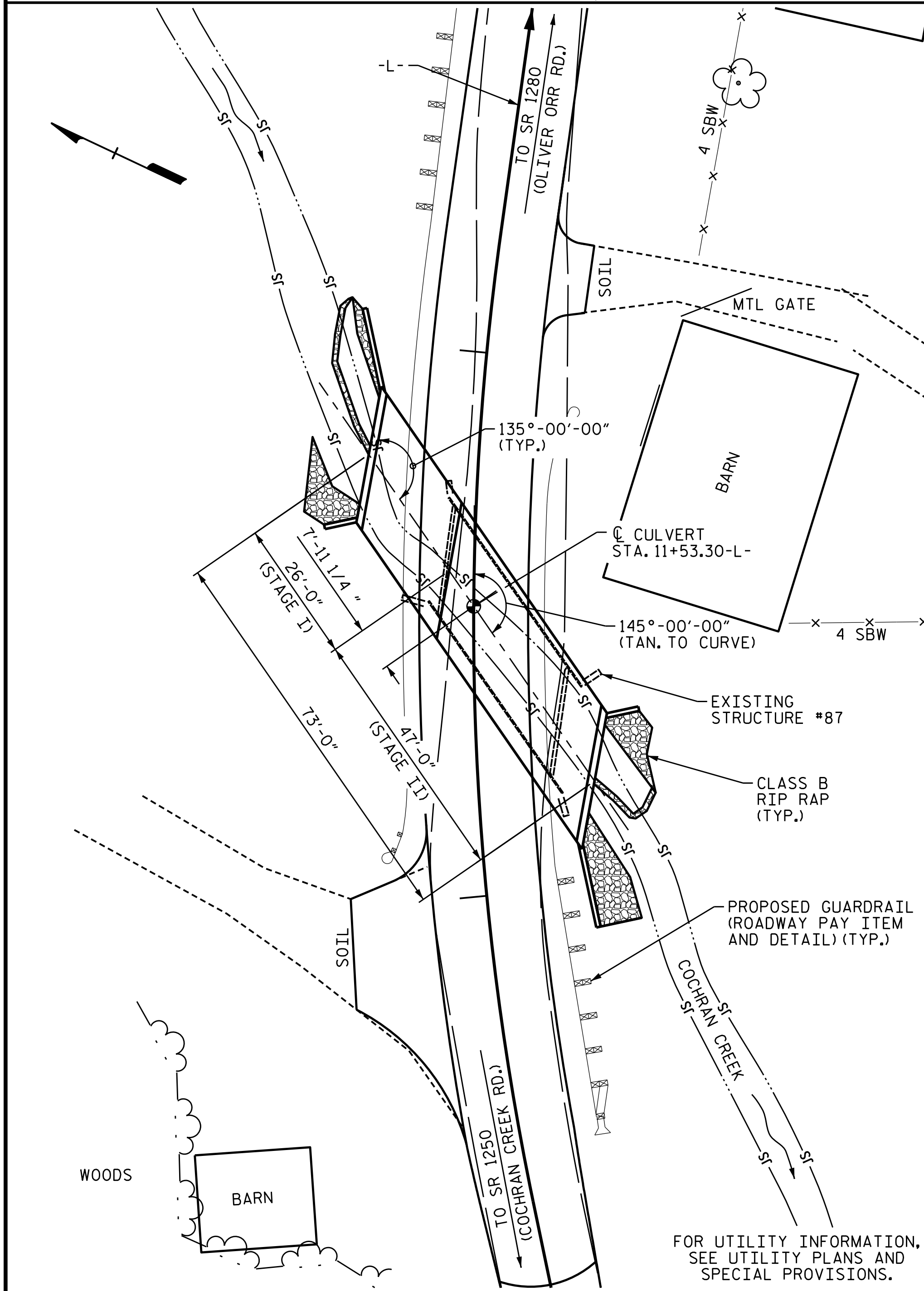


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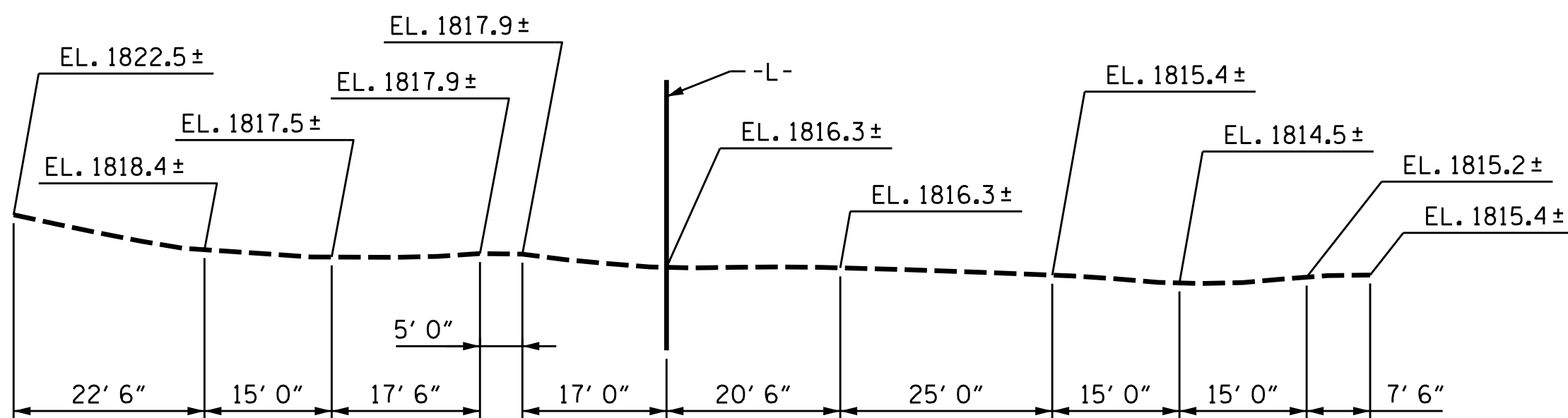
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BM1: 8" SPIKE SET IN BASE OF A 36" WALNUT TREE,  
41.83' RIGHT OF STA. 12+50.78 -L-, ELEV.= 1827.25



LOCATION SKETCH



PROFILE ALONG CULVERT

DRAWN BY : M. HOBBS DATE : 10/2014  
CHECKED BY : M. MILLS DATE : 10/2014

NOTES

ASSUMED LIVE LOAD.....HL-93 OR ALTERNATE LOADING.  
 MAXIMUM DESIGN FILL.....1.3'  
 MINIMUM DESIGN FILL.....1.1'  
 FOR OTHER DESIGN DATA AND GENERAL NOTES, SEE SHEET SN.  
 FOR CULVERT DIVERSION DETAILS, SEE EROSION CONTROL PLANS.  
 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.  
 CONCRETE IN STAGE I OR STAGE II CULVERT TO BE POURED IN THE FOLLOWING ORDER:  
 1. WING FOOTINGS AND FLOOR SLAB FOR PHASE I, INCLUDING 4" OF ALL VERTICAL WALLS OF PHASE I.  
 2. THE REMAINING PORTIONS OF THE WALLS OF PHASE I AND WINGS FULL HEIGHT.  
 3. WING FOOTING AND FLOOR SLAB FOR PHASE II, INCLUDING 4" OF ALL VERTICAL WALLS OF PHASE II.  
 4. THE REMAINING PORTIONS OF THE WALLS OF PHASE II AND WINGS FULL HEIGHT.  
 5. ROOF SLAB AND HEADWALLS OF PHASE II.  
 THIS STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH "HEC 18- EVALUATING SCOUR AT BRIDGES."  
 AFTER SERVING AS A TEMPORARY STRUCTURE, THE EXISTING STRUCTURE CONSISTING OF A SINGLE SPAN: 20'-6" WITH AN ASPHALT WEARING SURFACE ON A TIMBER DECK AND TIMBER JOISTS HAVING A CLEAR ROADWAY WIDTH OF 24'-0" SUPPORTED ON A SUBSTRUCTURE OF TIMBER CAPS ON TIMBER POSTS, AND CONCRETE SILLS SHALL BE REMOVED. THE EXISTING STRUCTURE IS PRESENTLY POSTED FOR LOAD LIMIT. SHOULD THE STRUCTURAL INTEGRITY OF THE BRIDGE DETERIORATE DURING CONSTRUCTION OF THE PROPOSED CULVERT, A LOAD LIMIT MAY BE POSTED AND MAY BE REDUCED AS FOUND NECESSARY DURING THE LIFE OF THE PROJECT.  
 AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF THE 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.  
 \*FOR LIMITS OF TEMPORARY SHORING FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS. FOR PAY ITEM FOR TEMPORARY SHORING FOR MAINTENANCE OF TRAFFIC, SEE ROADWAY PLANS.  
 DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.  
 THE EXISTING BRIDGE SHALL BE PARTIALLY REMOVED AS SHOWN IN THE TRAFFIC CONTROL PLANS. THE EXISTING RAIL SHALL BE REMOVED AND REATTACHED TO THE REMAINING PORTION OF THE EXISTING BRIDGE. FOR REMOVAL OF EXISTING STRUCTURE, SEE SPECIAL PROVISIONS.  
 FOR ASBESTOS ASSESSMENT FOR BRIDGE DEMOLITION AND RENOVATION ACTIVITIES, SEE SPECIAL PROVISIONS.  
 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.

REMOVAL OF THE EXISTING BRIDGE SHALL BE PERFORMED IN A MANNER THAT PREVENTS DEBRIS FROM FALLING INTO THE WATER. THE CONTRACTOR SHALL SUBMIT DEMOLITION PLANS FOR REVIEW AND REMOVE THE BRIDGE IN ACCORDANCE WITH ARTICLE 402-2 OF THE STANDARD SPECIFICATIONS.  
 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.  
 THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF THE CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.  
 AT THE CONTRACTOR'S OPTION HE MAY SUBMIT, TO THE ENGINEER FOR APPROVAL, DESIGN AND DETAIL 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.

TOTAL STRUCTURE QUANTITIES	
CLASS A CONCRETE	
STAGE I	56.8 CU. YDS.
STAGE II	93.0 CU. YDS.
TOTAL	149.8 CU. YDS.
REINFORCING STEEL	
STAGE I	8,503 LBS.
STAGE II	13,953 LBS.
TOTAL	22,456 LBS.
CULVERT EXCAVATION	LUMP SUM
FOUNDATION COND. MAT'L.	
STAGE I	33 TONS
STAGE II	60 TONS
TOTAL	93 TONS
REMOVAL OF EXISTING STRUCTURE	LUMP SUM
TEMPORARY EDGE BEAM	LUMP SUM
CLASS B RIP RAP	27 TONS
GEOTEXTILE FOR DRAINAGE	30 SQ. YDS.
ASBESTOS ASSESSMENT	LUMP SUM

HYDRAULIC DATA

DESIGN DISCHARGE = 380 CFS  
 FREQUENCY OF DESIGN FLOOD = 5 YEARS  
 DESIGN HIGH WATER ELEVATION = 1821.6  
 DRAINAGE AREA = 2.2 SQ.MI.  
 BASE DISCHARGE (Q100) = 1000 CFS  
 BASE HIGH WATER ELEVATION = 1824.09

HORIZONTAL CURVE DATA

PI STA 11+33.77  
 $\Delta = 19^\circ-44'-13.2"$  (RT)  
 $D = 11^\circ-00'-00.0"$   
 $L = 179.43'$   
 $T = 90.61'$   
 $R = 520.87'$

OVERTOPPING DATA

OVERTOPPING DISCHARGE = 450 CFS  
 FREQUENCY OF OVERTOPPING FLOOD = 5+ YEARS  
 OVERTOPPING FLOOD ELEVATION = 1822.4

GRADE DATA

GRADE POINT ELEV. @ STA. 11+53.30 -L- = 1822.13  
 INVERT ELEV. @ STA. 11+53.30 -L- = 1814.99  
 ROADWAY SIDE SLOPES = VARIES

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

PROJECT NO. 17BP.14.R.79

GRAHAM COUNTY

STATION: 11+53.30 -L-

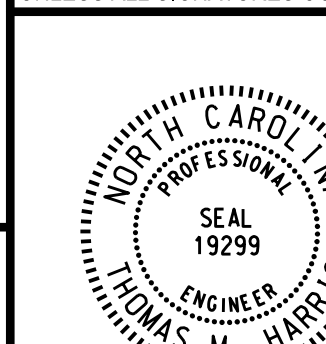
SHEET 1 OF 11 REPLACES BRIDGE #87

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

DOUBLE 8FT. X 5FT.  
CONCRETE BOX CULVERT  
145° SKEW

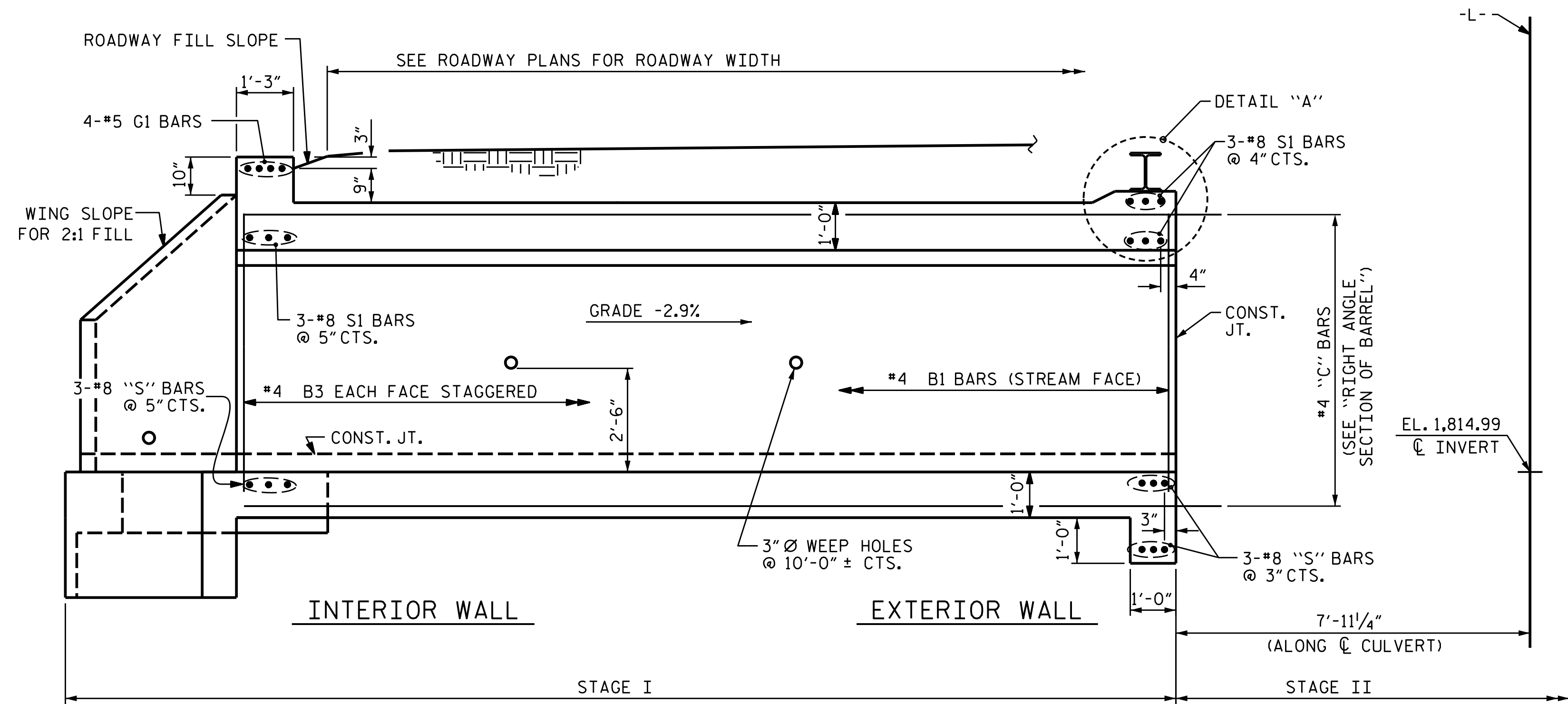
DESIGN ENGINEER OF RECORD:  
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DATE: 12/14/2018

