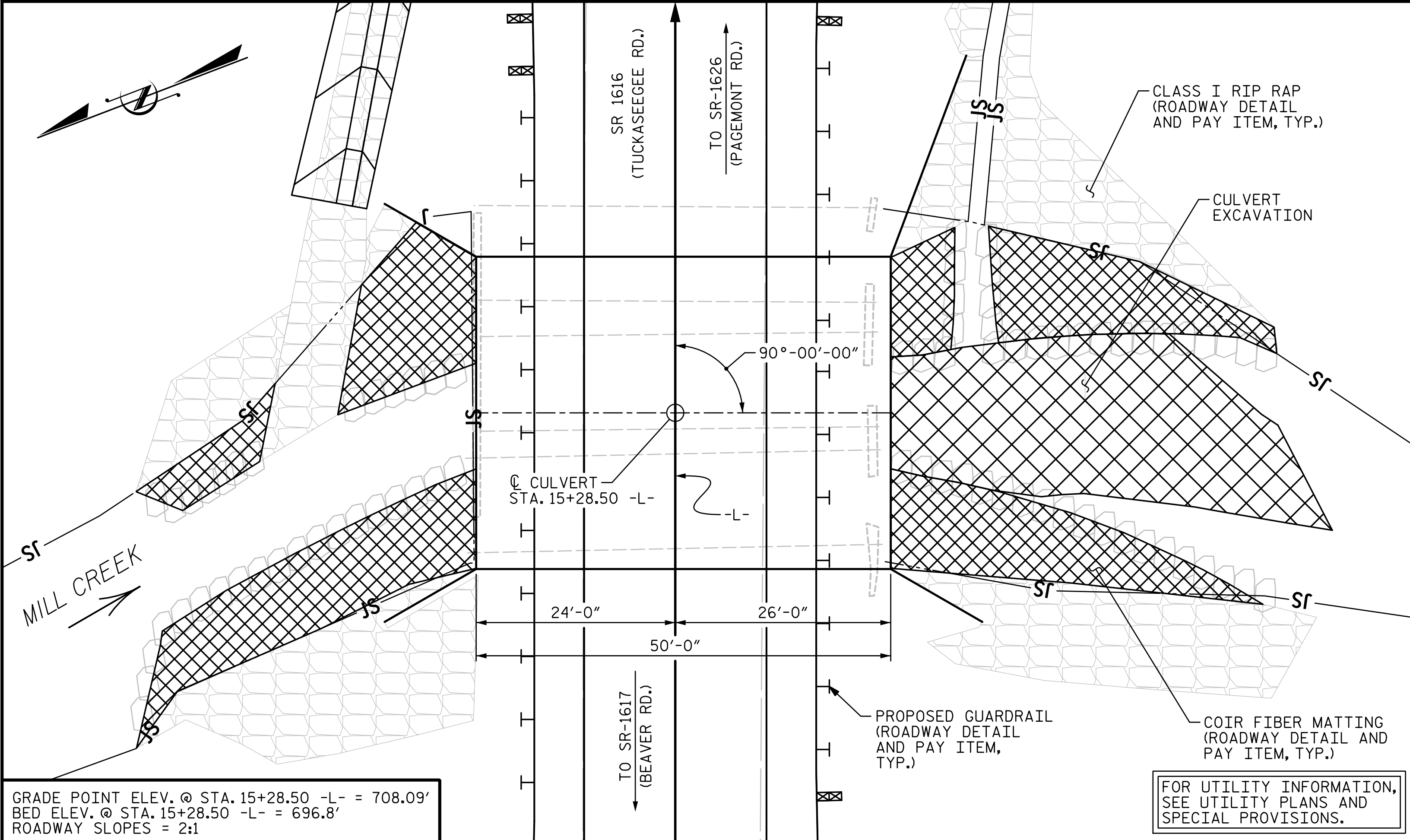


BENCHMARK BM-1: 10" SPIKE IN BASE OF 15" OAK, 34.29' LEFT, STA. 12+02.69 -L-, N 641986.3516, E 1494238.7767, EL. 718.27



GRADE POINT ELEV. @ STA. 15+28.50 -L- = 708.09'  
 BED ELEV. @ STA. 15+28.50 -L- = 696.8'  
 ROADWAY SLOPES = 2:1

FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

NOTES:

- ASSUMED LIVE LOAD-----HL-93 OR ALTERNATE LOADING.
- DESIGN FILL-----3.34' MAX. AND 2.61' MIN.
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- THE EXISTING STRUCTURE CONSISTING OF A TRIPLE 138" X 96" CORRUGATED METAL PIPE ARCH CULVERT AND LOCATED AT THE PROPOSED STRUCTURE SHALL BE REMOVED.
- REMOVAL OF THE EXISTING STRUCTURE 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 STRUCTURE IN ACCORDANCE WITH ARTICLE 402-2 OF THE STANDARD SPECIFICATIONS.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
  1. WING FOOTINGS AND FLOOR SLAB FOR EACH PHASE INCLUDING 4" OF ALL VERTICAL WALLS.
  2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FOR EACH PHASE FULL HEIGHT FOLLOWED BY THE SILLS.
  3. ROOF SLAB AND HEADWALLS.
- 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.
- DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON THE WING SHEETS.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF THE EXTERIOR WALL AND BOTH FACES OF INTERIOR WALLS ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE 2'-4" FOR #5 BARS AND 1'-10" FOR #4 BARS. EXTRA WEIGHT OF STEEL DUE TO SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- STEEL IN THE BOTTOM SLAB MAY BE SPLICED AT THE PERMITTED CONSTRUCTION JOINT AT THE CONTRACTOR'S OPTION. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- 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.
- FOR BOX CULVERT EXCAVATION, SEE SECTION 414 OF THE STANDARD SPECIFICATIONS.
- THE REINFORCED CONCRETE BOX CULVERT SHALL BE PLACED ON THE STANDARD 1.0 FOOT BLANKET OF FOUNDATION CONDITIONING MATERIAL.
- UNDERCUT SOFT/VERY LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL. IF MORE THAN 1 FT OF ADDITIONAL UNDERCUT IS REQUIRED, CONTACT THE OPERATIONS ENGINEER FOR APPROVAL.
- BED MATERIAL PLACED BETWEEN SILLS IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL BETWEEN THE LOWER SILLS. THE MATERIAL SHALL BE NATIVE MATERIAL EXCAVATED FROM THE STREAM BED OR FLOODPLAIN DURING CULVERT EXCAVATION AND IS SUBJECT TO APPROVAL BY THE ENGINEER. IF ENOUGH NATIVE MATERIAL IS NOT AVAILABLE TO BACKFILL THE HIGH FLOW BARRELS, CLASS B RIP RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL. IF RIP RAP IS USED TO SUPPLEMENT THE NATIVE MATERIAL, IT SHALL BE USED IN THE BOTTOM OF THE CULVERT BARRELS AND TOPPED WITH A MINIMUM 6" LAYER OF NATIVE MATERIAL. THE TOP SURFACE OF THE NATIVE BED MATERIAL SHALL BE PLACED AND LEVELED TO A FLAT SURFACE TO ALLOW FOR ANIMAL PASSAGE. THE COST OF PLACEMENT OF THE NATIVE BED MATERIAL OR SUPPLEMENTAL MATERIAL SHALL BE INCLUDED IN THE LUMP SUM BID FOR CULVERT EXCAVATION.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR ASBESTOS ASSESSMENT FOR BRIDGE DEMOLITION AND RENOVATION ACTIVITIES, SEE SPECIAL PROVISIONS.

HYDRAULIC DATA

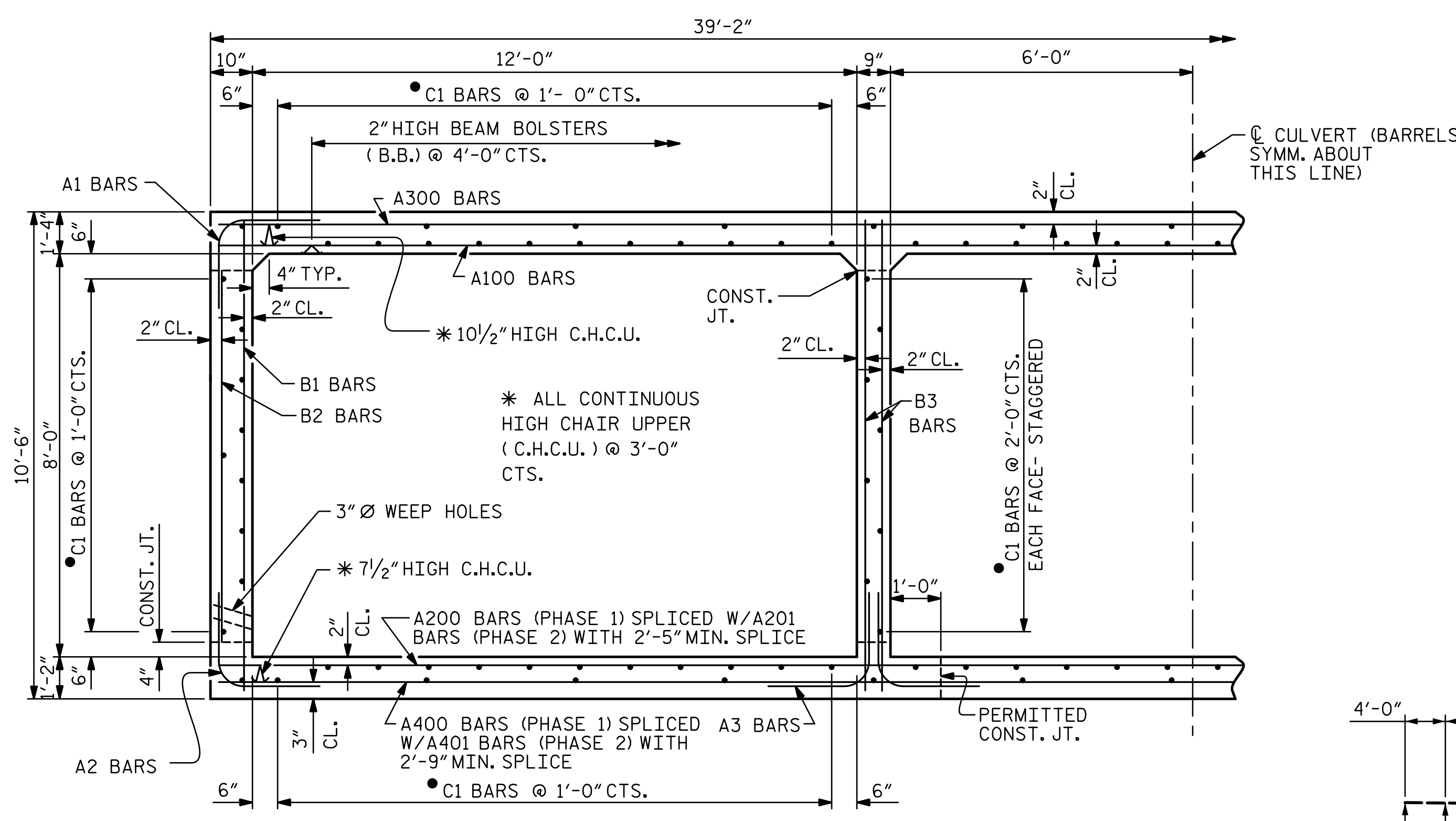
DESIGN DISCHARGE:	1200 CFS
FREQUENCY OF DESIGN FLOOD:	25 YRS.
DESIGN HIGH WATER ELEVATION:	706.3
DRAINAGE AREA:	3.6 SQ. MI.
BASE DISCHARGE (Q100):	1688 CFS
BASE HIGH WATER ELEVATION:	707.6

OVERTOPPING DATA

OVERTOPPING DISCHARGE:	1900 CFS
FREQUENCY OF OVERTOPPING:	100+ YRS.
OVERTOPPING FLOOD ELEVATION:	708.1
OVERTOPPING OCCURS AT STA. 15+67.85 -L-	

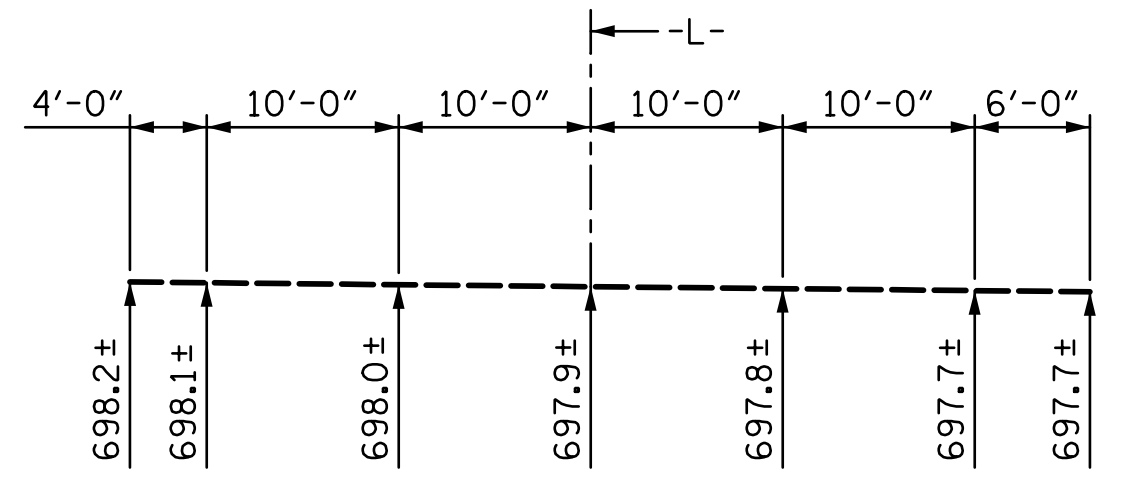
TOTAL STRUCTURE QUANTITIES

REMOVAL OF EXISTING STRUCTURE	LUMP SUM
ASBESTOS ASSESSMENT	LUMP SUM
CULVERT EXCAVATION @ STA. 15+28.50 -L-	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	
TOTAL:	152 TONS
CLASS A CONCRETE	
BARREL @ 4.577 C.Y./FT.	228.9 C.Y.
WINGS, ETC.	39.5 C.Y.
TOTAL	268.4 C.Y.
REINFORCING STEEL	
BARREL	27,991 LBS.
WINGS, ETC.	1,975 LBS.
TOTAL	29,966 LBS.



