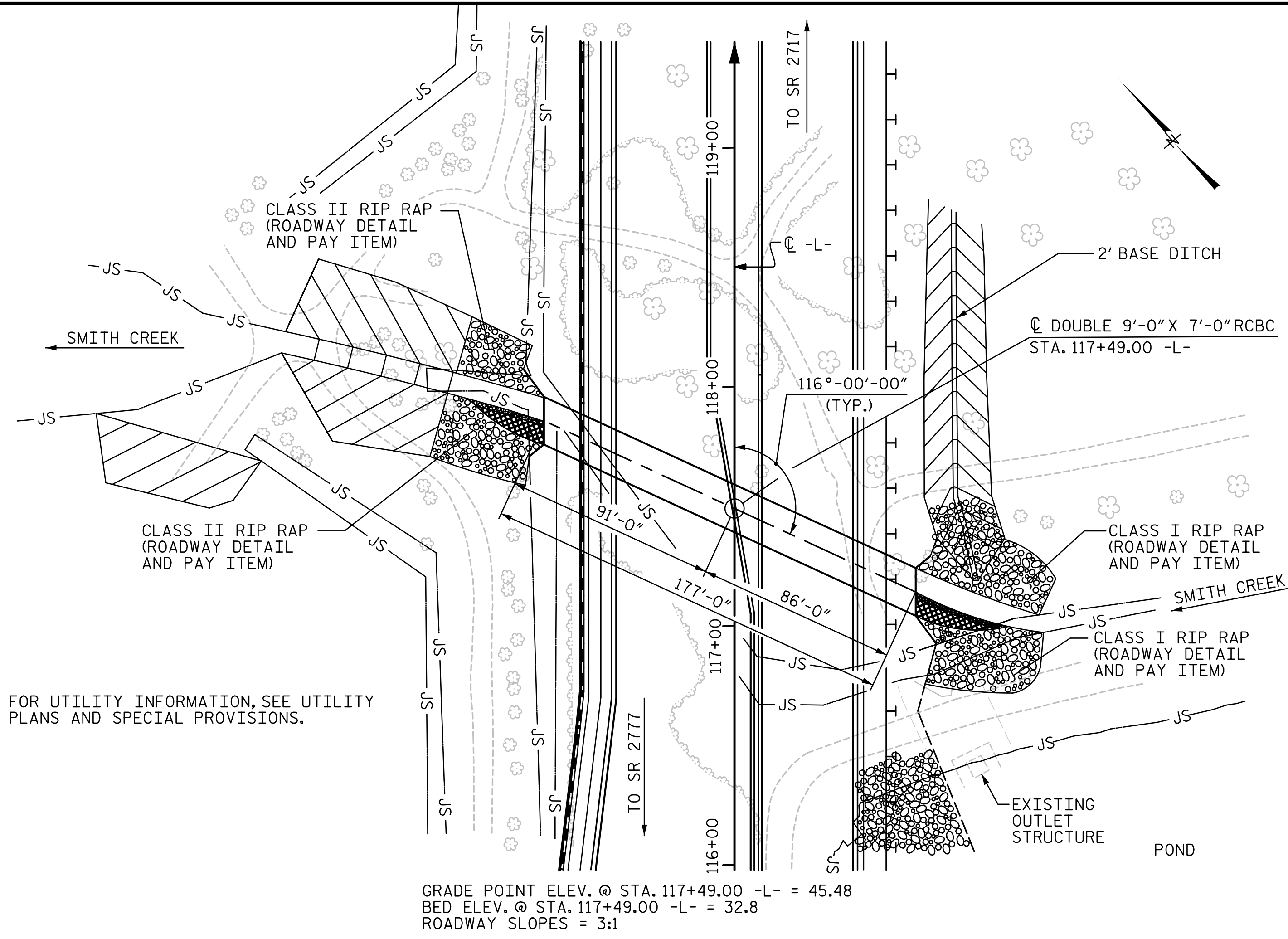
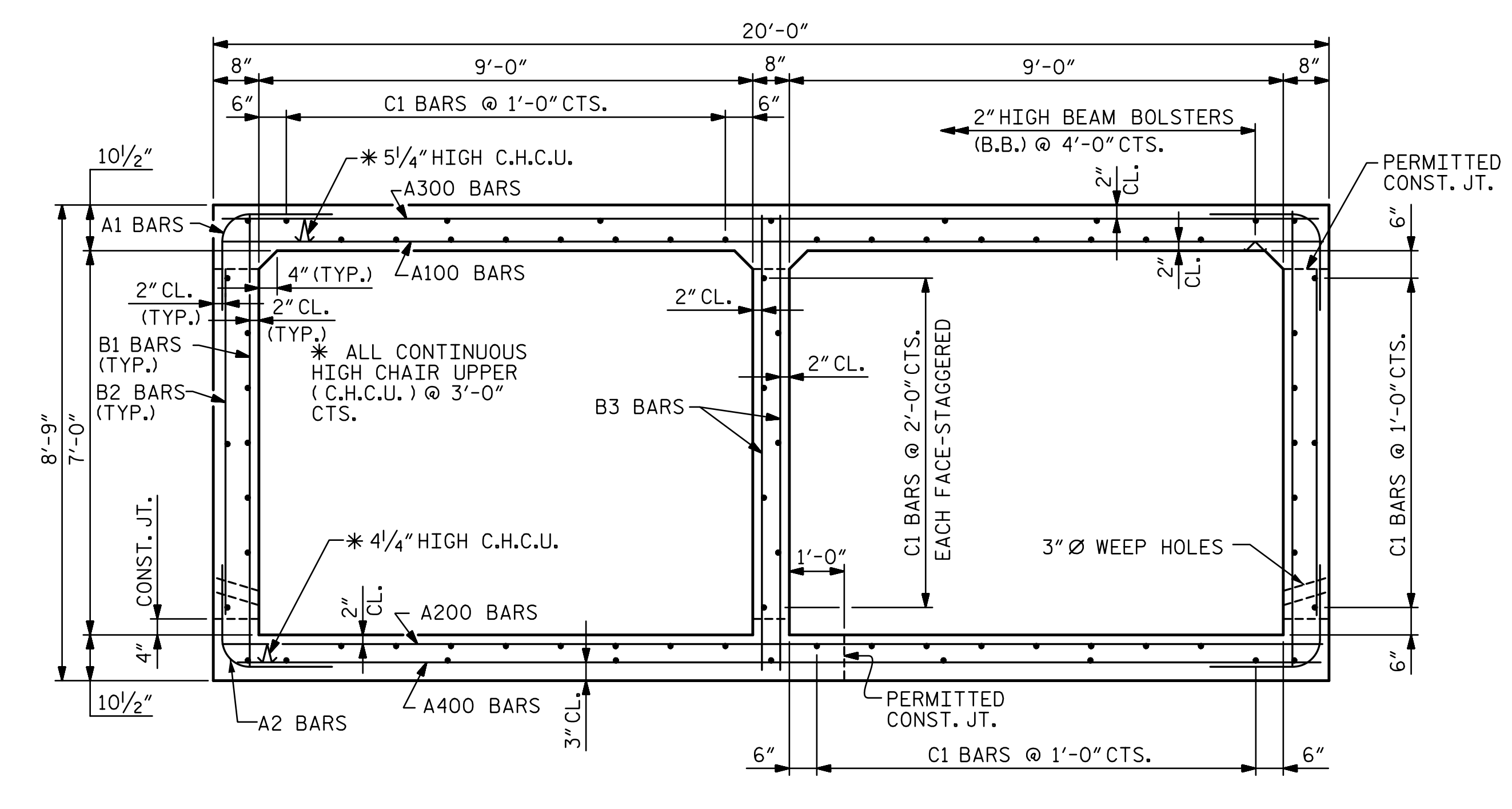