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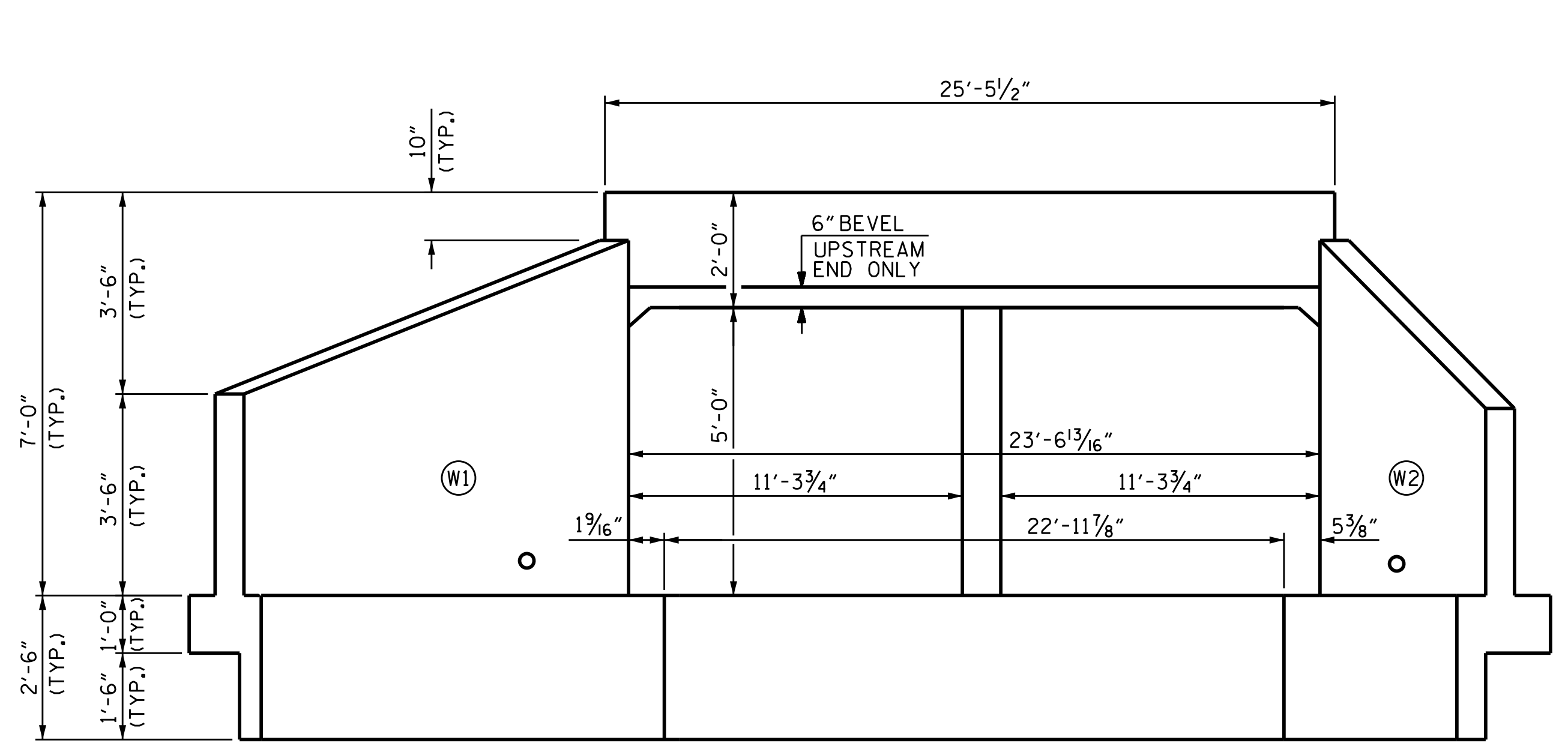


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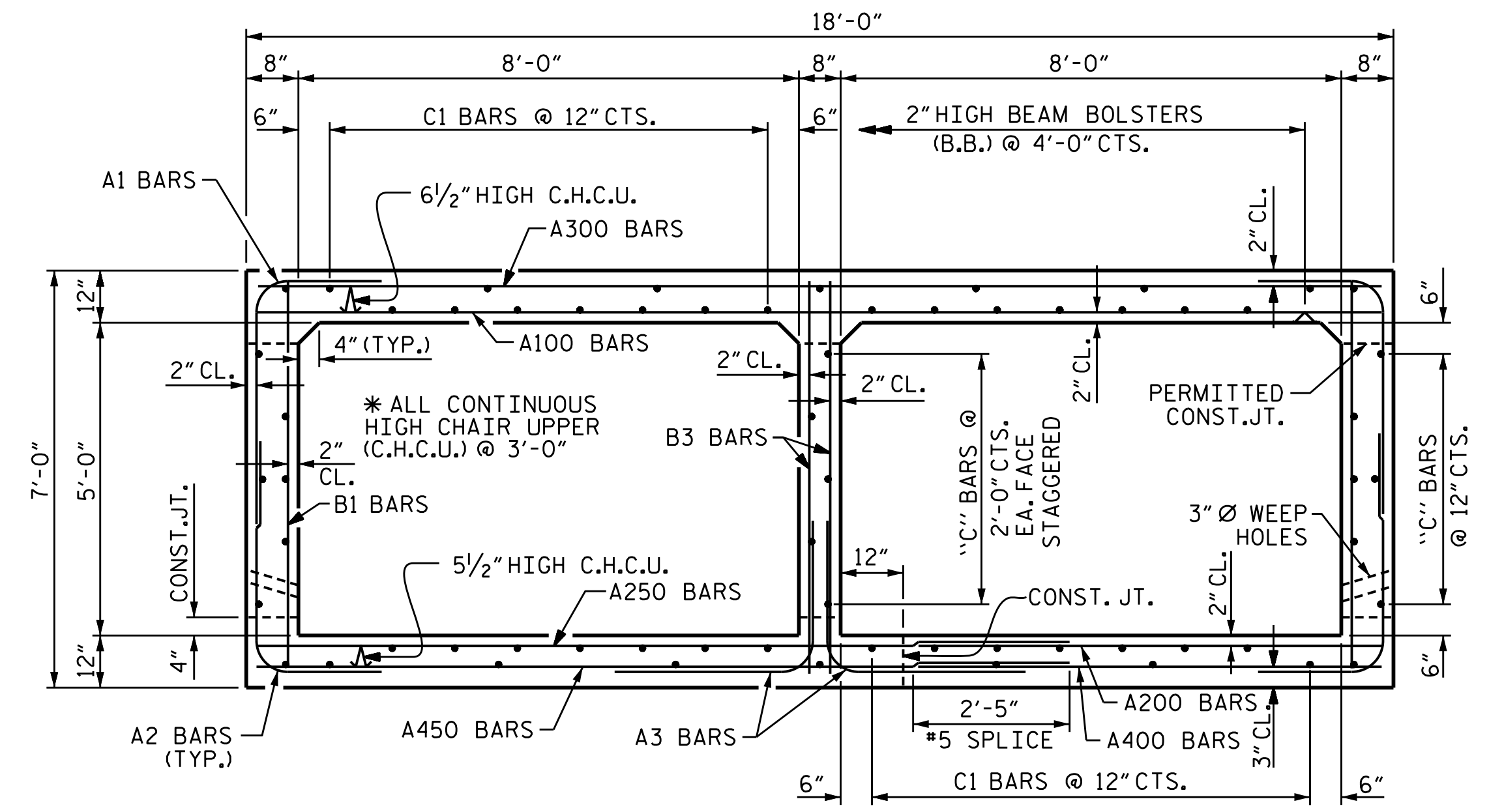
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NO.	BY:	DATE:	NO.	BY:	DATE:	C-1
1			3			TOTAL SHEETS
2			4			11



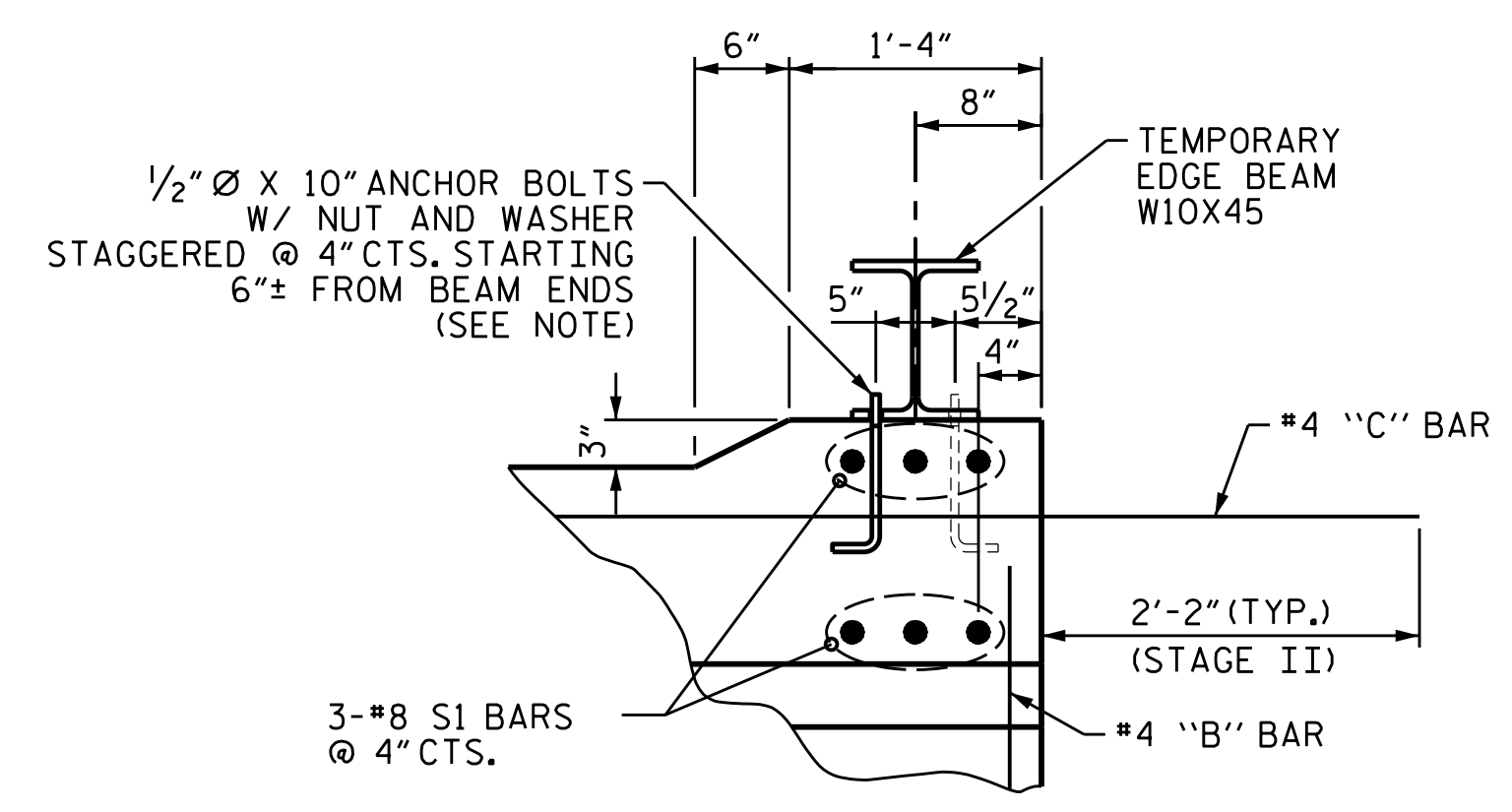
**CULVERT SECTION NORMAL TO ROADWAY (STAGE I)**



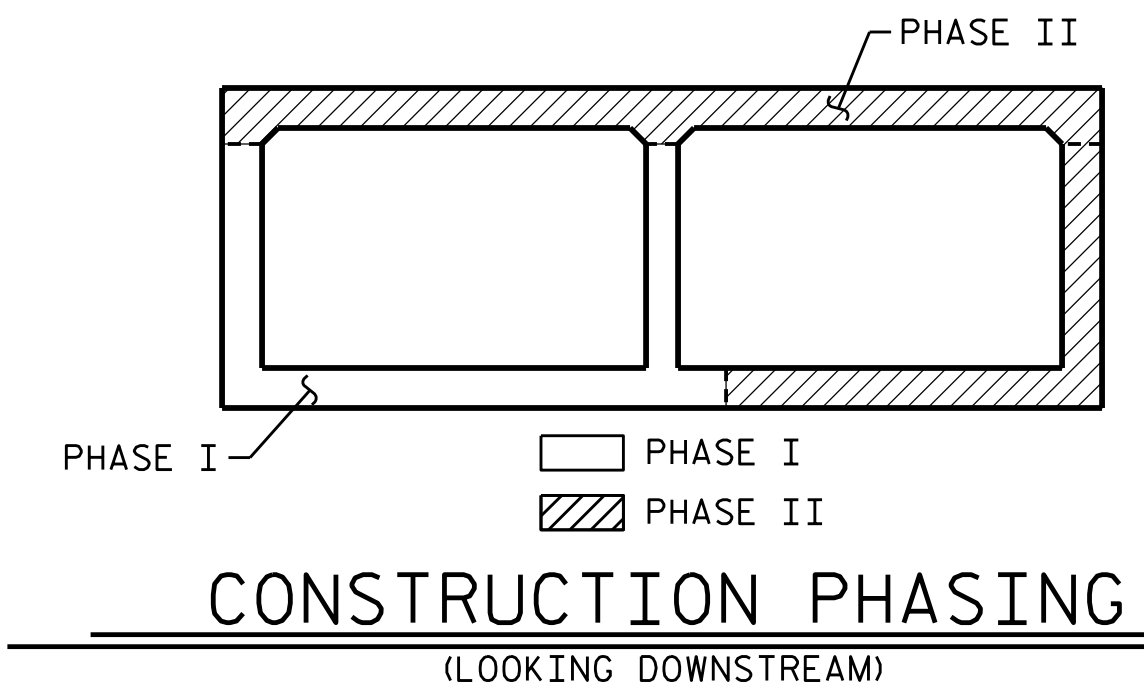
**END ELEVATION NORMAL TO HEADWALL SKEW (LOOKING DOWNSTREAM)**



**RIGHT ANGLE SECTION OF BARREL**  
THERE ARE 63 "C" BARS IN SECTION OF BARREL.



**DETAIL "A"**



**CONSTRUCTION PHASING (LOOKING DOWNSTREAM)**

NOTE: AFTER STAGE II IS COMPLETE, THE BEAM SHALL BE REMOVED AND ANCHOR BOLTS CUT SMOOTH AND EPOXY APPLIED TO EXPOSED BOLTS TO PREVENT CORROSION.

