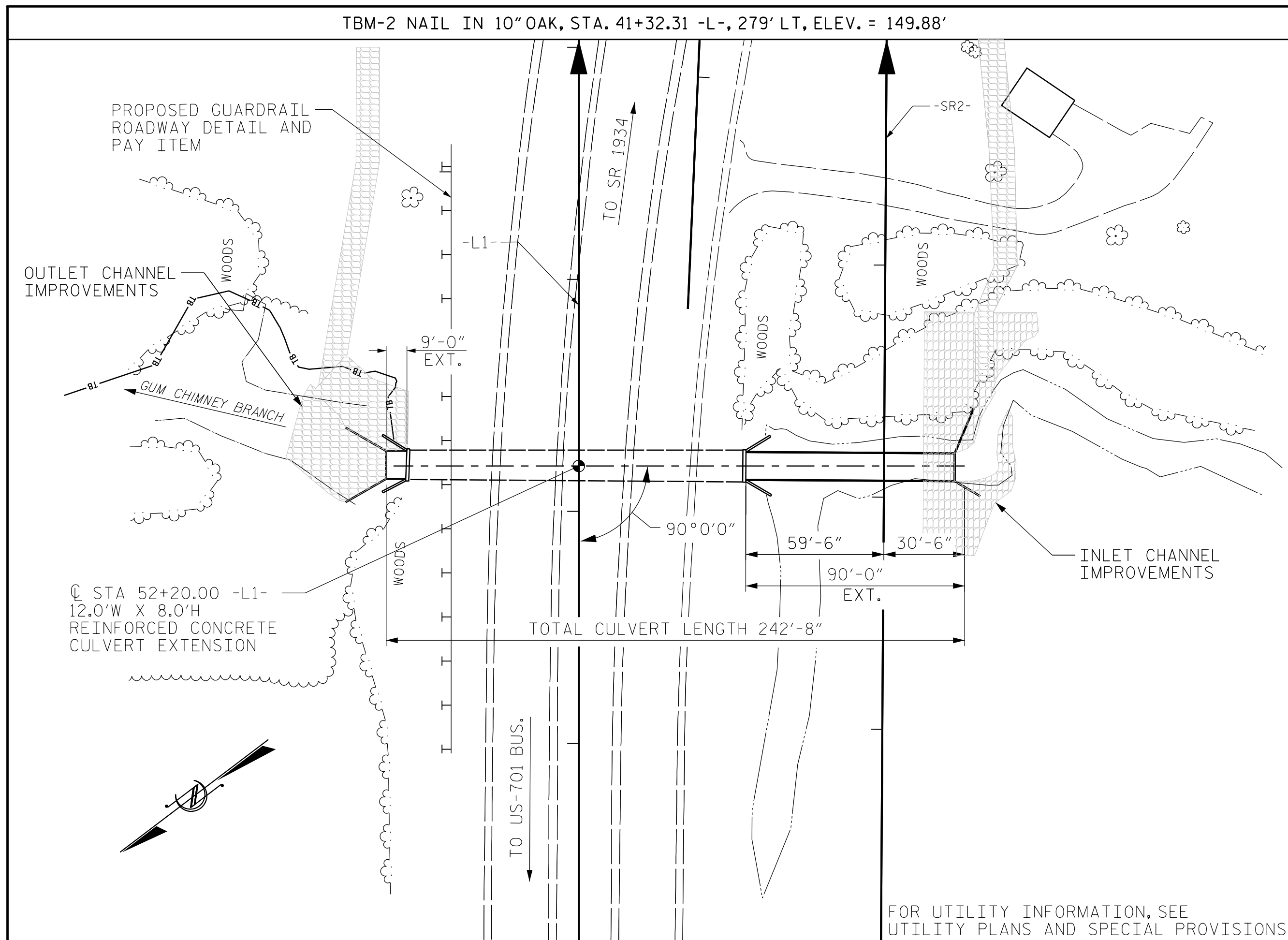


**This electronic collection of documents is provided  
for the convenience of the user  
and is Not a Certified Document –**

**The documents contained herein were originally issued  
and sealed by the individuals whose names and license  
numbers appear on each page, on the dates appearing  
with their signature on that page.**

**This file or an individual page  
shall not be considered a certified document.**



| TOTAL STRUCTURE QUANTITIES  |             |
|-----------------------------|-------------|
| CLASS A CONCRETE            |             |
| LEFT EXTENSION              | 36.6 C.Y.   |
| RIGHT EXTENSION             | 153.4 C.Y.  |
| TOTAL                       | 190.0 C.Y.  |
| REINFORCING STEEL           |             |
| LEFT EXTENSION              | 3,162 LBS.  |
| RIGHT EXTENSION             | 19,782 LBS. |
| TOTAL                       | 22,944 LBS. |
| CULVERT EXCAVATION LUMP SUM |             |
| FOUNDATION CONDITION MAT'L. |             |
| LEFT EXTENSION              | 11.8 TONS   |
| RIGHT EXTENSION             | 110.8 TONS  |
| TOTAL                       | 122.6 TONS  |

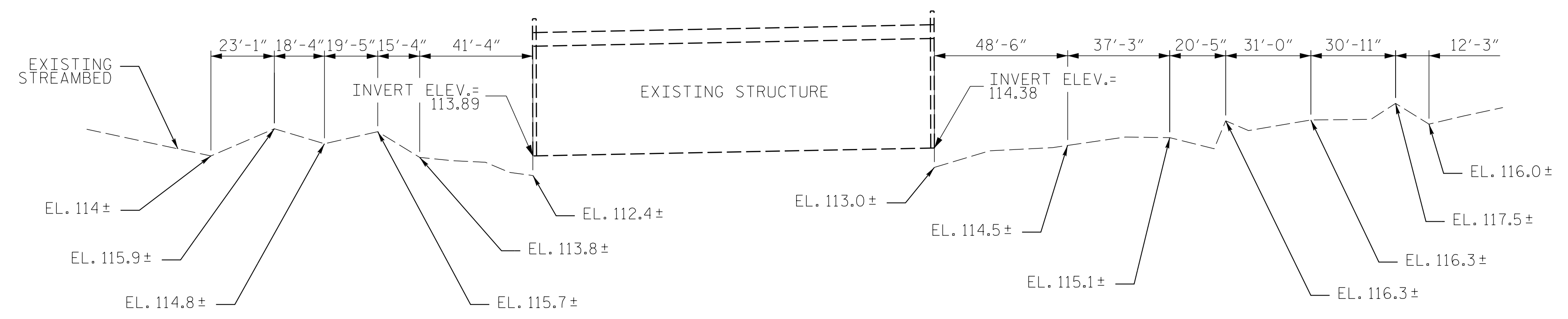
- NOTES**
- IF APPROVED BY THE ENGINEER, THE CONTRACTOR MAY USE THE EXISTING WINGS AS TEMPORARY SHORING FOR THE CONSTRUCTION OF THE CULVERT EXTENSIONS. IN THIS CASE, THE BOTTOM SLAB OF THE EXTENSION SHALL BE POURED AT LEAST 72 HOURS PRIOR TO CUTTING THE WINGS. THE WINGS MAY BE CUT EARLIER PROVIDED THE SLAB CONCRETE STRENGTH HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI.
  - DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.
  - ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.
  - DESIGN FILL = 4.5'
  - FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
  - 3"Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
  - CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
    - WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
    - THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.
  - TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
  - FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
  - A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
  - NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
  - AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
  - EXCAVATE AT LEAST 1 FOOT BELOW BOTTOM OF CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS.
  - THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
  - DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
  - FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
  - FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
  - FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
  - FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

-LOCATION SKETCH-

| HYDRAULIC DATA                 |              |
|--------------------------------|--------------|
| DESIGN DISCHARGE               | = 340 CFS    |
| FREQUENCY OF DESIGN FLOOD      | = 50 YR      |
| DESIGN HIGH WATER ELEVATION    | = 120.3      |
| DRAINAGE AREA                  | = 0.98 SQ MI |
| BASIC DISCHARGE (Q100)         | = 410 CFS    |
| BASIC HIGH WATER ELEVATION     | = 120.7      |
| OVERTOPPING FLOOD DATA         |              |
| OVERTOPPING DISCHARGE          | = 1600 CFS   |
| FREQUENCY OF OVERTOPPING FLOOD | = 500+ YR    |
| OVERTOPPING FLOOD ELEVATION    | = 129.9*     |

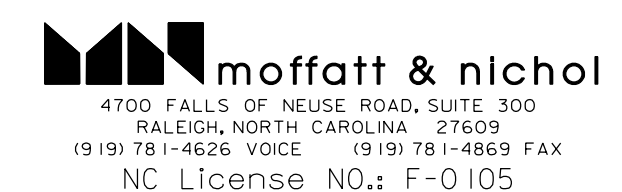
| GRADE DATA                                |  |
|---|--|
| GRADE POINT ELEV. @ STATION 52+20.00 -L1- | = 130.92   |
| BED ELEV. @ STATION 52+20.00 -L1-         | = 114.13   |
| ROADWAY SLOPES                            | RIGHT EXTENSION = 2:1 TO -SR2-<br>LEFT EXTENSION = 4:1 TO -L1- |

\* OVERTOPPING OCURS AT STA. 50+55.02 -L1-.

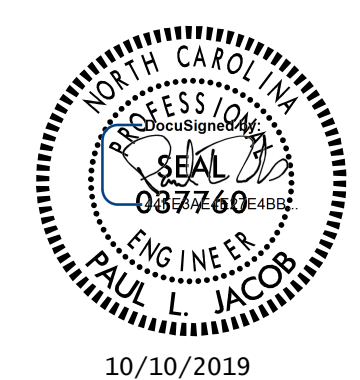


PROFILE ALONG CULVERT

DRAWN BY : J. WEIGER DATE : 01/2019  
 CHECKED BY : R. ASENCIO DATE : 12/2018  
 DESIGN ENGINEER OF RECORD: P. JACOB DATE : 08/2019



DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 52+20.00 -L1-  
 SHEET 1 OF 7

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 CONCRETE BOX CULVERT  
 LEFT & RIGHT EXTENSIONS  
 12 FT. X 8 FT.  
 90° SKEW

| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-1         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |

Q:\RA\6522-07\CADD\R2303E\Structures\Culvert\01\_CADD\02\_FinalDrawings\L1\R2303E\_SMU\_CUL.dgn

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

| 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                  |                  |          |                 |  |                  |          |                 | COMMENT NUMBER |  |   |
|--------------------------|--------------------------------------|----------------------|---------------------------------|-----------------------------------|---------------|---|------------------|----------|-----------------|--|------------------|----------|-----------------|----------------|--|---|
|                          |                                      |                      |                                 |                                   |               | MOMENT                                  |                  |          |                 | SHEAR  |                  |          |                 |                |  |   |
|                          |                                      |                      |                                 |                                   |               | LIVE-LOAD<br>FACTORS (γ <sub>LL</sub> ) | RATING<br>FACTOR | BOX NO.  | ELEMENT<br>TYPE | DISTANCE FROM<br>LEFT END OF<br>ELEMENT (ft) | RATING<br>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                               | 1.05                              | --            | 1.75                                    | 1.05             | 1        | TOP SLAB        | 6.67   | 1.39             | 1        | TOP SLAB        | 11.21          | 1  |   |
|                          | HL-93 (OPERATING)                    | N/A                  |                                 | 1.36                              | --            | 1.35                                    | 1.36             | 1        | TOP SLAB        | 6.67   | 1.81             | 1        | TOP SLAB        | 11.21          |  |   |
|                          | HS-20 (INVENTORY)                    | 36.000               | ②                               | 1.20                              | 43.20         | 1.75                                    | 1.20             | 1        | TOP SLAB        | 6.67   | 1.77             | 1        | TOP SLAB        | 11.21          | 2  |   |
|                          | HS-20 (OPERATING)                    | 36.000               |                                 | 1.55                              | 55.80         | 1.35                                    | 1.55             | 1        | TOP SLAB        | 6.67   | 2.30             | 1        | TOP SLAB        | 11.21          |  |   |
| LEGAL<br>LOAD<br>RATING  | SINGLE VEHICLE<br>(SV)               | SNSH                 | 13.500                          |                                   | 2.65          | 35.77                                   | 1.40             | 2.65     | 1               | TOP SLAB                                     | 6.67             | 3.58     | 1               | EXT. WALL      | 0.48   |   |
|                          |                                      | SNGARBS2             | 20.000                          |                                   | 2.48          | 49.6                                    | 1.40             | 2.48     | 1               | TOP SLAB                                     | 6.67             | 3.48     | 1               | EXT. WALL      | 0.48   |   |
|                          |                                      | SNAGRIS2             | 22.000                          |                                   | 2.65          | 58.30                                   | 1.40             | 2.65     | 1               | TOP SLAB                                     | 6.67             | 3.45     | 1               | EXT. WALL      | 0.48   |   |
|                          |                                      | SNCOTTS3             | 27.250                          | ③                                 | 1.51          | 41.14                                   | 1.40             | 1.51     | 1               | TOP SLAB                                     | 6.67             | 2.12     | 1               | TOP SLAB       | 11.21  | 3 |
|                          |                                      | SNAGGRS4             | 34.925                          |                                   | 1.65          | 57.62                                   | 1.40             | 1.65     | 1               | BOTTOM SLAB                                  | 6.67             | 2.07     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          |                                      | SNS5A                | 35.550                          |                                   | 1.57          | 55.81                                   | 1.40             | 1.57     | 1               | BOTTOM SLAB                                  | 6.67             | 1.95     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          |                                      | SNS6A                | 39.950                          |                                   | 1.57          | 62.72                                   | 1.40             | 1.57     | 1               | BOTTOM SLAB                                  | 6.67             | 1.93     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          | SNS7B                                | 42.000               |                                 | 1.57                              | 65.94         | 1.40                                    | 1.57             | 1        | BOTTOM SLAB     | 6.67   | 1.93             | 1        | BOTTOM SLAB     | 0.72           |  |   |
|                          | TRUCK TRACTOR SEMI-TRAILER<br>(TTST) | TNAGRIT3             | 33.000                          |                                   | 2.09          | 68.97                                   | 1.40             | 2.09     | 1               | BOTTOM SLAB                                  | 6.67             | 2.52     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          |                                      | TNT4A                | 33.075                          |                                   | 1.80          | 59.53                                   | 1.40             | 1.80     | 1               | TOP SLAB                                     | 6.67             | 2.53     | 1               | TOP SLAB       | 0.72   |   |
|                          |                                      | TNT6A                | 41.600                          |                                   | 1.70          | 70.72                                   | 1.40             | 1.70     | 1               | TOP SLAB                                     | 6.67             | 2.22     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          |                                      | TNT7A                | 42.000                          |                                   | 1.75          | 73.50                                   | 1.40             | 1.75     | 1               | TOP SLAB                                     | 6.67             | 2.42     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          |                                      | TNT7B                | 42.000                          |                                   | 1.61          | 67.62                                   | 1.40             | 1.61     | 1               | BOTTOM SLAB                                  | 6.67             | 1.94     | 1               | BOTTOM SLAB    | 0.72   |   |
|                          |                                      | TNAGRIT4             | 43.000                          |                                   | 1.80          | 77.40                                   | 1.40             | 1.80     | 1               | TOP SLAB                                     | 6.67             | 2.52     | 1               | BOTTOM SLAB    | 0.72   |   |
| TNAGT5A                  |                                      | 45.000               |                                 | 1.80                              | 81.00         | 1.40                                    | 1.80             | 1        | TOP SLAB        | 6.67   | 2.53             | 1        | TOP SLAB        | 11.21          |  |   |
| TNAGT5B                  | 45.000                               |                      | 1.80                            | 81.00                             | 1.40          | 1.80                                    | 1                | TOP SLAB | 6.67            | 2.53   | 1                | TOP SLAB | 11.21           |                |  |   |

### 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.

**COMMENTS:**

- THE CRITICAL FILL DEPTH FOR HL-93 LOADING IS 4.5'.
- THE CRITICAL FILL DEPTH FOR HS-20 LOADING IS 3.5'.
- THE CRITICAL FILL DEPTH FOR SNCOTTS3 LOADING IS 2.0'.
- RATINGS APPLY TO CULVERT EXTENSIONS AND NOT THE EXISTING CULVERT.

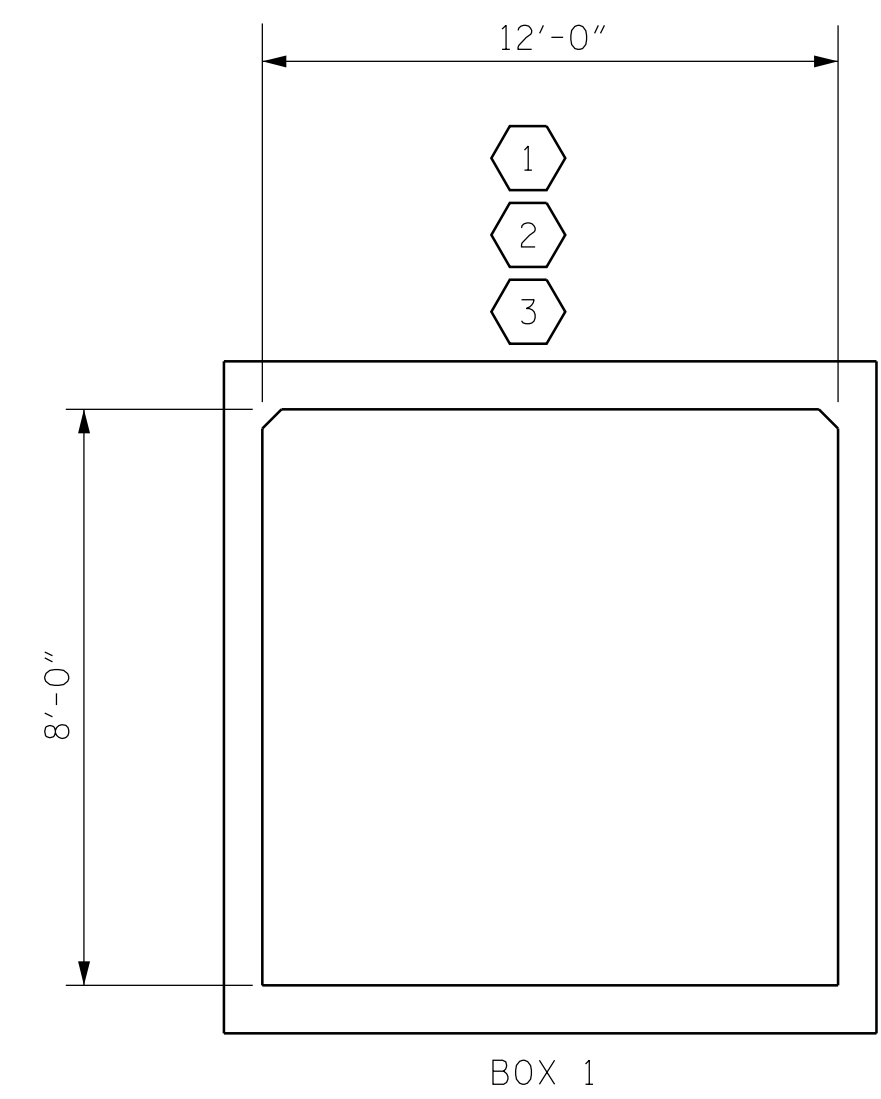
# CONTROLLING LOAD RATING

① DESIGN LOAD RATING (HL-93)

② DESIGN LOAD RATING (HS-20)

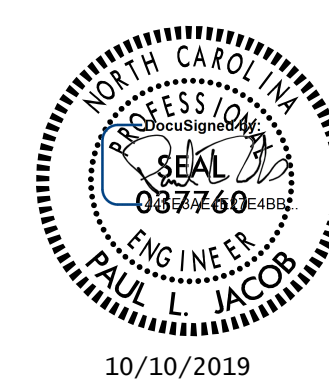
③ LEGAL LOAD RATING \*\*\*

\*\*\* SEE CHART FOR VEHICLE TYPE



**LRFR SUMMARY**  
(LOOKING DOWNSTREAM)

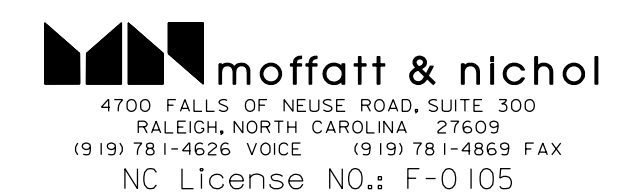
PROJECT NO. R-2303E  
SAMPSON COUNTY  
STATION: 52+20.00 -L1-  
SHEET 2 OF 7



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

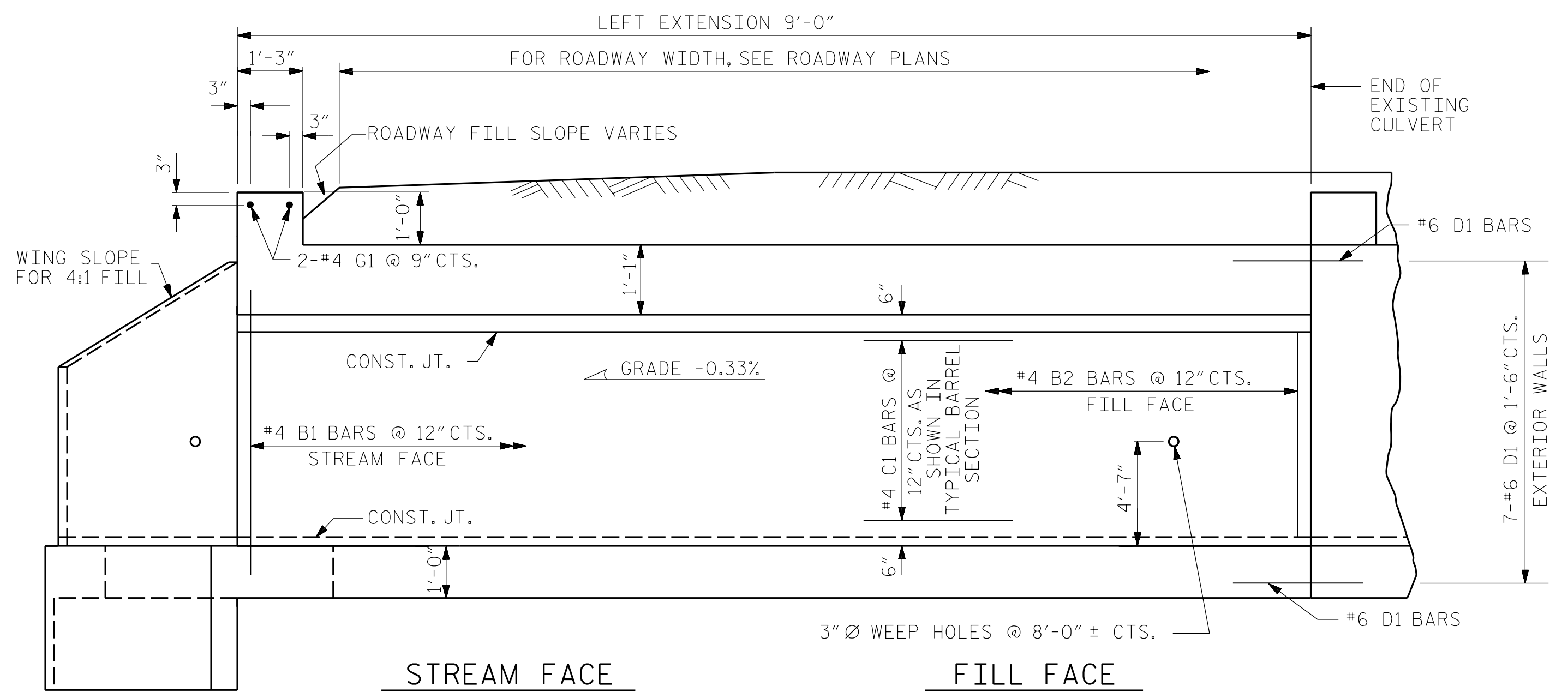
LRFR SUMMARY FOR  
REINFORCED CONCRETE  
BOX CULVERTS  
(NON-INTERSTATE TRAFFIC)