RIGHT ANGLE SECTION OF BARREL

THERE ARE 132 "C" BARS IN SECTION OF BARREL.  
 • SPLICE LENGTH FOR C1 BARS = 2'-5"  
 LONGITUDINAL CONSTRUCTION JOINT IN BOTTOM SLAB NOT SHOWN, SEE CONSTRUCTION SEQUENCE ON SHEET C-4.



PROFILE ALONG C CULVERT

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

PROJECT NO. 17BP.10.PE.4  
CABARRUS COUNTY  
 STATION: 15+28.50 -L-

REPLACES BRIDGE NO. 015

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 TRIPLE 12'-0" x 8'-0"  
 CONCRETE BOX CULVERT  
 90°-00'-00" SKEW

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

TOTAL SHEETS	C-1
	7

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## 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		
						LIVE-LOAD FACTORS (%LL)	MOMENT				SHEAR					
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (±)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (±)	
DESIGN LOAD RATING	HL-93 (INVENTORY)	N/A	①	1.35	--	1.75	1.35	1 & 3	FLOOR SLAB	12.83'	2.10	1 & 3	FLOOR SLAB	11.99'		
	HL-93 (OPERATING)	N/A		1.75	--	1.35	1.75	1 & 3	FLOOR SLAB	12.83'	2.73	1 & 3	FLOOR SLAB	11.99'		
	HS-20 (INVENTORY)	36.000	②	1.66	59.760	1.75	1.66	1 & 3	FLOOR SLAB	12.83'	2.22	1 & 3	FLOOR SLAB	11.99'		
	HS-20 (OPERATING)	36.000		2.15	77.400	1.35	2.15	1 & 3	FLOOR SLAB	12.83'	2.87	1 & 3	FLOOR SLAB	11.99'		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		3.01	40.635	1.40	3.01	1 & 3	FLOOR SLAB	12.83'	4.03	1 & 3	FLOOR SLAB	11.99'		
		SNGARBS2	20.000		2.82	56.400	1.40	2.82	1 & 3	FLOOR SLAB	12.83'	3.77	1 & 3	FLOOR SLAB	11.99'	
		SNAGRIS2	22.000		3.01	66.220	1.40	3.01	1 & 3	FLOOR SLAB	12.83'	4.03	1 & 3	FLOOR SLAB	11.99'	
		SNCOTTS3	27.250	③	1.82	49.595	1.40	1.82	1 & 3	FLOOR SLAB	12.83'	2.85	1 & 3	FLOOR SLAB	11.99'	
		SNAGGRS4	34.925		2.14	74.740	1.40	2.14	1 & 3	FLOOR SLAB	12.83'	4.32	1 & 3	FLOOR SLAB	11.99'	
		SNS5A	35.550		2.05	72.878	1.40	2.05	1 & 3	FLOOR SLAB	12.83'	4.58	1 & 3	FLOOR SLAB	11.99'	
		SNS6A	39.950		2.05	81.898	1.40	2.05	1 & 3	FLOOR SLAB	12.83'	4.61	1 & 3	FLOOR SLAB	11.99'	
		SNS7B	42.000		2.12	89.040	1.40	2.12	1 & 3	FLOOR SLAB	12.83'	4.98	1 & 3	FLOOR SLAB	11.99'	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		3.01	99.330	1.40	3.01	1 & 3	FLOOR SLAB	12.83'	4.03	1 & 3	FLOOR SLAB	11.99'	
		TNT4A	33.075		2.16	71.442	1.40	2.16	1 & 3	FLOOR SLAB	12.83'	3.39	1 & 3	FLOOR SLAB	11.99'	
		TNT6A	41.600		2.17	90.272	1.40	2.17	1 & 3	FLOOR SLAB	12.83'	3.65	1 & 3	FLOOR SLAB	11.99'	
		TNT7A	42.000		2.16	90.720	1.40	2.16	1 & 3	FLOOR SLAB	12.83'	3.50	1 & 3	FLOOR SLAB	11.99'	
		TNT7B	42.000		2.08	87.360	1.40	2.08	1 & 3	FLOOR SLAB	12.83'	3.69	1 & 3	FLOOR SLAB	11.99'	
		TNAGRIT4	43.000		2.16	92.880	1.40	2.16	1 & 3	FLOOR SLAB	12.83'	3.39	1 & 3	FLOOR SLAB	11.99'	
		TNACT5A	45.000		2.42	108.900	1.40	2.42	1 & 3	FLOOR SLAB	12.83'	3.82	1 & 3	FLOOR SLAB	11.99'	
TNACT5B	45.000		2.16	97.200	1.40	2.16	1 & 3	FLOOR SLAB	12.83'	3.39	1 & 3	FLOOR SLAB	11.99'			

**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	--

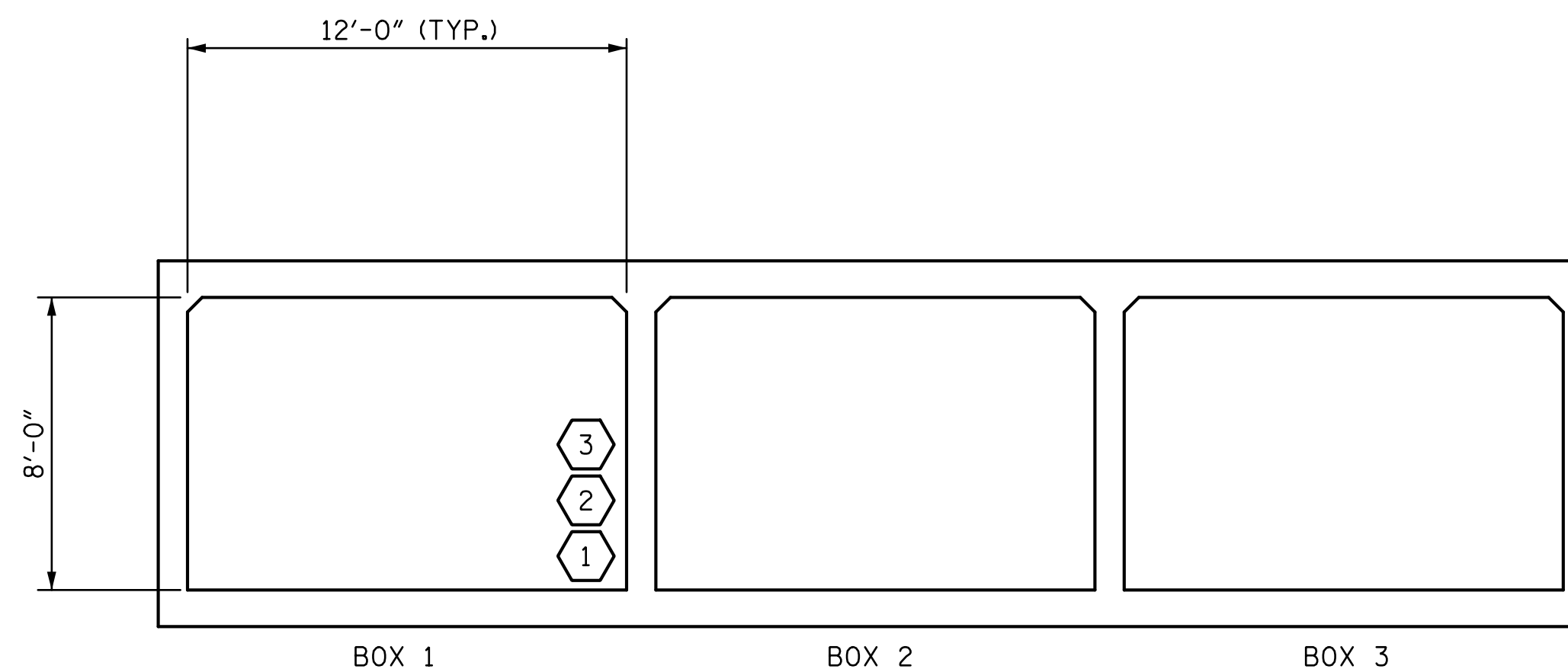
**NOTE:**

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

**COMMENTS:**

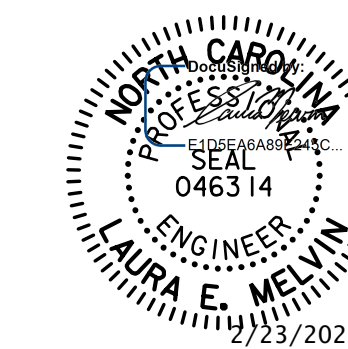
- 1.
- 2.
- 3.
- 4.

#	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.10.PE.4  
CABARRUS COUNTY  
 STATION: 15+28.50 -L-



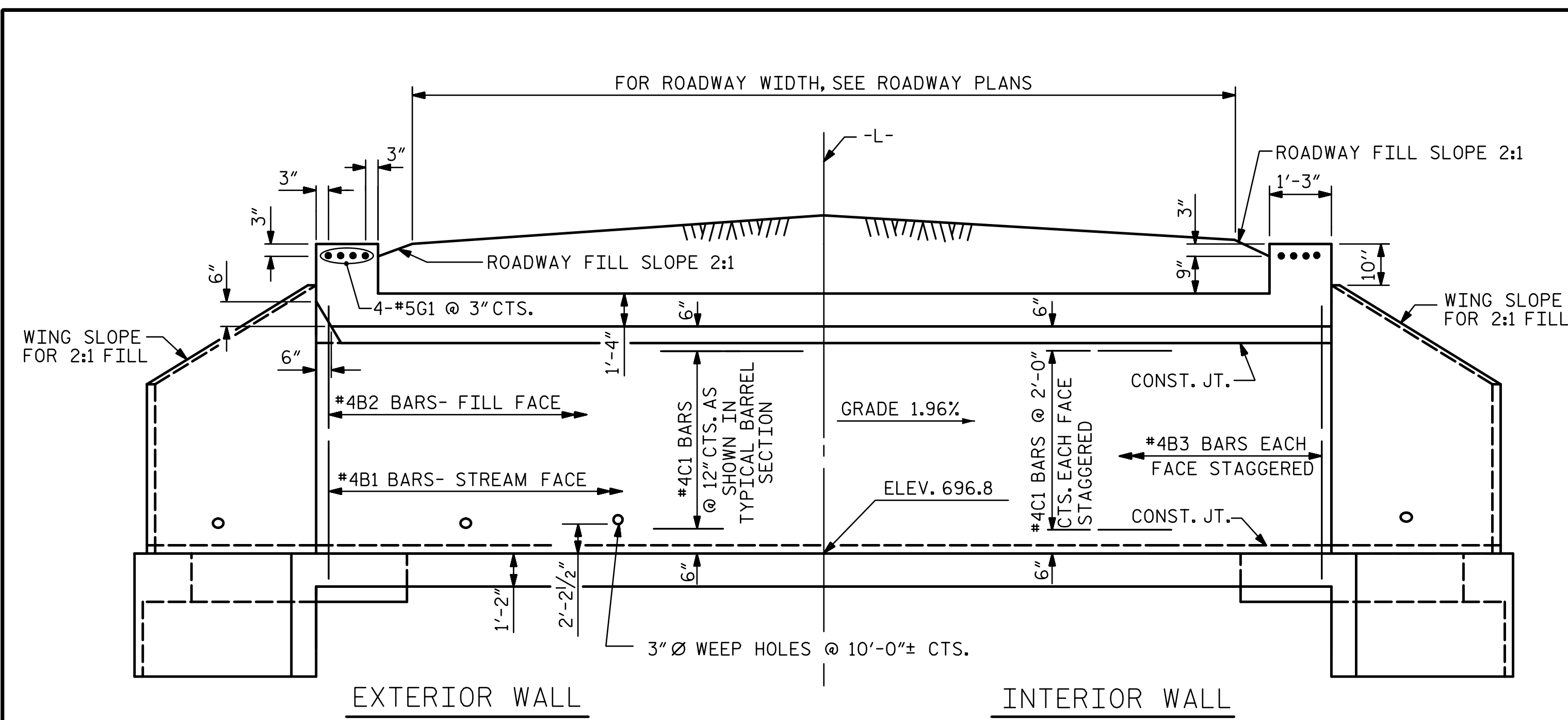
**STV** 100 YEARS  
 STV ENGINEERS, INC.  
 900 West Trade St., Suite 715  
 Charlotte, NC 28202  
 NC License Number F-0991