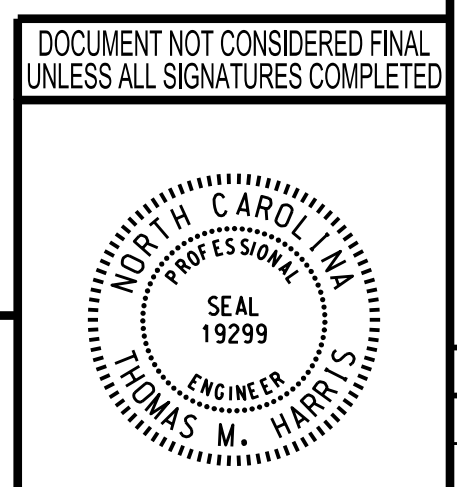
PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
STATION: 11+53.30 -L-

SHEET 2 OF 11

DRAWN BY: M. HOBBS DATE: 10/2014  
CHECKED BY: M. MILLS DATE: 10/2014

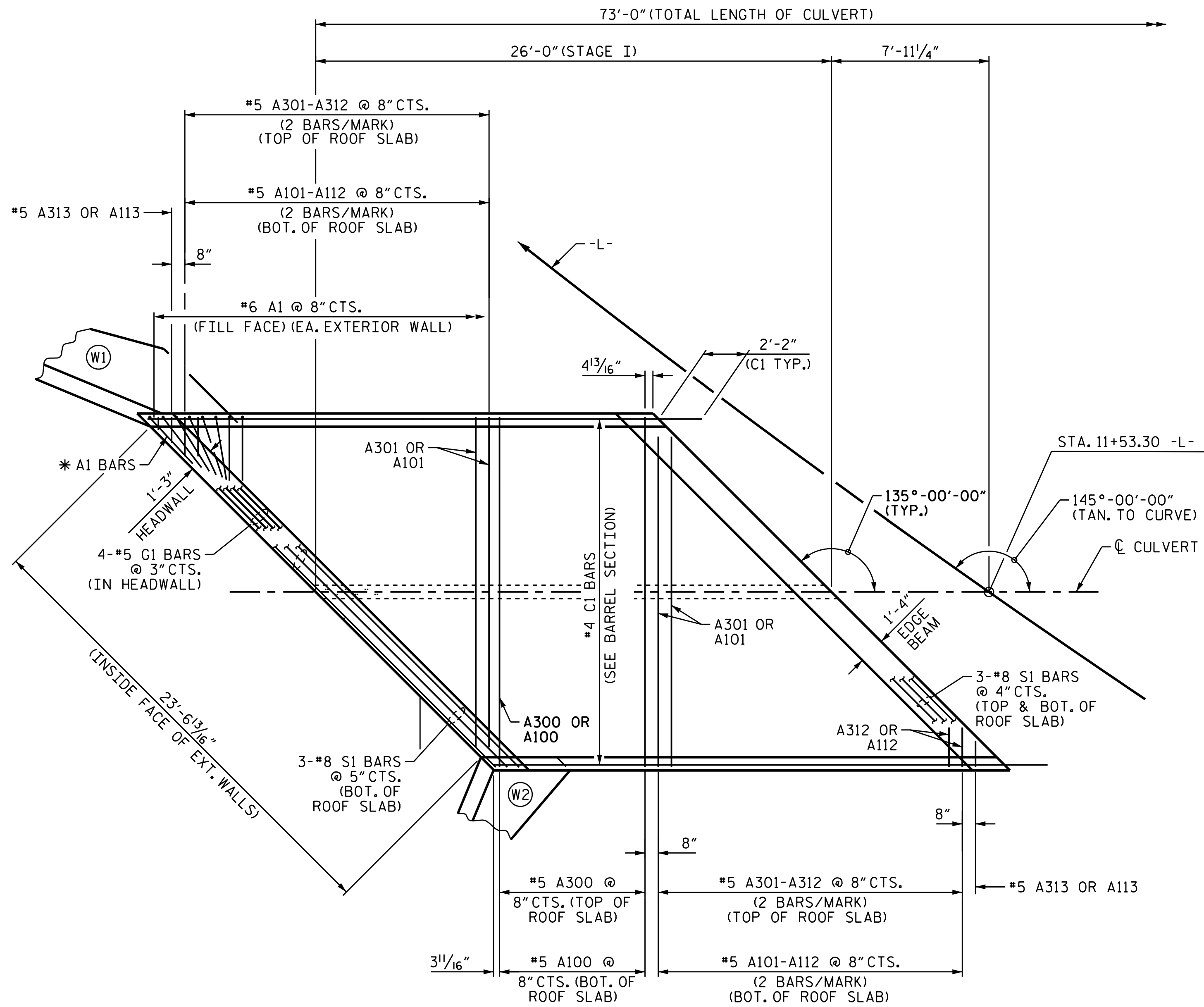
DESIGN ENGINEER OF RECORD:  
DocuSigned by:  
Thomas M. Harris  
DATE: 12/14/2018

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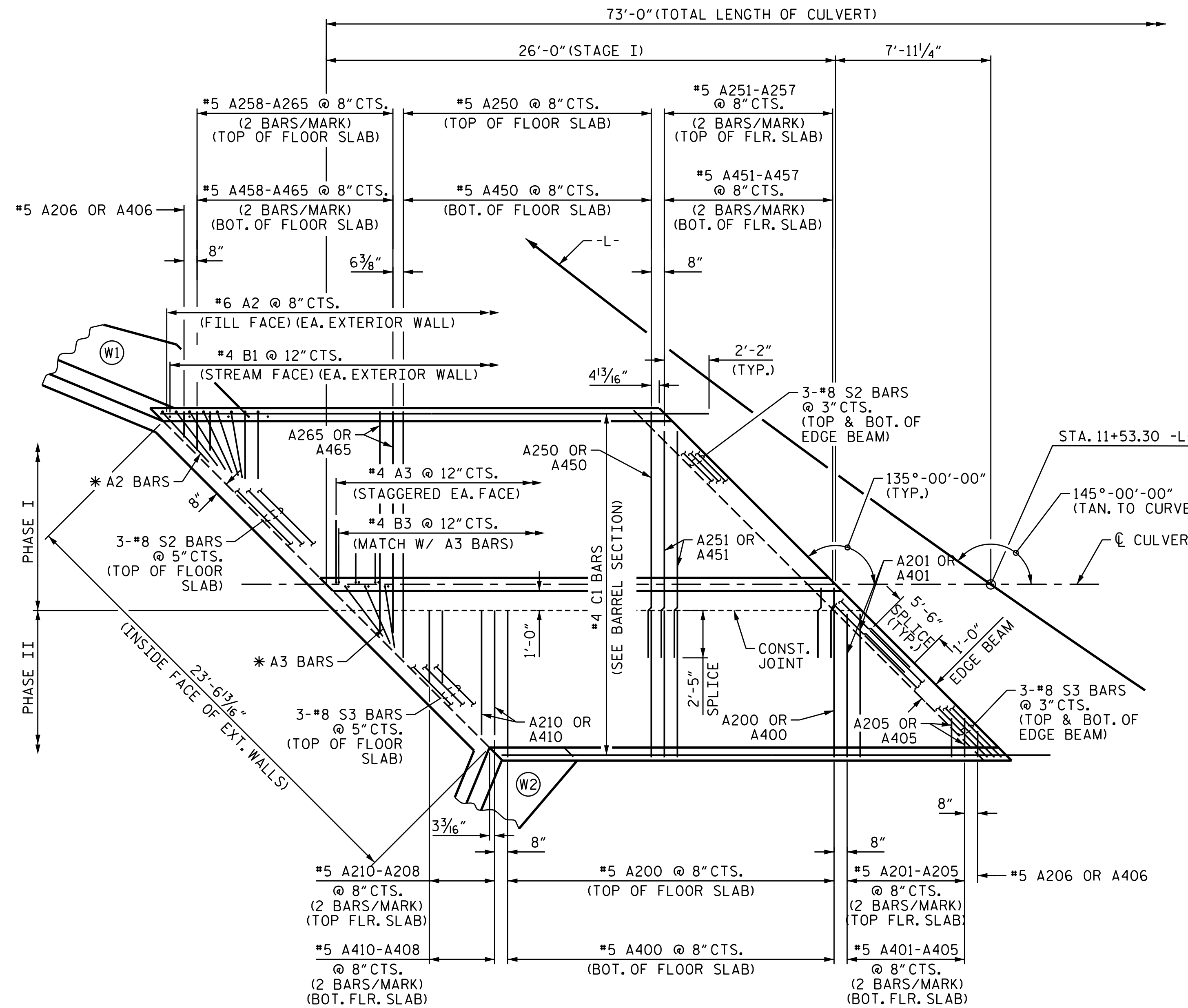
STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
**DOUBLE 8FT. X 5FT.  
CONCRETE BOX CULVERT  
STAGE I**

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-2
1			3			TOTAL SHEETS
2			4			11



**PLAN OF ROOF SLAB (STAGE I)**

(\* DENOTES SPLAYED "A" BARS @ 8" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)



**PLAN OF FLOOR SLAB (STAGE I)**

(\* DENOTES SPLAYED "A" BARS @ 8" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)

PROJECT NO. 17BP.14.R.79

GRAHAM COUNTY

STATION: 11+53.30 -L-

SHEET 3 OF 11

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

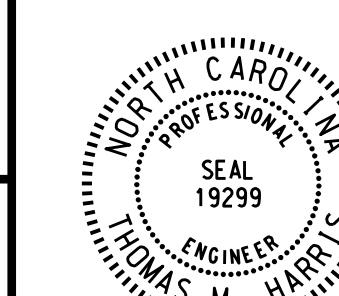
**DOUBLE 8FT. X 5FT.  
CONCRETE BOX CULVERT  
STAGE I**

DESIGN ENGINEER OF RECORD:

*Thomas M. Harris*

DATE: 12/14/2018

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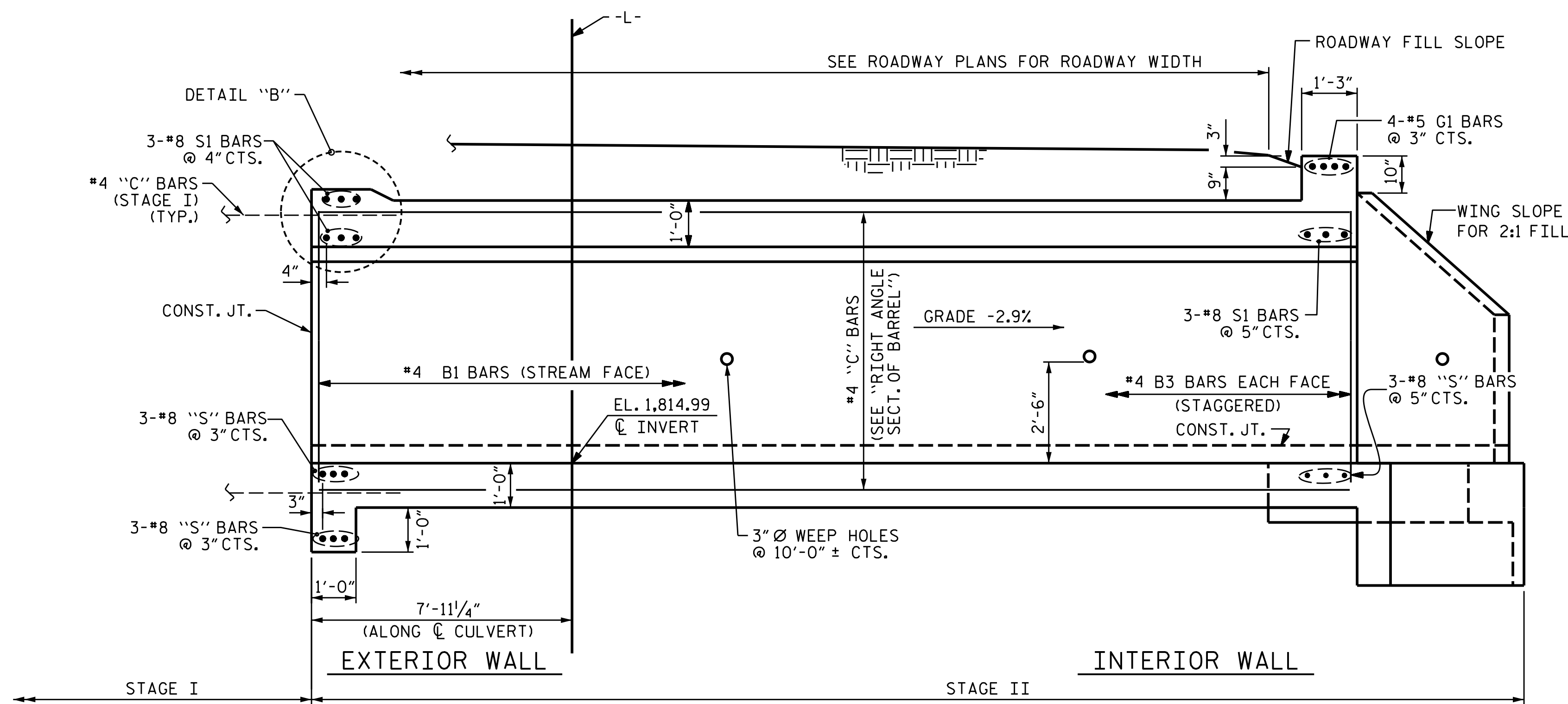
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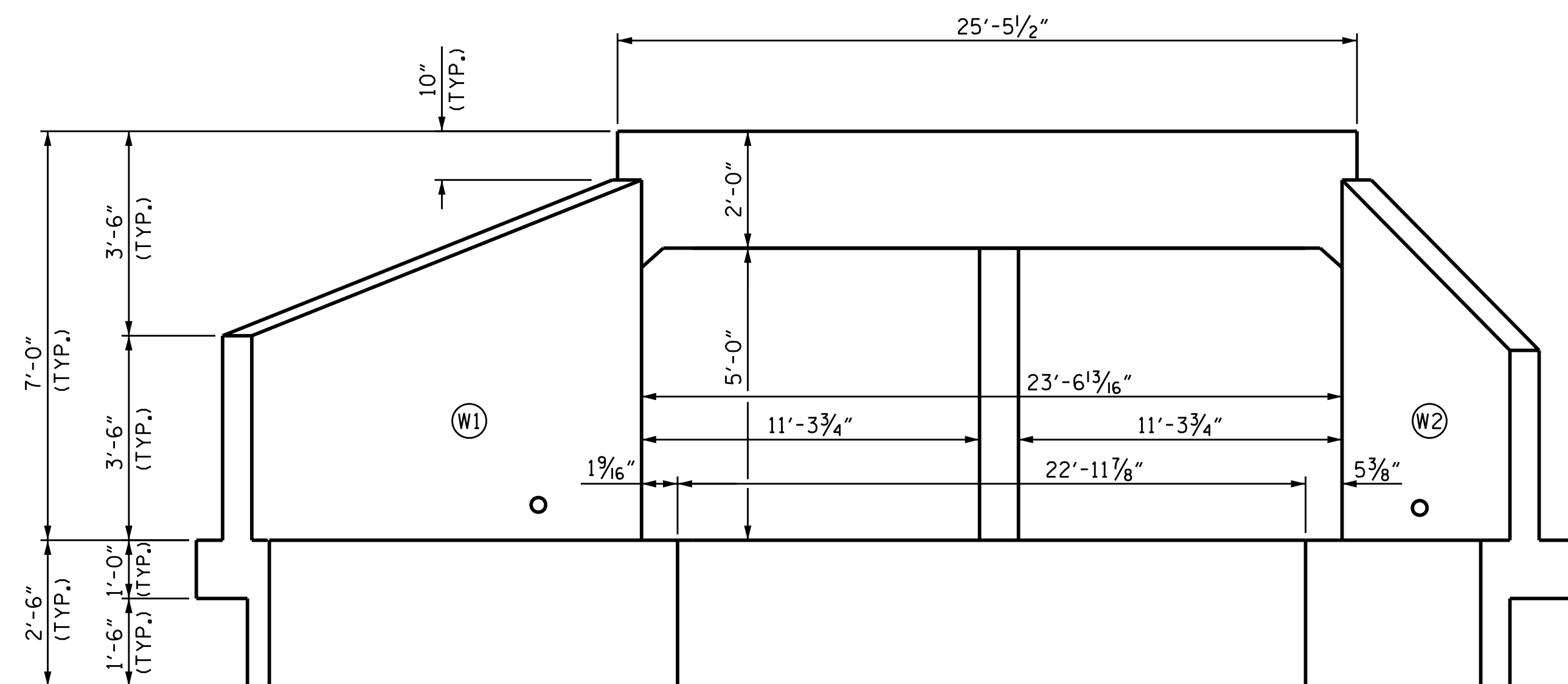
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SHEET NO.  
C-3  
TOTAL SHEETS  
11

