

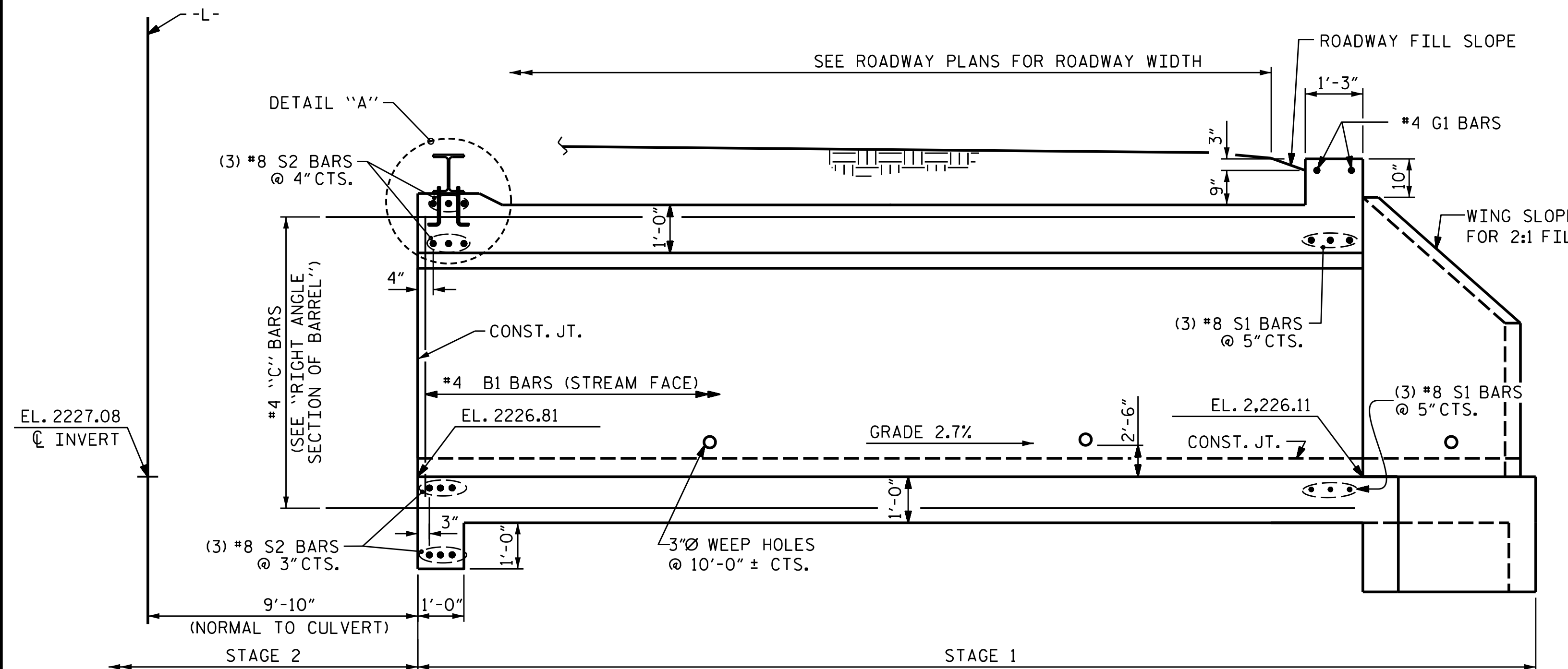
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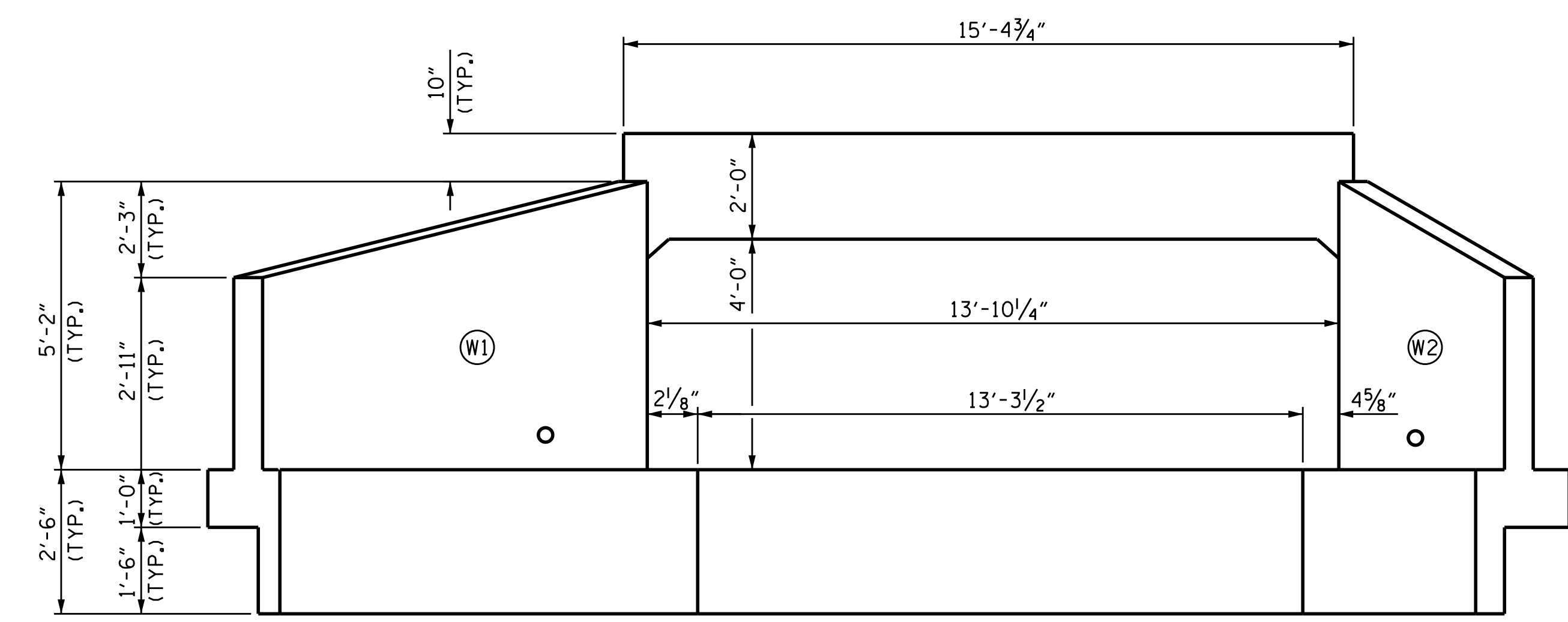
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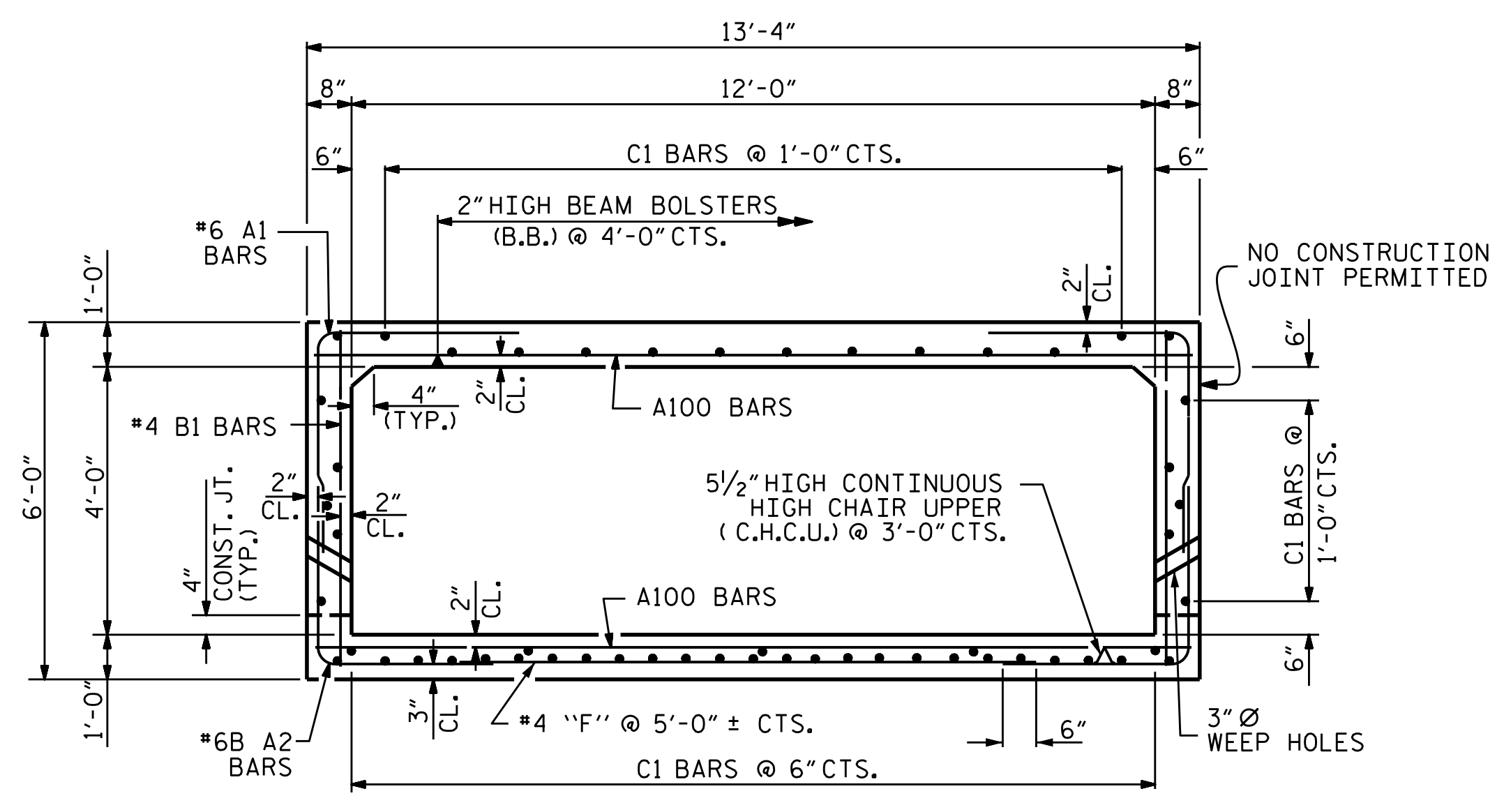




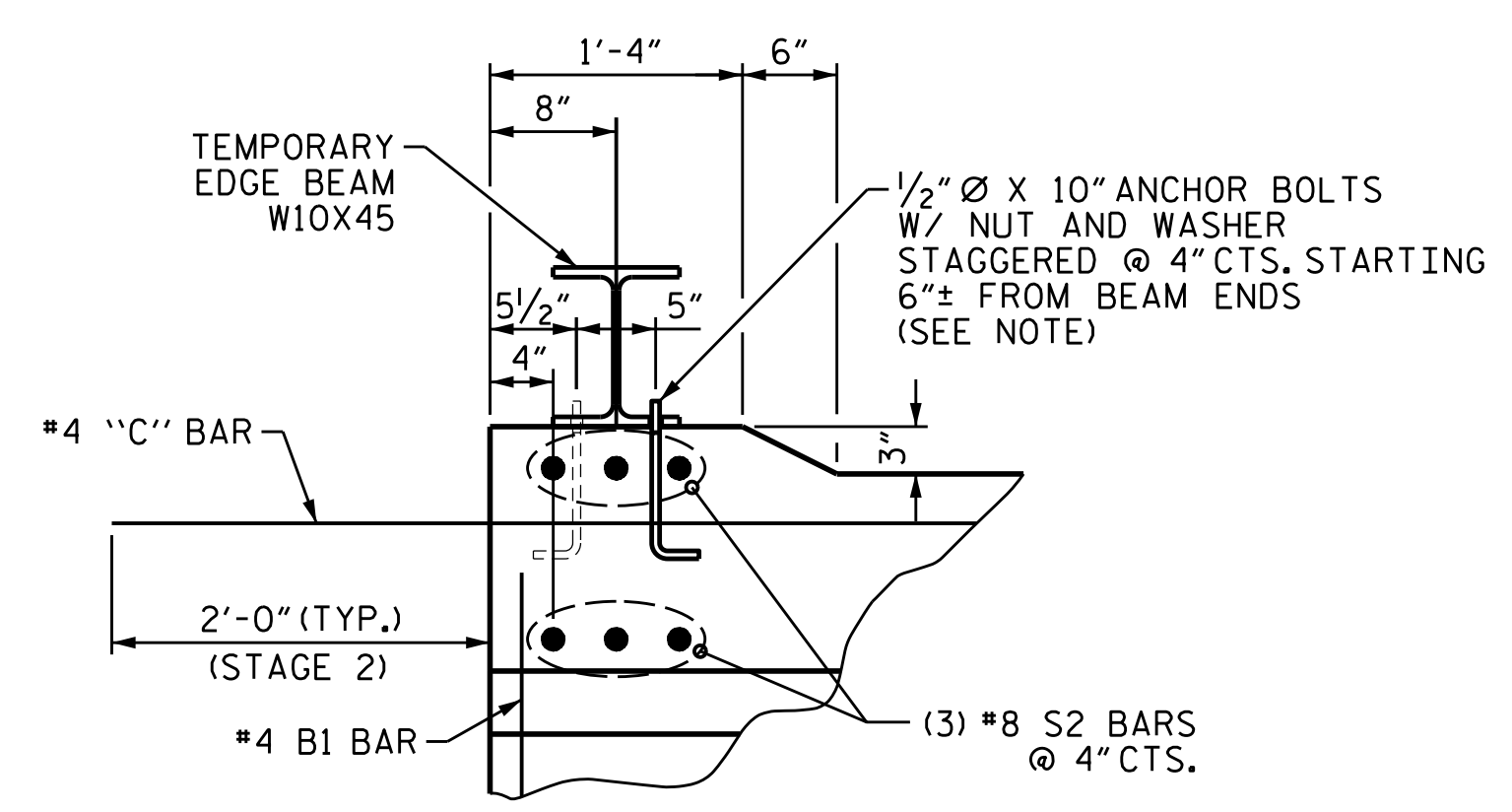
**CULVERT SECTION NORMAL TO ROADWAY (STAGE 1)**



**END ELEVATION NORMAL TO HEADWALL SKEW**



**RIGHT ANGLE SECTION OF BARREL**  
 THERE ARE 54 "C" BARS IN SECTION OF BARREL

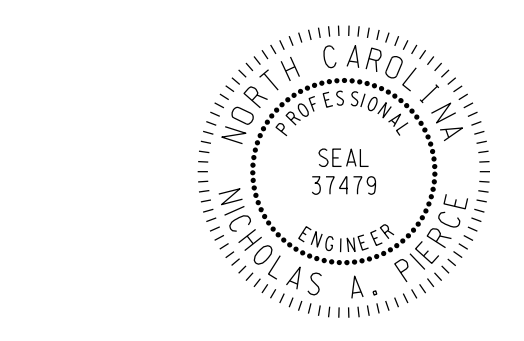


NOTE: AFTER STAGE 2 IS COMPLETE, THE BEAM SHALL BE REMOVED AND ANCHOR BOLTS CUT SMOOTH AND EPOXY APPLIED TO EXPOSED BOLTS TO PREVENT CORROSION.