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 SIGNATURES COMPLETED

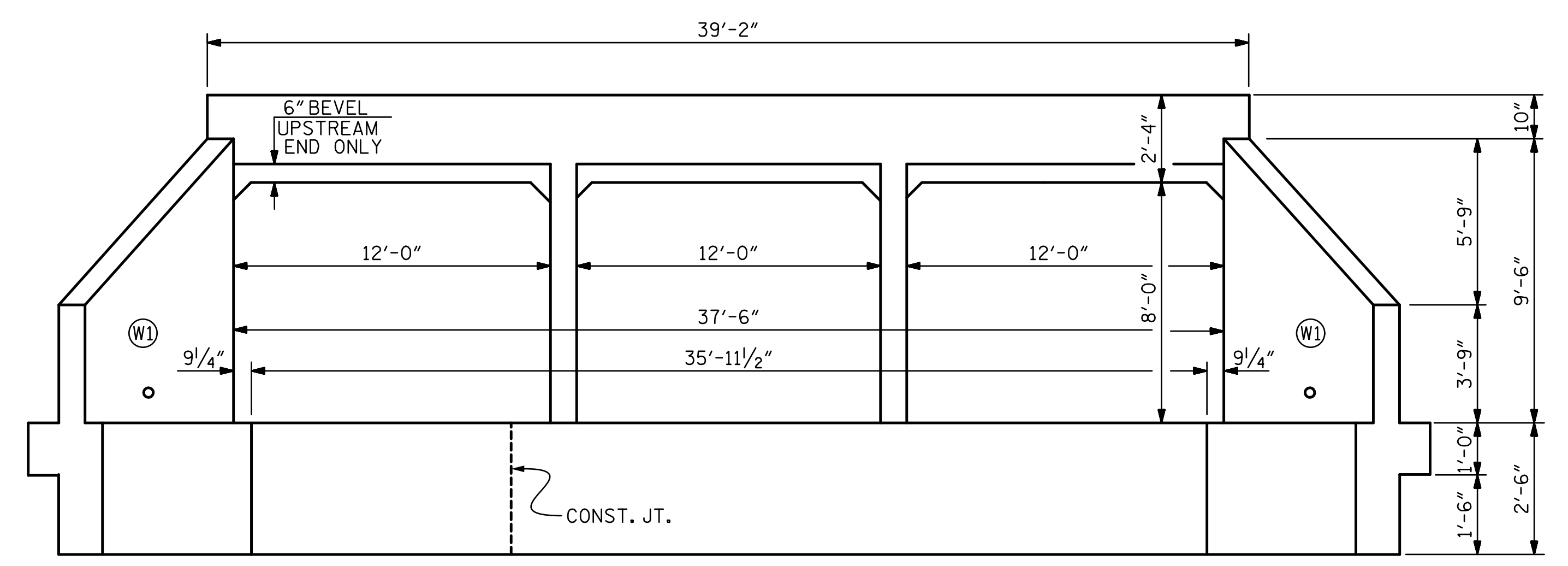
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NO.	BY:	DATE:	NO.	BY:	DATE:
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C-2  
TOTAL SHEETS  
7

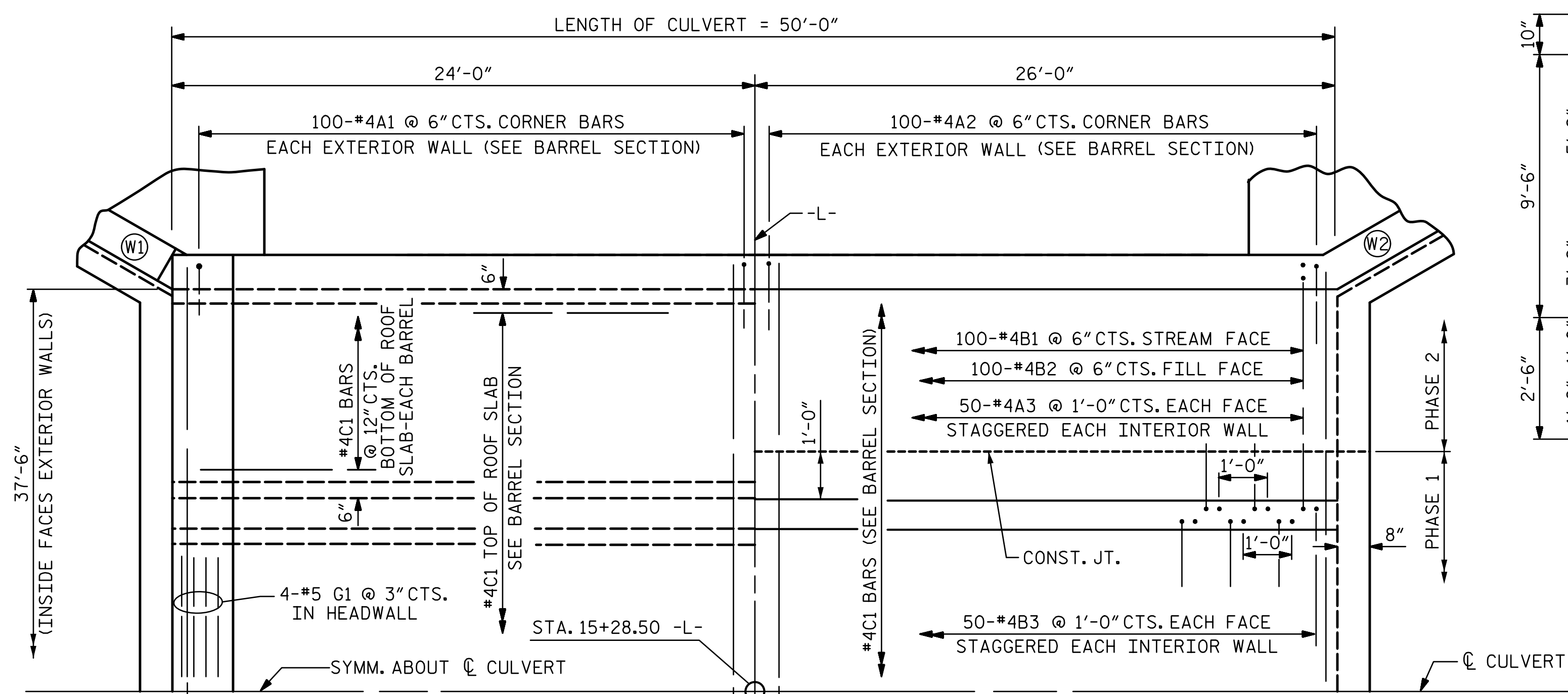
DRAWN BY : LEM DATE : 3-20  
 CHECKED BY : JWJ DATE : 1-21  
 DESIGN ENGINEER OF RECORD : LEM DATE : 2-21



CULVERT SECTION NORMAL TO ROADWAY

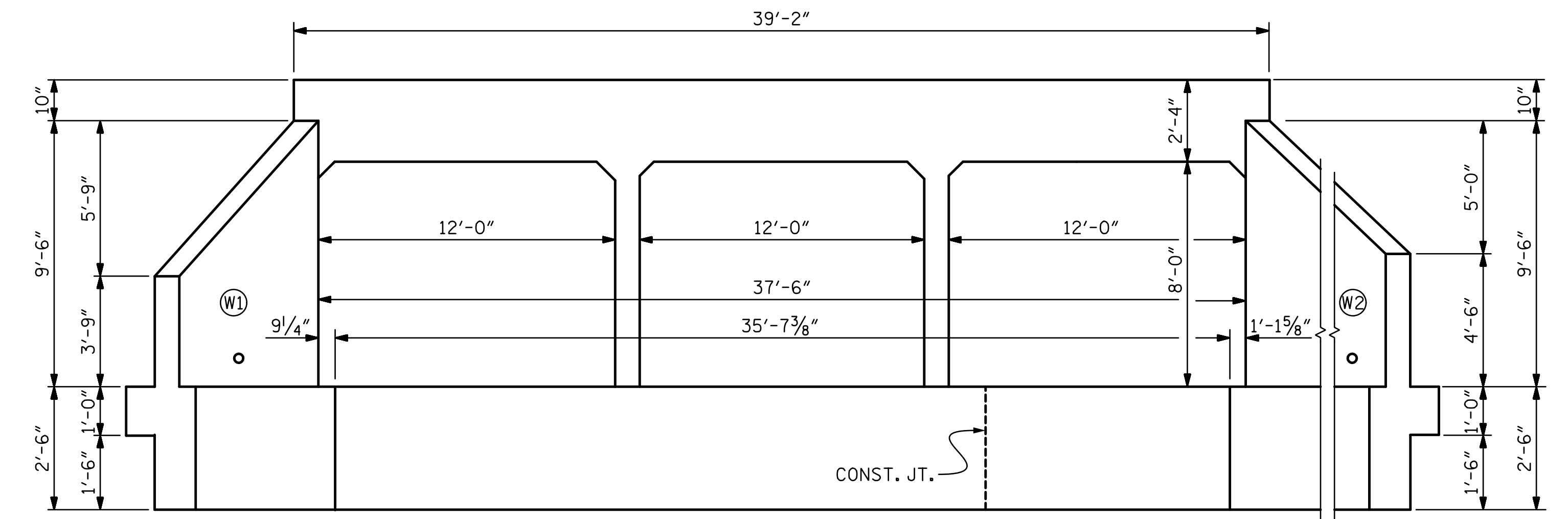


END ELEVATION AT INLET  
SILLS NOT SHOWN, SEE SHEET C-4



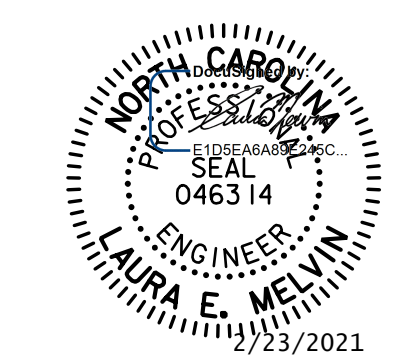
PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB



END ELEVATION AT OUTLET  
SILLS NOT SHOWN, SEE SHEET C-4

PROJECT NO. 17BP.10.PE.4  
CABARRUS COUNTY  
 STATION: 15+28.50 -L-



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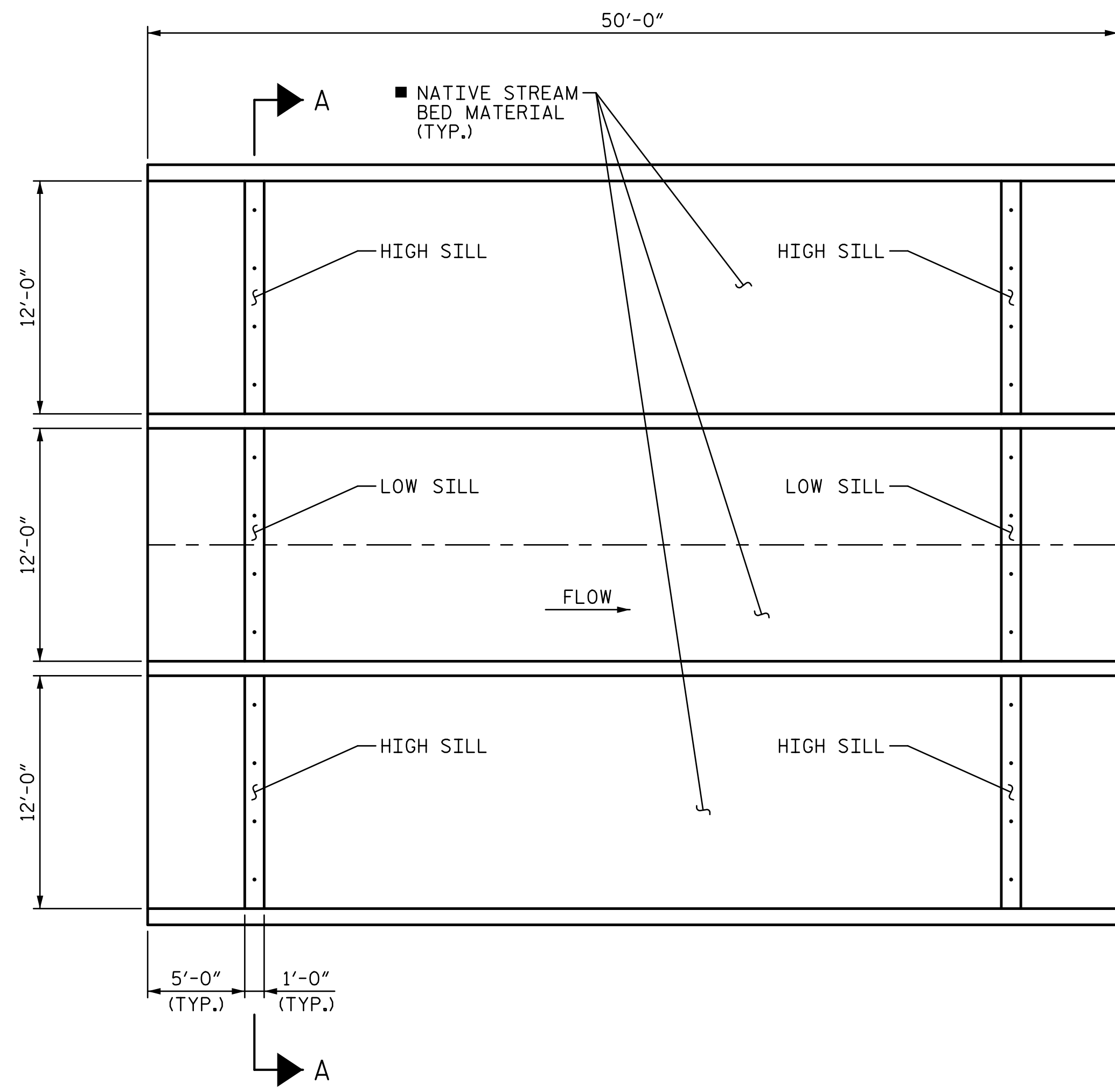
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
TRIPLE 12'-0" x 8'-0" CONCRETE BOX CULVERT 90°-00'-00" SKEW					
REVISIONS					SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:
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					C-3
					TOTAL SHEETS 7

