

# LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR STEEL GIRDERS

| LEVEL                    | VEHICLE                                | WEIGHT (W)<br>(TONS)  | CONTROLLING<br>LOAD RATING<br># | MINIMUM<br>RATING FACTORS<br>(RF) | TONS = W x RF | STRENGTH I LIMIT STATE                  |                              |               |      |                 |   |                              |               |      |                 | SERVICE II LIMIT STATE                    |   |                              |               |      | COMMENT NUMBER |                 |   |    |
|--------------------------|--|-----------------------|---------------------------------|-----------------------------------|---------------|---|------------------------------|---------------|------|-----------------|---|------------------------------|---------------|------|-----------------|---|---|------------------------------|---------------|------|----------------|-----------------|---|----|
|                          |  |                       |                                 |                                   |               | MOMENT                                  |                              |               |      |                 | SHEAR                                     |                              |               |      |                 | MOMENT                                    |   |                              |               |      |                |                 |   |    |
|                          |  |                       |                                 |                                   |               | LIVE-LOAD<br>FACTORS (γ <sub>LL</sub> ) | DISTRIBUTION<br>FACTORS (DF) | RATING FACTOR | SPAN | GIRDER LOCATION | DISTANCE FROM<br>LEFT END OF<br>SPAN (ft) | DISTRIBUTION<br>FACTORS (DF) | RATING FACTOR | SPAN | GIRDER LOCATION | DISTANCE FROM<br>LEFT END OF<br>SPAN (ft) | LIVE-LOAD<br>FACTORS (γ <sub>LL</sub> ) | DISTRIBUTION<br>FACTORS (DF) | RATING FACTOR | SPAN |                | GIRDER LOCATION | DISTANCE FROM<br>LEFT END OF<br>SPAN (ft) |    |
| DESIGN<br>LOAD<br>RATING | HL-93 (INVENTORY)                      | N/A                   | ①                               | 1.15                              | --            | 1.75                                    | --                           | 1.15          | H    | 4               | 0.00                                      | --                           | 1.48          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 1.72          | F    | 4              | 95.16           | --  |    |
|                          | HL-93 (OPERATING)                      | N/A                   |                                 | 1.49                              | --            | 1.35                                    | --                           | 1.49          | H    | 4               | 0.00                                      | --                           | 1.92          | G    | 3               | 0.00                                      | 1.00                                    | --                           | 2.24          | F    | 4              | 95.16           | --  |    |
|                          | HS-20 (INVENTORY)                      | 36.000                | ②                               | 1.99                              | 71.64         | 1.75                                    | --                           | 1.99          | F    | 4               | 45.13                                     | --                           | 2.49          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 2.94          | F    | 4              | 69.97           | --  |    |
|                          | HS-20 (OPERATING)                      | 36.000                |                                 | 2.58                              | 92.87         | 1.35                                    | --                           | 2.58          | F    | 4               | 45.13                                     | --                           | 3.23          | G    | 3               | 0.00                                      | 1.00                                    | --                           | 3.82          | F    | 4              | 69.97           | --  |    |
| LEGAL<br>LOAD<br>RATING  | SINGLE VEHICLE<br>(SV)                 | SH                    |                                 | 4.44                              | 55.50         | 1.40                                    | --                           | 4.44          | H    | 4               | 0.00                                      | --                           | 6.38          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 5.52          | I    | 4              | 0.00            | --  |    |
|                          |  | S3C                   | 21.500                          |                                   | 3.26          | 70.09                                   | 1.40                         | --            | 3.26 | I               | 4   | 22.10                        | --            | 4.47 | G               | 3   | 0.00                                    | 1.30                         | --            | 4.00 | J              | 4               | 0.00                                      | -- |
|                          |  | S3A                   | 22.750                          |                                   | 3.13          | 71.21                                   | 1.40                         | --            | 3.13 | I               | 4   | 22.10                        | --            | 4.28 | G               | 3   | 0.00                                    | 1.30                         | --            | 3.85 | J              | 4               | 0.00                                      | -- |
|                          |  | S4A                   | 26.750                          |                                   | 2.80          | 74.90                                   | 1.40                         | --            | 2.80 | I               | 4   | 22.10                        | --            | 3.87 | G               | 3   | 0.00                                    | 1.30                         | --            | 3.49 | J              | 4               | 0.00                                      | -- |
|                          |  | S5A                   | 30.500                          |                                   | 2.56          | 78.08                                   | 1.40                         | --            | 2.56 | I               | 4   | 22.10                        | --            | 3.40 | G               | 3   | 0.00                                    | 1.30                         | --            | 3.20 | J              | 4               | 0.00                                      | -- |
|                          |  | S6A                   | 34.500                          |                                   | 2.34          | 80.73                                   | 1.40                         | --            | 2.34 | I               | 4   | 22.10                        | --            | 3.06 | G               | 3   | 0.00                                    | 1.30                         | --            | 2.97 | I              | 4               | 0.00                                      | -- |
|                          |  | S7B                   | 38.500                          |                                   | 2.17          | 83.55                                   | 1.40                         | --            | 2.17 | I               | 4   | 22.10                        | --            | 2.89 | G               | 3   | 0.00                                    | 1.30                         | --            | 2.70 | F              | 4               | 45.13                                     | -- |
|                          | STA                                    | 40.000                | ③                               | 2.13                              | 85.20         | 1.40                                    | --                           | 2.13          | I    | 4               | 22.10                                     | --                           | 2.99          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 2.65          | F    | 4              | 69.97           | --  |    |
|                          | TRUCK TRACTOR<br>SEMI-TRAILER<br>(TTS) | T4A                   | 28.250                          |                                   | 2.72          | 76.84                                   | 1.40                         | --            | 2.72 | I               | 4   | 22.10                        | --            | 3.76 | G               | 3   | 0.00                                    | 1.30                         | --            | 3.40 | I              | 4               | 0.00                                      | -- |
|                          |  | T5B                   | 32.000                          |                                   | 2.49          | 79.68                                   | 1.40                         | --            | 2.49 | I               | 4   | 22.10                        | --            | 3.52 | G               | 3   | 0.00                                    | 1.30                         | --            | 3.14 | I              | 4               | 0.00                                      | -- |
| T6A                      |  | 36.000                |                                 | 2.30                              | 82.80         | 1.40                                    | --                           | 2.30          | I    | 4               | 22.10                                     | --                           | 3.34          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 2.91          | I    | 4              | 0.00            | --  |    |
|                          | T7A                                    | 40.000                |                                 | 2.14                              | 85.60         | 1.40                                    | --                           | 2.14          | I    | 4               | 22.10                                     | --                           | 3.06          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 2.66          | F    | 4              | 69.97           | --  |    |
|                          | T7B                                    | 40.000                |                                 | 2.14                              | 85.60         | 1.40                                    | --                           | 2.14          | I    | 4               | 22.10                                     | --                           | 2.82          | G    | 3               | 0.00                                      | 1.30                                    | --                           | 2.72          | F    | 4              | 45.13           | --  |    |
| FATIGUE                  | HL-93 (INVENTORY)                      | γ <sub>LL</sub> =0.75 |                                 | --                                |               |   |                              |               |      |                 |   |                              |               |      |                 |   |   |                              |               |      |                |                 |   |    |

