial Traffic

H: Specialized Hauling Vehicles

Permit Load Factors	AL	GVW	GVW/AL	# Lanes	γ_{LL}
	ft	k	k/ft		
None	0	0	0	1	1.4
None	0	0	0	1	1.4
None	0	0	0	1	1.4
None	0	0	0	1	1.4

Tbl 6A.4.5.4.2a-1

Design Live Loads	Interior Girder		Exterior Girder	
	M_{LL+IM} (ft-k)	f_{LL+IM} (ksi)	M_{LL+IM} (ft-k)	f_{LL+IM} (ksi)
HL-93 Flexure	1372.5	14.687	1432.6	16.034
HL-93 Shear *	104.64	X	79.642	X

$$M_{LL} = gM_{LL(total)}$$

$$M_{LL+IM} = M_{LL}IM$$

* Use V (k) in place of M (ft-k)

AASHTO Legal Live Loads	$M_{LL(total)}$ (ft-k)	IM	Interior Girders			Exterior Girders			W (tons)
			g	M_{LL} (ft-k)	M_{LL+IM} (ft-k)	g	M_{LL} (ft-k)	M_{LL+IM} (ft-k)	
Type 3	1085.71	1.33	0.518	562.36	747.94	0.5406	586.97	780.67	25
Type 3S2	1314.94	1.33	0.518	681.1	905.86	0.5406	710.9	945.5	36
Type 3-3	1324.21	1.33	0.518	685.9	912.25	0.5406	715.92	952.17	40
NRL	1717.79	1.33	0.518	889.77	1183.4	0.5406	928.7	1235.2	40
SU4	1204.08	1.33	0.518	623.68	829.49	0.5406	650.97	865.79	27
SU5	1347.80	1.33	0.518	698.12	928.5	0.5406	728.66	969.12	31
SU6	1504.68	1.33	0.518	779.38	1036.6	0.5406	813.48	1081.9	34.75
SU7	1653.92	1.33	0.518	856.68	1139.4	0.5406	894.16	1189.2	38.75



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Permit Vehicle Live Loads	M _{LL(total)} (ft-k)	IM	Interior Girders			Exterior Girders			W (tons)
			g	M _{LL} (ft-k)	M _{LL+IM} (ft-k)	g	M _{LL} (ft-k)	M _{LL+IM} (ft-k)	
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0
None	0.00	1	0	0	0	0	0	0	0

Capacities and Dead Loads	ϕM_n (ft-k)	ϕV_n (k)	M _{DC} (ft-k)	M _{DW} (ft-k)	V _{DC} (k)	V _{DW} (k)	S _x (in ³)	f _R (ksi)	f _{DC} (ksi)	f _{DW} (ksi)
Interior Girder	5617.2	856.81	1319.3	329.63	53.275	13.311	1121.4	47.5	19.57	3.9064
Exterior Girder	5194.8	856.81	975.7	844.24	39.399	34.091	1072.2	47.5	14.473	10.557

Deck Rating	Per Section 6.1.5.1, Decks do not need to be evaluated for load capacity but should be inspected regularly to verify satisfactory performance
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