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 DESIGN ENGINEER OF RECORD : LEM DATE : 2-21

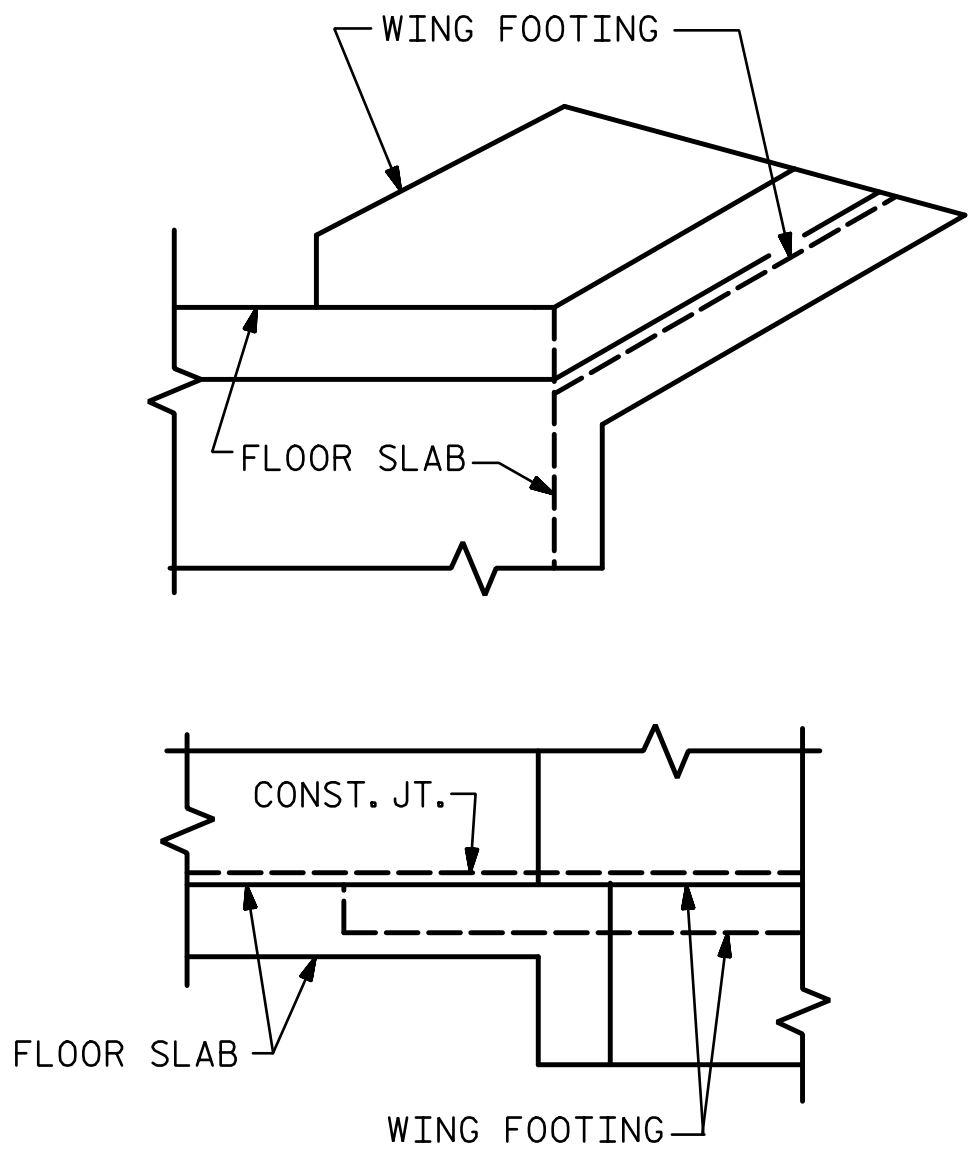


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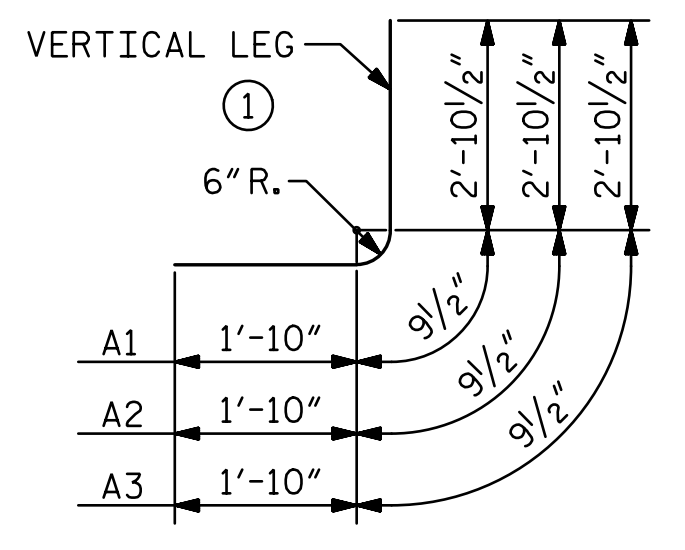
PLAN VIEW - LOCATION OF SILLS

■ NATIVE STREAM BED MATERIAL SHALL BE USED TO BACKFILL THE CULVERT BETWEEN SILLS. (SEE NOTE ON SHEET C-1)

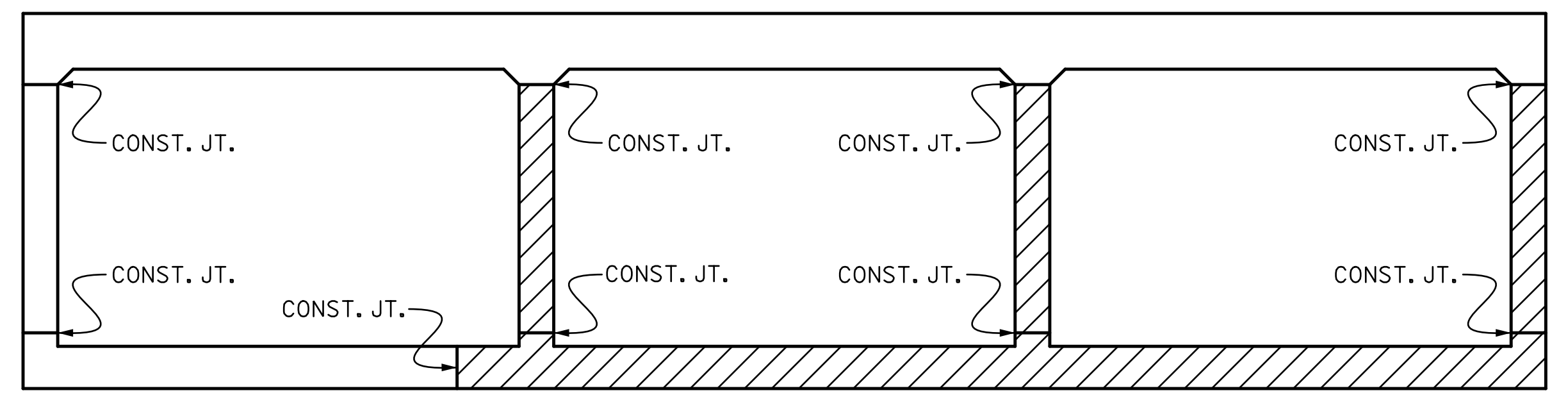


DETAIL  
CONNECTION OF WING FOOTING AND FLOOR SLAB WHEN SLAB IS THICKER THAN FOOTING

BAR TYPES		BILL OF REINFORCING FOR BARREL				
MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT	
A1	200	#4	①	5'-6"	735	
A2	200	#4	①	5'-6"	735	
A3	200	#4	①	5'-6"	735	
A100	100	#5	STR	38'-10"	4,050	
A200	100	#4	STR	29'-9"	1,987	
A201	100	#4	STR	11'-6"	768	
A300	100	#5	STR	38'-10"	4,050	
A400	100	#6	STR	30'-1"	4,519	
A401	100	#6	STR	11'-6"	1,727	
B1	200	#4	STR	10'-1"	1,347	
B2	200	#4	STR	7'-4"	980	
B3	200	#4	STR	10'-1"	1,347	
C1	264	#4	STR	26'-1"	4,600	
G1	8	#5	STR	38'-10"	324	
D1	16	#6	STR	2'-9"	66	
D2	8	#6	STR	1'-9"	21	
TOTAL BARREL REINFORCING STEEL =					27,991 LBS.	



ALL BAR DIMENSIONS ARE OUT TO OUT.

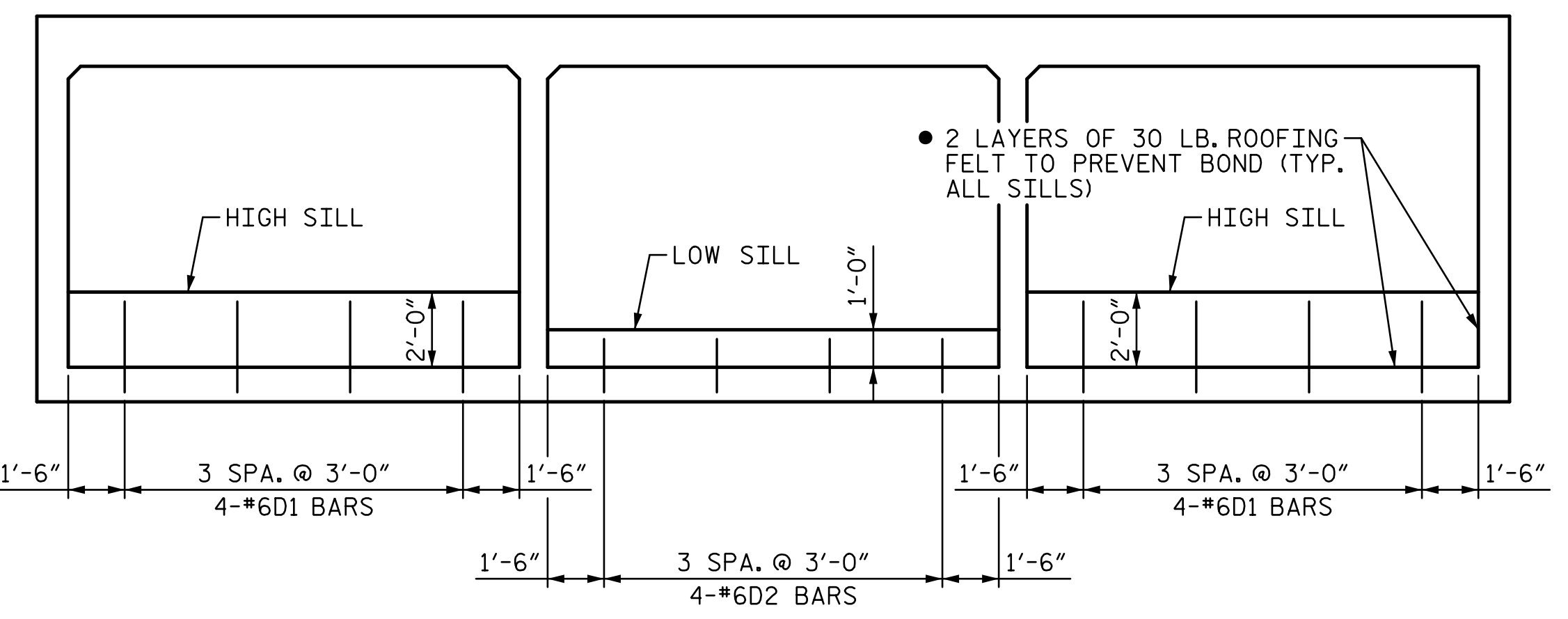


- PHASE 1**
- POUR 1. PHASE 1 FLOOR SLAB (INCLUDING WING FOOTINGS) WITH 4" OF VERTICAL WALLS/WINGS.
  - POUR 2. REMAINING PORTIONS OF PHASE 1 WALLS/WINGS TO FULL HEIGHT.
- PHASE 2**
- POUR 1. PHASE 2 FLOOR SLAB (INCLUDING WING FOOTINGS) WITH 4" OF VERTICAL WALL/WINGS.
  - POUR 2. REMAINING PORTIONS OF PHASE 2 WALL/WINGS TO FULL HEIGHT.
  - POUR 3. ENTIRE ROOF SLAB AND HEADWALLS.