**DETAIL "A"**

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

PROJECT NO. 17BP.14.R.90  
GRAHAM COUNTY  
 STATION: 12+66.58 -L-  
 SHEET 2 OF 6



DESIGN ENGINEER OF RECORD:  
 Nicholas Pierce  
 DATE: 1/6/2016



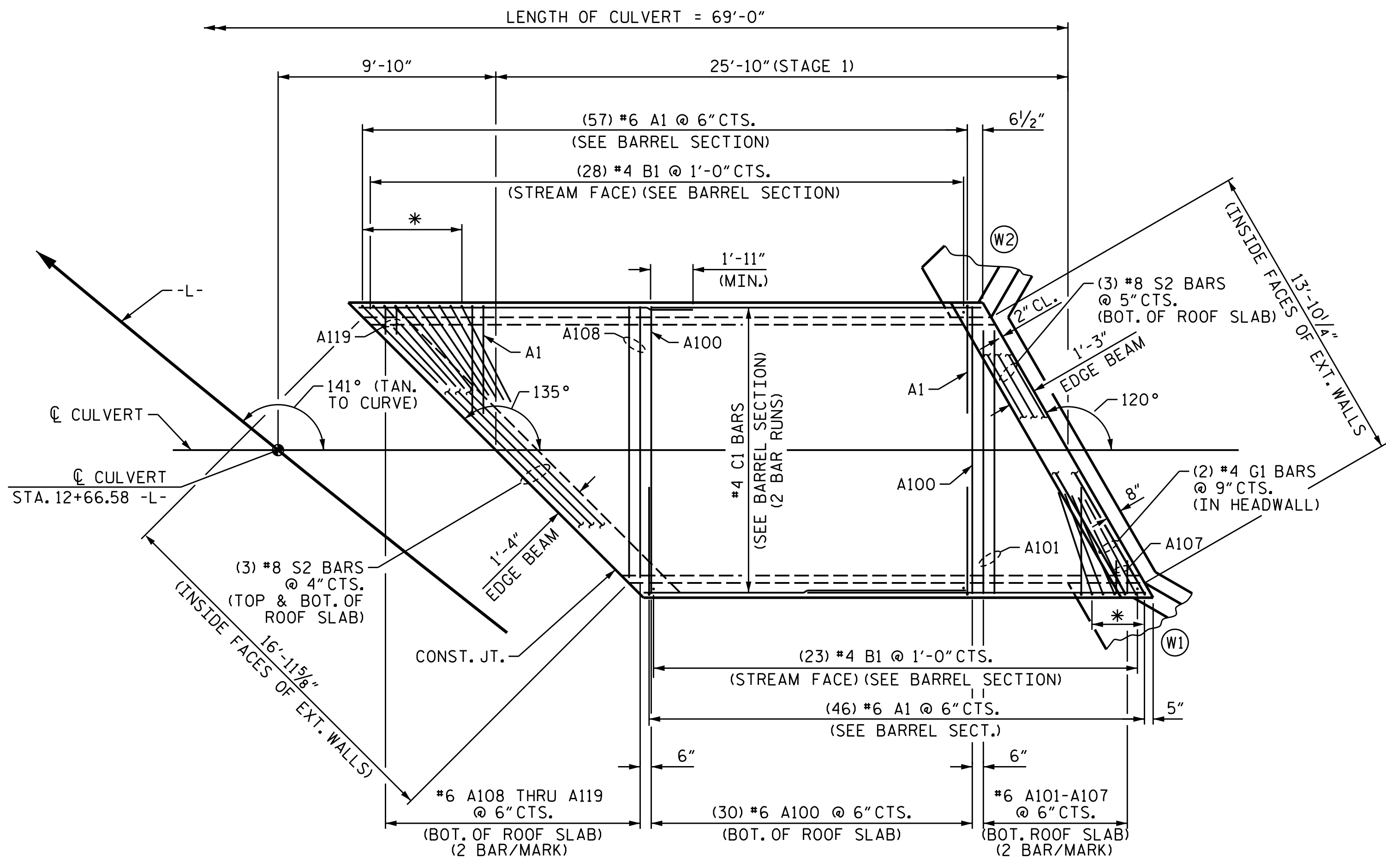
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**SINGLE 12FT. X 4FT. CONCRETE BOX CULVERT STAGE 1**

REVISIONS				SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

TOTAL SHEETS: 9

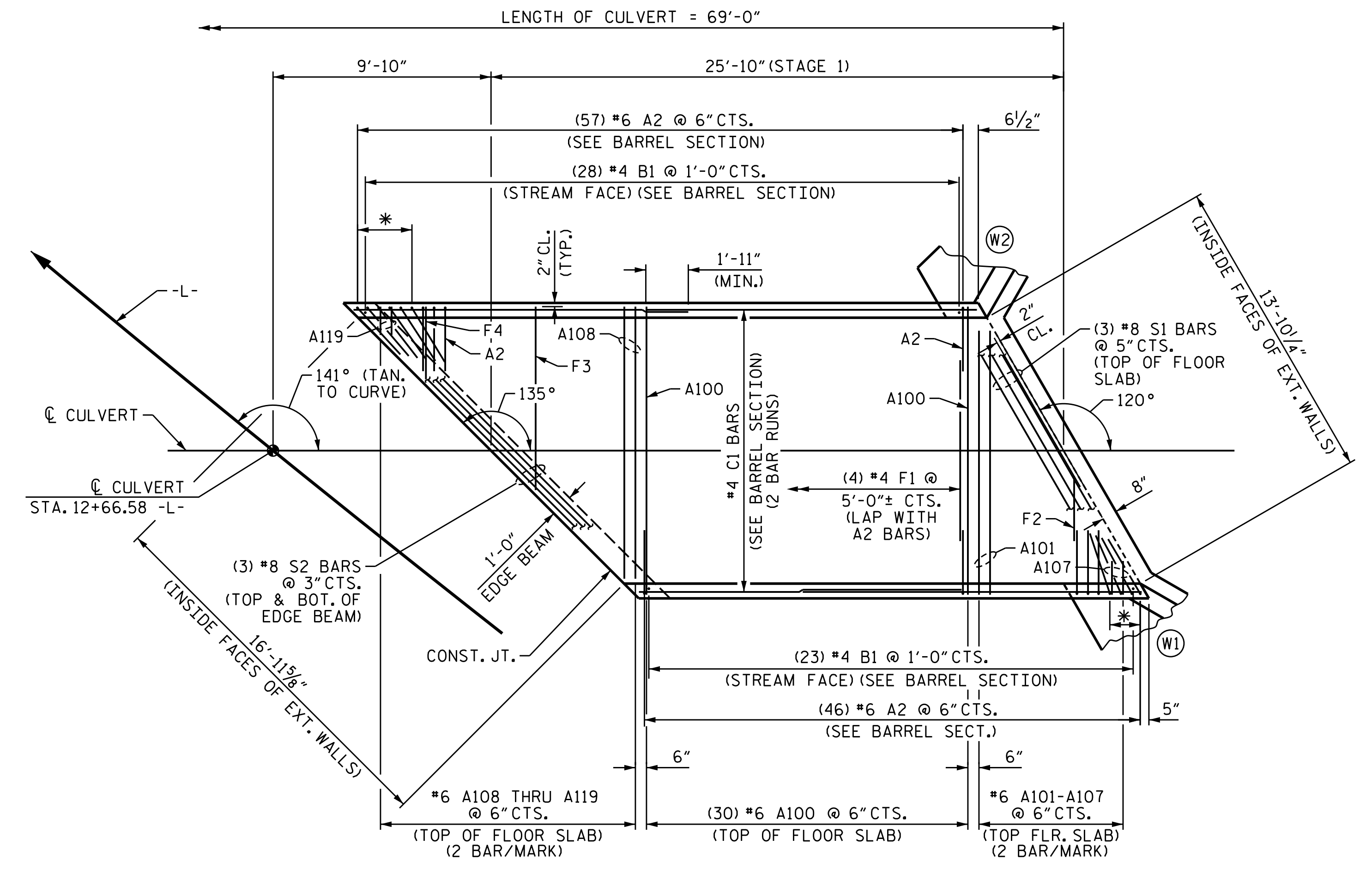
ASSEMBLED BY: M. HOBBS DATE: 08/2014  
 CHECKED BY: N. PIERCE DATE: 08/2014

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**PLAN OF ROOF SLAB (STAGE 1)**

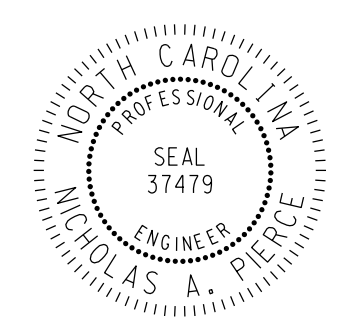
(\* DENOTES SPLAYED "A1" BARS @ 6" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)



**PLAN OF FLOOR SLAB (STAGE 1)**

(FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET)  
 (ALL "F" BARS ARE SPACED 5'-0"± CTS. AND ADJUSTED AS NEEDED TO TIE TO "A2" BARS)  
 (\* DENOTES SPLAYED "A2" BARS @ 6" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)

DRAWN BY : M. HOBBS DATE : 08/2014  
 CHECKED BY : N. PIERCE DATE : 08/2014



DESIGN ENGINEER OF RECORD:  
 Designed by: *Nicholas Pierce*  
 DATE: 1/6/2016

**WSP**  
 Transportation & Infrastructure  
 15401 Weston Parkway Suite 100  
 Cary, NC 27513 - 919.678.0035  
 www.wspgroup.com  
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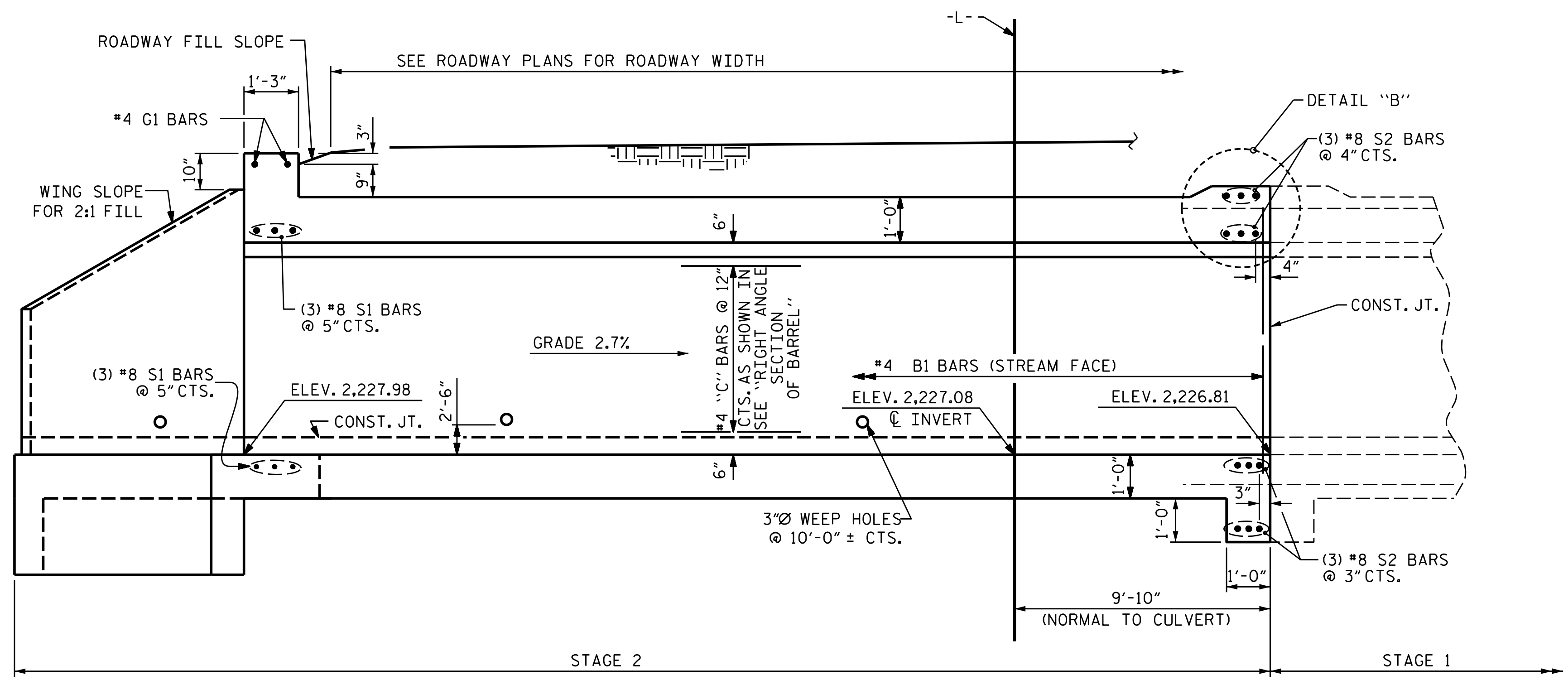
PROJECT NO. 17BP.14.R.90  
 GRAHAM COUNTY  
 STATION: 12+66.58 -L-

