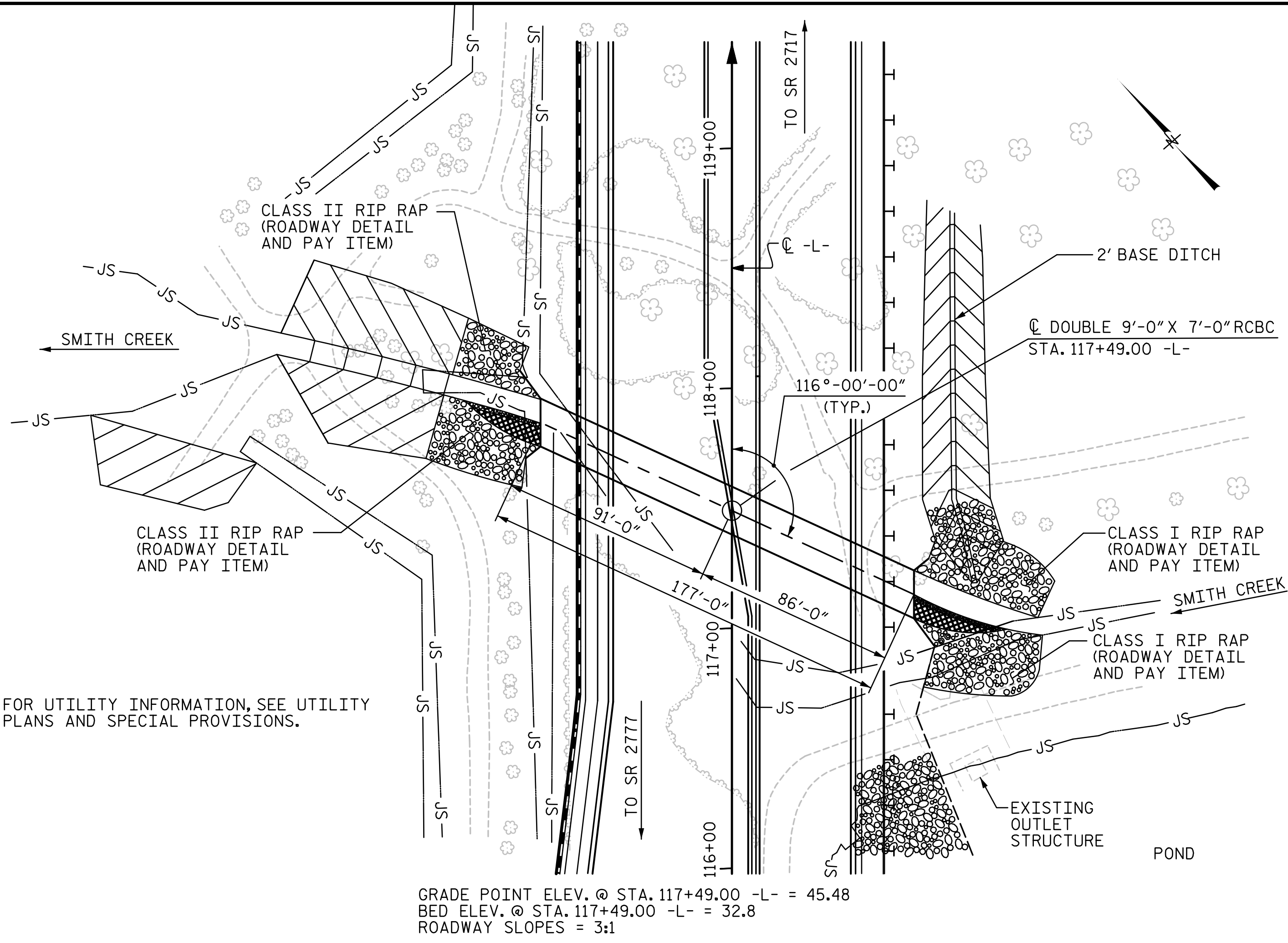


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with their signature on that page.**

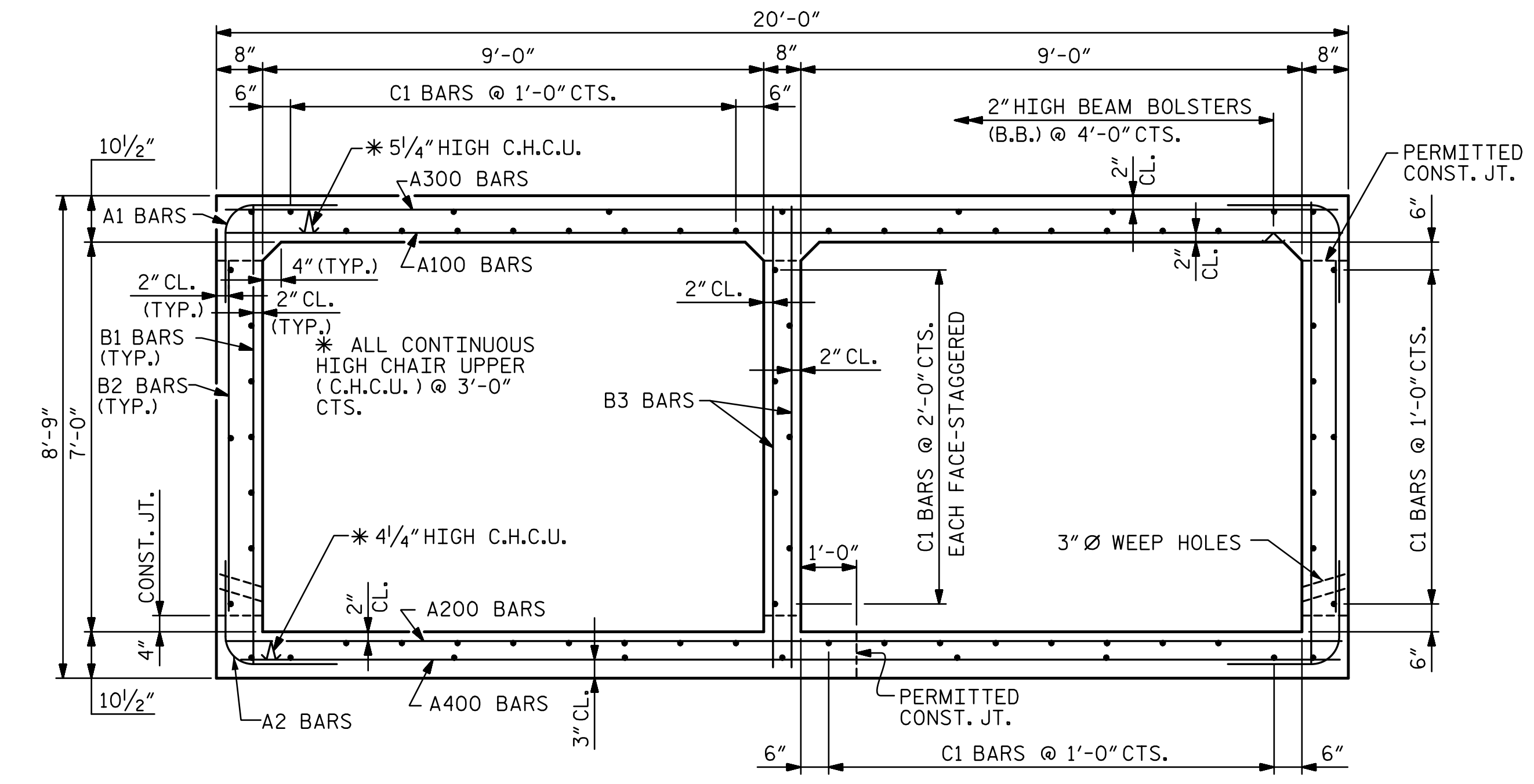
**This file or an individual page
shall not be considered a certified document.**

BENCHMARK 17: 317.03' RT., STA. 146+28.72 -L-, N=198704.150 E=2355984.737, EL. 45.01



GRADE POINT ELEV. @ STA. 117+49.00 -L- = 45.48
BED ELEV. @ STA. 117+49.00 -L- = 32.8
ROADWAY SLOPES = 3:1

LOCATION SKETCH



RIGHT ANGLE SECTION OF BARREL

THERE ARE 73 "C" BARS IN SECTION OF BARREL.

DRAWN BY : BMC DATE : 4-17
 CHECKED BY : MLO DATE : 4-17
 DESIGN ENGINEER OF RECORD: B. CURRY DATE : 4-17

HYDRAULIC DATA

DESIGN DISCHARGE	=	800 CFS
FREQUENCY OF DESIGN FLOOD	=	50 YRS.
DESIGN HIGH WATER ELEVATION	=	41.1 FT.
DRAINAGE AREA	=	267 ACRES
BASIC DISCHARGE (Q100)	=	900 CFS
BASIC HIGH WATER ELEVATION	=	41.6 FT.

OVERTOPPING FLOOD DATA

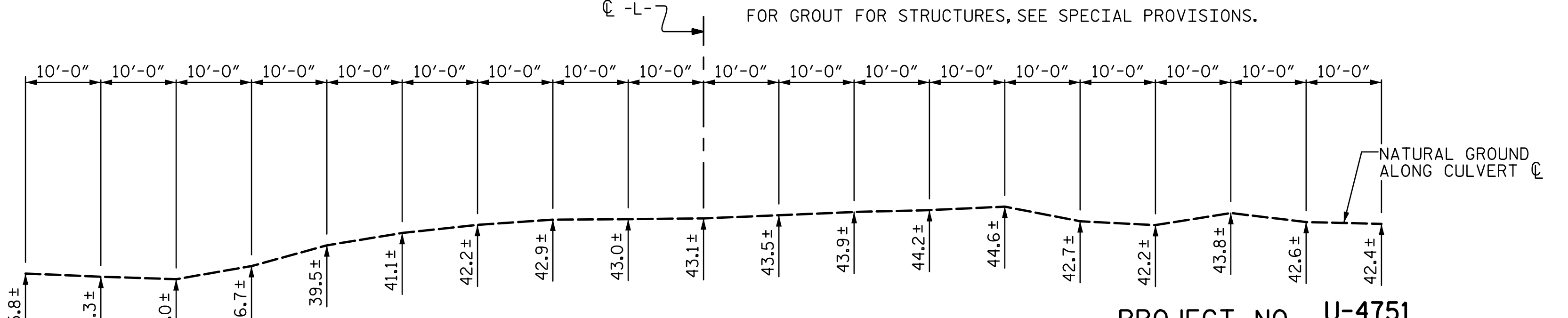
OVERTOPPING DISCHARGE	=	1,475 CFS
FREQUENCY OF OVERTOPPING FLOOD	=	100+ YRS.
OVERTOPPING FLOOD ELEVATION (@ STA. 117+42.00 -L-)	=	45.8 FT.

TOTAL STRUCTURE QUANTITIES

CULVERT EXCAVATION @ STA. 117+49.00 -L- LUMP SUM	
FOUNDATION CONDITIONING MATERIAL TOTAL: 300 TONS	
CLASS A CONCRETE	
BARREL @ 1.823 CU.YDS./FT.	322.7 CU.YDS.
WINGS, ETC.	33.7 CU.YDS.
TOTAL	356.4 CU.YDS.
REINFORCING STEEL	
BARREL	47,714 LBS.
WINGS, ETC.	1,798 LBS.
TOTAL	49,512 LBS.
PLACEMENT OF NATURAL STREAM BED MATERIAL LUMP SUM	

NOTES:

ASSUMED LIVE LOAD-----HL-93 OR ALTERNATE LOADING.
 DESIGN FILL-----6.04' MAX. AND 3.85' MIN.
 FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
 CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY THE SILLS, 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 SHEET (SHEET 6 OF 6).
 TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT POURS TO A MAXIMUM OF 70 FT. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
 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 AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
 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.
 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.
 NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED OR FLOODPLAIN AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE THE LOW FLOW CULVERT BARREL. RIP RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL IN THE HIGH FLOW CULVERT BARREL. NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.
 FOR PLACEMENT OF NATURAL STREAM BED MATERIAL, SEE SPECIAL PROVISIONS.
 FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
 FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
 FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.



PROFILE ALONG CULVERT

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 117+49.00 -L-
 SHEET 1 OF 6

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

DOUBLE 9'-0" X 7'-0" CONCRETE BOX CULVERT
 116°-00'-00" SKEW

STV ENGINEERS, INC.
 900 West Trade St., Suite 715
 Charlotte, NC 28202
 NC License Number F-5991

REVISIONS

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

SHEET NO. C1-1
 TOTAL SHEETS 6

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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	1.090	--	1.75	1.12	1 & 2	TOP SLAB	4.20'	1.09	1 & 2	TOP SLAB	9.04'		
	HL-93 (OPERATING)	N/A		1.420	--	1.35	1.45	1 & 2	TOP SLAB	4.20'	1.42	1 & 2	TOP SLAB	9.04'		
	HS-20 (INVENTORY)	36.000	2	1.210	43.560	1.75	1.21	1 & 2	TOP SLAB	4.20'	1.27	1 & 2	TOP SLAB	9.04'		
	HS-20 (OPERATING)	36.000		1.570	56.520	1.35	1.57	1 & 2	TOP SLAB	4.20'	1.65	1 & 2	TOP SLAB	9.04'		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		2.110	28.485	1.40	2.36	1 & 2	TOP SLAB	4.20'	2.11	1 & 2	TOP SLAB	9.04'		
		SNGARBS2	20.000		1.980	39.600	1.40	2.21	1 & 2	TOP SLAB	4.20'	1.98	1 & 2	TOP SLAB	9.04'	
		SNAGRIS2	22.000		2.110	46.420	1.40	2.36	1 & 2	TOP SLAB	4.20'	2.11	1 & 2	TOP SLAB	9.04'	
		SNCOTTS3	27.250	3	1.550	42.238	1.40	1.55	1 & 2	TOP SLAB	4.20'	1.56	1 & 2	BOTTOM SLAB	9.04'	
		SNAGGRS4	34.925		2.050	71.596	1.40	2.05	1 & 2	TOP SLAB	4.20'	2.05	1 & 2	BOTTOM SLAB	9.04'	
		SNS5A	35.550		1.850	65.768	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
		SNS6A	39.950		1.850	73.908	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
		SNS7B	42.000		1.850	77.700	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.110	69.630	1.40	2.36	1 & 2	TOP SLAB	4.20'	2.11	1 & 2	TOP SLAB	9.04'	
		TNT4A	33.075		1.850	61.189	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
		TNT6A	41.600		1.850	76.960	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
		TNT7A	42.000		1.850	77.700	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
		TNT7B	42.000		1.850	77.700	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'	
		TNAGRIT4	43.000		1.770	76.110	1.40	1.77	1 & 2	TOP SLAB	4.20'	1.77	1 & 2	BOTTOM SLAB	9.04'	
		TNACT5A	45.000		1.770	79.650	1.40	1.77	1 & 2	TOP SLAB	4.20'	1.77	1 & 2	BOTTOM SLAB	9.04'	
TNACT5B	45.000		1.850	83.250	1.40	1.85	1 & 2	TOP SLAB	4.20'	1.85	1 & 2	BOTTOM SLAB	9.04'			

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	--

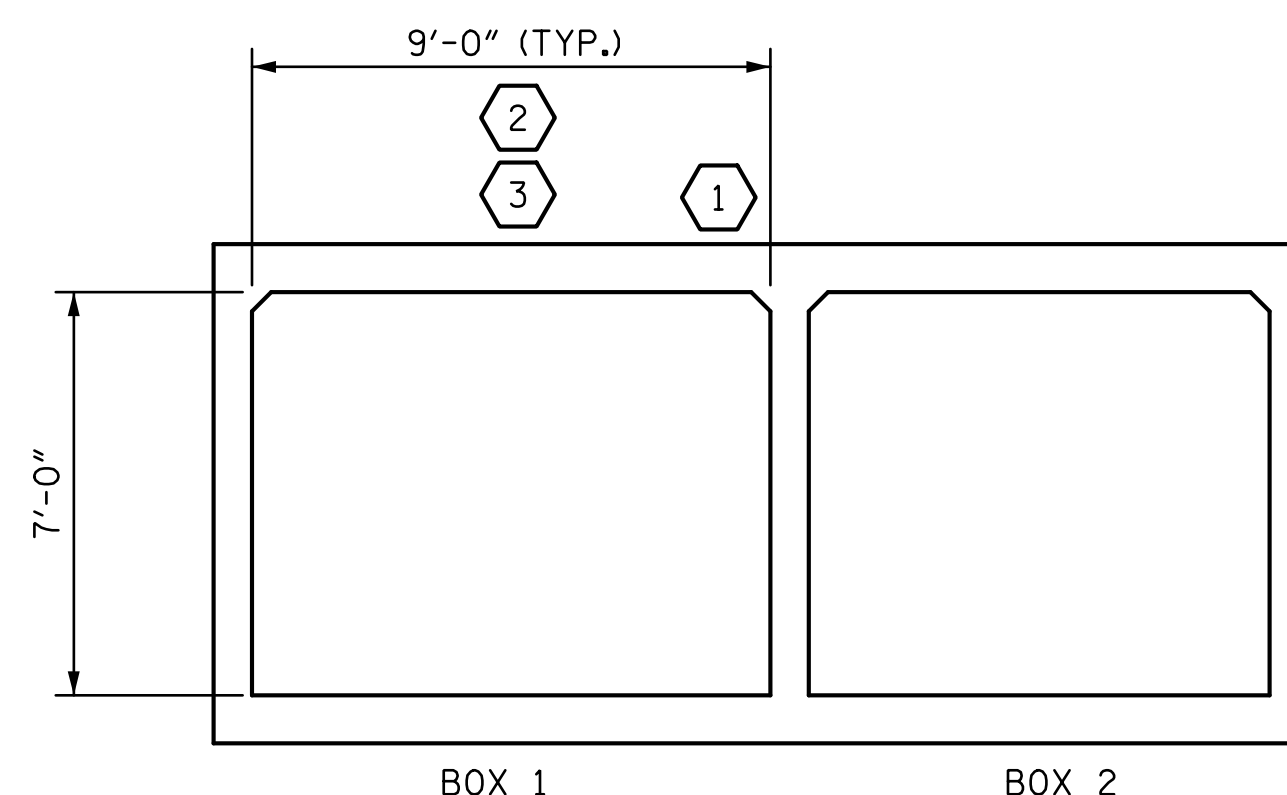
NOTE:

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. U-4751

NEW HANOVER COUNTY

STATION: 117+49.00 -L-

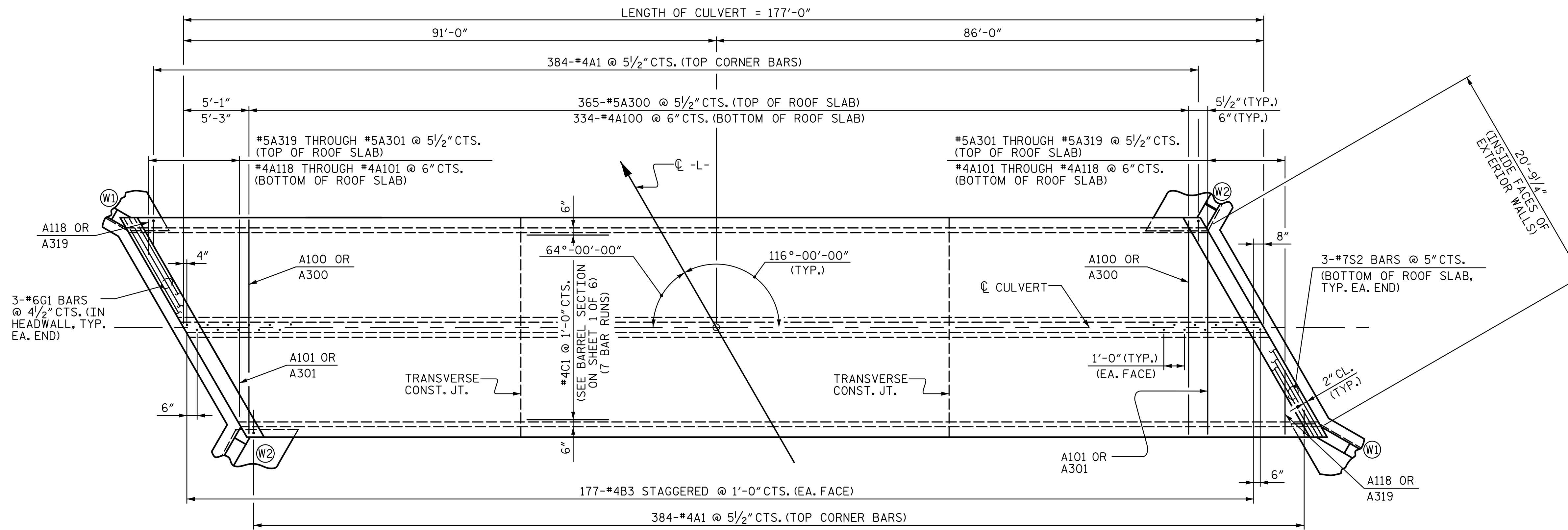
SHEET 2 OF 6

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																	
	STV ENGINEERS, INC. 900 West Trade St., Suite 715 Charlotte, NC 28202 NC License Number F-5991	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>	NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4	
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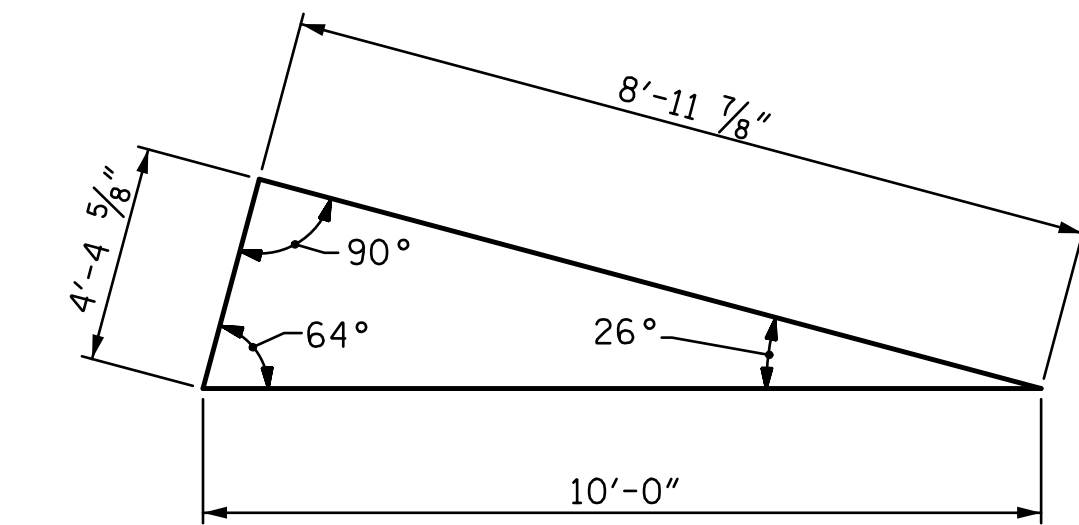
DRAWN BY : <u>BMC</u> DATE : <u>4-17</u>	DESIGN ENGINEER OF RECORD: <u>B. CURRY</u> DATE : <u>4-17</u>	
CHECKED BY : <u>JWJ</u> DATE : <u>5-17</u>		

SHEET NO.
C1-2
TOTAL SHEETS
6

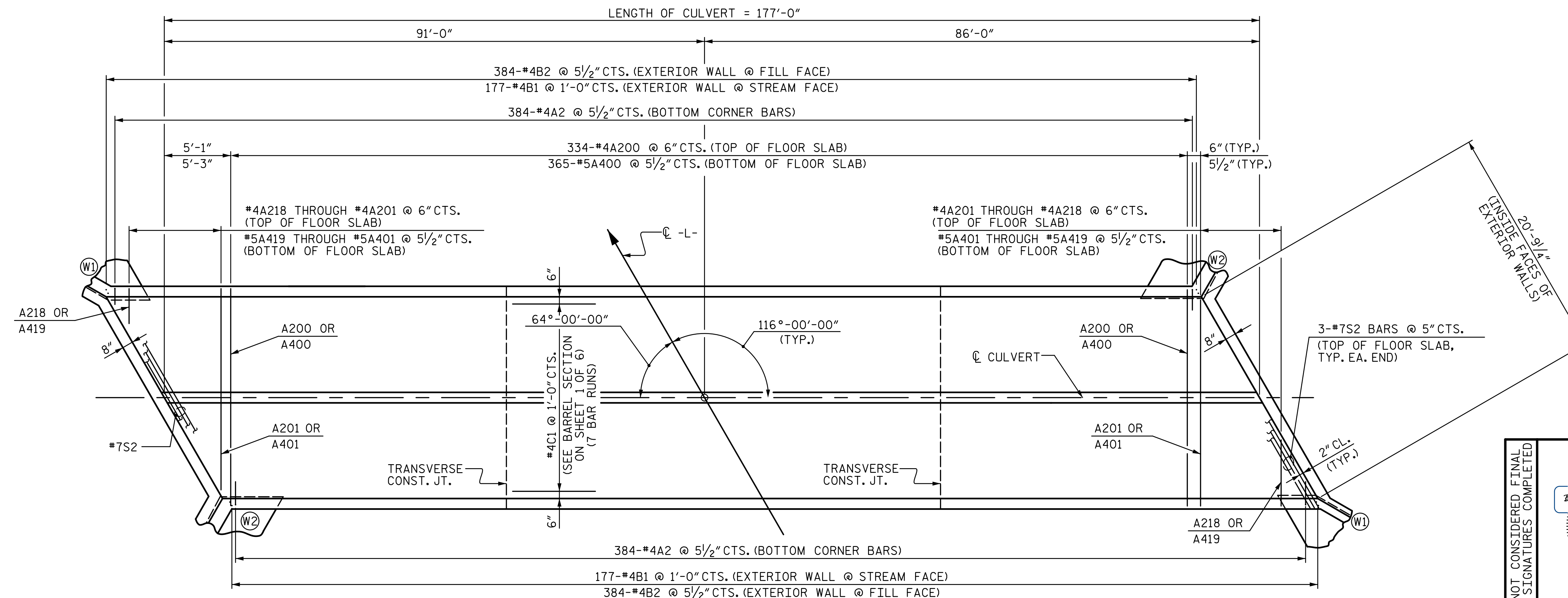
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ROOF PLAN
(SEE FLOOR PLAN FOR B1 & B2 BARS IN EXTERIOR WALLS)