CULVERT CONSTRUCTION SEQUENCE

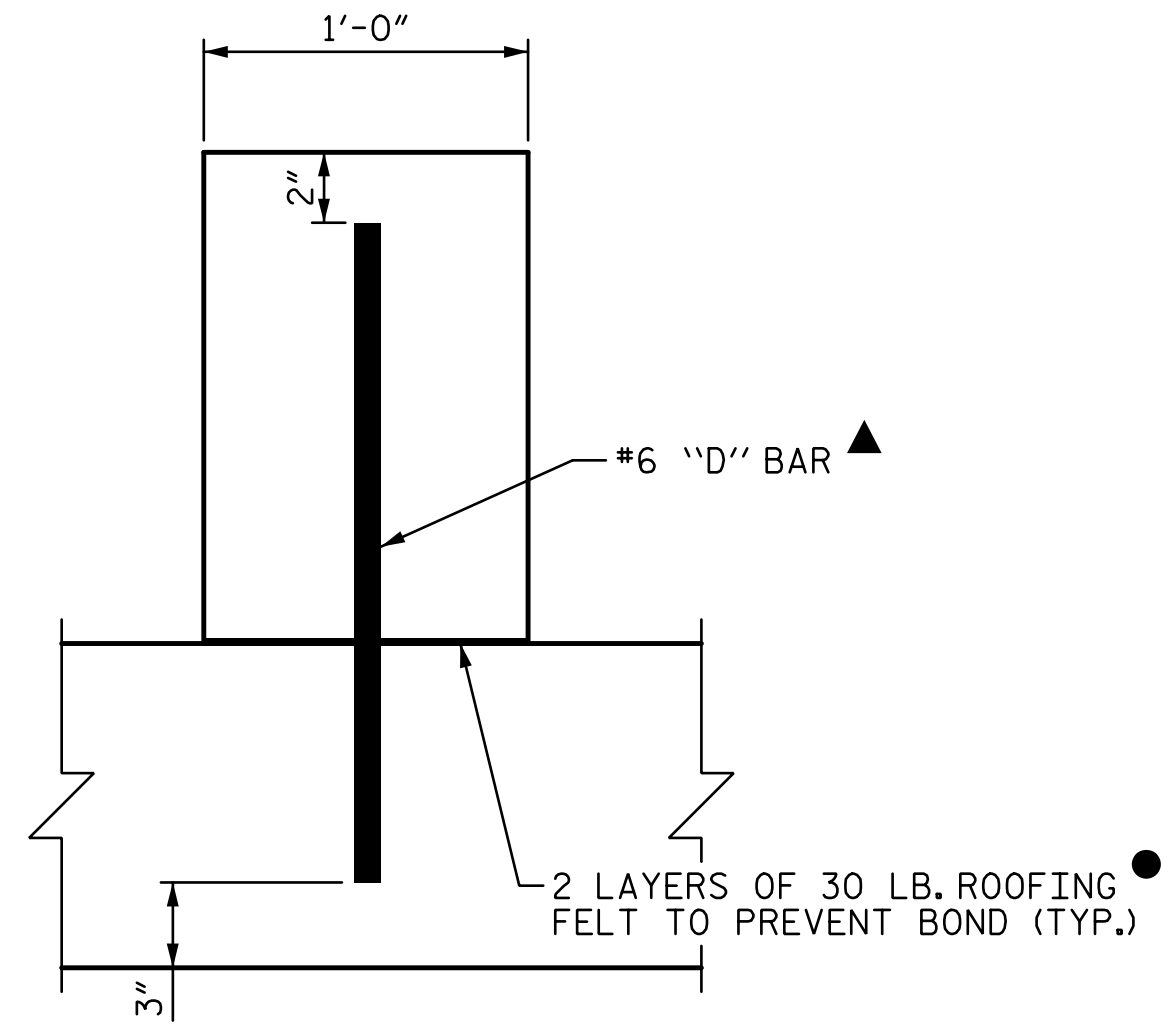
LOOKING DOWNSTREAM

PROJECT NO. 17BP.10.PE.4  
CABARRUS COUNTY  
 STATION: 15+28.50 -L-



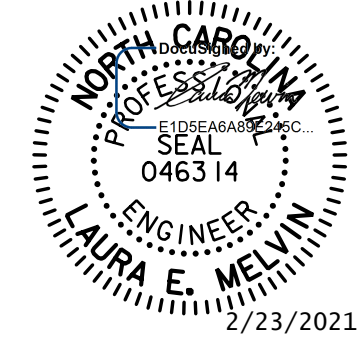
SECTION A-A

SECTION AT INLET SHOWN, SECTION AT OUTLET SIMILAR.  
 ● THE COST OF THE ROOFING FELT IS INCIDENTAL AND SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS.



SECTION THROUGH SILL

▲ DOWELS MAY BE PUSHED INTO GREEN CONCRETE AFTER SLAB HAS BEEN FLOAT FINISHED.



2/23/2021

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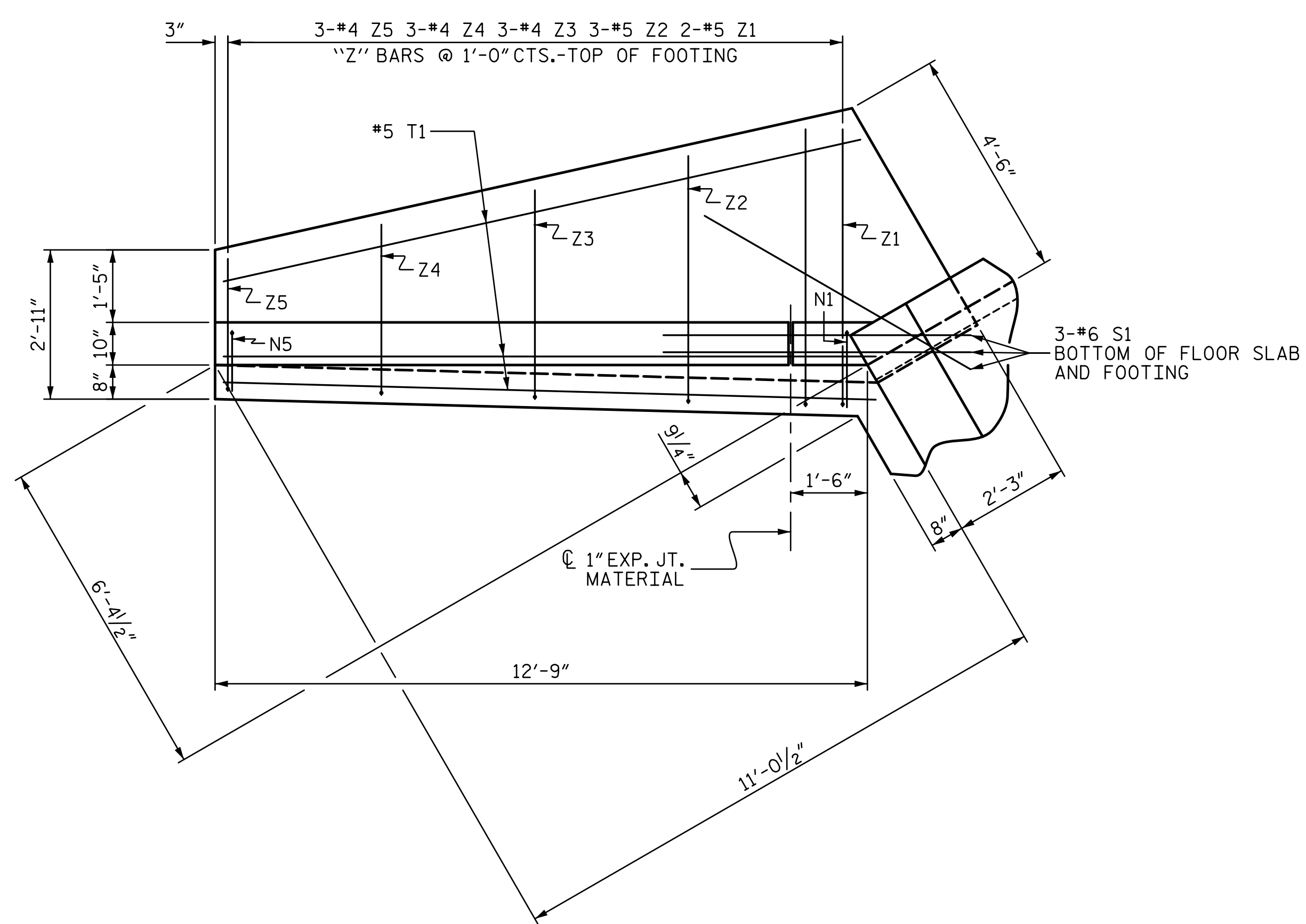
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

TRIPLE 12'-0" x 8'-0" CONCRETE BOX CULVERT  
 90°-00'-00" SKEW

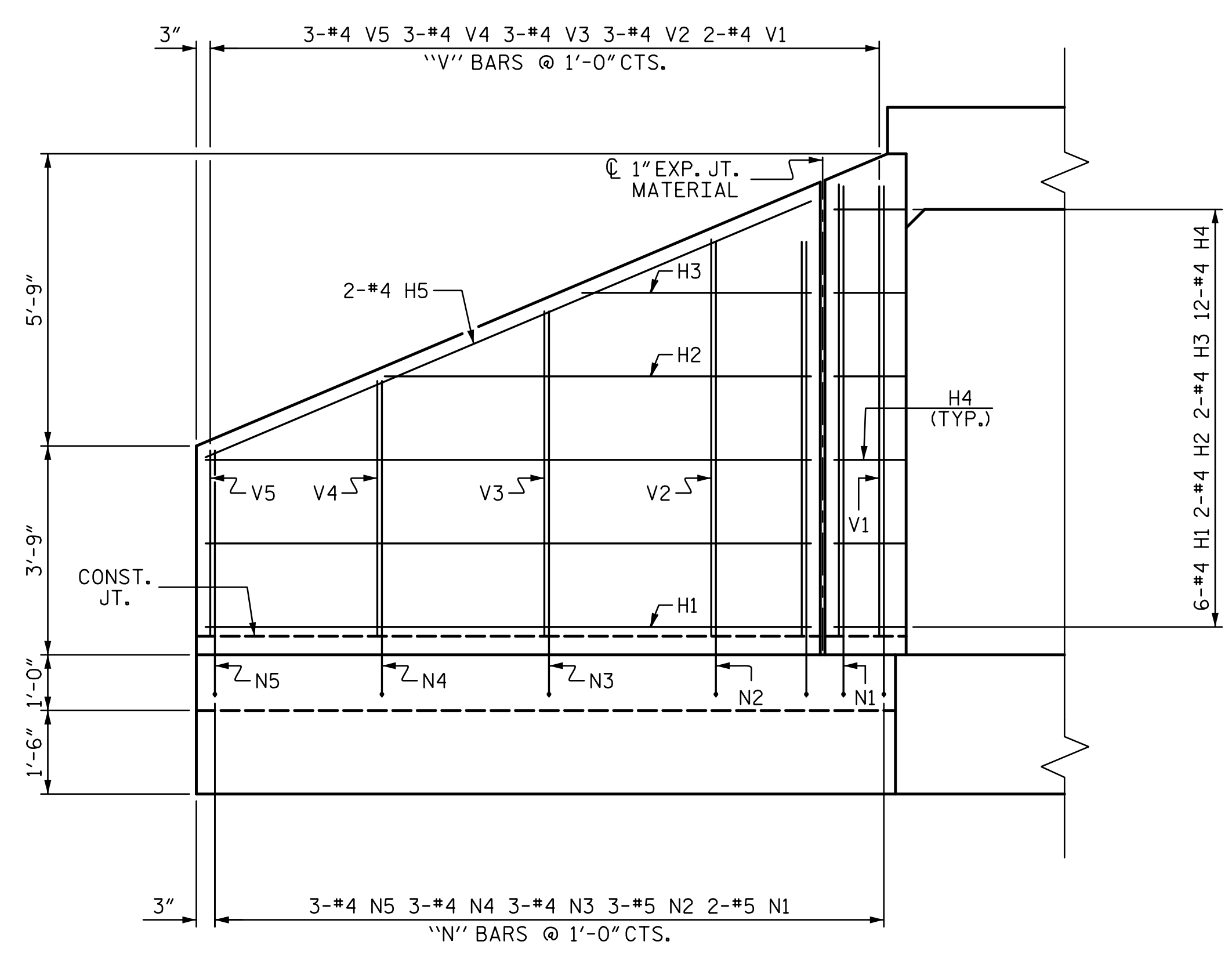
REVISIONS				SHEET NO.	
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C-4  
 TOTAL SHEETS 7

