

**LOAD AND RESISTANCE FACTOR RATING (LRFR)  
SUMMARY FOR REINFORCED CONCRETE BOX CULVERT**

| LEVEL                    | VEHICLE                              | WEIGHT (W)<br>(TONS) | CONTROLLING<br>LOAD RATING # | MINIMUM<br>RATING FACTORS<br>(RF) | TONS = W x RF | STRENGTH I LIMIT STATE    |               |         |                  |  |               |         |                 | COMMENT NUMBER |  |  |
|--------------------------|--------------------------------------|----------------------|------------------------------|-----------------------------------|---------------|---------------------------|---------------|---------|------------------|--|---------------|---------|-----------------|----------------|--|--|
|                          |                                      |                      |                              |                                   |               | MOMENT                    |               |         |                  | SHEAR  |               |         |                 |                |  |  |
|                          |                                      |                      |                              |                                   |               | LIVE-LOAD<br>FACTORS (LL) | RATING FACTOR | BOX NO. | ELEMENT<br>TYPE  | DISTANCE FROM<br>LEFT END OF<br>ELEMENT (ft) | RATING FACTOR | BOX NO. | ELEMENT<br>TYPE |                | DISTANCE FROM<br>LEFT END OF<br>ELEMENT (ft) |  |
| DESIGN<br>LOAD<br>RATING | HL-93 (INVENTORY)                    | N/A                  | ①                            | 1.39                              | --            | 1.75                      | 1.39          | 1       | BOT CORNER WALL  | 10.66  | 1.85          | 1       | EXTERIOR WALL   | 9.93           |  |  |
|                          | HL-93 (OPERATING)                    | N/A                  |                              | 1.80                              | --            | 1.35                      | 1.80          | 1       | BOT CORNER WALL  | 10.66  | 2.40          | 1       | EXTERIOR WALL   | 9.93           |  |  |
|                          | HS-20 (INVENTORY)                    | 36.000               | ②                            | 1.43                              | 51.650        | 1.75                      | 1.43          | 1       | BOT. CORNER WALL | 10.66  | 1.85          | 1       | EXTERIOR WALL   | 9.93           |  |  |
|                          | HS-20 (OPERATING)                    | 36.000               |                              | 1.86                              | 66.950        | 1.35                      | 1.86          | 1       | BOT. CORNER WALL | 10.66  | 2.40          | 1       | EXTERIOR WALL   | 9.93           |  |  |
| LEGAL<br>LOAD<br>RATING  | SINGLE VEHICLE<br>(SV)               | SNSH                 | 13.500                       |                                   | 1.83          | 24.640                    | 1.40          | 1.83    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNGARBS2             | 20.000                       |                                   | 1.82          | 36.500                    | 1.40          | 1.82    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNAGRIS2             | 22.000                       |                                   | 1.83          | 40.150                    | 1.40          | 1.83    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNCOTTS3             | 27.250                       | ③                                 | 1.73          | 47.060                    | 1.40          | 1.73    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNAGGRS4             | 34.925                       |                                   | 1.77          | 61.990                    | 1.40          | 1.77    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNS5A                | 35.550                       |                                   | 1.77          | 62.880                    | 1.40          | 1.77    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNS6A                | 39.950                       |                                   | 1.80          | 71.870                    | 1.40          | 1.80    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | SNS7B                | 42.000                       |                                   | 1.80          | 75.560                    | 1.40          | 1.80    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          | TRUCK TRACTOR SEMI-TRAILER<br>(TTST) | TNAGRIT3             | 33.000                       |                                   | 1.84          | 60.720                    | 1.40          | 1.84    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNT4A                | 33.075                       |                                   | 1.80          | 59.410                    | 1.40          | 1.80    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNT6A                | 41.600                       |                                   | 1.76          | 73.160                    | 1.40          | 1.76    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNT7A                | 42.000                       |                                   | 1.76          | 73.710                    | 1.40          | 1.76    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNT7B                | 42.000                       |                                   | 1.78          | 74.700                    | 1.40          | 1.78    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNAGRIT4             | 43.000                       |                                   | 1.80          | 77.450                    | 1.40          | 1.80    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNAGT5A              | 45.000                       |                                   | 1.80          | 81.060                    | 1.40          | 1.80    | 1                | BOT. CORNER WALL                             | 10.66         | 2.32    | 1               | EXTERIOR WALL  | 9.93   |  |
|                          |                                      | TNAGT5B              | 45.000                       |                                   | 1.87          | 84.200                    | 1.40          | 1.87    | 1                | BOT. CORNER WALL                             | 10.66         | 2.31    | 1               | EXTERIOR WALL  | 9.93   |  |