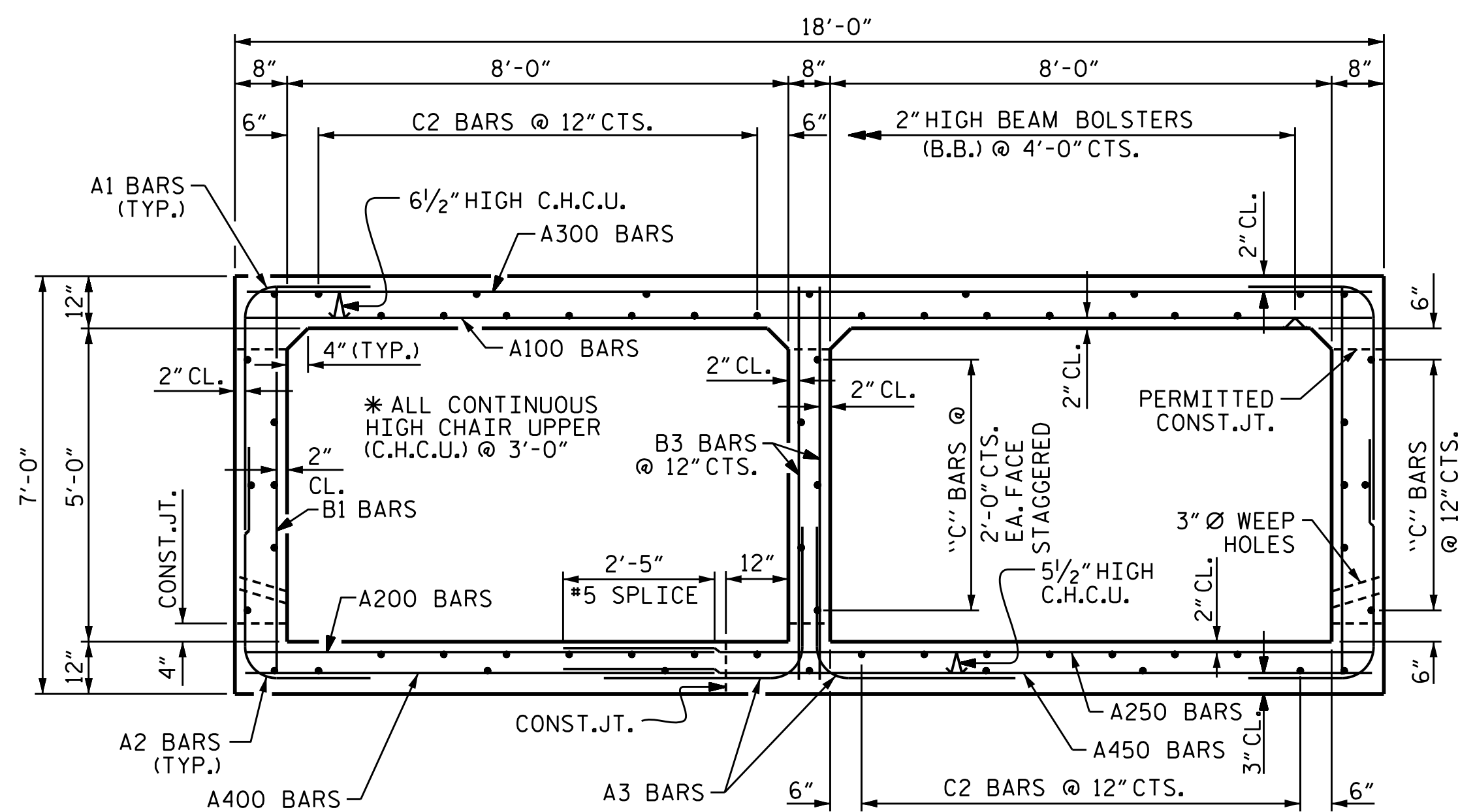
DRAWN BY : M. HOBBS DATE : 10/2014  
CHECKED BY : M. MILLS DATE : 10/2014



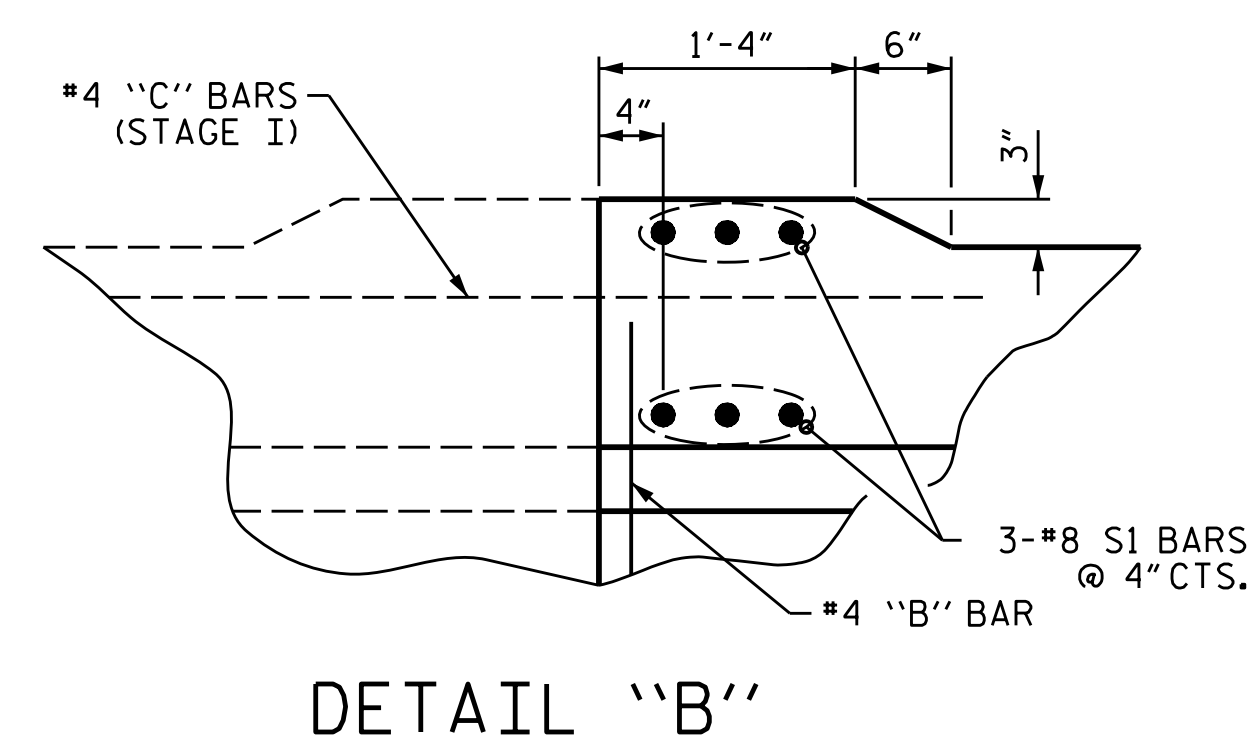
**CULVERT SECTION NORMAL TO ROADWAY (STAGE II)**



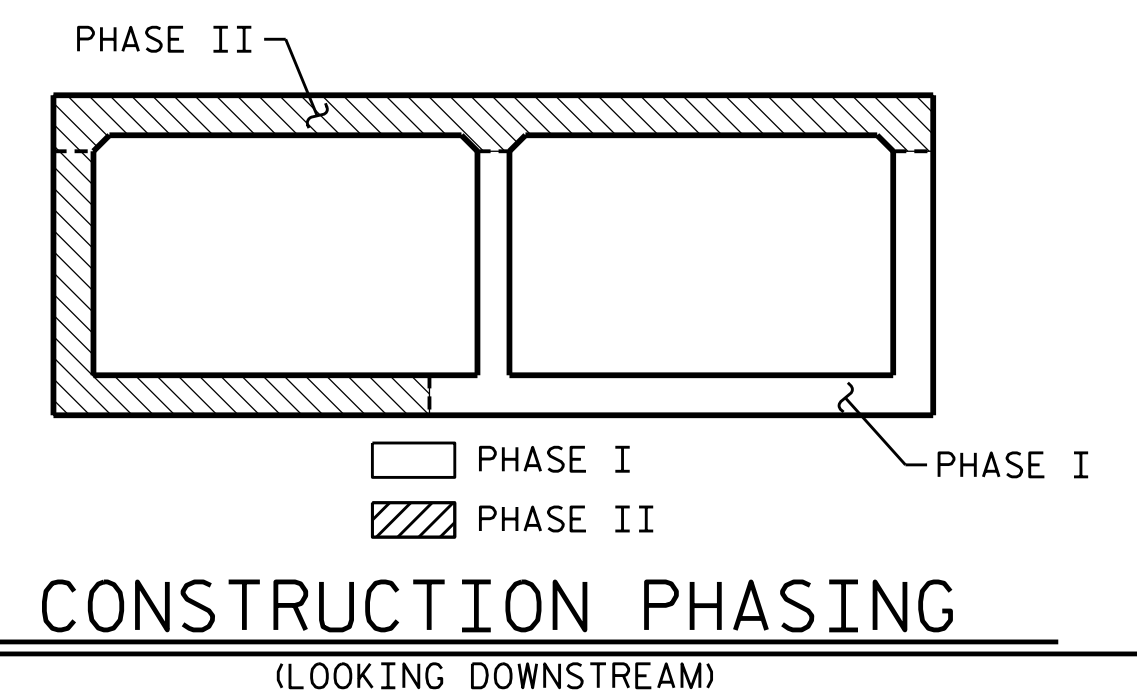
**END ELEVATION NORMAL TO HEADWALL SKEW**  
(LOOKING UPSTREAM)



**RIGHT ANGLE SECTION OF BARREL**  
THERE ARE 63 "C" BARS IN SECTION OF BARREL.



**DETAIL "B"**



**CONSTRUCTION PHASING**  
(LOOKING DOWNSTREAM)

PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
STATION: 11+53.30 -L-

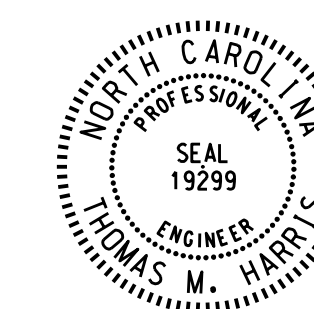
SHEET 4 OF 11

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

**DOUBLE 8FT. X 5FT.  
CONCRETE BOX CULVERT  
(STAGE II)**

DESIGN ENGINEER OF RECORD:  
Thomas M. Harris  
DATE: 12/14/2018

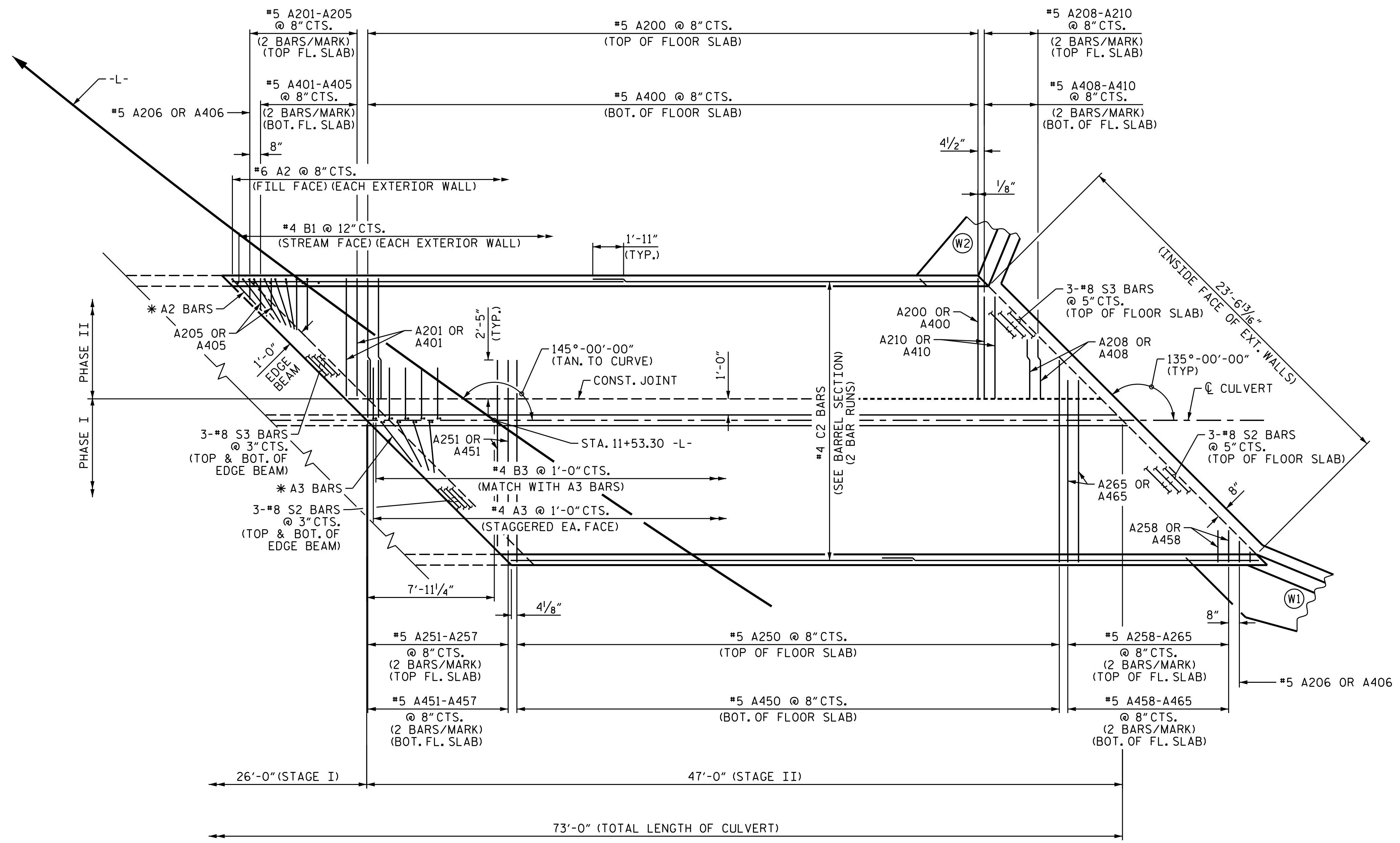
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1			3			TOTAL SHEETS
2			4			11

DRAWN BY: M. HOBBS DATE: 10/2014  
CHECKED BY: M. MILLS DATE: 10/2014



**PLAN OF FLOOR SLAB (STAGE II)**  
 (\* DENOTES SPLAYED "A" BARS @ 8" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)

PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
 STATION: 11+53.30 -L-

SHEET 5 OF 11

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**DOUBLE 8FT. X 5FT.  
 CONCRETE BOX CULVERT  
 STAGE II**

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-5
1			3			TOTAL SHEETS
2			4			11