BENCHMARK 17: 317.03' RT., STA. 146+28.72 -L-, N=198704.150 E=2355984.737, EL. 45.01



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

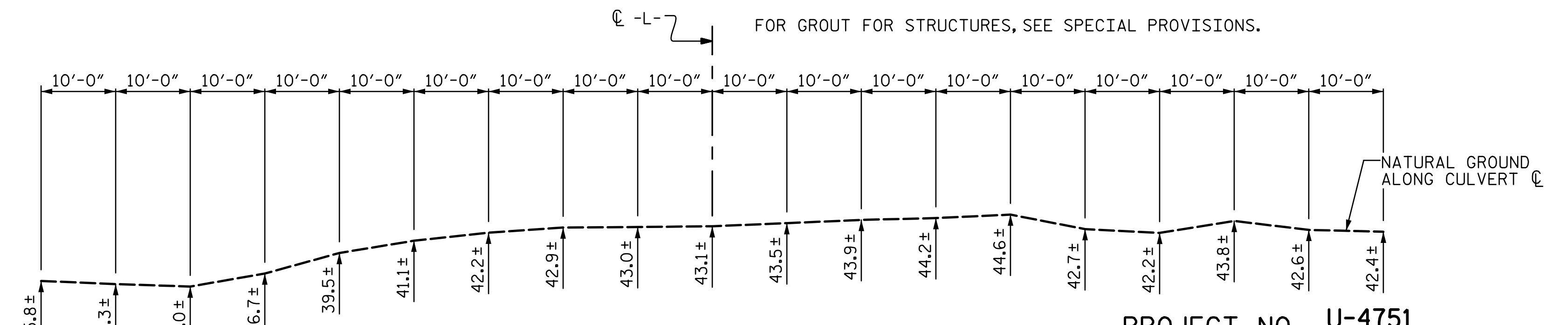
OVERTOPPING DISCHARGE	=	1,475 CFS
FREQUENCY OF OVERTOPPING FLOOD	=	100+ YRS.
OVERTOPPING FLOOD ELEVATION (@ STA. 117+42.00 -L-)	=	45.8 FT.

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 TOTAL:	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 SLLS, 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 100 years

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	--

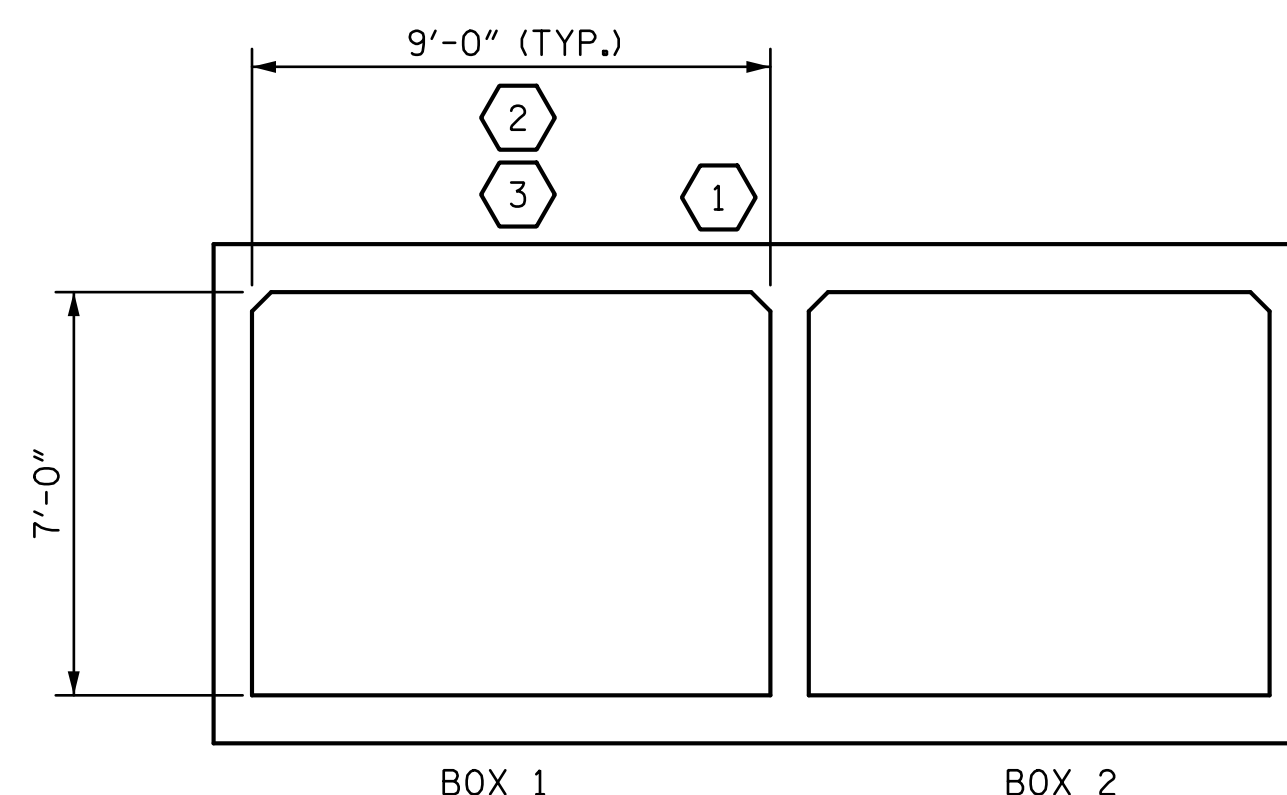
### NOTE:

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

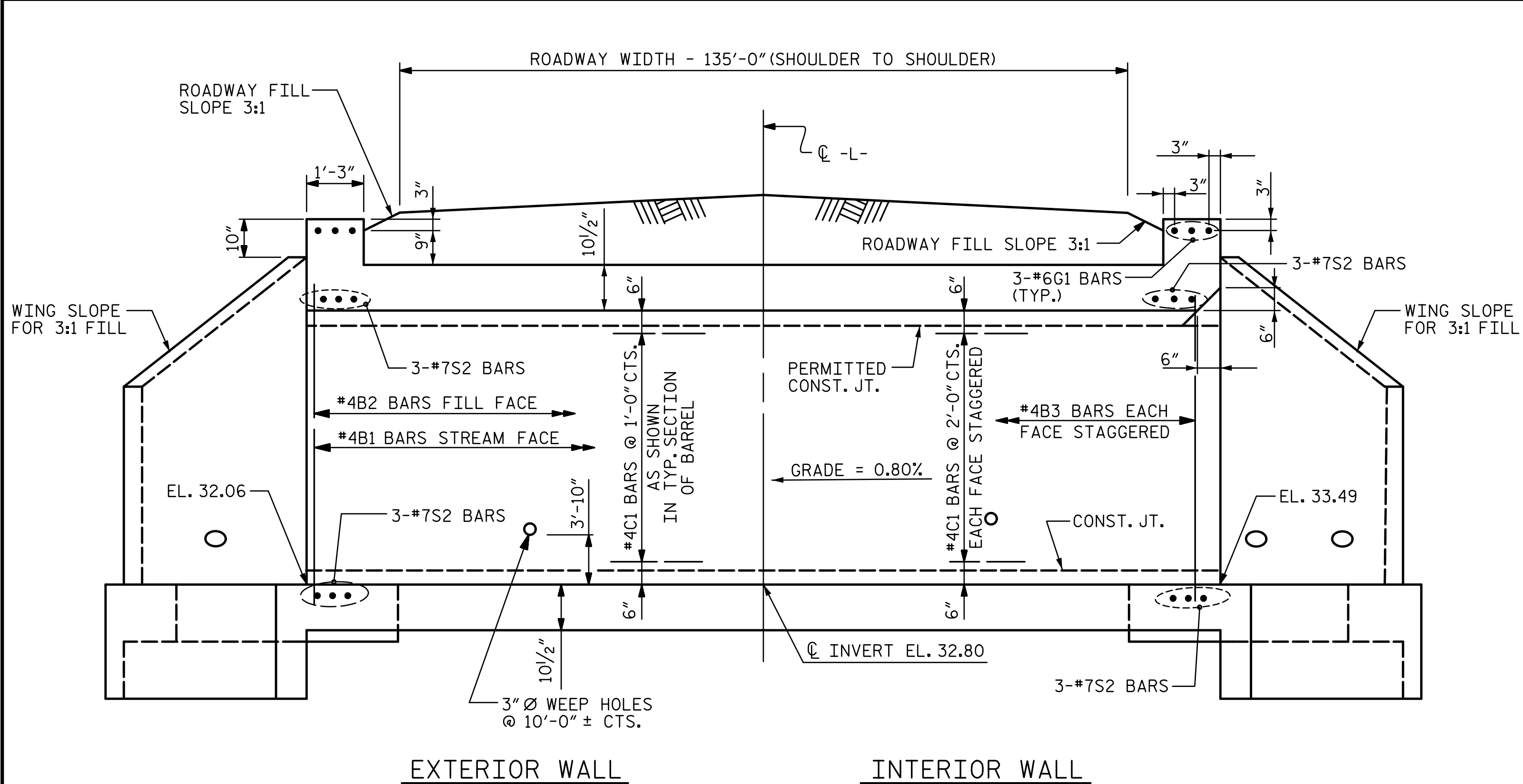
STATION: 117+49.00 -L-

SHEET 2 OF 6

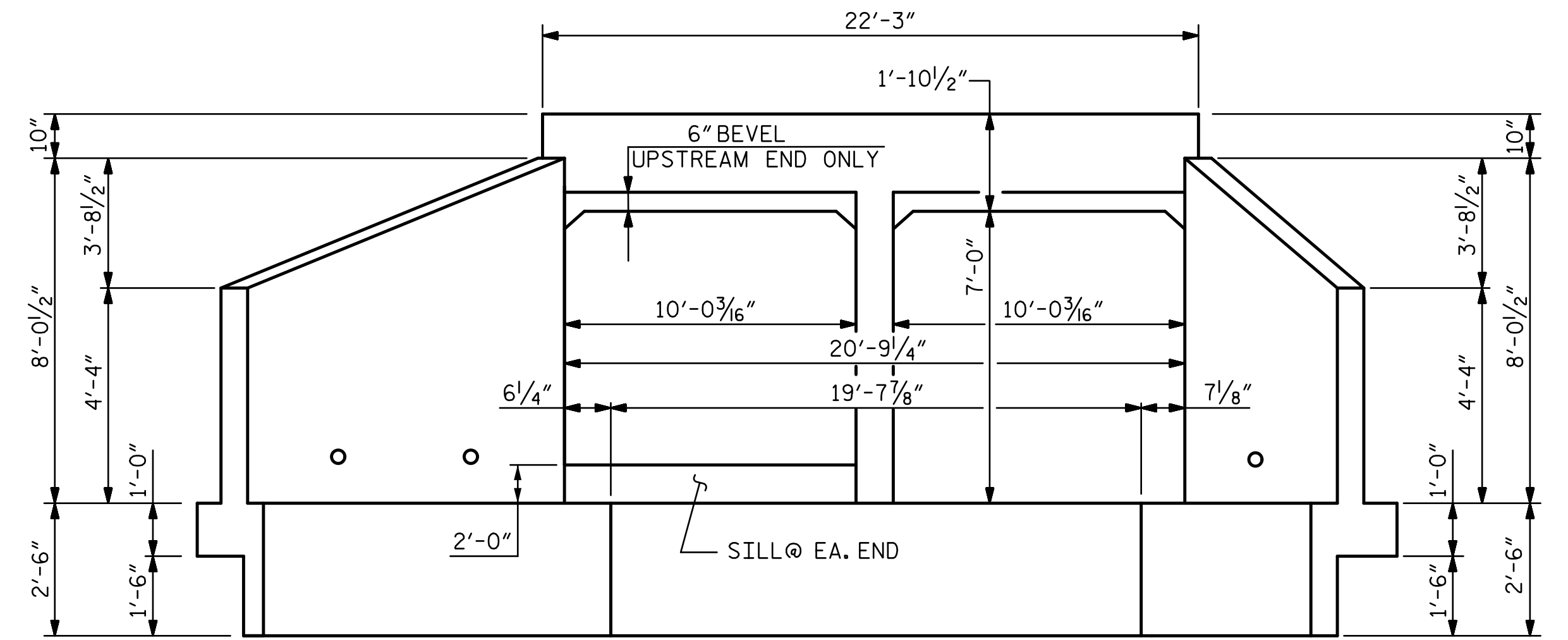
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH  <b>STANDARD LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)</b>																		
		REVISIONS	SHEET NO. C1-2																	
	STV ENGINEERS, INC. 900 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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2			4																	

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>		

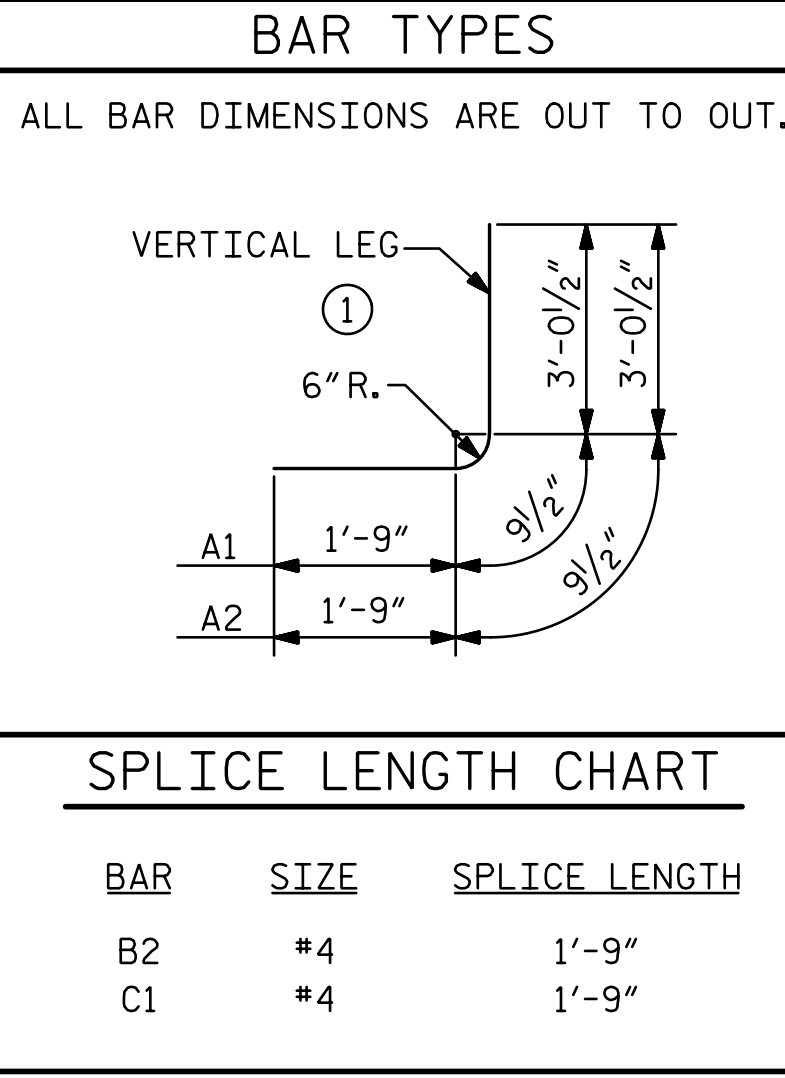
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EXTERIOR WALL                      INTERIOR WALL  
**CULVERT SECTION NORMAL TO ROADWAY**