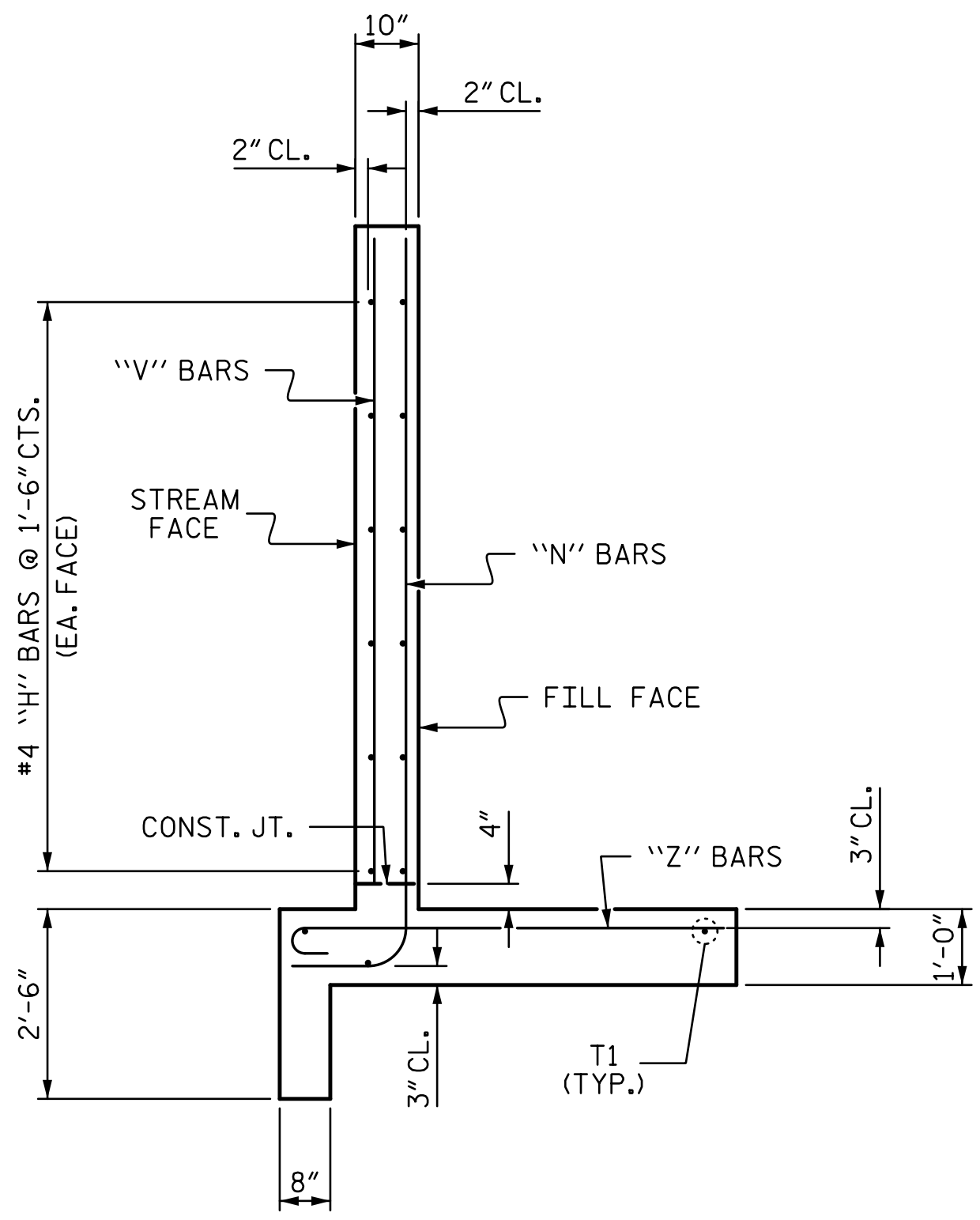
DRAWN BY : LEM DATE : 3-20  
 CHECKED BY : JWJ DATE : 1-21  
 DESIGN ENGINEER OF RECORD : LEM DATE : 2-21



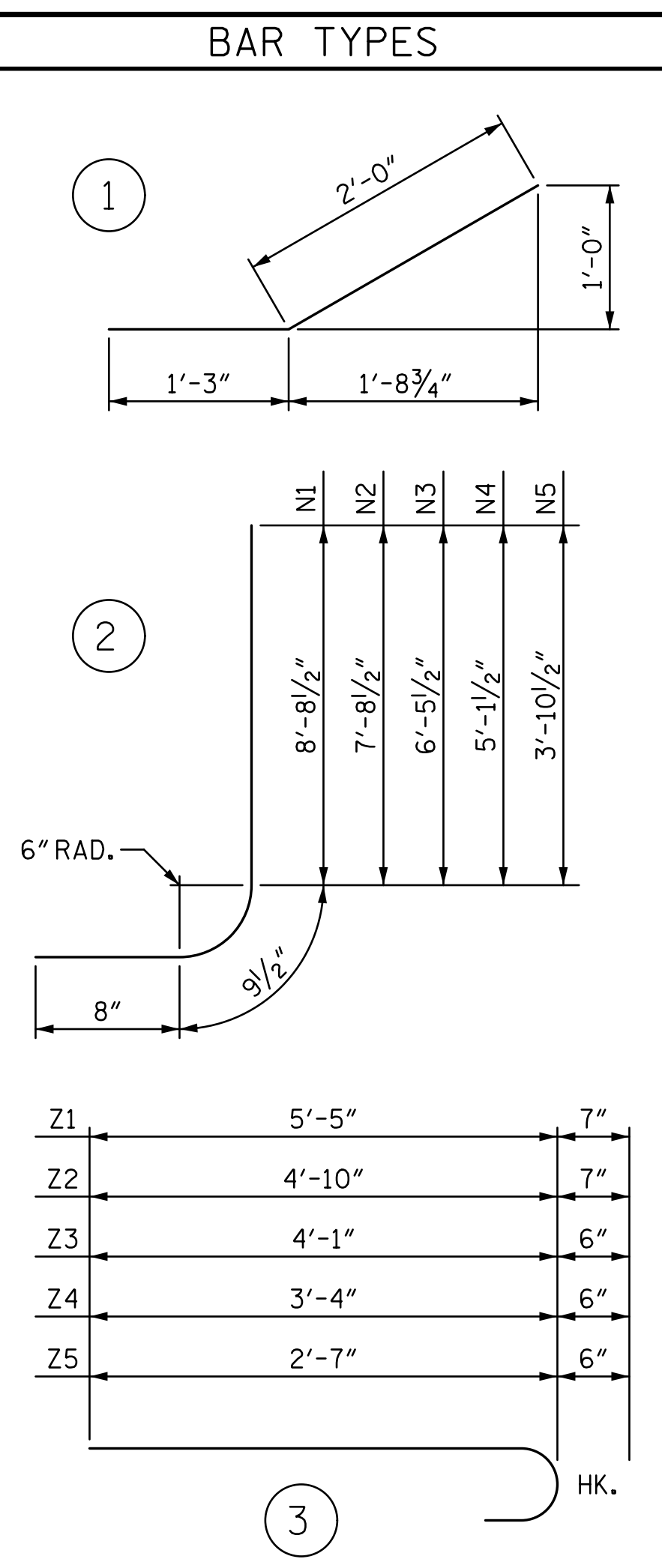
PLAN W1



ELEVATION W1



TYPICAL WING SECTION W1



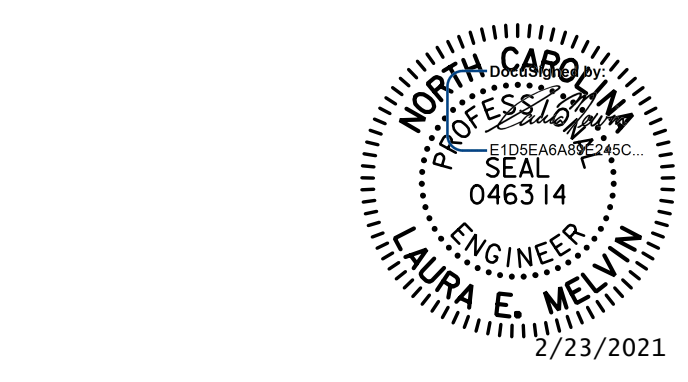
BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	18	#4	STR	10'-10"	130
H2	6	#4	STR	7'-8"	31
H3	6	#4	STR	4'-1"	16
H4	36	#4	1	3'-3"	78
H5	6	#4	STR	11'-9"	47
N1	6	#5	2	10'-2"	64
N2	9	#5	2	9'-2"	86
N3	9	#4	2	7'-11"	48
N4	9	#4	2	6'-7"	40
N5	9	#4	2	5'-4"	32
S1	9	#6	STR	6'-0"	81
T1	9	#5	STR	12'-9"	120
V1	6	#4	STR	8'-1"	32
V2	9	#4	STR	7'-1"	43
V3	9	#4	STR	5'-10"	35
V4	9	#4	STR	4'-7"	28
V5	9	#4	STR	3'-4"	20
Z1	6	#5	3	6'-0"	38
Z2	9	#5	3	5'-5"	51
Z3	9	#4	3	4'-7"	28
Z4	9	#4	3	3'-10"	23
Z5	9	#4	3	3'-1"	19

REINFORCING STEEL FOR 3 WINGS 1,090 LBS

NOTES:  
FOR LOCATION OF W1 WINGS, SEE SHEET C-3  
FOR CLASS A CONCRETE, SEE SHEET C-6.

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DESIGN ENGINEER OF RECORD : LEM DATE : 2-21



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Charlotte, NC 28202  
NC License Number F-0991

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PROJECT NO. 17BP.10.PE.4  
CABARRUS COUNTY  
STATION: 15+28.50 -L-

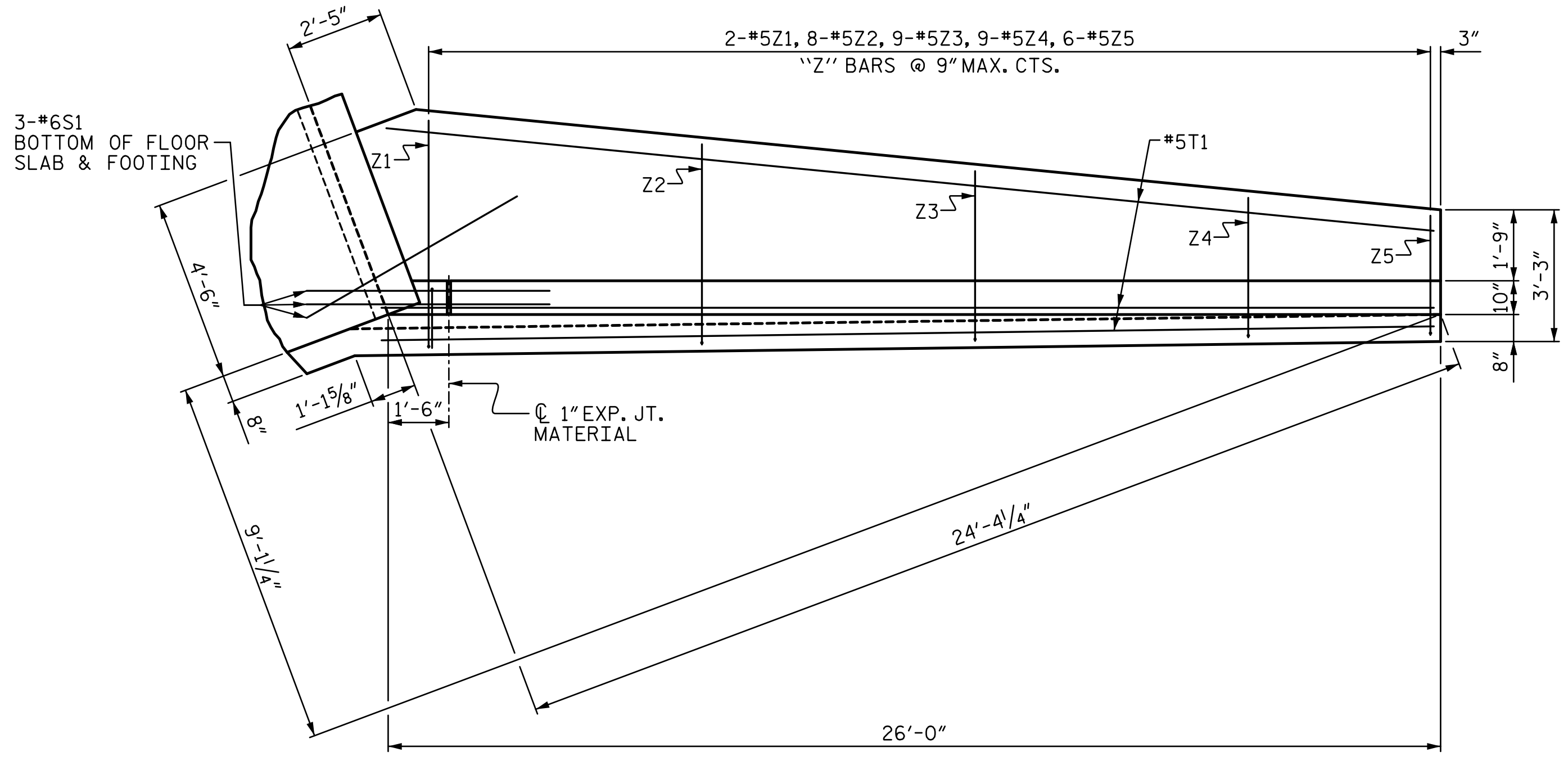
STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
WINGS FOR CONCRETE BOX CULVERT  
H = 8'-0" SLOPE = 2:1  
90° SKEW