SKEW TRIANGLE



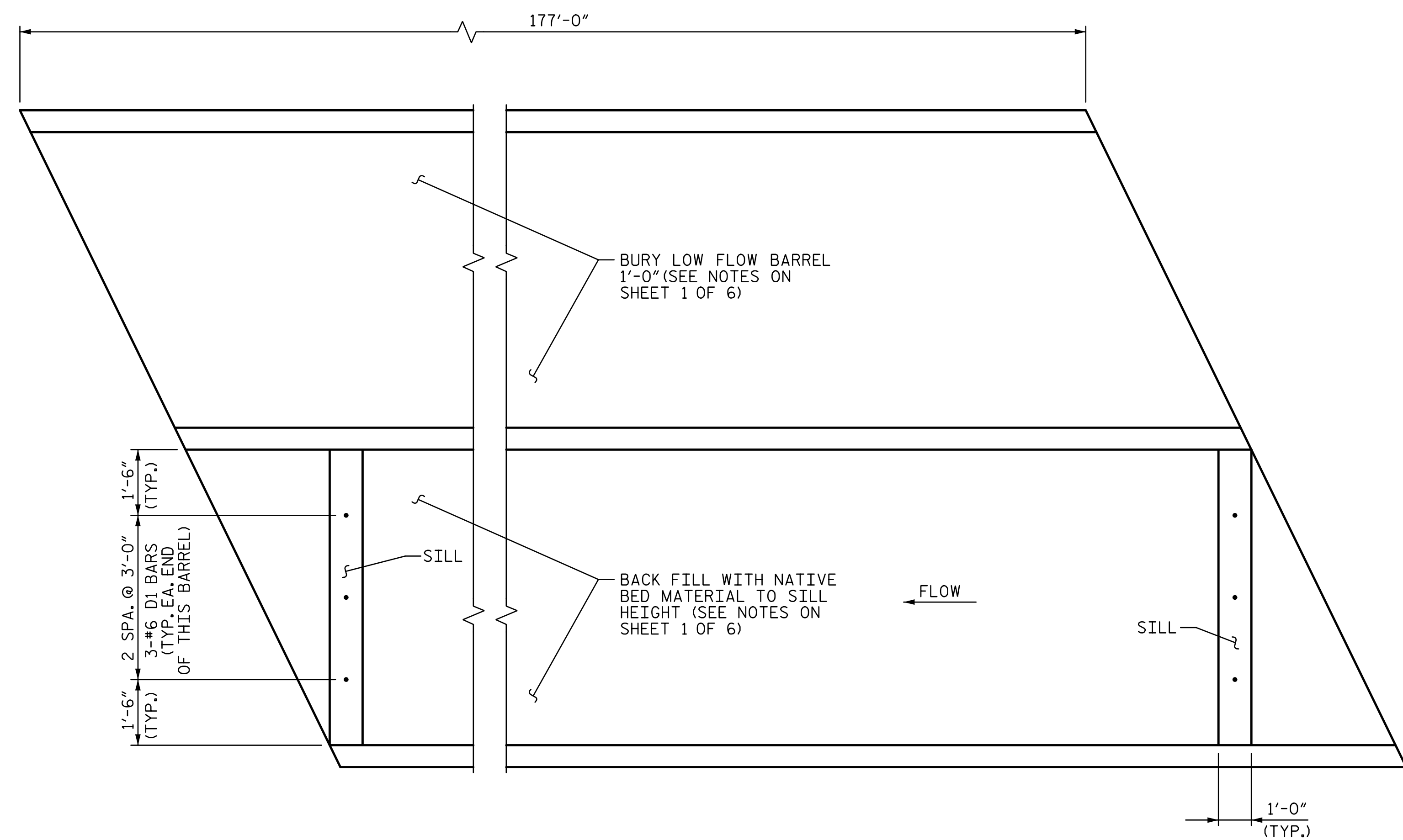
FLOOR PLAN
(SEE ROOF PLAN FOR B3 BARS IN INTERIOR WALL)
(SILLS NOT SHOWN, SEE SHEET 5 OF 6)

PROJECT NO. U-4751
NEW HANOVER COUNTY
 STATION: 117+49.00 -L-
 SHEET 4 OF 6

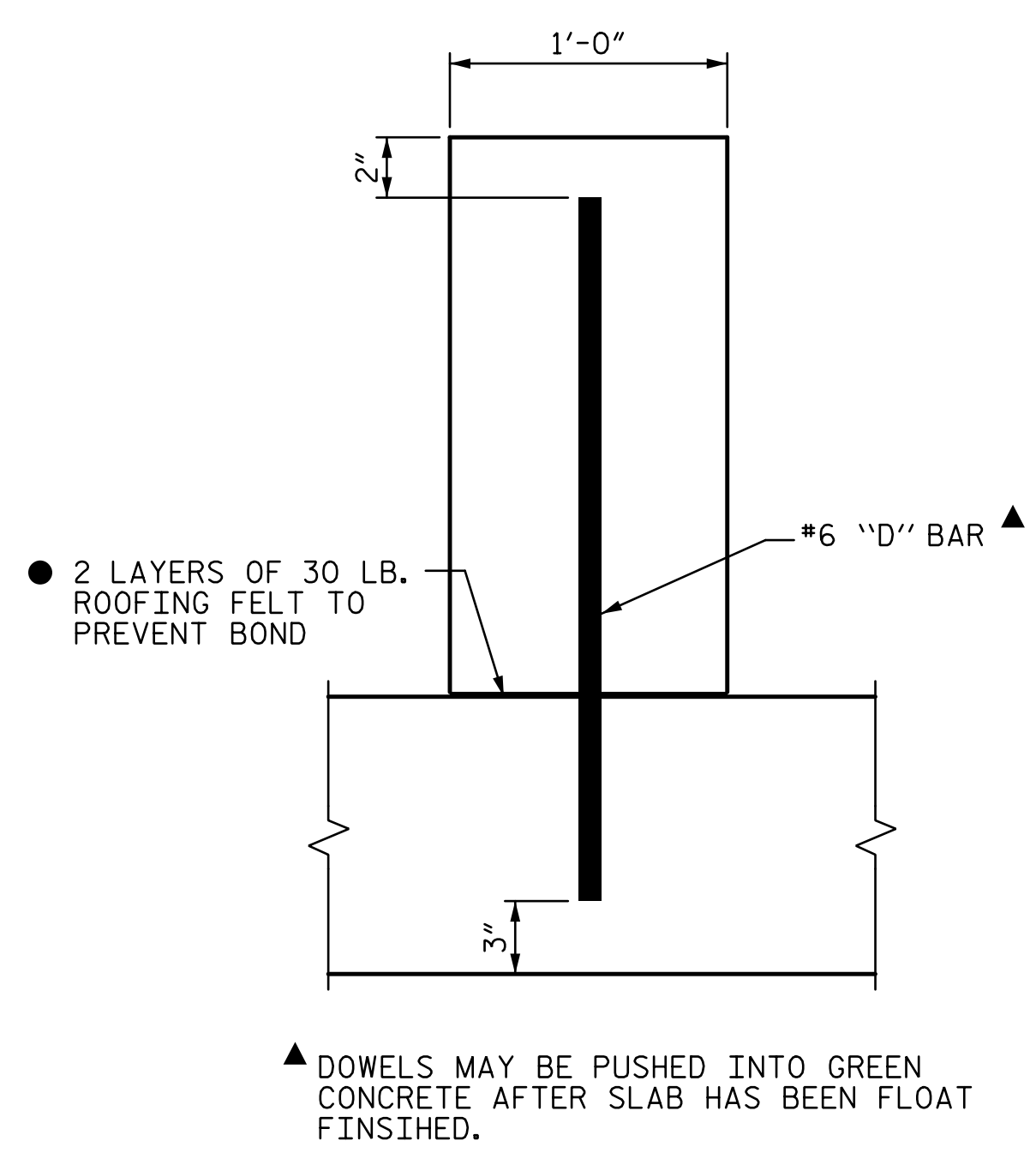
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		DOUBLE 9'-0" X 7'-0" CONCRETE BOX CULVERT 116'-00'-00" SKEW			TOTAL SHEETS 6																
		REVISIONS <table border="1"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>				NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4
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DRAWN BY: BMC DATE: 4-17
 CHECKED BY: MLO DATE: 4-17
 DESIGN ENGINEER OF RECORD: B. CURRY DATE: 4-17

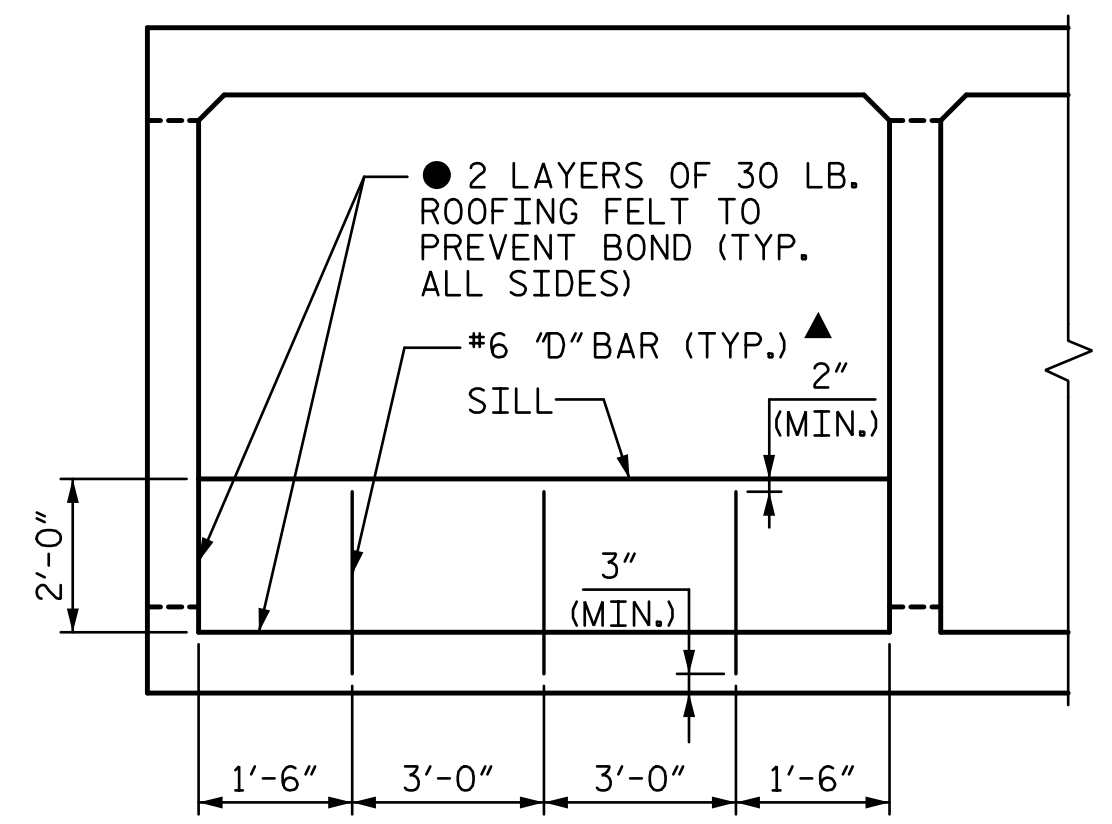
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PLAN VIEW - LOCATION OF SILLS



SECTION THROUGH SILL



ELEVATION
(INLET VIEW SHOWN)

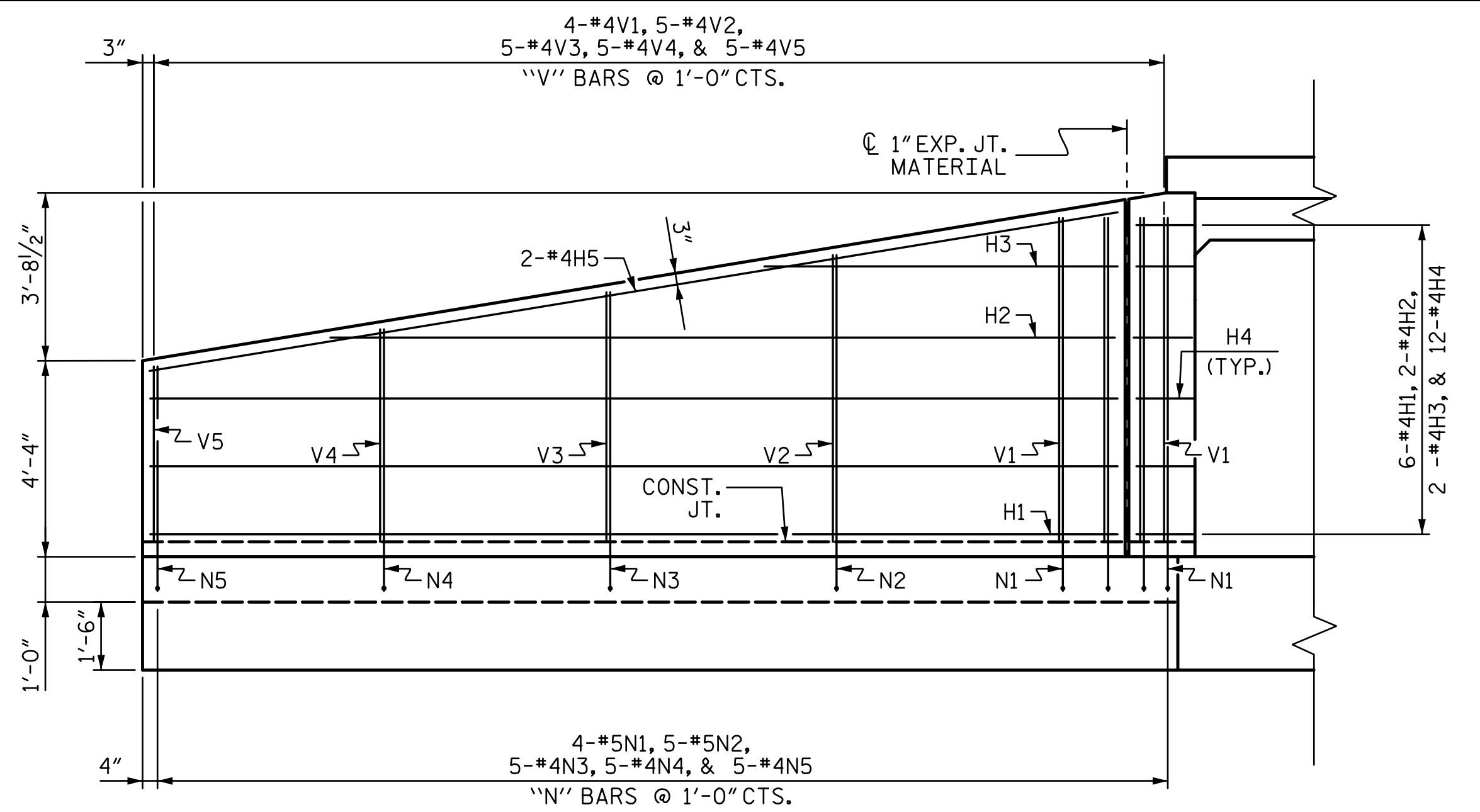
● THE COST OF THE ROOFING FELT IS INCIDENTAL AND SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS

PROJECT NO. U-4751
NEW HANOVER COUNTY
 STATION: 117+49.00 -L-
 SHEET 5 OF 6

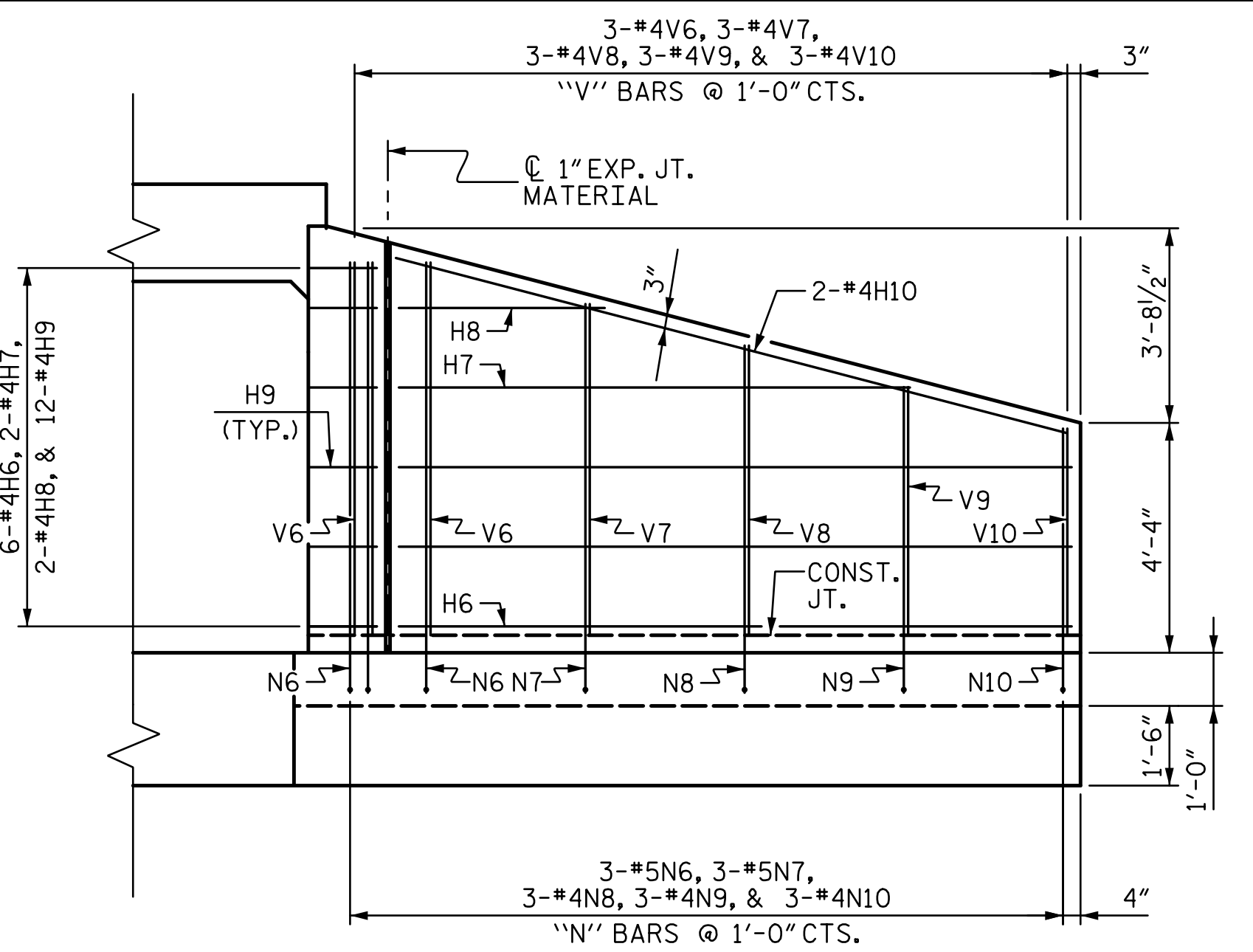
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	SILL DETAILS				TOTAL SHEETS 6
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DRAWN BY : BMC DATE : 4-17 DESIGN ENGINEER OF RECORD: B. CURRY DATE : 4-17
 CHECKED BY : MLO DATE : 4-17

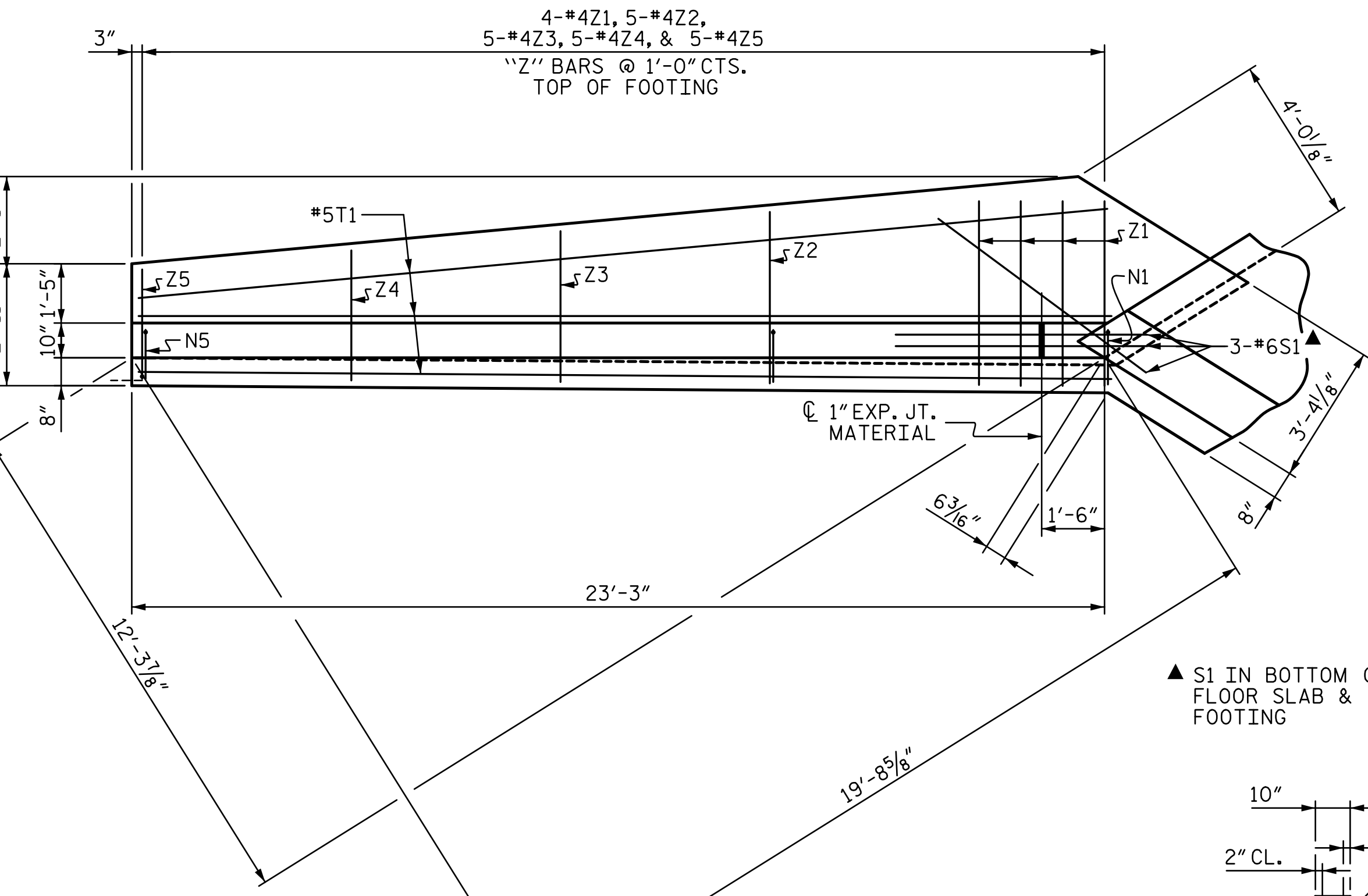
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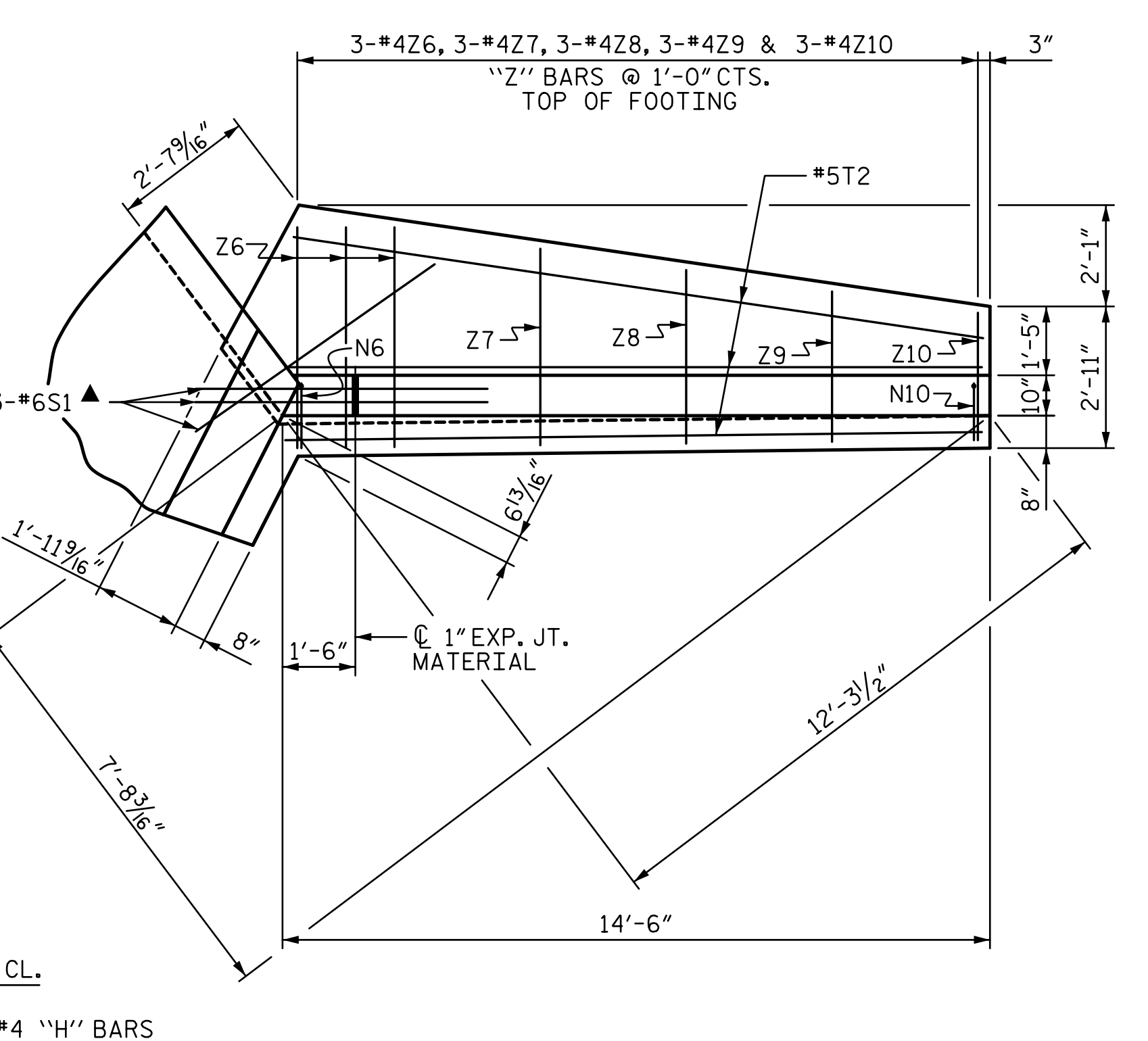
ELEVATION W1