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



BILL OF REINFORCING FOR BARREL					
MARK	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	768	#4	①	5'-7"	2,864
A2	768	#4	①	5'-7"	2,864
A100	334	#4	STR	19'-8"	4,388
A101	2	#4	STR	19'-2"	26
A102	2	#4	STR	18'-2"	24
A103	2	#4	STR	17'-1"	23
A104	2	#4	STR	16'-1"	21
A105	2	#4	STR	15'-1"	20
A106	2	#4	STR	14'-0"	19
A107	2	#4	STR	13'-0"	17
A108	2	#4	STR	12'-0"	16
A109	2	#4	STR	10'-11"	15
A110	2	#4	STR	9'-11"	13
A111	2	#4	STR	8'-11"	12
A112	2	#4	STR	7'-10"	10
A113	2	#4	STR	6'-10"	9
A114	2	#4	STR	5'-10"	8
A115	2	#4	STR	4'-10"	6
A116	2	#4	STR	3'-9"	5
A117	2	#4	STR	2'-9"	4
A118	2	#4	STR	1'-9"	2
A200	334	#4	STR	19'-8"	24,388
A201	2	#4	STR	19'-2"	26
A202	2	#4	STR	18'-2"	24
A203	2	#4	STR	17'-1"	23
A204	2	#4	STR	16'-1"	21
A205	2	#4	STR	15'-1"	20
A206	2	#4	STR	14'-0"	19
A207	2	#4	STR	13'-0"	17
A208	2	#4	STR	12'-0"	16
A209	2	#4	STR	10'-11"	15
A210	2	#4	STR	9'-11"	13
A211	2	#4	STR	8'-11"	12
A212	2	#4	STR	7'-10"	10
A213	2	#4	STR	6'-10"	9
A214	2	#4	STR	5'-10"	8
A215	2	#4	STR	4'-10"	6
A216	2	#4	STR	3'-9"	5
A217	2	#4	STR	2'-9"	4
A218	2	#4	STR	1'-9"	2
A300	365	#5	STR	19'-8"	7,487
A301	2	#5	STR	18'-11"	39
A302	2	#5	STR	17'-11"	37
A303	2	#5	STR	17'-0"	35
A304	2	#5	STR	16'-1"	34
A305	2	#5	STR	15'-2"	32
A306	2	#5	STR	14'-2"	30
A307	2	#5	STR	13'-3"	28
A308	2	#5	STR	12'-4"	26
A309	2	#5	STR	11'-5"	24
A310	2	#5	STR	10'-5"	22
A311	2	#5	STR	9'-6"	20
A312	2	#5	STR	8'-7"	18
A313	2	#5	STR	7'-7"	16
A314	2	#5	STR	6'-8"	14
A315	2	#5	STR	5'-9"	12
A316	2	#5	STR	4'-10"	10
A317	2	#5	STR	3'-10"	8
A318	2	#5	STR	2'-11"	6
A319	2	#5	STR	2'-0"	4
A400	365	#5	STR	19'-8"	7,487
A401	2	#5	STR	18'-11"	39
A402	2	#5	STR	17'-11"	37
A403	2	#5	STR	17'-0"	35
A404	2	#5	STR	16'-1"	34
A405	2	#5	STR	15'-2"	32
A406	2	#5	STR	14'-2"	30
A407	2	#5	STR	13'-3"	28
A408	2	#5	STR	12'-4"	26
A409	2	#5	STR	11'-5"	24
A410	2	#5	STR	10'-5"	22
A411	2	#5	STR	9'-6"	20
A412	2	#5	STR	8'-7"	18
A413	2	#5	STR	7'-7"	16
A414	2	#5	STR	6'-8"	14
A415	2	#5	STR	5'-9"	12
A416	2	#5	STR	4'-10"	10
A417	2	#5	STR	3'-10"	8
A418	2	#5	STR	2'-11"	6
A419	2	#5	STR	2'-0"	4
B1	354	#4	STR	8'-4"	1,971
B2	768	#4	STR	6'-0"	3,078
B3	354	#4	STR	8'-4"	1,971
C1	522	#4	STR	26'-9"	9,131
D1	6	#6	STR	2'-5"	22
G1	6	#6	STR	21'-10"	197
S2	12	#7	STR	21'-10"	536

TOTAL BARREL REINFORCING STEEL = 47,714 LBS.

PROJECT NO. U-4751  
 NEW HANOVER COUNTY  
 STATION: 117+49.00 -L-  
 SHEET 3 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

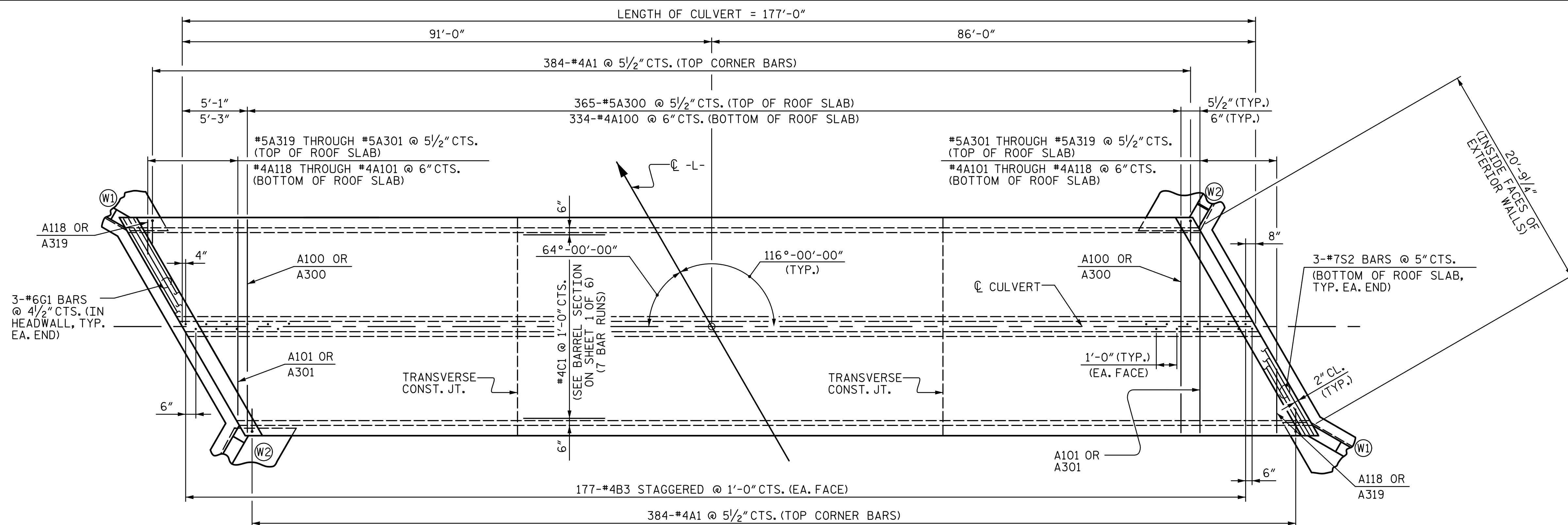
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**DOUBLE 9'-0" X 7'-0"  
 CONCRETE BOX CULVERT  
 116°-00'-00" SKEW**

REVISIONS			
NO.	BY:	DATE:	DATE:
1			
2			

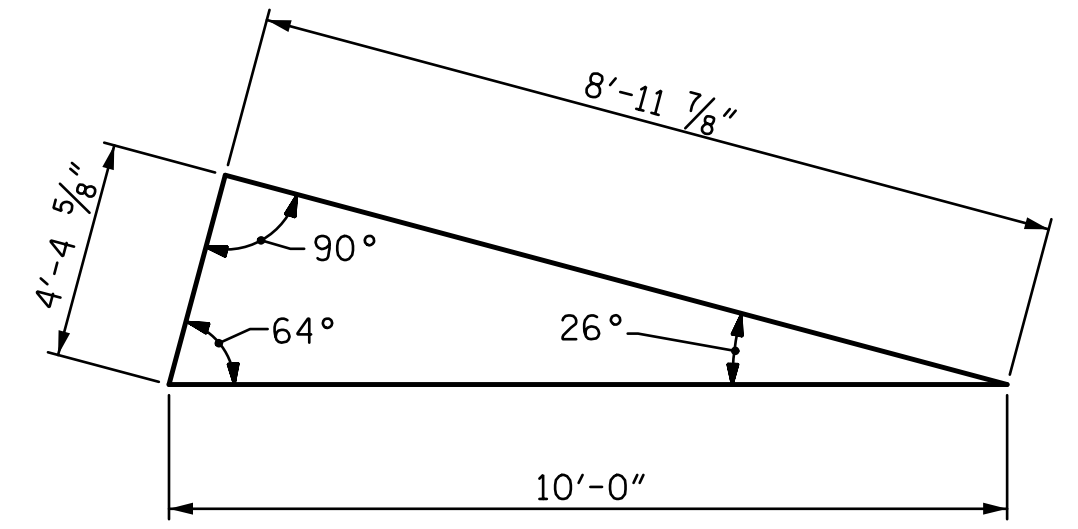
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C1-3	TOTAL SHEETS
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DRAWN BY: BMC DATE: 4-17  
 CHECKED BY: MLO DATE: 4-17  
 DESIGN ENGINEER OF RECORD: B. CURRY DATE: 4-17