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

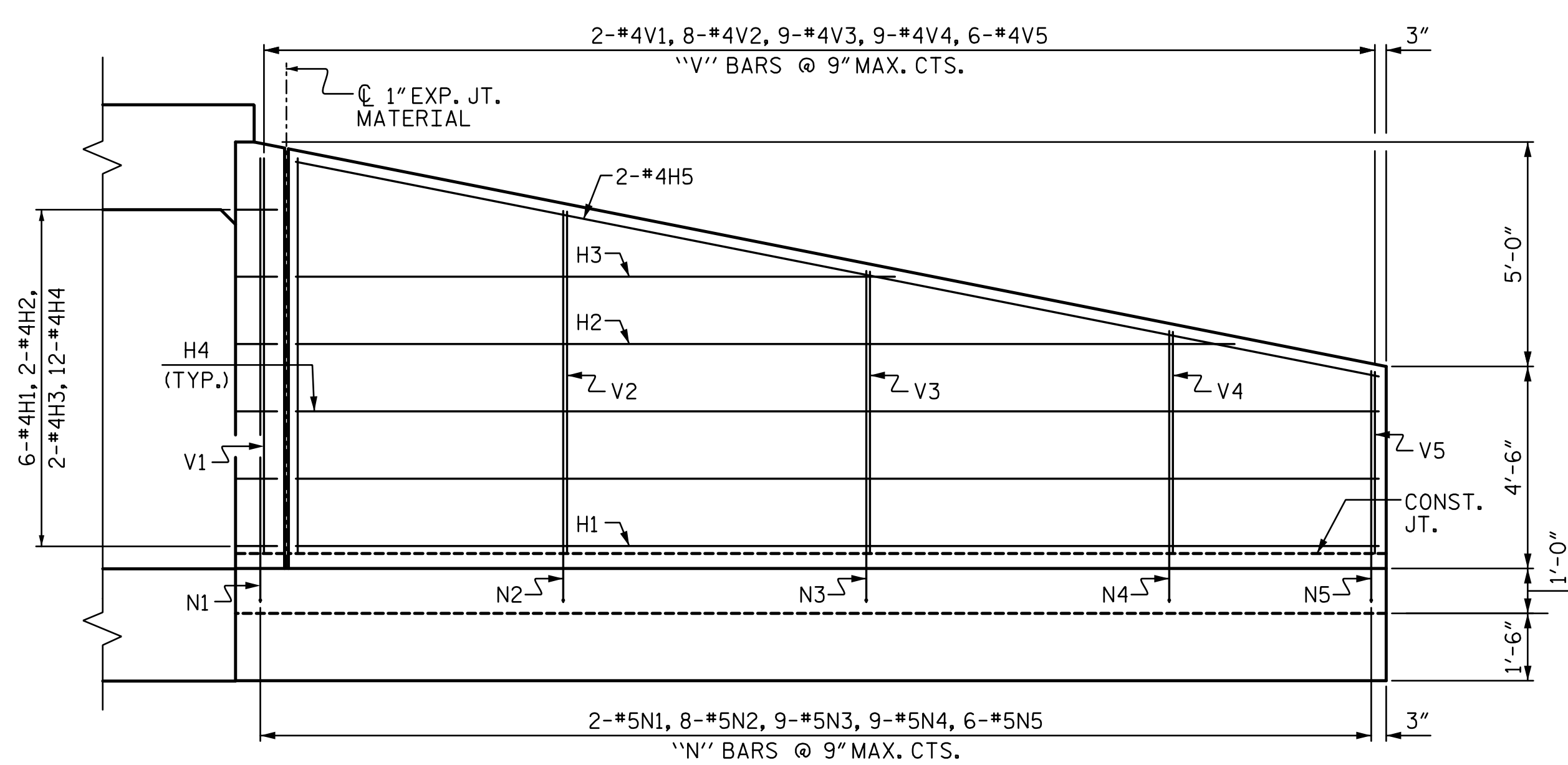
C-5  
TOTAL SHEETS 7



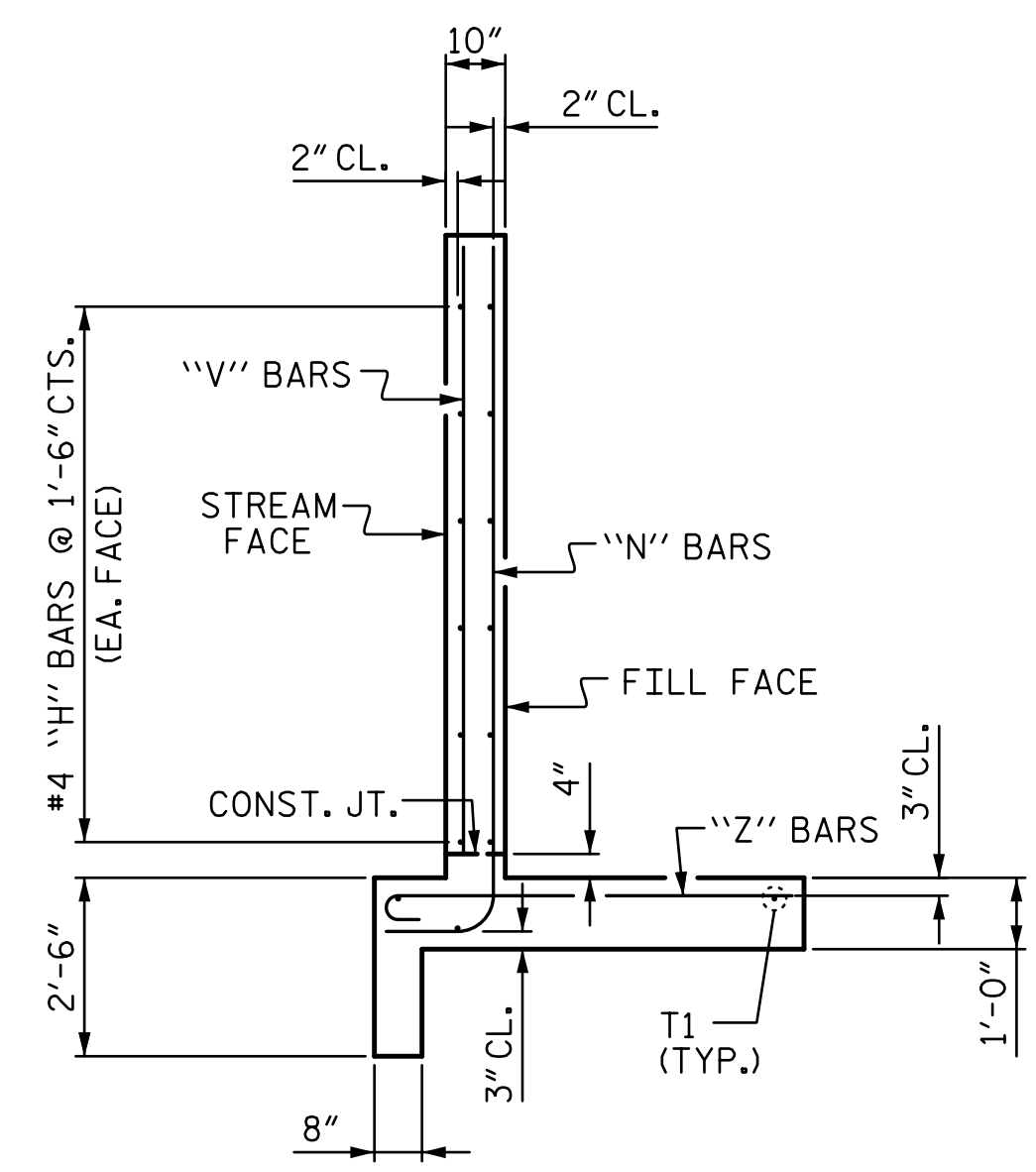
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PLAN W2

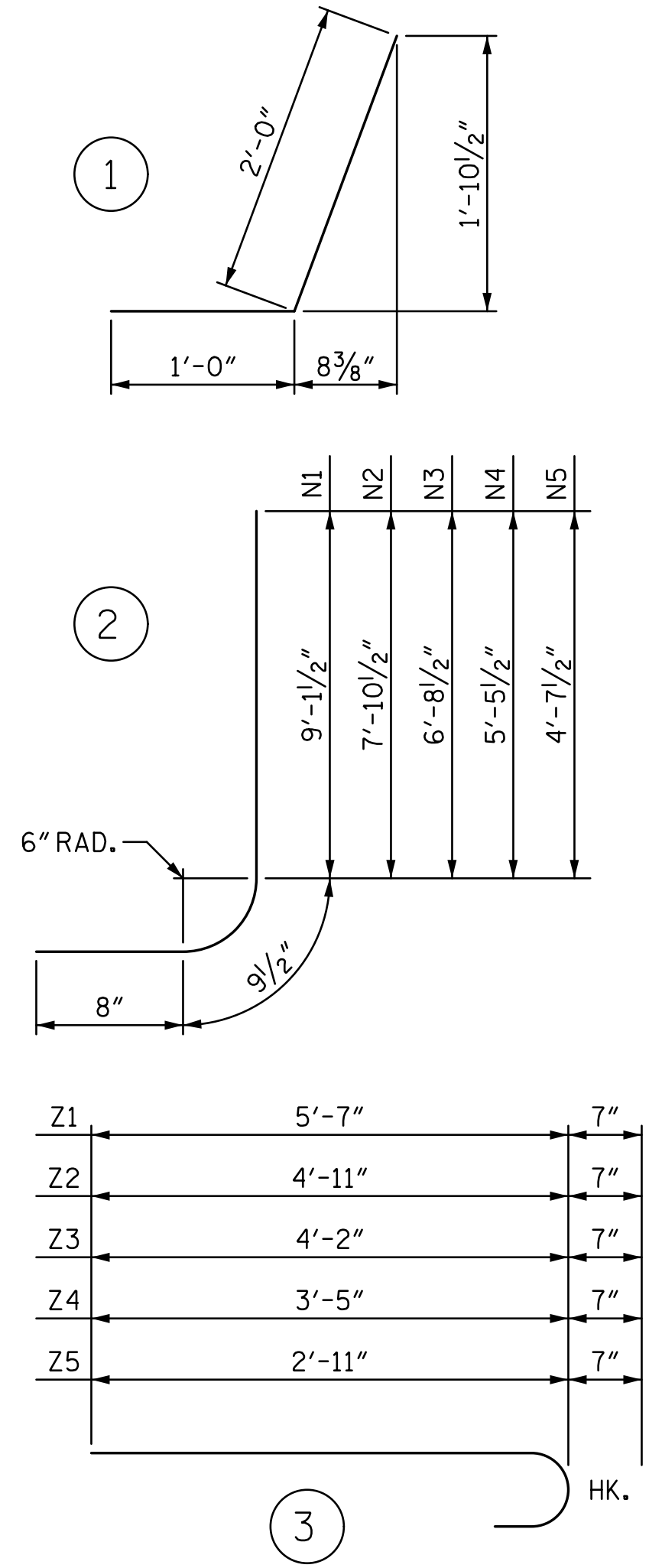


ELEVATION W2



TYPICAL WING SECTION W2

BAR TYPES



BILL OF MATERIAL

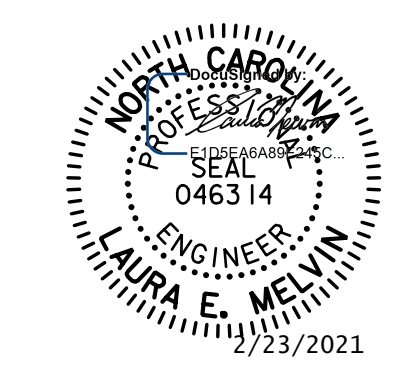
BAR NO.	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	24'-1"	97
H2	2	#4	STR	20'-10"	28
H3	2	#4	STR	13'-4"	18
H4	12	#4	1	3'-0"	24
H5	2	#4	STR	24'-7"	33
N1	2	#5	2	10'-7"	22
N2	8	#5	2	9'-4"	78
N3	9	#5	2	8'-2"	77
N4	9	#5	2	6'-11"	65
N5	6	#5	2	6'-1"	38
S1	3	#6	STR	6'-0"	27
T1	3	#5	STR	26'-0"	81
V1	2	#4	STR	8'-6"	11
V2	8	#4	STR	7'-4"	39
V3	9	#4	STR	6'-1"	37
V4	9	#4	STR	4'-11"	30
V5	6	#4	STR	4'-0"	16
Z1	2	#5	3	6'-2"	13
Z2	8	#5	3	5'-6"	46
Z3	9	#5	3	4'-9"	45
Z4	9	#5	3	4'-0"	38
Z5	6	#5	3	3'-6"	22

REINFORCING STEEL FOR 1 WING		885 LBS
CLASS A CONCRETE		
4 WINGS		24.6 CY
2 HEADWALLS		3.6 CY
2 END CURTAIN WALLS		6.9 CY
6 SILLS		4.4 CY
<b>TOTAL</b>		<b>39.5 CY</b>

NOTE:  
FOR LOCATION OF W2 WING, SEE SHEET C-3.

ALL BAR DIMENSIONS ARE OUT TO OUT.

PROJECT NO. 17BP.10.PE.4  
CABARRUS COUNTY  
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**STV** 100 YEARS  
 STV ENGINEERS, INC.  
 900 West Trade St., Suite 715  
 Charlotte, NC 28202  
 NC License Number F-0991