DRAWN BY : J. WEIGER DATE : 03/2019  
CHECKED BY : R. ASENCIO DATE : 12/2018  
DESIGN ENGINEER OF RECORD: P. JACOB DATE : 08/2019

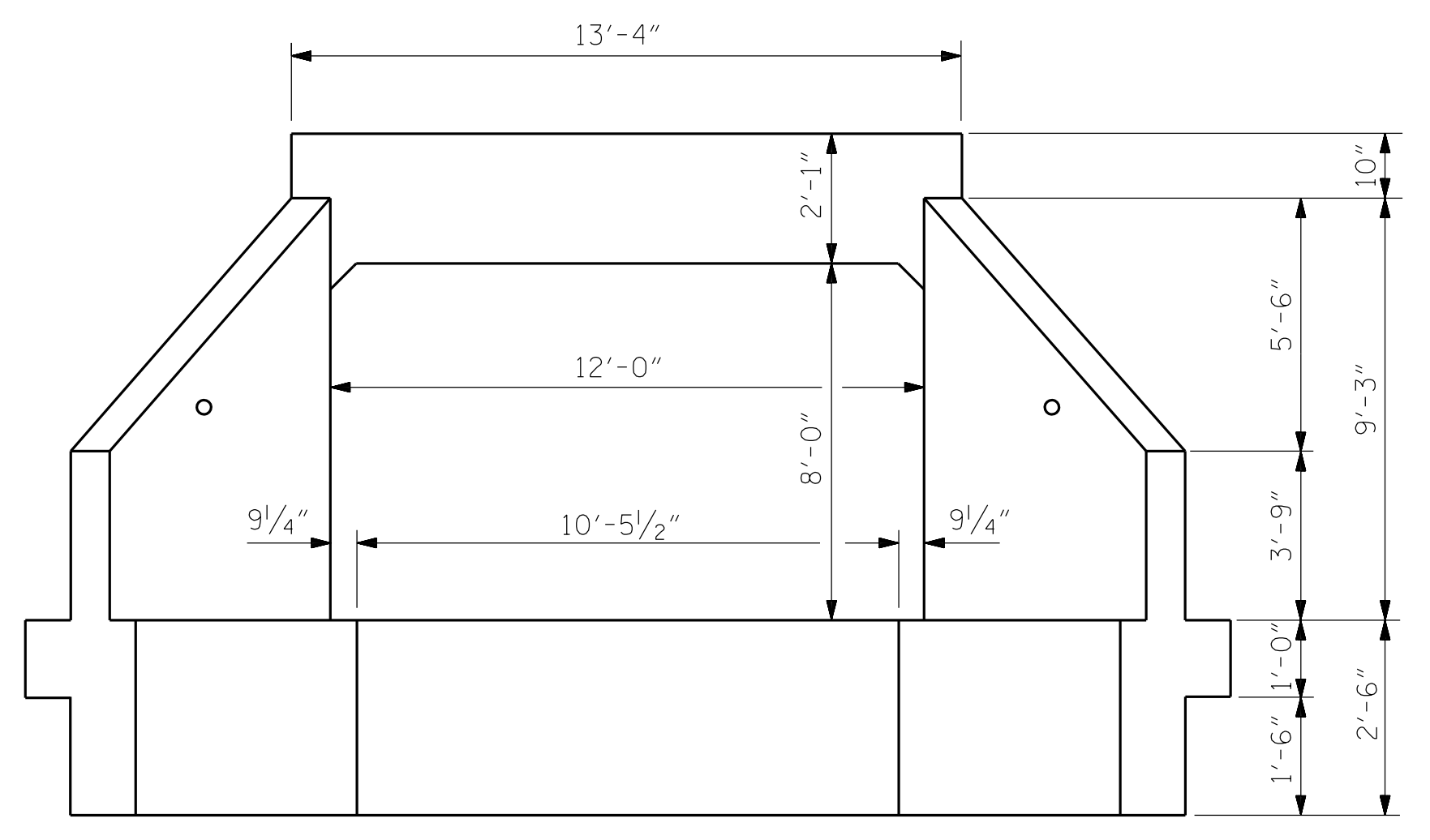


DOCUMENT NOT CONSIDERED  
FINAL UNLESS ALL  
SIGNATURES COMPLETED

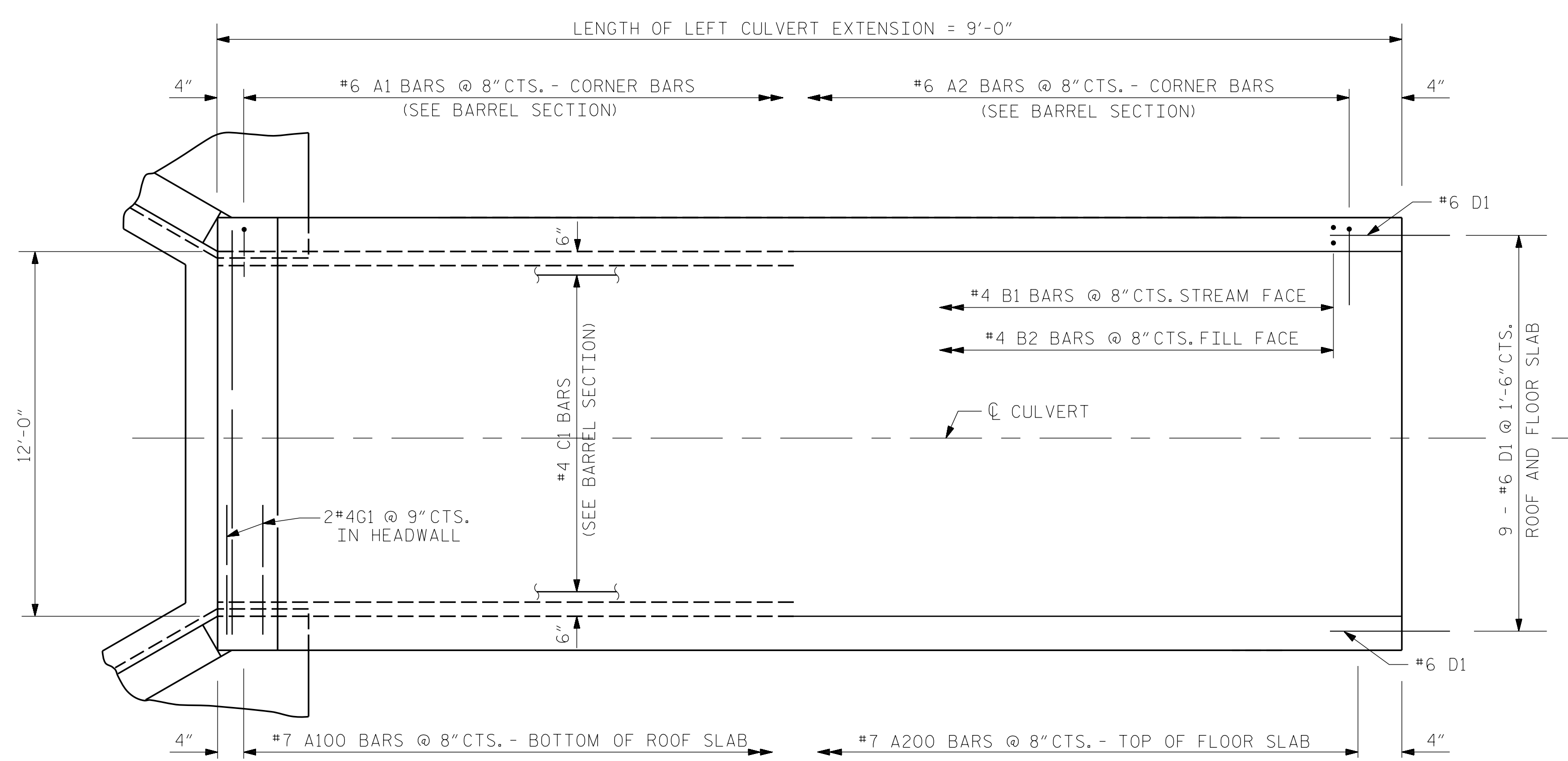
| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-1         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |



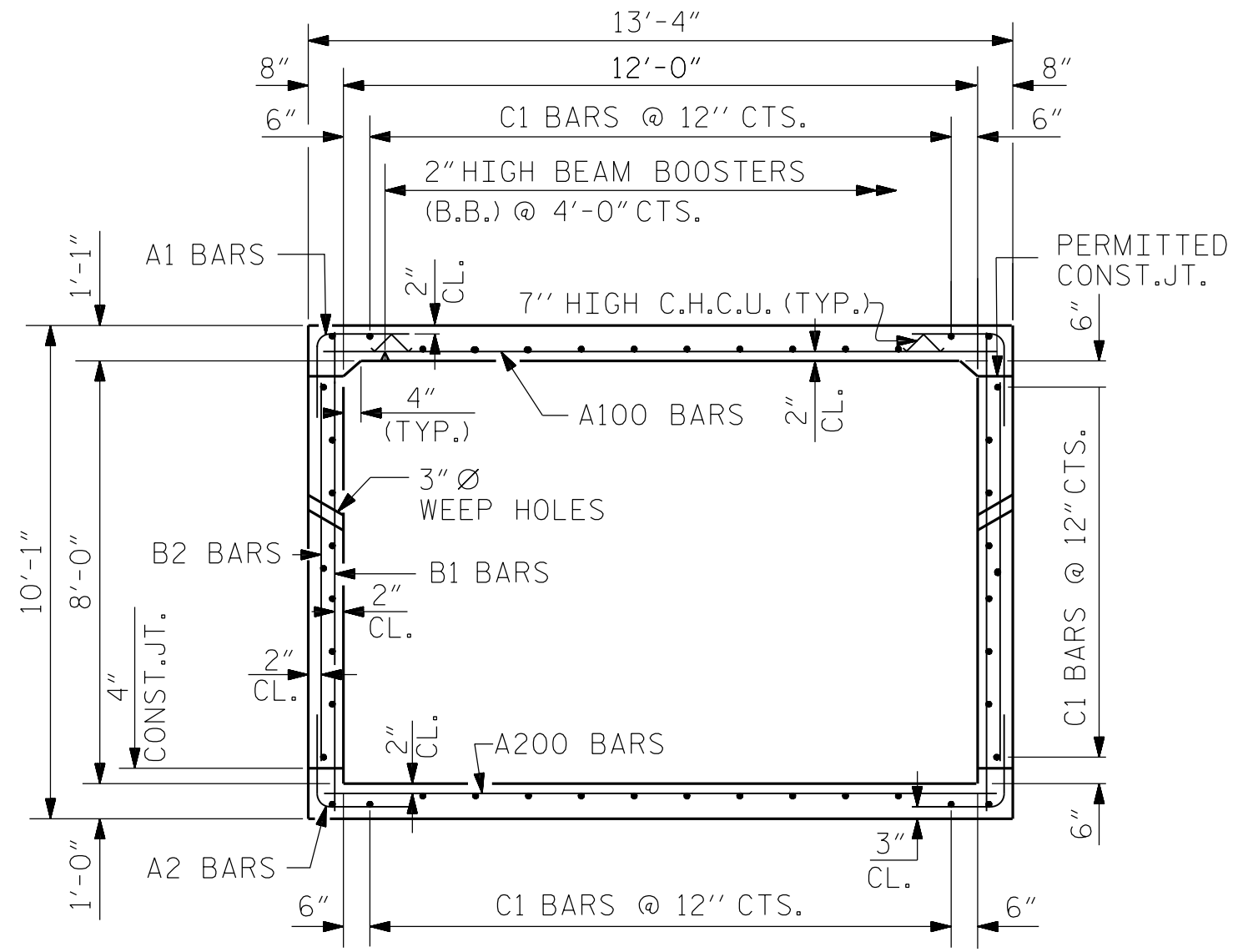
**LEFT EXTENSION CULVERT SECTION NORMAL TO ROADWAY**  
NOT TO SCALE



**END ELEVATION**



**PART PLAN ROOF SLAB**      **PART PLAN FLOOR SLAB**  
NOT TO SCALE



**RIGHT ANGLE SECTION OF BARREL**  
THERE ARE 46 'C' BARS IN SECTION OF BARREL

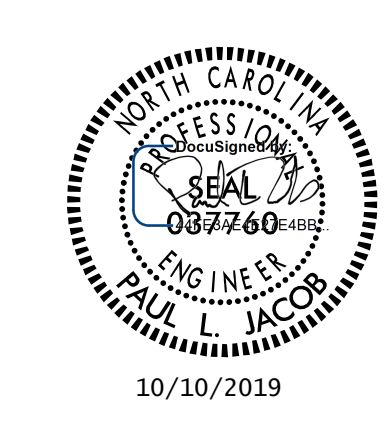
| LEFT EXTENSION                 |     |      |      |        |          |
|--------------------------------|-----|------|------|--------|----------|
| REINFORCING STEEL BAR SCHEDULE |     |      |      |        |          |
| BAR                            | NO. | SIZE | TYPE | LENGTH | WEIGHT   |
| A100                           | 14  | #7   | STR  | 13'-0" | 372      |
| A200                           | 14  | #7   | STR  | 13'-0" | 372      |
| A1                             | 28  | #6   | 1    | 5'-7"  | 235      |
| A2                             | 28  | #6   | 1    | 5'-5"  | 228      |
| B1                             | 20  | #4   | STR  | 9'-8"  | 129      |
| B2                             | 20  | #4   | STR  | 7'-4"  | 98       |
| C1                             | 46  | #4   | STR  | 8'-8"  | 266      |
| D1                             | 32  | #6   | STR  | 2'-6"  | 120      |
| G1                             | 2   | #4   | STR  | 13'-0" | 17       |
| REINFORCING STEEL              |     |      |      |        | 1837 LBS |
| BAR TYPES                      |     |      |      |        |          |

VERTICAL LEG

ALL BAR DIMENSIONS ARE OUT TO OUT

| BAR TYPES |                       |
|-----------|-----------------------|
| BARREL    | @ 1.428 CY/FT 12.9 CY |

PROJECT NO. R-2303E  
SAMPSON COUNTY  
STATION: 52+20.00 -L1-  
SHEET 3 OF 7



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

12 FT. X 8 FT.  
CONCRETE BOX CULVERT  
LEFT EXTENSION  
90° SKEW

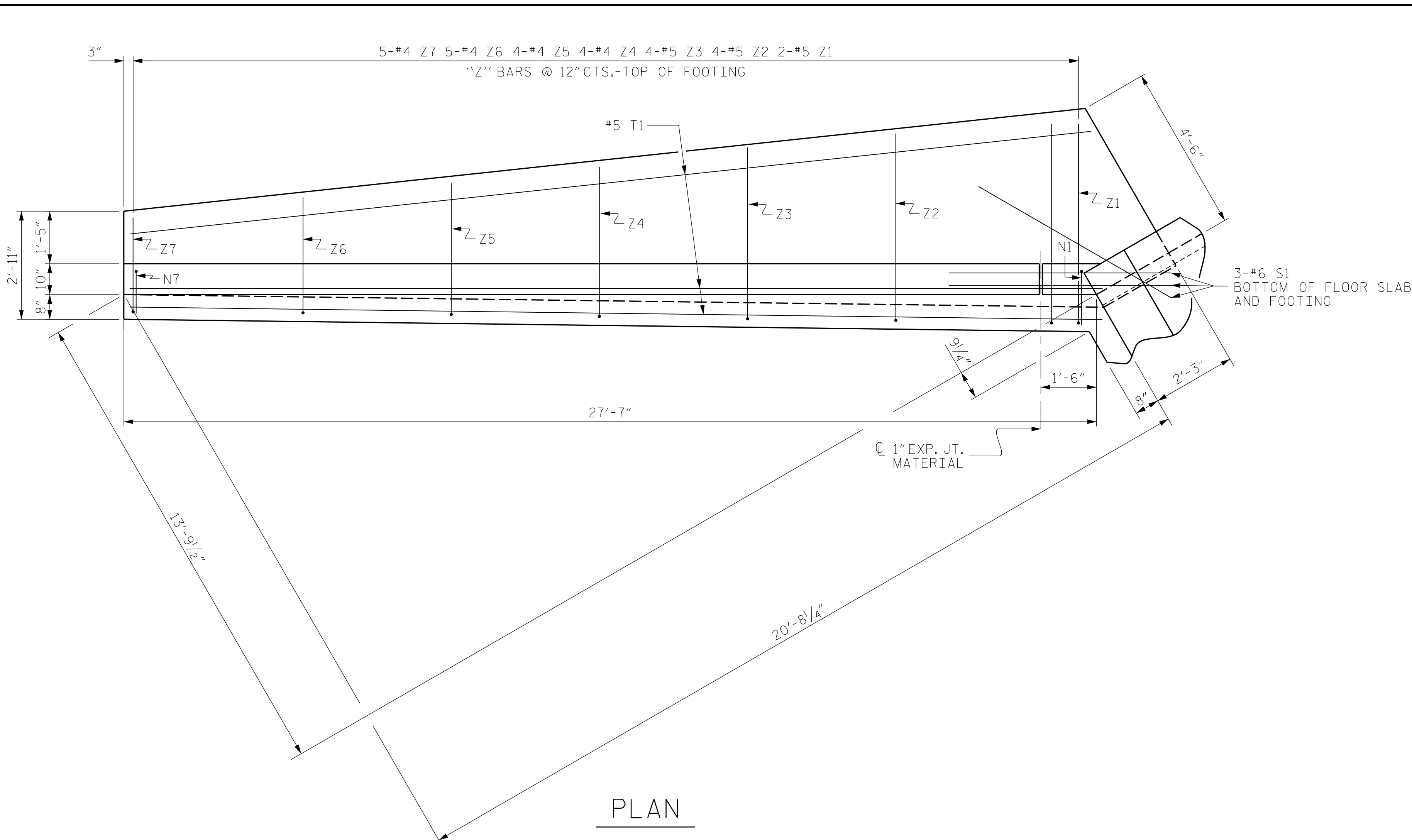
DRAWN BY : J. WEIGER DATE : 03/2019  
CHECKED BY : R. ASENCIO DATE : 12/2018  
DESIGN ENGINEER OF RECORD : P. JACOB DATE : 08/2019

**moffatt & nichol**  
4700 FALLS OF NEUSE ROAD, SUITE 300  
RALEIGH, NORTH CAROLINA 27609  
(919) 781-4626 VOICE (919) 781-4869 FAX  
NC License No.: F-0105

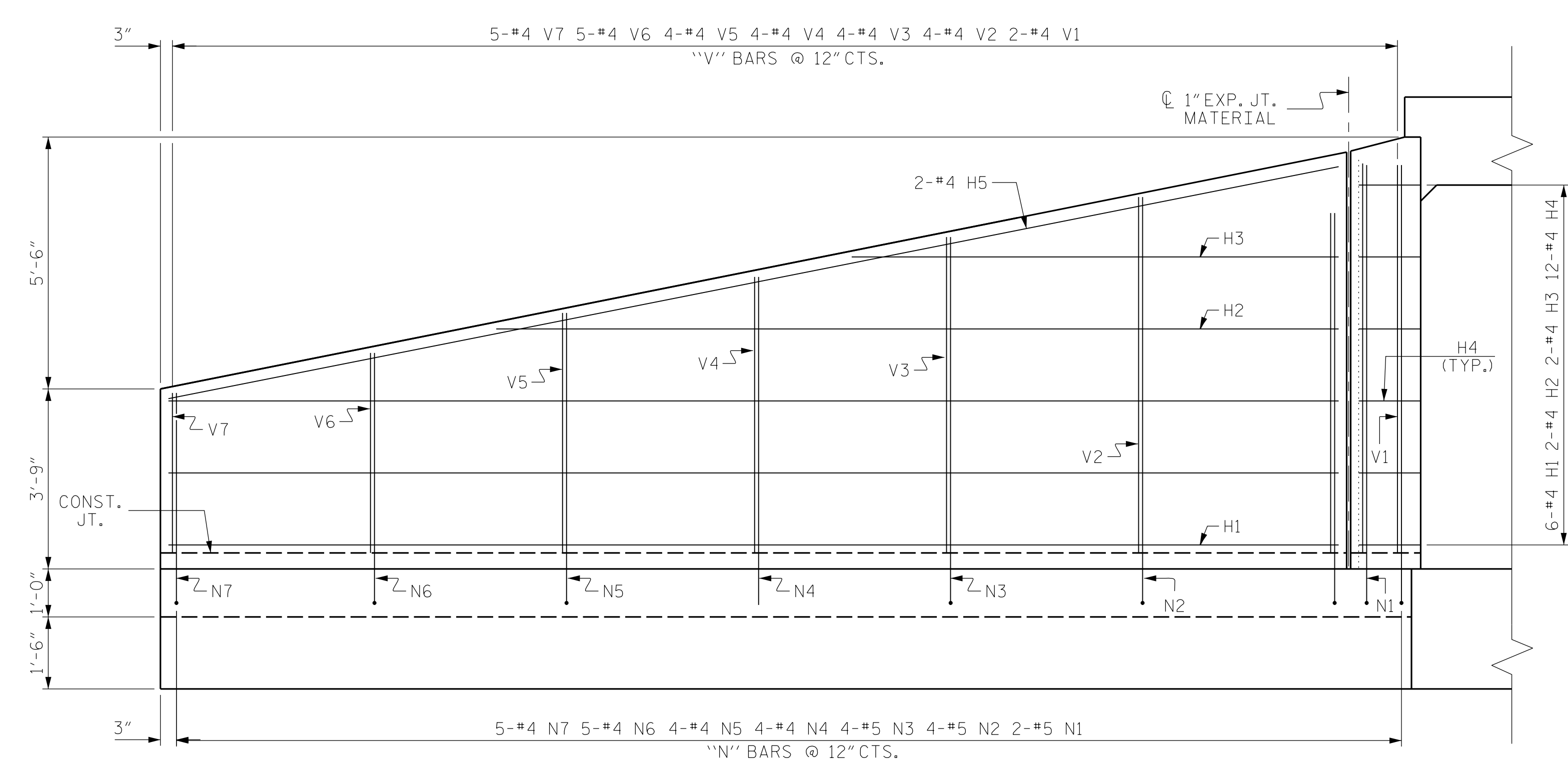
DOCUMENT NOT CONSIDERED  
FINAL UNLESS ALL  
SIGNATURES COMPLETED

| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-1         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |

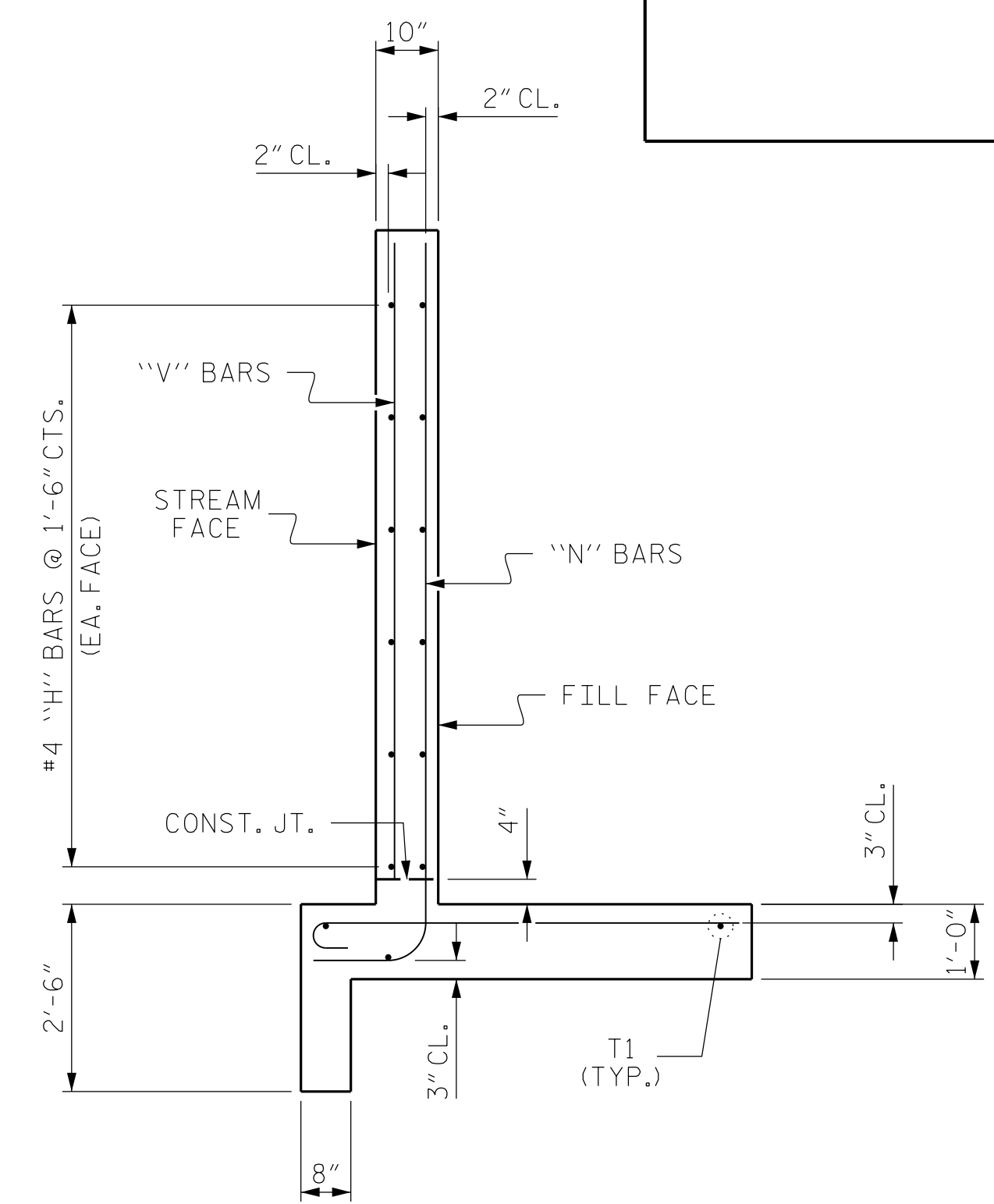
Q:\RA\6522-07\CADD\R2303E\Structures\Culvert\tsa\01\_CADD\02\_FinalDrawings\L1\R2303E\_SMU\_CU3.dgn



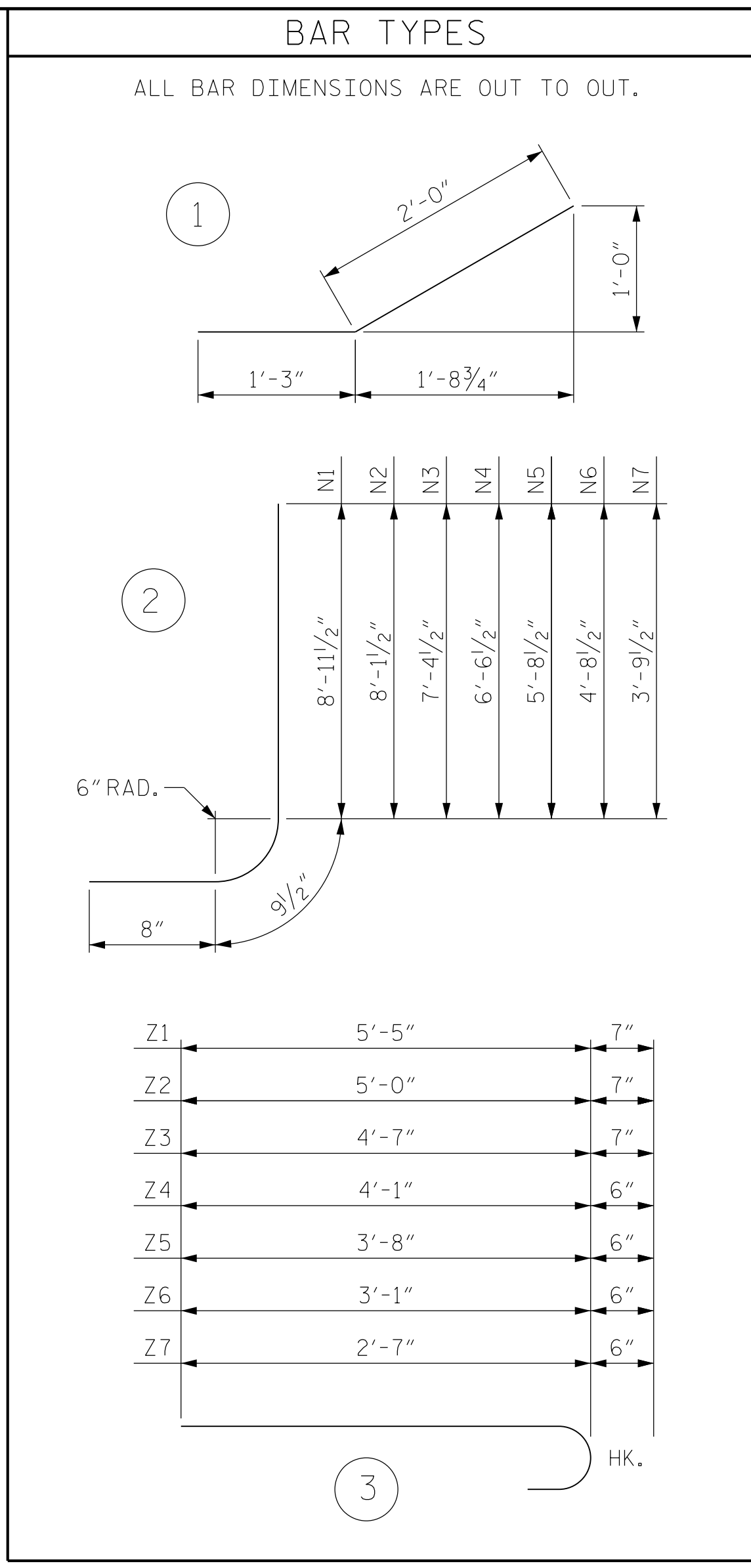
PLAN



ELEVATION

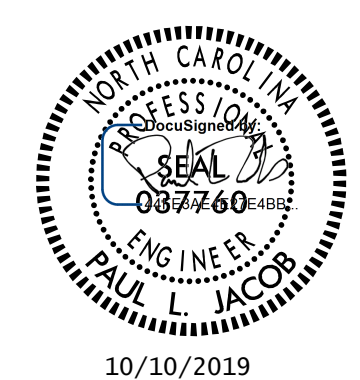


TYPICAL WING SECTION



| BILL OF MATERIAL              |     |      |      |         |          |
|-------------------------------|-----|------|------|---------|----------|
| BAR                           | NO. | SIZE | TYPE | LENGTH  | WEIGHT   |
| H1                            | 12  | #4   | STR  | 25'-8"  | 206      |
| H2                            | 4   | #4   | STR  | 18'-5"  | 49       |
| H3                            | 4   | #4   | STR  | 10'-10" | 29       |
| H4                            | 24  | #4   | 1    | 3'-3"   | 52       |
| H5                            | 4   | #4   | STR  | 26'-2"  | 70       |
| N1                            | 4   | #5   | 2    | 10'-5"  | 43       |
| N2                            | 8   | #5   | 2    | 9'-7"   | 80       |
| N3                            | 8   | #5   | 2    | 8'-10"  | 74       |
| N4                            | 8   | #4   | 2    | 8'-0"   | 43       |
| N5                            | 8   | #4   | 2    | 7'-2"   | 38       |
| N6                            | 10  | #4   | 2    | 6'-2"   | 41       |
| N7                            | 10  | #4   | 2    | 5'-3"   | 35       |
| S1                            | 6   | #6   | STR  | 6'-0"   | 54       |
| T1                            | 6   | #5   | STR  | 27'-7"  | 173      |
| V1                            | 4   | #4   | STR  | 8'-5"   | 22       |
| V2                            | 8   | #4   | STR  | 7'-7"   | 41       |
| V3                            | 8   | #4   | STR  | 6'-10"  | 37       |
| V4                            | 8   | #4   | STR  | 6'-0"   | 32       |
| V5                            | 8   | #4   | STR  | 5'-2"   | 28       |
| V6                            | 10  | #4   | STR  | 4'-2"   | 28       |
| V7                            | 10  | #4   | STR  | 3'-3"   | 22       |
| Z1                            | 4   | #5   | 3    | 6'-0"   | 25       |
| Z2                            | 8   | #5   | 3    | 5'-7"   | 47       |
| Z3                            | 8   | #5   | 3    | 5'-2"   | 43       |
| Z4                            | 8   | #4   | 3    | 4'-7"   | 24       |
| Z5                            | 8   | #4   | 3    | 4'-2"   | 22       |
| Z6                            | 10  | #4   | 3    | 3'-7"   | 24       |
| Z7                            | 10  | #4   | 3    | 3'-1"   | 21       |
| REINFORCING STEEL FOR 2 WINGS |     |      |      |         | 1325 LBS |
| CLASS A CONCRETE              |     |      |      |         |          |
| 2 WINGS                       |     |      |      |         | 22.5 CY  |
| 1 HEADWALL                    |     |      |      |         | 0.6 CY   |
| 1 END CURTAIN WALL            |     |      |      |         | 0.6 CY   |
| TOTAL                         |     |      |      |         | 23.7 CY  |

PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 52+20.00 -L1-  
 SHEET 4 OF 7



STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 LEFT EXTENSION  
 WINGS FOR  
 CONCRETE BOX CULVERT  
 H = 8'-0" SLOPE = 4:1  
 90° SKEW

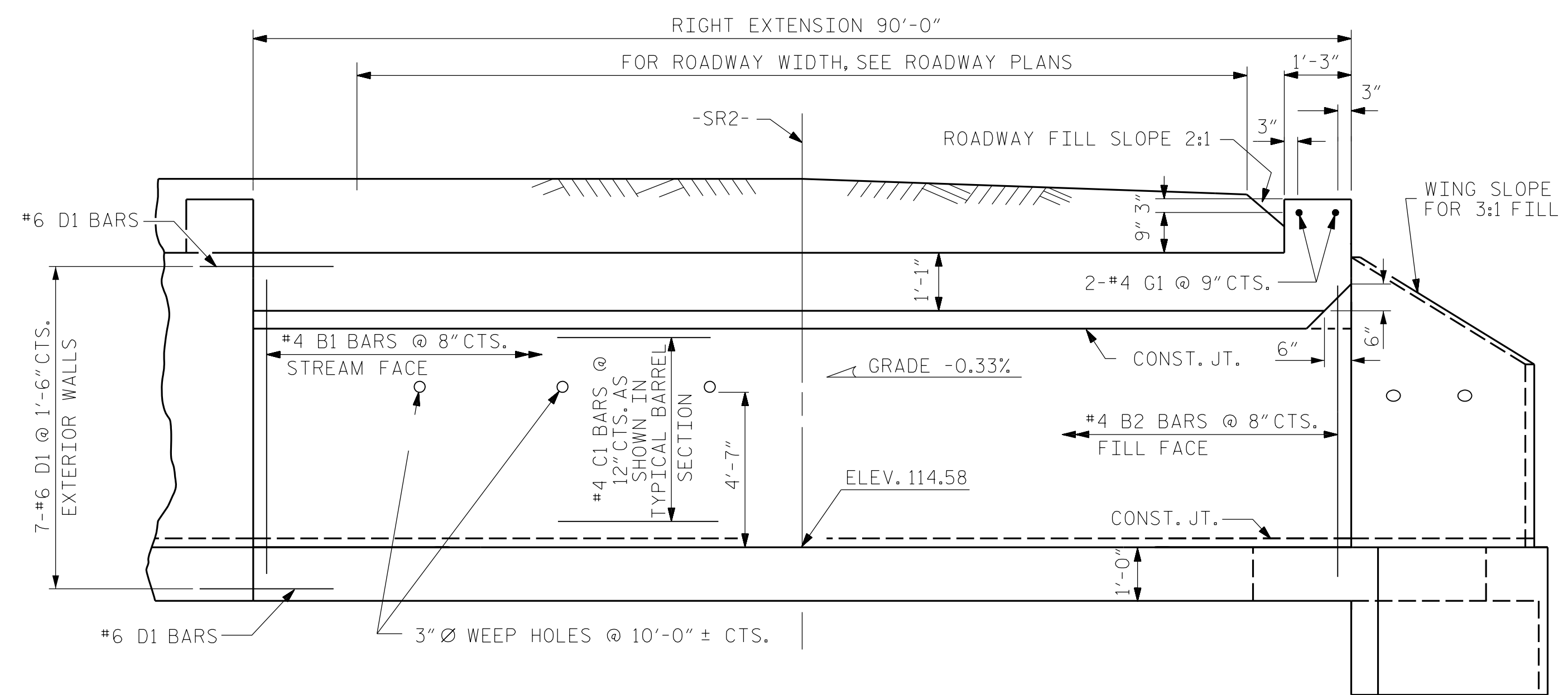
DRAWN BY : J. WEIGER DATE : 12/2018  
 CHECKED BY : R. ASENCIO DATE : 12/2018  
 DESIGN ENGINEER OF RECORD: P. JACOB DATE : 09/2019

**moffatt & nichol**  
 4700 FALLS OF NEUSE ROAD, SUITE 300  
 RALEIGH, NORTH CAROLINA 27609  
 (919) 781-4626 VOICE (919) 781-4869 FAX  
 NC License NO.: F-0105

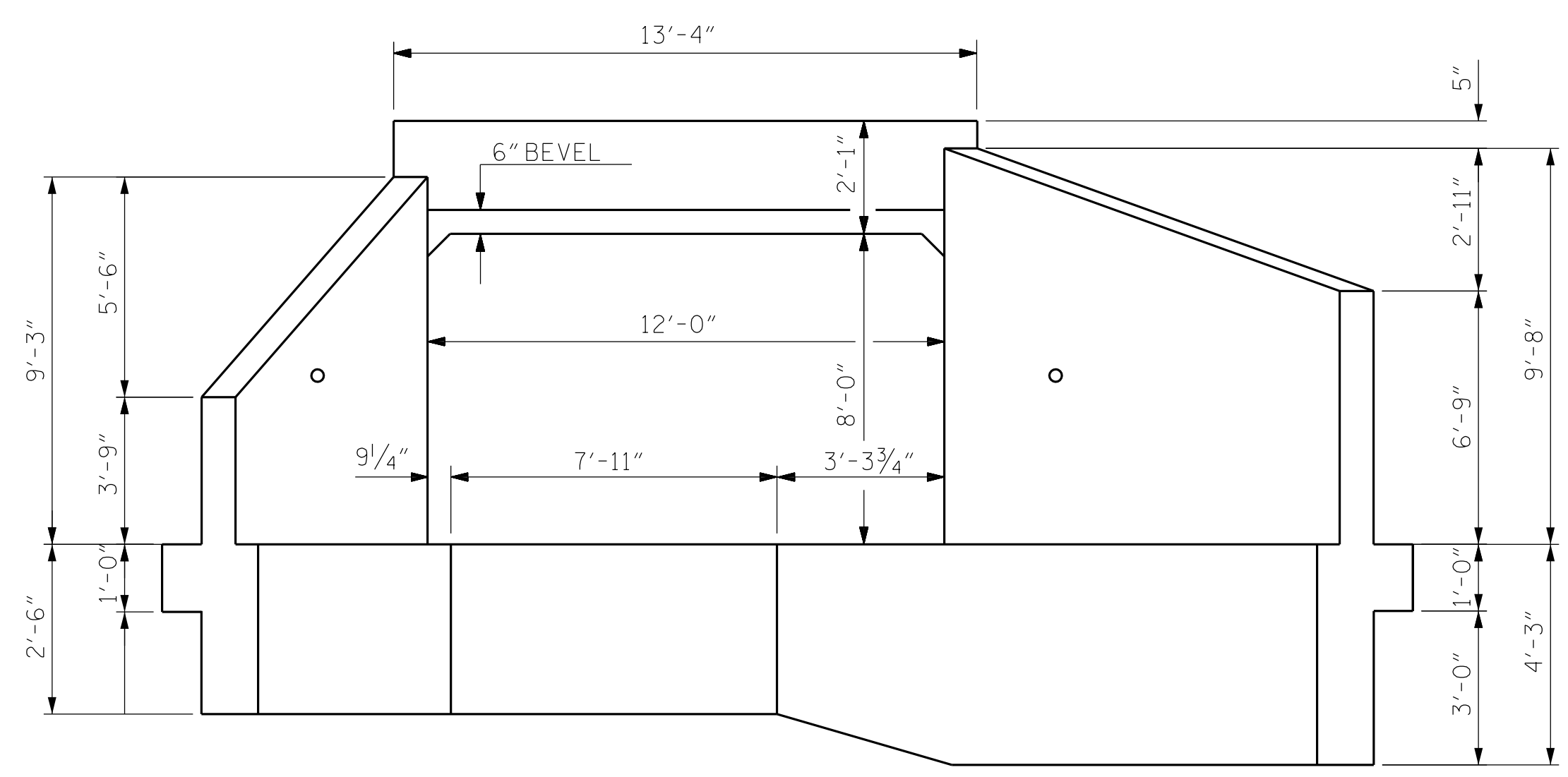
DOCUMENT NOT CONSIDERED  
 FINAL UNLESS ALL  
 SIGNATURES COMPLETED

| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-4         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |

Q:\RA\6522-07\CADD\R2303E\Structures\Culverts\01\_CADD\02\_FinalDrawings\L1\R2303E\_SMU\_CU4.dgn



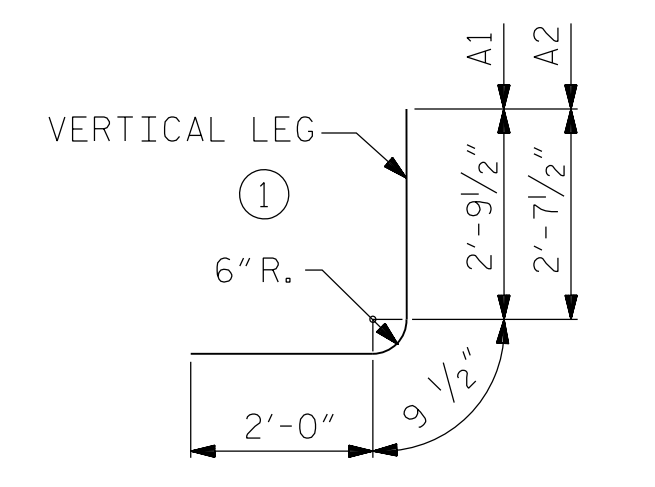
RIGHT CULVERT EXTENSION SECTION NORMAL TO ROADWAY



END ELEVATION

| RIGHT EXTENSION                |     |      |      |         |           |
|--------------------------------|-----|------|------|---------|-----------|
| REINFORCING STEEL BAR SCHEDULE |     |      |      |         |           |
| BAR                            | NO. | SIZE | TYPE | LENGTH  | WEIGHT    |
| A100                           | 136 | #7   | STR  | 13'-0"  | 3614      |
| A200                           | 136 | #7   | STR  | 13'-0"  | 3614      |
| A1                             | 272 | #6   | 1    | 5'-7"   | 2281      |
| A2                             | 272 | #6   | 1    | 5'-5"   | 2213      |
| B1                             | 272 | #4   | STR  | 9'-8"   | 1756      |
| B2                             | 272 | #4   | STR  | 7'-4"   | 1332      |
| C1                             | 184 | #4   | STR  | 23'-11" | 2940      |
| D1                             | 32  | #6   | STR  | 2'-6"   | 120       |
| G1                             | 2   | #4   | STR  | 13'-0"  | 17        |
| REINFORCING STEEL              |     |      |      |         | 17877 LBS |