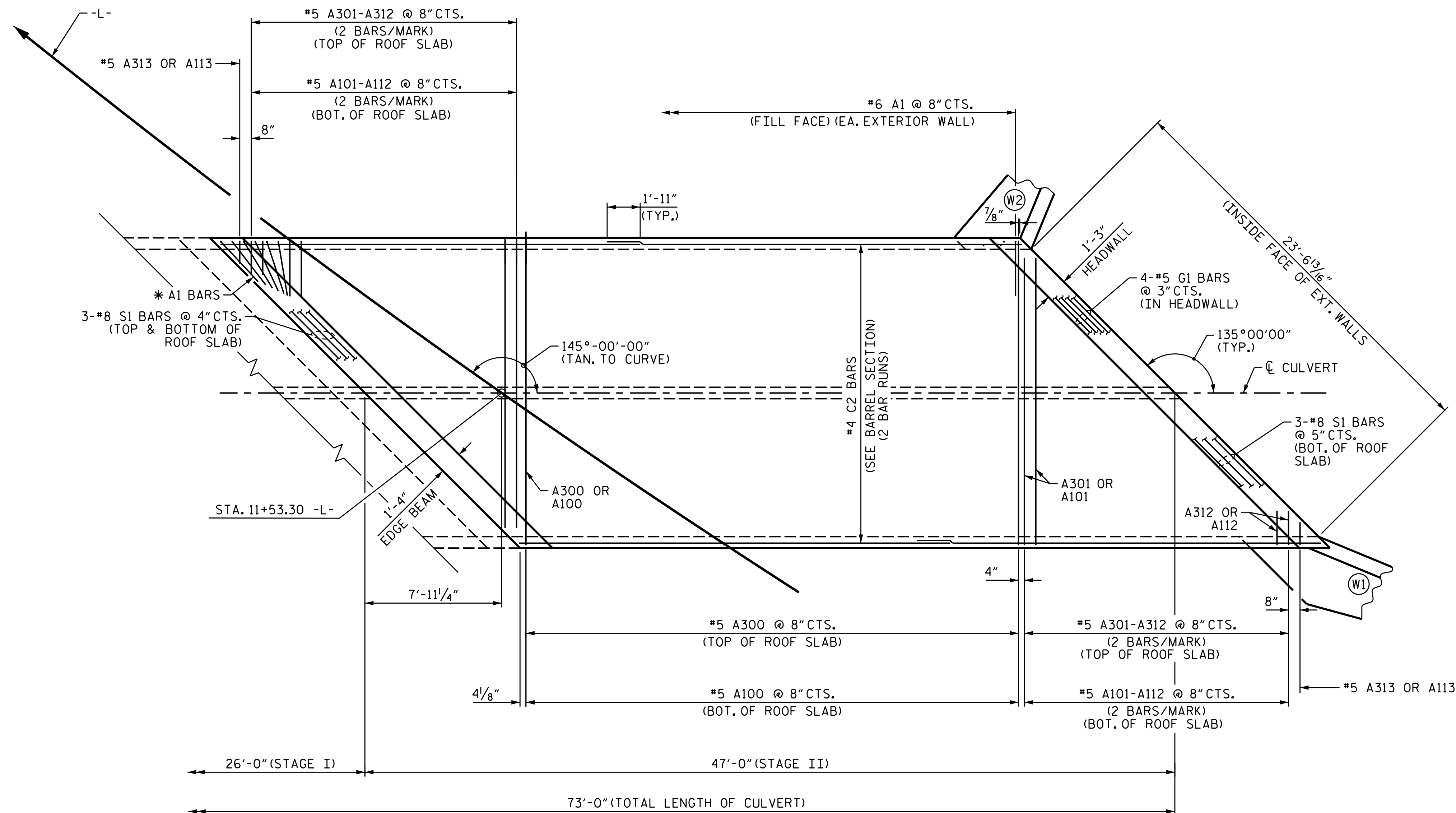
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 USM004281

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**PLAN OF ROOF SLAB (STAGE II)**

(\* DENOTES SPLAYED "A" BARS @ 8" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)

PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
 STATION: 11+53.30 -L-

SHEET 6 OF 11

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

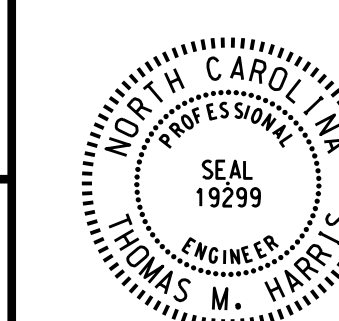
**DOUBLE 8FT. X 5FT.  
 CONCRETE BOX CULVERT  
 STAGE II**

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DATE: 12/14/2018

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1			3			TOTAL SHEETS
2			4			11

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**NOTES**

NATIVE MATERIAL EXCAVATED FROM THE EXISTING STREAM BED OR FLOOD PLAIN AT THE PROJECT SITE DURING CULVERT CONSTRUCTION SHALL BE STOCKPILED AND LATER PLACED IN THE PROPOSED CULVERT BETWEEN SILLS TO PROVIDE A CONTINUOUS LOW FLOW CHANNEL. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

THE STOCKPILED NATIVE MATERIAL SHALL BE PLACED AS SHOWN IN THE "PLAN OF FLOOR SILL LAYOUT" SKETCH TO PROVIDE A 1'-6" DEPTH LOW FLOW CHANNEL BETWEEN LOW FLOW SILLS, AND SHALL BE PLACED TO THE DEPTH OF 2'-6" BETWEEN HIGH FLOW SILLS.

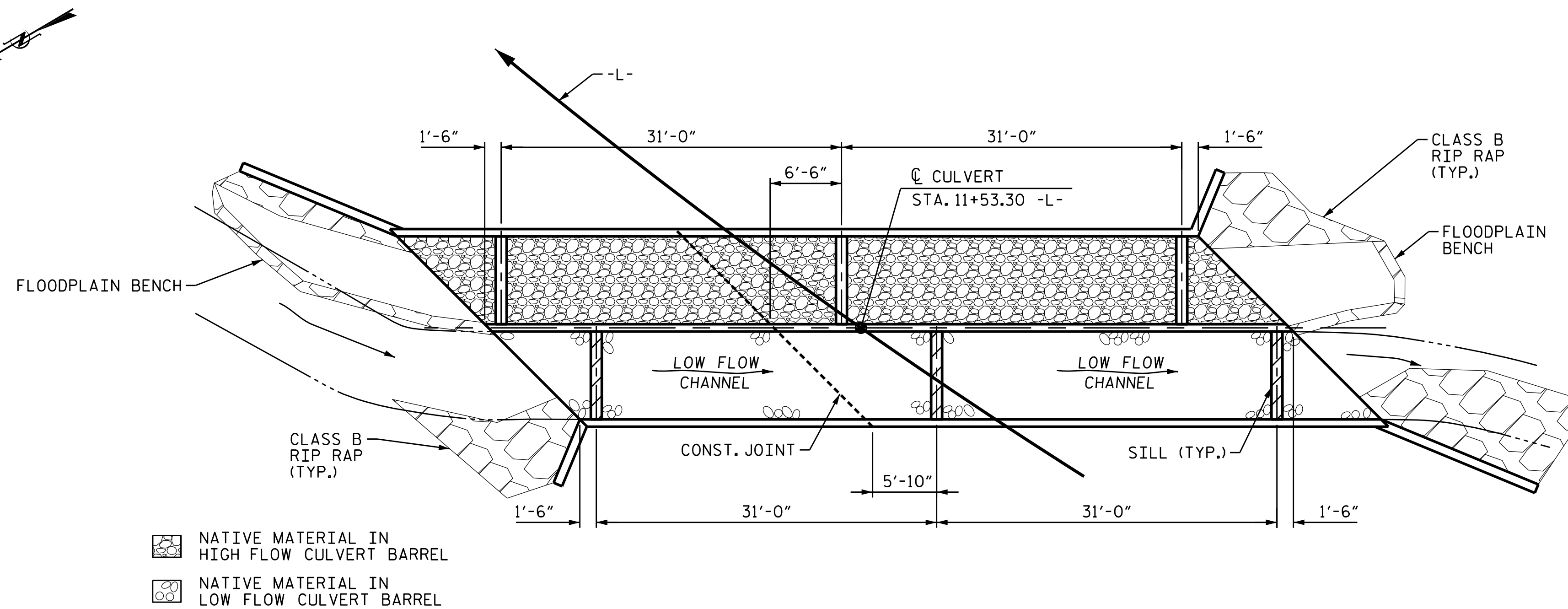
IF NECESSARY, SUPPLEMENTAL STONE OF SIMILAR CHARACTERISTIC OF THE NATIVE MATERIAL MAYBE USED WITH APPROVAL BY ENGINEER. SUPPLEMENTAL STONE WILL BE PAID FOR UNDER THE CONTRACT PRICE FOR CHANNEL SUBSTRATE MATERIAL FOR NATIVE STONE.

THE ENTIRE COST OF WORK REQUIRED TO PLACE THE EXCAVATED MATERIAL SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE BID FOR CULVERT EXCAVATION.

THE ENTIRE COST OF WORK REQUIRED TO CONSTRUCT THE SILLS SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS. NO SEPARATE PAYMENT WILL BE MADE FOR THE 30 LB. ROOFING FELT.

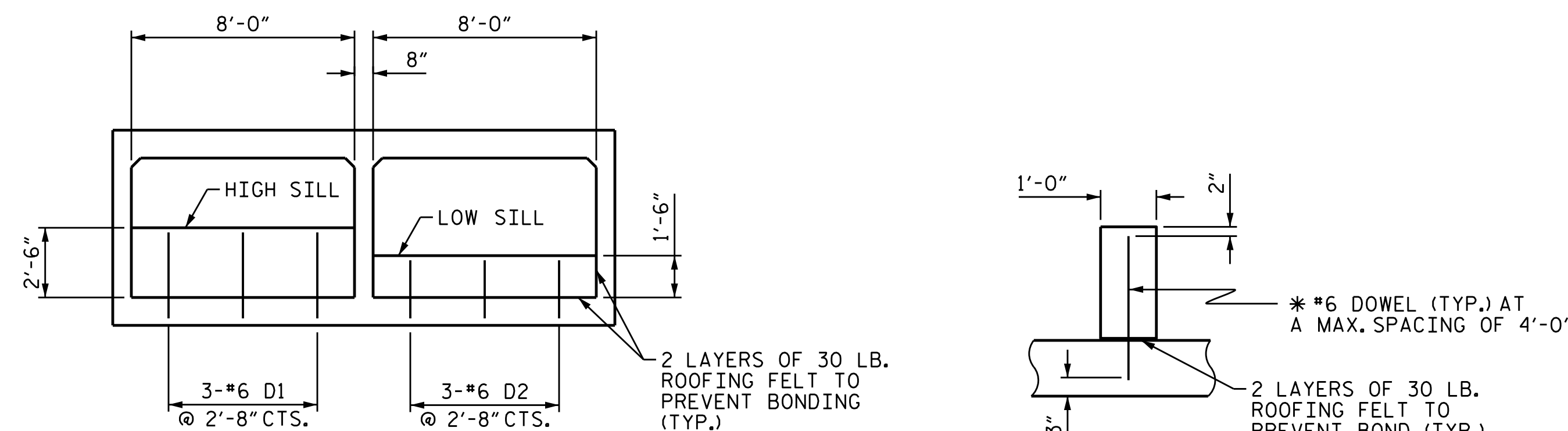
TOP OF LOW FLOW SILLS SHOULD MATCH STREAM BED ELEVATION IN LOW FLOW CHANNEL OF STREAM. (THALWEG)

DO NOT SET ELEVATION OF HIGH SILL ABOVE BANK FULL.



**PLAN OF FLOOR SILL LAYOUT**

LOW FLOW SILLS DENOTED BY CROSSHATCHED AREA.



**ELEVATION**  
LOOKING DOWNSTREAM

**SECTION THROUGH SILL**  
\* DOWELS MAY BE PUSHED INTO GREEN CONCRETE AFTER SLAB HAS BEEN FLOAT FINISHED

**CULVERT SILL DETAILS**

PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
STATION: 11+53.30 -L-

SHEET 7 OF 11

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
**DOUBLE 8FT. X 5FT.  
CONCRETE BOX CULVERT  
STAGES I & II  
BAFFLE/SILL LAYOUT**

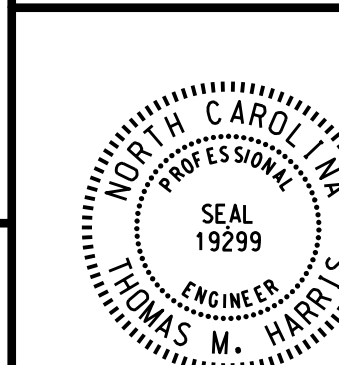
DESIGN ENGINEER OF RECORD:

*Thomas M. Harris*

DATE: 12/14/2018

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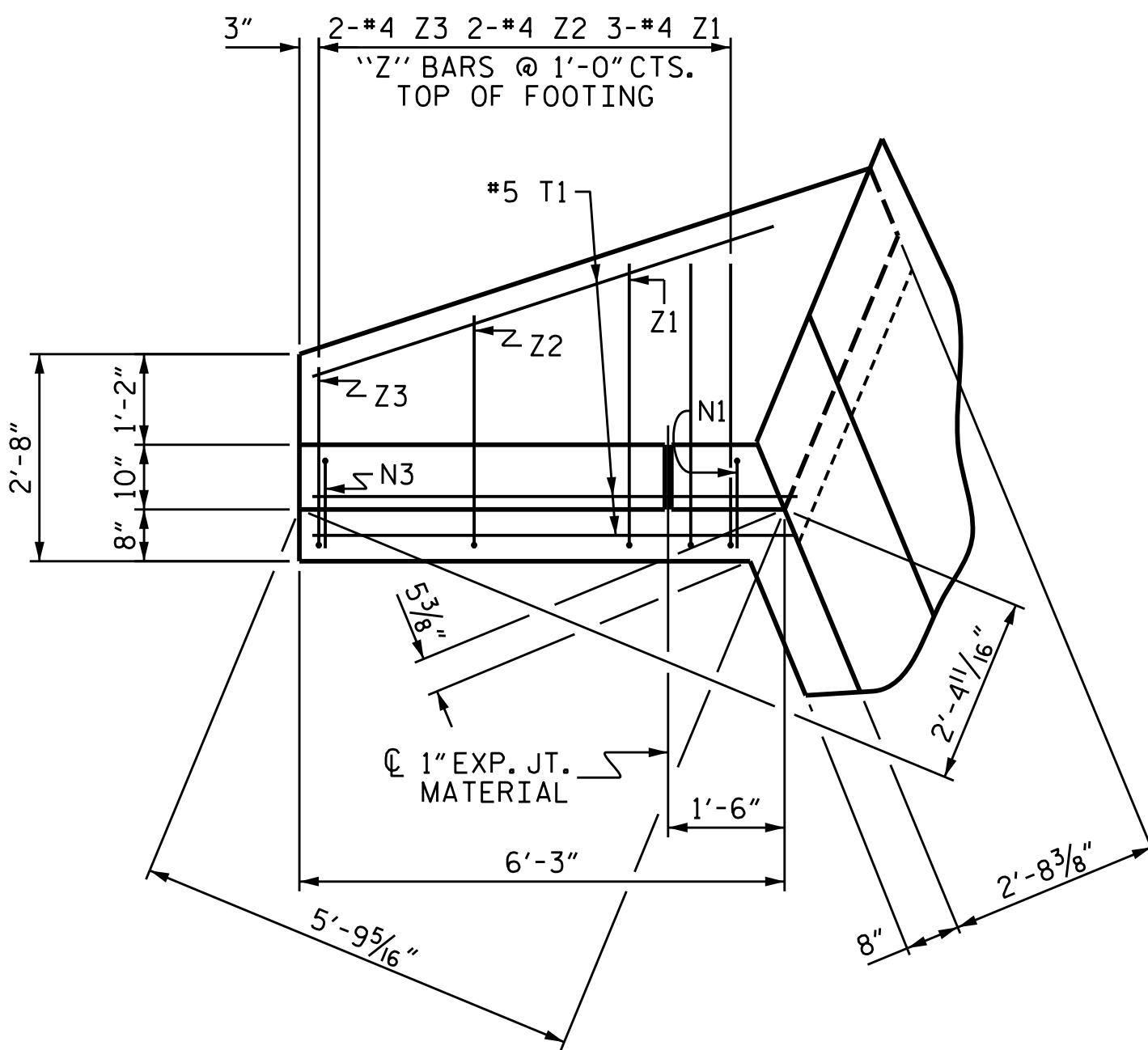