SHEET 3 OF 6

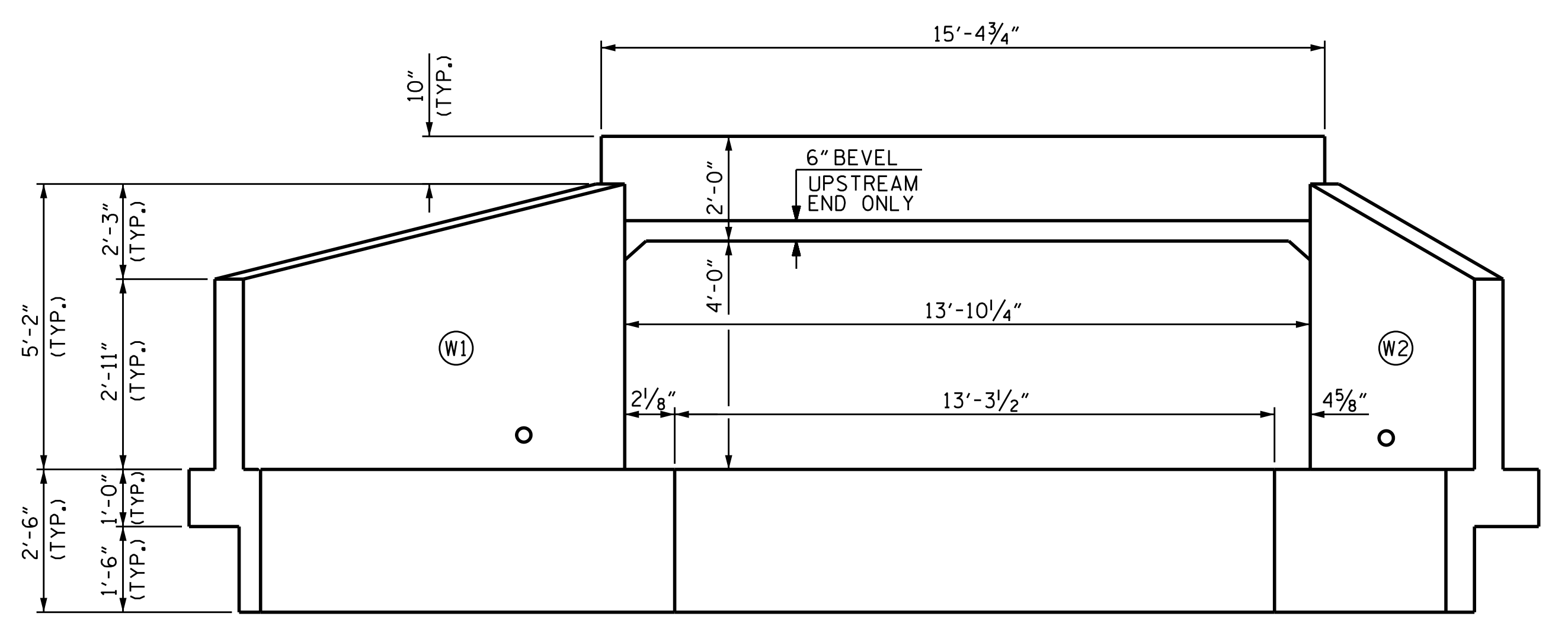
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 SINGLE 12FT. X 4FT.  
 CONCRETE BOX CULVERT  
 STAGE 1

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

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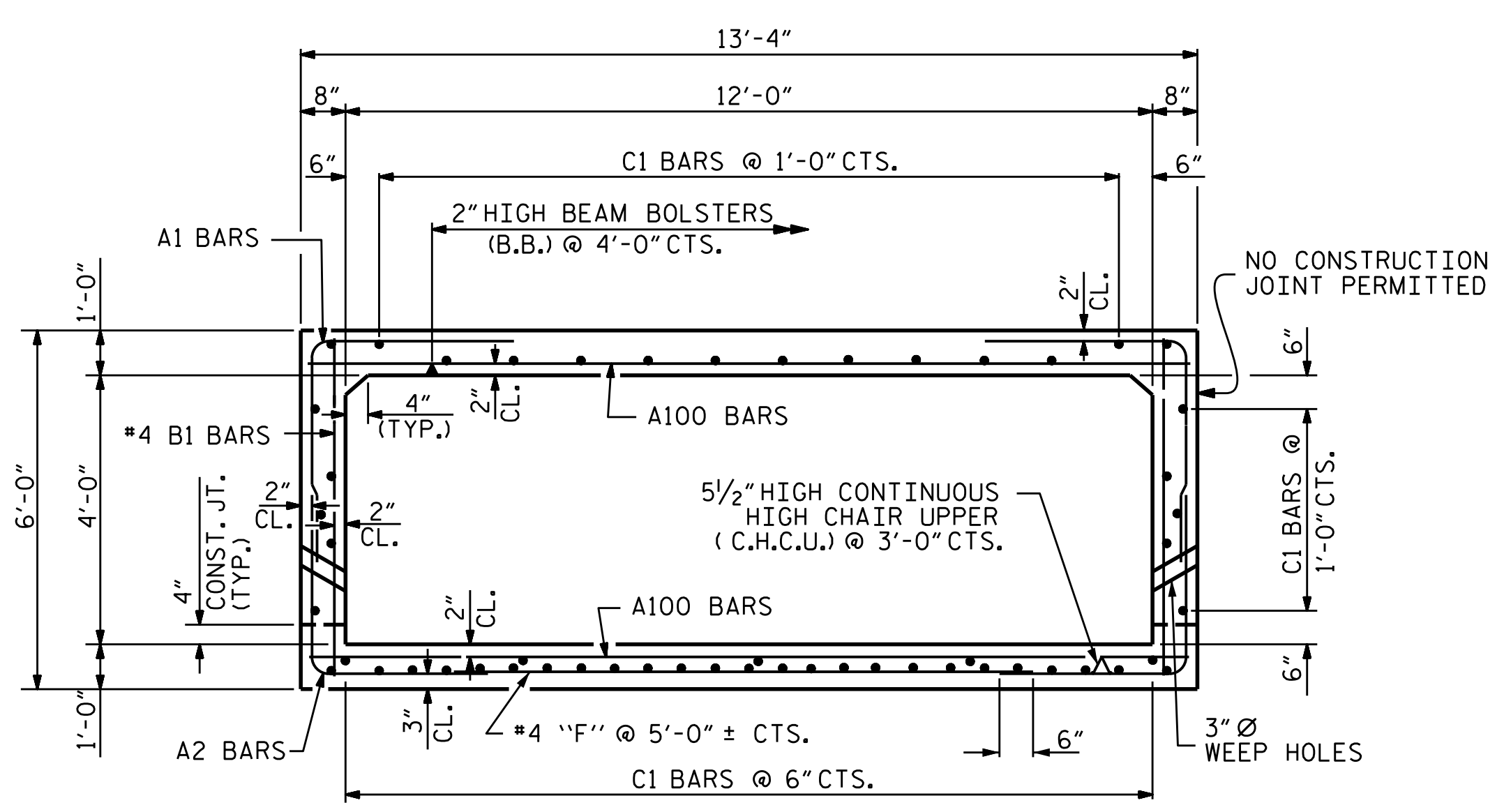


**CULVERT SECTION NORMAL TO ROADWAY (STAGE 2)**

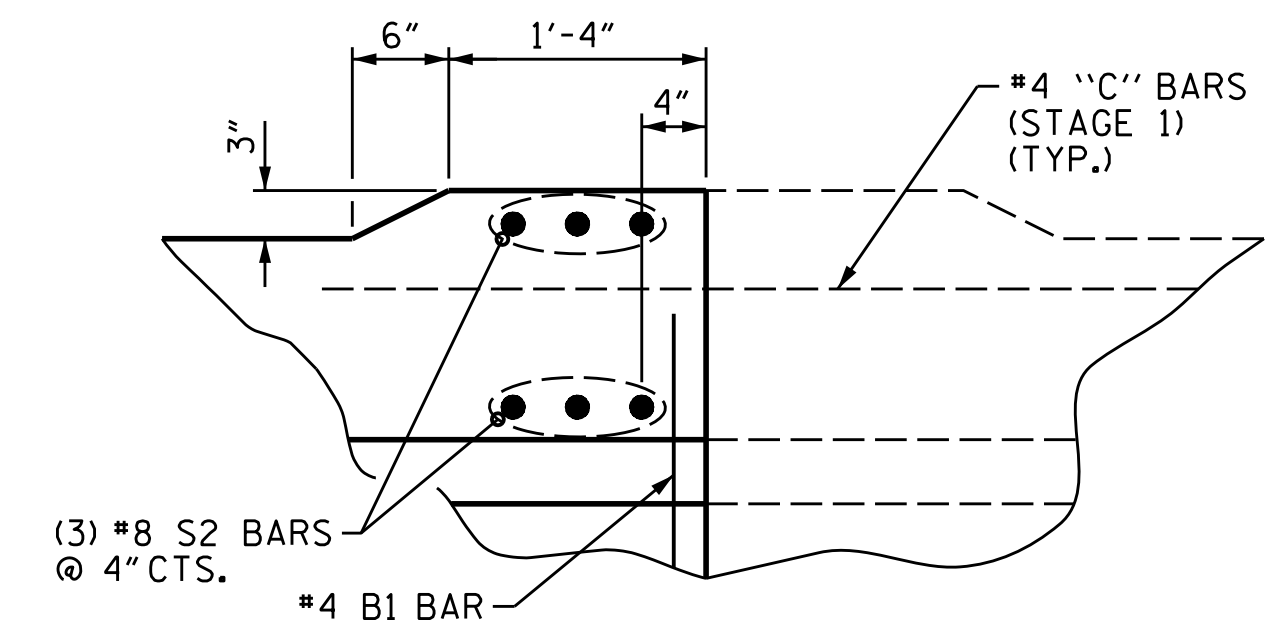


**END ELEVATION NORMAL TO HEADWALL SKEW**

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS



**RIGHT ANGLE SECTION OF BARREL**  
THERE ARE 54 "C" BARS IN SECTION OF BARREL



**DETAIL "B"**

DESIGN ENGINEER OF RECORD:  
*Nicholas Pierce*  
SEAL 37479  
NICHOLAS A. PIERCE  
ENGINEER

DATE: 1/6/2016

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Transportation & Infrastructure  
15401 Weston Parkway Suite 100  
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PROJECT NO. 17BP.14.R.90  
GRAHAM COUNTY  
STATION: 12+66.58 -L-  
SHEET 4 OF 6

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
**SINGLE 12FT. X 4FT.  
CONCRETE BOX CULVERT  
STAGE 2**

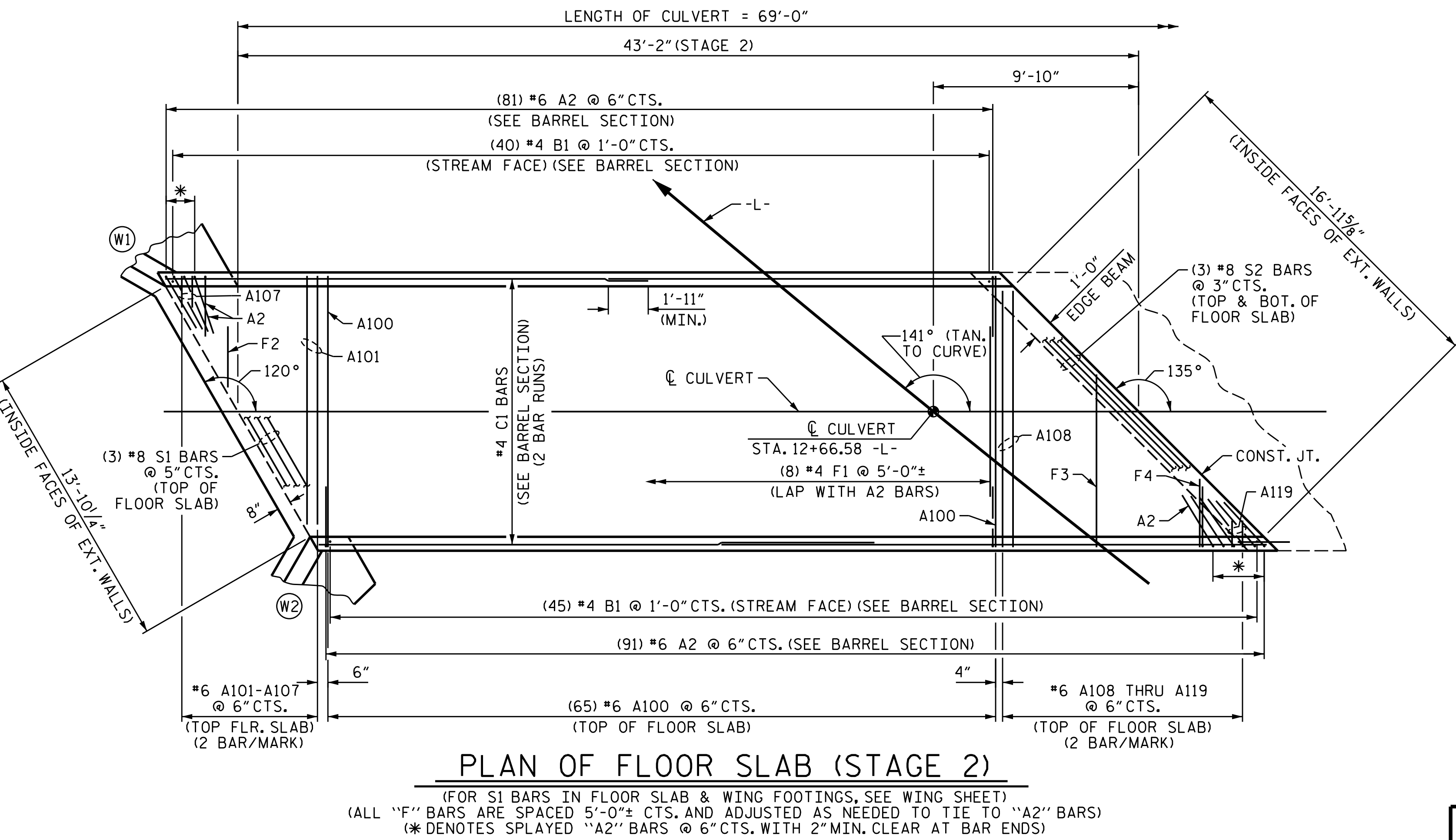
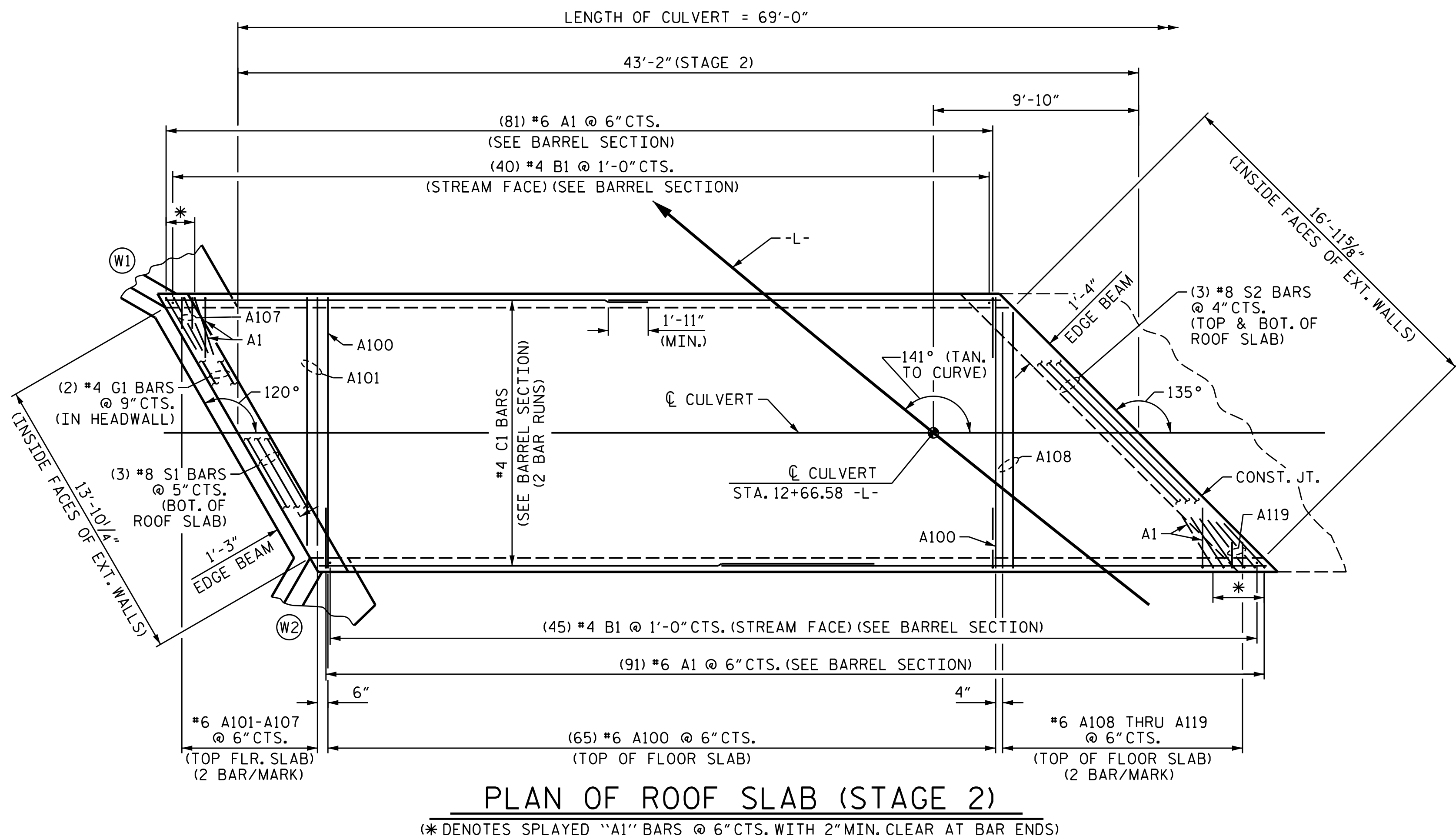
REVISIONS					SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