BAR TYPES

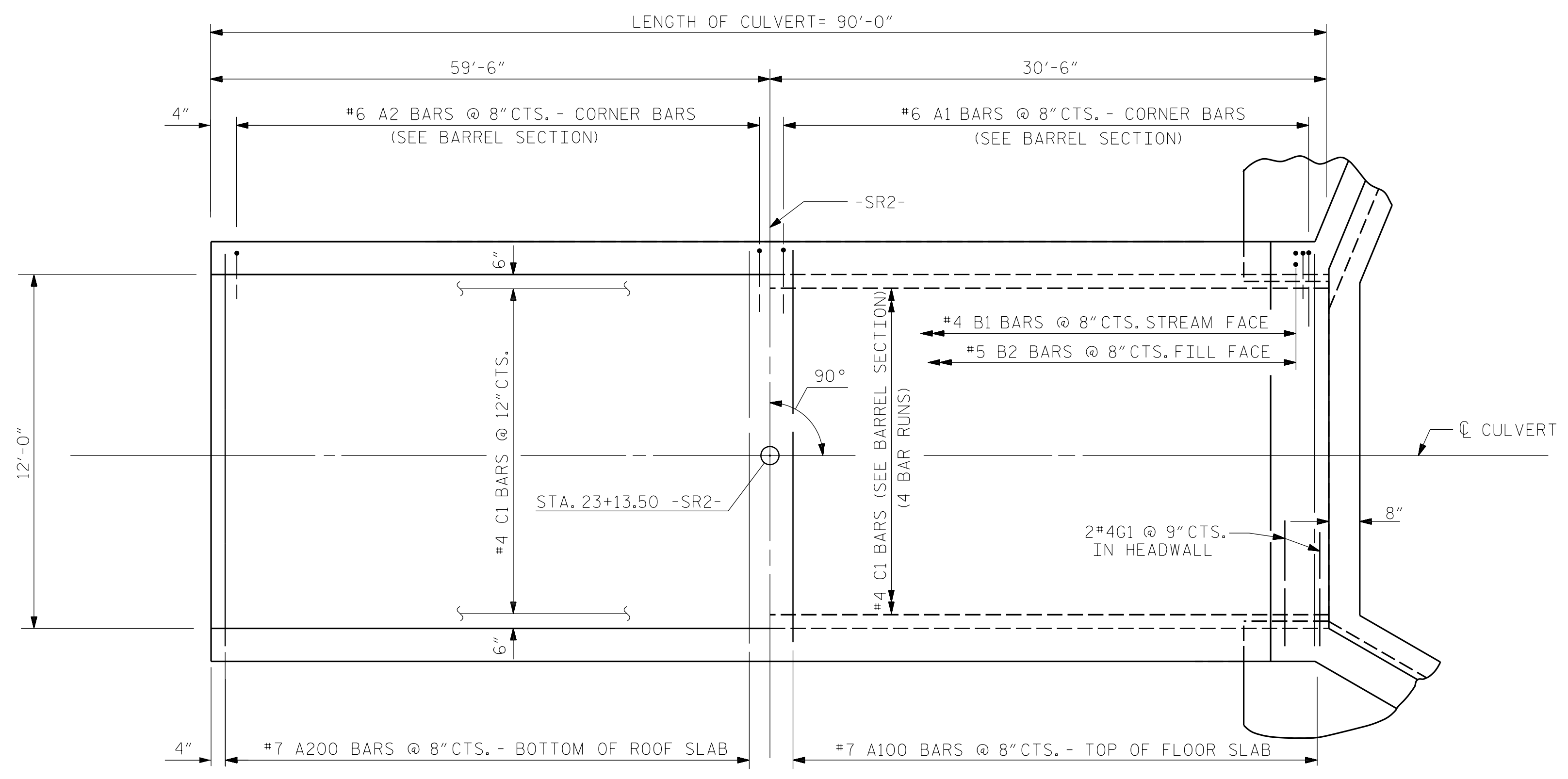


ALL BAR DIMENSIONS ARE OUT TO OUT

BAR TYPES

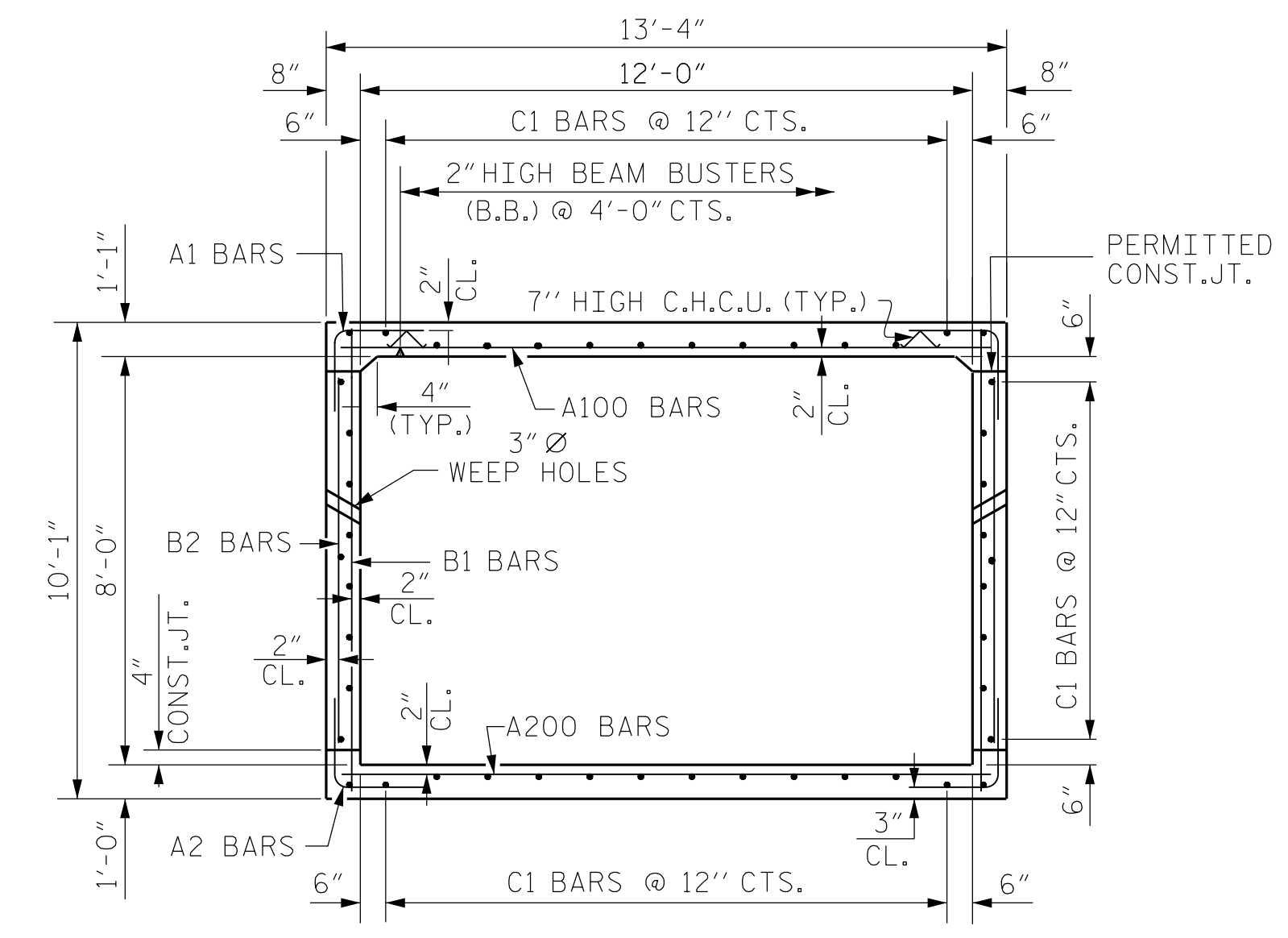
| BAR | SIZE | SPLICE LENGTH |
|-----|------|---------------|
| C1  | #4   | 1'-11"        |

BARREL @ 1.428 CY/FT = 128.5 CY



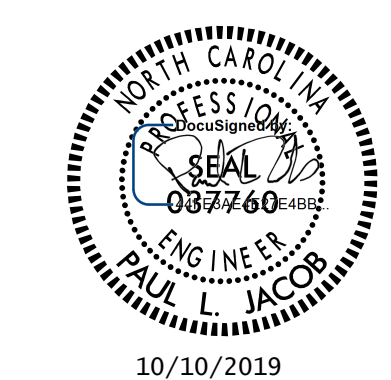
PART PLAN FLOOR SLAB

PART PLAN ROOF SLAB



RIGHT ANGLE SECTION OF BARREL  
THERE ARE 46 "C" BARS IN SECTION OF BARREL

PROJECT NO. R-2303E  
SAMPSON COUNTY  
STATION: 52+20.00 -L1-  
SHEET 5 OF 7



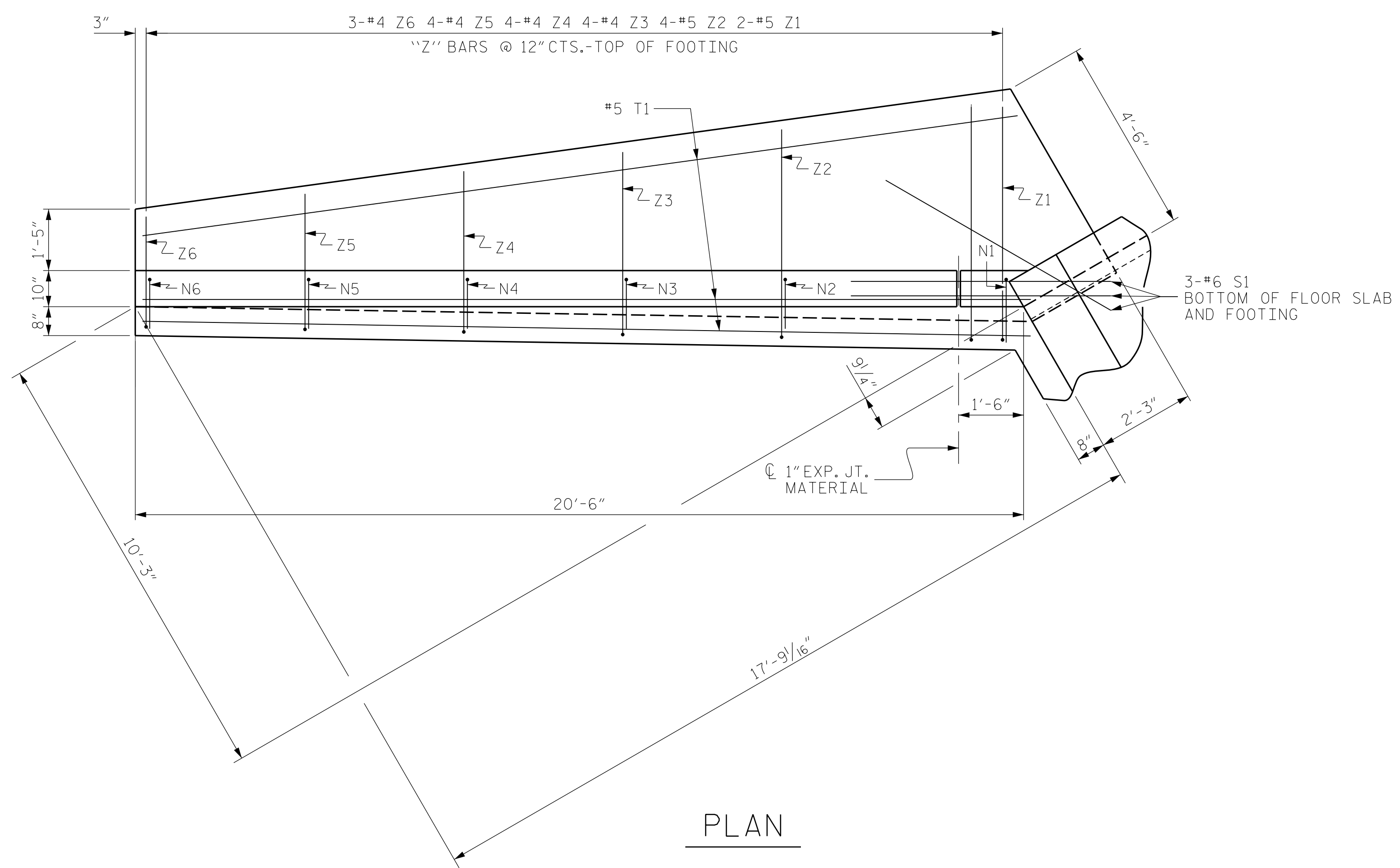
10/10/2019



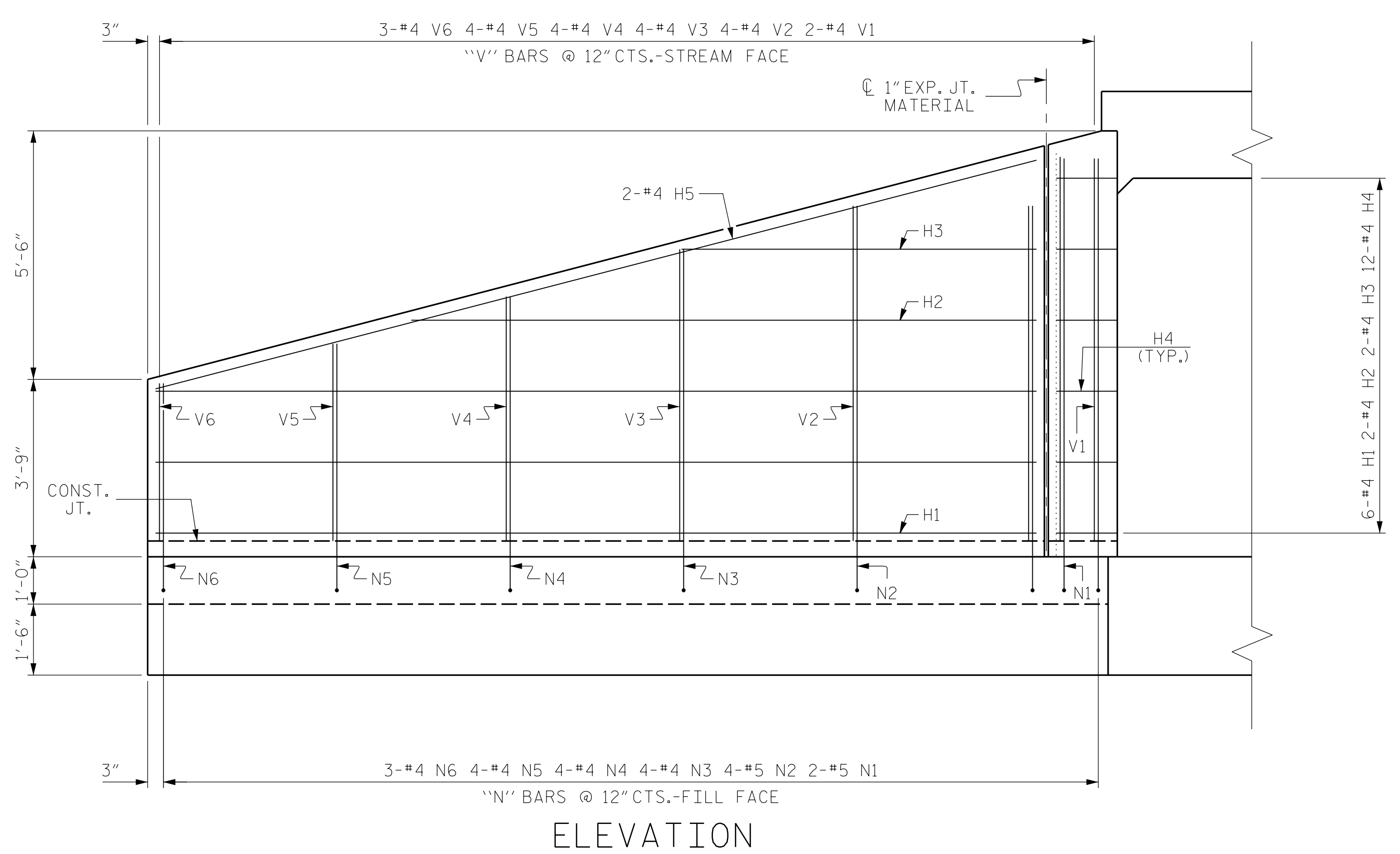
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-5         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |

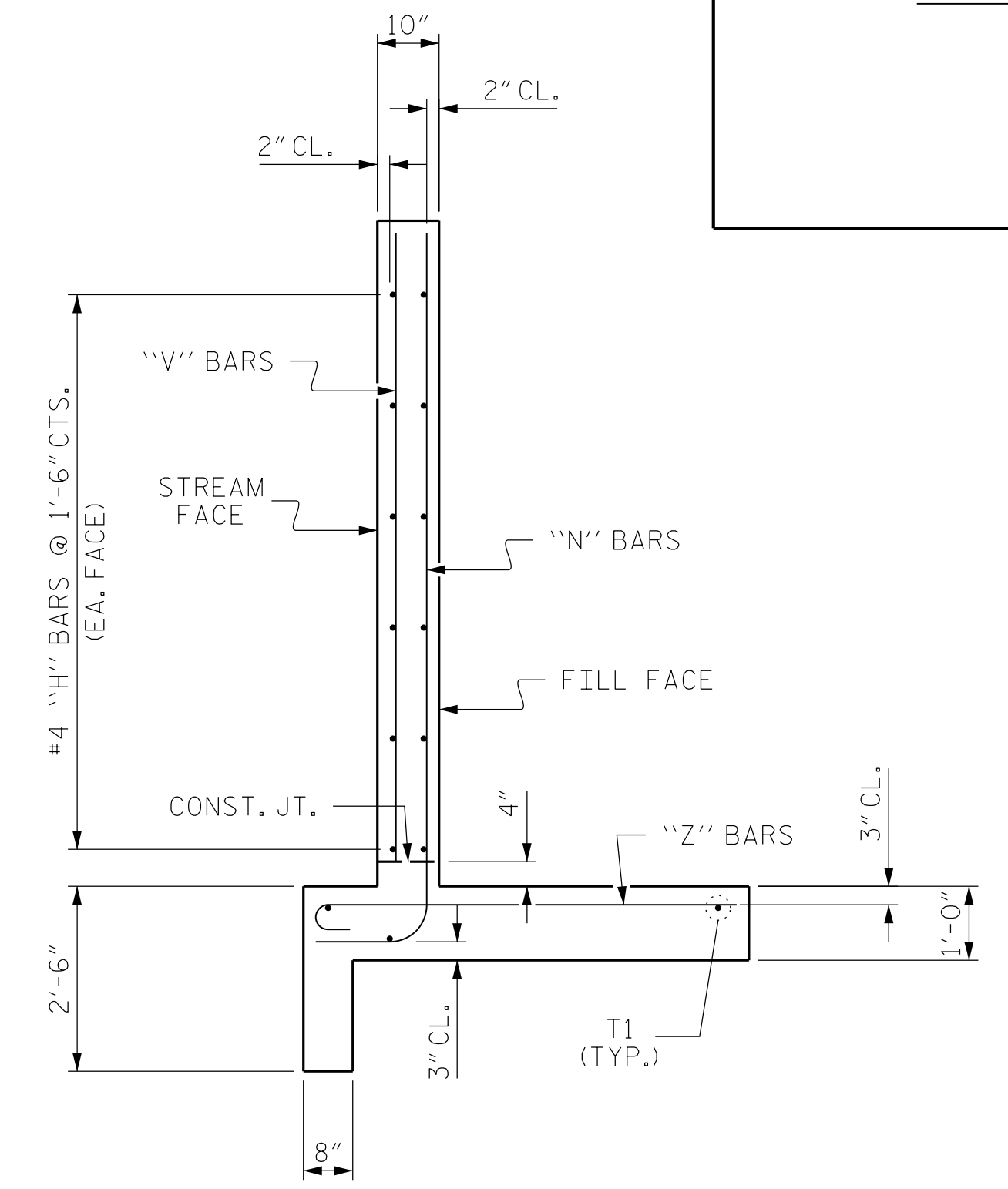
Q:\RA 6522-07\CADD\R2303E\Structures\Culvert\tsa\01\_CADD\02\_FinalDrawings\L1\R2303E\_SMU\_CU5.dgn