**LOAD FACTORS**

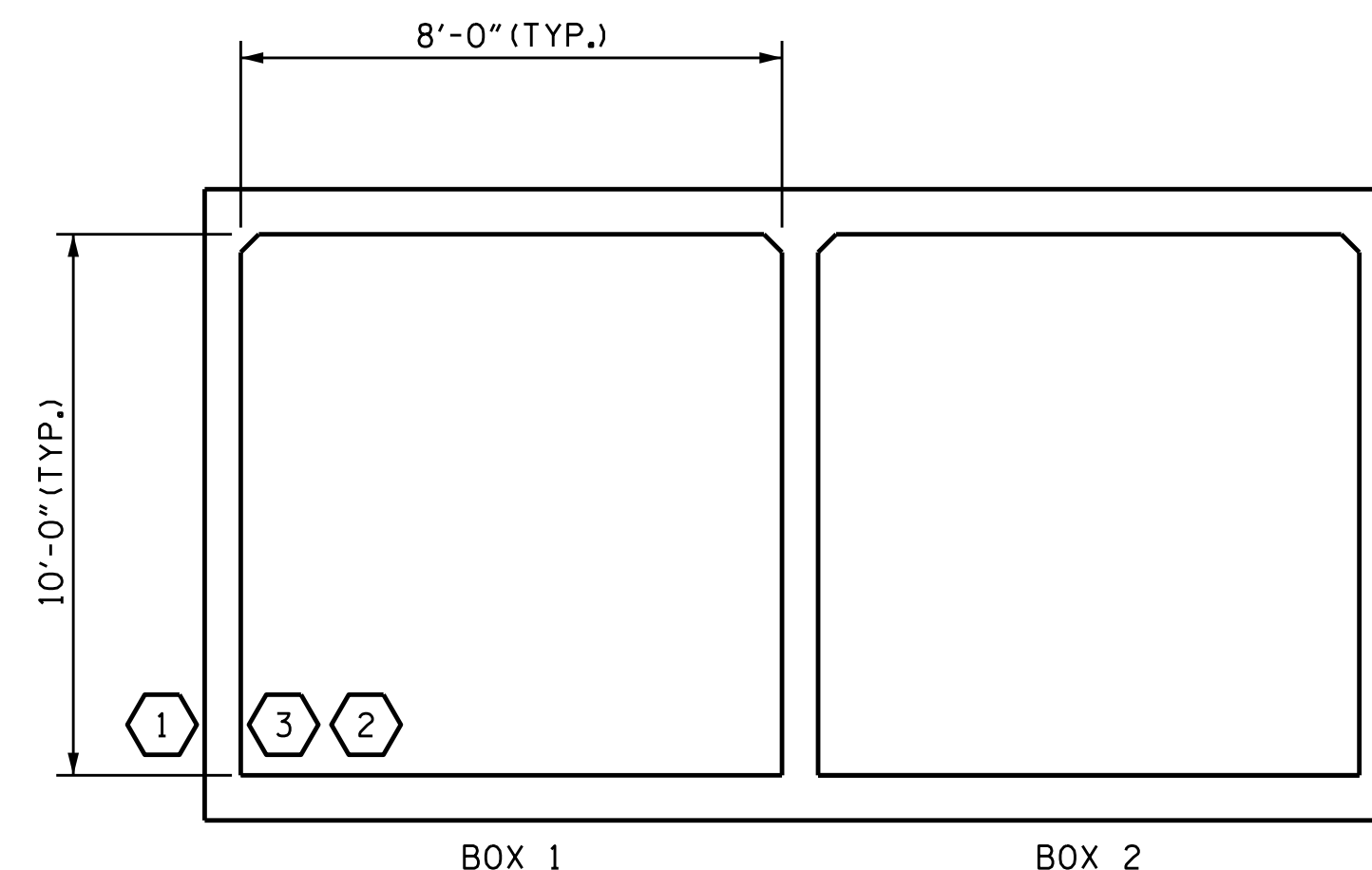
DESIGN LOAD RATING FACTORS

| 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.

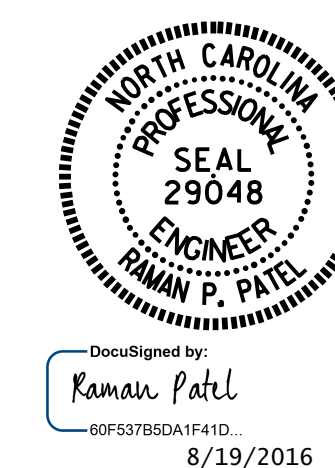
|                               |                            |
|-------------------------------|----------------------------|
| #                             | CONTROLLING LOAD RATING    |
| ①                             | DESIGN LOAD RATING (HL-93) |
| ②                             | DESIGN LOAD RATING (HS-20) |
| ③                             | LEGAL LOAD RATING **       |
| ** SEE CHART FOR VEHICLE TYPE |                            |



**LRFR SUMMARY**  
(LOOKING DOWNSTREAM)

PROJECT NO. U-3440  
CABARRUS COUNTY  
STATION: 117+50.00 -L-

SHEET 2 OF 8



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
STANDARD  
LRFR SUMMARY FOR  
REINFORCED CONCRETE  
BOX CULVERTS  
(NON-INTERSTATE TRAFFIC)

ASSEMBLED BY : R.P.PATEL DATE : 5/23/16  
CHECKED BY : H.P.KIM DATE : 5/23/16

DESIGN ENGINEER OF RECORD:  
R.P. PATEL DATE : 6/3/16

DOCUMENT NOT CONSIDERED  
FINAL UNLESS ALL  
SIGNATURES COMPLETED

| REVISIONS |     |       |     |     |       | SHEET NO.    |  |
|-----------|-----|-------|-----|-----|-------|--------------|--|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C2-2         |  |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |  |
| 2         |     |       | 4   |     |       | 8            |  |