TOTAL SHEETS: 9

ASSEMBLED BY: M. HOBBS DATE: 08/2014  
CHECKED BY: N. PIERCE DATE: 08/2014

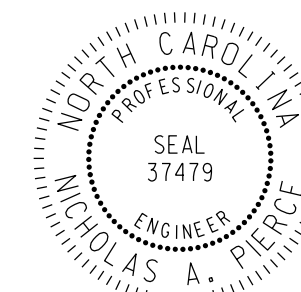
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DRAWN BY : M. HOBBS DATE : 08/2014  
 CHECKED BY : N. PIERCE DATE : 08/2014

(FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET)  
 (ALL "F" BARS ARE SPACED 5'-0"± CTS. AND ADJUSTED AS NEEDED TO TIE TO "A2" BARS)  
 (\* DENOTES SPLAYED "A2" BARS @ 6" CTS. WITH 2" MIN. CLEAR AT BAR ENDS)



DESIGN ENGINEER OF RECORD:  
 Nicholas Pierce  
 DATE: 1/6/2016



PROJECT NO. 17BP.14.R.90  
 GRAHAM COUNTY  
 STATION: 12+66.58 -L-

SHEET 5 OF 6

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

SINGLE 12FT. X 4FT.  
 CONCRETE BOX CULVERT  
 STAGE 2

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-5
1			3			TOTAL SHEETS
2			4			9

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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'-0" BETWEEN HIGH FLOW SILL.

SUPPLEMENTAL STONE OF SIMILAR CHARACTERISTICS OF THE NATIVE MATERIAL MAYBE USED AS NECESSARY WITH APPROVAL BY ENGINEER.

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.

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.

NUMBER OF SILLS DETERMINED BY THE ENGINEER.

STAGE 1 QUANTITIES			
CLASS A CONCRETE			
BARREL @ 1.1926 CY/FT	30.8	CY	
WINGS, ETC.	7.7	CY	
SILLS	1.5	CY	
TOTAL	40.0	CY	
REINFORCING STEEL			
BARREL & SILLS	6,634	LBS.	
WINGS, ETC.	322	LBS.	
TOTAL	6,956	LBS.	
* CULVERT EXCAVATION		LUMP SUM	
FOUNDATION COND. MAT'L		25 TONS	

STAGE 2 QUANTITIES			
CLASS A CONCRETE			
BARREL @ 1.1926 CY/FT	51.5	CY	
WINGS, ETC.	7.7	CY	
SILLS	2.2	CY	
TOTAL	61.4	CY	
REINFORCING STEEL			
BARREL & SILLS	10,336	LBS.	
WINGS, ETC.	322	LBS.	
TOTAL	10,658	LBS.	
* CULVERT EXCAVATION		LUMP SUM	
FOUNDATION COND. MAT'L		41 TONS	

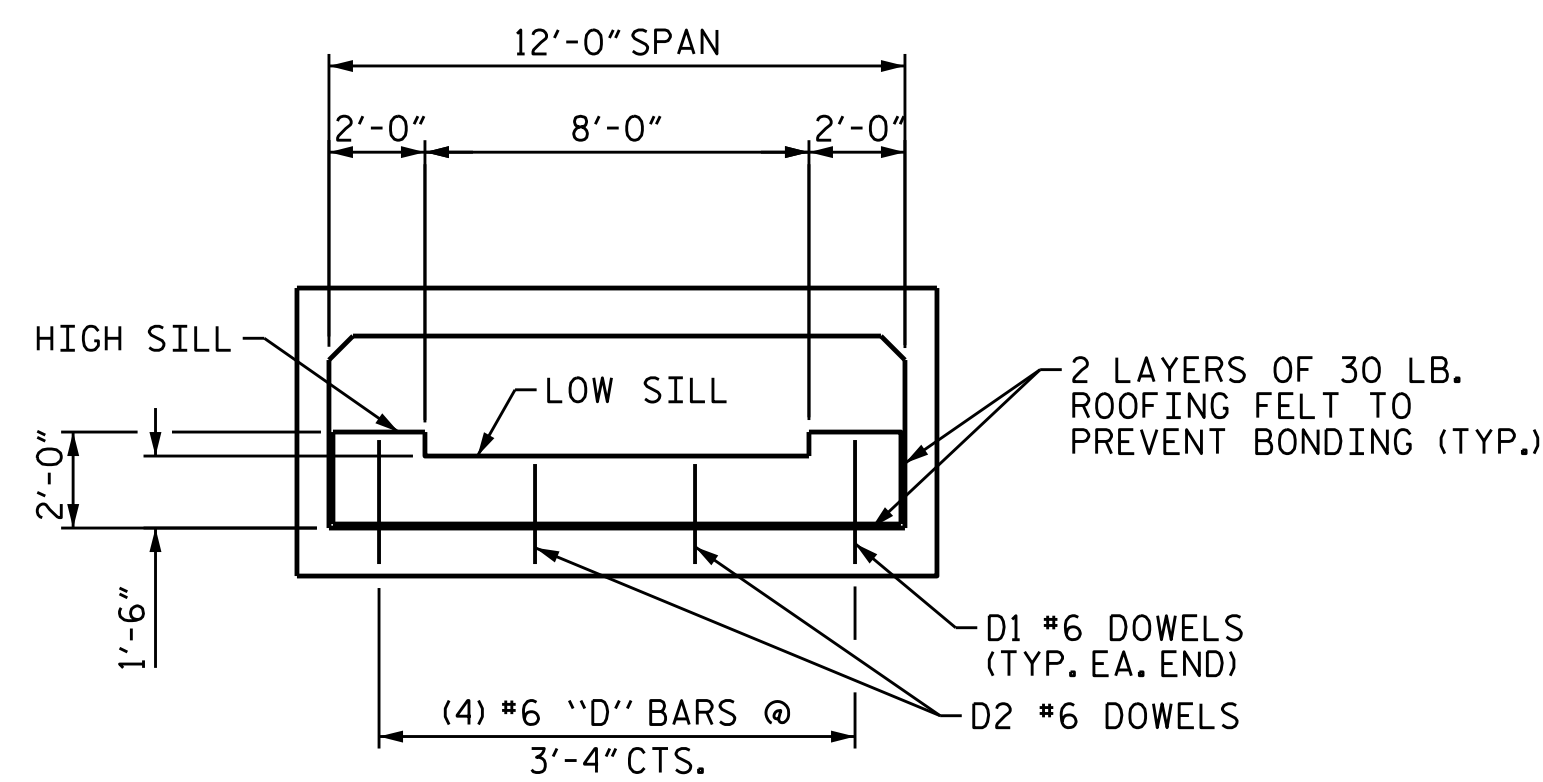
\* CULVERT EXCAVATION PAY ITEM PAID ONCE FOR THE PROJECT.

BAR TYPE		BAR SCHEDULE STAGE 1					BAR SCHEDULE STAGE 2						
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT		
A1	103	#6	1	8'-10"	1367	A1	172	#6	1	8'-10"	2282		
A2	103	#6	1	6'-10"	1057	A2	172	#6	1	6'-10"	1765		
A100	60	#6	STR	13'-0"	1172	A100	130	#6	STR	13'-0"	2538		
A101	4	#6	STR	11'-11"	72	A101	4	#6	STR	11'-11"	72		
A102	4	#6	STR	10'-2"	61	A102	4	#6	STR	10'-2"	61		
A103	4	#6	STR	8'-5"	51	A103	4	#6	STR	8'-5"	51		
A104	4	#6	STR	6'-8"	40	A104	4	#6	STR	6'-8"	40		
A105	4	#6	STR	4'-11"	30	A105	4	#6	STR	4'-11"	30		
A106	4	#6	STR	3'-3"	20	A106	4	#6	STR	3'-3"	20		
A107	4	#6	STR	1'-6"	9	A107	4	#6	STR	1'-6"	9		
A108	4	#6	STR	12'-3"	74	A108	4	#6	STR	12'-3"	74		
A109	4	#6	STR	11'-3"	68	A109	4	#6	STR	11'-3"	68		
A110	4	#6	STR	10'-3"	62	A110	4	#6	STR	10'-3"	62		
A111	4	#6	STR	9'-3"	56	A111	4	#6	STR	9'-3"	56		
A112	4	#6	STR	8'-3"	50	A112	4	#6	STR	8'-3"	50		
A113	4	#6	STR	7'-3"	44	A113	4	#6	STR	7'-3"	44		
A114	4	#6	STR	6'-3"	38	A114	4	#6	STR	6'-3"	38		
A115	4	#6	STR	5'-3"	32	A115	4	#6	STR	5'-3"	32		
A116	4	#6	STR	4'-3"	26	A116	4	#6	STR	4'-3"	26		
A117	4	#6	STR	3'-3"	20	A117	4	#6	STR	3'-3"	20		
A118	4	#6	STR	2'-3"	14	A118	4	#6	STR	2'-3"	14		
A119	4	#6	STR	1'-3"	8	A119	4	#6	STR	1'-3"	8		
B1	51	#4	STR	5'-8"	193	B1	85	#4	STR	5'-8"	322		
C1	108	#4	STR	16'-1"	1160	C1	108	#4	STR	23'-8"	1707		
D1	4	#6	STR	2'-7"	16	D1	6	#6	STR	2'-7"	23		
D2	4	#6	STR	2'-1"	13	D2	6	#6	STR	2'-1"	19		
G1	2	#4	STR	15'-0"	20	G1	2	#4	STR	15'-0"	20		
F1	4	#4	STR	8'-9"	23	F1	8	#4	STR	8'-9"	47		
F2	1	#4	STR	5'-0"	3	F2	1	#4	STR	5'-0"	3		
F3	1	#4	STR	8'-3"	6	F3	1	#4	STR	8'-3"	6		
F4	1	#4	STR	3'-3"	2	F4	1	#4	STR	3'-3"	2		
S1	6	#8	STR	15'-0"	240	S1	6	#8	STR	15'-0"	240		
S2	12	#8	STR	18'-4"	587	S2	12	#8	STR	18'-4"	587		
REINFORCING STEEL					LBS.	6,634	REINFORCING STEEL					LBS.	10,336

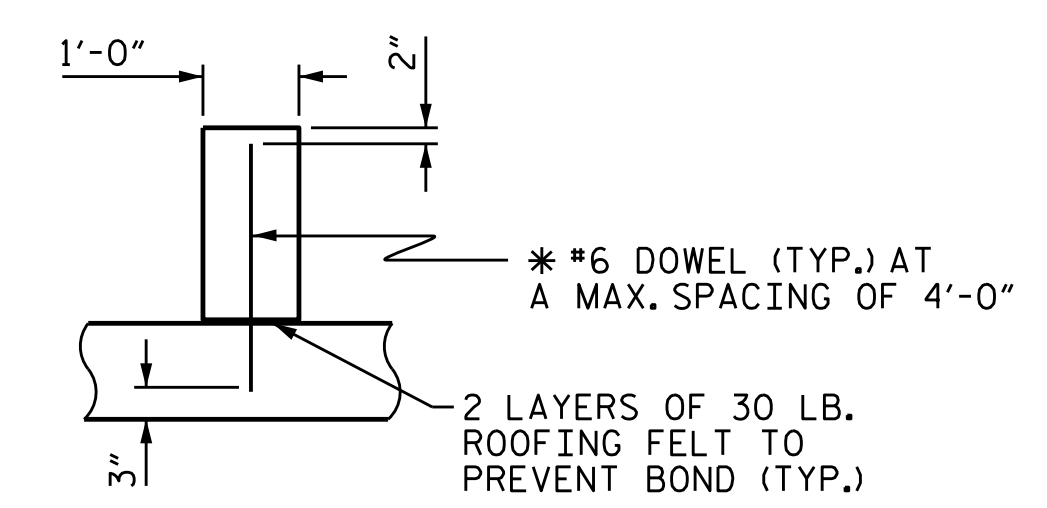
BAR DIMENSIONS ARE OUT TO OUT.