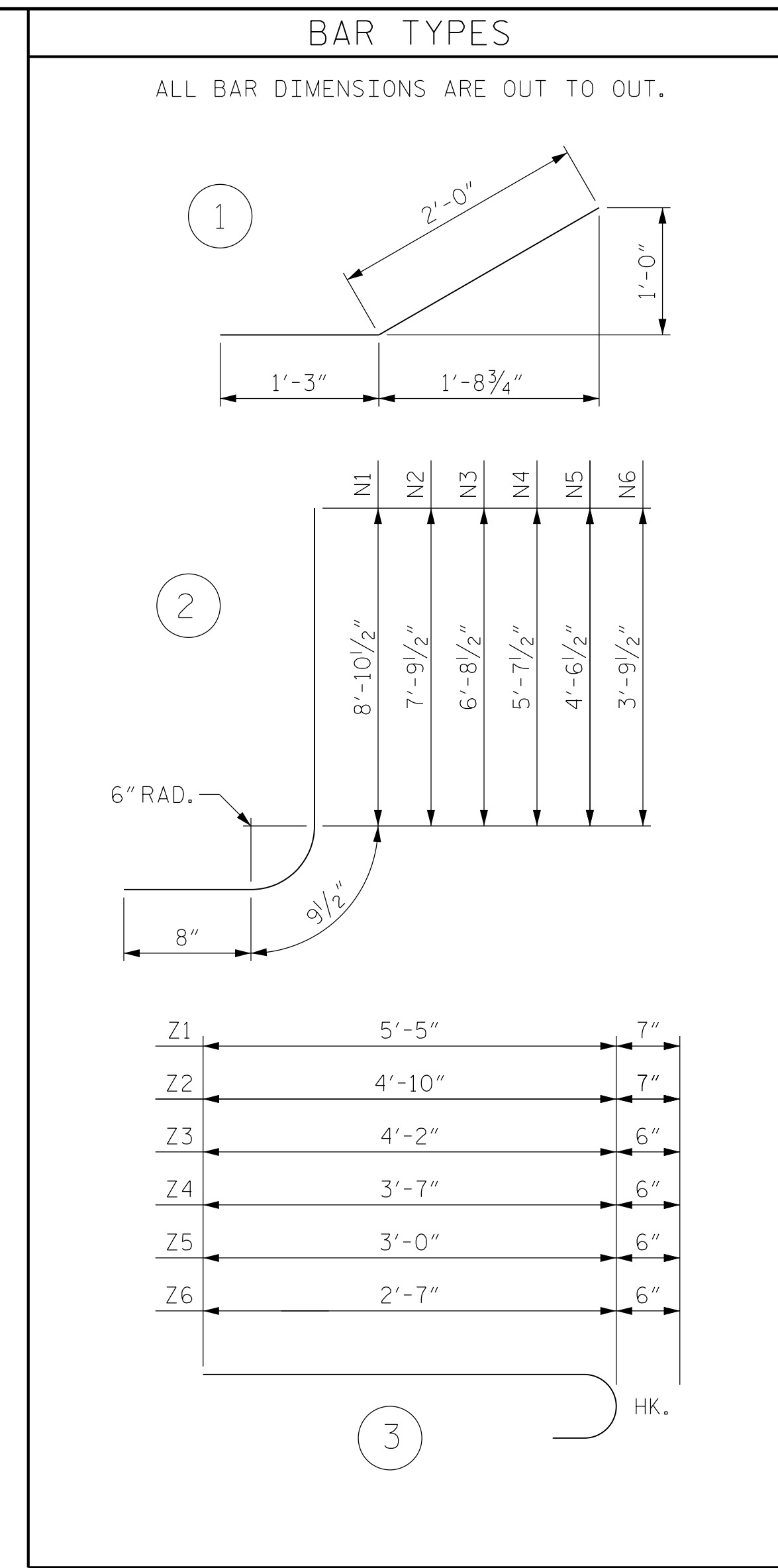
PLAN



ELEVATION

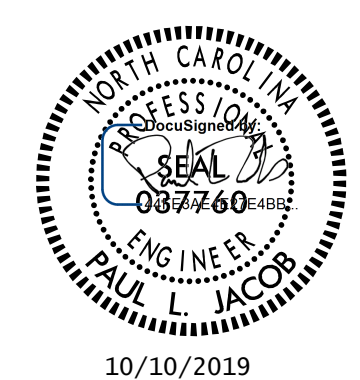


TYPICAL WING SECTION

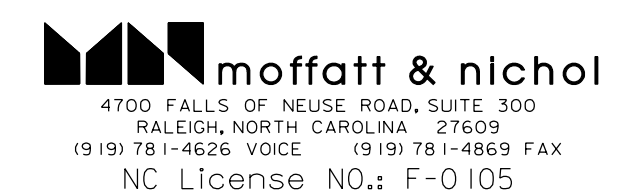


| BILL OF MATERIAL           |     |      |      |         |        |
|----------------------------|-----|------|------|---------|--------|
| BAR                        | NO. | SIZE | TYPE | LENGTH  | WEIGHT |
| H1                         | 6   | #4   | STR  | 18'-7"  | 74     |
| H2                         | 2   | #4   | STR  | 13'-2"  | 18     |
| H3                         | 2   | #4   | STR  | 7'-6"   | 10     |
| H4                         | 12  | #4   | 1    | 3'-3"   | 26     |
| H5                         | 2   | #4   | STR  | 19'-2"  | 26     |
| N1                         | 2   | #5   | 2    | 10'-4"  | 22     |
| N2                         | 4   | #5   | 2    | 9'-3"   | 39     |
| N3                         | 4   | #4   | 2    | 8'-2"   | 22     |
| N4                         | 4   | #4   | 2    | 7'-1"   | 19     |
| N5                         | 4   | #4   | 2    | 6'-0"   | 16     |
| N6                         | 3   | #4   | 2    | 5'-3"   | 11     |
| S1                         | 3   | #6   | STR  | 6'-0"   | 27     |
| T1                         | 3   | #5   | STR  | 20'-6"  | 64     |
| V1                         | 2   | #4   | STR  | 8'-4"   | 11     |
| V2                         | 4   | #4   | STR  | 7'-3"   | 19     |
| V3                         | 4   | #4   | STR  | 6'-2"   | 16     |
| V4                         | 4   | #4   | STR  | 5'-1"   | 14     |
| V5                         | 4   | #4   | STR  | 4'-0"   | 11     |
| V6                         | 3   | #4   | STR  | 3'-3"   | 7      |
| Z1                         | 2   | #5   | 3    | 6'-0"   | 13     |
| Z2                         | 4   | #5   | 3    | 5'-5"   | 23     |
| Z3                         | 4   | #4   | 3    | 4'-8"   | 12     |
| Z4                         | 4   | #4   | 3    | 4'-1"   | 11     |
| Z5                         | 4   | #4   | 3    | 3'-6"   | 9      |
| Z6                         | 3   | #4   | 3    | 3'-1"   | 6      |
| REINFORCING STEEL FOR WING |     |      |      | 526 LBS |        |
| CLASS A CONCRETE           |     |      |      |         |        |
| 1 WING                     |     |      |      | 8.4 CY  |        |
| 1 HEADWALL                 |     |      |      | 0.6 CY  |        |
| 1 END CURTAIN WALL         |     |      |      | 0.5 CY  |        |
| TOTAL                      |     |      |      | 9.5 CY  |        |

PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 52+20.00 -L1-  
 SHEET 6 OF 7

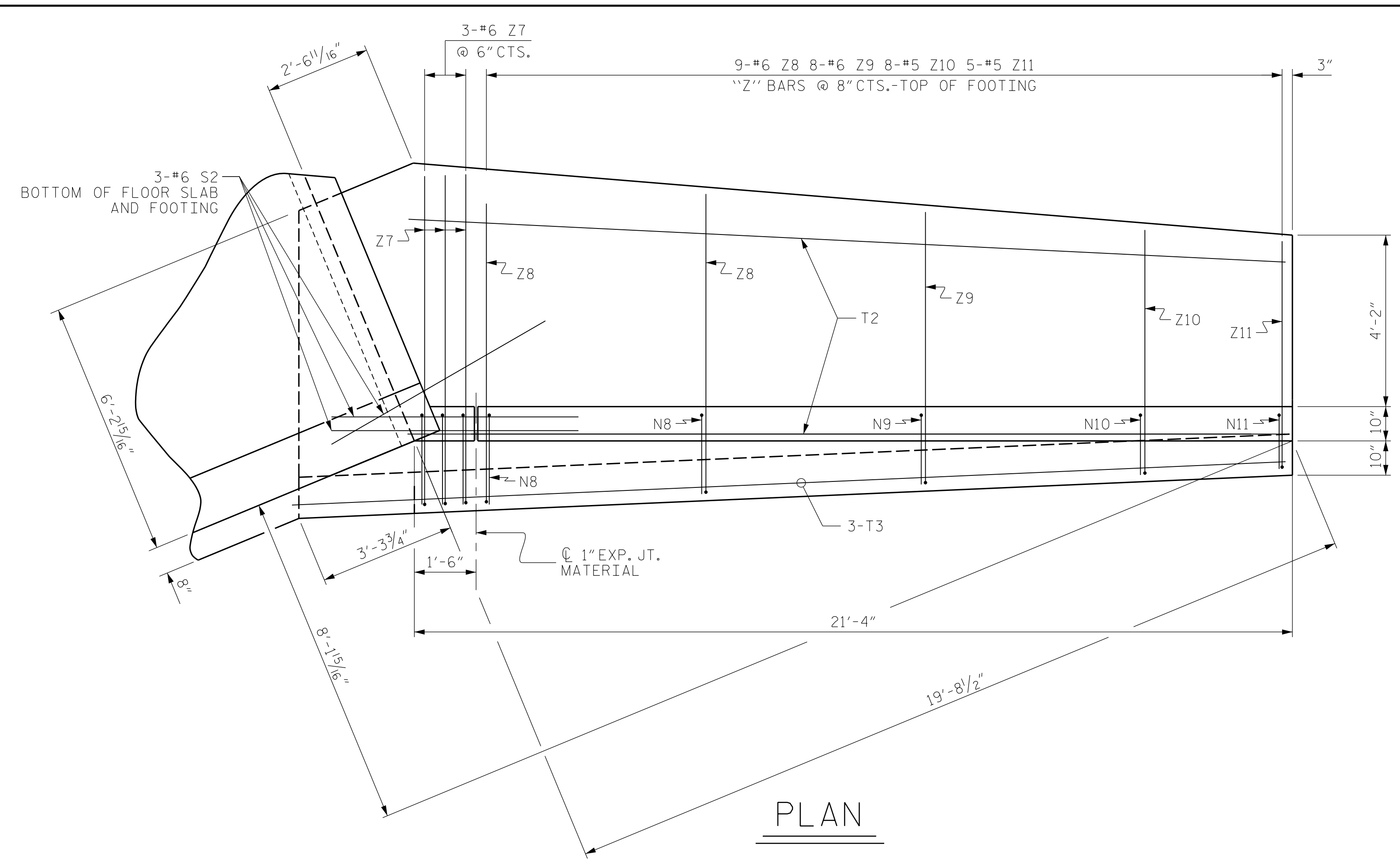


STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 RIGHT EXTENSION  
 WING FOR  
 CONCRETE BOX CULVERT  
 H = 8'-0" SLOPE = 3:1  
 90° SKEW

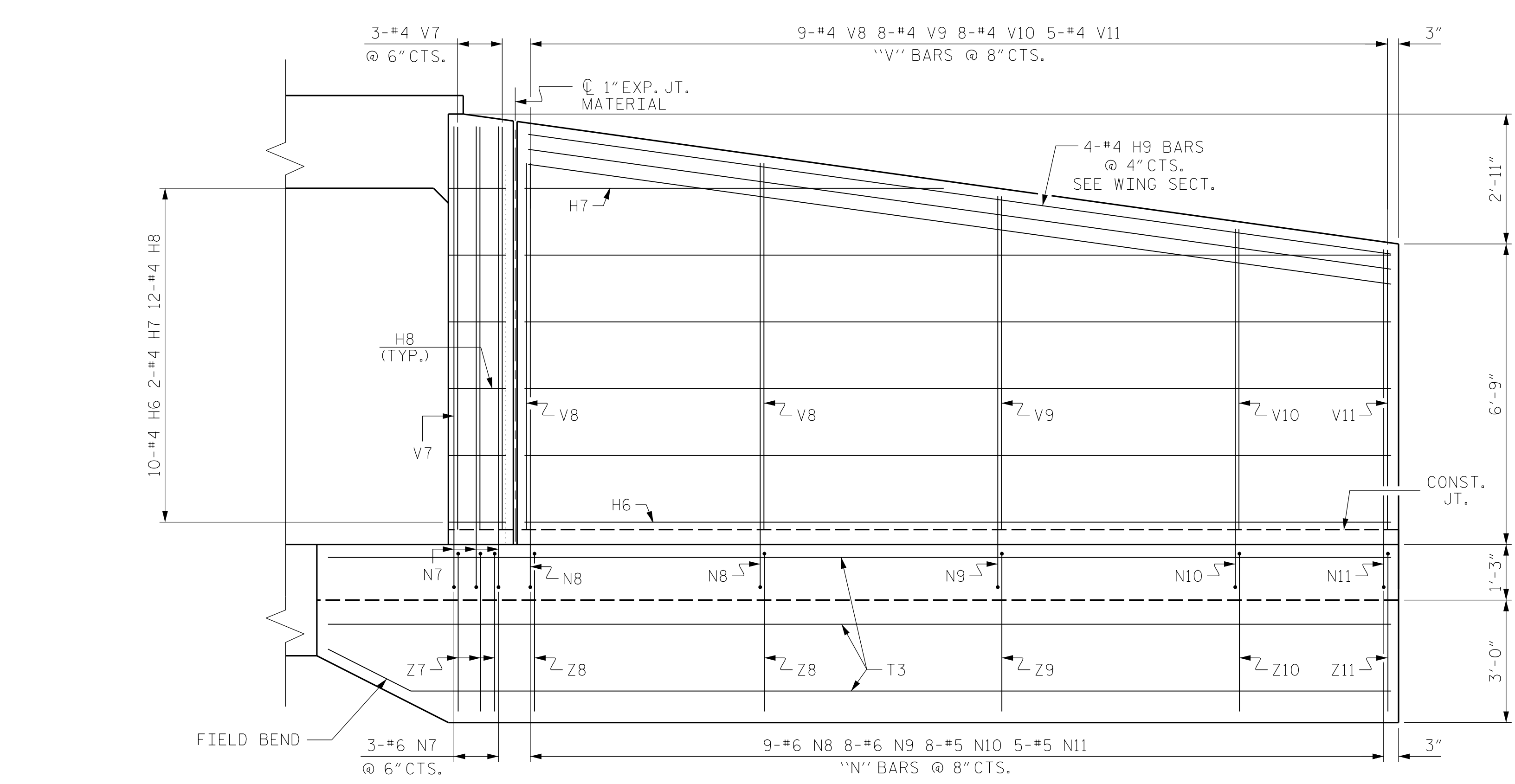


DOCUMENT NOT CONSIDERED  
 FINAL UNLESS ALL  
 SIGNATURES COMPLETED

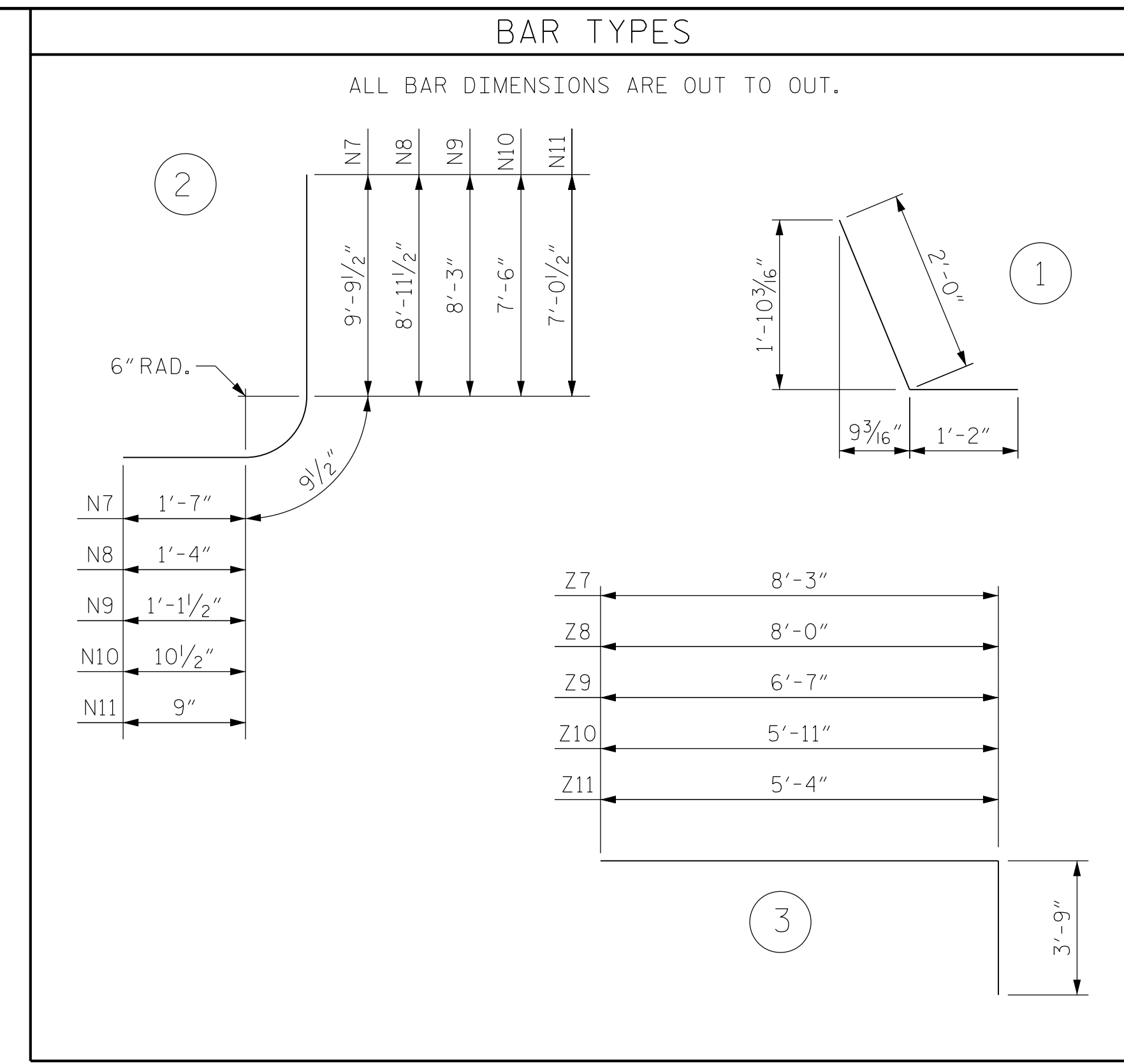
| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-6         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |



PLAN



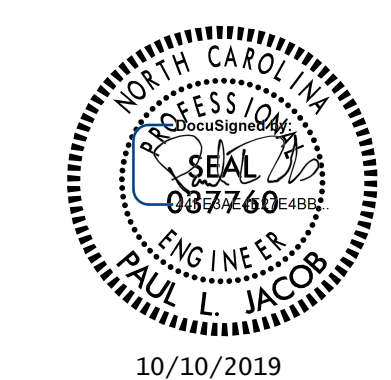
ELEVATION



TYPICAL WING SECTION

| BILL OF MATERIAL           |     |      |      |        |          |
|----------------------------|-----|------|------|--------|----------|
| BAR                        | NO. | SIZE | TYPE | LENGTH | WEIGHT   |
| H6                         | 10  | #4   | STR  | 19'-5" | 130      |
| H7                         | 2   | #4   | STR  | 8'-10" | 12       |
| H8                         | 12  | #4   | 1    | 3'-3"  | 26       |
| H9                         | 4   | #4   | STR  | 19'-7" | 52       |
| N7                         | 3   | #6   | 2    | 12'-2" | 55       |
| N8                         | 9   | #6   | 2    | 11'-1" | 150      |
| N9                         | 8   | #6   | 2    | 10'-2" | 122      |
| N10                        | 8   | #5   | 2    | 9'-2"  | 76       |
| N11                        | 5   | #5   | 2    | 8'-7"  | 45       |
| S2                         | 3   | #6   | STR  | 6'-0"  | 27       |
| T2                         | 2   | #5   | STR  | 21'-4" | 45       |
| T3                         | 3   | #5   | STR  | 24'-1" | 75       |
| V7                         | 3   | #4   | STR  | 8'-11" | 18       |
| V8                         | 9   | #4   | STR  | 8'-1"  | 49       |
| V9                         | 8   | #4   | STR  | 7'-5"  | 40       |
| V10                        | 8   | #4   | STR  | 6'-8"  | 36       |
| V11                        | 5   | #4   | STR  | 6'-3"  | 21       |
| Z7                         | 3   | #6   | 3    | 12'-0" | 54       |
| Z8                         | 9   | #6   | 3    | 11'-9" | 159      |
| Z9                         | 8   | #6   | 3    | 10'-4" | 124      |
| Z10                        | 8   | #5   | 3    | 9'-8"  | 81       |
| Z11                        | 5   | #5   | 3    | 9'-1"  | 47       |
| REINFORCING STEEL FOR WING |     |      |      |        | 1369 LBS |
| CLASS A CONCRETE WING      |     |      |      |        | 15.4 CY  |

PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 52+20.00 -L1-  
 SHEET 7 OF 7



STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 RIGHT EXTENSION  
 WING FOR  
 CONCRETE BOX CULVERT  
 H = 8'-0" SLOPE = 2:1  
 90° SKEW

DRAWN BY : J. WEIGER DATE : 12/2018  
 CHECKED BY : P. JACOB DATE : 09/2019  
 DESIGN ENGINEER OF RECORD: P. JACOB DATE : 09/2019

**moffatt & nichol**  
 4700 FALLS OF NEUSE ROAD, SUITE 300  
 RALEIGH, NORTH CAROLINA 27609  
 (919) 781-4626 VOICE (919) 781-4869 FAX  
 NC License NO.: F-0105

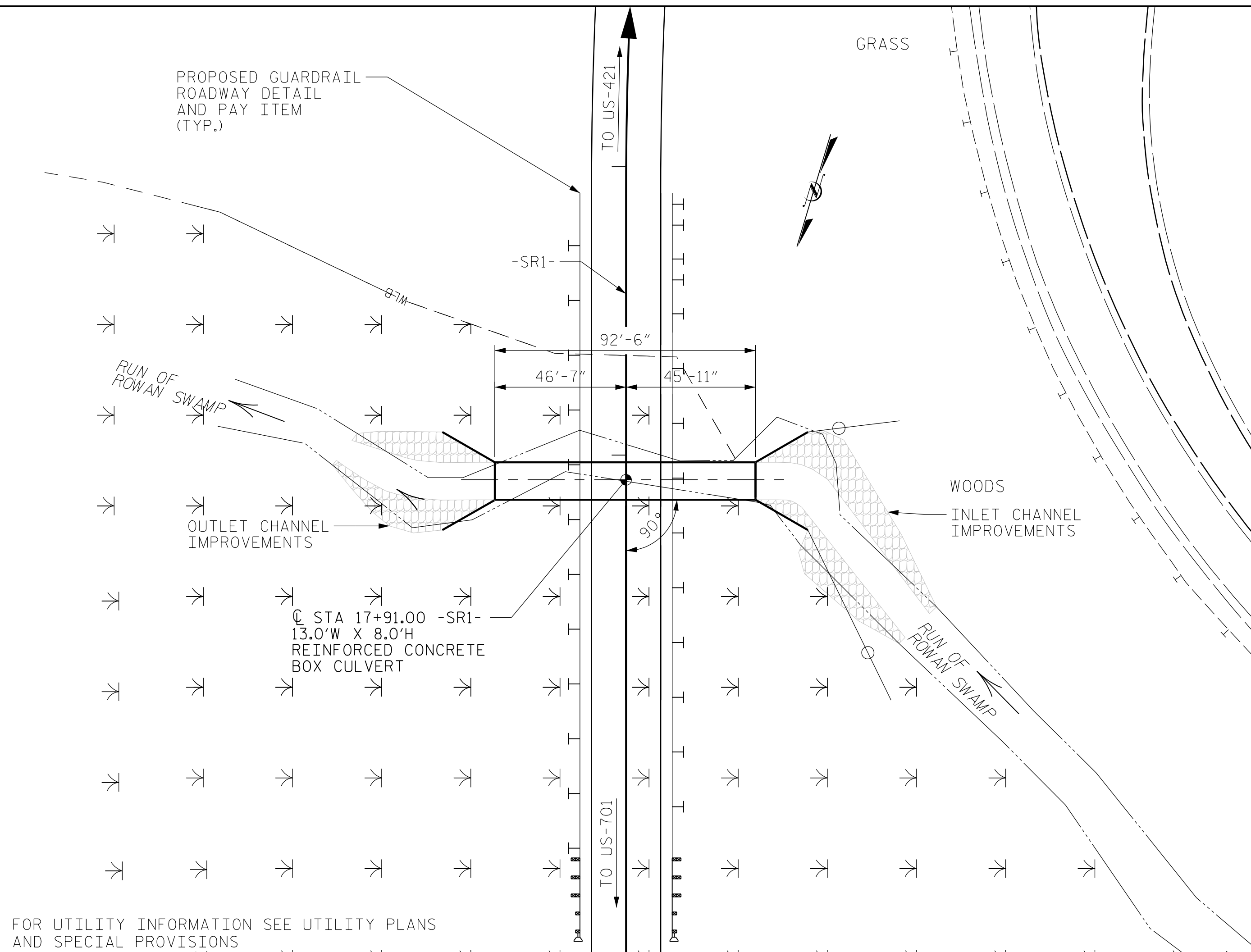
DOCUMENT NOT CONSIDERED  
 FINAL UNLESS ALL  
 SIGNATURES COMPLETED

| REVISIONS |     |       |     |     |       | SHEET NO.    |
|-----------|-----|-------|-----|-----|-------|--------------|
| NO.       | BY: | DATE: | NO. | BY: | DATE: | C1-7         |
| 1         |     |       | 3   |     |       | TOTAL SHEETS |
| 2         |     |       | 4   |     |       | 7            |