## LOAD FACTORS:

| DESIGN<br>LOAD<br>RATING<br>FACTORS | LIMIT STATE | γ <sub>DC</sub> | γ <sub>DW</sub> |
|-------------------------------------|-------------|-----------------|-----------------|
|                                     | STRENGTH I  | 1.25            | 1.50            |
|                                     | SERVICE II  | 1.00            | 1.00            |

## NOTES:

MINIMUM RATING FACTORS ARE BASED ON THE STRENGTH I AND SERVICE II LIMIT STATES.  
ALLOWABLE STRESS FOR SERVICE II LIMIT STATE ARE AS REQUIRED FOR DESIGN.

## COMMENTS:

- THE ORIGINAL DESIGN AND RATING OF THIS BRIDGE WAS BASED ON AN INFLUENCE SURFACE ANALYSIS. LIVE LOAD DISTRIBUTION FACTORS WERE NOT USED AND ARE NOT PROVIDED.
- DISTANCE FROM LEFT END OF SPAN IS GIVEN WITH RESPECT TO CENTERLINE OF BEARING AND IS MEASURED ALONG THE CONTROLLING GIRDER.
- FATIGUE RATING IS NOT REQUIRED OR REPORTED SINCE GIRDER DESIGN DOES NOT INCLUDE FATIGUE-PRONE DETAILS.
- LARSA 4D VERSION 8.00 r8101 WAS USED FOR INFLUENCE SURFACE ANALYSIS.
- AS APPLICABLE FOR THIS UNIT, LEGAL LOAD RATING INCLUDES CONSIDERATION OF THE FOLLOWING (PER AASHTO MANUAL FOR BRIDGE EVALUATION, 3RD ED., 2018, 6A.4.4.2.1a):
  - 100% OF ONE LEGAL LOAD VEHICLE WITH NO LANE LOAD
  - 75% OF ONE LEGAL LOAD VEHICLE WITH 0.200 KLF LANE LOAD
  - 75% OF TWO LEGAL LOAD VEHICLES SEPARATED BY 30 FEET WITH 0.200 KLF LANE LOAD (NEGATIVE MOMENT ONLY)

**# CONTROLLING LOAD RATING**

① DESIGN LOAD RATING (HL-93)

② DESIGN LOAD RATING (HS-20)