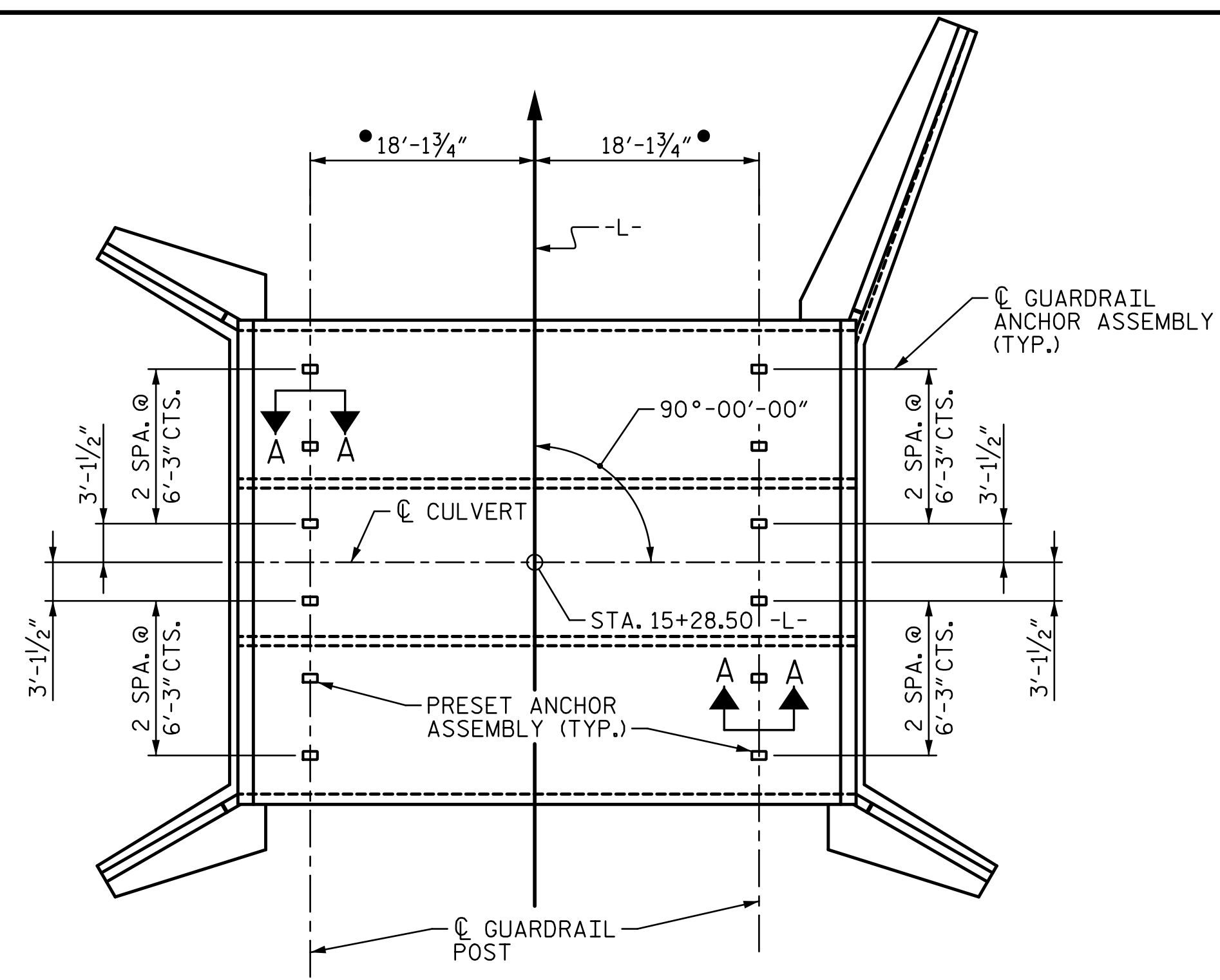
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

REVISIONS				SHEET NO.
NO.	BY:	DATE:	NO.	DATE:
1			3	
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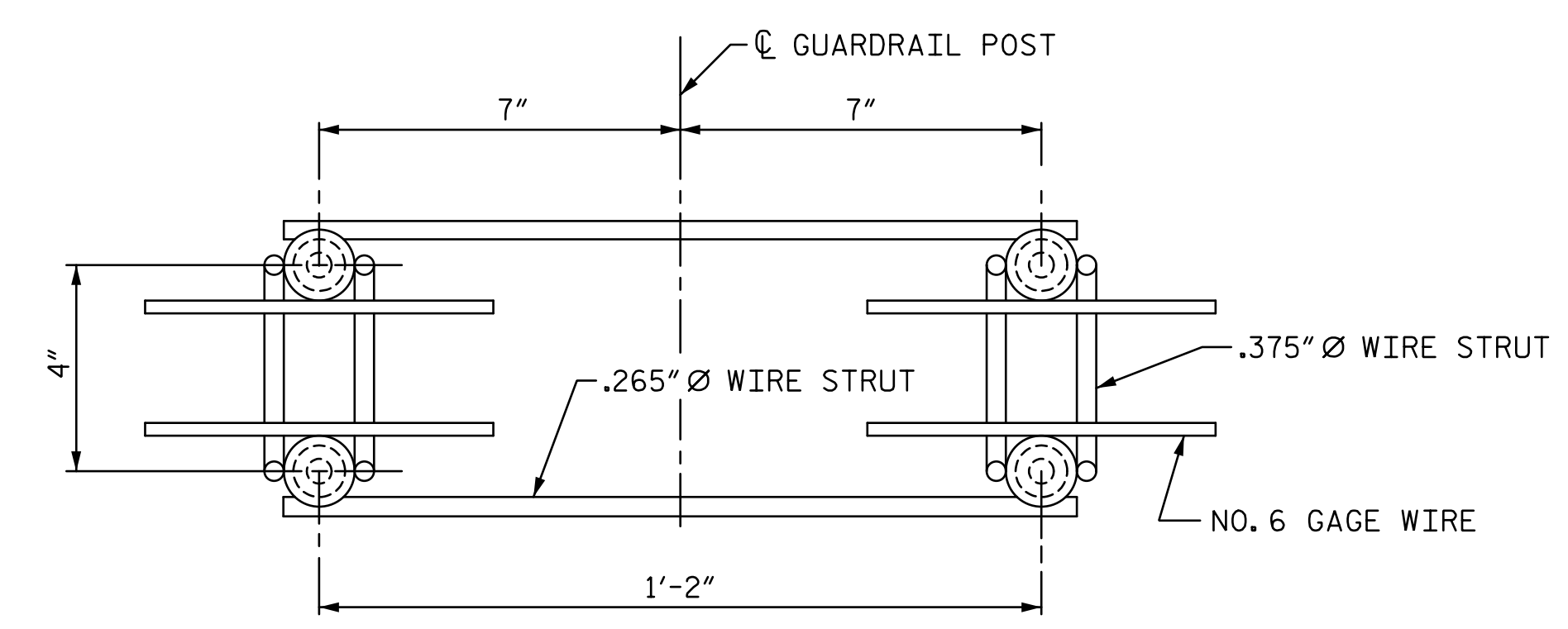
C-6
TOTAL SHEETS
7

DRAWN BY : LEM DATE : 3-20  
 CHECKED BY : JWJ DATE : 1-21  
 DESIGN ENGINEER OF RECORD : LEM DATE : 2-21

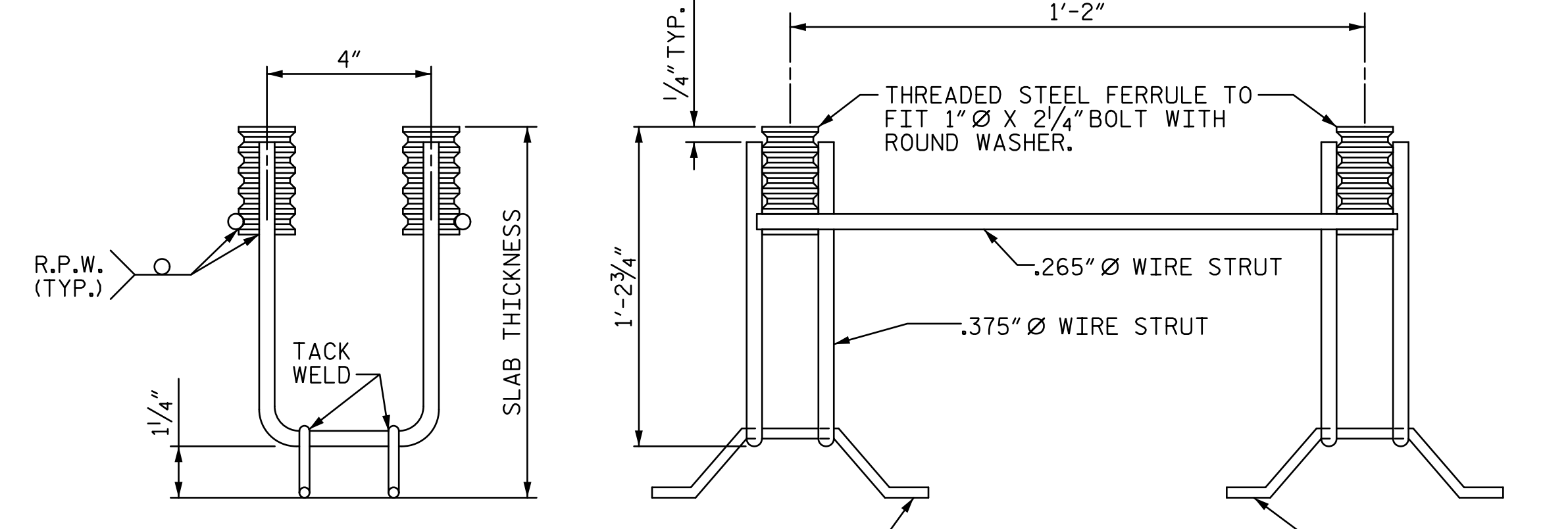


**PLAN OF CULVERT GUARDRAIL ANCHOR ASSEMBLY SPACING**

• THIS DIMENSION TO BE CONFIRMED BY THE ENGINEER IN THE FIELD.



**PLAN**

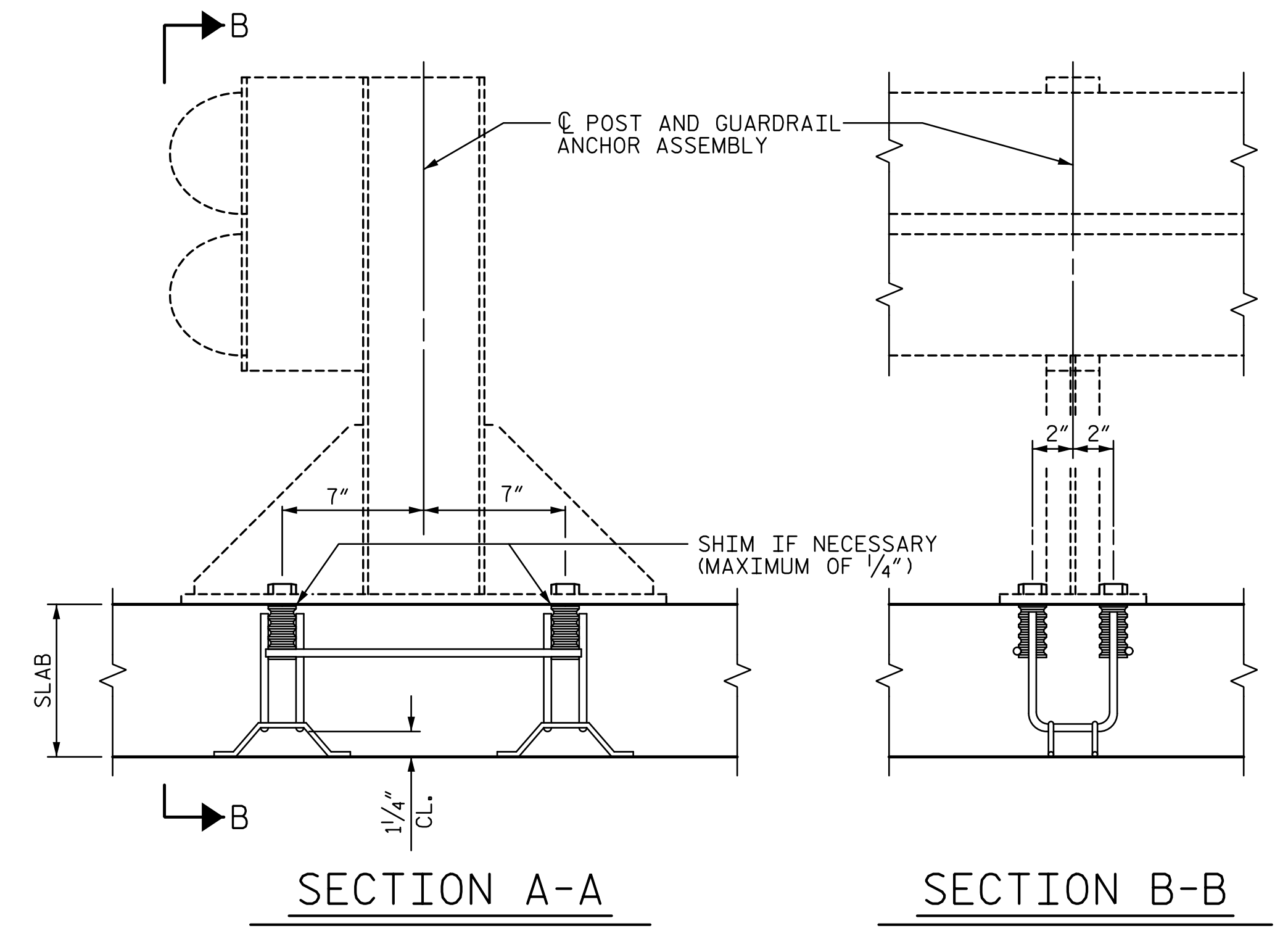


THIS SUPPORT SHALL MEET THE REQUIREMENTS AS SPECIFIED FOR SUPPORTS FOR REINFORCING STEEL. SEE SPECIFICATIONS.

**ELEVATION**

**SIDE VIEW**

**GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS**



**SECTION A-A**

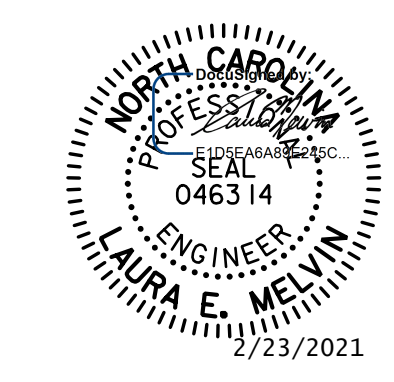
**SECTION B-B**

**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.

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PROJECT NO. 17BP.10.PE.4  
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STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 STANDARD  
 ANCHORAGE DETAILS FOR  
 GUARDRAIL ANCHOR ASSEMBLY  
 FOR CULVERTS

DRAWN BY :	LEM	DATE :	3-20
CHECKED BY :	JWJ	DATE :	1-21
DESIGN ENGINEER OF RECORD :	LEM	DATE :	2-21

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

TOTAL SHEETS: 7



## 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.
	--	27,000 LBS. PER SQ. IN.
	--	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  $\frac{5}{16}$ " 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. 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