Q:\RA\6522-07\CADD\R2303E\Structures\Culverts\01\_CADD\02\_FinalDrawings\L1\R2303E\_SMU\_CUT.dgn

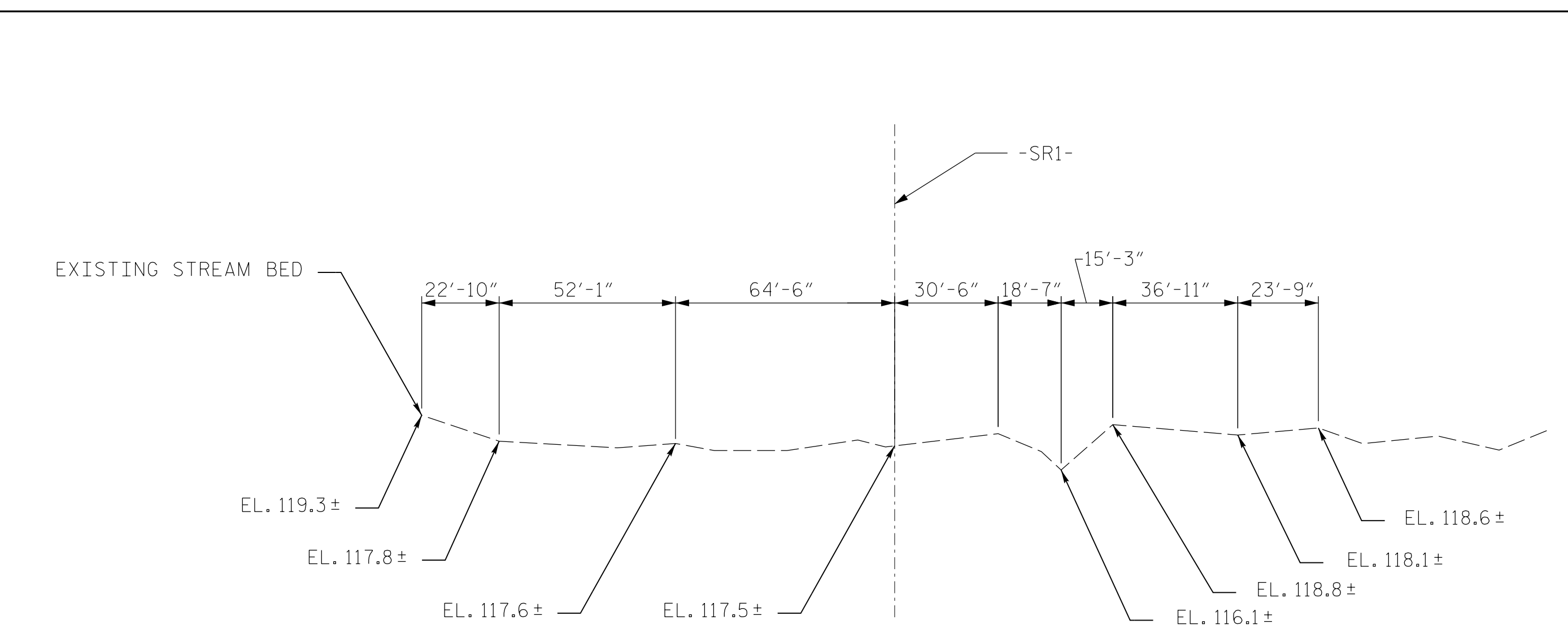


BYI-130 TRAVERSING CAP AND REBAR, STA. 19+91.0 -SR1- 108' RT. ELEV. 147.54'



FOR UTILITY INFORMATION SEE UTILITY PLANS AND SPECIAL PROVISIONS

-LOCATION SKETCH-



PROFILE ALONG CULVERT

DRAWN BY : J. WEIGER DATE : 03/2019  
 CHECKED BY : P. JACOB DATE : 09/2019  
 DESIGN ENGINEER OF RECORD: P. JACOB DATE : 09/2019

NOTES

1. ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.
2. DESIGN FILL = 9.7'
3. FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
4. 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
5. CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
  1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
  2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.
6. TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
7. THERE ARE 48 "C" BARS IN SECTION OF BARREL. (FOR "C" BARS SEE BARREL SECTION)
8. FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
9. A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
10. AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
11. AT THE CONTRACTOR'S OPTION HE MAY SUBMIT, TO THE ENGINEER FOR APPROVAL, DESIGN AND DETAILED DRAWINGS FOR A PRECAST REINFORCED CONCRETE BOX CULVERT IN LIEU OF THE CAST-IN-PLACE CULVERT SHOWN ON THE PLANS. THE DESIGN SHALL PROVIDE THE SAME SIZE AND NUMBER OF BARRELS AS USED ON THE CAST-IN-PLACE DESIGN. FOR OPTIONAL PRECAST REINFORCED CONCRETE BOX CULVERT, SEE SPECIAL PROVISIONS.
12. EXCAVATE AT LEAST 1 FOOT BELOW BOTTOM OF CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS.
13. THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
14. DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
15. FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
16. FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
17. FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
18. FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

| HYDRAULIC DATA              |              |
|-----------------------------|--------------|
| DESIGN DISCHARGE            | = 350 CFS    |
| FREQUENCY OF DESIGN FLOOD   | = 25 YR      |
| DESIGN HIGH WATER ELEVATION | = 123.7      |
| DRAINAGE AREA               | = 1.76 SQ MI |
| BASIC DISCHARGE (Q100)      | = 530 CFS    |
| BASIC HIGH WATER ELEVATION  | = 124.7      |

| OVERTOPPING FLOOD DATA         |            |
|--------------------------------|------------|
| OVERTOPPING DISCHARGE          | = 1300 CFS |
| FREQUENCY OF OVERTOPPING FLOOD | = 500+ YR  |
| OVERTOPPING FLOOD ELEVATION    | = 129.4*   |

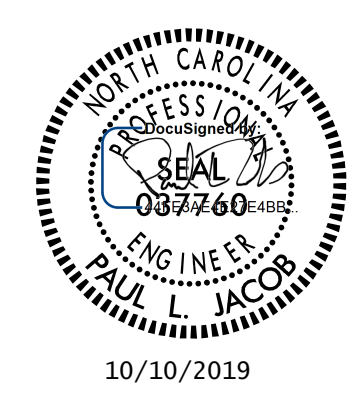
  

| GRADE DATA                                 |          |
|--|----------|
| GRADE POINT ELEV. @ STATION 17+91.00 -SR1- | = 135.68 |
| BED ELEV. @ STATION 17+91.00 -SR1-         | = 116.67 |
| ROADWAY SLOPES                             | = 3:1    |

\* OVERTOPPING OCCURS AT STA. 15+27.83 -SR1-

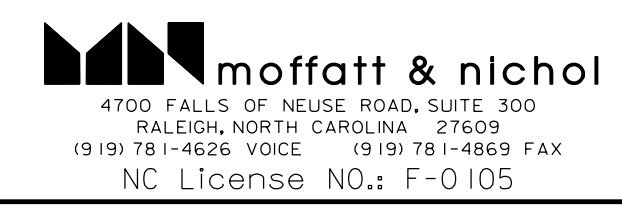
| TOTAL STRUCTURE QUANTITIES |          |            |
|----------------------------|----------|------------|
| CLASS A CONCRETE           |          |            |
| BARREL @ 1.505             | CY/FT    | 139.2 C.Y. |
| WING ETC.                  | 36.4     | C.Y.       |
| TOTAL                      | 175.6    | C.Y.       |
| REINFORCING STEEL          |          |            |
| BARREL                     | 24,082   | LBS.       |
| WINGS ETC.                 | 2,095    | LBS.       |
| TOTAL                      | 26,177   | LBS.       |
| FOUND. COND. MATERIAL      | 121.3    | TONS       |
| CULVERT EXCAVATION         | LUMP SUM |            |

PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 17+91.00 -SR1-  
 SHEET 1 OF 4



STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

13.0 FT. X 8.0 FT.  
 REINFORCED CONCRETE BOX  
 CULVERT 90° SKEW



DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

Q:\RA\6522-07\CADD\R2303E\Structures\Culverts\01\_CADD\02\_FinalDrawings\SR1\R2303E\_SMUL\_SRI\_CUL.dgn

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

| 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 |  |  |
|--------------------|-----------------------------------|----------------------|----------------------------|-----------------------------------|---------------|---|---------------|-------------|--------------|--|---------------|-------------|---------------|----------------|--|--|
|                    |                                   |                      |                            |                                   |               | LIVE-LOAD<br>FACTORS (γ <sub>LL</sub> ) | 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                          | 1.36                              | --            | 1.75                                    | 1.36          | 1           | TOP SLAB     | 7.17                                   | 1.44          | 1           | BOTTOM SLAB   | 0.72           |  |  |
|                    | HL-93 (OPERATING)                 | N/A                  |                            | 1.76                              | --            | 1.35                                    | 1.76          | 1           | TOP SLAB     | 7.17                                   | 1.87          | 1           | BOTTOM SLAB   | 0.72           |  |  |
|                    | HS-20 (INVENTORY)                 | 36.000               | 2                          | 1.63                              | 58.68         | 1.75                                    | 1.63          | 1           | TOP SLAB     | 7.17                                   | 1.92          | 1           | BOTTOM SLAB   | 0.72           |  |  |
|                    | HS-20 (OPERATING)                 | 36.000               |                            | 2.11                              | 75.96         | 1.35                                    | 2.11          | 1           | TOP SLAB     | 7.17                                   | 2.49          | 1           | BOTTOM SLAB   | 0.72           |  |  |
| LEGAL LOAD RATING  | SINGLE VEHICLE (SV)               | SNSH                 |                            | 2.74                              | 36.99         | 1.40                                    | 3.60          | 1           | BOTTOM SLAB  | 7.17                                   | 2.74          | 1           | EXTERIOR WALL | 0.48           |  |  |
|                    |                                   | SNGARBS2             | 20.000                     |                                   | 2.69          | 53.80                                   | 1.40          | 3.37        | 1            | BOTTOM SLAB                            | 7.17          | 2.69        | 1             | EXTERIOR WALL  | 0.48                                   |  |
|                    |                                   | SNAGRIS2             | 22.000                     |                                   | 2.68          | 58.96                                   | 1.40          | 3.60        | 1            | BOTTOM SLAB                            | 7.17          | 2.68        | 1             | EXTERIOR WALL  | 0.48                                   |  |
|                    |                                   | SNCOTTS3             | 27.250                     |                                   | 1.67          | 45.50                                   | 1.40          | 1.86        | 1            | BOTTOM SLAB                            | 7.17          | 1.67        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | SNAGGRS4             | 34.925                     |                                   | 1.61          | 56.22                                   | 1.40          | 1.79        | 1            | BOTTOM SLAB                            | 7.17          | 1.61        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | SNS5A                | 35.550                     |                                   | 1.77          | 62.92                                   | 1.40          | 1.97        | 1            | BOTTOM SLAB                            | 7.17          | 1.77        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | SNS6A                | 39.950                     |                                   | 1.48          | 59.12                                   | 1.40          | 1.65        | 1            | BOTTOM SLAB                            | 7.17          | 1.48        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | SNS7B                | 42.000                     | 3                                 | 1.42          | 59.64                                   | 1.40          | 1.58        | 1            | BOTTOM SLAB                            | 7.17          | 1.42        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    | TRUCK TRACTOR SEMI-TRAILER (TTST) | TNAGRIT3             | 33.000                     |                                   | 2.10          | 69.30                                   | 1.40          | 2.36        | 1            | BOTTOM SLAB                            | 7.17          | 2.10        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | TNT4A                | 33.075                     |                                   | 1.83          | 60.52                                   | 1.40          | 2.04        | 1            | BOTTOM SLAB                            | 7.17          | 1.83        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | TNT6A                | 41.600                     |                                   | 1.59          | 66.14                                   | 1.40          | 1.78        | 1            | BOTTOM SLAB                            | 7.17          | 1.59        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | TNT7A                | 42.000                     |                                   | 1.76          | 73.92                                   | 1.40          | 1.96        | 1            | BOTTOM SLAB                            | 7.17          | 1.76        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | TNT7B                | 42.000                     |                                   | 1.62          | 68.04                                   | 1.40          | 1.80        | 1            | BOTTOM SLAB                            | 7.17          | 1.62        | 1             | BOTTOM SLAB    | 0.72                                   |  |
|                    |                                   | TNAGRIT4             | 43.000                     |                                   | 1.70          | 73.10                                   | 1.40          | 1.91        | 1            | BOTTOM SLAB                            | 7.17          | 1.70        | 1             | BOTTOM SLAB    | 0.72                                   |  |
| TNAGT5A            | 45.000                            |                      | 1.69                       | 76.05                             | 1.40          | 1.90                                    | 1             | BOTTOM SLAB | 7.17         | 1.69                                   | 1             | BOTTOM SLAB | 0.72          |                |  |  |
| TNAGT5B            | 45.000                            |                      | 1.63                       | 73.35                             | 1.40          | 1.82                                    | 1             | BOTTOM SLAB | 7.17         | 1.63                                   | 1             | BOTTOM SLAB | 0.72          |                |  |  |

**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.

**COMMENTS:**

- 1.
- 2.
- 3.
- 4.

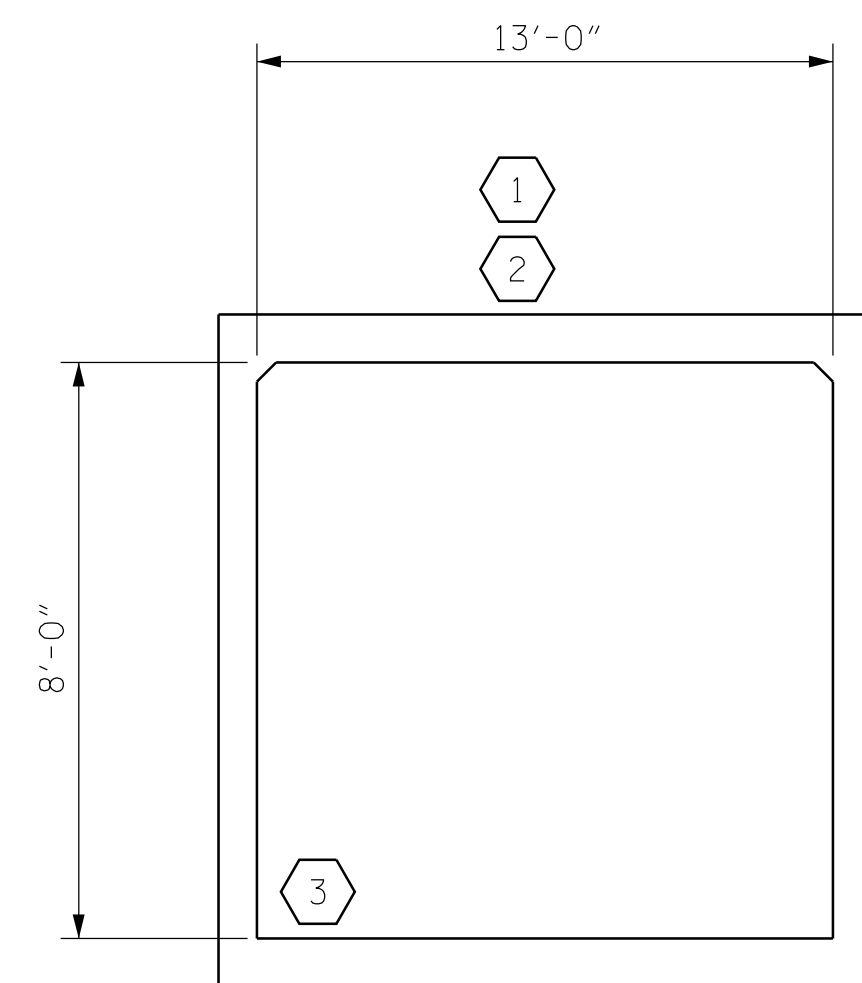
# CONTROLLING LOAD RATING

1 DESIGN LOAD RATING (HL-93)

2 DESIGN LOAD RATING (HS-20)

3 LEGAL LOAD RATING \*\*

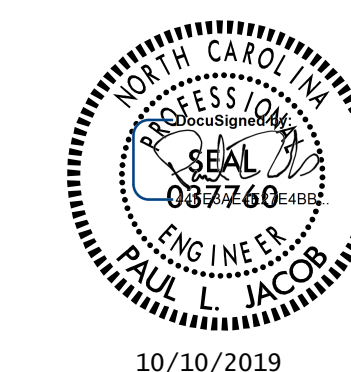
\*\* SEE CHART FOR VEHICLE TYPE



**LRFR SUMMARY**  
(LOOKING DOWNSTREAM)

PROJECT NO. R-2303E  
SAMPSON COUNTY  
STATION: 17+91.00 -SR1-

SHEET 2 OF 4



10/10/2019

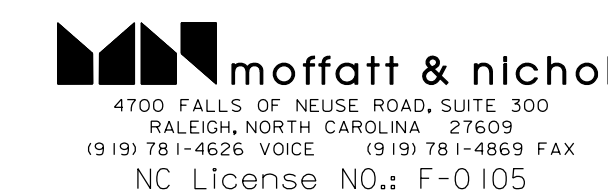
STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
STANDARD  
LRFR SUMMARY FOR  
REINFORCED CONCRETE  
BOX CULVERTS  
(NON-INTERSTATE TRAFFIC)

REVISIONS

| NO. | BY: | DATE: | NO. | BY: | DATE: |
|-----|-----|-------|-----|-----|-------|
| 1   |     |       | 3   |     |       |
| 2   |     |       | 4   |     |       |

| SHEET NO.      |
|----------------|
| C2-2           |
| TOTAL SHEETS 4 |

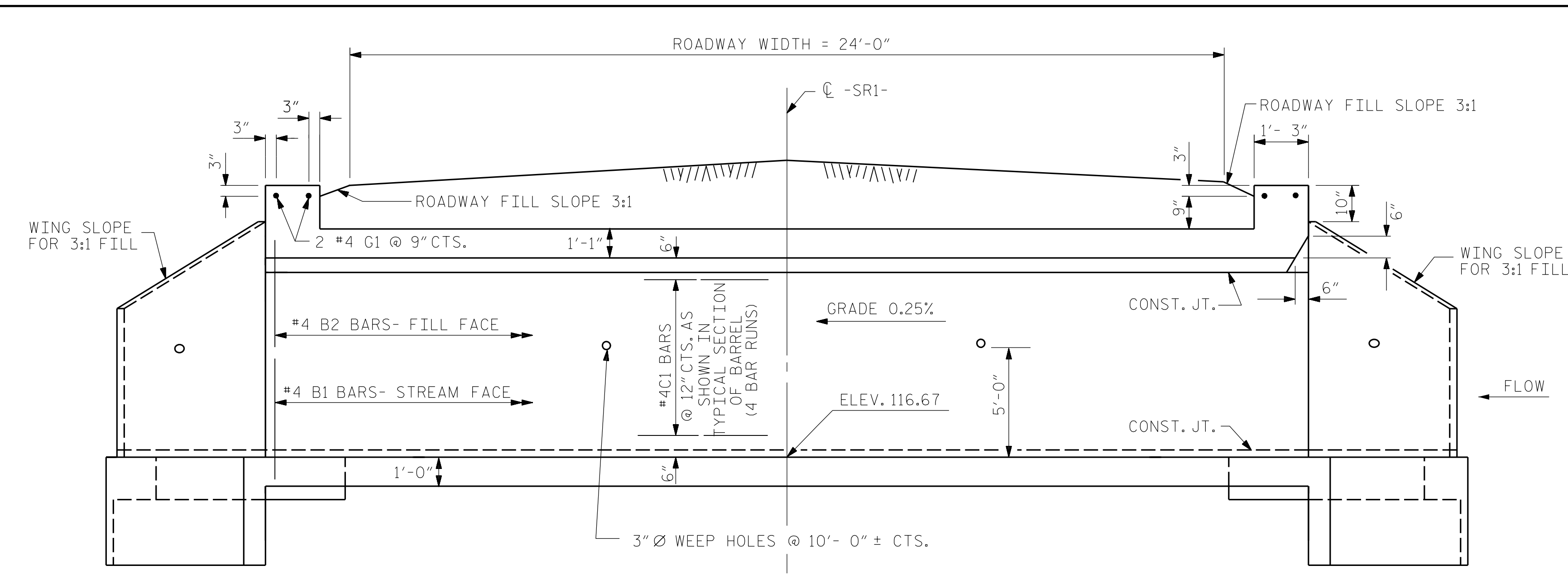
DRAWN BY : J. WEIGER DATE : 03/2019  
CHECKED BY : P. JACOB DATE : 09/2019  
DESIGN ENGINEER OF RECORD: P. JACOB DATE : 09/2019