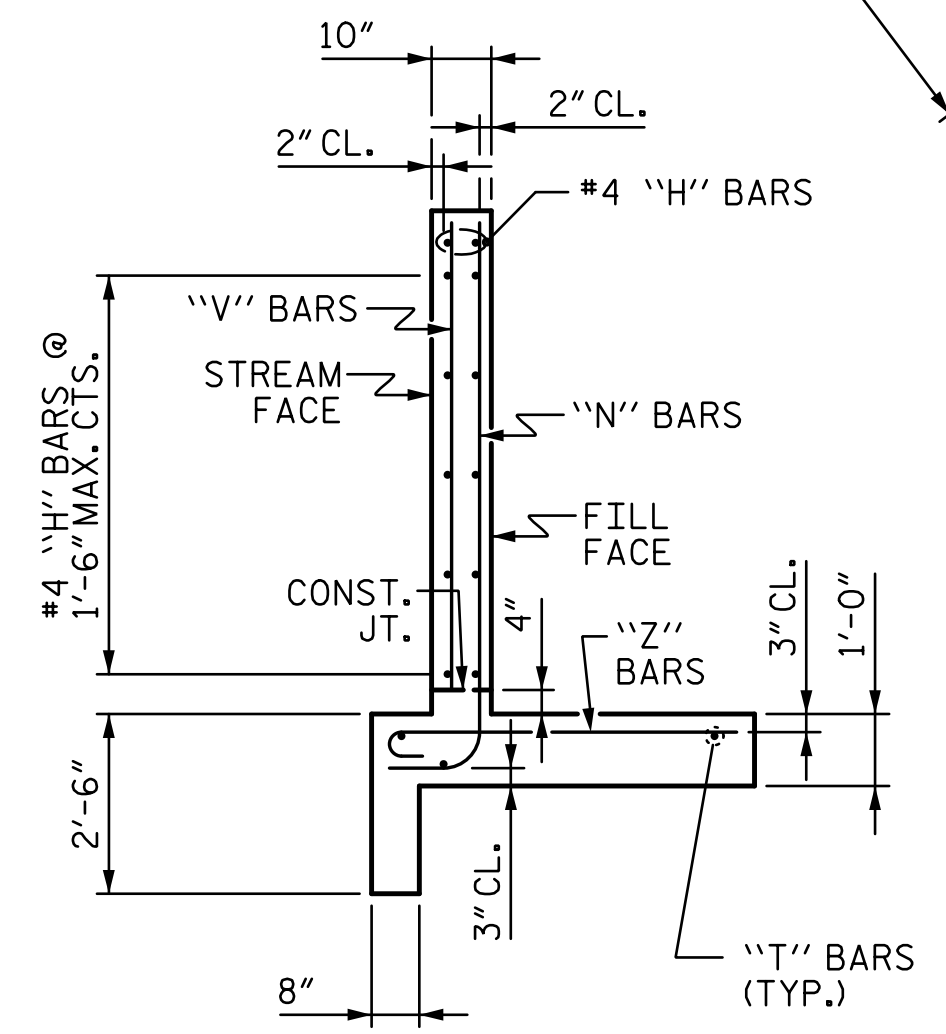
ELEVATION W2



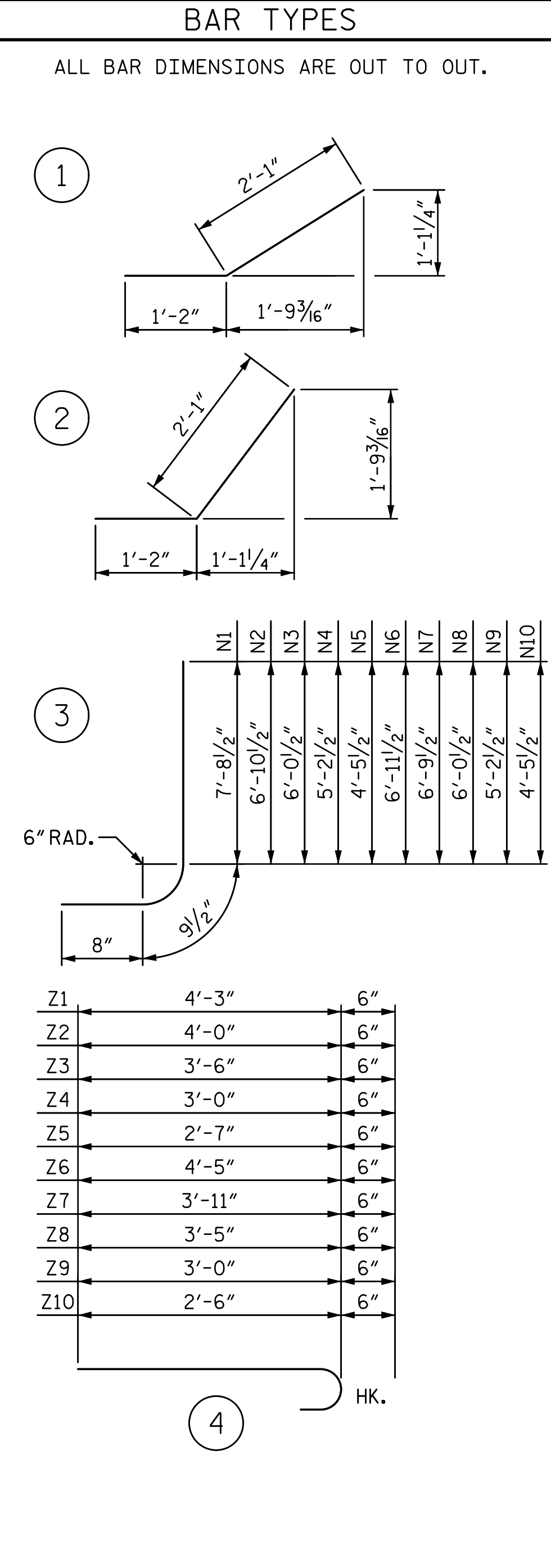
PLAN W1



PLAN W2



TYPICAL WING SECTION



BILL OF MATERIAL					
MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	21'-4"	171
H2	4	#4	STR	15'-11"	43
H3	4	#4	STR	7'-3"	19
H4	24	#4	①	3'-3"	52
H5	4	#4	STR	21'-7"	58
H6	12	#4	STR	12'-7"	101
H7	4	#4	STR	9'-7"	26
H8	4	#4	STR	3'-10"	10
H9	24	#4	②	3'-3"	52
H10	4	#4	STR	13'-0"	35
N1	8	#5	③	9'-2"	76
N2	10	#5	③	8'-4"	87
N3	10	#4	③	7'-6"	50
N4	10	#4	③	6'-8"	45
N5	10	#4	③	5'-11"	40
N6	6	#5	③	8'-5"	53
N7	6	#5	③	8'-3"	52
N8	6	#4	③	7'-6"	30
N9	6	#4	③	6'-8"	27
N10	6	#4	③	5'-11"	24
S1	12	#6	STR	6'-0"	108
T1	6	#4	STR	23'-3"	93
T2	6	#4	STR	14'-3"	57
V1	8	#4	STR	7'-1"	38
V2	10	#4	STR	6'-4"	42
V3	10	#4	STR	5'-6"	37
V4	10	#4	STR	4'-8"	31
V5	10	#4	STR	3'-10"	26
V6	6	#4	STR	7'-0"	28
V7	6	#4	STR	6'-2"	25
V8	6	#4	STR	5'-5"	22
V9	6	#4	STR	4'-8"	19
V10	6	#4	STR	3'-10"	15
Z1	8	#4	④	4'-9"	25
Z2	10	#4	④	4'-6"	30
Z3	10	#4	④	4'-0"	27
Z4	10	#4	④	3'-6"	23
Z5	10	#4	④	3'-1"	21
Z6	6	#4	④	4'-11"	20
Z7	6	#4	④	4'-5"	18
Z8	6	#4	④	3'-11"	16
Z9	6	#4	④	3'-6"	14
Z10	6	#4	④	3'-0"	12
REINFORCING STEEL FOR 4 WINGS					1,798 LBS
CLASS A CONCRETE					
4 WINGS					13.5 CY
2 HEADWALLS					2.1 CY
2 END CURTAIN WALLS					18.1 CY
TOTAL					33.7 CY

INCLUDES WING FOOTINGS

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 117+49.00 -L-
 SHEET 6 OF 6

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STV ENGINEERS, INC.
 900 West Trade St., Suite 715
 Charlotte, NC 28202
 NC License Number F-5991

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

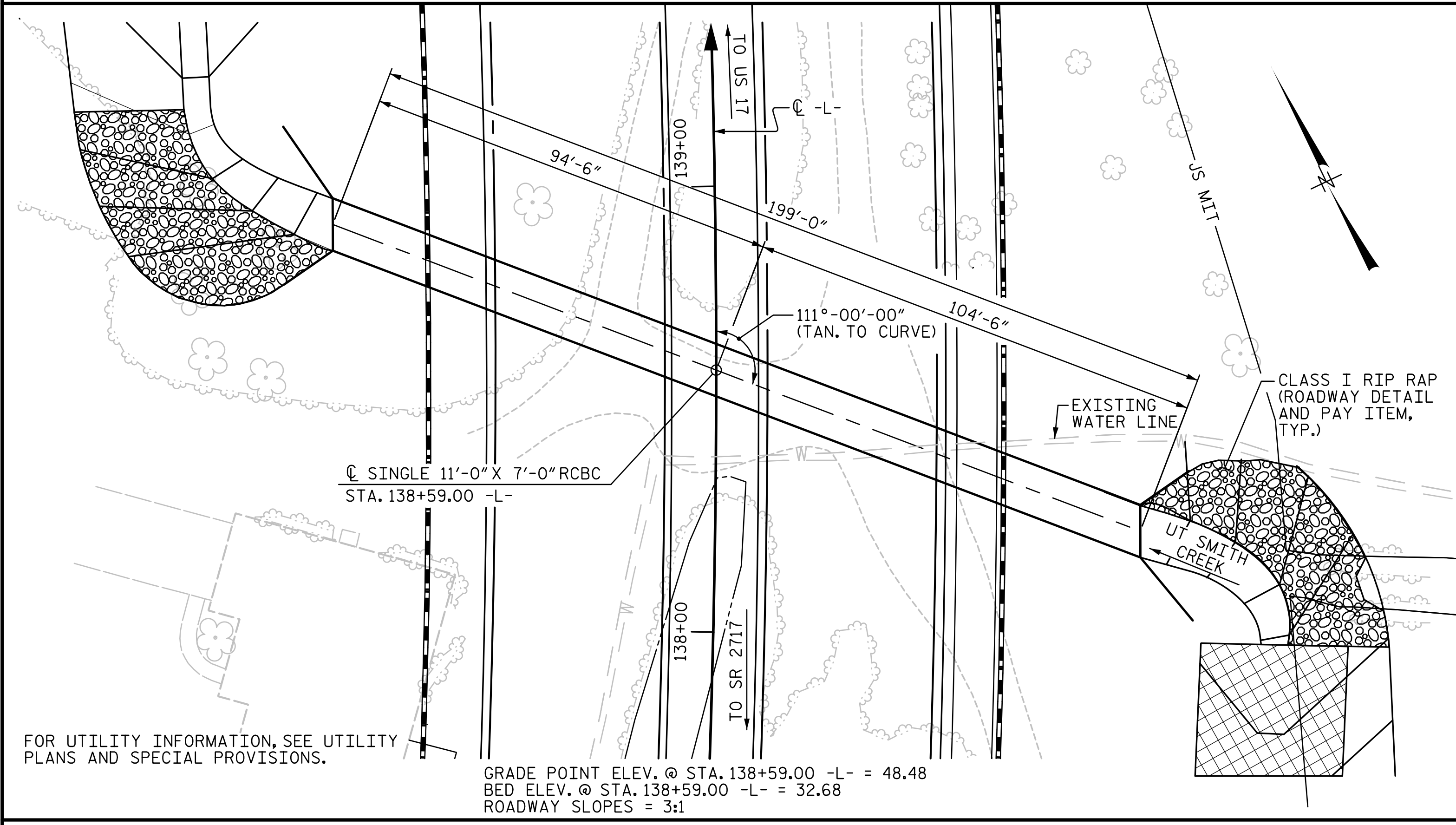
WINGS FOR CONCRETE BOX CULVERT
 H = 7'-0" SLOPE = 3:1
 116°-00'-00" SKEW

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

TOTAL SHEETS: 6

DRAWN BY: BMC DATE: 4-17
 CHECKED BY: MLO DATE: 4-17
 DESIGN ENGINEER OF RECORD: B. CURRY DATE: 4-17

BENCHMARK 17: 317.03' RT., STA. 146+28.72 -L-, N=198704.150 E=2355984.737, EL. 45.01



LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	=	390 CFS
FREQUENCY OF DESIGN FLOOD	=	50 YRS.
DESIGN HIGH WATER ELEVATION	=	40.0 FT.
DRAINAGE AREA	=	71 ACRES
BASE DISCHARGE (Q100)	=	440 CFS
BASE HIGH WATER ELEVATION	=	40.48 FT.

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	=	600 CFS
FREQUENCY OF OVERTOPPING FLOOD	=	100+ YRS.
OVERTOPPING FLOOD ELEVATION @ STA. 18+40 -Y4-	=	42.4 FT.

-L- CURVE DATA

P.I. STA. = 146+07.40 -L-
 $\Delta = 58^{\circ}-00'-14.91''$ (LT)
 RADIUS = 2,610'
 TANGENT = 1,446.87'
 LENGTH = 2,642.27'

TOTAL STRUCTURE QUANTITIES

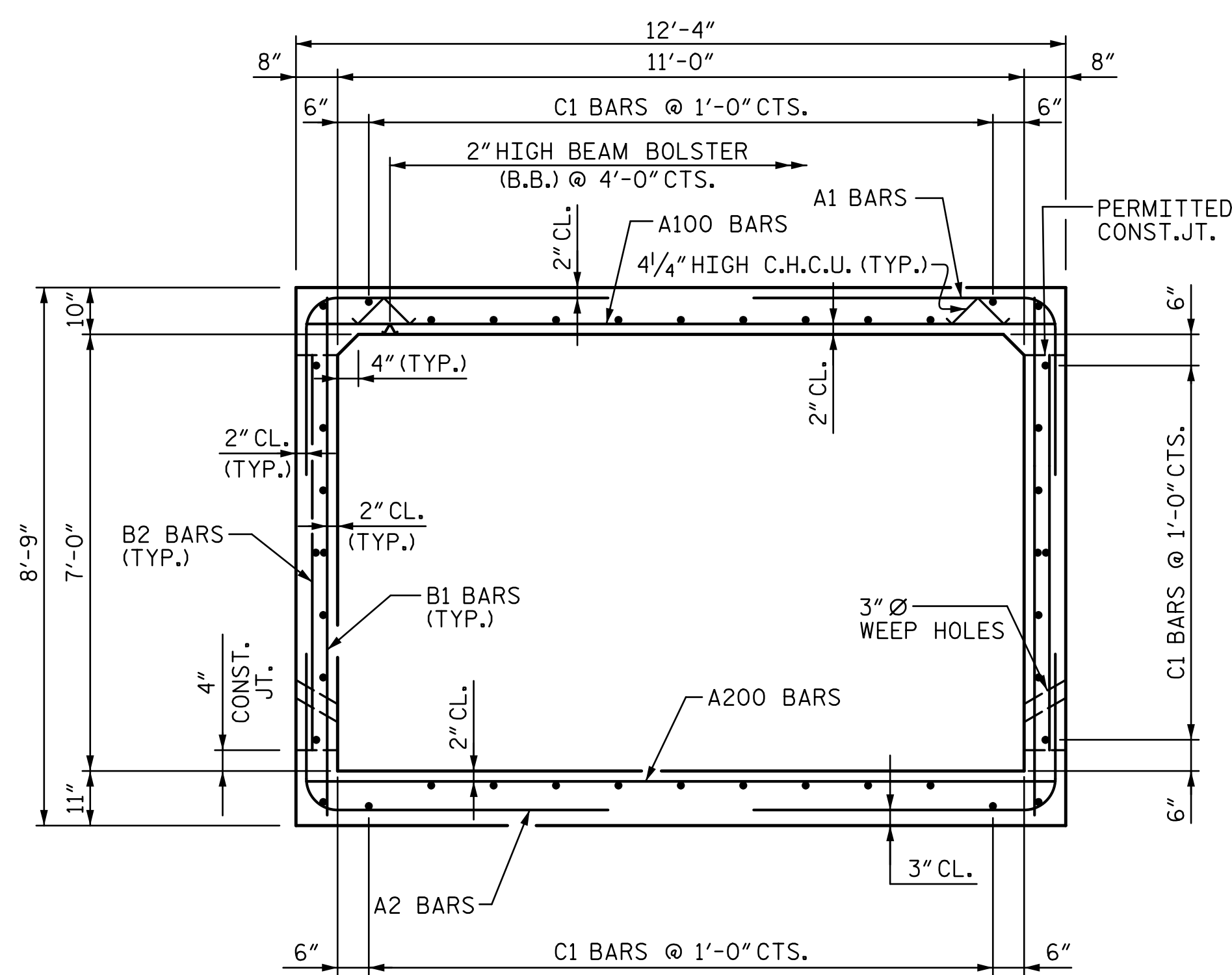
CULVERT EXCAVATION @ STA. 138+59.00 -L-	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	235 TONS
CLASS A CONCRETE	
BARREL @ 1.149 CU.YDS./FT.	228.7 CU.YDS.
WING ETC.	30.6 CU.YDS.
TOTAL	259.3 CU.YDS.
REINFORCING STEEL	
BARREL	39,822 LBS.
WINGS ETC.	1,797 LBS.
TOTAL	41,619 LBS.
PLACEMENT OF NATURAL STREAM BED MATERIAL	LUMP SUM

NOTES:

- ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.
- DESIGN FILL = 6.91' MIN. AND 11.22' MAX.
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERT TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS, AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALL.
- THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
- DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET (SHEET 4 OF 4).
- TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- 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.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- CULVERT TO BE BACK FILLED WITH NATIVE MATERIAL TO A DEPTH OF 1'-0". NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.
- FOR PLACEMENT OF NATURAL STREAM BED MATERIAL, 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.
- 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.

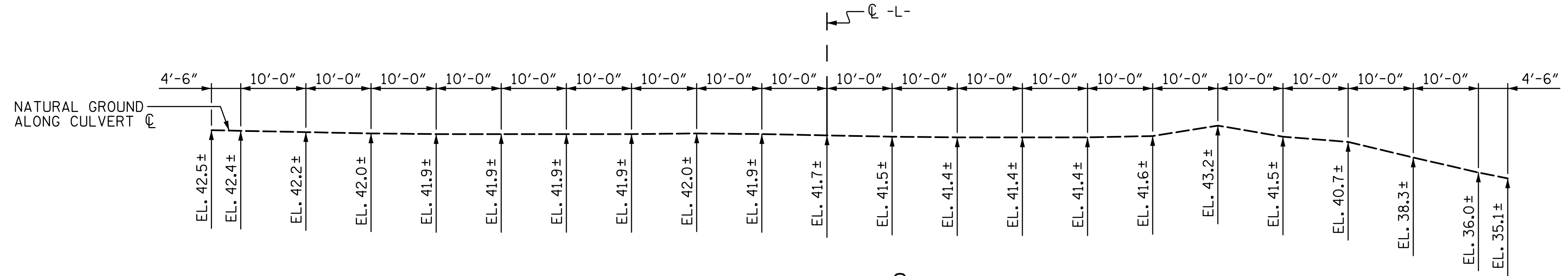
FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

GRADE POINT ELEV. @ STA. 138+59.00 -L- = 48.48
 BED ELEV. @ STA. 138+59.00 -L- = 32.68
 ROADWAY SLOPES = 3:1



RIGHT ANGLE SECTION OF BARREL

THERE ARE 42 "C" BARS IN SECTION OF BARREL



PROFILE ALONG CULVERT

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 138+59.00 -L-
 SHEET 1 OF 4

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

SINGLE 11'-0" X 7'-0" CONCRETE BOX CULVERT
111°-00'-00" SKEW

REVISIONS

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

SHEET NO.
C2-1

TOTAL SHEETS
4

DRAWN BY : JWJ DATE : 5-17
 CHECKED BY : MLO DATE : 5-17
 DESIGN ENGINEER OF RECORD: J. JONES DATE : 5-17

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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 (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING	HL-93 (INVENTORY)	N/A	①	1.14	--	1.75	1.14	1	TOP SLAB	6.17	1.28	1	BOTTOM SLAB	1.33		
	HL-93 (OPERATING)	N/A		1.48	--	1.35	1.48	1	TOP SLAB	6.17	1.66	1	BOTTOM SLAB	1.33		
	HS-20 (INVENTORY)	36.000	②	1.60	57.600	1.75	1.60	1	TOP SLAB	6.17	1.79	1	BOTTOM SLAB	1.33		
	HS-20 (OPERATING)	36.000		2.07	74.520	1.35	2.07	1	TOP SLAB	6.17	2.32	1	BOTTOM SLAB	1.33		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.90	39.150	1.40	2.90	1	TOP SLAB	6.17	3.25	1	BOTTOM SLAB	1.33	
		SNGARBS2	20.000		2.72	54.400	1.40	2.72	1	TOP SLAB	6.17	3.04	1	BOTTOM SLAB	1.33	
		SNAGRIS2	22.000		2.90	63.800	1.40	2.90	1	TOP SLAB	6.17	3.25	1	BOTTOM SLAB	1.33	
		SNCOTTS3	27.250		2.55	69.488	1.40	2.55	1	TOP SLAB	6.17	2.85	1	BOTTOM SLAB	1.33	
		SNAGRS4	34.925		2.13	74.390	1.40	2.13	1	TOP SLAB	6.17	2.39	1	BOTTOM SLAB	1.33	
		SNS5A	35.550		2.37	84.254	1.40	2.37	1	TOP SLAB	6.17	2.66	1	BOTTOM SLAB	1.33	
		SNS6A	39.950		2.36	94.282	1.40	2.36	1	TOP SLAB	6.17	2.65	1	BOTTOM SLAB	1.33	
		SNS7B	42.000		2.48	104.160	1.40	2.48	1	TOP SLAB	6.17	2.78	1	BOTTOM SLAB	1.33	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.33	76.890	1.40	2.33	1	TOP SLAB	6.17	2.61	1	BOTTOM SLAB	1.33	
		TNT4A	33.075		2.63	86.987	1.40	2.63	1	TOP SLAB	6.17	2.94	1	BOTTOM SLAB	1.33	
		TNT6A	41.600		2.57	106.912	1.40	2.57	1	TOP SLAB	6.17	2.88	1	BOTTOM SLAB	1.33	
		TNT7A	42.000		2.78	116.760	1.40	2.78	1	TOP SLAB	6.17	3.12	1	BOTTOM SLAB	1.33	
		TNT7B	42.000		2.78	116.760	1.40	2.78	1	TOP SLAB	6.17	3.12	1	BOTTOM SLAB	1.33	
		TNAGRIT4	43.000	③	2.02	86.860	1.40	2.02	1	TOP SLAB	6.17	2.26	1	BOTTOM SLAB	1.33	
		TNAGT5A	45.000		2.15	96.750	1.40	2.15	1	TOP SLAB	6.17	2.41	1	BOTTOM SLAB	1.33	
TNAGT5B	45.000		2.15	96.750	1.40	2.15	1	TOP SLAB	6.17	2.41	1	BOTTOM SLAB	1.33			

LOAD FACTORS:

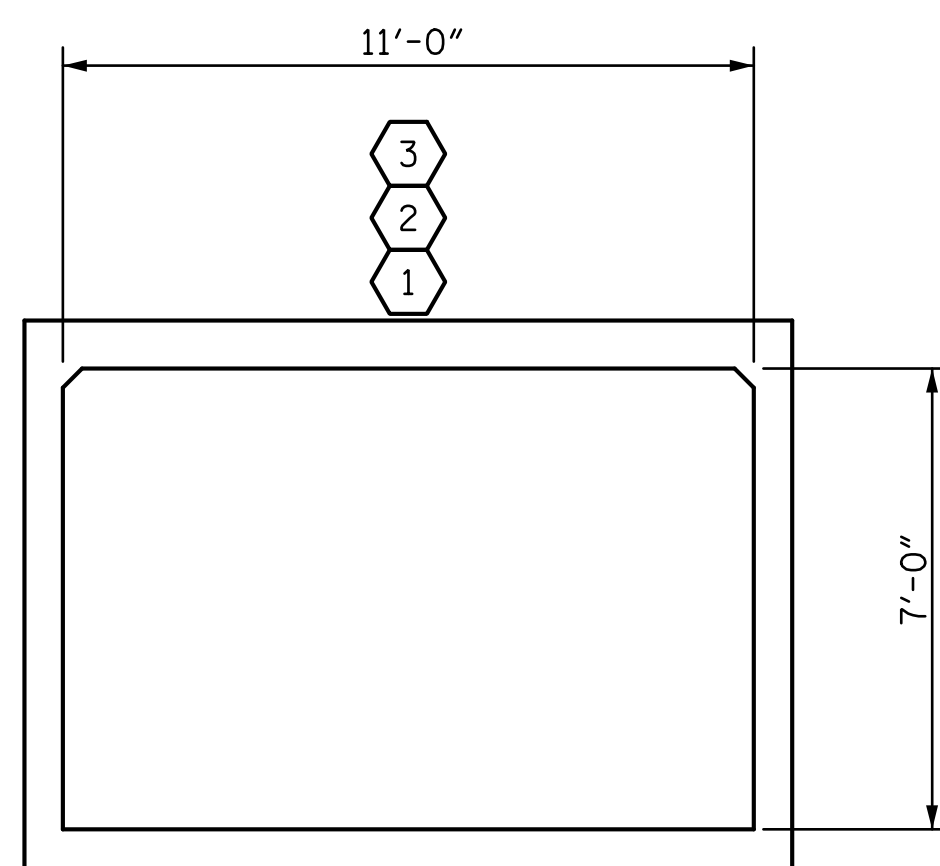
DESIGN LOAD RATING FACTORS

LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

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



LRFR SUMMARY
(LOOKING DOWNSTREAM)