**SPLICE LENGTH TABLE**

BAR	SIZE	LENGTH
C	4	1'-11"

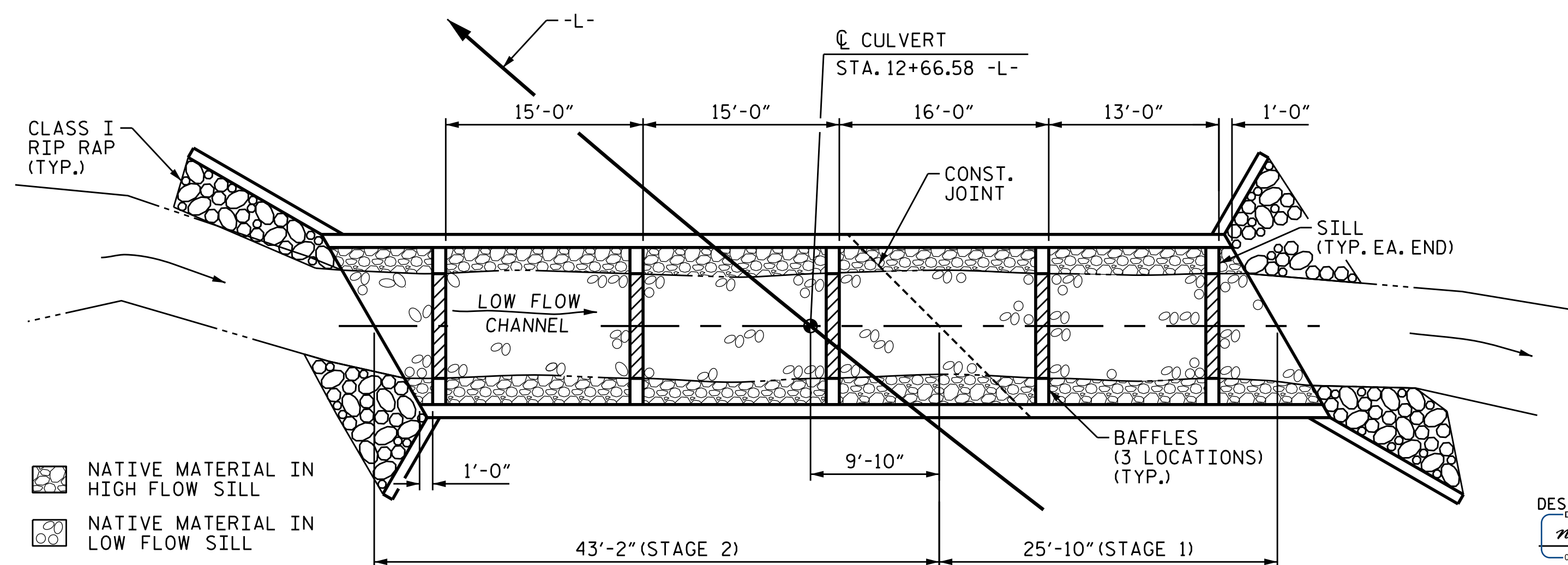


**ELEVATION**  
LOOKING DOWNSTREAM



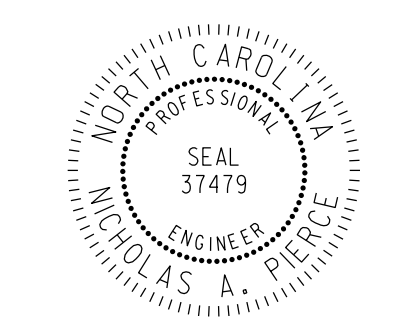
**SECTION THROUGH SILL**  
\* DOWELS MAY BE PUSHED INTO GREEN CONCRETE AFTER SLAB HAS BEEN FLOAT FINISHED

**CULVERT SILL DETAILS**



**PLAN OF FLOOR SILL LAYOUT**

LOW FLOW SILLS DENOTED BY CROSSHATCHED AREA.



DESIGN ENGINEER OF RECORD:  
*Nicholas Pierce*  
DATE: 4/20/2016

**WSP**  
Transportation & Infrastructure  
15401 Weston Parkway Suite 100  
Cary, NC 27513 - 919.678.0035  
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PROJECT NO. 17BP.14.R.90  
GRAHAM COUNTY  
STATION: 12+66.58 -L-

SHEET 6 OF 6

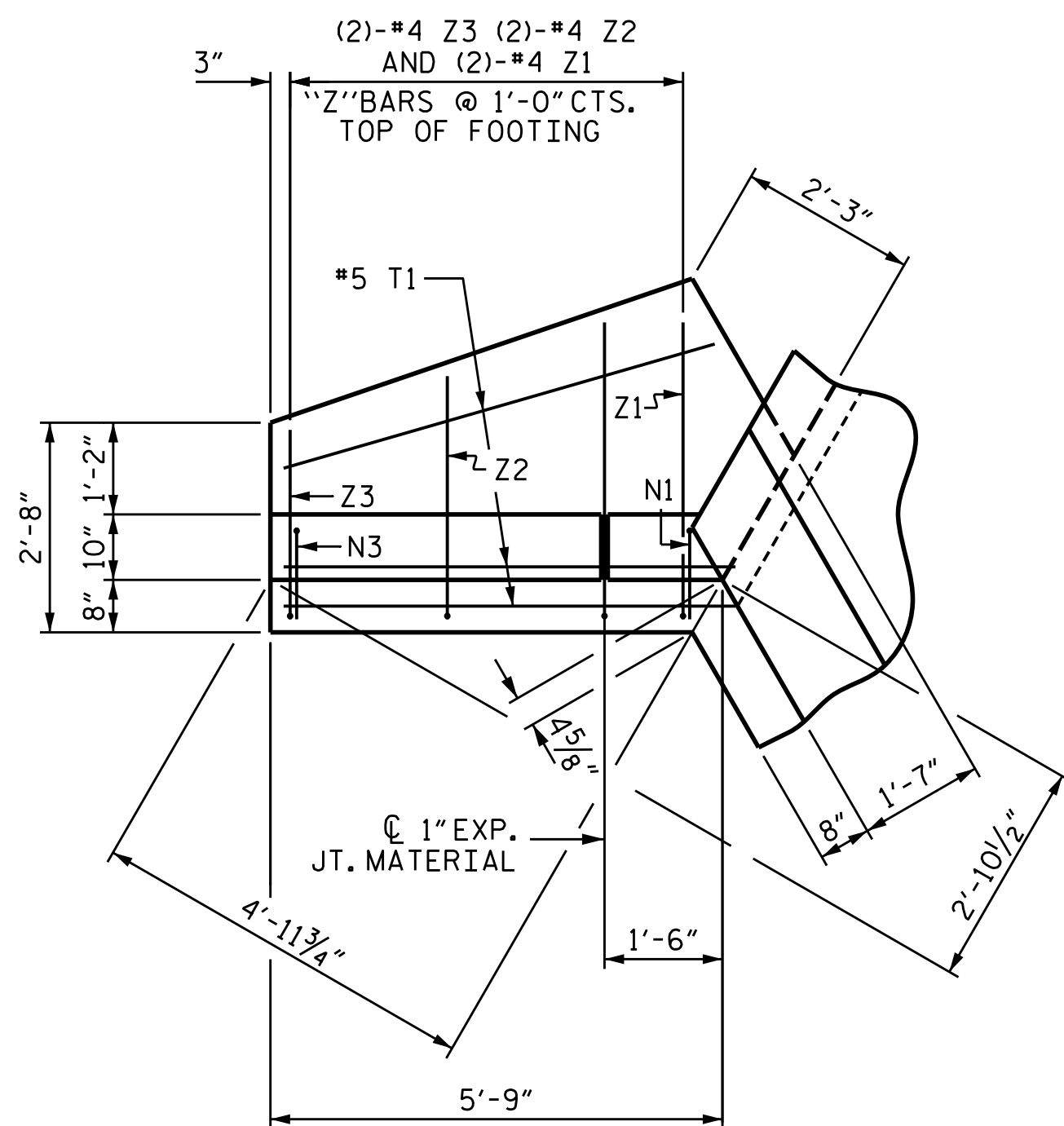
STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
SINGLE 12FT. X 4FT.  
CONCRETE BOX CULVERT  
STAGES 1 & 2  
BILL OF MATERIAL

REVISIONS						TOTAL SHEETS
NO.	BY:	DATE:	NO.	BY:	DATE:	9
1			3			
2			4			

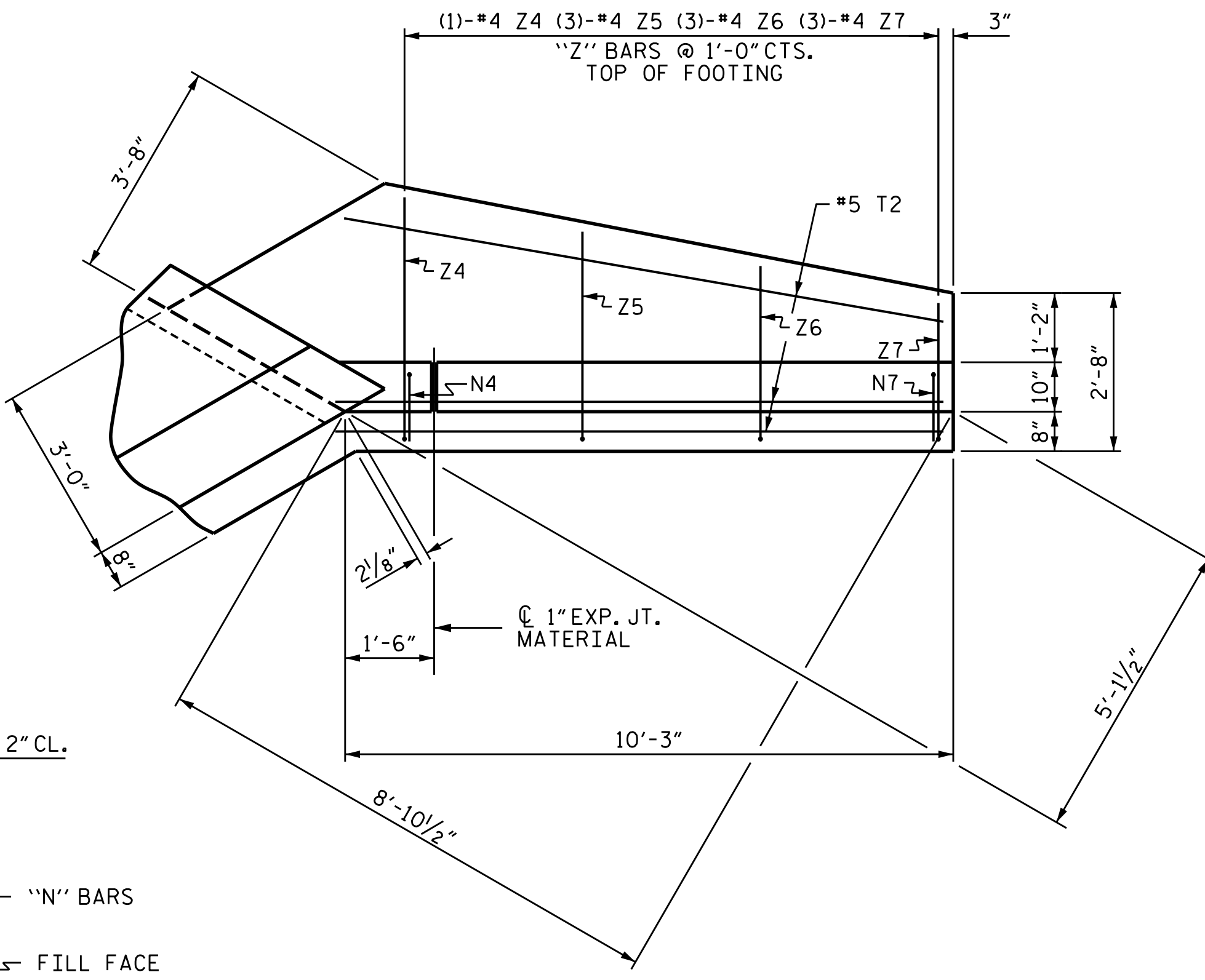
DRAWN BY : M. HOBBS DATE : 08/2014  
CHECKED BY : N. PIERCE DATE : 08/2014