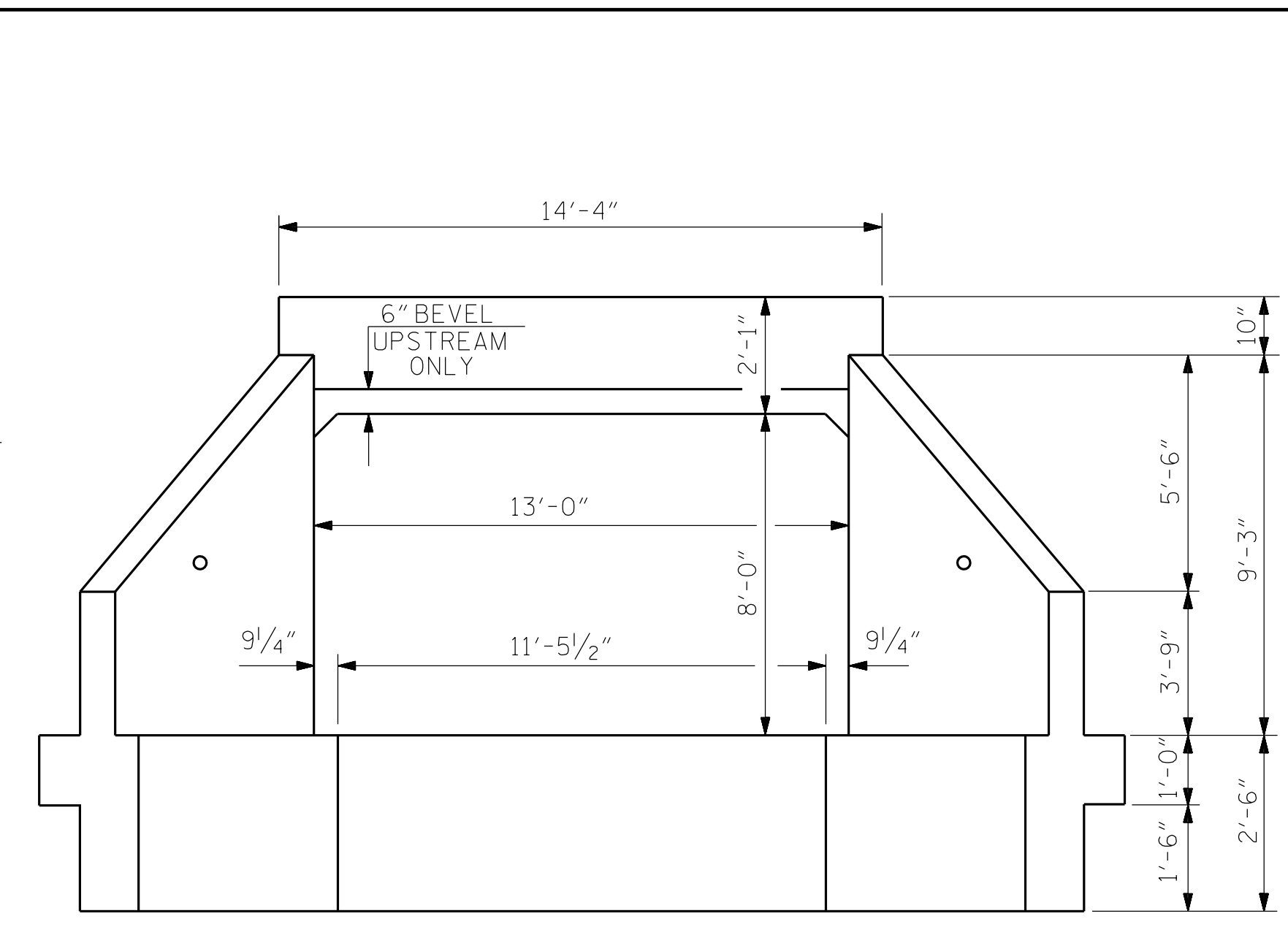
DOCUMENT NOT CONSIDERED  
FINAL UNLESS ALL  
SIGNATURES COMPLETED

4700 FALLS OF NEUSE ROAD, SUITE 300  
RALEIGH, NORTH CAROLINA 27609  
(919) 781-4626 VOICE (919) 781-4869 FAX  
NC License NO.: F-0105

Q:\RA\6522-07\CADD\R2303E\Structures\Culverts\01\_CADD\02\_FinalDrawings\SR1\R2303E\_SMUL\_SRI\_CUL.dgn



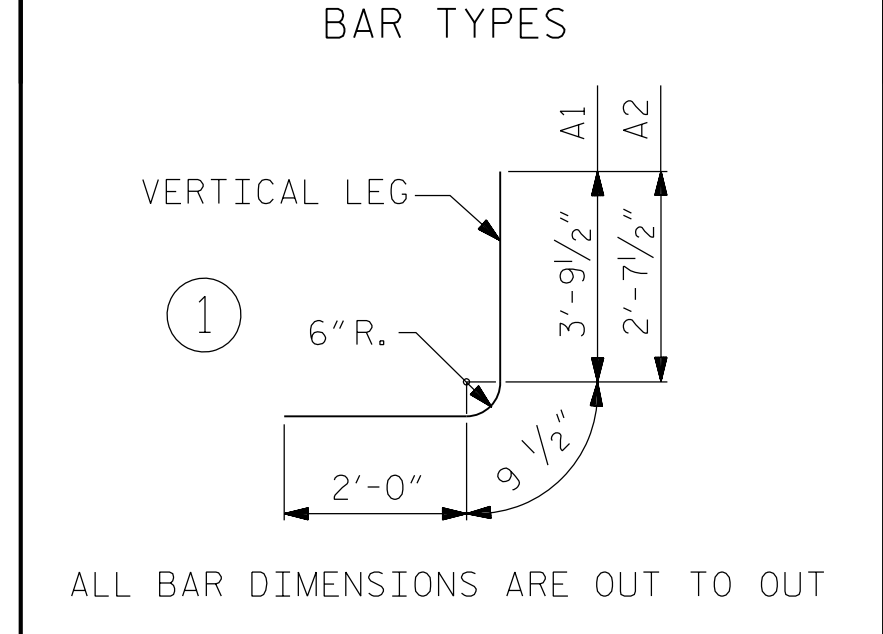
**CULVERT SECTION NORMAL TO ROADWAY**



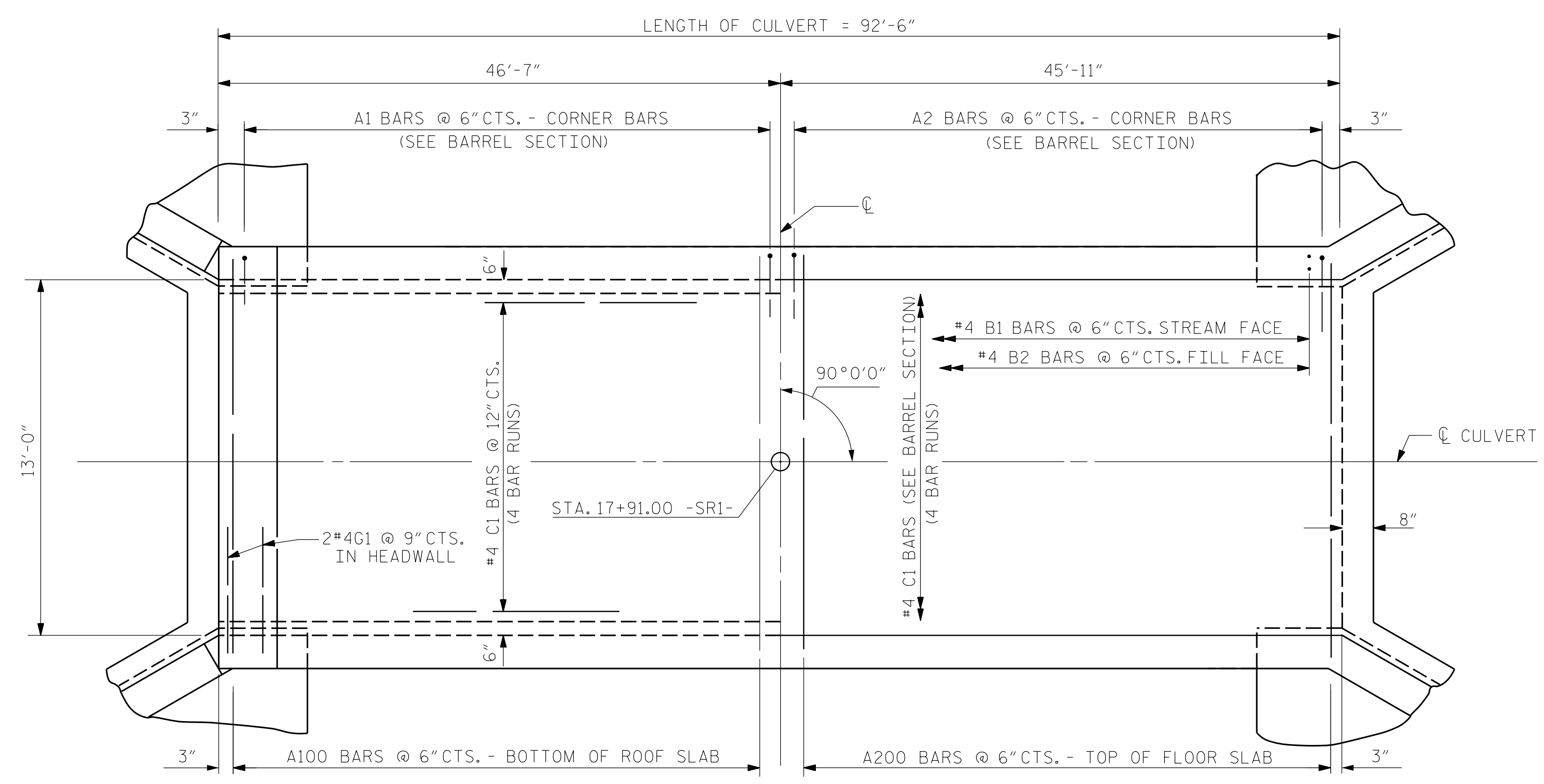
**END ELEVATION**

| BAR  | NO. | SIZE | TYPE | LENGTH | WEIGHT |
|------|-----|------|------|--------|--------|
| A100 | 185 | #7   | STR  | 14'-0" | 5294   |
| A200 | 185 | #7   | STR  | 14'-0" | 5294   |
| A1   | 370 | #6   | 1    | 5'-7"  | 3103   |
| A2   | 370 | #6   | 1    | 5'-5"  | 3010   |
| B1   | 370 | #4   | STR  | 9'-8"  | 2389   |
| B2   | 370 | #4   | STR  | 7'-4"  | 1813   |
| C1   | 192 | #4   | STR  | 24'-6" | 3142   |
| G1   | 4   | #4   | STR  | 14'-0" | 37     |

REINFORCING STEEL 24082 LBS

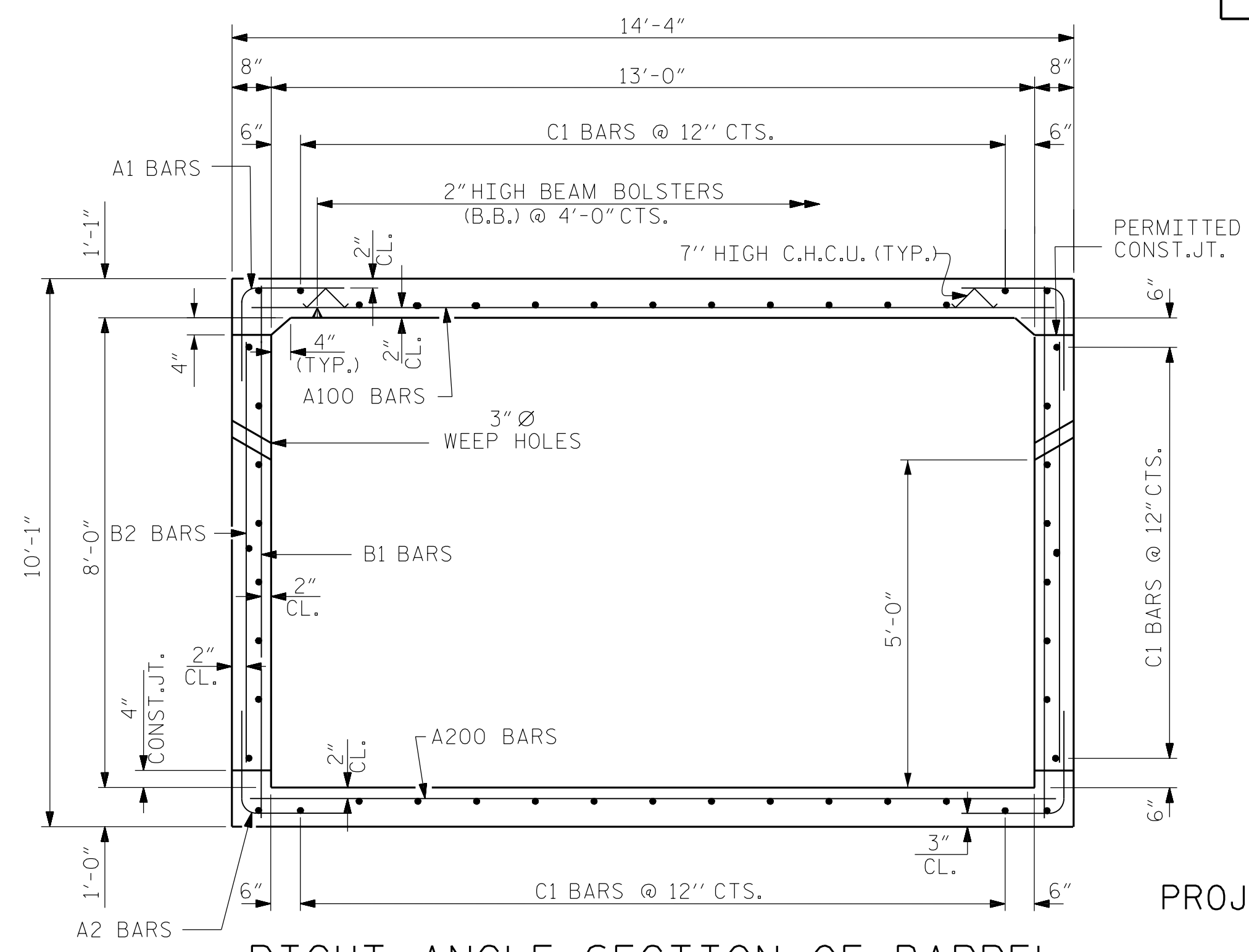


| SPLICE LENGTH CHART |      |               |
|---------------------|------|---------------|
| BAR                 | SIZE | SPLICE LENGTH |
| C1                  | #4   | 1'-11"        |



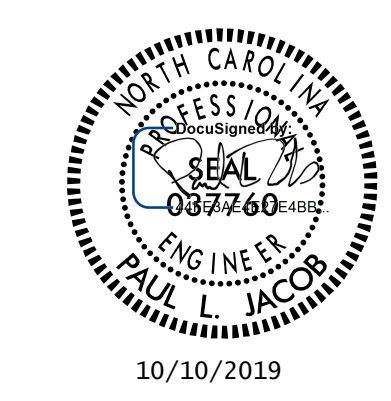
**PART PLAN ROOF SLAB**

**PART PLAN FLOOR SLAB**



**RIGHT ANGLE SECTION OF BARREL**  
THERE ARE 48 #4 C1 BARS IN SECTION OF BARREL

PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 17+91.00 -SR1-  
 SHEET 3 OF 4



STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 REINFORCED CONCRETE  
 BOX CULVERT  
 13 FT. X 8 FT.  
 90° SKEW

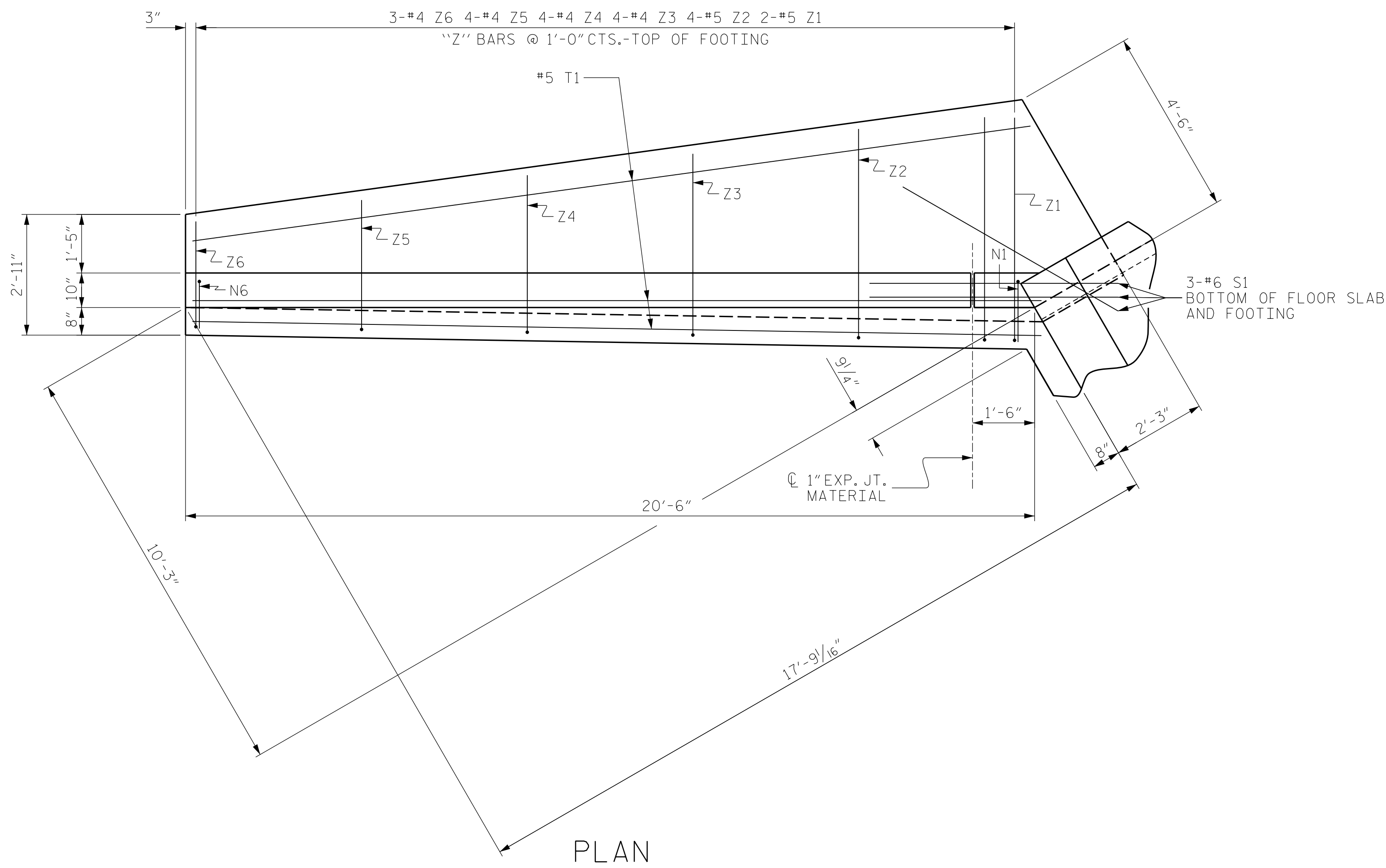
DRAWN BY : J. WEIGER DATE : 03/2019  
 CHECKED BY : P. JACOB DATE : 09/2019  
 DESIGN ENGINEER OF RECORD: P. JACOB DATE : 09/2019

**moffatt & nichol**  
 4700 FALLS OF NEUSE ROAD, SUITE 300  
 RALEIGH, NORTH CAROLINA 27609  
 (919) 781-4626 VOICE (919) 781-4869 FAX  
 NC License NO.: F-0105