PROJECT NO. U-4751

NEW HANOVER COUNTY

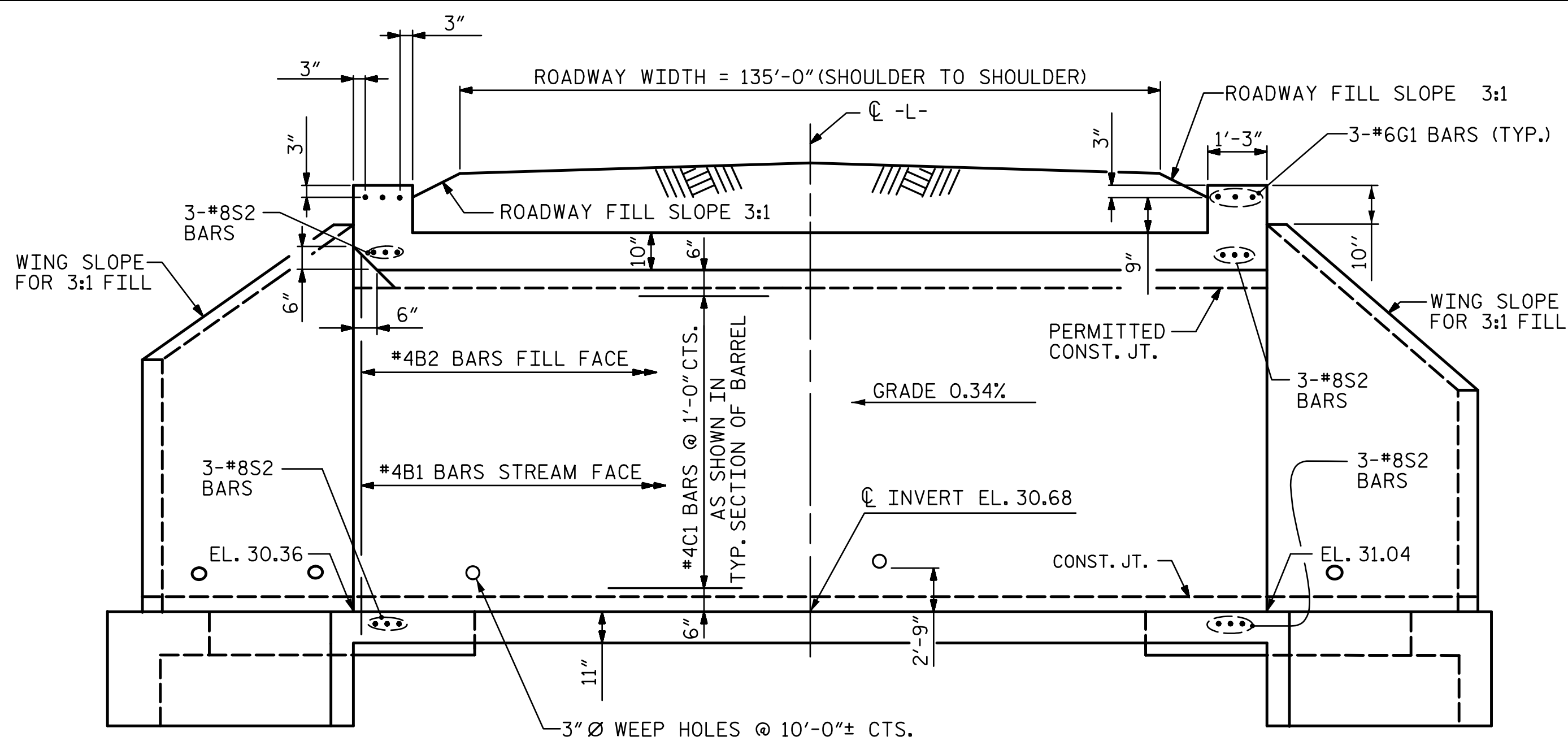
STATION: 138+59.00 -L-

SHEET 2 OF 4

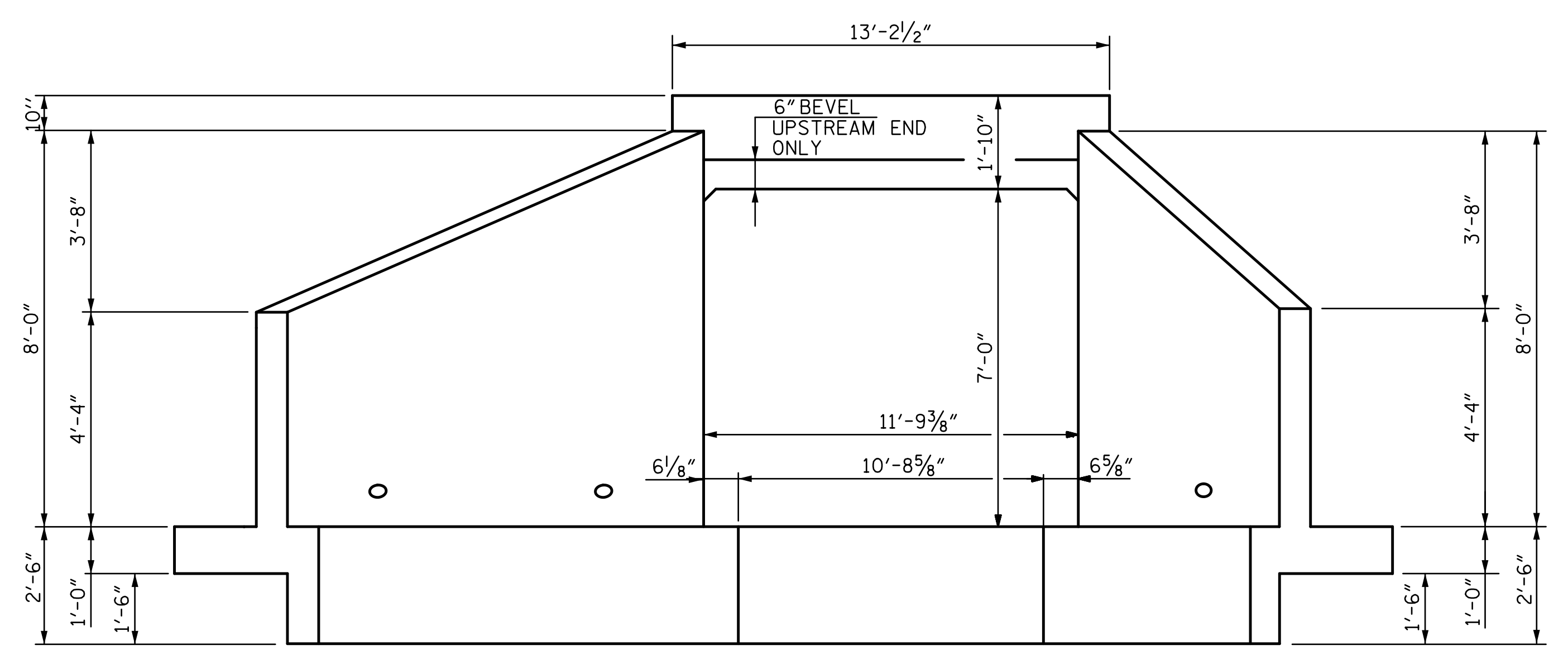
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH STANDARD LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)																		
		REVISIONS	SHEET NO. C2-2																	
	STV ENGINEERS, INC. 900 West Trade St., Suite 715 Charlotte, NC 28202 NC License Number F-5991	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>	NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4		
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DRAWN BY : JWJ DATE : 5-17
 CHECKED BY : BMC DATE : 5-17
 DESIGN ENGINEER OF RECORD: J. JONES DATE : 5-17

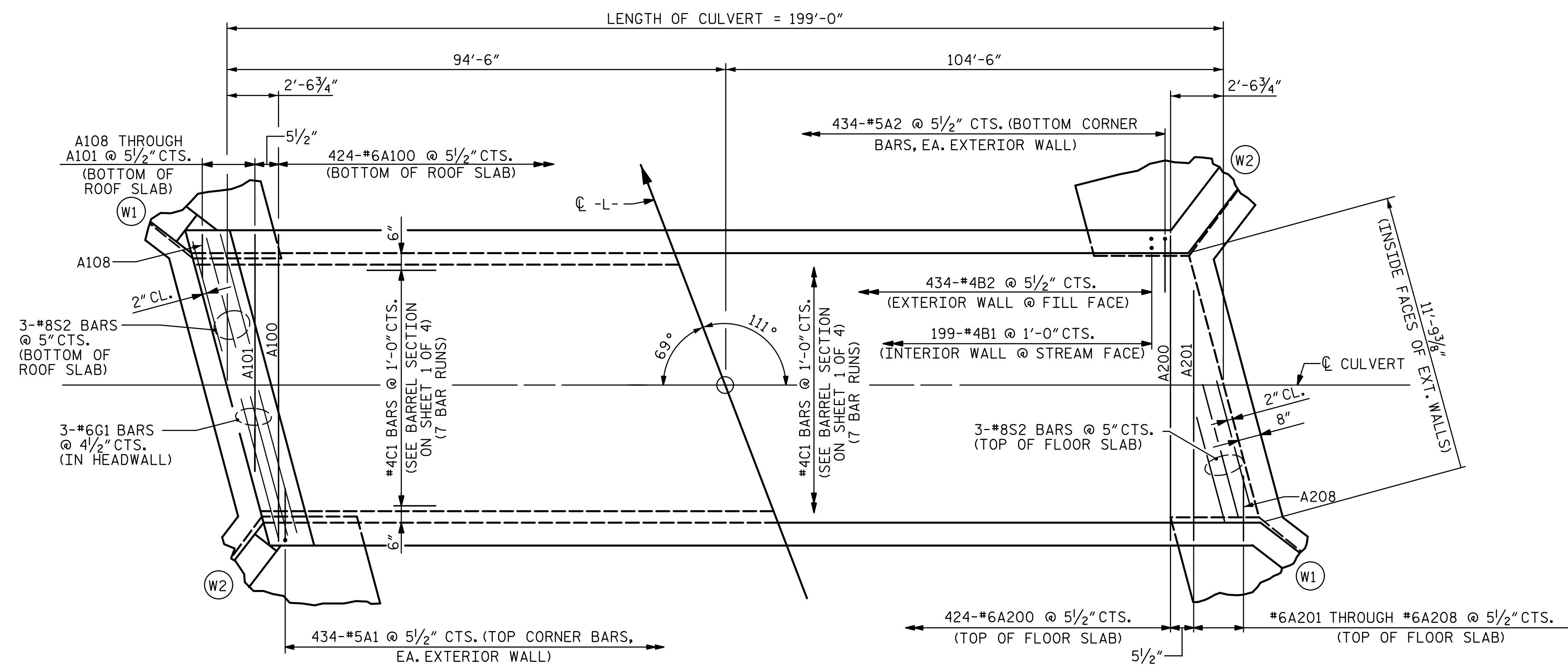
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CULVERT SECTION NORMAL TO ROADWAY

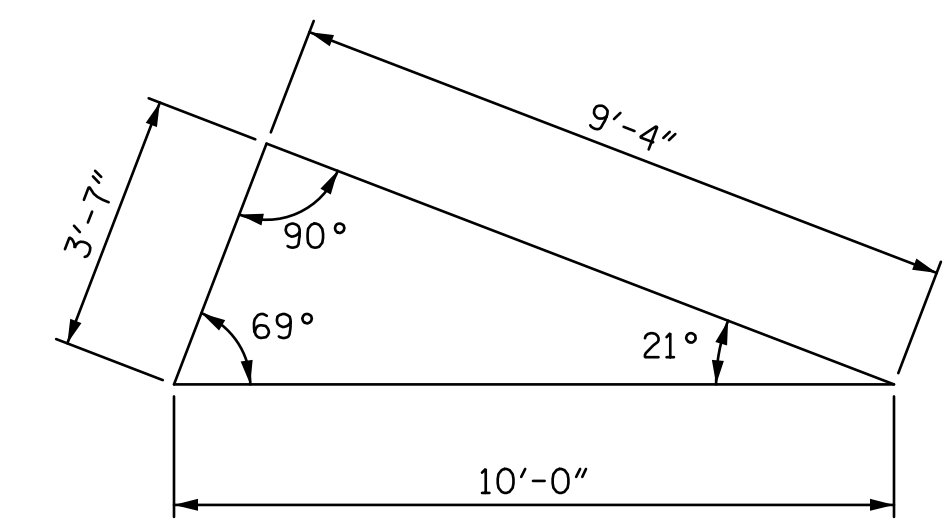


END ELEVATION NORMAL TO SKEW
(INLET END SHOWN, OUTLET END SIMILAR)



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB



SKEW TRIANGLE

BILL OF REINFORCING FOR BARREL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	868	#5	①	6'-7"	5,960
A2	868	#5	①	6'-7"	5,960
A100	424	#6	STR	12'-0"	7,642
A101	2	#6	STR	11'-0"	33
A102	2	#6	STR	9'-9"	29
A103	2	#6	STR	8'-7"	26
A104	2	#6	STR	7'-5"	22
A105	2	#6	STR	6'-2"	19
A106	2	#6	STR	5'-0"	15
A107	2	#6	STR	3'-10"	12
A108	2	#6	STR	2'-7"	8
A200	424	#6	STR	12'-0"	7,642
A201	2	#6	STR	11'-0"	33
A202	2	#6	STR	9'-9"	29
A203	2	#6	STR	8'-7"	26
A204	2	#6	STR	7'-5"	22
A205	2	#6	STR	6'-2"	19
A206	2	#6	STR	5'-0"	15
A207	2	#6	STR	3'-10"	12
A208	2	#6	STR	2'-7"	8
B1	398	#4	STR	8'-4"	2,216
B2	868	#4	STR	6'-4"	3,672
C1	294	#4	STR	29'-11"	5,875
G1	6	#6	STR	12'-10"	116
S2	12	#8	STR	12'-10"	411
TOTAL REINFORCING STEEL					39,822 LBS.

BAR TYPES
ALL BAR DIMENSIONS ARE OUT TO OUT.

SPLICE LENGTH CHART

BAR	SIZE	SPLICE LENGTH
B2	#4	1'-9"
C1	#4	1'-9"

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 138+59.00 -L-
 SHEET 3 OF 4

DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED

STV 100 years
 STV ENGINEERS, INC.
 900 West Trade St., Suite 715
 Charlotte, NC 28202
 NC License Number F-5991

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

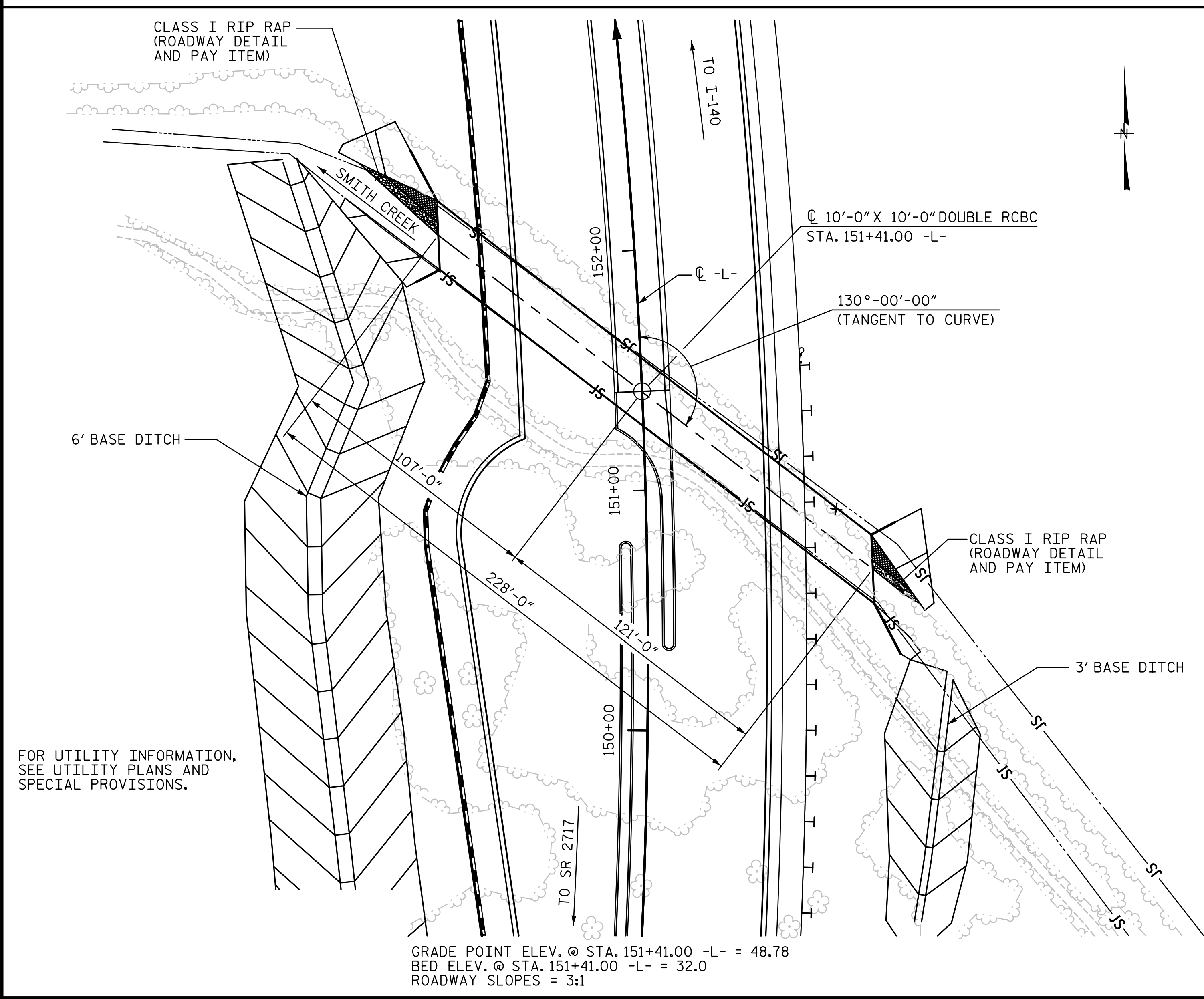
SINGLE 11'-0" X 7'-0" CONCRETE BOX CULVERT
 110°-00'-00" SKEW

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

SHEET NO. C2-3
 TOTAL SHEETS 4

DRAWN BY: JWJ DATE: 5-17
 CHECKED BY: MLO DATE: 5-17
 DESIGN ENGINEER OF RECORD: J. JONES DATE: 5-17

BENCHMARK 17: 317.03' RT., STA. 146+28.72 -L-, N=198704.150 E=2355984.737, EL. 45.01



LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	=	800 CFS
FREQUENCY OF DESIGN FLOOD	=	50 YRS.
DESIGN HIGH WATER ELEVATION	=	42.2 FT.
DRAINAGE AREA	=	264 ACRES
BASE DISCHARGE (Q100)	=	900 CFS
BASE HIGH WATER ELEVATION	=	42.7 FT.

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	=	655 CFS
FREQUENCY OF OVERTOPPING FLOOD	=	10+ YRS.
OVERTOPPING FLOOD ELEVATION (@ STA. 13+25 -Y6-)	=	42.6 FT.

-L- CURVE DATA

PI STA. = 146+07.40 -L-
 $\Delta = 58^{\circ}-00'-14.91"$ (LT)
 RADIUS = 2,610'
 TANGENT = 1,446.87'
 LENGTH = 2,642.27'

TOTAL STRUCTURE QUANTITIES

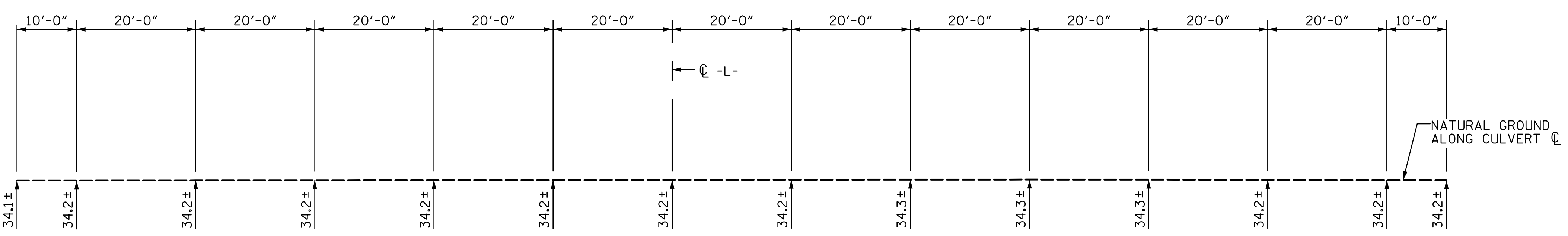
CULVERT EXCAVATION @ STA. 151+41.00 -L-	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	425 TONS
CLASS A CONCRETE	
BARREL @ 2.352 CU.YDS./FT.	536.3 CU.YDS.
WINGS, ETC.	64.3 CU.YDS.
TOTAL	600.6 CU.YDS.
REINFORCING STEEL	
BARREL	89,168 LBS.
WINGS, ETC.	4,419 LBS.
TOTAL	93,587 LBS.
PLACEMENT OF NATURAL STREAM BED MATERIAL	
TOTAL:	LUMP SUM

NOTES:

ASSUMED LIVE LOAD-----HL-93 OR ALTERNATE LOADING.
 DESIGN FILL-----9.52' MAX. AND 4.66' MIN.
 FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
 3"Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
 CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY THE SILLS, 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 (SHEET 6 OF 7 AND SHEET 7 OF 7).
 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 AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
 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.
 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.
 TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
 FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
 A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
 NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED OR FLOODPLAIN AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE THE LOW FLOW CULVERT BARREL RIP RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL IN THE HIGH FLOW CULVERT BARREL. IF RIP RAP IS USED TO LINE THE HIGH FLOW CULVERT BARREL, NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.
 FOR PLACEMENT OF NATURAL STREAM BED MATERIAL, SEE SPECIAL PROVISIONS.
 FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
 FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
 FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

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PROFILE ALONG CULVERT

PROJECT NO. U-4751
NEW HANOVER COUNTY
 STATION: 151+41.00 -L-
 SHEET 1 OF 7

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH		DOUBLE 10'-0" X 10'-0" CONCRETE BOX CULVERT 130°-00'-00" SKEW																
		REVISIONS <table border="1"> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </table>			NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4
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DRAWN BY : BMC DATE : 5-17
 CHECKED BY : MLO DATE : 5-17
 DESIGN ENGINEER OF RECORD: B. CURRY DATE : 5-17

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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	1.130	--	1.75	1.13	1 & 2	TOP SLAB	4.69'	1.14	1 & 2	BOTTOM SLAB	10.10'		
	HL-93 (OPERATING)	N/A		1.460	--	1.35	1.46	1 & 2	TOP SLAB	4.69'	1.48	1 & 2	BOTTOM SLAB	10.10'		
	HS-20 (INVENTORY)	36.000	②	1.250	45.000	1.75	1.29	1 & 2	TOP SLAB	4.69'	1.25	1 & 2	TOP SLAB	10.16'		
	HS-20 (OPERATING)	36.000		1.620	58.320	1.35	1.68	1 & 2	TOP SLAB	4.69'	1.62	1 & 2	TOP SLAB	10.16'		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		1.910	25.785	1.40	2.36	1 & 2	TOP SLAB	4.69'	1.91	1 & 2	EXTERIOR WALL	1.53'		
		SNGARBS2	20.000		1.900	38.000	1.40	2.20	1 & 2	TOP SLAB	4.69'	1.90	1 & 2	EXTERIOR WALL	1.53'	
		SNAGRIS2	22.000		1.910	42.020	1.40	2.36	1 & 2	TOP SLAB	4.69'	1.91	1 & 2	EXTERIOR WALL	1.53'	
		SNCOTTS3	27.250	③	1.720	46.870	1.40	1.72	1 & 2	TOP SLAB	4.69'	1.89	1 & 2	EXTERIOR WALL	1.53'	
		SNAGGRS4	34.925		1.880	65.659	1.40	2.27	1 & 2	TOP SLAB	4.69'	1.88	1 & 2	EXTERIOR WALL	1.53'	
		SNS5A	35.550		1.900	67.545	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.90	1 & 2	EXTERIOR WALL	1.53'	
		SNS6A	39.950		1.900	75.905	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.90	1 & 2	EXTERIOR WALL	1.53'	
		SNS7B	42.000		1.900	79.800	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.90	1 & 2	EXTERIOR WALL	1.53'	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.900	62.700	1.40	2.36	1 & 2	TOP SLAB	4.69'	1.90	1 & 2	EXTERIOR WALL	1.53'	
		TNT4A	33.075		1.910	63.173	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.91	1 & 2	EXTERIOR WALL	1.53'	
		TNT6A	41.600		1.910	79.456	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.91	1 & 2	EXTERIOR WALL	1.53'	
		TNT7A	42.000		1.910	80.220	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.91	1 & 2	EXTERIOR WALL	1.53'	
		TNT7B	42.000		1.910	80.220	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.91	1 & 2	EXTERIOR WALL	1.53'	
		TNAGRIT4	43.000		1.880	80.840	1.40	1.96	1 & 2	TOP SLAB	4.69'	1.88	1 & 2	EXTERIOR WALL	1.53'	
TNACT5A	45.000		1.890	85.050	1.40	1.96	1 & 2	TOP SLAB	4.69'	1.89	1 & 2	EXTERIOR WALL	1.53'			
TNACT5B	45.000		1.890	85.050	1.40	2.05	1 & 2	TOP SLAB	4.69'	1.89	1 & 2	EXTERIOR WALL	1.53'			