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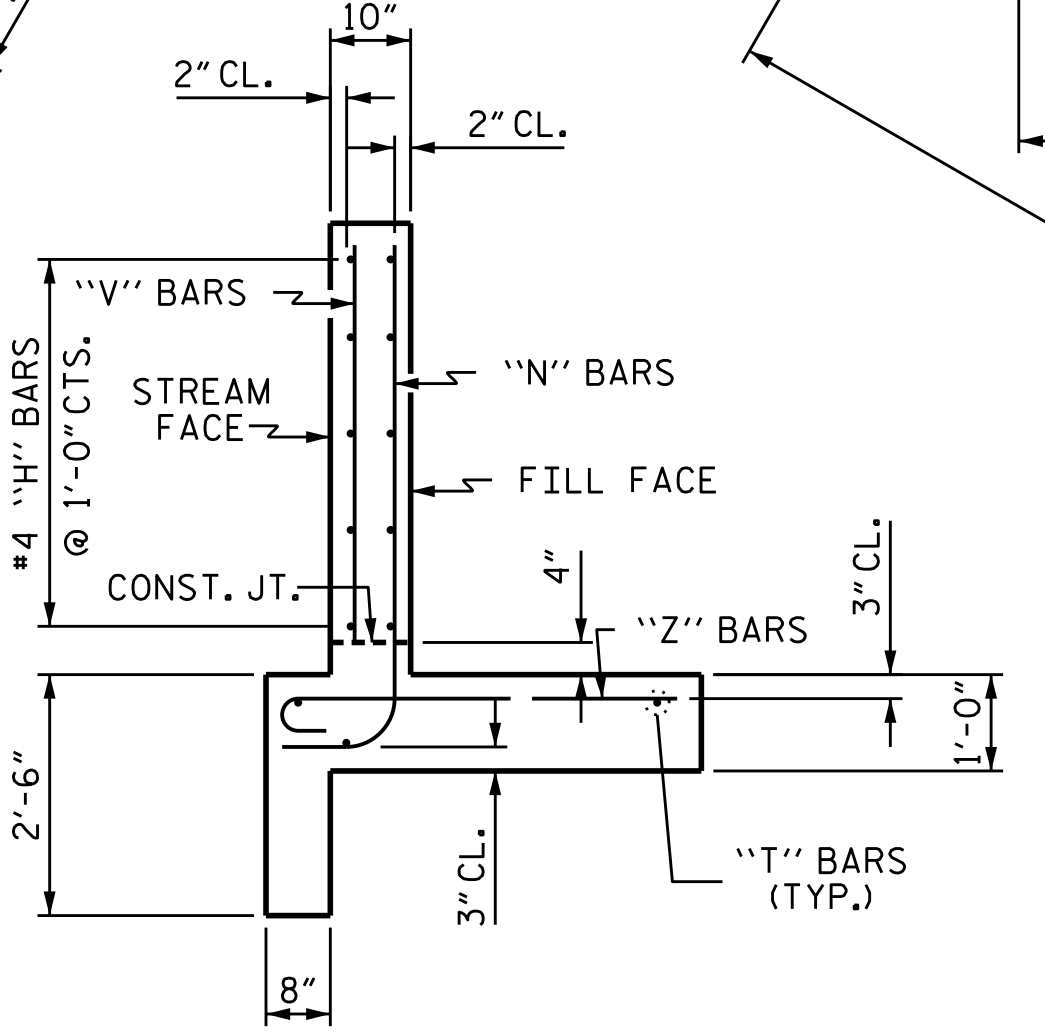




