DocuSign Envelope ID: 62F4EDF2-40A2-456A-8C52-0B1183872025

# LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

| LEVEL | | VEHICLE | WEIGHT (W) (TONS) | CONTROLLING LOAD RATING (#) | MINIMUM RATING FACTORS (RF) | TONS = W × RF | STRENGTH I LIMIT STATE | | | | | | | | | COMMENT NUMBER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | LIVE-LOAD FACTORS $\gamma_{(LL)}$ | MOMENT | | | | SHEAR | | | | |
| | | | | | | | | RATING FACTOR | BOX NO. | ELEMENT TYPE | DISTANCE FROM LEFT END OF ELEMENT (ft) | RATING FACTOR | BOX NO. | ELEMENT TYPE | DISTANCE FROM LEFT END OF ELEMENT (ft) | |
| DESIGN LOAD RATING | | HL-93 (INVENTORY) | N/A | 1 | 1.42 | -- | 1.75 | 1.42 | 1 | EXTERIOR WALL | 9.00 | 1.75 | 1 | TOP SLAB | 9.00 | |
| | | HL-93 (OPERATING) | N/A | | 1.84 | -- | 1.35 | 1.84 | 1 | EXTERIOR WALL | 9.00 | 2.27 | 1 | TOP SLAB | 9.00 | |
| | | HS-20 (INVENTORY) | 36.000 | 2 | 1.42 | 51.12 | 1.75 | 1.42 | 1 | EXTERIOR WALL | 9.00 | 1.75 | 1 | TOP SLAB | 9.00 | |
| | | HS-20 (OPERATING) | 36.000 | | 1.84 | 66.24 | 1.35 | 1.84 | 1 | EXTERIOR WALL | 9.00 | 2.27 | 1 | TOP SLAB | 9.00 | |
| LEGAL LOAD RATING | SINGLE VEHICLE (SV) | SNSH | 13.500 | | 2.31 | 31.19 | 1.40 | 2.31 | 1 | EXTERIOR WALL | 9.00 | 3.26 | 1 | TOP SLAB | 9.00 | |
| | | SNGARBS2 | 20.000 | | 2.21 | 44.20 | 1.40 | 2.21 | 1 | EXTERIOR WALL | 9.00 | 3.01 | 1 | TOP SLAB | 9.00 | |
| | | SNAGRIS2 | 22.000 | | 2.31 | 50.82 | 1.40 | 2.31 | 1 | EXTERIOR WALL | 9.00 | 3.17 | 1 | TOP SLAB | 9.00 | |
| | | SNCOTTS3 | 27.250 | 3 | 1.38 | 37.61 | 1.40 | 1.38 | 1 | EXTERIOR WALL | 9.00 | 1.91 | 1 | TOP SLAB | 9.00 | |
| | | SNAGGRS4 | 34.925 | | 1.50 | 52.39 | 1.40 | 1.50 | 1 | EXTERIOR WALL | 9.00 | 2.12 | 1 | TOP SLAB | 9.00 | |
| | | SNS5A | 35.550 | | 1.45 | 51.55 | 1.40 | 1.45 | 1 | EXTERIOR WALL | 9.00 | 2.00 | 1 | TOP SLAB | 9.00 | |
| | | SNS6A | 39.950 | | 1.45 | 57.93 | 1.40 | 1.45 | 1 | EXTERIOR WALL | 9.00 | 2.00 | 1 | TOP SLAB | 9.00 | |
| | | SNS7B | 42.000 | | 1.45 | 60.90 | 1.40 | 1.45 | 1 | EXTERIOR WALL | 9.00 | 1.97 | 1 | TOP SLAB | 9.00 | |
| | TRUCK TRACTOR SEMI-TRAILER (TTST) | TNAGRIT3 | 33.000 | | 2.31 | 76.23 | 1.40 | 2.31 | 1 | EXTERIOR WALL | 9.00 | 2.78 | 1 | TOP SLAB | 9.00 | |
| | | TNT4A | 33.075 | | 1.58 | 52.26 | 1.40 | 1.58 | 1 | EXTERIOR WALL | 9.00 | 2.21 | 1 | TOP SLAB | 9.00 | |
| | | TNT6A | 41.600 | | 1.50 | 62.40 | 1.40 | 1.50 | 1 | EXTERIOR WALL | 9.00 | 2.04 | 1 | TOP SLAB | 9.00 | |
| | | TNT7A | 42.000 | | 1.54 | 64.68 | 1.40 | 1.54 | 1 | EXTERIOR WALL | 9.00 | 2.16 | 1 | TOP SLAB | 9.00 | |
| | | TNT7B | 42.000 | | 1.50 | 63.00 | 1.40 | 1.50 | 1 | EXTERIOR WALL | 9.00 | 2.07 | 1 | TOP SLAB | 9.00 | |
| | | TNAGRIT4 | 43.000 | | 1.58 | 67.94 | 1.40 | 1.58 | 1 | EXTERIOR WALL | 9.00 | 2.15 | 1 | TOP SLAB | 9.00 | |
| | | TNAGT5A | 45.000 | | 1.58 | 71.10 | 1.40 | 1.58 | 1 | EXTERIOR WALL | 9.00 | 2.15 | 1 | TOP SLAB | 9.00 | |
| | | TNAGT5B | 45.000 | | 1.58 | 71.10 | 1.40 | 1.58 | 1 | EXTERIOR WALL | 9.00 | 2.11 | 1 | TOP SLAB | 9.00 | |