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	--

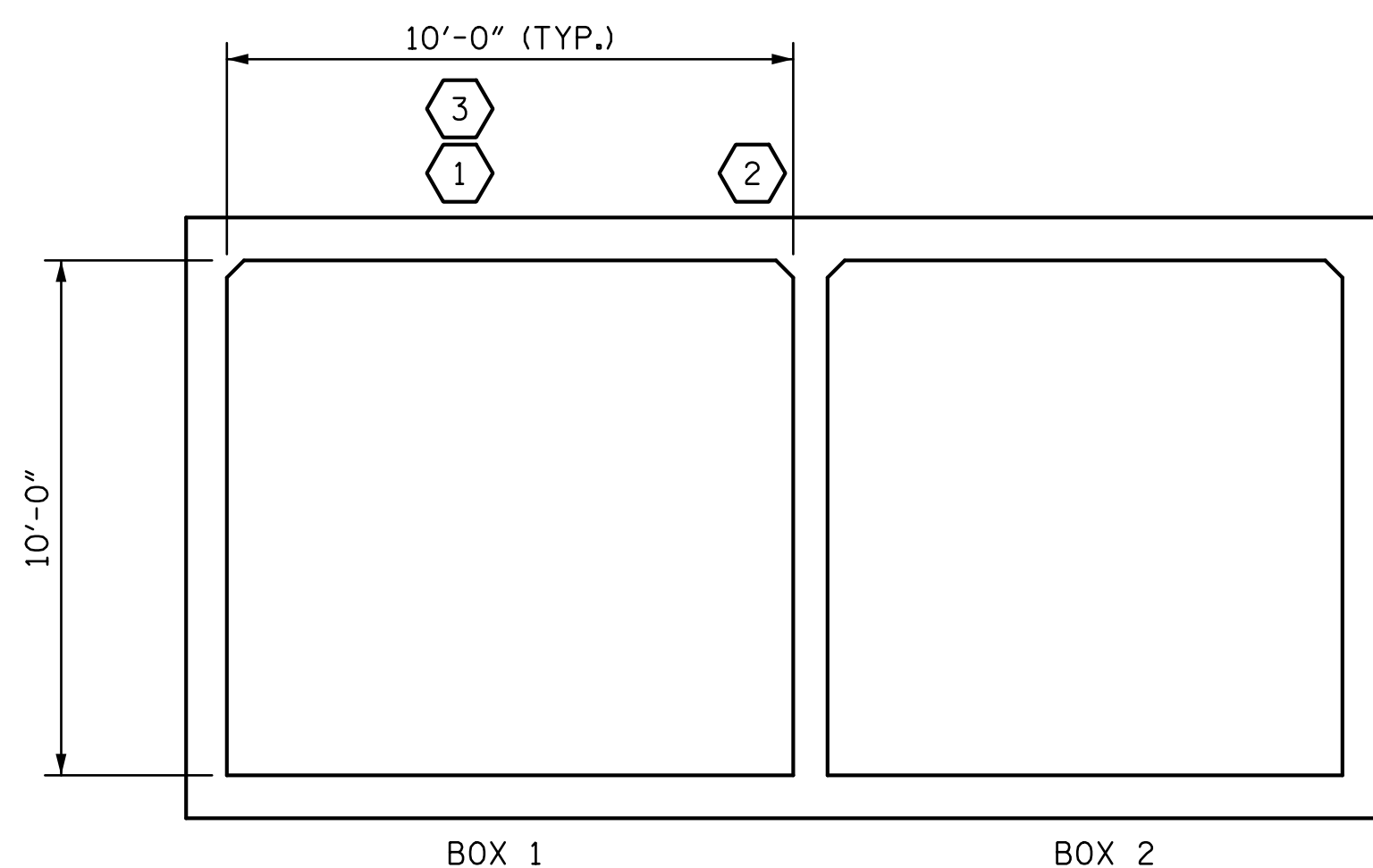
NOTE:

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. U-4751

NEW HANOVER COUNTY

STATION: 151+41.00 -L-

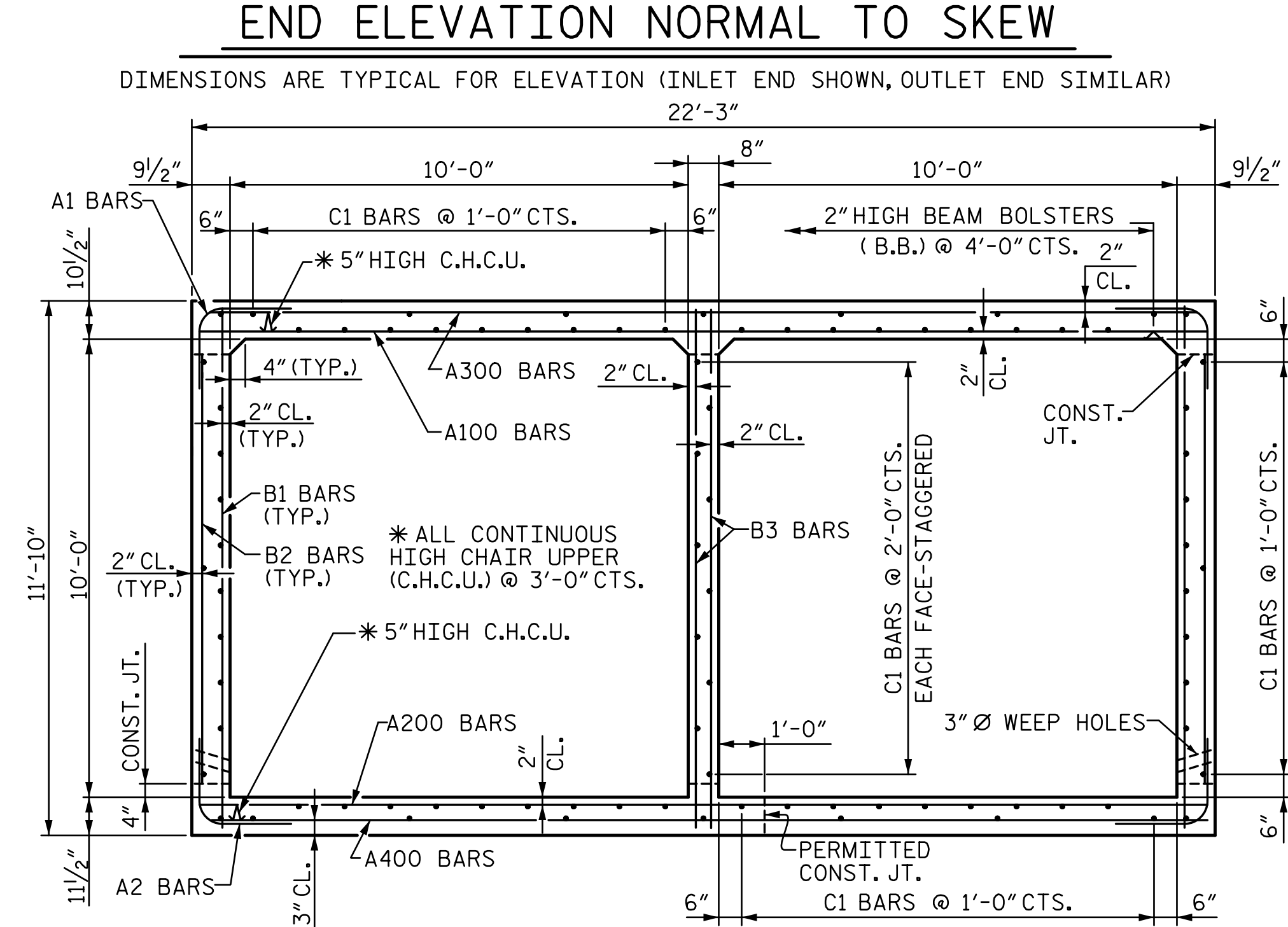
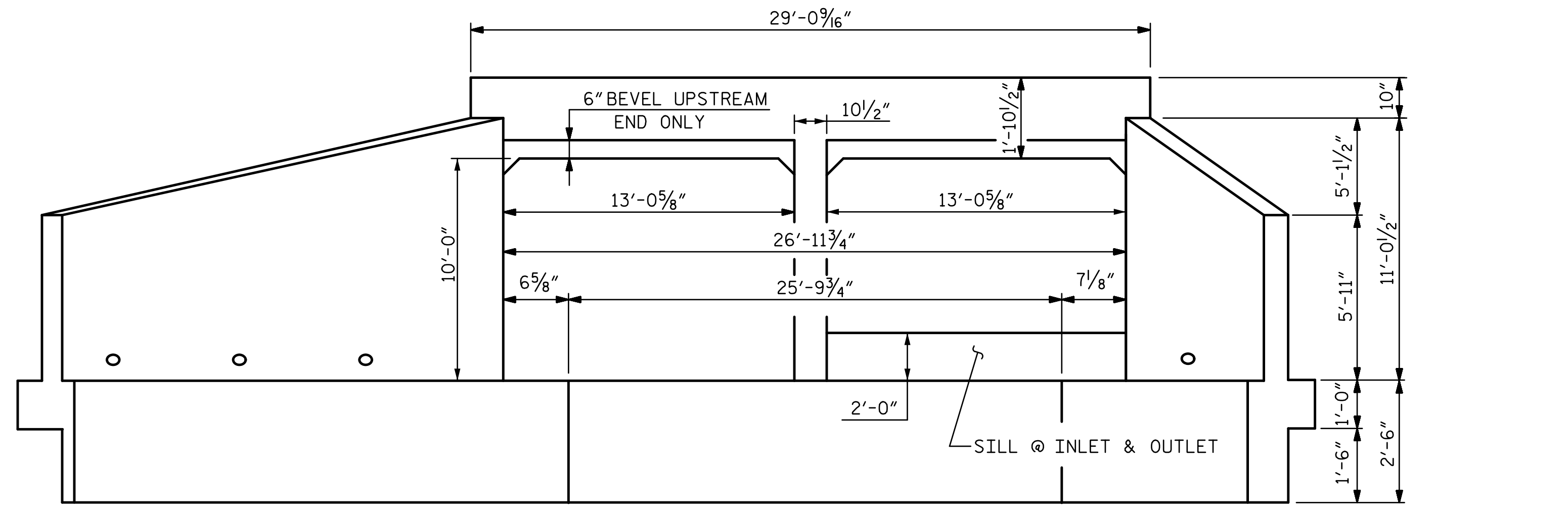
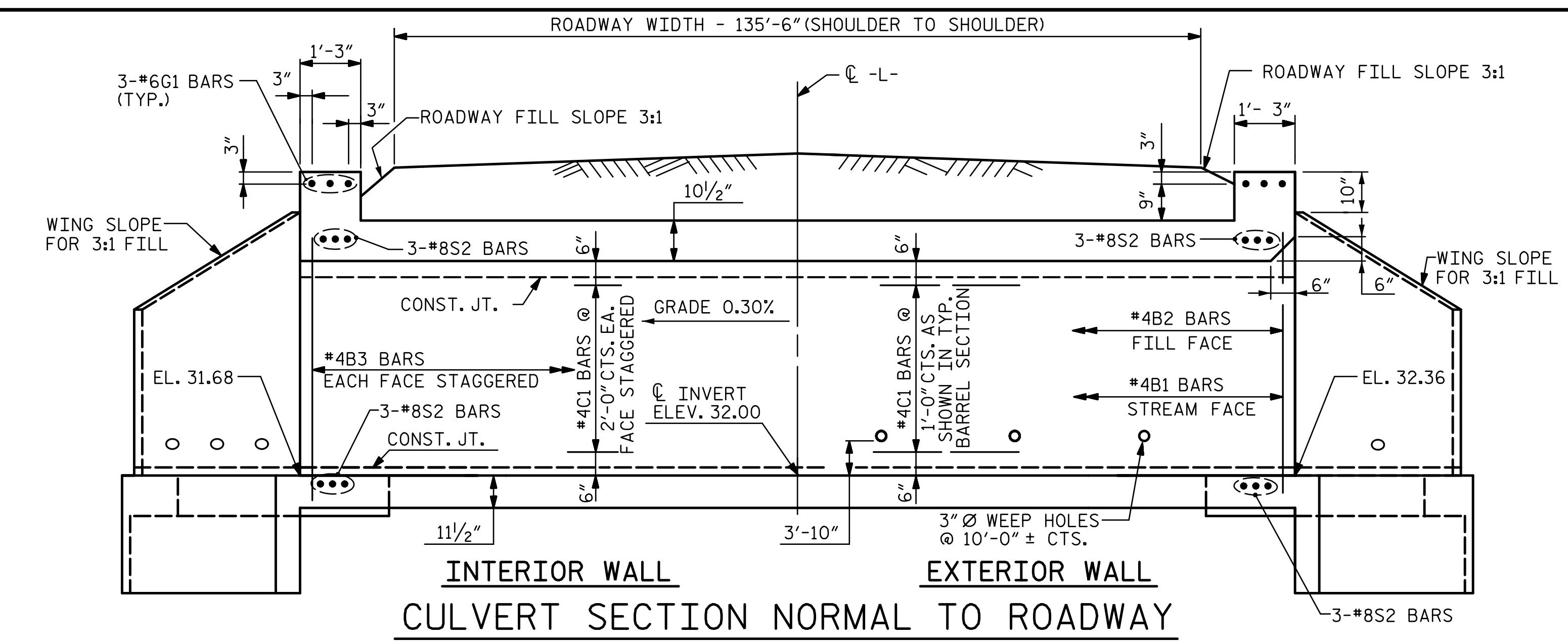
SHEET 2 OF 7

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																	
	STV ENGINEERS, INC. 900 West Trade St., Suite 715 Charlotte, NC 28202 NC License Number F-5991	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>	NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4	
NO.	BY:	DATE:	NO.	BY:	DATE:														
1			3																
2			4																

DRAWN BY : <u>BMC</u> DATE : <u>5-17</u>	DESIGN ENGINEER OF RECORD: <u>B. CURRY</u> DATE : <u>5-17</u>	
CHECKED BY : <u>JWJ</u> DATE : <u>5-17</u>		

SHEET NO.
C3-2
TOTAL SHEETS
7

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RIGHT ANGLE SECTION OF BARREL
THERE ARE 86 "C" BARS IN SECTION OF BARREL.

MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT	MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT	MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	902	#6	①	6'-4"	8,580	A221	2	#4	STR	9'-6"	13	A412	2	#6	STR	14'-10"	20
A2	902	#6	①	6'-4"	8,580	A222	2	#4	STR	8'-10"	12	A413	2	#6	STR	14'-3"	19
A100	457	#4	STR	21'-11"	6,691	A223	2	#4	STR	8'-3"	11	A414	2	#6	STR	13'-8"	18
A101	2	#4	STR	21'-5"	29	A224	2	#4	STR	7'-8"	10	A415	2	#6	STR	13'-1"	17
A102	2	#4	STR	20'-11"	28	A225	2	#4	STR	7'-1"	9	A416	2	#6	STR	12'-5"	17
A103	2	#4	STR	20'-4"	27	A226	2	#4	STR	6'-6"	9	A417	2	#6	STR	11'-10"	16
A104	2	#4	STR	19'-10"	26	A227	2	#4	STR	5'-11"	8	A418	2	#6	STR	11'-3"	15
A105	2	#4	STR	19'-3"	26	A228	2	#4	STR	5'-4"	7	A419	2	#6	STR	10'-8"	14
A106	2	#4	STR	18'-8"	25	A229	2	#4	STR	4'-8"	6	A420	2	#6	STR	10'-1"	13
A107	2	#4	STR	18'-2"	24	A230	2	#4	STR	4'-1"	5	A421	2	#6	STR	9'-6"	13
A108	2	#4	STR	17'-7"	23	A231	2	#4	STR	3'-6"	5	A422	2	#6	STR	8'-10"	12
A109	2	#4	STR	17'-1"	23	A232	2	#4	STR	2'-11"	4	A423	2	#6	STR	8'-3"	11
A110	2	#4	STR	16'-6"	22	A233	2	#4	STR	2'-4"	3	A424	2	#6	STR	7'-8"	10
A111	2	#4	STR	16'-0"	21	A234	2	#4	STR	1'-9"	2	A425	2	#6	STR	7'-1"	9
A112	2	#4	STR	15'-5"	21	A300	419	#6	STR	21'-11"	6,134	A426	2	#6	STR	6'-6"	9
A113	2	#4	STR	14'-11"	20	A301	2	#6	STR	21'-5"	29	A427	2	#6	STR	5'-11"	8
A114	2	#4	STR	14'-4"	19	A302	2	#6	STR	20'-9"	28	A428	2	#6	STR	5'-4"	7
A115	2	#4	STR	13'-9"	18	A303	2	#6	STR	20'-2"	27	A429	2	#6	STR	4'-8"	6
A116	2	#4	STR	13'-3"	18	A304	2	#6	STR	19'-7"	26	A430	2	#6	STR	4'-1"	5
A117	2	#4	STR	12'-8"	17	A305	2	#6	STR	19'-0"	25	A431	2	#6	STR	3'-6"	5
A118	2	#4	STR	12'-2"	16	A306	2	#6	STR	18'-5"	25	A432	2	#6	STR	2'-11"	4
A119	2	#4	STR	11'-7"	15	A307	2	#6	STR	17'-10"	24	A433	2	#6	STR	2'-4"	3
A120	2	#4	STR	11'-1"	15	A308	2	#6	STR	17'-3"	23	A434	2	#6	STR	1'-9"	2
A121	2	#4	STR	10'-6"	14	A309	2	#6	STR	16'-7"	22	B1	456	#4	STR	11'-5"	3,478
A122	2	#4	STR	10'-0"	13	A310	2	#6	STR	16'-0"	21	B2	994	#4	STR	9'-4"	6,197
A123	2	#4	STR	9'-5"	13	A311	2	#6	STR	15'-5"	21	B3	458	#4	STR	11'-5"	3,493
A124	2	#4	STR	8'-10"	12	A312	2	#6	STR	14'-10"	20	C1	688	#4	STR	30'-0"	13,788
A125	2	#4	STR	8'-4"	11	A313	2	#6	STR	14'-3"	19	D1	6	#6	STR	2'-5"	22
A126	2	#4	STR	7'-9"	10	A314	2	#6	STR	13'-8"	18	G1	6	#6	STR	28'-7"	258
A127	2	#4	STR	7'-3"	10	A315	2	#6	STR	13'-1"	17	S2	12	#8	STR	28'-7"	916
A128	2	#4	STR	6'-8"	9	A316	2	#6	STR	12'-5"	17	TOTAL BARREL REINFORCING STEEL = 89,168 LBS.					
A129	2	#4	STR	6'-2"	8	A317	2	#6	STR	11'-10"	16	BAR TYPES					
A130	2	#4	STR	5'-7"	7	A318	2	#6	STR	11'-3"	15	ALL BAR DIMENSIONS ARE OUT TO OUT.					
A131	2	#4	STR	5'-1"	7	A319	2	#6	STR	10'-8"	14	VERTICAL LEG					
A132	2	#4	STR	4'-6"	6	A320	2	#6	STR	10'-1"	13	①					
A133	2	#4	STR	3'-11"	5	A321	2	#6	STR	9'-6"	13	6" R.					
A134	2	#4	STR	3'-5"	5	A322	2	#6	STR	8'-10"	12	3'-3 1/2"					
A135	2	#4	STR	2'-10"	4	A323	2	#6	STR	8'-3"	11	3'-3 1/2"					
A136	2	#4	STR	2'-4"	3	A324	2	#6	STR	7'-8"	10	9 1/2"					
A137	2	#4	STR	1'-9"	2	A325	2	#6	STR	7'-1"	9	9 1/2"					
A200	419	#4	STR	21'-11"	6,134	A326	2	#6	STR	6'-6"	9	A1 2'-3"					
A201	2	#4	STR	21'-5"	29	A327	2	#6	STR	5'-11"	8	A2 2'-3"					
A202	2	#4	STR	20'-9"	28	A328	2	#6	STR	5'-4"	7						
A203	2	#4	STR	20'-2"	27	A329	2	#6	STR	4'-8"	6						
A204	2	#4	STR	19'-7"	26	A330	2	#6	STR	4'-1"	5						
A205	2	#4	STR	19'-0"	25	A331	2	#6	STR	3'-6"	5						
A206	2	#4	STR	18'-5"	25	A332	2	#6	STR	2'-11"	4						
A207	2	#4	STR	17'-10"	24	A333	2	#6	STR	2'-4"	3						
A208	2	#4	STR	17'-3"	23	A334	2	#6	STR	1'-9"	2						
A209	2	#4	STR	16'-7"	22	A400	419	#6	STR	21'-11"	6,134						
A210	2	#4	STR	16'-0"	21	A401	2	#6	STR	21'-5"	29						
A211	2	#4	STR	15'-5"	21	A402	2	#6	STR	20'-9"	28						
A212	2	#4	STR	14'-10"	20	A403	2	#6	STR	20'-2"	27						
A213	2	#4	STR	14'-3"	19	A404	2	#6	STR	19'-7"	26						
A214	2	#4	STR	13'-8"	18	A405	2	#6	STR	19'-0"	25						
A215	2	#4	STR	13'-1"	17	A406	2	#6	STR	18'-5"	25						
A216	2	#4	STR	12'-5"	17	A407	2	#6	STR	17'-10"	24						
A217	2	#4	STR	11'-10"	16	A408	2	#6	STR	17'-3"	23						
A218	2	#4	STR	11'-3"	15	A409	2	#6	STR	16'-7"	22						
A219	2	#4	STR	10'-8"	14	A410	2	#6	STR	16'-0"	21						
A220	2	#4	STR	10'-1"	13	A411	2	#6	STR	15'-5"	21						

BAR	SIZE	SPLICE LENGTH
B2	#4	1'-9"
C1	#4	1'-9"

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 10'-0" X 10'-0"
CONCRETE BOX CULVERT
130°-00'-00" SKEW

7/12/2017

STV ENGINEERS, INC.
900 West Trade St., Suite 715
Charlotte, NC 28202
NC License Number F-5991

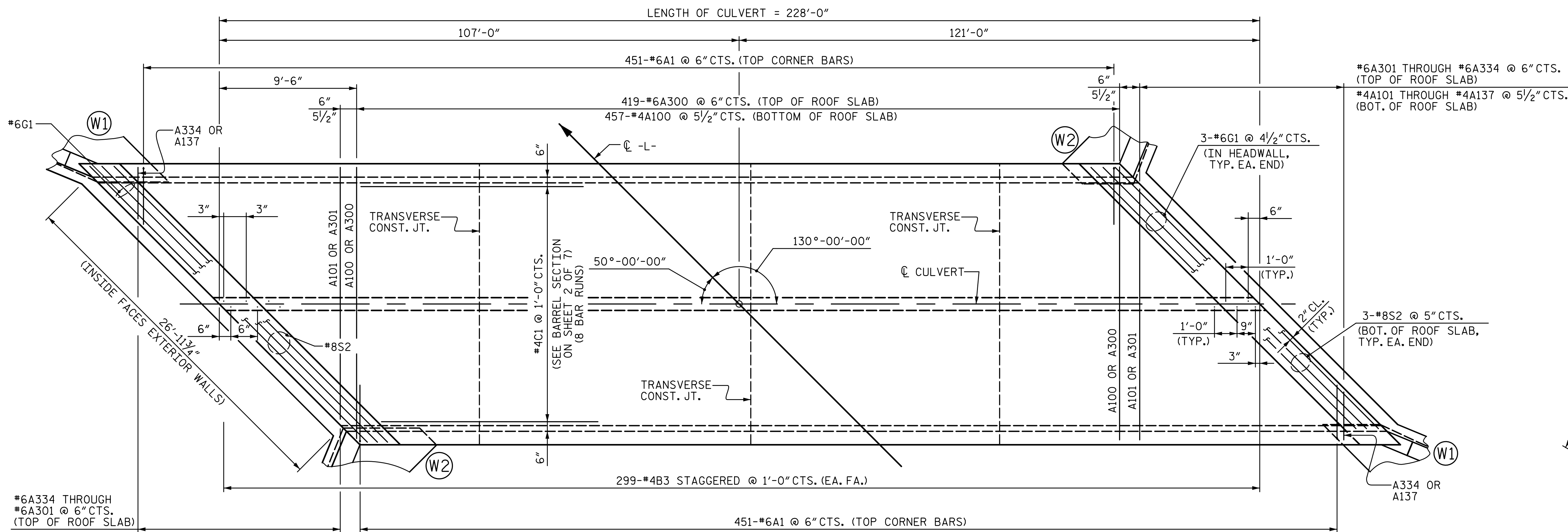
PROJECT NO. U-4751
NEW HANOVER COUNTY
STATION: 151+41.00 -L-
SHEET 3 OF 7

