



CON/SPAN O-SERIES LOAD RATING



CONTECH PROJECT #468920

US ROUTE 2 BIRDGE NO. 126 TOWN OF LUNENBURG ESSEX COUNTY, VERMONT  
Vermont Agency of Transportation  
RECEIVED  
ON: April 26, 2016  
and Checked for CONFORMANCE

BY: Danny Landry DATE: 04/26/16

SHOP DRAWING REVIEW

REVIEWED AS REQUIRED BY THE CONSTRUCTION CONTRACT DOCUMENTS AND APPROVED, BUT ONLY FOR CONFORMANCE TO THE DESIGN CONCEPT OF THE WORK, AND SUBJECT TO FURTHER LIMITATIONS AND REQUIREMENTS CONTAINED IN THE CONSTRUCTION CONTRACT DOCUMENTS

DATE: April 14, 2016

REJECTED  REVISE AND RESUBMIT  APPROVED AS NOTED

CORRECTIONS OR COMMENTS MADE ON THE SHOP DRAWINGS DURING THIS REVIEW DID NOT RELIEVE CONTRACTOR FROM COMPLIANCE WITH REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. THIS CHECK IS ONLY FOR REVIEW OF GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR: CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS; SELECTING FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION; COORDINATING THEIR WORK WITH THAT OF ALL OTHER TRADES; AND PERFORMING THEIR WORK IN A SAFE AND SATISFACTORY MANNER.



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Job Number: 120106  
Reviewed by: NDC  
Date: 4/22/16



LRFR LOAD RATING FACTORS							
LOADING LEVELS	TRUCK						
	<i>H-20</i>	<i>HL-93</i>	<i>3S2</i>	<i>6 AXLE</i>	<i>3A STR.</i>	<i>4A STR.</i>	<i>5A SEMI</i>
<i>TONNAGE</i>	20	36	36	66	30	34.5	38
<i>INVENTORY</i>	5.1	4.1					
<i>POSTING</i>							
<i>OPERATING</i>	6.1	4.3	13.3	6.5	9.2	8.2	12.8
<i>COMMENTS:</i>							



## LRFR LOAD RATING ANALYSIS

**PROJECT NAME:** US ROUTE 2 BIRDGE NO. 126 TOWN OF LUNENBURG  
**CON/SPAN REF:** 468920  
**DATE:** 14-Apr-16  
**BY:** KDK

### DEFINITIONS

- O.R.F.** = Operating Rating Factor
- I.R.F.** = Inventory Rating Factor
- f<sub>y</sub>** = Yield Stress of Steel  
65 ksi (welded wire fabric)  
60 ksi (plain rebar)
- f<sub>s(DL)</sub>** = Dead Load Stress on Steel (from CANDE output)
- f<sub>s(LL+I)</sub>** = Live Load + Impact Stress on Steel (from CANDE output)
- φ** = Reduction Factor (per AASHTO LRFD 12.5.5)  
0.95 (COMBINED FLEXURE & THRUST)  
0.90 (SHEAR)
- v<sub>c</sub>** = Nominal Shear Strength (PER AASHTO LRFD 5.8.3.3 for <2'-0" cover,  
per 5.14.5 for > 2'-0" Cover)
- v<sub>(DL)</sub>** = Dead Load Shear Stress (from CANDE output)
- v<sub>(LL+I)</sub>** = Live Load + Impact Shear Stress (from CANDE output)

### EQUATIONS USED IN SPREADSHEET\*

- Legal Load O.R.F.** =  $(f - 1.25DC - 1.50DW) / (1.40L)$
- LRFR Design Load O.R.F.** =  $(f - 1.25DC - 1.50DW) / (1.75L)$
- LRFR Design Load I.R.F.** =  $(f - 1.25DC - 1.50DW) / (1.35L)$

Where:  $D = f_{s(DL)} / f_y$  or  $v_{(DL)} / v_c$

$L = f_{s(LL+I)} / f_y$  or  $v_{(LL+I)} / v_c$

\*Factors applied in CANDE

### INPUT PARAMETERS

- |                           |  |
|---------------------------|--|
| <b>Span</b> = 20'-0"      | <b>f<sub>y</sub> (ksi)</b> = 65        |
| <b>Rise</b> = 9'-3 5/8"   | <b>f<sub>c</sub> (psi)</b> = 5000      |
| <b>Max Cover</b> = 13'-0" | <b>v<sub>c&gt;2'</sub> (psi)</b> = 212 |
| <b>Min Cover</b> = 1'-0"  | <b>v<sub>c≤2'</sub> (psi)</b> = 141    |



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SUMMARY SHEET 3S2 (LRFR)

DESCRIPTION OPR COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR $\phi$	OPERATING FACTORED LOAD STRESSES		INVENTORY FACTORED LOAD STRESSES		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			Steel Stress - ksi		Steel Stress - ksi					
			Shear - psi		Shear - psi					
DL + LL + I		DL ONLY	DL + LL + I		DL ONLY					
<b>3S2</b> <b>13'-0"</b> pos. moment	36	0.95	41.6	41.1	N/A	N/A	41.3	1486.8	N/A	N/A
<b>3S2</b> <b>13'-0"</b> <i>Neg. Moment, (M-)</i>	36	0.95	34.6	32.4	N/A	N/A	13.3	480.3	N/A	N/A
<b>3S2</b> <b>13'-0"</b> shear	36	0.90	111.0	110.2	N/A	N/A	100.7	3626.2	N/A	N/A

The Operating Rating Factor is: **13.3**



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SUMMARY SHEET 6 AXLE TRAILER (LRFR)