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2			4			11

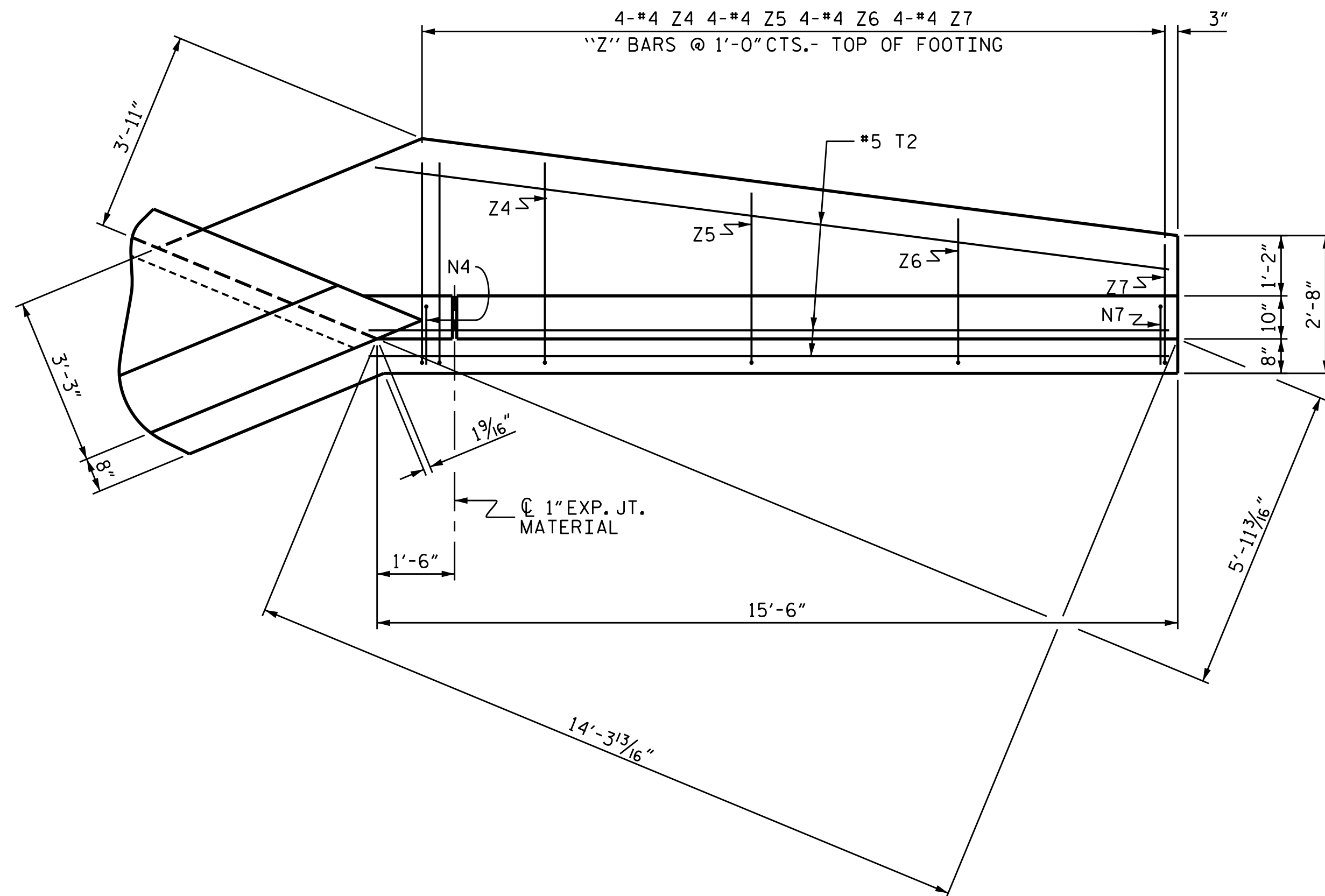
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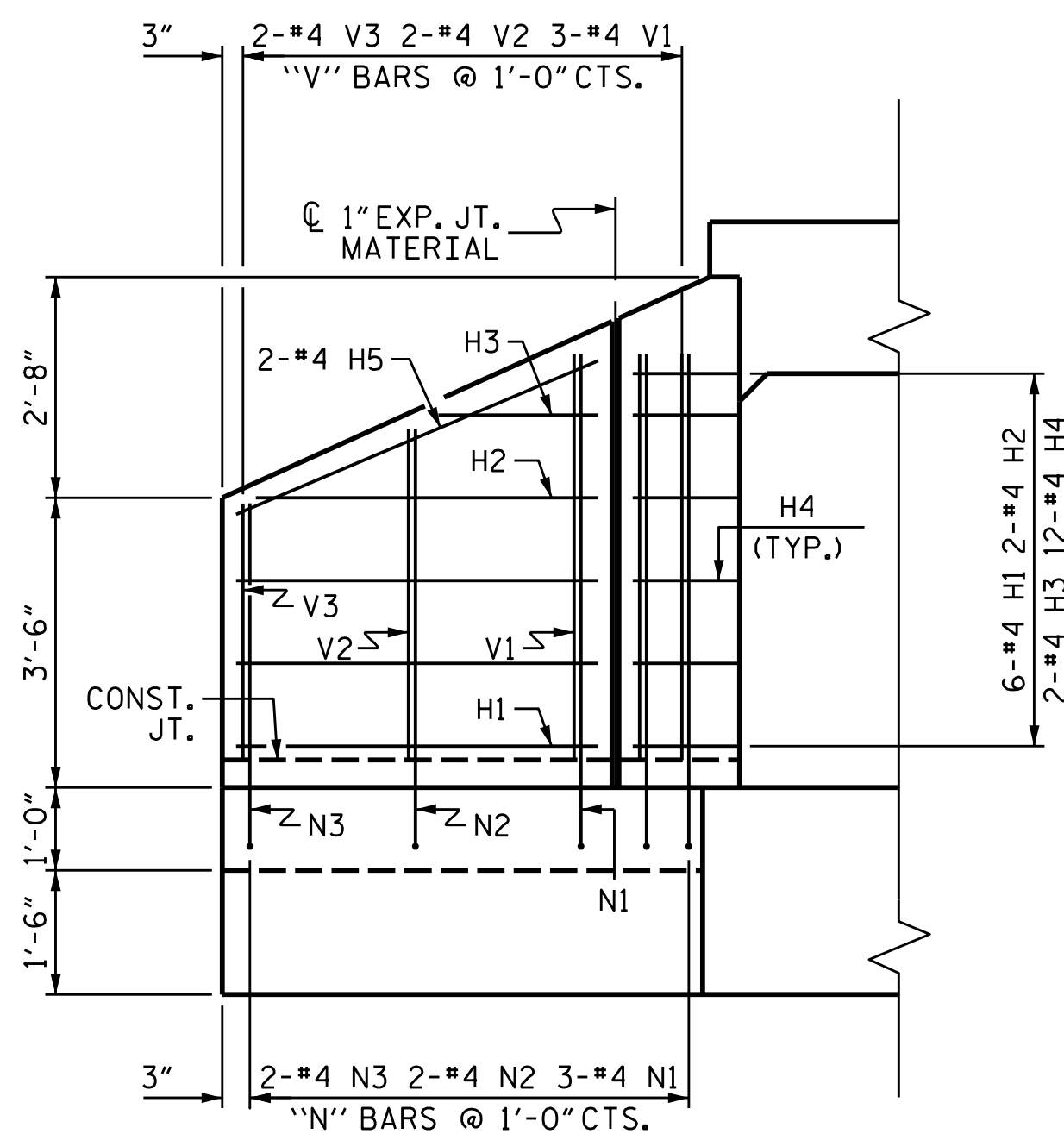




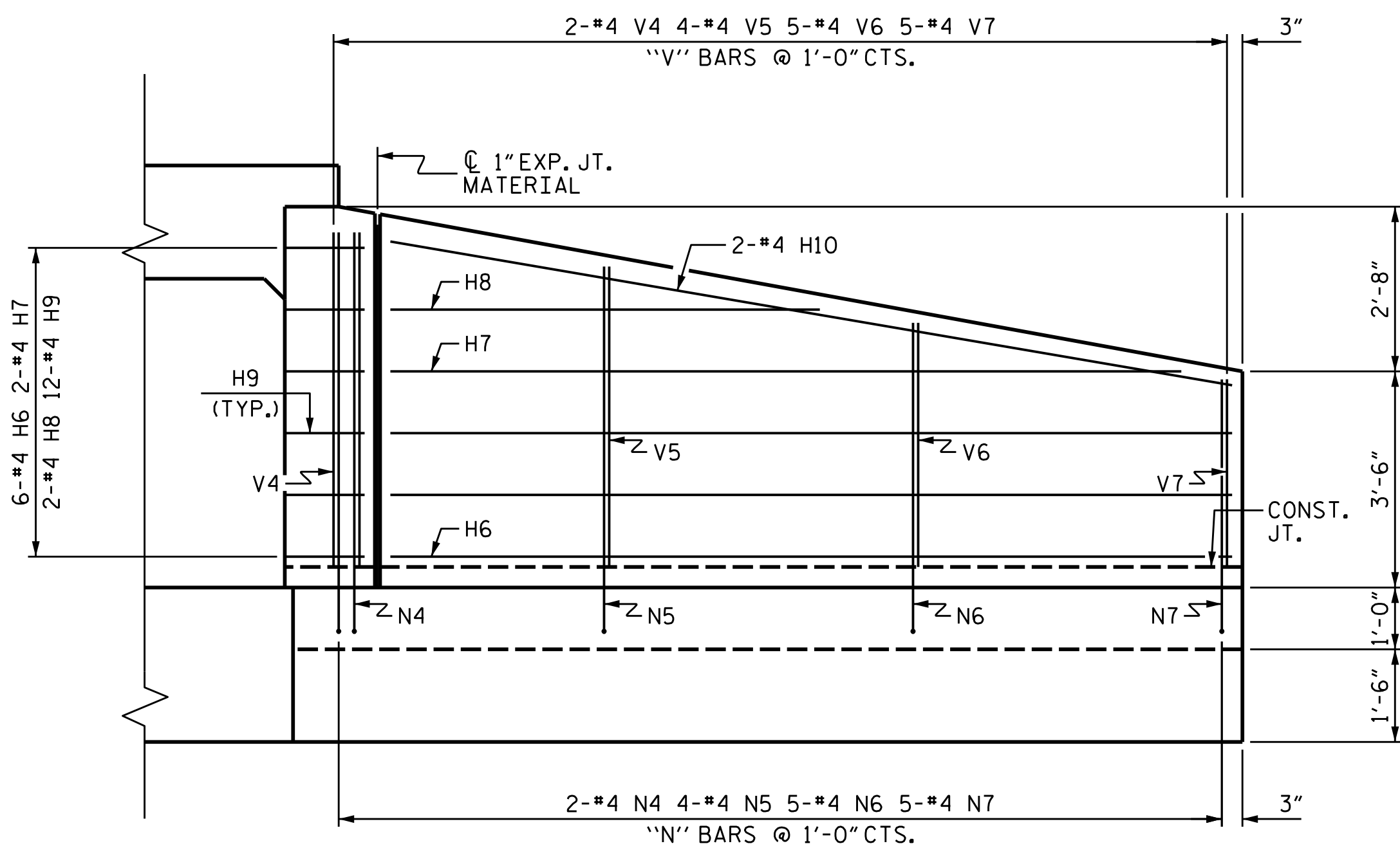
PLAN W2



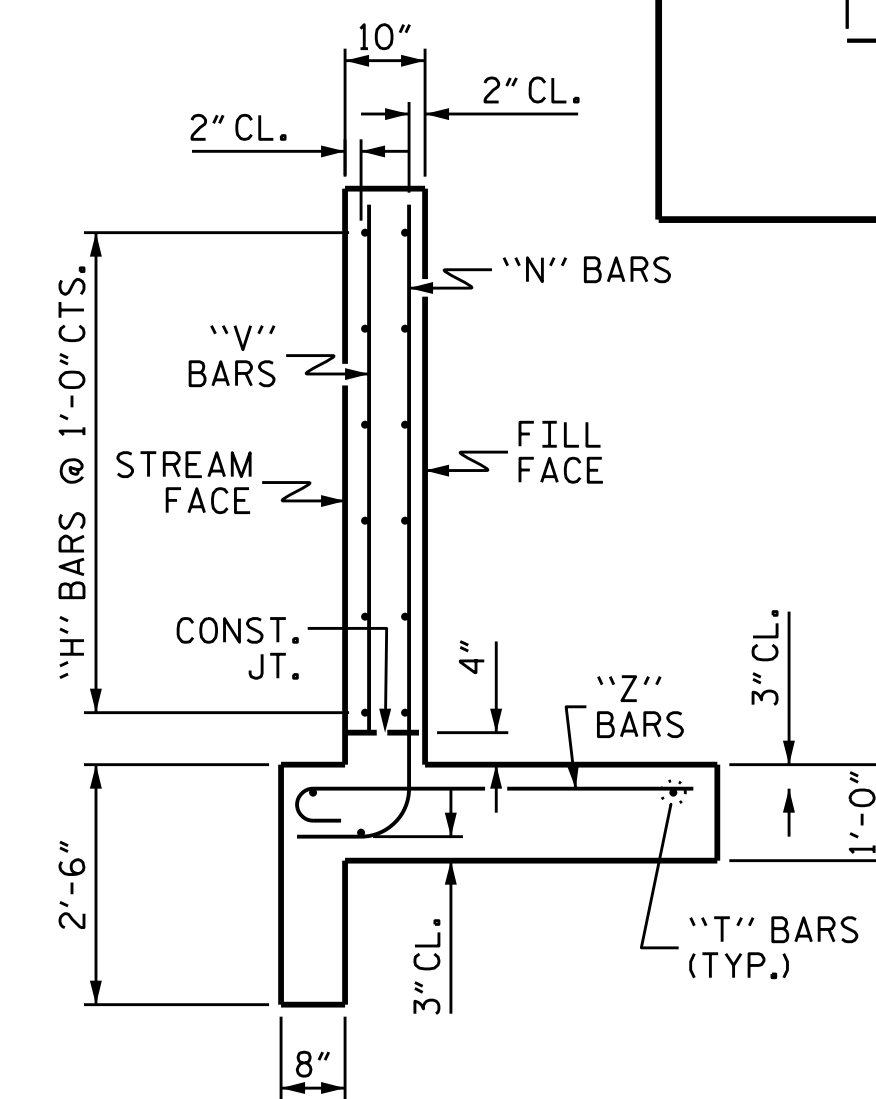
PLAN W1



ELEVATION W2



ELEVATION W1



TYPICAL WING SECTION

DESIGN ENGINEER OF RECORD:

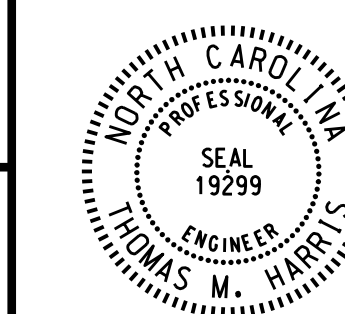
Thomas M. Harris

DATE: 12/14/2018



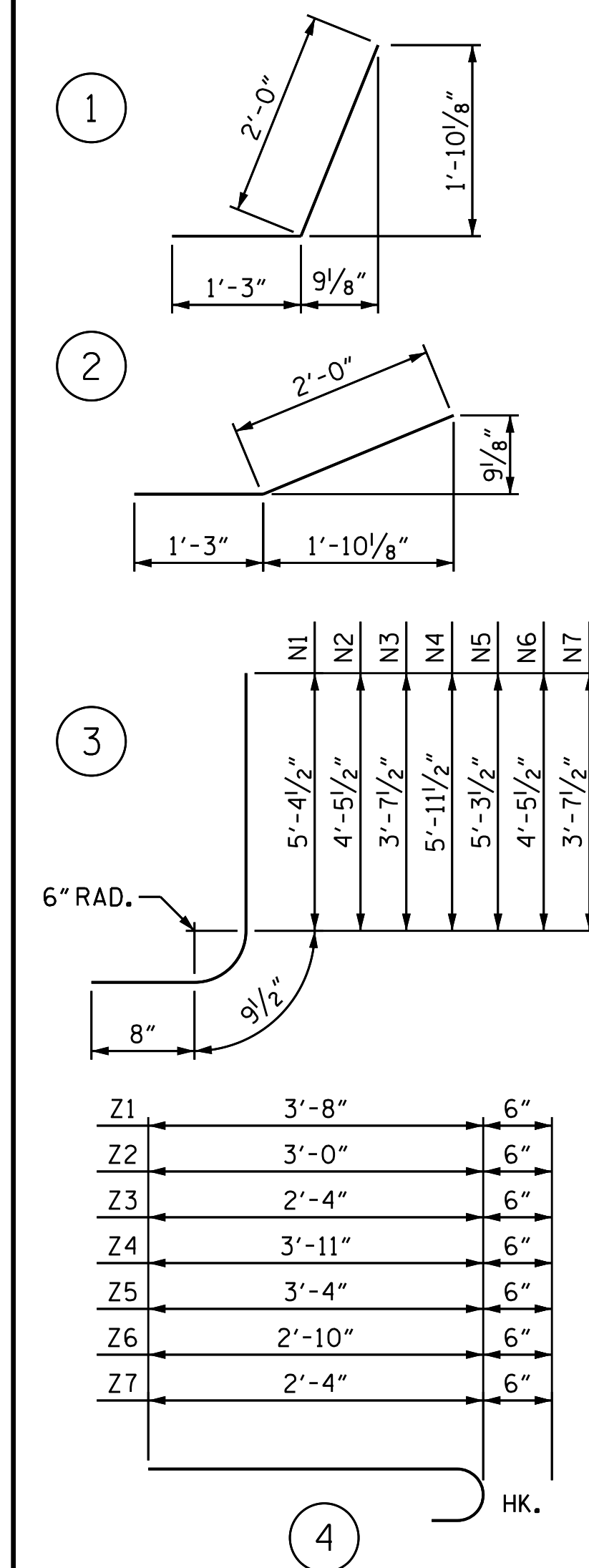
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BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL

BAR NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	#4	STR	4'-4"	17
H2	#4	STR	4'-1"	5
H3	#4	STR	1'-9"	2
H4	#4	1	3'-3"	26
H5	#4	STR	4'-9"	6
H6	#4	STR	13'-7"	54
H7	#4	STR	12'-9"	17
H8	#4	STR	6'-11"	9
H9	#4	2	3'-3"	26
H10	#4	STR	13'-9"	18

N1	#4	3	6'-10"	14
N2	#4	3	5'-11"	8
N3	#4	3	5'-1"	7
N4	#4	3	7'-5"	10
N5	#4	3	6'-9"	18
N6	#4	3	5'-11"	20
N7	#4	3	5'-1"	17

T1	#5	STR	6'-3"	20
T2	#5	STR	15'-6"	48

V1	#4	STR	4'-9"	10
V2	#4	STR	3'-11"	5
V3	#4	STR	3'-1"	4
V4	#4	STR	5'-5"	7
V5	#4	STR	4'-9"	13
V6	#4	STR	3'-10"	13
V7	#4	STR	3'-0"	10

Z1	#4	4	4'-2"	8
Z2	#4	4	3'-6"	5
Z3	#4	4	2'-10"	4
Z4	#4	4	4'-5"	12
Z5	#4	4	3'-10"	10
Z6	#4	4	3'-4"	9
Z7	#4	4	2'-10"	8

REINFORCING STEEL FOR 2 WINGS (STAGE I & II) 460 LBS

CLASS A CONCRETE - STAGE I	
2 WINGS	7.4 CY
1 HEADWALL	1.2 CY
1 END CURTAIN WALL	1.4 CY
2 EDGE BEAMS	1.3 CY
<b>TOTAL</b>	<b>11.3 CY</b>

CLASS A CONCRETE - STAGE II	
2 WINGS	7.4 CY
1 HEADWALL	1.2 CY
1 END CURTAIN WALL	1.4 CY
2 EDGE BEAMS	1.3 CY
<b>TOTAL</b>	<b>11.3 CY</b>

PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
STATION: 11+53.30 -L-

SHEET 9 OF 11

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

STANDARD WINGS  
FOR  
CONCRETE BOX CULVERT  
H = 5'-0" SLOPE = 2:1  
STAGES I AND II

REVISIONS						SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:	C-9	
1			3			TOTAL SHEETS 11	
2			4				

ASSEMBLED BY : M. HOBBS	DATE : 10/2014
CHECKED BY : M. MILLS	DATE : 10/2014
DRAWN BY : CCJ	01/00
CHECKED BY : RWW	03/00

NOTES

THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS SHALL CONSIST OF THE FOLLOWING COMPONENTS :

- A. FERRULES SHALL BE MADE FROM STEEL MEETING THE REQUIREMENTS OF AASHTO M169, GRADE 12L14 AND SHALL HAVE A MINIMUM LENGTH OF THREADS OF 2 1/2".
- B. 4 - 1" Ø X 2 1/4" BOLTS WITH WASHERS, BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307. BOLTS AND WASHERS SHALL BE GALVANIZED. (AT THE CONTRACTOR'S OPTION, STAINLESS STEEL BOLTS AND WASHERS MAY BE USED AS AN ALTERNATE FOR THE 1" Ø X 2 1/4" GALVANIZED BOLTS AND WASHERS. THEY SHALL CONFORM TO OR EXCEED THE MECHANICAL REQUIREMENTS OF ASTM A307. THE USE OF THIS ALTERNATE SHALL BE APPROVED BY THE ENGINEER.)
- C. WIRE STRUTS SHOWN IN THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS DETAIL ARE MINIMUM ALLOWABLE SIZE AND SHALL HAVE A MINIMUM TENSILE STRENGTH OF 100,000 P.S.I. AS AN OPTION, A 1/16" Ø WIRE STRUT WITH A MINIMUM TENSILE STRENGTH OF 90,000 PSI IS ACCEPTABLE.

GUARDRAIL ANCHOR ASSEMBLY WITH BOLTS SHALL BE ASSEMBLED IN THE SHOP. BOLT THREADS MAY BE RECUT AS NECESSARY TO INSURE FIT.

THE COST OF THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS COMPLETE IN PLACE, SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR CLASS "A" CONCRETE.

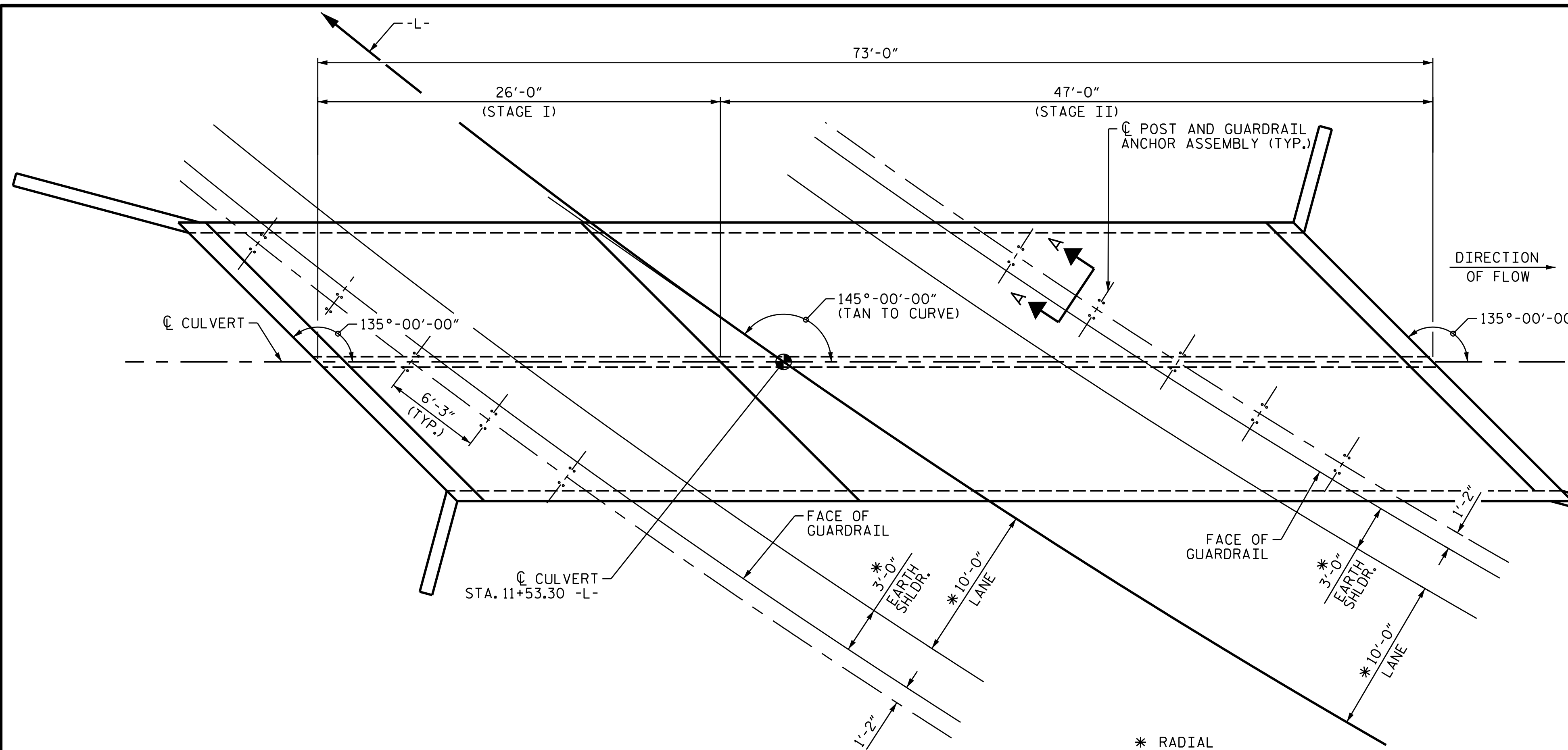
FERRULES TO BE PLUGGED DURING POURING OF SLAB AS RECOMMENDED BY THE MANUFACTURER.

AT THE CONTRACTOR'S OPTION, FERRULES WITH OPEN OR CLOSED ENDS MAY BE USED.

PAYMENT FOR GUARDRAIL, POSTS, AND POST BASE PLATES IS INCLUDED IN ROADWAY PAY ITEMS.

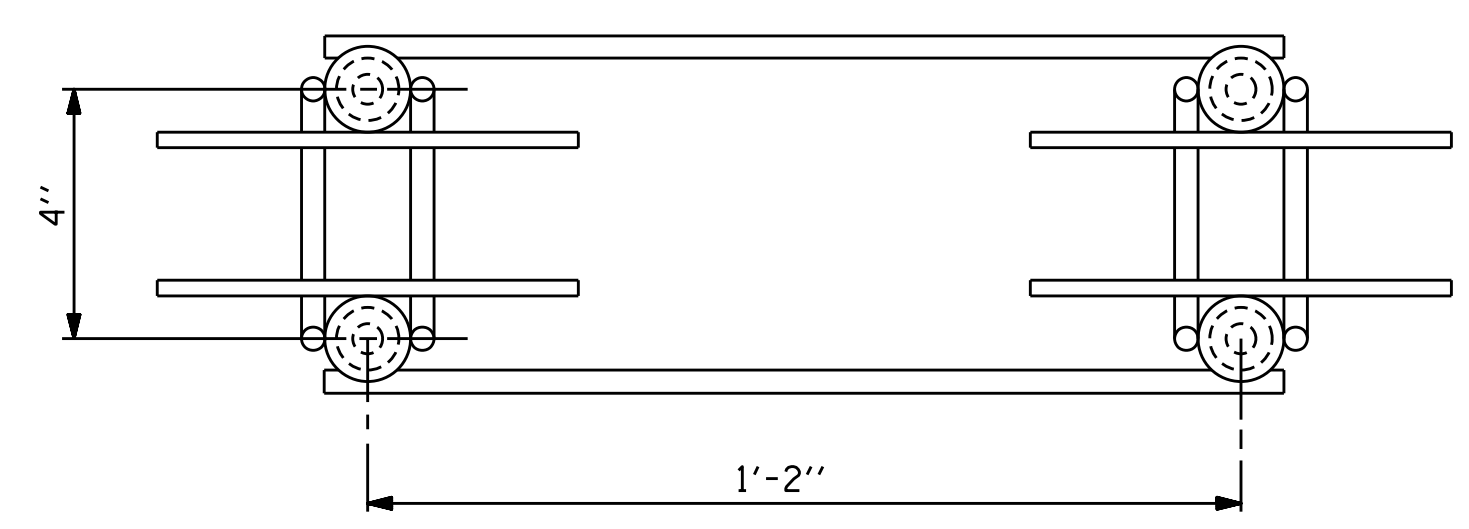
SLAB REINFORCING STEEL MAY BE SHIFTED AS NECESSARY TO CLEAR GUARDRAIL ANCHOR ASSEMBLY. CARE SHOULD BE TAKEN TO KEEP THE SHIFTING OF REINFORCING STEEL TO A MINIMUM.

THE CONTRACTOR MAY USE ADHESIVELY ANCHORED ANCHOR BOLTS IN PLACE OF GUARDRAIL ANCHOR ASSEMBLY. LEVEL TWO FIELD TESTING IS REQUIRED, AND THE YIELD LOAD OF THE 1" Ø BOLT IS 21.8 KIPS. FOR ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS, SEE STANDARD SPECIFICATIONS.

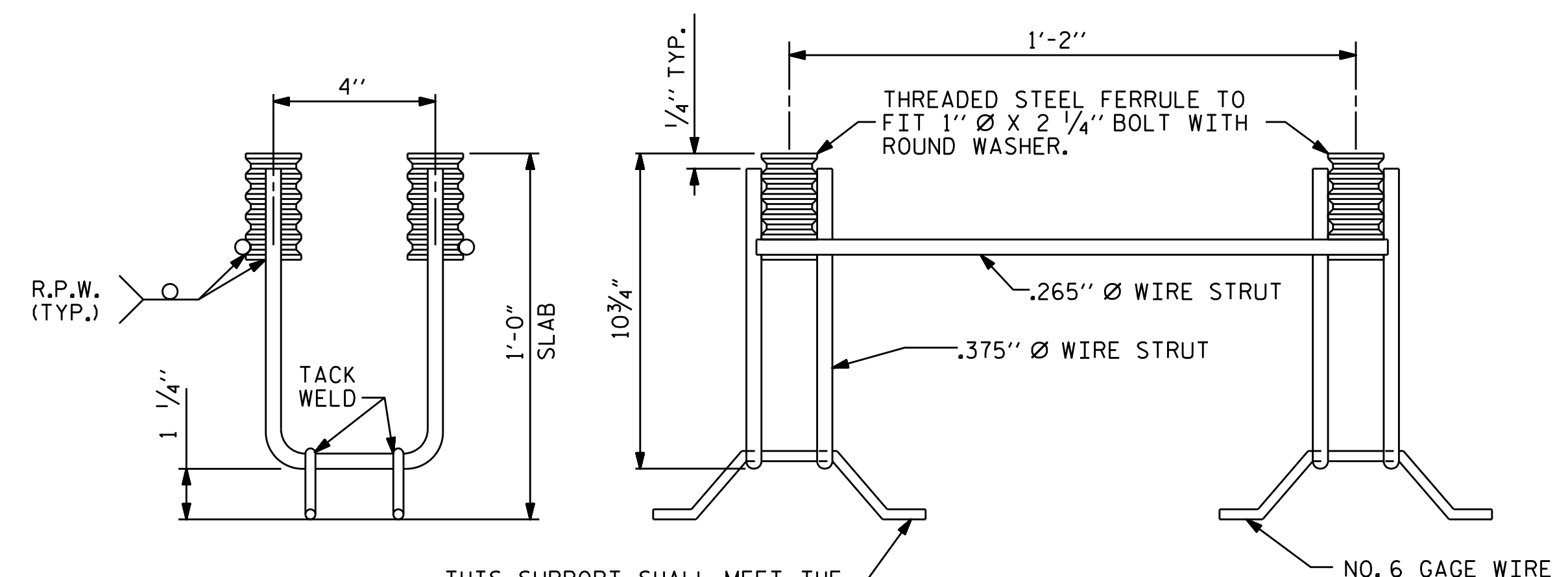


PLAN

SHOWING : GUARDRAIL ANCHOR ASSEMBLY SPACING.