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

TOTAL SHEETS: 7

DRAWN BY: BMC DATE: 5-17
CHECKED BY: MLO DATE: 5-17
DESIGN ENGINEER OF RECORD: B. CURRY DATE: 5-17

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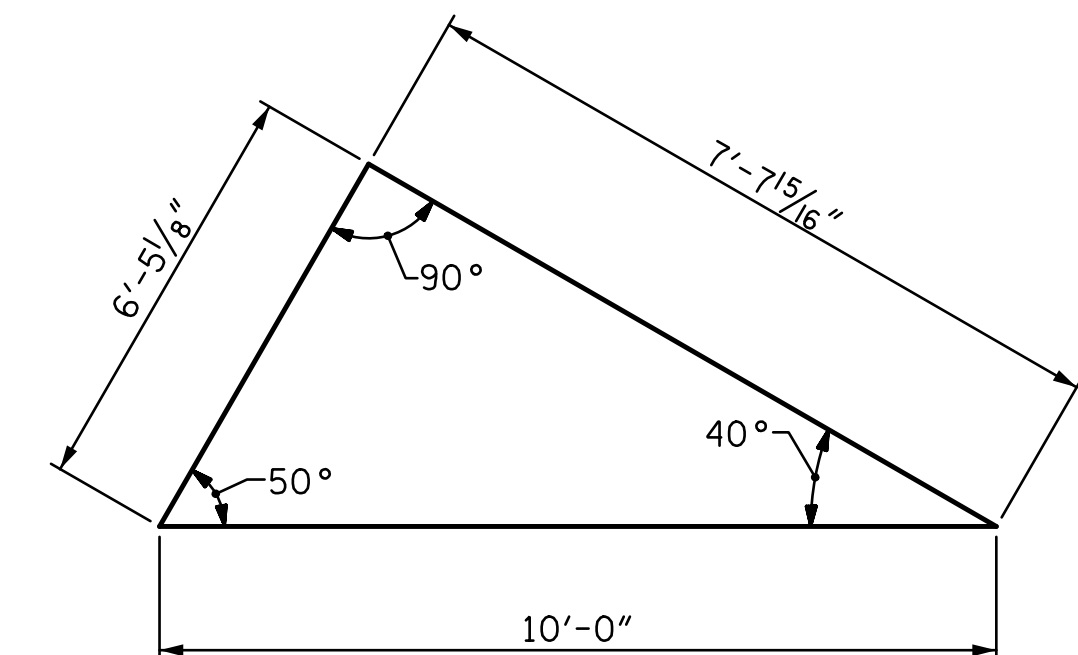


ROOF SLAB

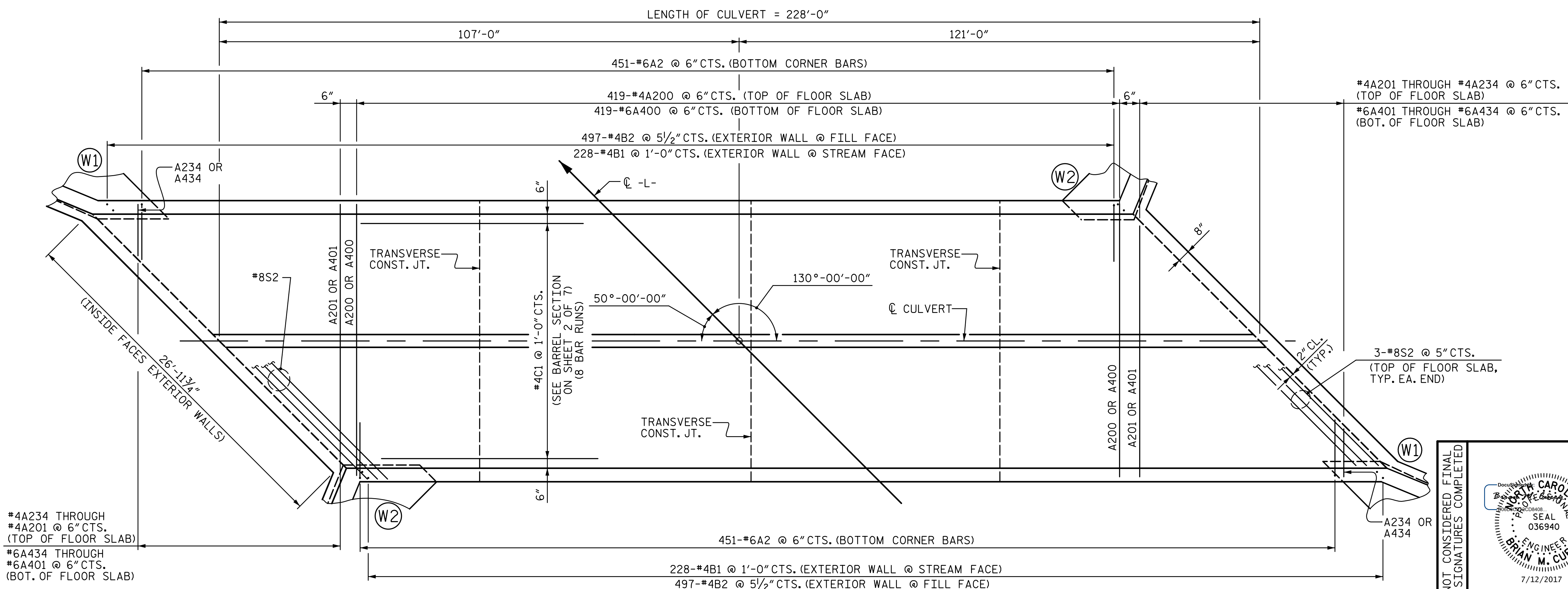
(SEE FLOOR PLAN FOR B1 & B2 IN EXTERIOR WALLS)

#6A334 THROUGH #6A301 @ 6" CTS. (TOP OF ROOF SLAB)
#4A137 THROUGH #4A101 @ 5 1/2" CTS. (BOT. OF ROOF SLAB)

#6A301 THROUGH #6A334 @ 6" CTS. (TOP OF ROOF SLAB)
#4A101 THROUGH #4A137 @ 5 1/2" CTS. (BOT. OF ROOF SLAB)



SKEW TRIANGLE



FLOOR SLAB

(SEE ROOF PLAN FOR B3 BARS IN INTERIOR WALL)
(SILLS NOT SHOWN, SEE SHEET 5 OF 7)

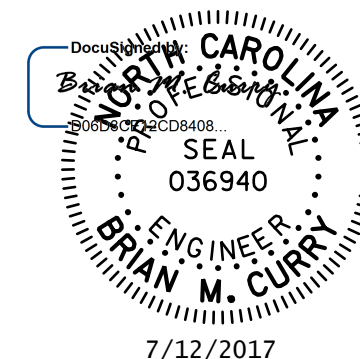
#4A234 THROUGH #4A201 @ 6" CTS. (TOP OF FLOOR SLAB)
#6A434 THROUGH #6A401 @ 6" CTS. (BOT. OF FLOOR SLAB)

#4A201 THROUGH #4A234 @ 6" CTS. (TOP OF FLOOR SLAB)
#6A401 THROUGH #6A434 @ 6" CTS. (BOT. OF FLOOR SLAB)

PROJECT NO. U-4751
NEW HANOVER COUNTY
STATION: 151+41.00 -L-
SHEET 4 OF 7

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 10'-0" X 10'-0" CONCRETE BOX CULVERT
130°-00'-00" SKEW



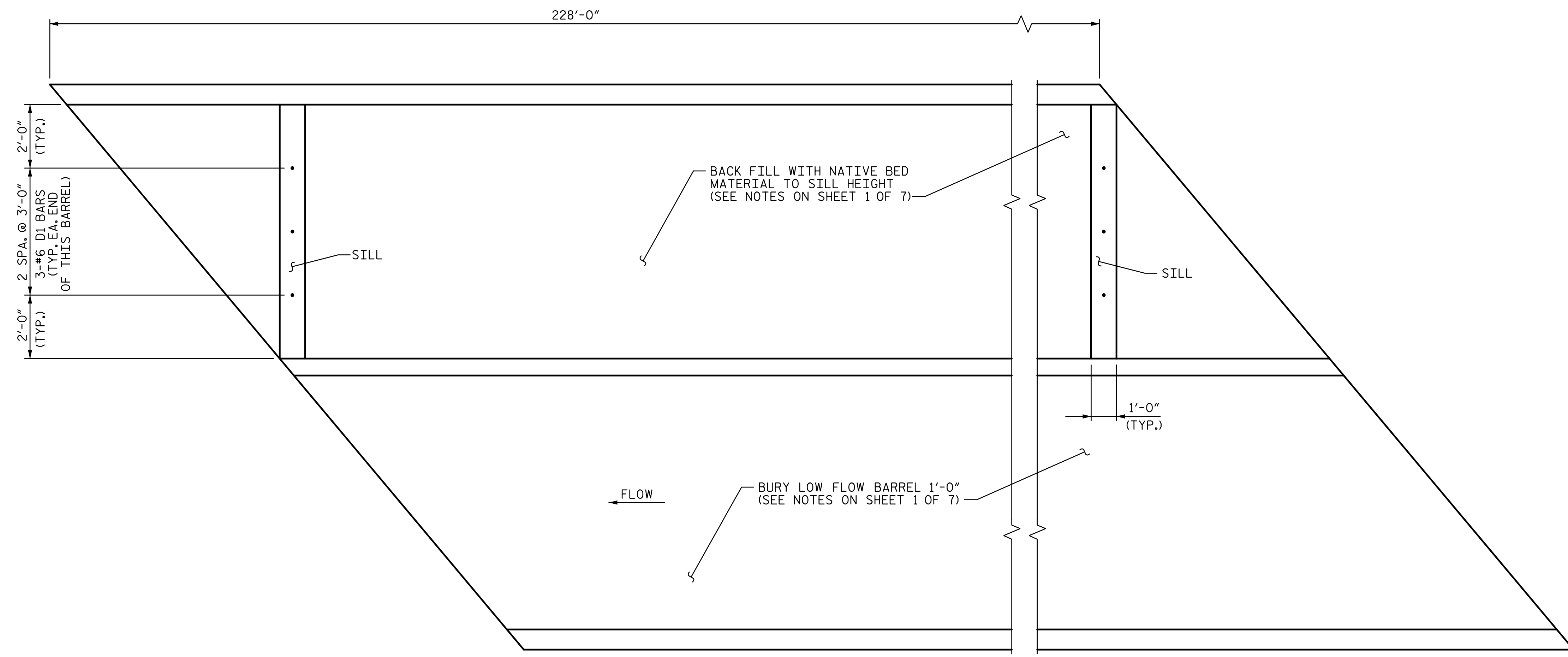
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CHECKED BY: MLO DATE: 5-17
DESIGN ENGINEER OF RECORD: B. CURRY DATE: 5-17

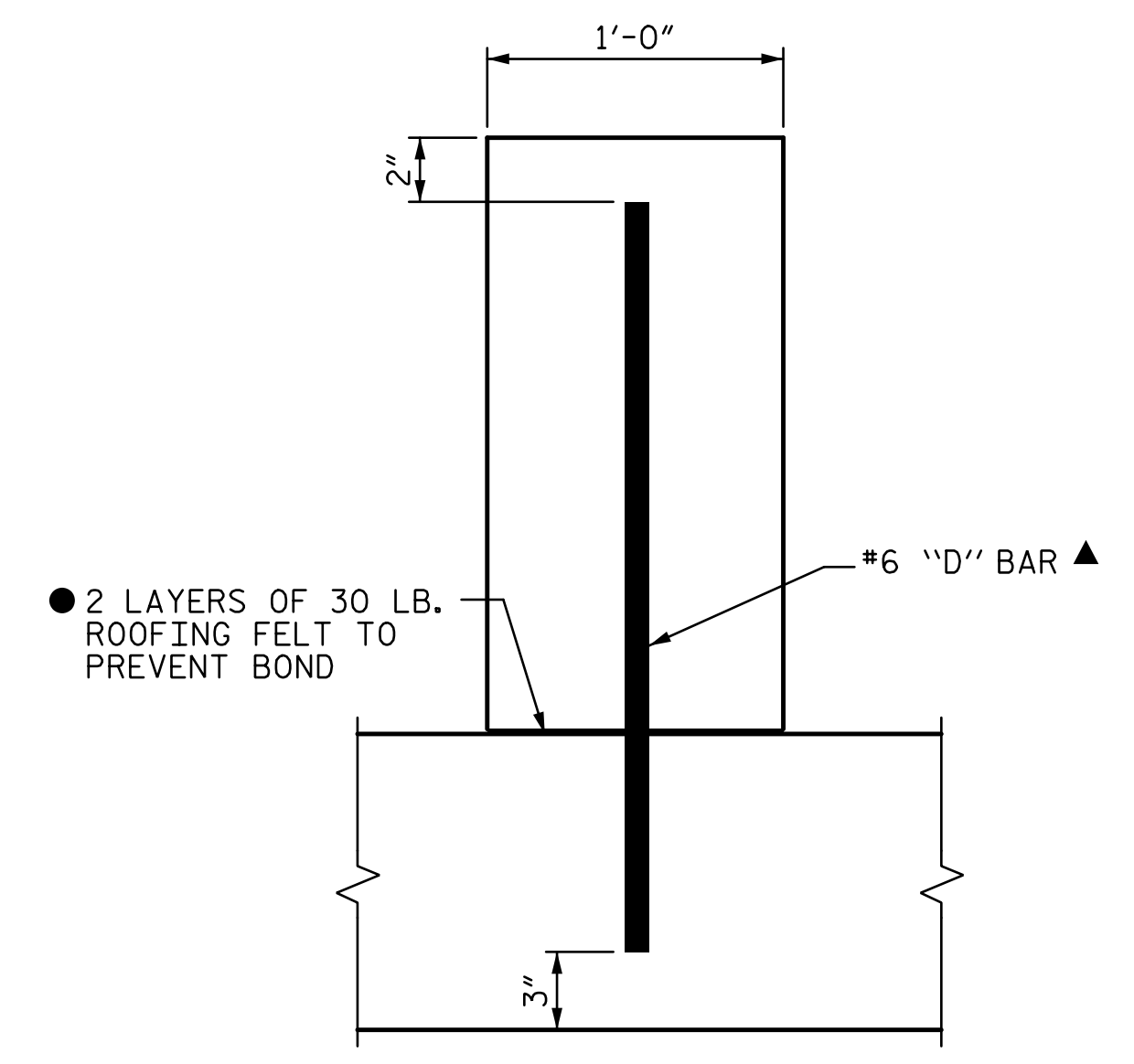


REVISIONS				SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
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					TOTAL SHEETS
					7

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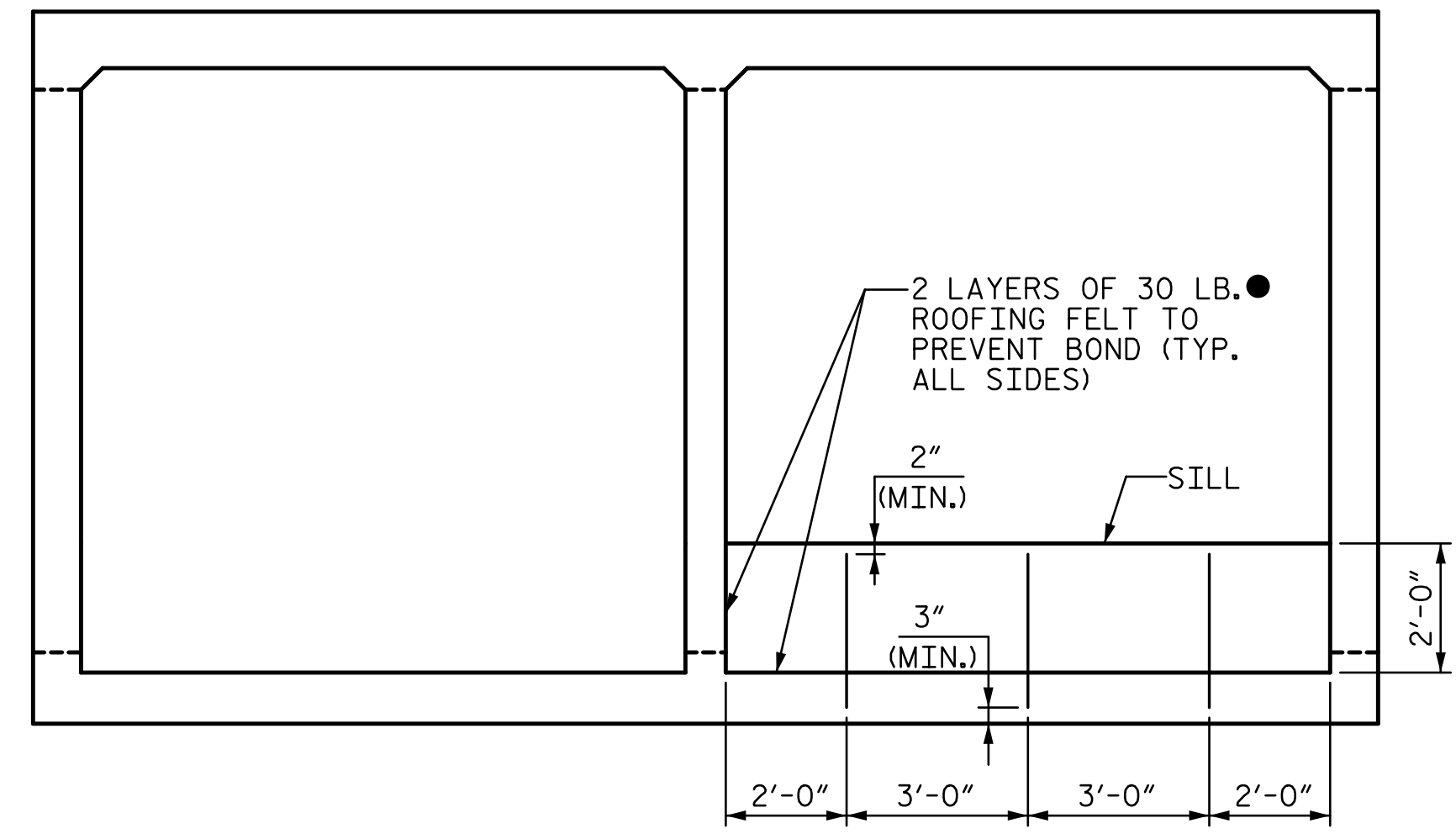


PLAN VIEW - LOCATION OF SILLS



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

SECTION THROUGH SILL



ELEVATION

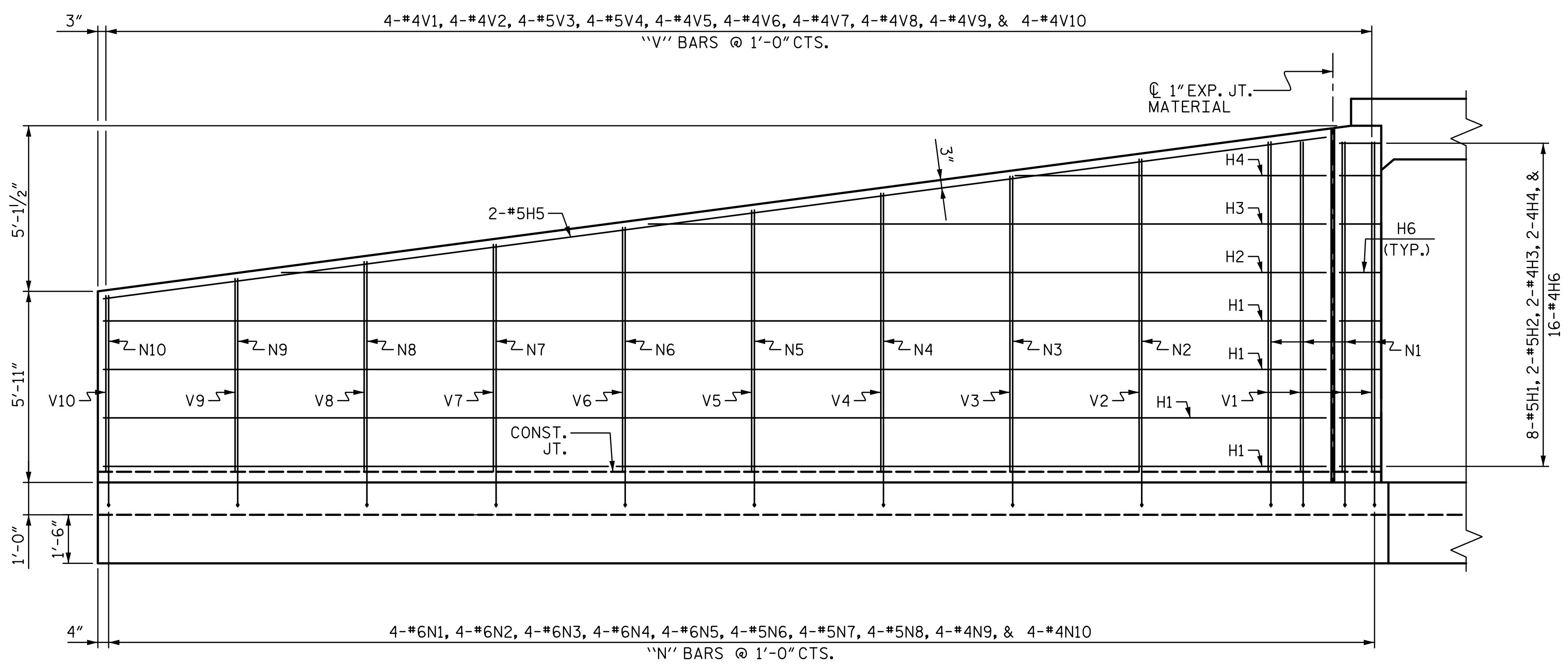
(INLET VIEW SHOWN)
● THE COST OF THE ROOFING FELT IS INCIDENTAL AND SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS

PROJECT NO. U-4751
NEW HANOVER COUNTY
 STATION: 151+41.00 -L-
 SHEET 5 OF 7

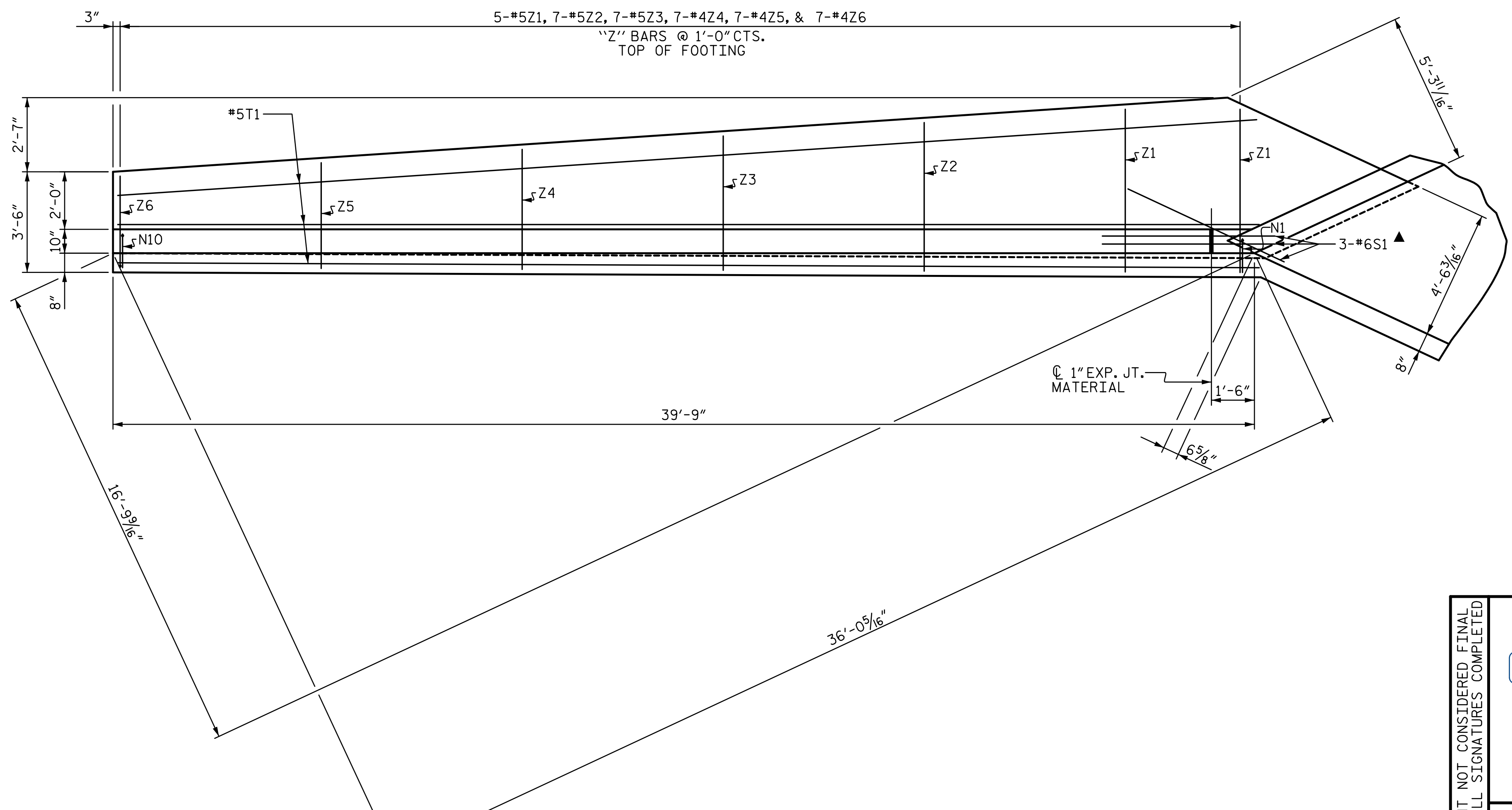
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	<h3>SILL DETAILS</h3>				TOTAL SHEETS 7
	REVISIONS				
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

DRAWN BY : <u>BMC</u>	DATE : <u>5-17</u>	DESIGN ENGINEER OF RECORD: <u>B. CURRY</u>	DATE : <u>5-17</u>
CHECKED BY : <u>MLO</u>	DATE : <u>5-17</u>		