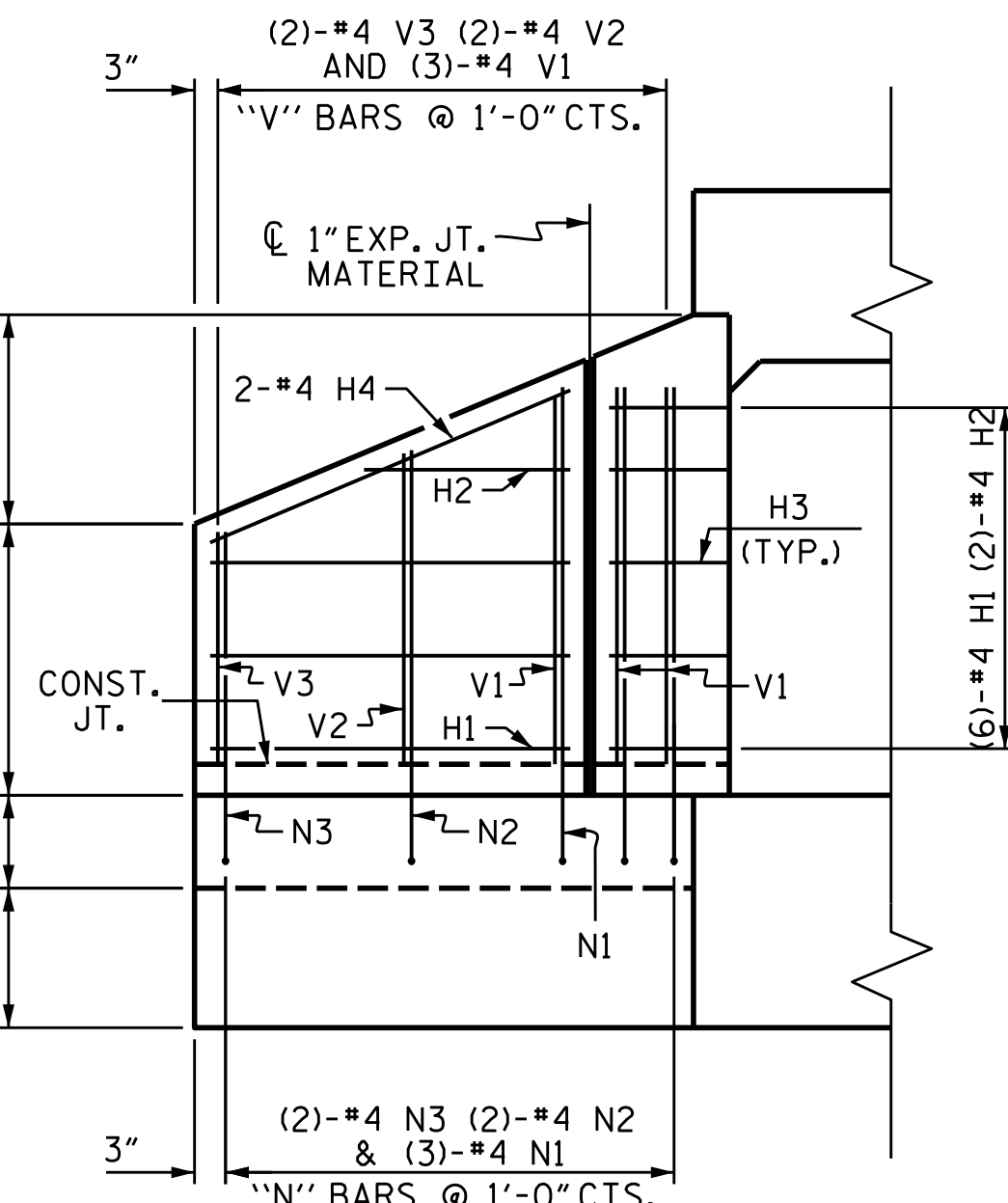
PLAN W2



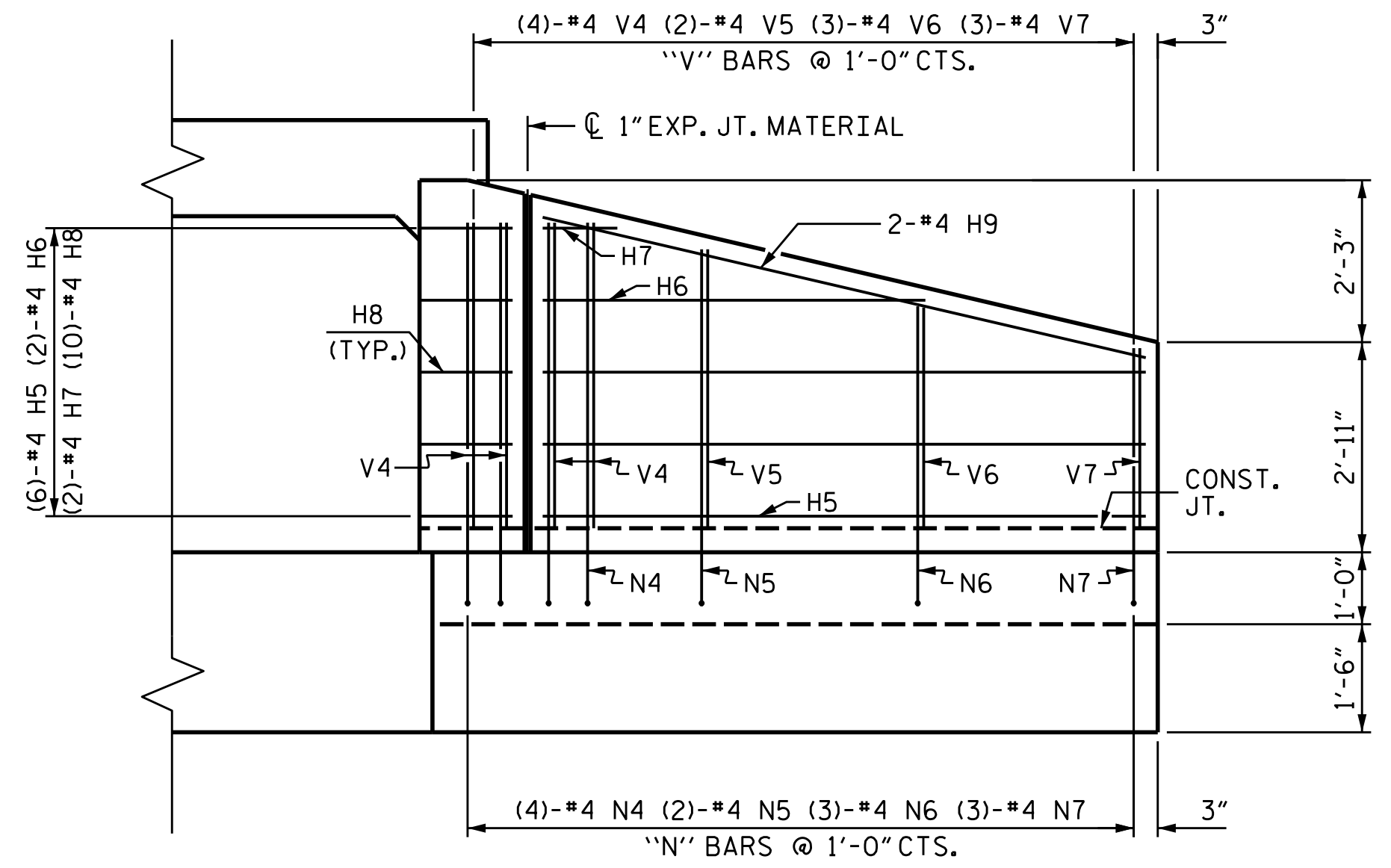
PLAN W1



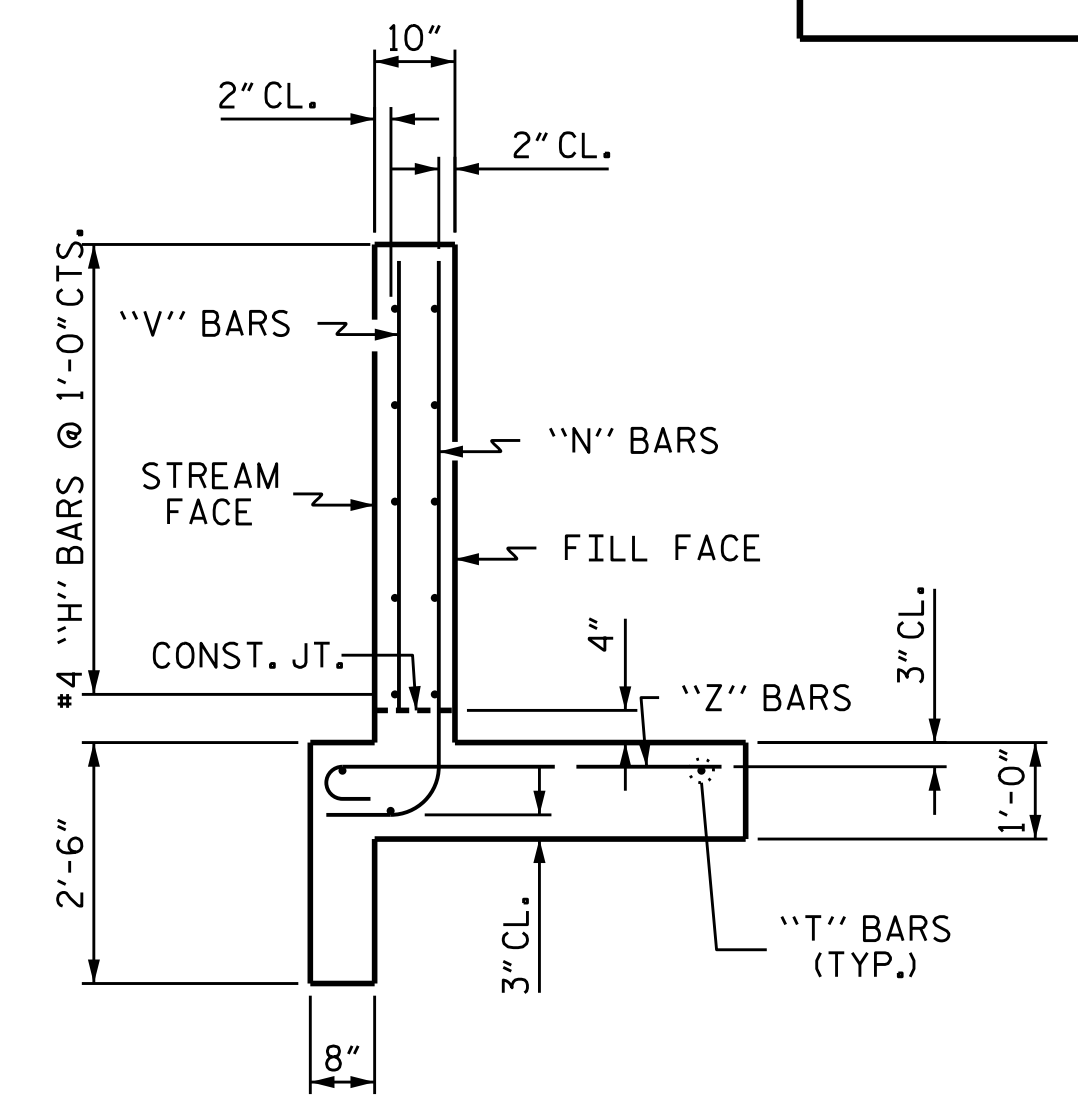
WING W2 SECTION



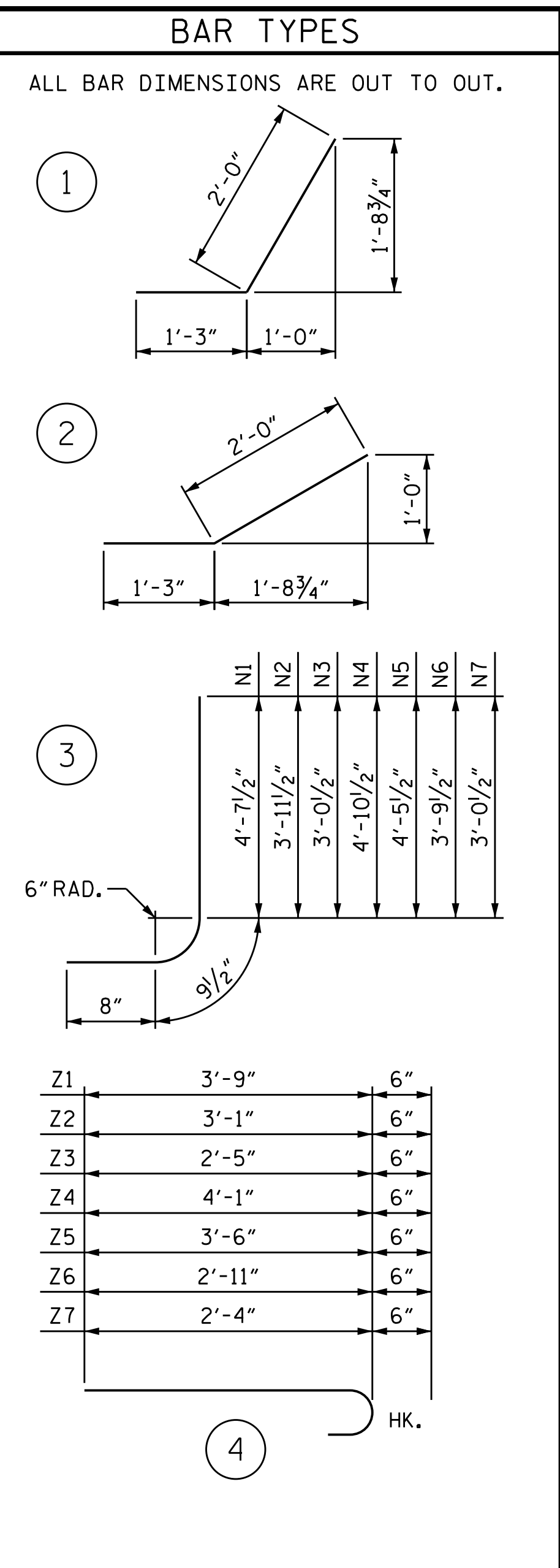
ELEVATION W2



ELEVATION W1



WING W1 SECTION



BILL OF MATERIAL					
BAR NO.	SIZE	TYPE	LENGTH	WEIGHT	
H1	12	#4	STR	3'-10"	31
H2	4	#4	STR	2'-2"	6
H3	20	#4	1	3'-3"	43
H4	4	#4	STR	4'-2"	11
H5	12	#4	STR	8'-4"	67
H6	4	#4	STR	5'-3"	14
H7	4	#4	STR	1'-0"	3
H8	20	#4	2	3'-3"	43
H9	4	#4	STR	8'-7"	23
N1	6	#4	3	6'-1"	24
N2	4	#4	3	5'-5"	14
N3	4	#4	3	4'-6"	12
N4	8	#4	3	6'-4"	34
N5	4	#4	3	5'-11"	16
N6	6	#4	3	5'-3"	21
N7	6	#4	3	4'-6"	18
T1	6	#5	STR	5'-9"	36
T2	6	#5	STR	10'-3"	64
V1	6	#4	STR	4'-0"	16
V2	4	#4	STR	3'-4"	9
V3	4	#4	STR	2'-6"	7
V4	8	#4	STR	4'-3"	23
V5	4	#4	STR	3'-10"	10
V6	6	#4	STR	3'-2"	13
V7	6	#4	STR	2'-5"	10
Z1	4	#4	4	4'-3"	11
Z2	4	#4	4	3'-7"	10
Z3	4	#4	4	2'-11"	8
Z4	2	#4	4	4'-7"	6
Z5	6	#4	4	4'-0"	16
Z6	6	#4	4	3'-5"	14
Z7	6	#4	4	2'-10"	11
REINFORCING STEEL FOR 4 WINGS				644	LBS
CLASS A CONCRETE (STAGE 1)					
2 WINGS			5.3	CY	
1 HEADWALLS			0.7	CY	
1 END CURTAIN WALLS			0.8	CY	
2 EDGE BEAMS			0.9	CY	
TOTAL				7.7	CY
CLASS A CONCRETE (STAGE 2)					
2 WINGS			5.3	CY	
1 HEADWALLS			0.7	CY	
1 END CURTAIN WALLS			0.8	CY	
2 EDGE BEAMS			0.9	CY	
TOTAL				7.7	CY



DESIGN ENGINEER OF RECORD:  
*Nicholas Pierce*  
 DATE: 1/6/2016



PROJECT NO. 17BP.14.R.90  
 GRAHAM COUNTY  
 STATION: 12+66.58 -L-

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**WINGS FOR CONCRETE BOX CULVERT**  
 H = 4'-0" SLOPE = 2:1  
 60° OR 120° SKEW  
 STAGE 1 & 2

ASSEMBLED BY : M HOBBS DATE : 08/14  
 CHECKED BY : N. PIERCE DATE : 08/14

**DOCUMENT NOT CONSIDERED FINAL  
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REVISIONS					SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

TOTAL SHEETS: 9



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 7/16" 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.

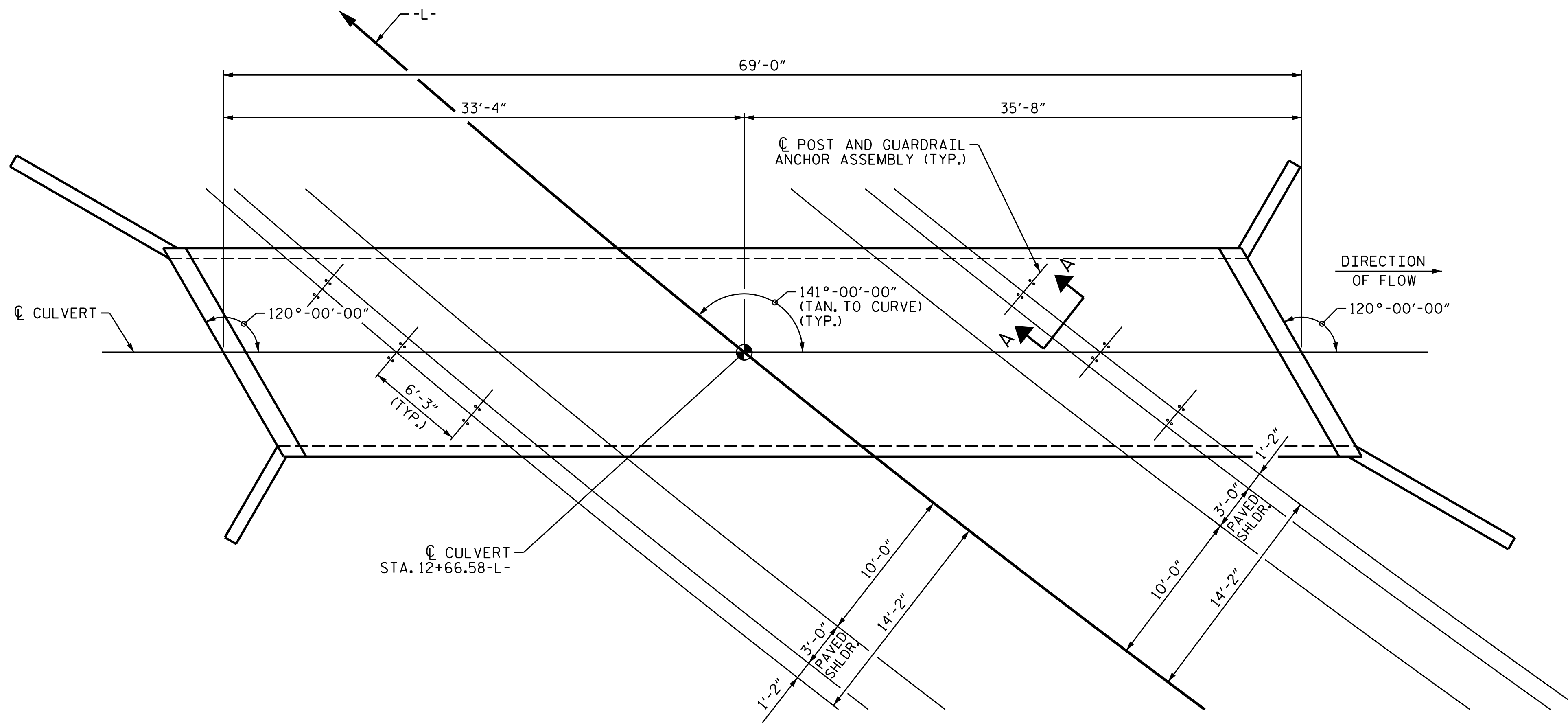
AT THE CONTRACTOR'S OPTION, FERRULES WITH OPEN OR CLOSED ENDS MAY BE USED.

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.

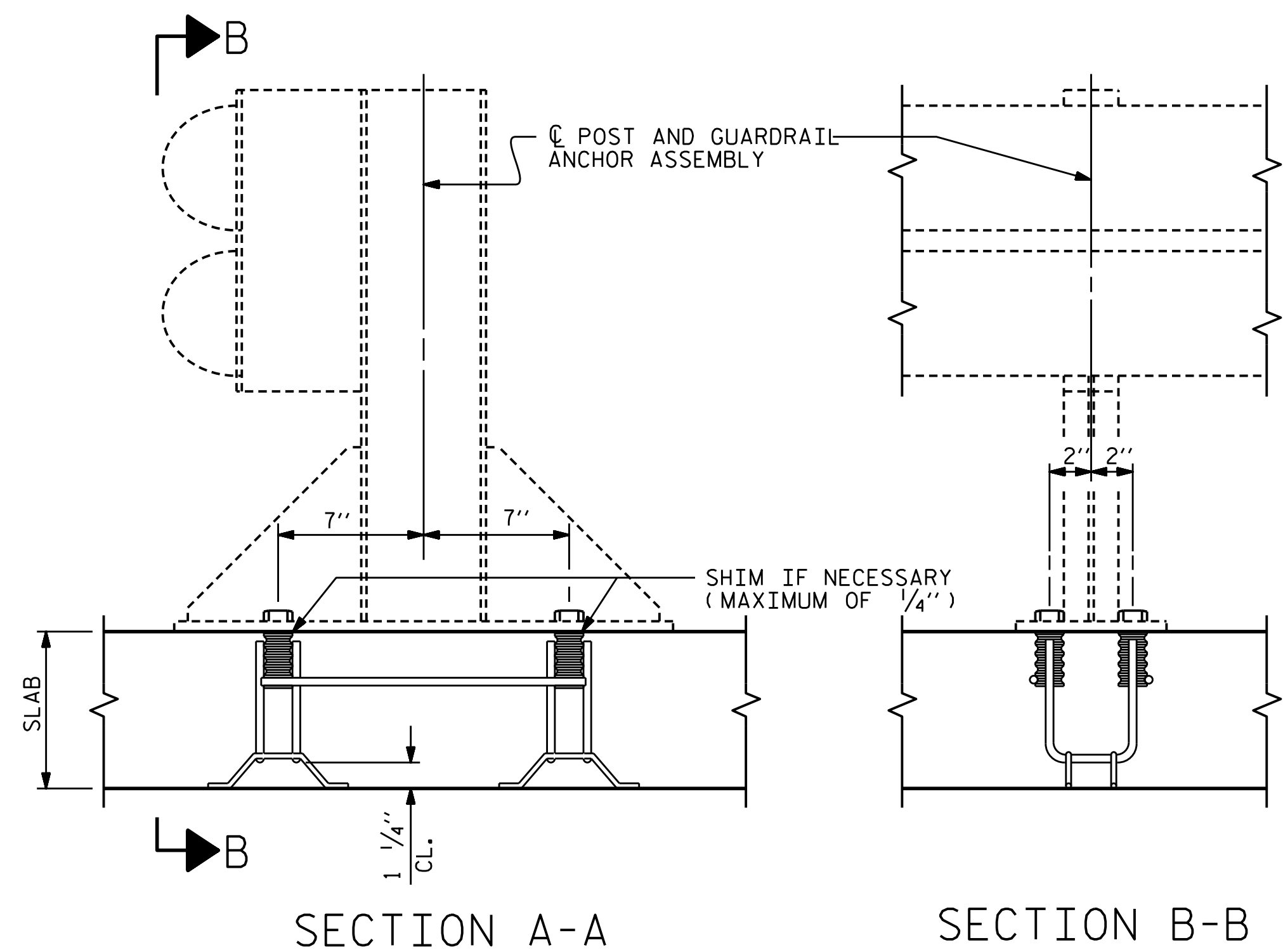
THE CONTRACTOR MAY USE ADHESIVELY ANCHORED ANCHOR BOLTS IN PLACE OF GUARDRAIL ANCHOR ASSEMBLY. LEVEL TWO FIELD TESTING IS REQUIRED, AND THE YIELD LOAD OF THE 1" Ø BOLT IS 21.8 KIPS. FOR ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS, SEE STANDARD SPECIFICATIONS.

FOR CULVERTS 24FT OR LESS, SEE ROADWAY STD 862.01 SHEET 10 OF 12 AS OPTIONAL GUARDRAIL PLACEMENT.