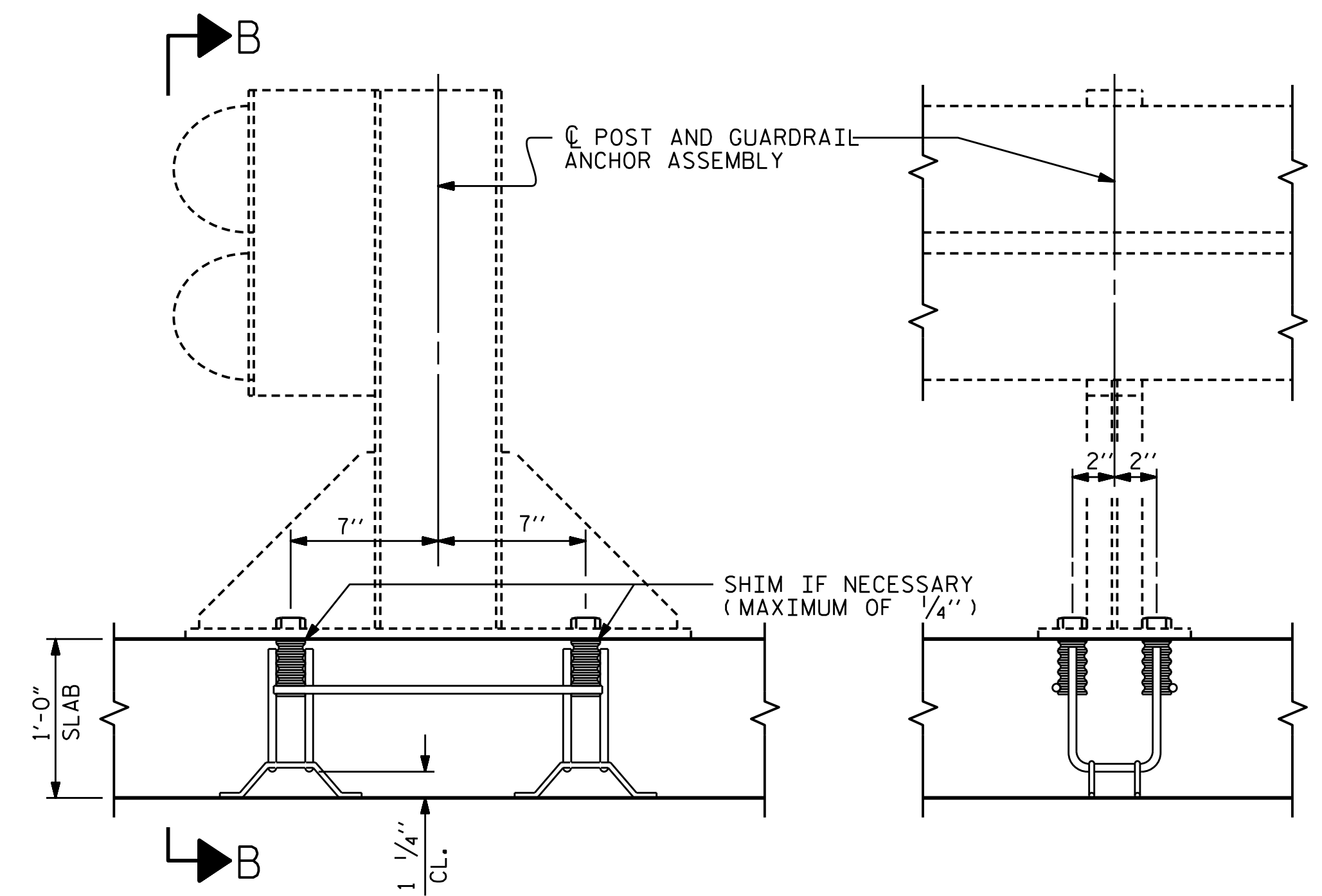


PLAN



ELEVATION

SIDE VIEW



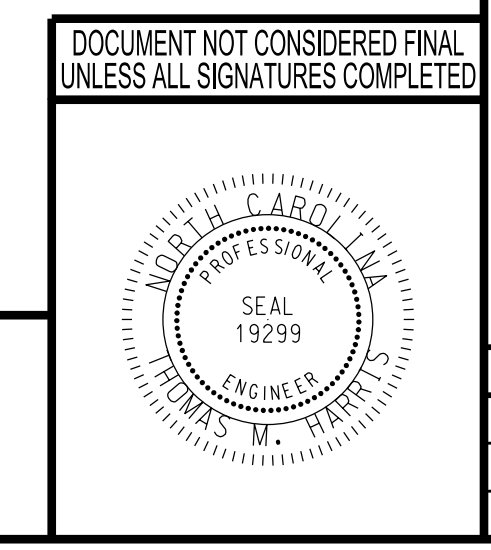
SECTION A-A

SECTION B-B

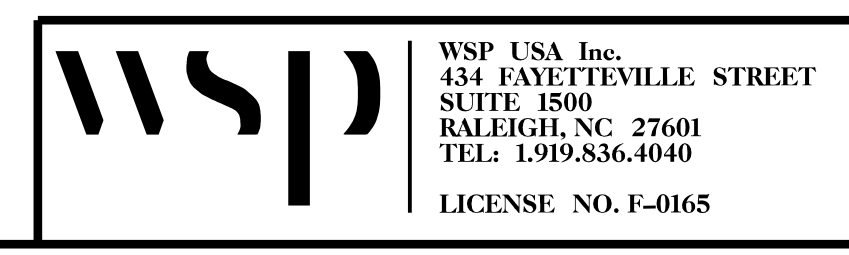
PROJECT NO. 17BP.14.R.79  
GRAHAM COUNTY  
STATION: 11+53.30 -L-

SHEET 10 OF 11

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
STANDARD  
ANCHORAGE DETAILS FOR  
GUARDRAIL ANCHOR ASSEMBLY  
FOR CULVERTS



DESIGN ENGINEER OF RECORD:  
Thomas M. Harris  
DATE: 12/14/2018



REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-10
1			3			TOTAL SHEETS
2			4			11

ASSEMBLED BY : M. HOBBS	DATE : 10/2014
CHECKED BY : M. MILLS	DATE : 10/2014
DRAWN BY : FCJ 6/88	REV. 5/1/06R KMM/GM
CHECKED BY : ARB 6/88	REV. 10/1/11 MAA/GM
	REV. 12/17 MAA/THC

GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS

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

LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING #	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER	
						MOMENT				SHEAR					
						LIVE-LOAD FACTORS (γ <sub>LL</sub> )	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	1.00	--	1.75	1.27	1	TOP SLAB	4.67	1.00	1	TOP SLAB	8.67	.
	HL-93 (OPERATING)	N/A	.	1.29	--	1.35	1.65	1	TOP SLAB	4.67	1.29	1	TOP SLAB	8.67	.
	HS-20 (INVENTORY)	36.000	2	1.26	45:36	1.75	1.27	1	TOP SLAB	4.67	1.26	1	TOP SLAB	8.67	.
	HS-20 (OPERATING)	36.000	.	1.63	58:68	1.35	1.65	1	TOP SLAB	4.67	1.63	1	TOP SLAB	8.67	.
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	.	2.31	31:19	1.40	2.31	1	TOP SLAB	4.67	2.76	1	TOP SLAB	8.67	.
		SNGARBS2	.	2.16	43:20	1.40	2.16	1	TOP SLAB	4.67	2.51	1	TOP SLAB	8.67	.
		SNAGRIS2	.	2.31	50:82	1.40	2.31	1	TOP SLAB	4.67	2.76	1	TOP SLAB	8.67	.
		SNCOTTS3	3	1.25	34:06	1.40	1.92	1	TOP SLAB	4.67	1.25	1	TOP SLAB	8.67	.
		SNAGGRS4	.	1.67	58:32	1.40	1.67	1	BOTTOM SLAB	8.67	1.77	1	TOP SLAB	8.67	.
		SNS5A	.	1.58	56:17	1.40	1.85	1	BOTTOM SLAB	8.67	1.58	1	TOP SLAB	8.67	.
		SNS6A	.	1.58	63:12	1.40	1.72	1	BOTTOM SLAB	8.67	1.58	1	TOP SLAB	8.67	.
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	.	2.25	74:25	1.40	2.25	1	TOP SLAB	8.67	2.60	1	TOP SLAB	8.67	.
		TNT4A	.	1.61	53:25	1.40	2.07	1	BOTTOM SLAB	8.67	1.61	1	TOP SLAB	8.67	.
		TNT6A	.	1.58	65:73	1.40	1.86	1	BOTTOM SLAB	8.67	1.58	1	TOP SLAB	8.67	.
		TNT7A	.	1.61	67:62	1.40	1.82	1	BOTTOM SLAB	8.67	1.61	1	TOP SLAB	8.67	.
		TNT7B	.	1.58	66:36	1.40	1.93	1	TOP SLAB	8.67	1.58	1	TOP SLAB	8.67	.
		TNAGRIT4	.	1.59	68:37	1.40	1.77	1	BOTTOM SLAB	8.67	1.59	1	TOP SLAB	8.67	.
		TNAGT5A	.	1.61	72:45	1.40	1.73	1	BOTTOM SLAB	8.67	1.61	1	TOP SLAB	8.67	.
TNAGT5B	.	1.42	63:90	1.40	1.42	1	BOTTOM SLAB	8.67	1.59	1	TOP SLAB	8.67	.		

### 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	--

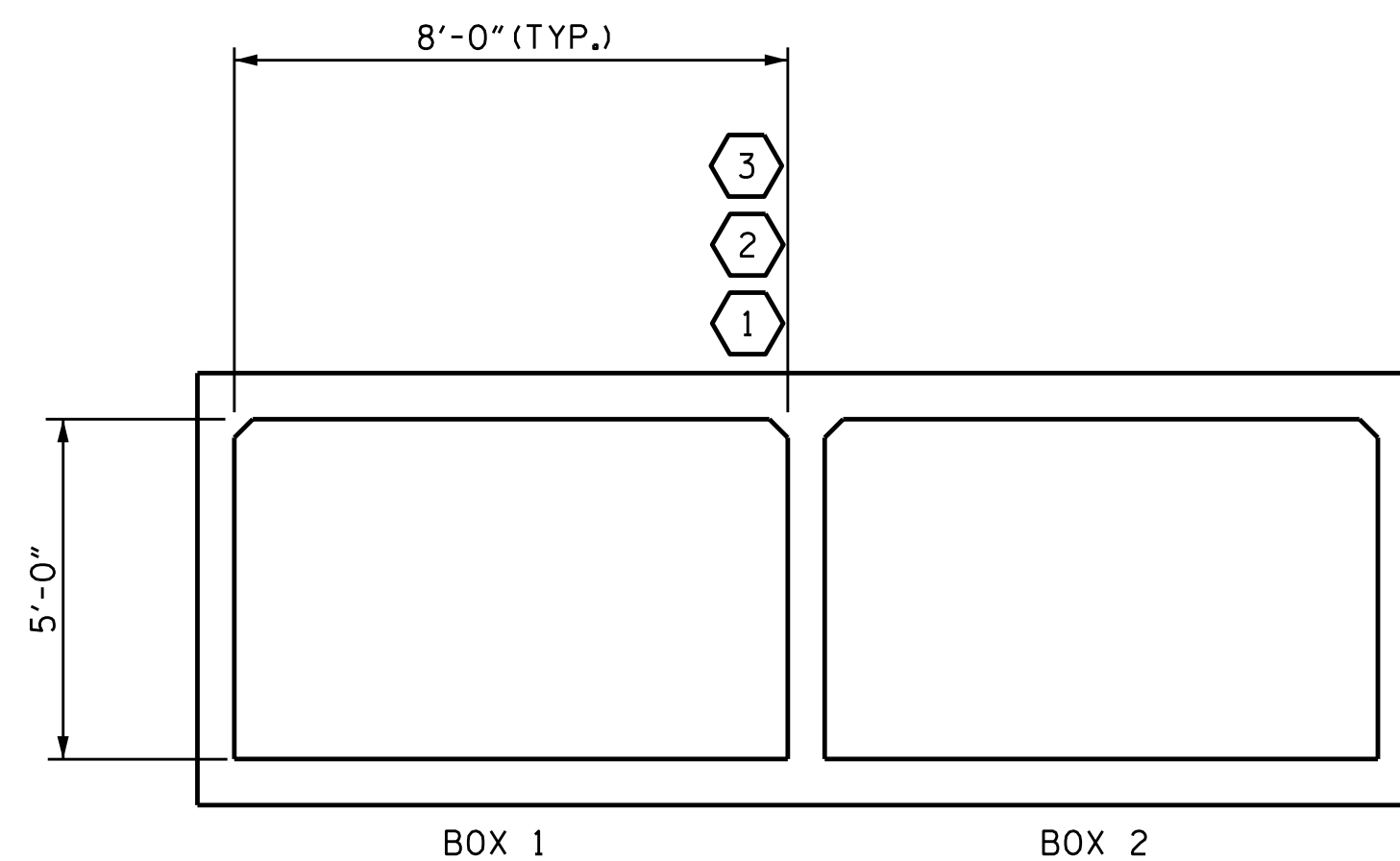
### NOTE:

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. 17BP.14.R.79  
GRAHAM COUNTY  
STATION: 11+53.30 -L-  
SHEET 11 OF 11

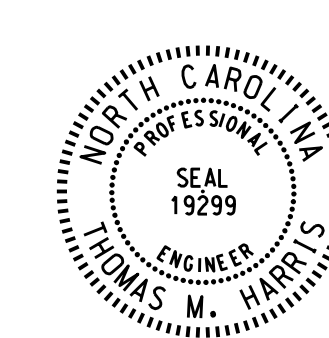
ASSEMBLED BY : C. HOWARD	DATE : 10/20/14
CHECKED BY : M. MILLS	DATE : 10/20/14
DRAWN BY : WMC	7/11
CHECKED BY : GM	7/11
REV. 10/1/11	MAA/GM
REV. 12/17	MAA/THC

12/14/2018  
\*\*\*\*\*DCN\*\*\*\*\*  
USM004281

DESIGN ENGINEER OF RECORD:  
*Thomas M. Harris*  
DATE: 12/14/2018

**wsp** WSP USA Inc.  
434 FAYETTEVILLE STREET  
SUITE 1500  
RALEIGH, NC 27601  
TEL: 1.919.836.4040  
LICENSE NO. F-0165

DOCUMENT NOT CONSIDERED FINAL  
UNLESS ALL SIGNATURES COMPLETED



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

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-11
1			3			TOTAL SHEETS 11
2			4			

STD. NO. LRFR5

## 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 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 EXTREME FIBER STRESS	- - -	1,800 LBS. PER SQ. IN.
COMPRESSION PERPENDICULAR TO GRAIN OF TIMBER	- - - - -	375 LBS. PER SQ. IN.
EQUIVALENT FLUID PRESSURE OF EARTH	- - - - -	30 LBS. PER CU. FT. (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  $\frac{3}{16}$ " 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. FINS 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