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bcurry



ELEVATION W1



PLAN W1

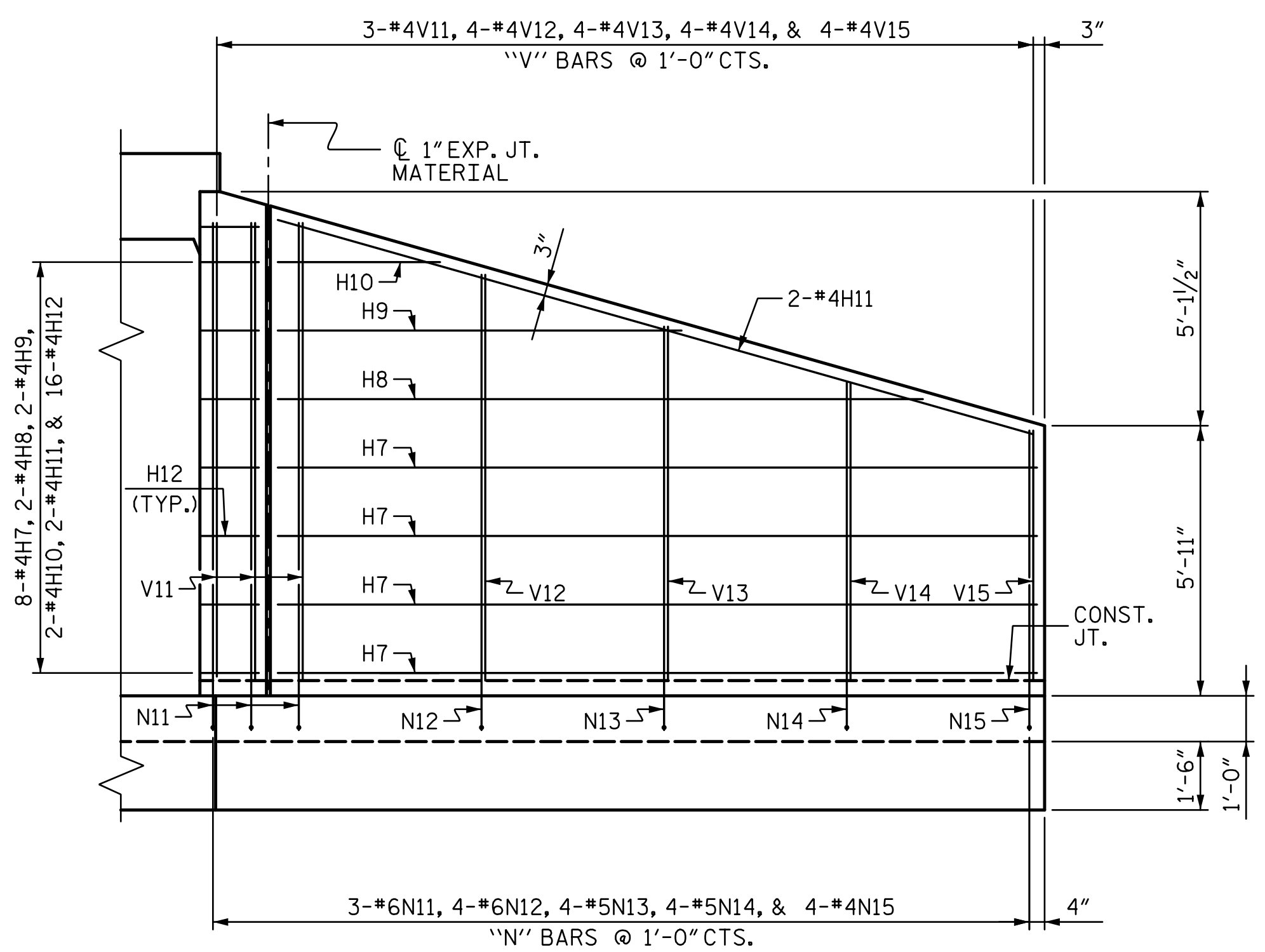
▲ S1 IN BOTTOM OF FLOOR SLAB AND FOOTING

PROJECT NO. U-4751
NEW HANOVER COUNTY
 STATION: 151+41.00 -L-
 SHEET 6 OF 7

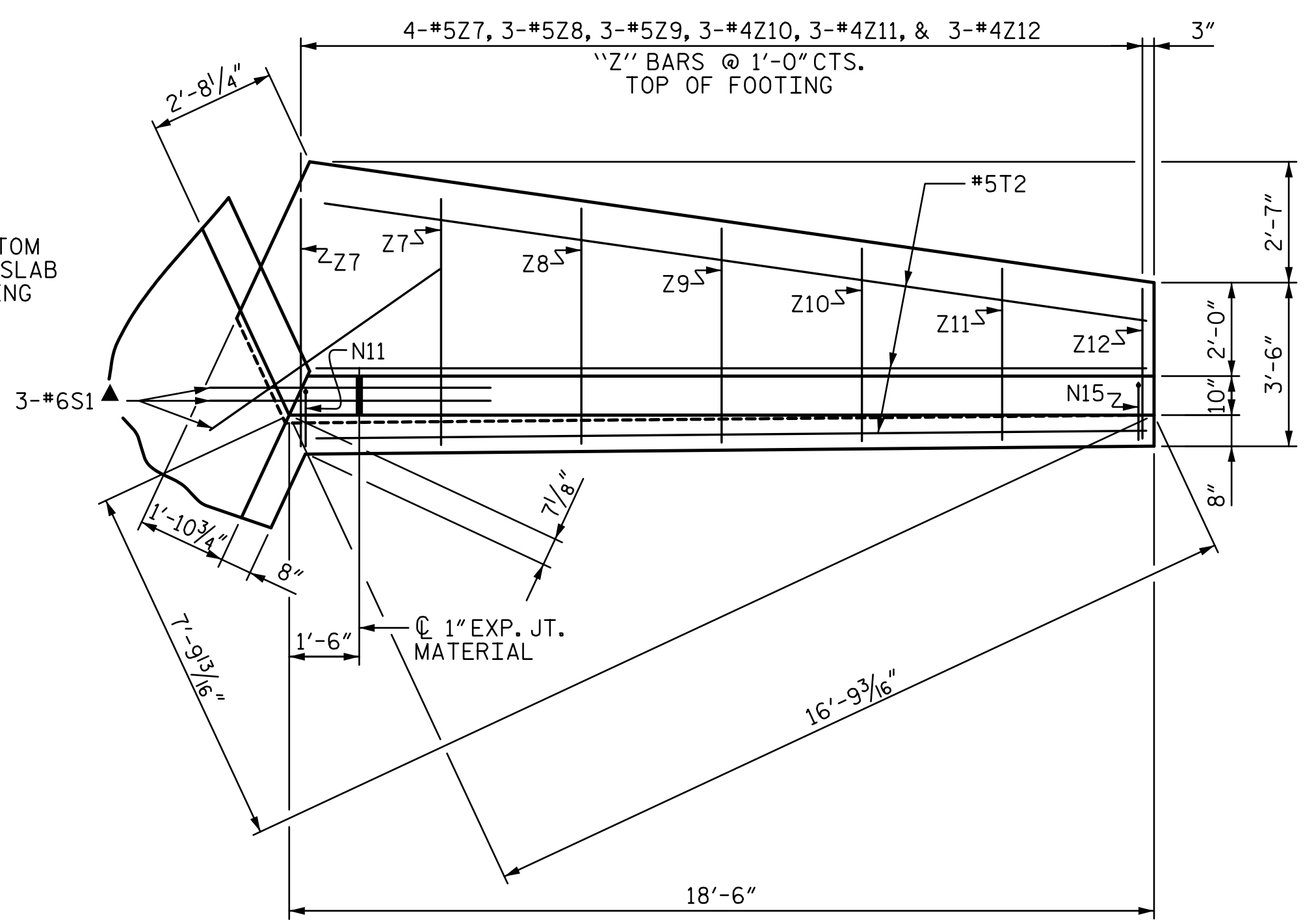
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		WINGS FOR CONCRETE BOX CULVERT H = 10'-0" SLOPE = 3:1 130°-00'-00" SKEW		TOTAL SHEETS 7																	
		REVISIONS <table border="1"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>			NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4	
NO.	BY:	DATE:	NO.	BY:	DATE:																
1			3																		
2			4																		

DRAWN BY : <u>BMC</u>	DATE : <u>5-17</u>	DESIGN ENGINEER OF RECORD: <u>B. CURRY</u>	DATE : <u>5-17</u>
CHECKED BY : <u>MLO</u>	DATE : <u>5-17</u>		

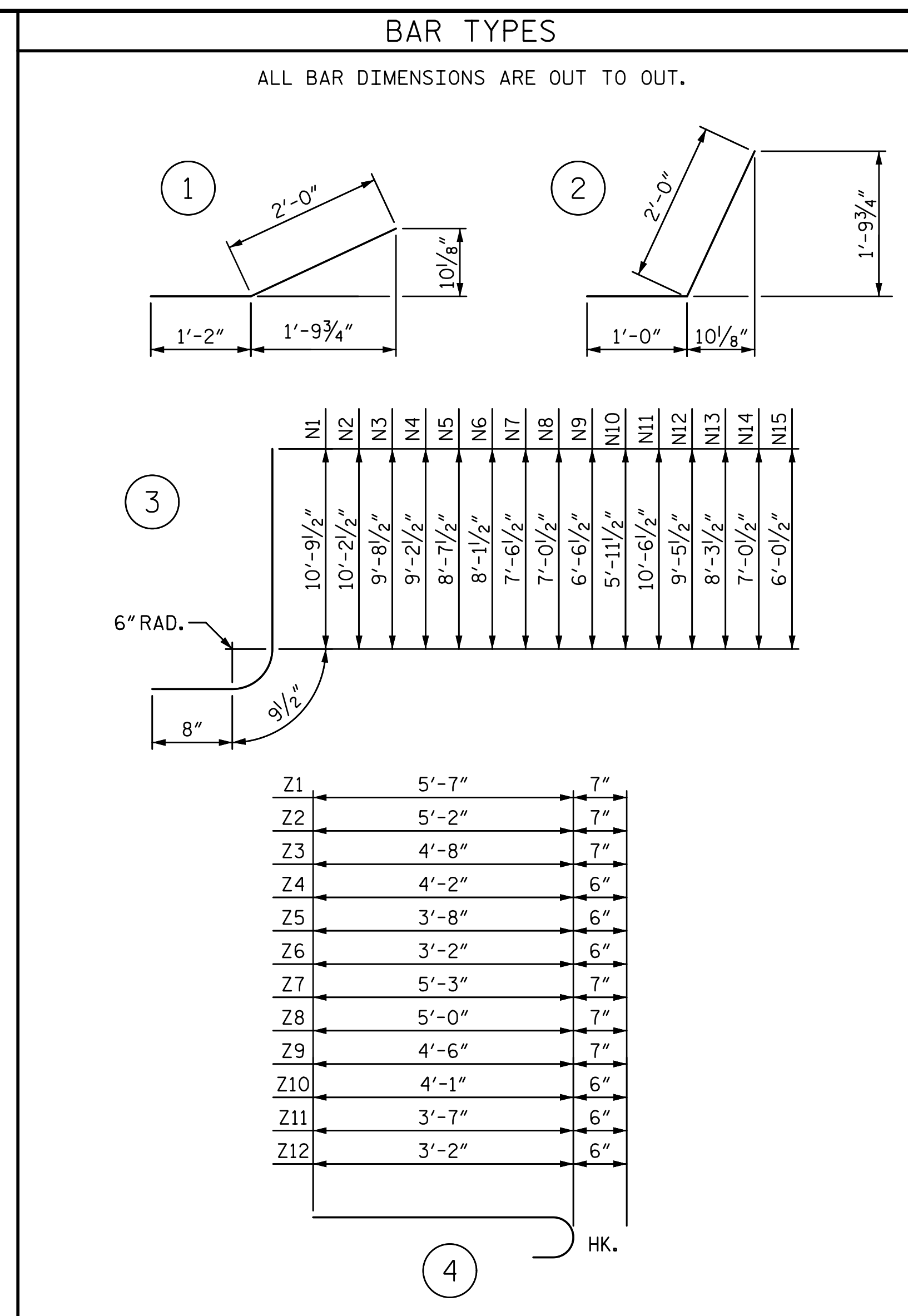
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ELEVATION W2



PLAN W2



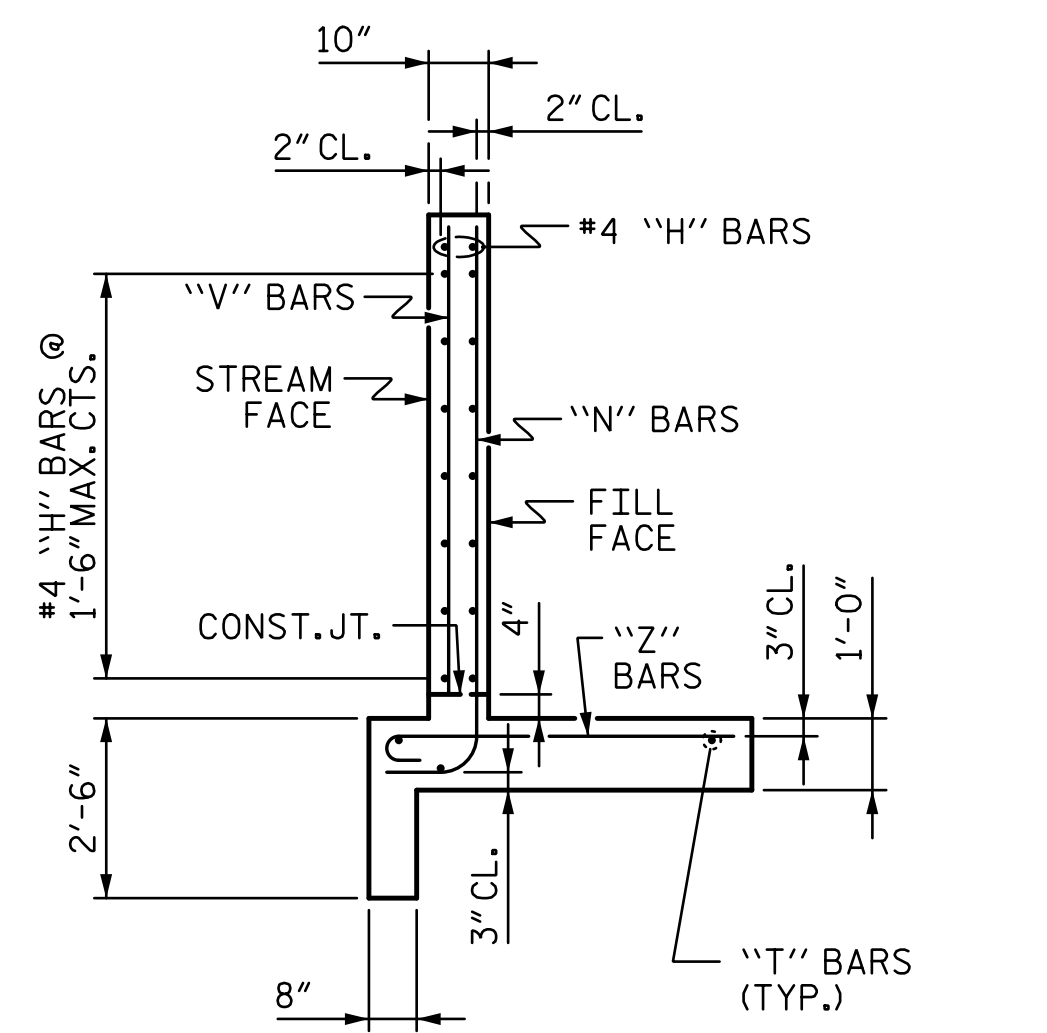
BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT	MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	16	#5	STR	37'-10"	631	V1	8	#4	STR	10'-2"	54
H2	4	#5	STR	32'-4"	135	V2	8	#4	STR	9'-8"	52
H3	4	#4	STR	20'-11"	56	V3	8	#4	STR	9'-1"	49
H4	4	#4	STR	9'-7"	26	V4	8	#4	STR	8'-7"	46
H5	4	#5	STR	38'-2"	159	V5	8	#4	STR	8'-1"	43
H6	32	#4	①	3'-2"	68	V6	8	#4	STR	7'-6"	40
H7	16	#4	STR	15'-10"	169	V7	8	#4	STR	7'-0"	37
H8	4	#4	STR	14'-1"	38	V8	8	#4	STR	6'-6"	35
H9	4	#4	STR	8'-10"	24	V9	8	#4	STR	5'-11"	32
H10	4	#4	STR	3'-6"	9	V10	8	#4	STR	5'-5"	29
H11	4	#4	STR	17'-2"	46	V11	6	#4	STR	10'-0"	40
H12	32	#4	②	3'-0"	64	V12	8	#4	STR	8'-10"	47
N1	8	#6	③	12'-3"	147	V13	8	#4	STR	7'-9"	41
N2	8	#6	③	11'-8"	140	V14	8	#4	STR	6'-6"	35
N3	8	#6	③	11'-2"	134	V15	8	#4	STR	5'-5"	29
N4	8	#6	③	10'-8"	128	Z1	10	#5	④	6'-2"	64
N5	8	#6	③	10'-1"	121	Z2	14	#5	④	5'-9"	84
N6	8	#5	③	9'-7"	80	Z3	14	#5	④	5'-3"	77
N7	8	#5	③	9'-0"	75	Z4	14	#4	④	4'-8"	44
N8	8	#5	③	8'-6"	71	Z5	14	#4	④	4'-2"	39
N9	8	#4	③	8'-0"	43	Z6	14	#4	④	3'-8"	34
N10	8	#4	③	7'-5"	40	Z7	8	#5	④	5'-10"	49
N11	6	#6	③	12'-0"	108	Z8	6	#5	④	5'-7"	35
N12	8	#6	③	10'-11"	131	Z9	6	#5	④	5'-1"	32
N13	8	#5	③	9'-9"	81	Z10	6	#4	④	4'-7"	18
N14	8	#5	③	8'-6"	71	Z11	6	#4	④	4'-1"	16
N15	8	#4	③	7'-6"	40	Z12	6	#4	④	3'-8"	15
S1	12	#6	STR	6'-0"	108						
T1	6	#5	STR	39'-9"	249						
T2	6	#5	STR	17'-9"	111						

REINFORCING STEEL FOR 4 WINGS 4,419 LBS
 CLASS A CONCRETE
 4 WINGS 28.9 CY
 2 HEADWALLS 2.7 CY
 2 SILLS 1.5 CY
 2 END CURTAIN WALLS 31.2 CY
 TOTAL 64.3 CY



TYPICAL WING SECTION

◆ INCLUDES WING FOOTINGS

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 151+41.00 -L-
 SHEET 7 OF 7

DOCUMENT NOT CONSIDERED FINAL
 UNLESS ALL SIGNATURES COMPLETED

STV 100 Years
 STV ENGINEERS, INC.
 900 West Trade St., Suite 715
 Charlotte, NC 28202
 NC License Number F-5991

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

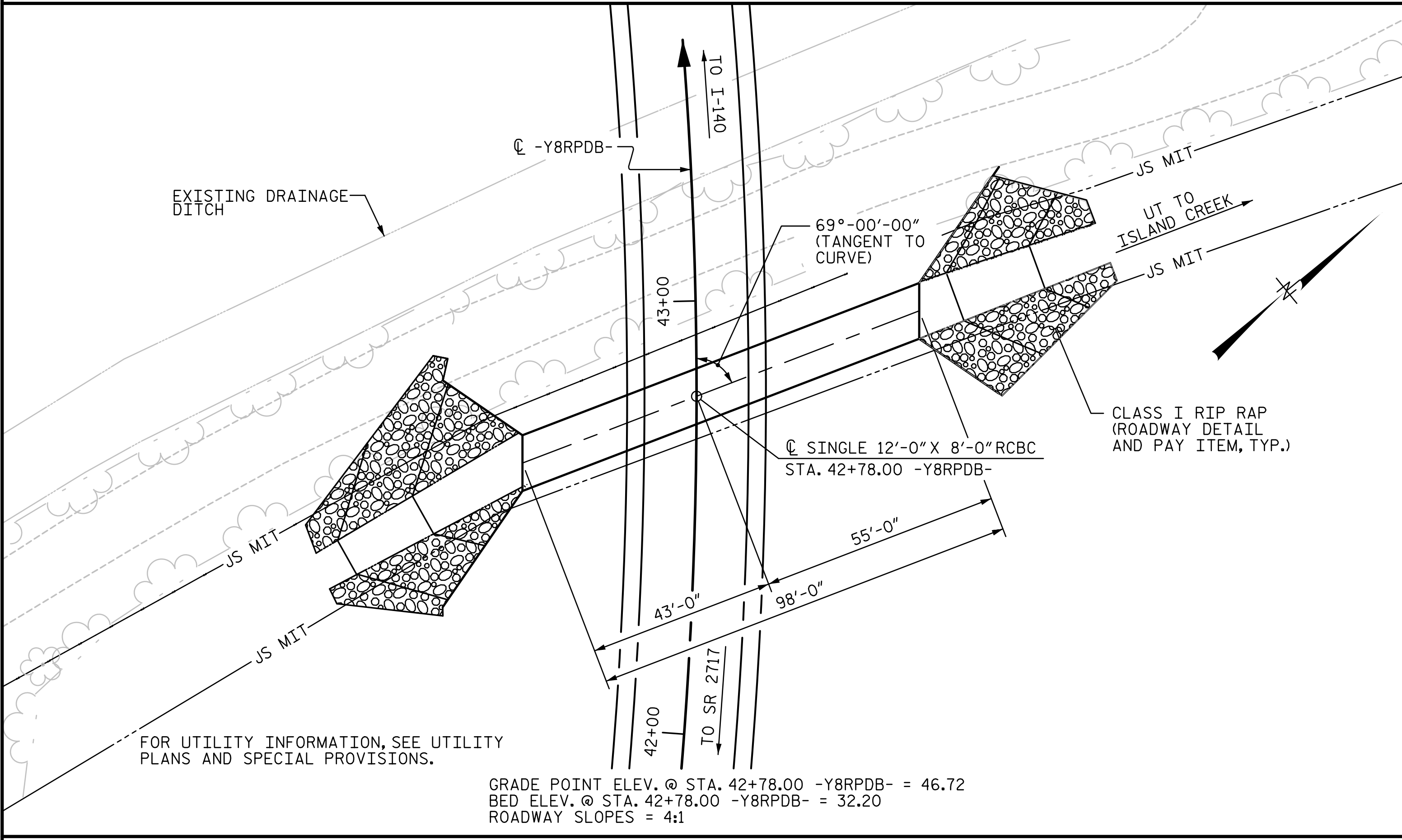
WINGS FOR CONCRETE BOX CULVERT
H = 10'-0" SLOPE = 3:1
130°-00'-00" SKEW

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

TOTAL SHEETS 7

DRAWN BY : BMC	DATE : 5-17	DESIGN ENGINEER OF RECORD : B. CURRY	DATE : 5-17
CHECKED BY : MLO	DATE : 5-17		

BENCHMARK 11: 101.28' RT., STA. 93+93.61 -Y8-, N=206326.526 E=2354194.253, EL. 43.53



LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	=	500 CFS
FREQUENCY OF DESIGN FLOOD	=	50 YRS.
DESIGN HIGH WATER ELEVATION	=	40.0 FT.
DRAINAGE AREA	=	274 ACRES
BASE DISCHARGE (Q100)	=	600 CFS
BASE HIGH WATER ELEVATION	=	40.85 FT.

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	=	1200 CFS
FREQUENCY OF OVERTOPPING FLOOD	=	500 YRS.
OVERTOPPING FLOOD ELEVATION @ STA. 43+76 -Y8RPDB-	=	47.2 FT.