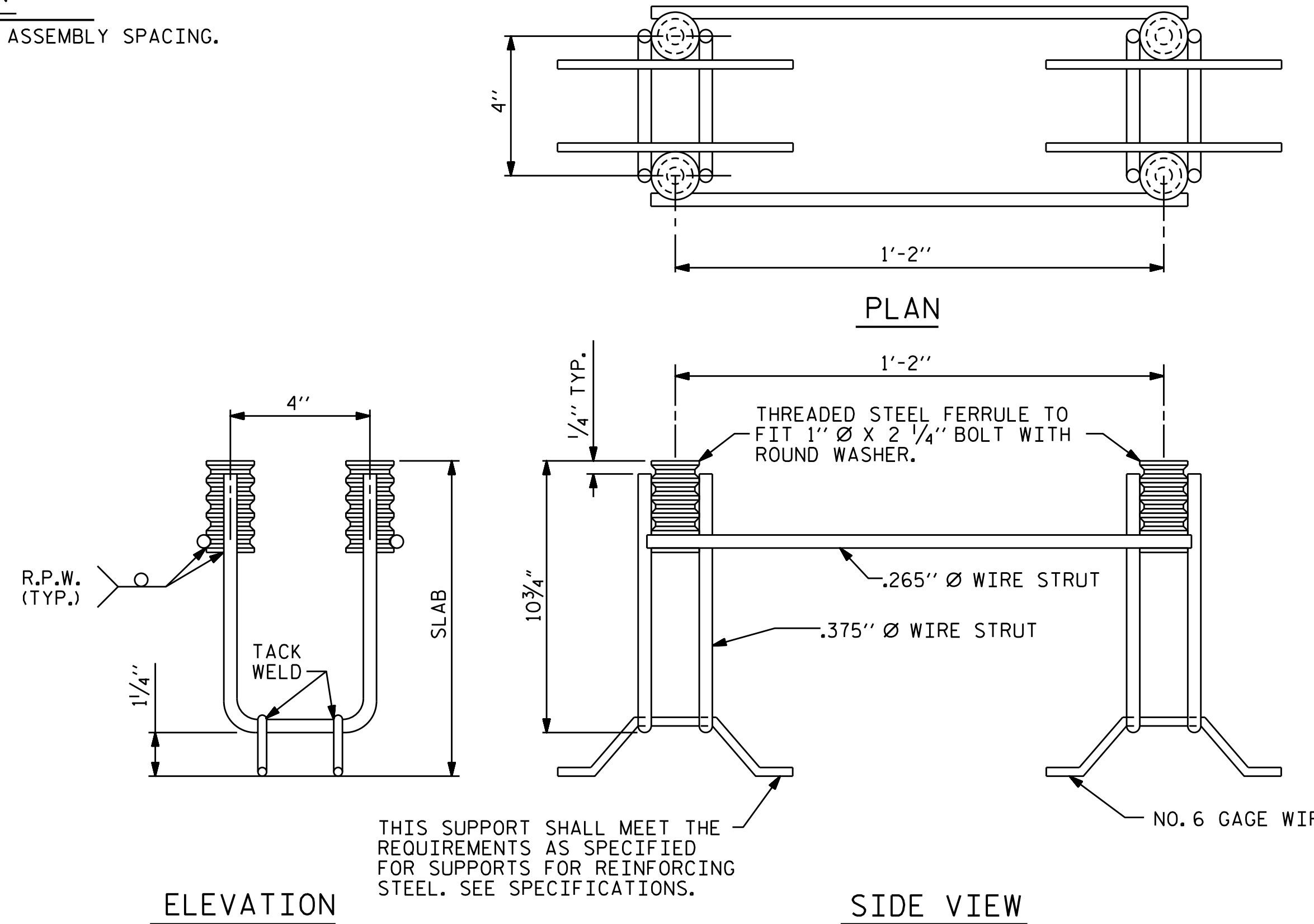
PLAN

SHOWING : GUARDRAIL ANCHOR ASSEMBLY SPACING.



SECTION A-A

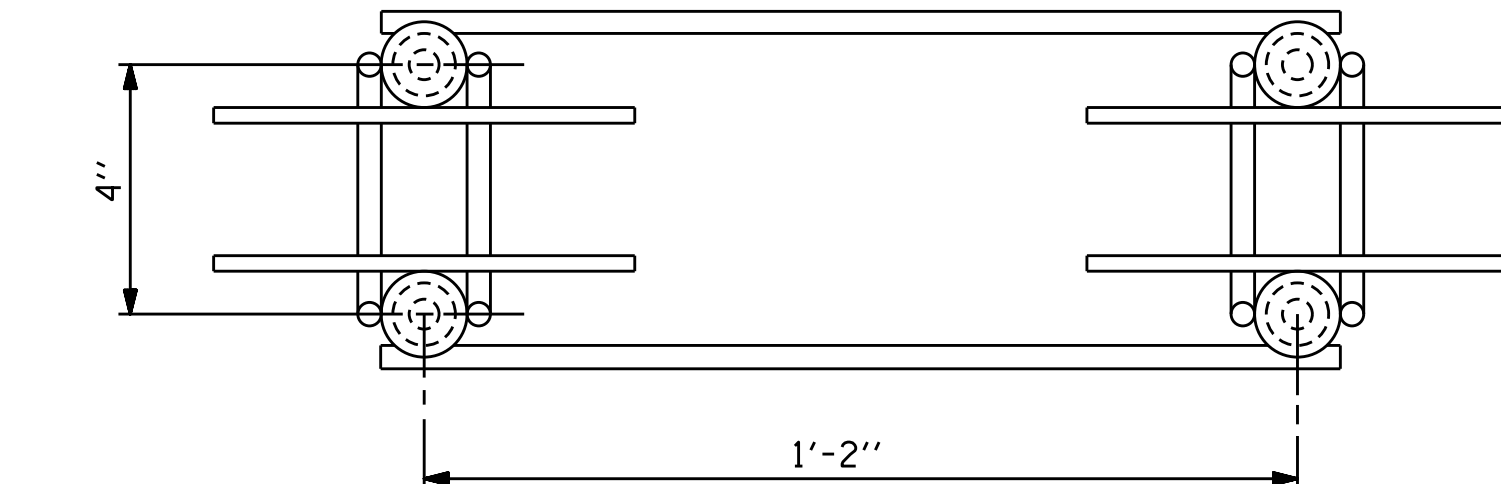
SECTION B-B



ELEVATION

SIDE VIEW

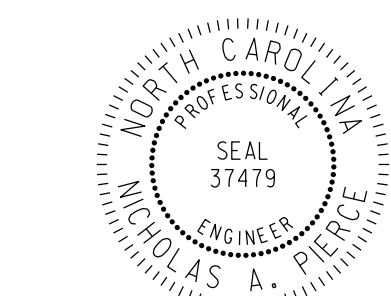
GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS



PLAN

DESIGN ENGINEER OF RECORD:  
*Nicholas Perce*  
08F097FA0470438 1/6/2016

**WSP**  
 Transportation & Infrastructure  
 15401 Weston Parkway Suite 100  
 Cary, NC 27513 - 919.678.0035  
 www.wspgroup.com  
 LICENSE NO. F-0891



PROJECT NO. 17BP.14.R.90  
 GRAHAM COUNTY  
 STATION: 12+66.58 -L-

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

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-8
1			3			TOTAL SHEETS
2			4			9

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

STD. NO. GRA1

ASSEMBLED BY : M. HOBBS	DATE : 08/2014
CHECKED BY : N. PIERCE	DATE : 08/2014
DRAWN BY : FCJ 6/88	REV. 7/10/01 LES/RDR
CHECKED BY : ARB 6/88	REV. 5/7/03 RWW/JTE
	REV. 5/1/06R KMM/GM

## 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 (%LL)	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	1.28	--	1.75	1.36	1	TOP SLAB	6.67	1.28	1	TOP SLAB	0.67		
	HL-93 (OPERATING)	N/A		1.65	--	1.35	1.77	1	TOP SLAB	6.67	1.65	1	TOP SLAB	0.67		
	HS-20 (INVENTORY)	36.000	②	1.40	50.40	1.75	1.40	1	TOP SLAB	6.67	1.75	1	TOP SLAB	0.67		
	HS-20 (OPERATING)	36.000		1.82	65.52	1.35	1.82	1	TOP SLAB	6.67	2.26	1	TOP SLAB	0.67		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.55	34.43	1.40	2.55	1	TOP SLAB	6.67	3.55	1	TOP SLAB	0.67	
		SNGARBS2	20.000		2.39	47.80	1.40	2.39	1	TOP SLAB	6.67	3.27	1	TOP SLAB	0.67	
		SNAGRIS2	22.000		2.55	56.10	1.40	2.55	1	TOP SLAB	6.67	3.55	1	TOP SLAB	0.67	
		SNCOTTS3	27.250	③	1.59	43.33	1.40	1.70	1	TOP SLAB	6.67	1.59	1	TOP SLAB	0.67	
		SNAGGRS4	34.925		1.87	65.31	1.40	1.87	1	TOP SLAB	6.67	2.00	1	TOP SLAB	0.67	
		SNS5A	35.550		1.85	63.92	1.40	1.85	1	TOP SLAB	6.67	1.88	1	TOP SLAB	0.67	
		SNS6A	39.950		1.86	74.31	1.40	1.86	1	TOP SLAB	6.67	1.92	1	TOP SLAB	0.67	
		SNS7B	42.000		1.86	78.12	1.40	1.86	1	TOP SLAB	6.67	1.86	1	TOP SLAB	0.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.55	84.15	1.40	2.55	1	TOP SLAB	6.67	3.02	1	TOP SLAB	0.67	
		TNT4A	33.075		2.03	67.14	1.40	2.03	1	TOP SLAB	6.67	2.03	1	TOP SLAB	0.67	
		TNT6A	41.600		1.86	77.38	1.40	1.86	1	TOP SLAB	6.67	1.88	1	TOP SLAB	0.67	
		TNT7A	42.000		1.94	81.48	1.40	1.94	1	TOP SLAB	6.67	1.95	1	TOP SLAB	0.67	
		TNT7B	42.000		1.86	78.12	1.40	1.86	1	TOP SLAB	6.67	1.92	1	TOP SLAB	0.67	
		TNAGRIT4	43.000		2.03	87.29	1.40	2.03	1	TOP SLAB	6.67	2.03	1	TOP SLAB	0.67	
TNAGT5A	45.000		2.02	90.90	1.40	2.03	1	TOP SLAB	6.67	2.02	1	TOP SLAB	0.67			
TNAGT5B	45.000		2.02	90.90	1.40	2.03	1	TOP SLAB	6.67	2.02	1	TOP SLAB	0.67			

### 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	--

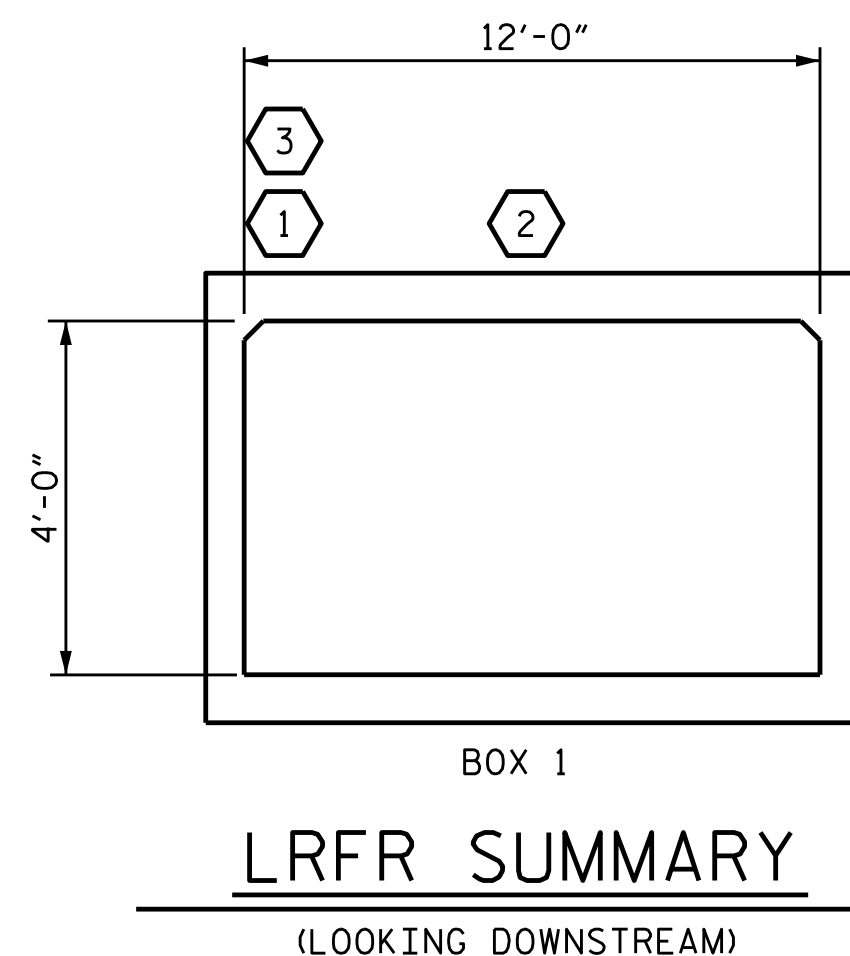
### NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

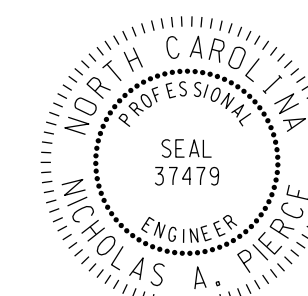
### COMMENTS:

- 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	



PROJECT NO. 17BP.14.R.90  
GRAHAM COUNTY  
STATION: 12+66.58 -L-



DESIGN ENGINEER OF RECORD:  
*Nicholas Pierce*  
DATE: 1/6/2016



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-9
1			3			TOTAL SHEETS 9
2			4			

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

ASSEMBLED BY : C. HOWARD	DATE : 8/14
CHECKED BY : N. PIERCE	DATE : 8/14
DRAWN BY : WMC	7/11
CHECKED BY : GM	7/11
REV. 10/1/11	MAA/GM



## 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 2012 "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 3/4" WITH THE FOLLOWING EXCEPTIONS: TOP CORNERS OF CURBS MAY BE ROUNDED TO 1-1/2" RADIUS WHICH IS BUILT INTO CURB FORMS; CORNERS OF TRANSVERSE FLOOR EXPANSION JOINTS SHALL BE ROUNDED WITH A 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 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 7/8" Ø SHEAR STUDS FOR THE 3/4" Ø STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 - 7/8" Ø STUDS FOR 4 - 3/4" Ø STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF 7/8" Ø STUDS ALONG THE BEAM AS SHOWN FOR 3/4" Ø STUDS BASED ON THE RATIO OF 3 - 7/8" Ø STUDS FOR 4 - 3/4" Ø 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 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 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. FINIS 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