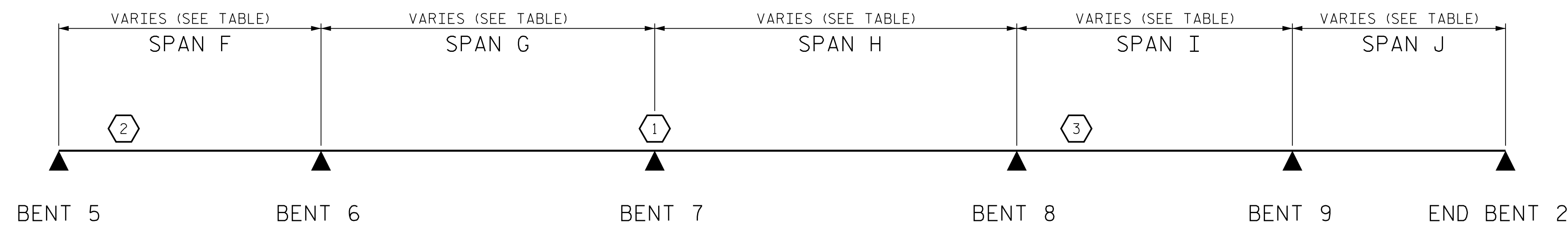
③ LEGAL LOAD RATING \*\*

\*\* SEE CHART FOR VEHICLE TYPE

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**GIRDER LOCATION**

GIRDER LOCATION IS PROVIDED USING GIRDER NUMBER, WHERE GIRDER 1 IS THE EXTERIOR GIRDER TO THE LEFT OF -Y15FLYAC-



| C BRG - C BRG SPAN LENGTHS |  |  |  |  |  |
|----------------------------|--|--|--|--|--|
| GIRDER                     | SPAN F                                 | SPAN G                                 | SPAN H                                 | SPAN I                                 | SPAN J                                 |
| 1                          | 173'-2 <sup>5</sup> / <sub>16</sub> "  | 222'-7 <sup>7</sup> / <sub>8</sub> "   | 241'-6 <sup>7</sup> / <sub>16</sub> "  | 183'-10 <sup>5</sup> / <sub>8</sub> "  | 139'-3 <sup>11</sup> / <sub>16</sub> " |
| 2                          | 173'-9 <sup>1</sup> / <sub>4</sub> "   | 223'-4 <sup>5</sup> / <sub>8</sub> "   | 242'-4 <sup>1</sup> / <sub>16</sub> "  | 184'-5 <sup>15</sup> / <sub>16</sub> " | 139'-9 <sup>5</sup> / <sub>16</sub> "  |
| 3                          | 174'-4 <sup>1</sup> / <sub>8</sub> "   | 224'-1 <sup>1</sup> / <sub>16</sub> "  | 243'-1 <sup>5</sup> / <sub>8</sub> "   | 185'-1 <sup>3</sup> / <sub>16</sub> "  | 140'-2 <sup>15</sup> / <sub>16</sub> " |
| 4                          | 174'-11 <sup>1</sup> / <sub>16</sub> " | 224'-10 <sup>5</sup> / <sub>16</sub> " | 243'-11 <sup>3</sup> / <sub>16</sub> " | 185'-8 <sup>1</sup> / <sub>2</sub> "   | 140'-8 <sup>9</sup> / <sub>16</sub> "  |

## LRFR SUMMARY

PROJECT NO. U-2579AB  
FORSYTH COUNTY  
 STATION: 60+66.06 -Y15FLYAC-

SHEET 2 OF 2



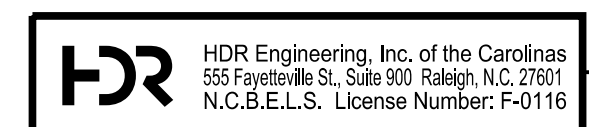
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**LRFR SUMMARY FOR  
 STEEL GIRDERS  
 (INTERSTATE TRAFFIC)  
 (UNIT 2)**

| REVISIONS |     |       |     |     |       | SHEET NO.<br>S04-013<br>TOTAL SHEETS<br>144 |
|-----------|-----|-------|-----|-----|-------|---|
| NO.       | BY: | DATE: | NO. | BY: | DATE: |   |
| 1         | --  | --    | 3   | --  | --    |   |
| 2         | --  | --    | 4   | --  | --    |   |

PLOT DRIVER: NCDOT\_pdf\_color\_eng-50dpi  
 USER: PPETERSO    DATE: 10/14/2021    TIME: 3:58:43 PM  
 FILE: ...LRFR S

|                           |                    |                           |                    |
|---------------------------|--------------------|---------------------------|--------------------|
| DES BY: <u>T. ANDREWS</u> | DATE: <u>09/19</u> | DWG BY: <u>M. SELLS</u>   | DATE: <u>07/19</u> |
| DES CHK: <u>D. OLDS</u>   | DATE: <u>10/19</u> | CHK BY: <u>T. ANDREWS</u> | DATE: <u>10/19</u> |



**DOCUMENT NOT CONSIDERED FINAL  
 UNLESS ALL SIGNATURES COMPLETED**