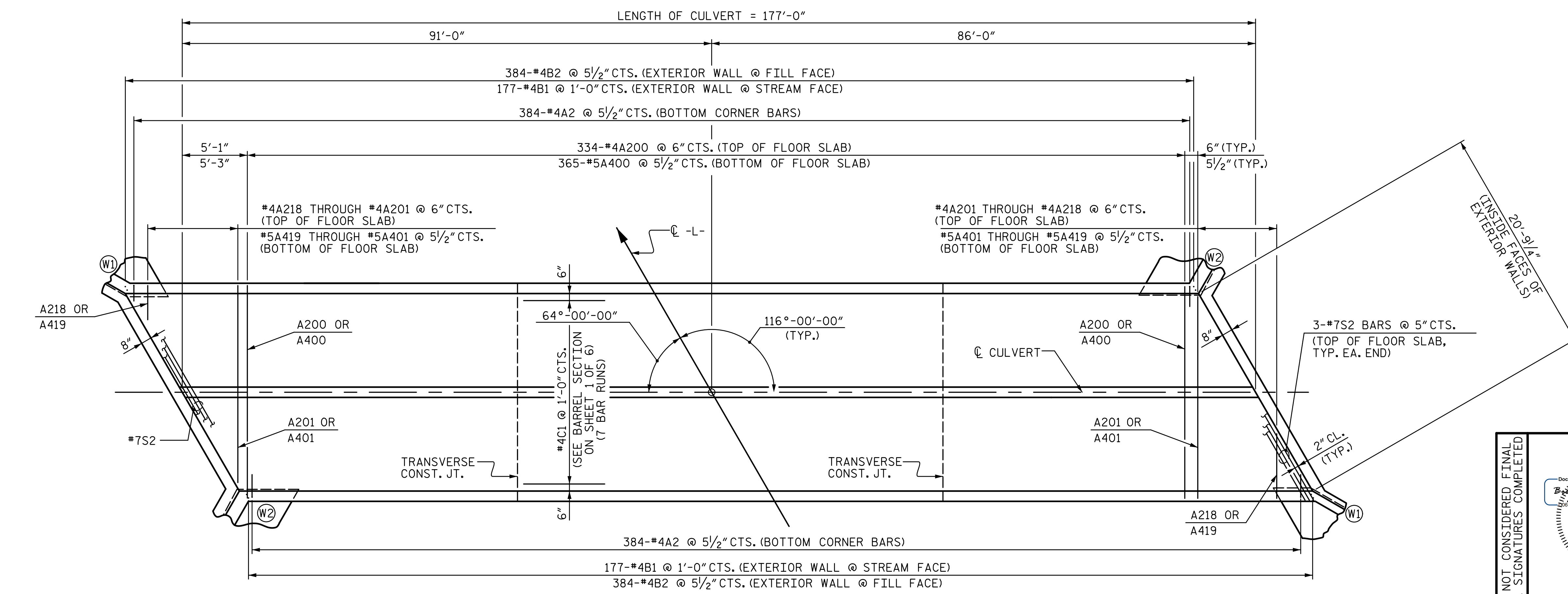
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**ROOF PLAN**  
(SEE FLOOR PLAN FOR B1 & B2 BARS IN EXTERIOR WALLS)



**SKEW TRIANGLE**



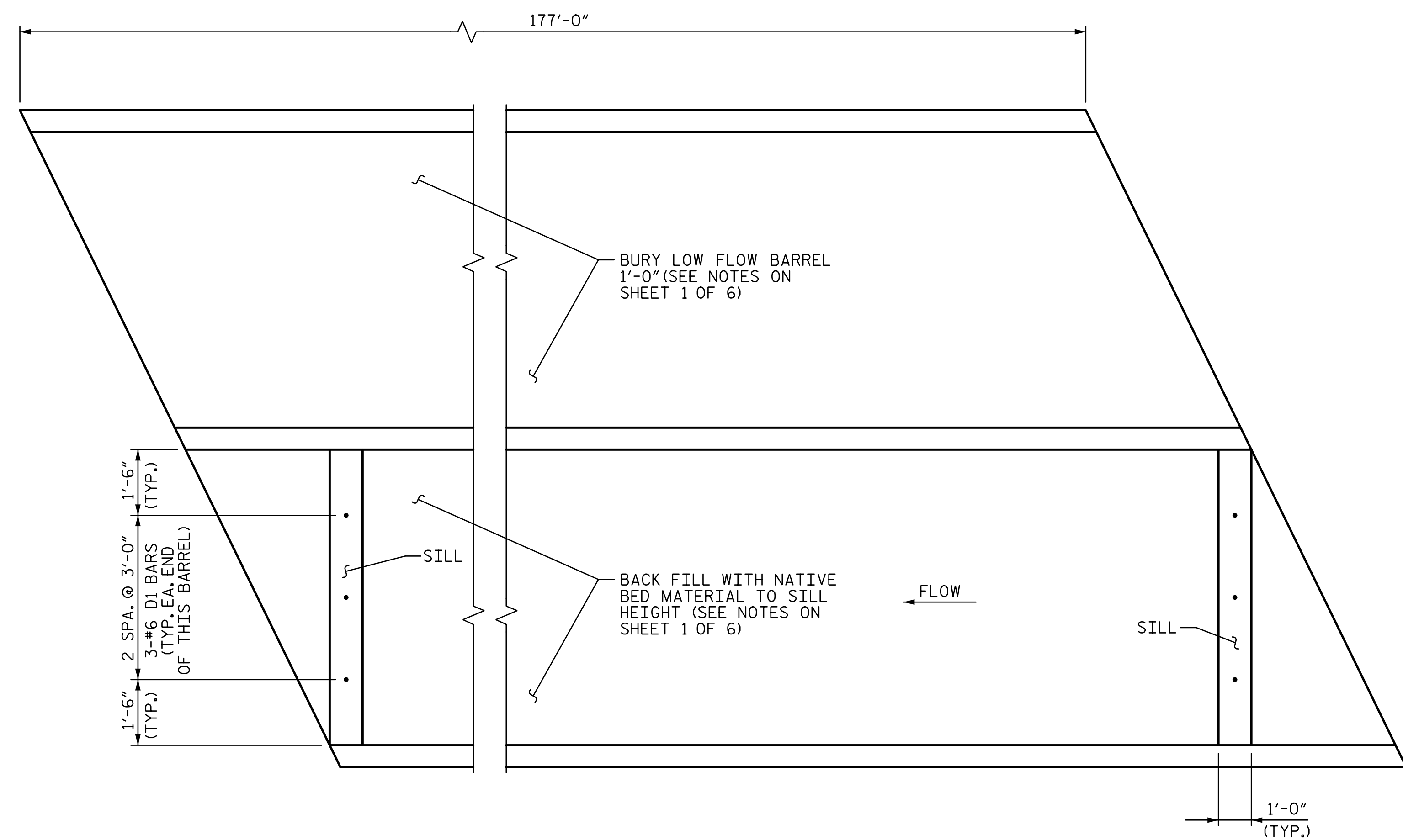
**FLOOR PLAN**  
(SEE ROOF PLAN FOR B3 BARS IN INTERIOR WALL)  
(SILLS NOT SHOWN, SEE SHEET 5 OF 6)