-Y8RPDB- CURVE DATA

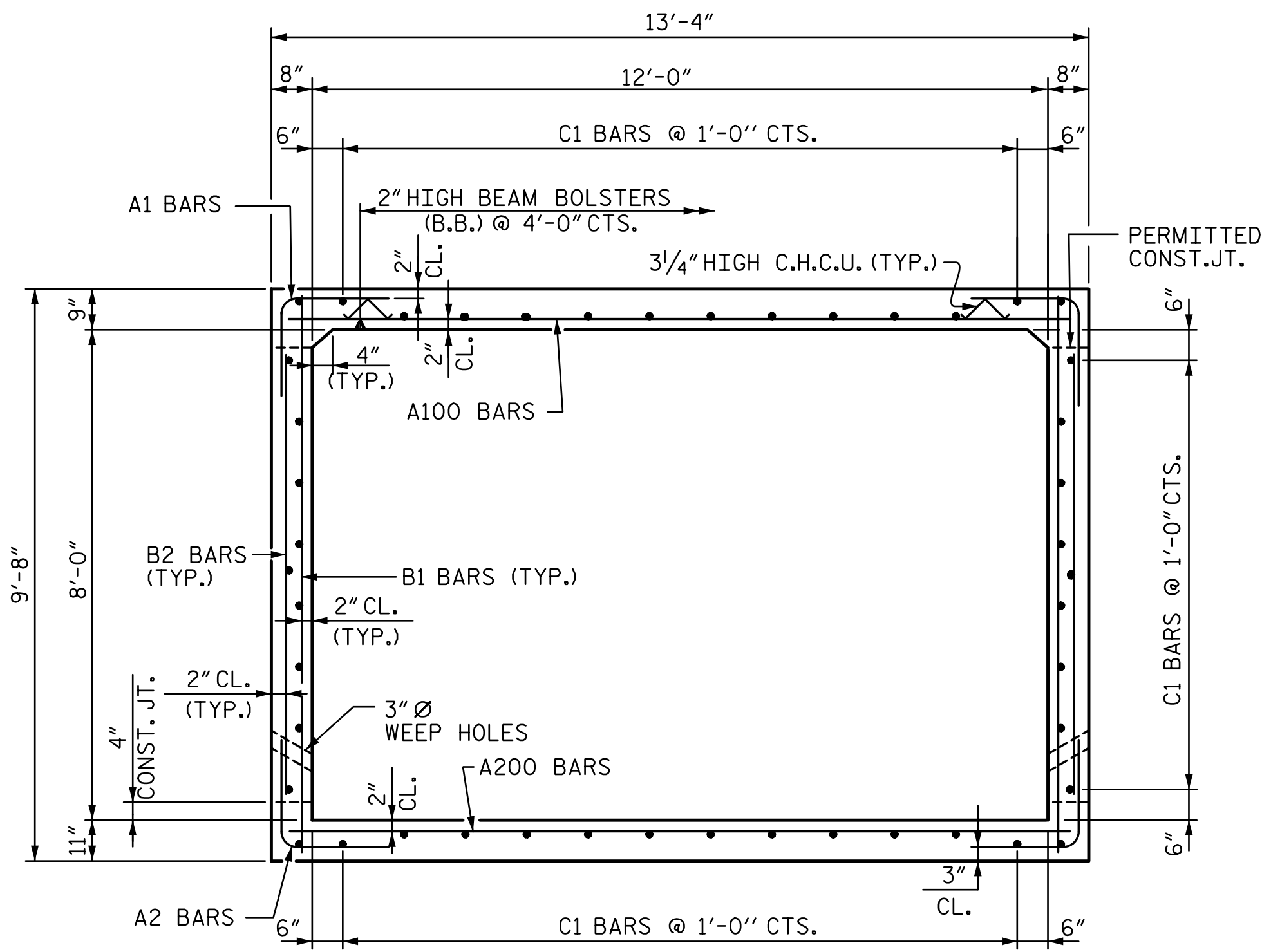
P.I. STA. = 50+39.08 -Y8RPDB-
 $\Delta = 126^\circ-18'-36.03"$ (LT)
 RADIUS = 1,060'
 TANGENT = 2,094.35'
 LENGTH = 2,336.80'

TOTAL STRUCTURE QUANTITIES

CULVERT EXCAVATION @ STA. 42+78.00 -Y8RPDB-	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	TOTAL: 125 TONS
CLASS A CONCRETE	
BARREL @ 1.222 CU.YDS./FT.	119.8 CU.YDS.
WINGS, ETC.	48.8 CU.YDS.
TOTAL	148.0 CU.YDS.
REINFORCING STEEL	
BARREL	21,906 LBS.
WINGS, ETC.	3,142 LBS.
TOTAL	25,048 LBS.
PLACEMENT OF NATURAL STREAM BED MATERIAL	LUMP SUM
TOTAL:	

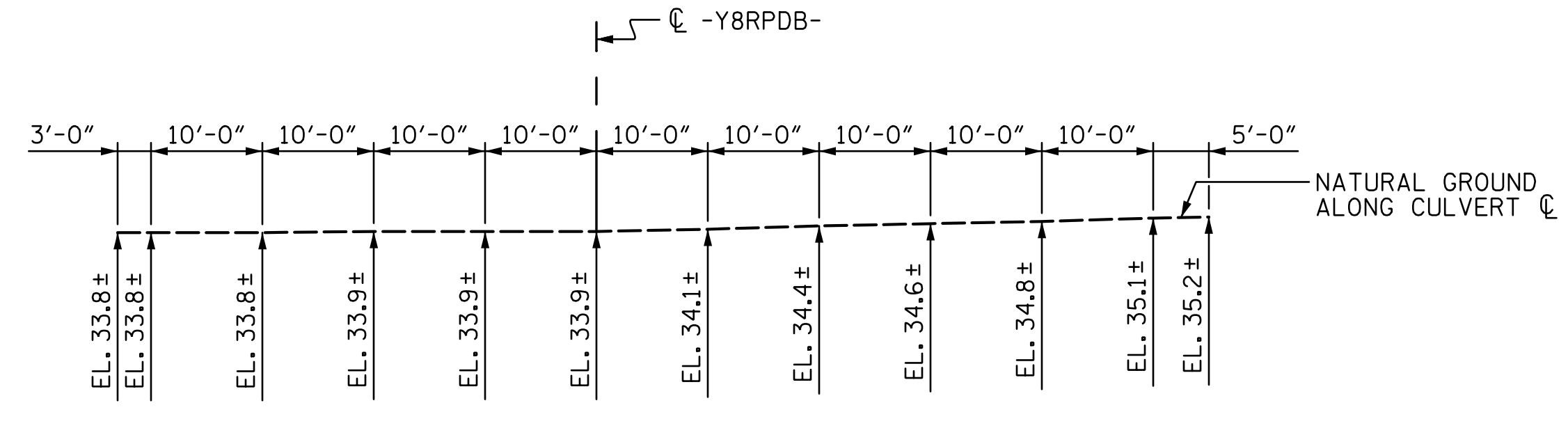
NOTES:

ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.
 DESIGN FILL = 4.86' MIN. AND 7.54' MAX.
 FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
 CONCRETE IN CULVERT TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.
 THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
 DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET (SHEET 4 OF 4).
 TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
 AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
 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.
 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.
 CULVERT TO BE BACK FILLED WITH NATIVE MATERIAL TO A DEPTH OF 1'-0". NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.
 FOR PLACEMENT OF NATURAL STREAM BED MATERIAL, SEE SPECIAL PROVISIONS.
 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.



RIGHT ANGLE SECTION OF BARREL

THERE ARE 46 "C" BARS IN SECTION OF BARREL



PROFILE ALONG CULVERT

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 42+78.00 -Y8RPDB-
 SHEET 1 OF 4

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH SEAL 036940 ENGINEER BRIAN M. CURRY 7/12/2017	SINGLE 12'-0" X 8'-0" CONCRETE BOX CULVERT 69°-00'-00" SKEW		
	REVISIONS			SHEET NO. C4-1
	NO. 1 BY: LGH DATE: 5-17	NO. 2 BY: MLO DATE: 5-17	NO. 3 BY: J. JONES DATE: 5-17	NO. 4 BY: J. JONES DATE: 5-17

DRAWN BY: LGH DATE: 5-17
 CHECKED BY: MLO DATE: 5-17
 DESIGN ENGINEER OF RECORD: J. JONES DATE: 5-17

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bcjrfy

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 (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING	HL-93 (INVENTORY)	N/A	1	1.04	--	1.75	1.04	1	TOP SLAB	6.67	1.21	1	TOP SLAB	1.21		
	HL-93 (OPERATING)	N/A		1.35	--	1.35	1.35	1	TOP SLAB	6.67	1.56	1	TOP SLAB	1.21		
	HS-20 (INVENTORY)	36.000	2	1.41	50.760	1.75	1.41	1	TOP SLAB	6.67	1.58	1	TOP SLAB	1.21		
	HS-20 (OPERATING)	36.000		1.83	65.880	1.35	1.83	1	TOP SLAB	6.67	2.05	1	TOP SLAB	1.21		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		2.57	34.695	1.40	2.57	1	TOP SLAB	6.67	2.88	1	TOP SLAB	1.21		
		SNGARBS2	20.000		2.40	48.000	1.40	2.40	1	TOP SLAB	6.67	2.70	1	TOP SLAB	1.21	
		SNAGRIS2	22.000		2.57	56.540	1.40	2.57	1	TOP SLAB	6.67	2.88	1	TOP SLAB	1.21	
		SNCOTTS3	27.250		2.55	69.488	1.40	2.55	1	TOP SLAB	6.67	3.00	1	TOP SLAB	1.21	
		SNAGRS4	34.925		2.15	75.089	1.40	2.15	1	TOP SLAB	6.67	2.54	1	TOP SLAB	1.21	
		SNS5A	35.550		2.45	87.098	1.40	2.45	1	TOP SLAB	6.67	2.88	1	TOP SLAB	1.21	
		SNS6A	39.950		2.47	98.677	1.40	2.47	1	TOP SLAB	6.67	2.91	1	TOP SLAB	1.21	
		SNS7B	42.000		2.63	110.460	1.40	2.63	1	TOP SLAB	6.67	3.10	1	TOP SLAB	1.21	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.36	77.880	1.40	2.36	1	TOP SLAB	6.67	2.68	1	TOP SLAB	1.21	
		TNT4A	33.075		2.72	89.964	1.40	2.72	1	TOP SLAB	6.67	3.21	1	TOP SLAB	1.21	
		TNT6A	41.600		2.73	113.568	1.40	2.73	1	TOP SLAB	6.67	3.21	1	TOP SLAB	1.21	
		TNT7A	42.000		2.98	125.160	1.40	2.98	1	TOP SLAB	6.67	3.51	1	TOP SLAB	1.21	
		TNT7B	42.000		2.98	125.160	1.40	2.98	1	TOP SLAB	6.67	3.51	1	TOP SLAB	1.21	
		TNAGRIT4	43.000	3	2.09	89.870	1.40	2.09	1	TOP SLAB	6.67	2.47	1	TOP SLAB	1.21	
		TNAGT5A	45.000		2.26	101.700	1.40	2.26	1	TOP SLAB	6.67	2.66	1	TOP SLAB	1.21	
TNAGT5B	45.000		2.26	101.700	1.40	2.26	1	TOP SLAB	6.67	2.66	1	TOP SLAB	1.21			

LOAD FACTORS:

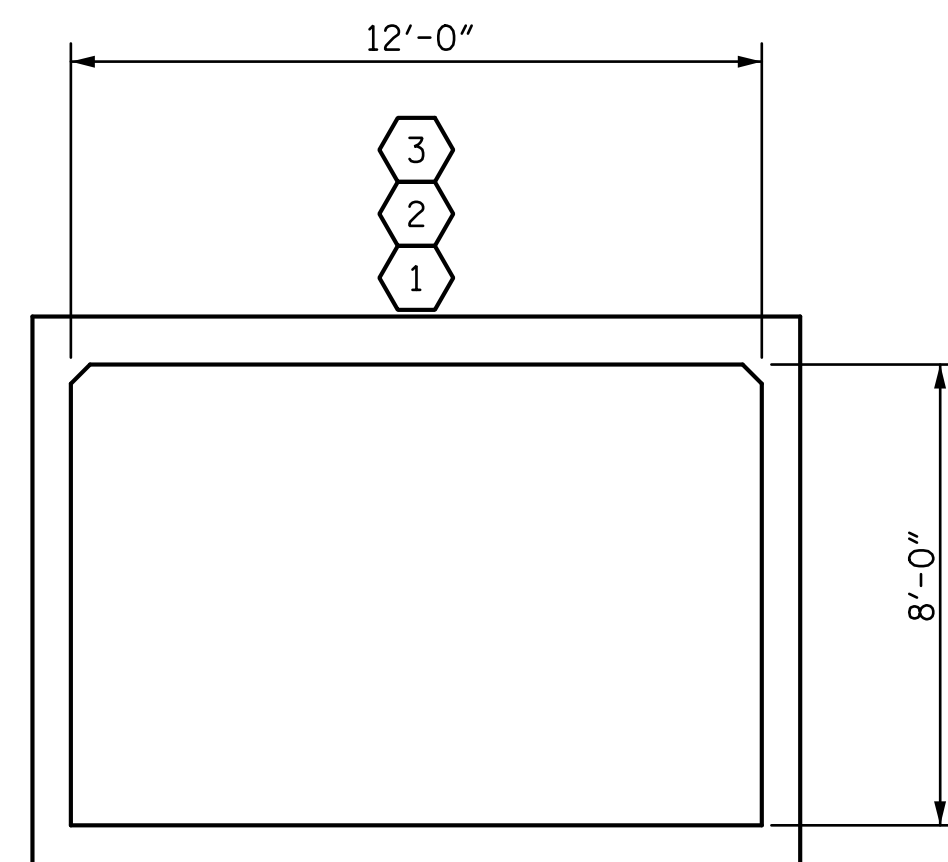
DESIGN LOAD RATING FACTORS

LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

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



LRFR SUMMARY
(LOOKING DOWNSTREAM)

PROJECT NO. U-4751

NEW HANOVER COUNTY

STATION: 42+78.00 -Y8RPDB-

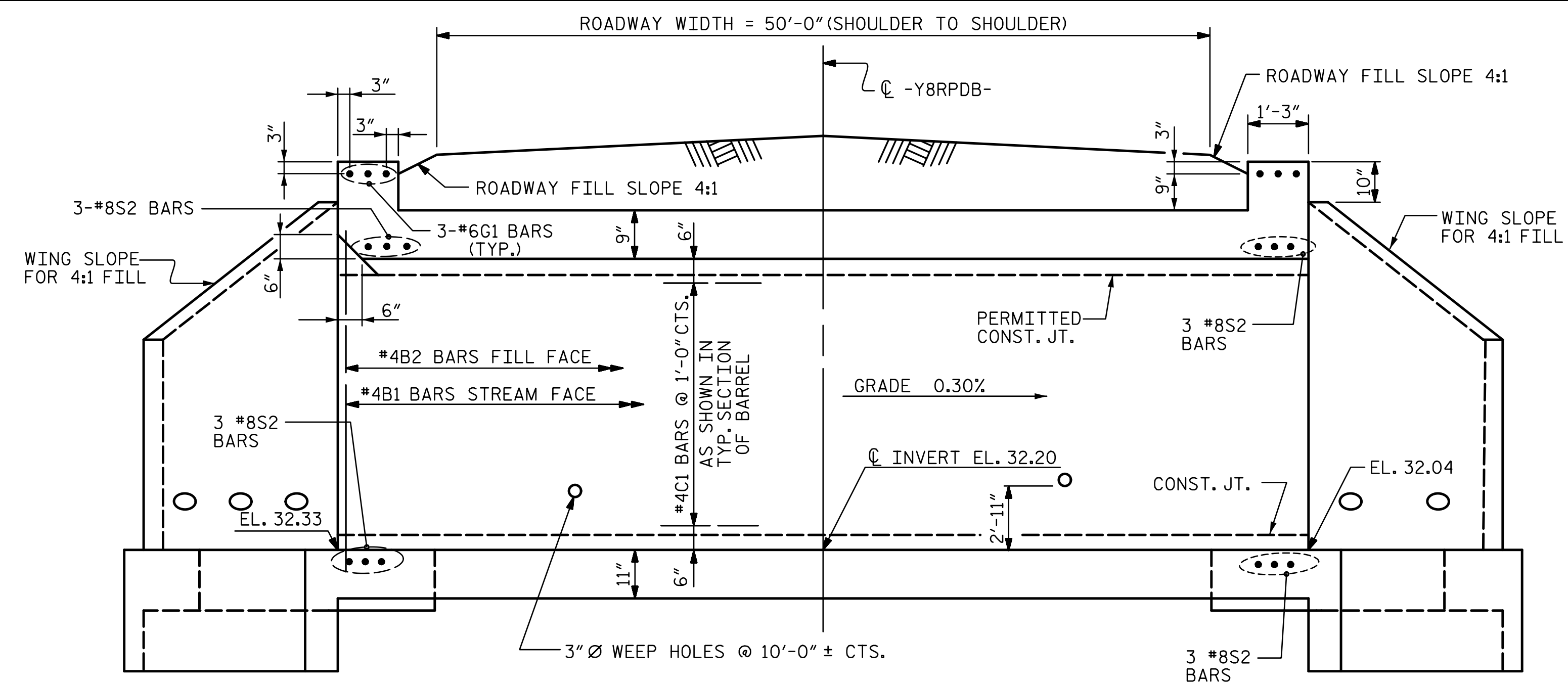
SHEET 2 OF 4

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																	
	STV ENGINEERS, INC. 900 West Trade St., Suite 715 Charlotte, NC 28202 NC License Number F-5991	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> <td></td> <td>3</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td></td> <td></td> <td>4</td> <td></td> <td></td> </tr> </tbody> </table>	NO.	BY:	DATE:	NO.	BY:	DATE:	1			3			2			4	
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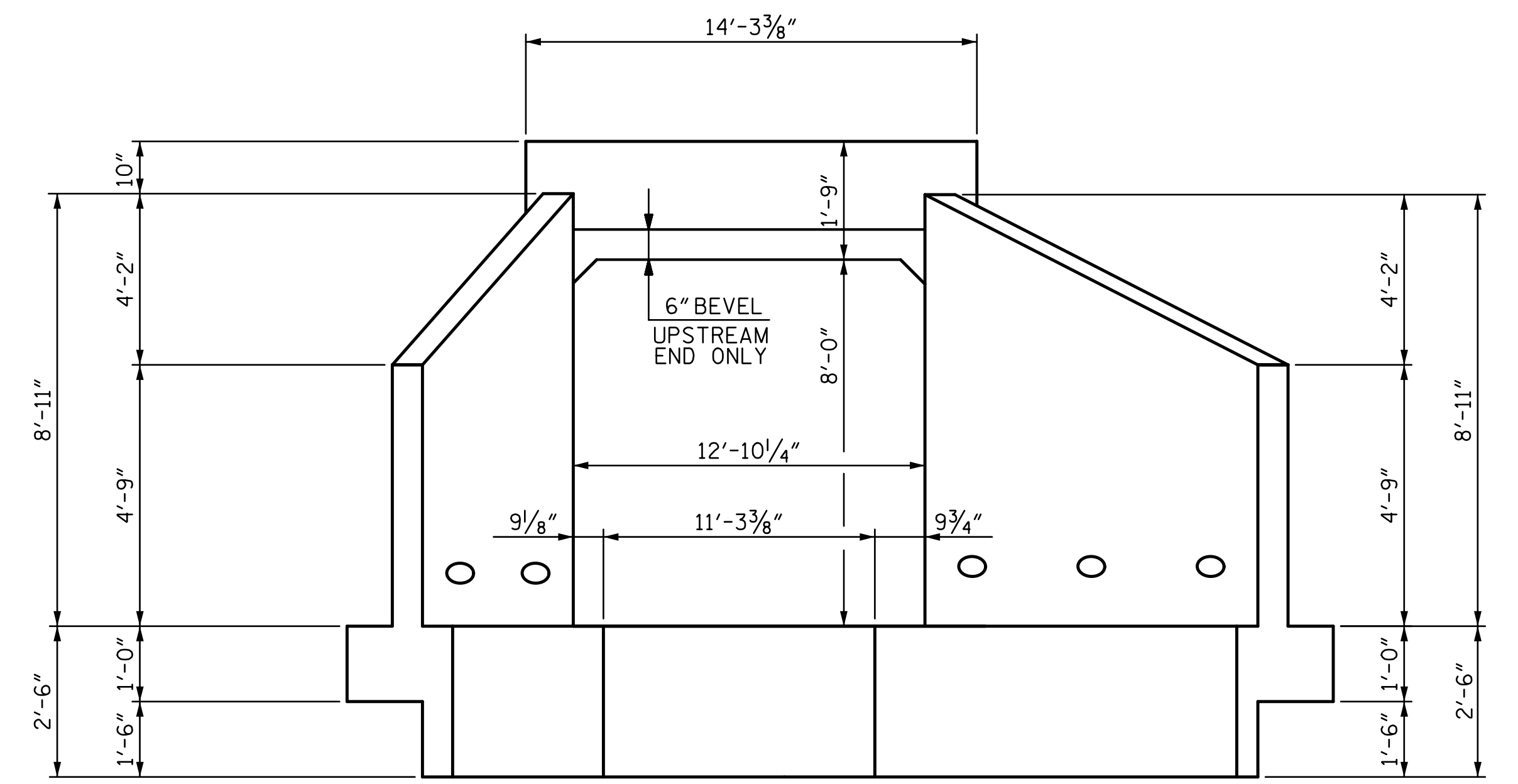
DRAWN BY : <u>LGH</u>	DATE : <u>5-17</u>	DESIGN ENGINEER OF RECORD: <u>J. JONES</u>
CHECKED BY : <u>BMC</u>	DATE : <u>5-17</u>	DATE : <u>5-17</u>

SHEET NO.
C4-2
TOTAL SHEETS
4

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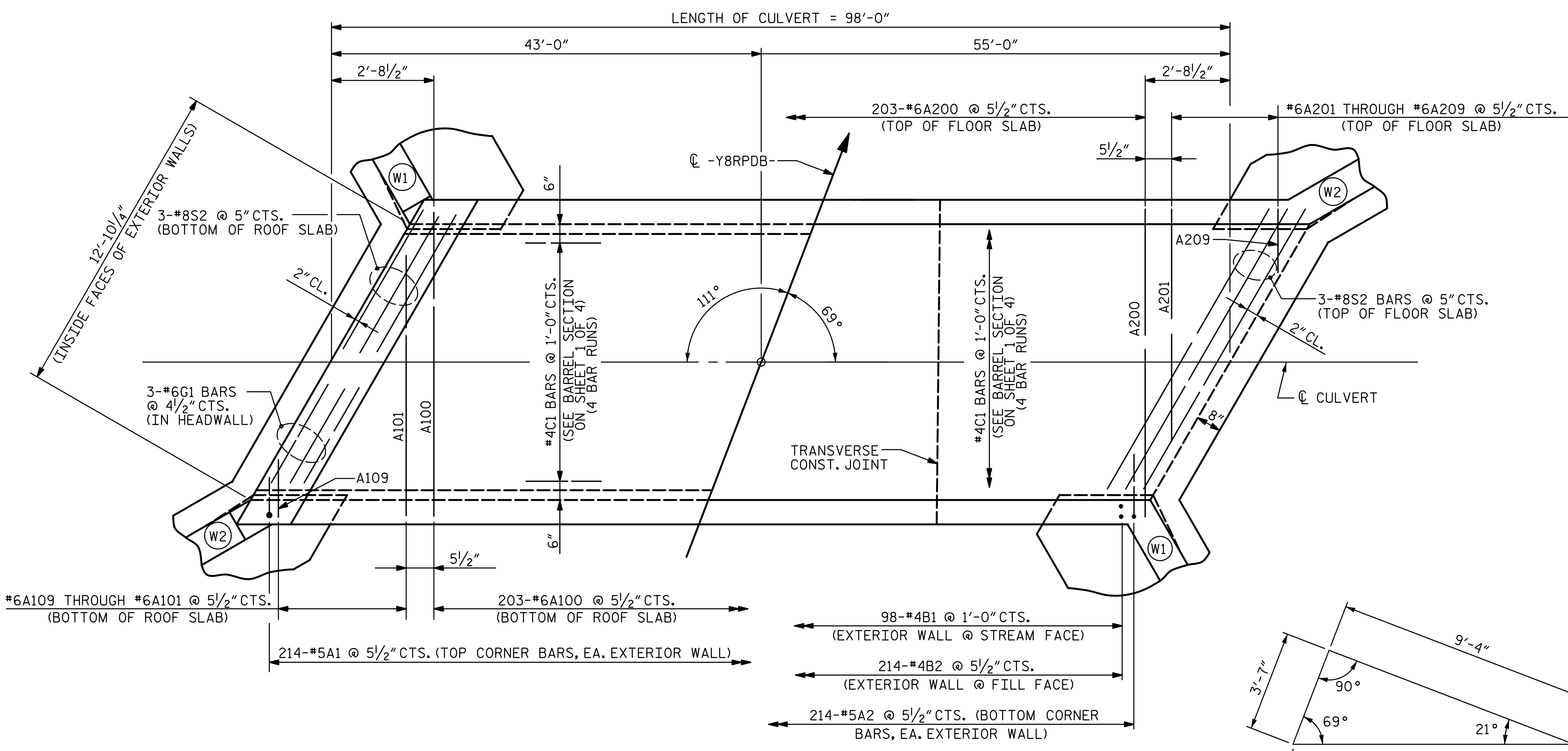


CULVERT SECTION NORMAL TO ROADWAY



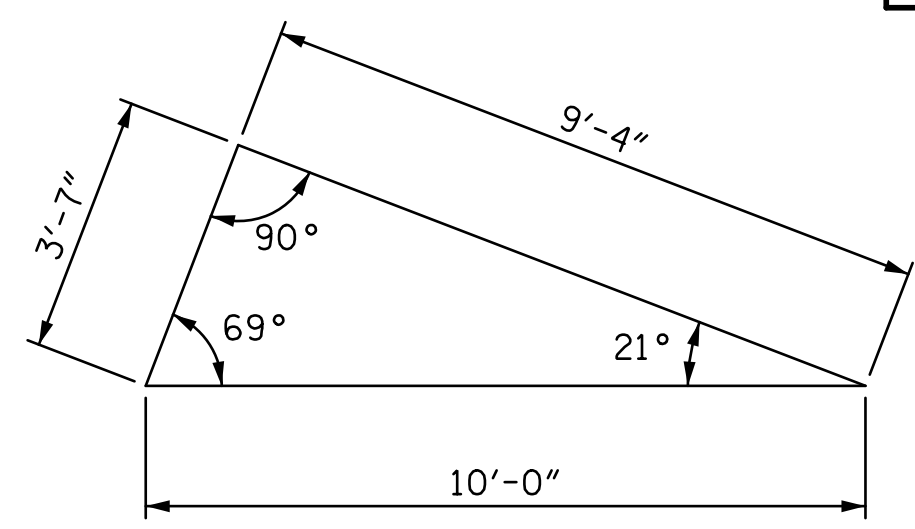
END ELEVATION NORMAL TO SKEW

(INLET END SHOWN, OUTLET END SIMILAR)



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB



SKEW TRIANGLE

BILL OF REINFORCING FOR BARREL											
BAR NO.	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR NO.	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	428	#5	⓪	7'-4"	3,274	A200	203	#6	STR	13'-0"	3,964
A2	428	#5	⓪	7'-4"	3,274	A201	2	#6	STR	11'-10"	36
A100	203	#6	STR	13'-0"	3,964	A202	2	#6	STR	10'-8"	32
A101	2	#6	STR	11'-10"	36	A203	2	#6	STR	9'-6"	29
A102	2	#6	STR	10'-8"	32	A204	2	#6	STR	8'-3"	25
A103	2	#6	STR	9'-6"	29	A205	2	#6	STR	7'-1"	21
A104	2	#6	STR	8'-3"	25	A206	2	#6	STR	5'-11"	18
A105	2	#6	STR	7'-1"	21	A207	2	#6	STR	4'-8"	14
A106	2	#6	STR	5'-11"	18	A208	2	#6	STR	3'-6"	11
A107	2	#6	STR	4'-8"	14	A209	2	#6	STR	2'-4"	7
A108	2	#6	STR	3'-6"	11	B1	196	#4	STR	9'-3"	1,211
A109	2	#6	STR	2'-4"	7	B2	428	#4	STR	7'-4"	2,097
BAR TYPES											
ALL BAR DIMENSIONS ARE OUT TO OUT.											
C1	184	#4	STR	25'-9"	3,165						
G1	6	#6	STR	13'-11"	125						
S2	22	#8	STR	13'-11"	446						
TOTAL REINFORCING STEEL 21,906 LBS.											

SPLICE LENGTH CHART

BAR	SIZE	SPLICE LENGTH
B2	#4	1'-9"
C1	#4	1'-9"

PROJECT NO. U-4751
 NEW HANOVER COUNTY
 STATION: 42+78.00 -Y8RPDB-
 SHEET 3 OF 4

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 7/12/2017

 STV ENGINEERS, INC.
 900 West Trade St., Suite 715
 Charlotte, NC 28202
 NC License Number F-5991

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
SINGLE 12'-0" X 8'-0"
CONCRETE BOX CULVERT
69°-00'-00" SKEW

DRAWN BY : LGH DATE : 5-17
 CHECKED BY : MLO DATE : 5-17
 DESIGN ENGINEER OF RECORD : J. JONES DATE : 5-17

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

TOTAL SHEETS 4

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.

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