## LOAD FACTORS:

DESIGN LOAD RATING FACTORS

| LOAD TYPE | MAX FACTOR | MIN FACTOR |
|---|---|---|
| DC | 1.25 | 0.90 |
| DW | 1.50 | 0.65 |
| EV | 1.30 | 0.90 |
| EH | 1.35 | 0.90 |
| ES | 1.35 | 0.90 |
| LS | 1.75 | -- |
| WA | 1.00 | -- |

## NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

SHEAR RATING FACTORS COMPUTED WITH A FILL DEPTH OF 4.8 FT.

## COMMENTS:

1. VERTICAL ELEMENTS ARE REFERENCED STARTING AT THE BOTTOM.
2.
3.
4.

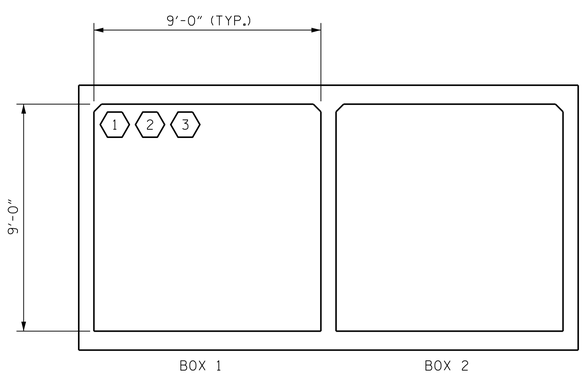
(#) CONTROLLING LOAD RATING

(1) DESIGN LOAD RATING (HL-93)

(2) DESIGN LOAD RATING (HS-20)

(3) LEGAL LOAD RATING **

** SEE CHART FOR VEHICLE TYPE




LRFR SUMMARY
(LOOKING DOWNSTREAM)

PROJECT NO. W-5107
JOHNSTON COUNTY
STATION: 17+33.63 -Y6LPB-

SHEET 7 OF 7

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS
(NON-INTERSTATE TRAFFIC)

NORTH CAROLINA PROFESSIONAL SEAL 027799 ENGINEER PAUL A. de PAOLI
DOCUSIGNED BY:
11/20/2014

MI ENGINEERING
1011 SCHAUB DRIVE, SUITE 100
RALEIGH, NC 27606
(919) 851-6606
FIRM PE NUMBER : P-0671

| REVISIONS | | | | | | SHEET NO. |
|---|---|---|---|---|---|---|
| NO. | BY: | DATE: | NO. | BY: | DATE: | C-23 |
| 1 | | | 3 | | | TOTAL SHEETS |
| 2 | | | 4 | | | 36 |

ASSEMBLED BY: J.S. ISRAELNAIM DATE: 06/14
CHECKED BY : P.A. de PAOLI DATE: 06/14
DESIGN ENGINEER OF RECORD: P.A. de PAOLI DATE: 06/14
DRAWN BY : WMC 7/11
CHECKED BY : GM 7/11
REV. 10/1/11 MAA/GM

11/20/2014
10:19:04 AM
User:blanning
Filename: P:\NC Bridges\WI2005 - W-5107 Johnston Co\WI2005.05_Culvert 3_New_Quincosin Swamp at -Y6LPB-\Structures\412.035_C03_W5107_SMU_CU7.dgn