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

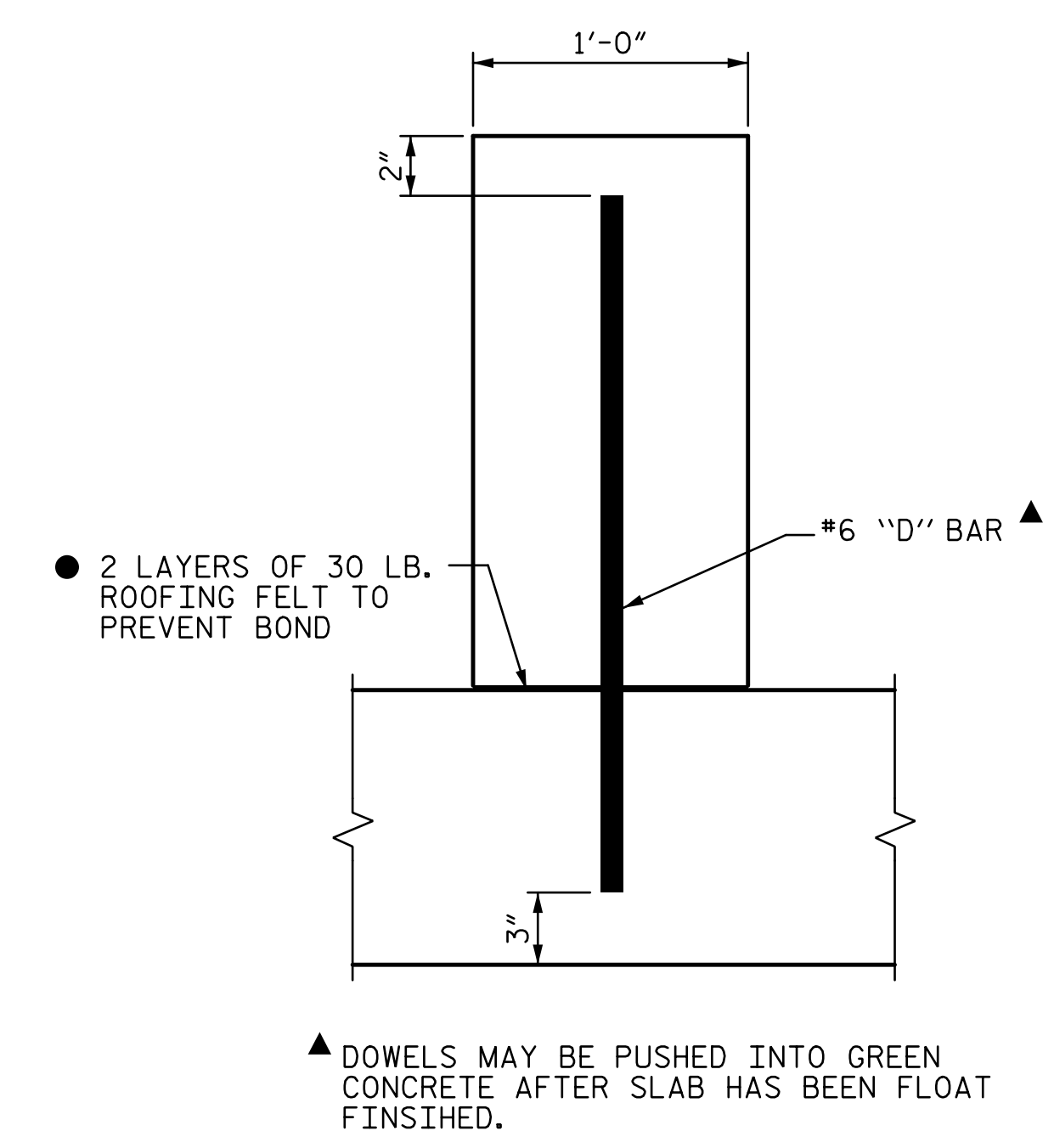
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		<b>DOUBLE 9'-0" X 7'-0"</b> <b>CONCRETE BOX CULVERT</b> <b>116'-00'-00" SKEW</b>			TOTAL SHEETS 6																
		REVISIONS <table border="1"> <thead> <tr> <th>NO.</th> <th>BY:</th> <th>DATE:</th> <th>NO.</th> <th>BY:</th> <th>DATE:</th> </tr>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

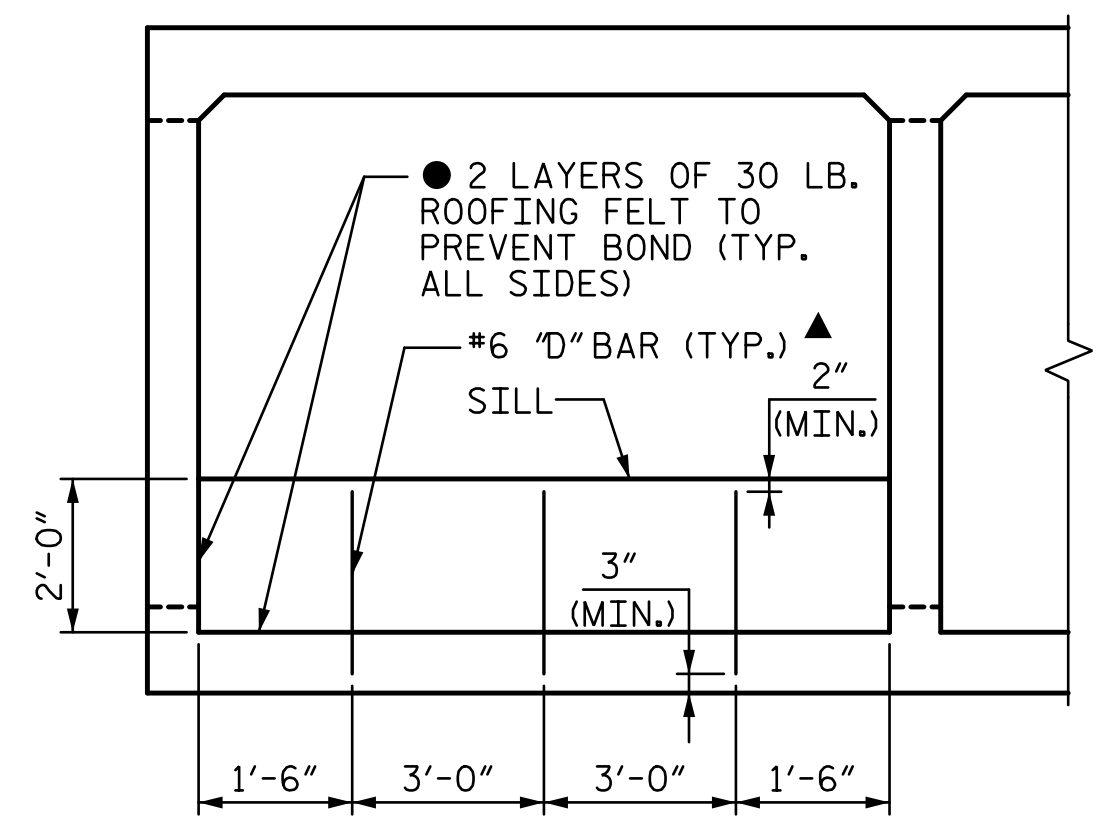
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PLAN VIEW - LOCATION OF SILLS



SECTION THROUGH SILL



ELEVATION  
(INLET VIEW SHOWN)

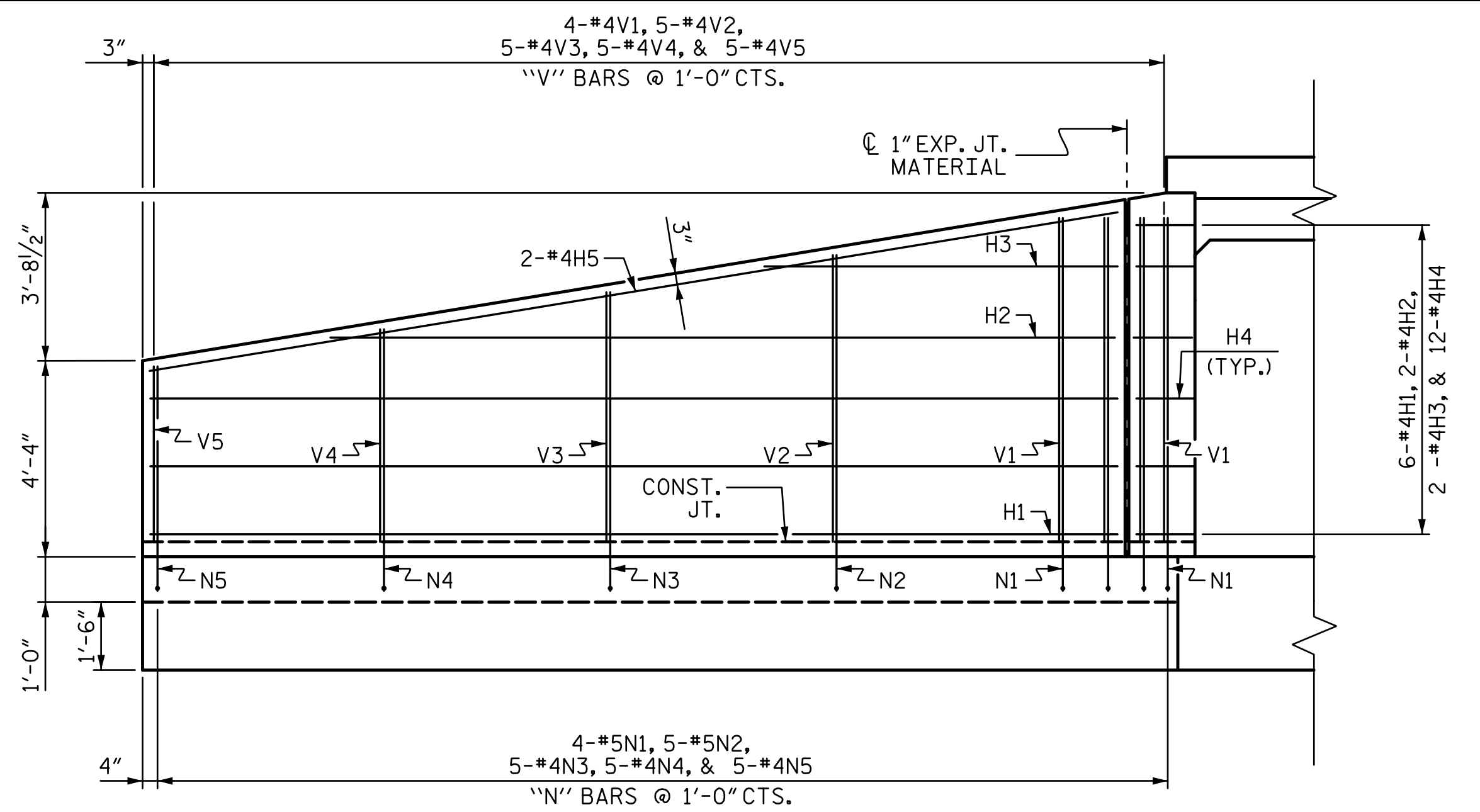
● THE COST OF THE ROOFING FELT IS INCIDENTAL AND SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS

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

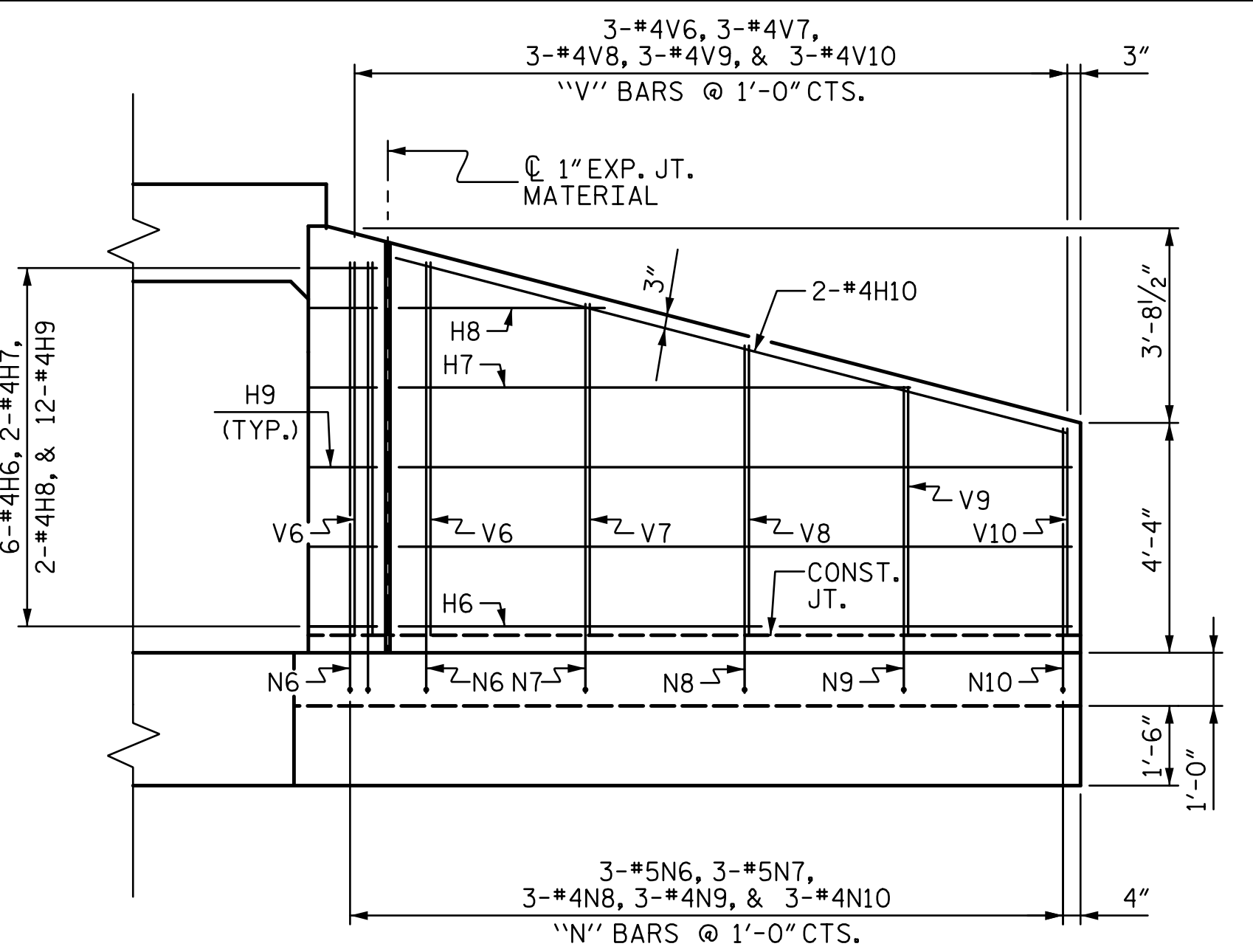
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	<b>SILL DETAILS</b>				TOTAL SHEETS 6
	REVISIONS				
NO.		BY:		DATE:	
1				3	
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 CHECKED BY : MLO DATE : 4-17  
 DESIGN ENGINEER OF RECORD: B. CURRY DATE : 4-17