DESCRIPTION OPR COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR $\phi$	OPERATING FACTORED LOAD STRESSES		INVENTORY FACTORED LOAD STRESSES		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			Steel Stress - ksi		Steel Stress - ksi					
			Shear - psi		Shear - psi					
DL + LL + I		DL ONLY	DL + LL + I		DL ONLY					
6 AXLE TRAILER 13'-0" pos. moment	66	0.95	41.8	41.1	N/A	N/A	29.5	1947.0	N/A	N/A
6 AXLE TRAILER 13'-0" <i>Neg. Moment, (M-)</i>	66	0.95	36.9	32.4	N/A	N/A	6.5	430.5	N/A	N/A
6 AXLE TRAILER 13'-0" shear	66	0.90	111.5	110.2	N/A	N/A	62.0	4091.1	N/A	N/A

The Operating Rating Factor is: **6.5**



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SUMMARY SHEET 3 AXLE STRAIGHT (LRFR)

DESCRIPTION OPR COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR φ	OPERATING FACTORED LOAD STRESSES		INVENTORY FACTORED LOAD STRESSES		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			Steel Stress - ksi		Steel Stress - ksi					
			Shear - psi		Shear - psi					
DL + LL + I		DL ONLY	DL + LL + I		DL ONLY					
<b>3 AXLE STRAIGHT 13'-0"</b> pos. moment	30	0.95	41.6	41.1	N/A	N/A	41.3	1239.0	N/A	N/A
<b>3 AXLE STRAIGHT 13'-0"</b> <i>Neg. Moment, (M-)</i>	30	0.95	35.6	32.4	N/A	N/A	9.2	275.2	N/A	N/A
<b>3 AXLE STRAIGHT 13'-0"</b> shear	30	0.90	111.3	110.2	N/A	N/A	73.3	2197.7	N/A	N/A

The Operating Rating Factor is: **9.2**



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SUMMARY SHEET 4 AXLE STRAIGHT (LRFR)

DESCRIPTION OPR COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR $\phi$	OPERATING FACTORED LOAD STRESSES		INVENTORY FACTORED LOAD STRESSES		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			Steel Stress - ksi		Steel Stress - ksi					
			Shear - psi		Shear - psi					
DL + LL + I		DL ONLY	DL + LL + I		DL ONLY					
4 AXLE STRAIGHT 13'-0" pos. moment	34.5	0.95	41.5	41.1	N/A	N/A	51.6	1781.1	N/A	N/A
4 AXLE STRAIGHT 13'-0" <i>Neg. Moment, (M-)</i>	34.5	0.95	36.0	32.4	N/A	N/A	8.2	281.3	N/A	N/A
4 AXLE STRAIGHT 13'-0" shear	34.5	0.90	111.2	110.2	N/A	N/A	80.6	2780.1	N/A	N/A

The Operating Rating Factor is: **8.2**



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SUMMARY SHEET 5 AXLE SEMI (LRFR)

DESCRIPTION OPR COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR φ	OPERATING FACTORED LOAD STRESSES		INVENTORY FACTORED LOAD STRESSES		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			Steel Stress - ksi		Steel Stress - ksi					
			Shear - psi		Shear - psi					
DL + LL + I		DL ONLY	DL + LL + I		DL ONLY					
5 AXLE SEMI 13'-0" pos. moment	38	0.95	41.4	41.1	N/A	N/A	68.8	2615.7	N/A	N/A
5 AXLE SEMI 13'-0" <i>Neg. Moment, (M-)</i>	38	0.95	34.7	32.4	N/A	N/A	12.8	484.9	N/A	N/A
5 AXLE SEMI 13'-0" shear	38	0.90	111.0	110.2	N/A	N/A	100.7	3827.6	N/A	N/A

The Operating Rating Factor is: **12.8**

		PROJECT 468920	SUMMARY SHEET H20 (LRFR)							
DESCRIPTION OPR/INV COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR $\phi$	OPERATING FACTORED LOAD STRESSES Steel Stress - ksi Shear - psi		INVENTORY FACTORED LOAD STRESSES Steel Stress - ksi Shear - psi		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			DL + LL + I	DL ONLY	DL + LL + I	DL ONLY				
H20 13'-0"   13'-0" pos. moment	20	0.95	42.1	41.1	42.3	41.1	20.7	413.0	17.2	344.2
H20 13'-0"   13'-0" Neg. Moment, (M-)	20	0.95	37.2	32.4	38.2	32.4	6.1	122.3	5.1	101.2
H20 13'-0"   13'-0" shear	20	0.90	111.9	110.2	112.4	110.2	47.4	948.0	36.6	732.6

The Inventory Rating Factor is:	5.1
The Operating Rating Factor is:	6.1

		PROJECT 468920	SUMMARY SHEET HL93 TRUCK (LRFR)							
DESCRIPTION OPR/INV COVER <i>Controlling</i>	TOTAL LIVE LOAD TONNAGE	REDUCTION FACTOR $\phi$	OPERATING FACTORED LOAD STRESSES Steel Stress - ksi Shear - psi		INVENTORY FACTORED LOAD STRESSES Steel Stress - ksi Shear - psi		O.R.F.	OPERATING RATING (TONS)	I.R.F.	INVENTORY RATING (TONS)
			DL + LL + I	DL ONLY	DL + LL + I	DL ONLY				
HL93 TRUCK 13'-0"   13'-0" pos. moment	36	0.95	41.8	41.1	41.9	41.1	29.5	1062.0	25.8	929.3
HL93 TRUCK 13'-0"   13'-0" Neg. Moment, (M-)	36	0.95	39.3	32.4	39.5	32.4	4.3	153.1	4.1	148.8
HL93 TRUCK 13'-0"   13'-0" shear	36	0.90	112.1	110.2	112.6	110.2	42.4	1526.8	33.6	1208.7

The Inventory Rating Factor is:	4.1
The Operating Rating Factor is:	4.3