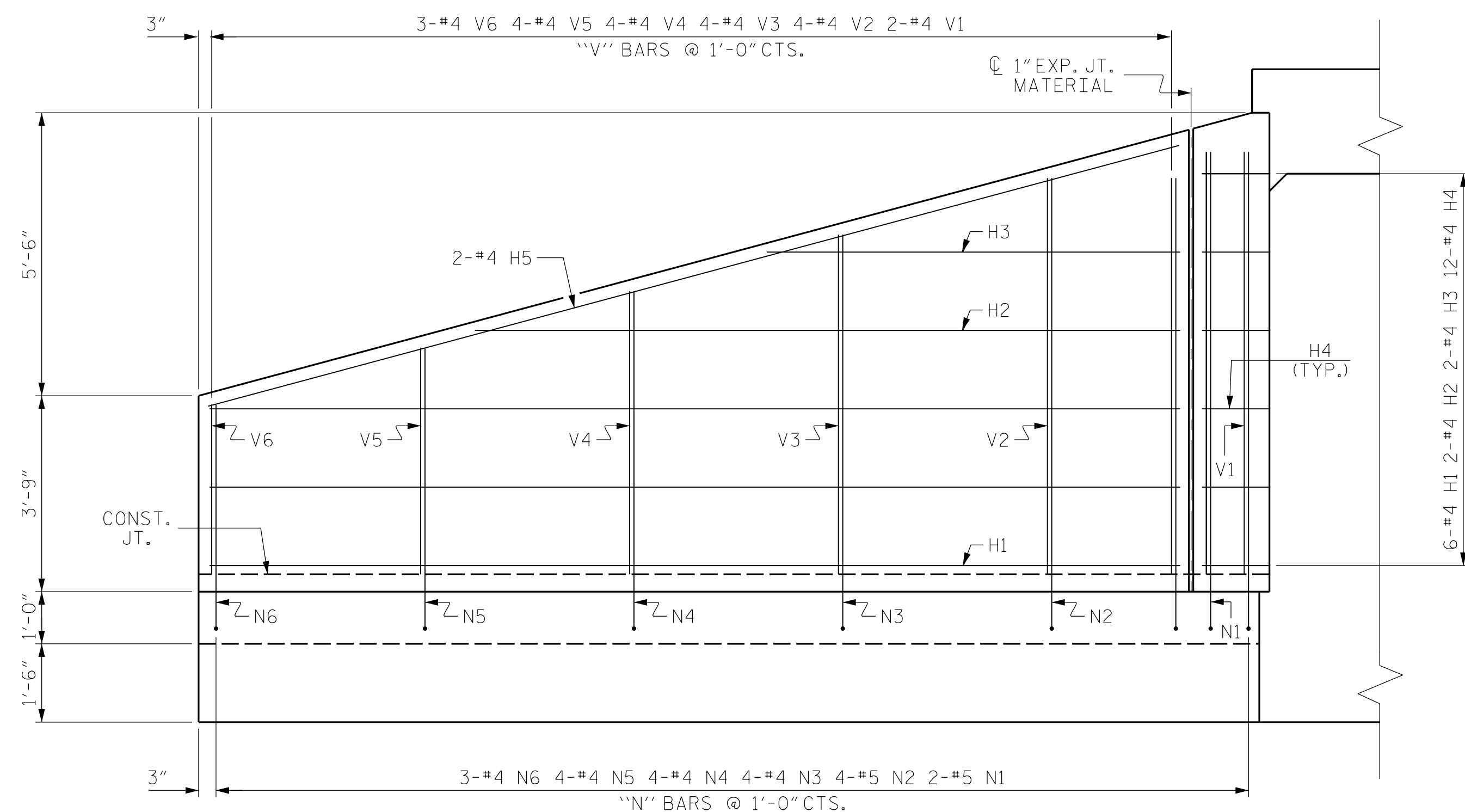
DOCUMENT NOT CONSIDERED  
 FINAL UNLESS ALL  
 SIGNATURES COMPLETED

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

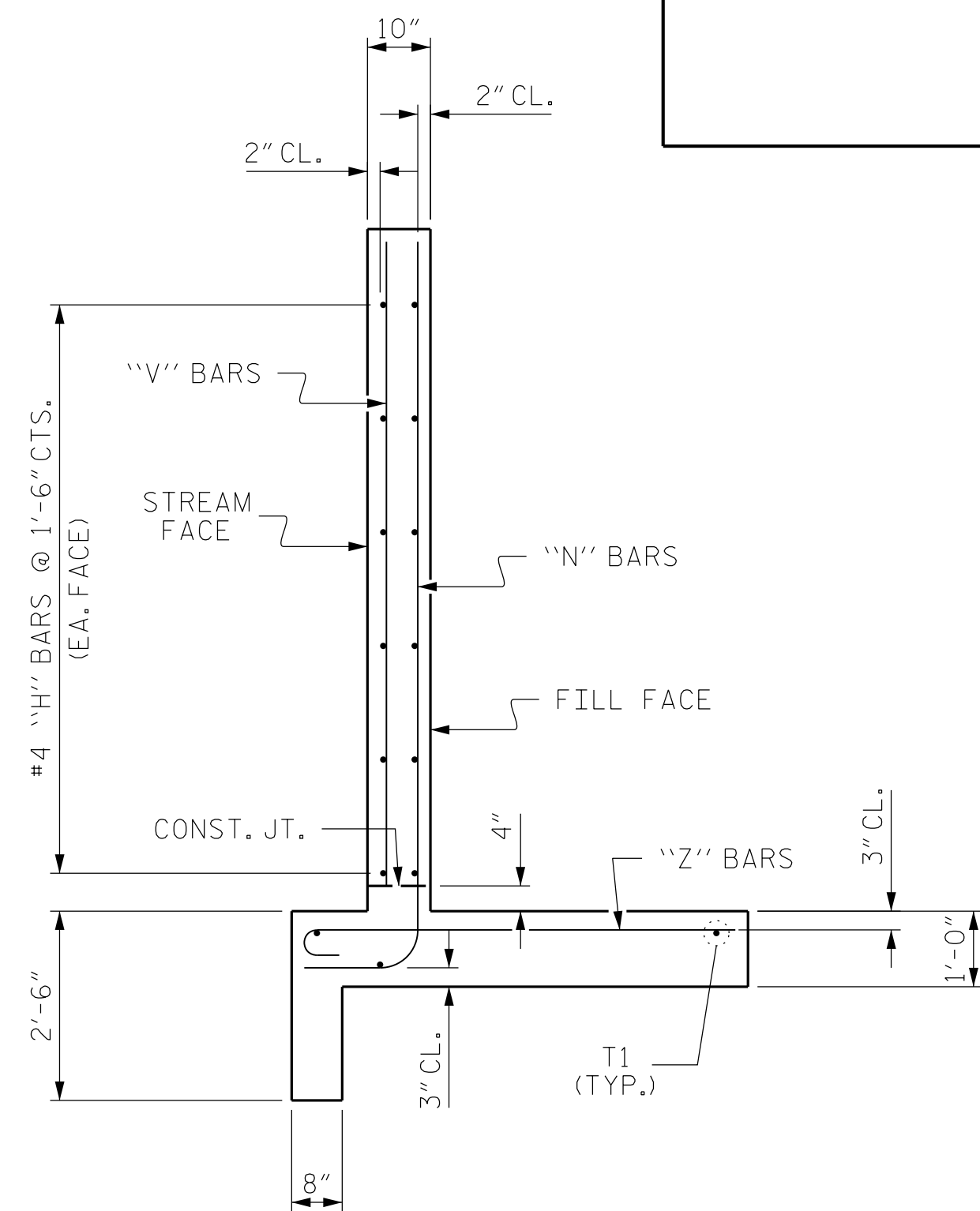
Q:\RA 6522-07\CADD\R2303E\Structures\Culverts\01\_CADD\02\_FinalDrawings\SR1\R2303E\_SMUL\_SRL\_CU3.dgn



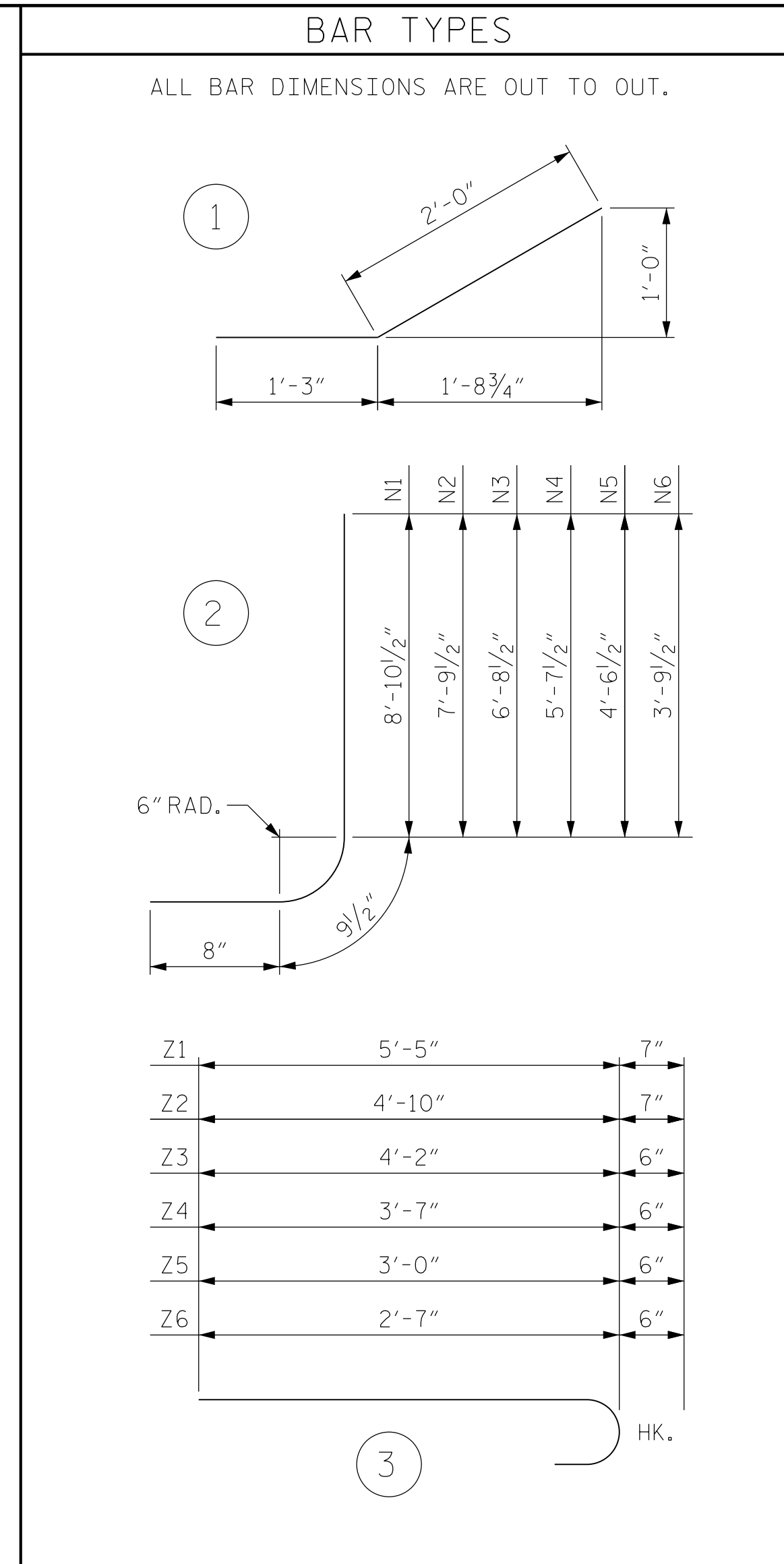
PLAN



ELEVATION

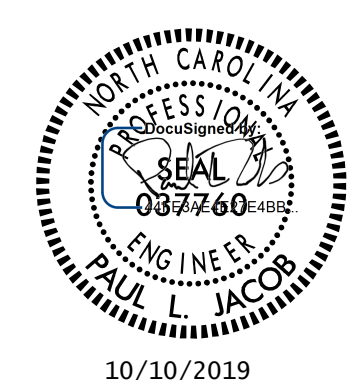


TYPICAL WING SECTION



| BILL OF MATERIAL              |     |      |      |          |        |
|-------------------------------|-----|------|------|----------|--------|
| BAR                           | NO. | SIZE | TYPE | LENGTH   | WEIGHT |
| H1                            | 24  | #4   | STR  | 18'-7"   | 298    |
| H2                            | 8   | #4   | STR  | 13'-2"   | 70     |
| H3                            | 8   | #4   | STR  | 7'-6"    | 40     |
| H4                            | 48  | #4   | 1    | 3'-3"    | 104    |
| H5                            | 8   | #4   | STR  | 19'-2"   | 102    |
| N1                            | 8   | #5   | 2    | 10'-4"   | 86     |
| N2                            | 16  | #5   | 2    | 9'-3"    | 154    |
| N3                            | 16  | #4   | 2    | 8'-2"    | 87     |
| N4                            | 16  | #4   | 2    | 7'-1"    | 76     |
| N5                            | 16  | #4   | 2    | 6'-0"    | 64     |
| N6                            | 12  | #4   | 2    | 5'-3"    | 42     |
| S1                            | 12  | #6   | STR  | 6'-0"    | 108    |
| T1                            | 12  | #5   | STR  | 20'-6"   | 257    |
| V1                            | 8   | #4   | STR  | 8'-4"    | 45     |
| V2                            | 16  | #4   | STR  | 7'-3"    | 77     |
| V3                            | 16  | #4   | STR  | 6'-2"    | 66     |
| V4                            | 16  | #4   | STR  | 5'-1"    | 54     |
| V5                            | 16  | #4   | STR  | 4'-0"    | 43     |
| V6                            | 12  | #4   | STR  | 3'-3"    | 26     |
| Z1                            | 8   | #5   | 3    | 6'-0"    | 50     |
| Z2                            | 16  | #5   | 3    | 5'-5"    | 90     |
| Z3                            | 16  | #4   | 3    | 4'-8"    | 50     |
| Z4                            | 16  | #4   | 3    | 4'-1"    | 44     |
| Z5                            | 16  | #4   | 3    | 3'-6"    | 37     |
| Z6                            | 12  | #4   | 3    | 3'-1"    | 25     |
| REINFORCING STEEL FOR 4 WINGS |     |      |      | 2095 LBS |        |
| CLASS A CONCRETE              |     |      |      |          |        |
| 4 WINGS                       |     |      |      | 33.7 CY  |        |
| 2 HEADWALLS                   |     |      |      | 1.3 CY   |        |
| 2 END CURTAIN WALLS           |     |      |      | 1.4 CY   |        |
| TOTAL                         |     |      |      | 36.4 CY  |        |

PROJECT NO. R-2303E  
SAMPSON COUNTY  
 STATION: 17+91.00 -SR1-  
 SHEET 4 OF 4



STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

WINGS FOR  
 CONCRETE BOX CULVERT  
 H = 8'-0" SLOPE = 3:1  
 90° SKEW

DRAWN BY : J. WEIGER DATE : 03/2019  
 CHECKED BY : P. JACOB DATE : 09/2019  
 DESIGN ENGINEER OF RECORD: P. JACOB DATE : 09/2019

**moffatt & nichol**  
 4700 FALLS OF NEUSE ROAD, SUITE 300  
 RALEIGH, NORTH CAROLINA 27609  
 (919) 781-4626 VOICE (919) 781-4869 FAX  
 NC License No.: F-0105

DOCUMENT NOT CONSIDERED  
 FINAL UNLESS ALL  
 SIGNATURES COMPLETED

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

Q:\RA 6522-07\CADD\R2303E\Structures\Culverts\01.CADD\02.FinalDrawings\SR1\N2303E\_SMUL\_SRI\_CU4.dgn

## STANDARD NOTES

### DESIGN DATA:

|   |           |                                  |
|---|-----------|----------------------------------|
| SPECIFICATIONS  | - - - - - | A.A.S.H.T.O. (CURRENT)           |
| LIVE LOAD   | - - - - - | SEE PLANS                        |
| IMPACT ALLOWANCE  | - - - - - | SEE A.A.S.H.T.O.                 |
| STRESS IN EXTREME FIBER OF<br>STRUCTURAL STEEL - AASHTO M270 GRADE 36 | - -       | 20,000 LBS. PER SQ. IN.          |
| - AASHTO M270 GRADE 50W   | - -       | 27,000 LBS. PER SQ. IN.          |
| - AASHTO M270 GRADE 50  | - -       | 27,000 LBS. PER SQ. IN.          |
| REINFORCING STEEL IN TENSION - GRADE 60                               | - - -     | 24,000 LBS. PER SQ. IN.          |
| CONCRETE IN COMPRESSION   | - - - - - | 1,200 LBS. PER SQ. IN.           |
| CONCRETE IN SHEAR   | - - - - - | SEE A.A.S.H.T.O.                 |
| STRUCTURAL TIMBER - TREATED OR UNTREATED<br>EXTREME FIBER STRESS      | - - -     | 1,800 LBS. PER SQ. IN.           |
| COMPRESSION PERPENDICULAR TO GRAIN<br>OF TIMBER                       | - - - - - | 375 LBS. PER SQ. IN.             |
| EQUIVALENT FLUID PRESSURE OF EARTH                                    | - - - - - | 30 LBS. PER CU. FT.<br>(MINIMUM) |

### MATERIAL AND WORKMANSHIP:

EXCEPT AS MAY OTHERWISE BE SPECIFIED ON PLANS OR IN THE SPECIAL PROVISIONS, ALL MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE 2018 "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES" OF THE N. C. DEPARTMENT OF TRANSPORTATION.

STEEL SHEET PILING FOR PERMANENT OR TEMPORARY APPLICATIONS SHALL BE HOT ROLLED.

### CONCRETE:

UNLESS OTHERWISE REQUIRED ON PLANS, CLASS A CONCRETE SHALL BE USED FOR ALL PORTIONS OF ALL STRUCTURES WITH THE EXCEPTION THAT: CLASS AA CONCRETE SHALL BE USED IN BRIDGE SUPERSTRUCTURES, ABUTMENT BACKWALLS, AND APPROACH SLABS; AND CLASS B CONCRETE SHALL BE USED FOR SLOPE PROTECTION AND RIP RAP.

### CONCRETE CHAMFERS:

UNLESS OTHERWISE NOTED ON THE PLANS, ALL EXPOSED CORNERS ON STRUCTURES SHALL BE CHAMFERED  $\frac{3}{4}$ " WITH THE FOLLOWING EXCEPTIONS: TOP CORNERS OF CURBS MAY BE ROUNDED TO  $1\frac{1}{2}$ " RADIUS WHICH IS BUILT INTO CURB FORMS; CORNERS OF TRANSVERSE FLOOR EXPANSION JOINTS SHALL BE ROUNDED WITH A  $\frac{1}{4}$ " FINISHING TOOL UNLESS OTHERWISE REQUIRED ON PLANS; AND CORNERS OF EXPANSION JOINTS IN THE ROADWAY FACES AND TOPS OF CURBS AND SIDEWALKS SHALL BE ROUNDED TO A  $\frac{1}{4}$ " RADIUS WITH A FINISHING STONE OR TOOL UNLESS OTHERWISE REQUIRED ON PLANS.

### DOWELS:

DOWELS WHEN INDICATED ON PLANS AS FOR CULVERT EXTENSIONS, SHALL BE EMBEDDED AT LEAST 12" INTO THE OLD CONCRETE AND GROUTED INTO PLACE WITH 1:2 CEMENT MORTAR.

### ALLOWANCE FOR DEAD LOAD DEFLECTION, SETTLEMENT, ETC. IN CASTING SUPERSTRUCTURES:

BRIDGES SHALL BE BUILT ON THE GRADE OR VERTICAL CURVE SHOWN ON PLANS. SLABS, CURBS AND PARAPETS SHALL CONFORM TO THE GRADE OR CURVE.

ALL DIMENSIONS WHICH ARE GIVEN IN SECTION AND ARE AFFECTED BY DEAD LOAD DEFLECTIONS ARE DIMENSIONS AT CENTER LINE OF BEARING UNLESS OTHERWISE NOTED ON PLANS. IN SETTING FORMS FOR STEEL BEAM BRIDGES AND PRESTRESSED CONCRETE GIRDER BRIDGES, ADJUSTMENTS SHALL BE MADE DUE TO THE DEAD LOAD DEFLECTIONS FOR THE ELEVATIONS SHOWN. WHERE BLOCKS ARE SHOWN OVER BEAMS FOR BUILDING UP TO THE SLAB, THE VERTICAL DIMENSIONS OF THE BLOCKS SHALL BE ADJUSTED BETWEEN BEARINGS TO COMPENSATE FOR DEAD LOAD DEFLECTIONS, VERTICAL CURVE ORDINATE, AND ACTUAL BEAM CAMBER. WHERE BOTTOM OF SLAB IS IN LINE WITH BOTTOM OF TOP FLANGES, DEPTH OF SLAB BETWEEN BEARINGS SHALL BE ADJUSTED TO COMPENSATE FOR DEAD LOAD DEFLECTION, VERTICAL CURVE ORDINATE, AND ACTUAL BEAM CAMBER.

IN SETTING FALSEWORK AND FORMS FOR REINFORCED CONCRETE SPANS, AN ALLOWANCE SHALL BE MADE FOR DEAD LOAD DEFLECTIONS, SETTLEMENT OF FALSEWORK, AND PERMANENT CAMBER WHICH SHALL BE PROVIDED FOR IN ADDITION TO THE ELEVATIONS SHOWN. AFTER REMOVAL OF THE FALSEWORK, THE FINISHED STRUCTURES SHALL CONFORM TO THE PROFILE AND ELEVATIONS SHOWN ON THE PLANS AND CONSTRUCTION ELEVATIONS FURNISHED BY THE ENGINEER.

DETAILED DRAWINGS FOR FALSEWORK OR FORMS FOR BRIDGE SUPERSTRUCTURE AND ANY STRUCTURE OR PARTS OF A STRUCTURE AS NOTED ON THE PLANS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL BEFORE CONSTRUCTION OF THE FALSEWORK OR FORMS IS STARTED.

### REINFORCING STEEL:

ALL REINFORCING STEEL SHALL BE DEFORMED. DIMENSIONS RELATIVE TO PLACEMENT OF REINFORCING ARE TO CENTERS OF BARS UNLESS OTHERWISE INDICATED IN THE PLANS. DIMENSIONS ON BAR DETAILS ARE TO CENTERS OF BARS OR ARE OUT TO OUT AS INDICATED ON PLANS.

WIRE BAR SUPPORTS SHALL BE PROVIDED FOR REINFORCING STEEL WHERE INDICATED ON THE PLANS. WHEN BAR SUPPORT PIECES ARE PLACED IN CONTINUOUS LINES, THEY SHALL BE SO PLACED THAT THE ENDS OF THE SUPPORTING WIRES SHALL BE LAPPED TO LOCK LEGS ON ADJOINING PIECES.

### STRUCTURAL STEEL:

AT THE CONTRACTOR'S OPTION, HE MAY SUBSTITUTE  $\frac{7}{8}$ "  $\emptyset$  SHEAR STUDS FOR THE  $\frac{3}{4}$ "  $\emptyset$  STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 -  $\frac{7}{8}$ "  $\emptyset$  STUDS FOR 4 -  $\frac{3}{4}$ "  $\emptyset$  STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF  $\frac{7}{8}$ "  $\emptyset$  STUDS ALONG THE BEAM AS SHOWN FOR  $\frac{3}{4}$ "  $\emptyset$  STUDS BASED ON THE RATIO OF 3 -  $\frac{7}{8}$ "  $\emptyset$  STUDS FOR 4 -  $\frac{3}{4}$ "  $\emptyset$  STUDS. STUDS OF THE LENGTH SPECIFIED ON THE PLANS MUST BE PROVIDED. THE MAXIMUM SPACING SHALL BE 2'-0".

EXCEPT AT THE INTERIOR SUPPORTS OF CONTINUOUS BEAMS WHERE THE COVER PLATE IS IN CONTACT WITH BEARING PLATE, THE CONTRACTOR MAY, AT HIS OPTION, SUBSTITUTE FOR THE COVER PLATES DESIGNATED ON THE PLANS COVER PLATES OF THE EQUIVALENT AREA PROVIDED THESE PLATES ARE AT LEAST  $\frac{5}{16}$ " IN THICKNESS AND DO NOT EXCEED A WIDTH EQUAL TO THE FLANGE WIDTH LESS 2" OR A THICKNESS EQUAL TO 2 TIMES THE FLANGE THICKNESS. THE SIZE OF FILLET WELDS SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT ANSI/AASHTO/AWS "BRIDGE WELDING CODE". ELECTROSLAG WELDING WILL NOT BE PERMITTED.

WITH THE SOLE EXCEPTION OF EDGES AT SURFACES WHICH BEAR ON OTHER SURFACES, ALL SHARP EDGES AND ENDS OF SHAPES AND PLATES SHALL BE SLIGHTLY ROUNDED BY SUITABLE MEANS TO A RADIUS OF APPROXIMATELY  $\frac{1}{16}$ " INCH OR EQUIVALENT FLAT SURFACE AT A SUITABLE ANGLE PRIOR TO PAINTING, GALVANIZING, OR METALLIZING.

### HANDRAILS AND POSTS:

METAL STANDARDS AND FACES OF THE CONCRETE END POSTS FOR THE METAL RAIL SHALL BE SET NORMAL TO THE GRADE OF THE CURB, UNLESS OTHERWISE SHOWN ON PLANS. THE METAL RAIL AND TOPS OF CONCRETE POSTS USED WITH THE ALUMINUM RAIL SHALL BE BUILT PARALLEL TO THE GRADE OF THE CURB.

METAL HANDRAILS SHALL BE IN ACCORDANCE WITH THE PLANS. RAILS SHALL BE AS MANUFACTURED FOR BRIDGE RAILING. CASTINGS SHALL BE OF A UNIFORM APPEARANCE. FINISHES AND OTHER DEFORMATIONS RESULTING FROM CASTING OR OTHERWISE SHALL BE REMOVED IN A MANNER SO THAT A UNIFORM COLORING OF THE COMPLETED CASTING SHALL BE OBTAINED. CASTINGS WITH DISCOLORATIONS OR OF NON-UNIFORM COLORING WILL NOT BE ACCEPTED. CERTIFIED MILL REPORTS ARE REQUIRED FOR METAL RAILS AND POSTS.

### SPECIAL NOTES:

GENERALLY, IN CASE OF DISCREPANCY, THIS STANDARD SHEET OF NOTES SHALL GOVERN OVER THE SPECIFICATIONS, BUT THE REMAINDER OF THE PLANS SHALL GOVERN OVER NOTES HEREON, AND SPECIAL PROVISIONS SHALL GOVERN OVER ALL. SEE SPECIFICATIONS ARTICLE 105-4.

# ENGLISH

JANUARY, 1990

STD. NO. SN