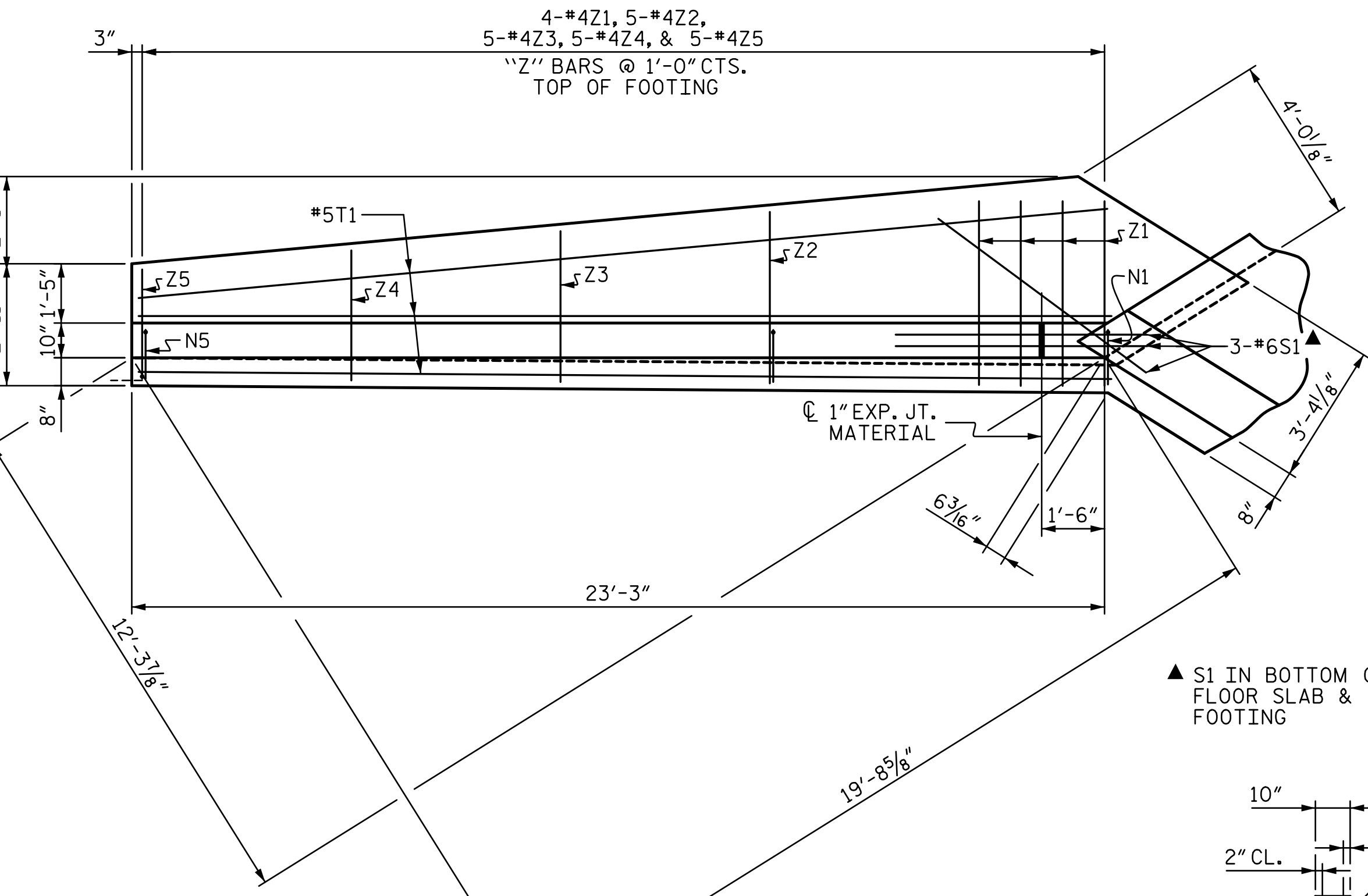
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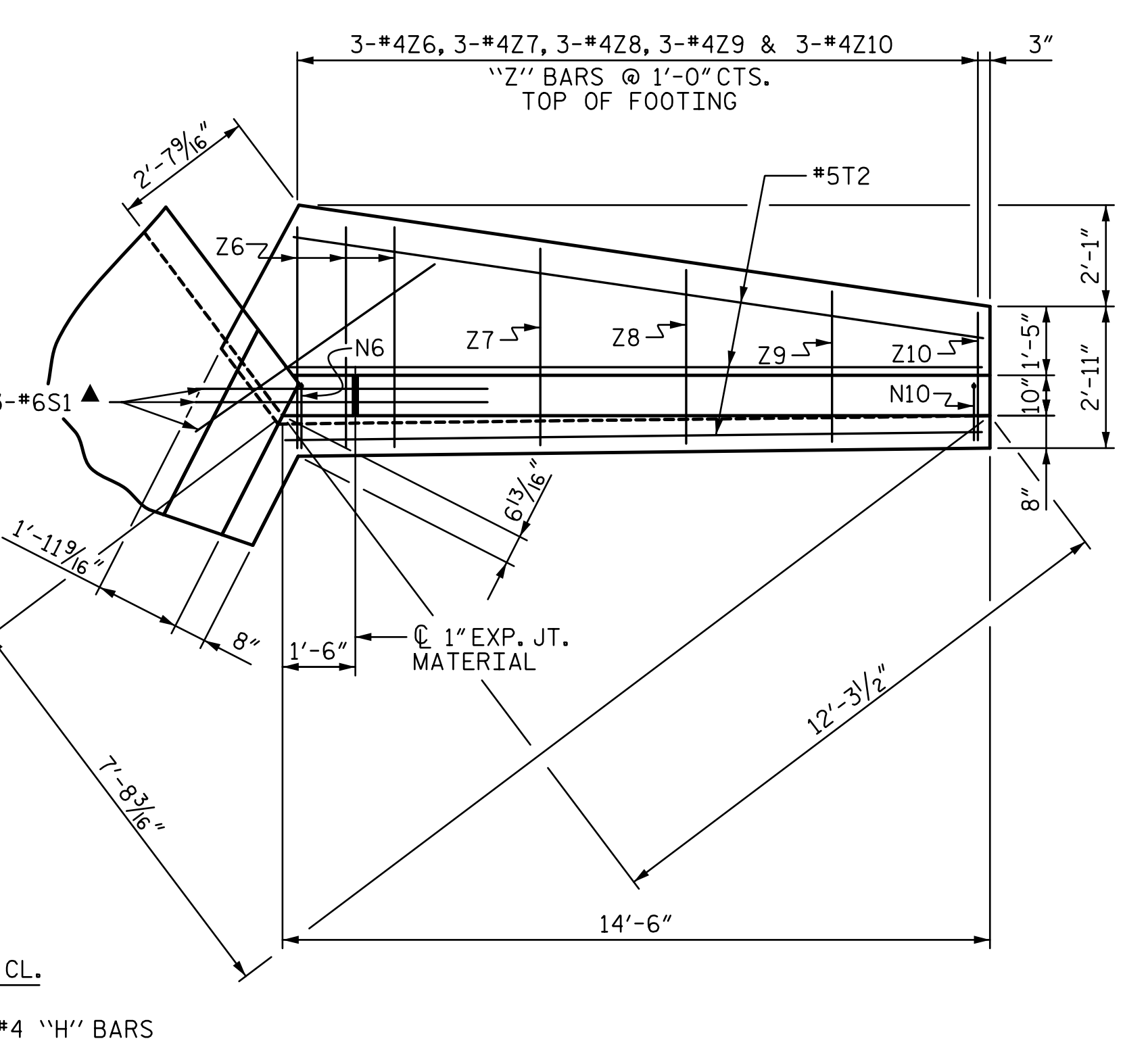
ELEVATION W1



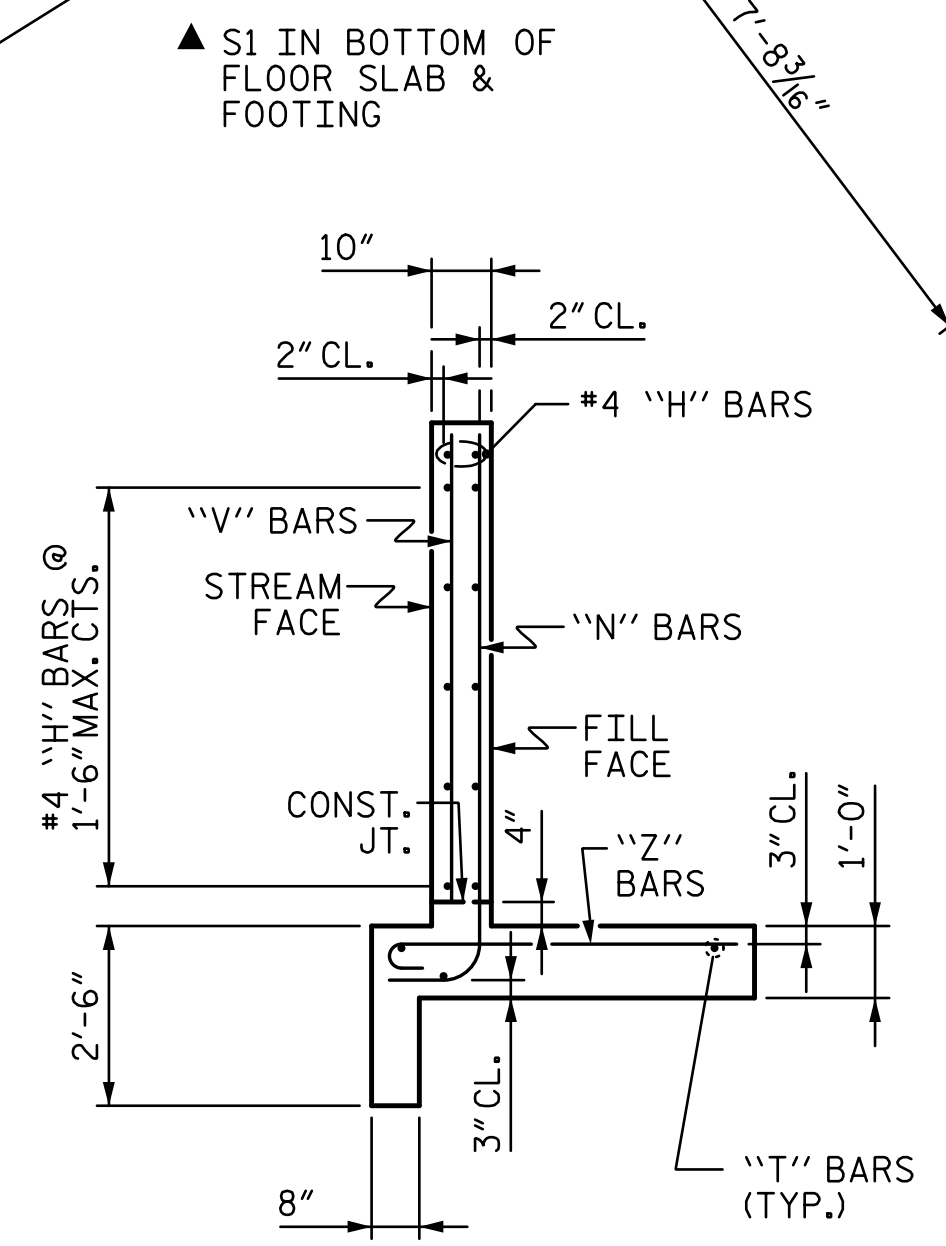
ELEVATION W2



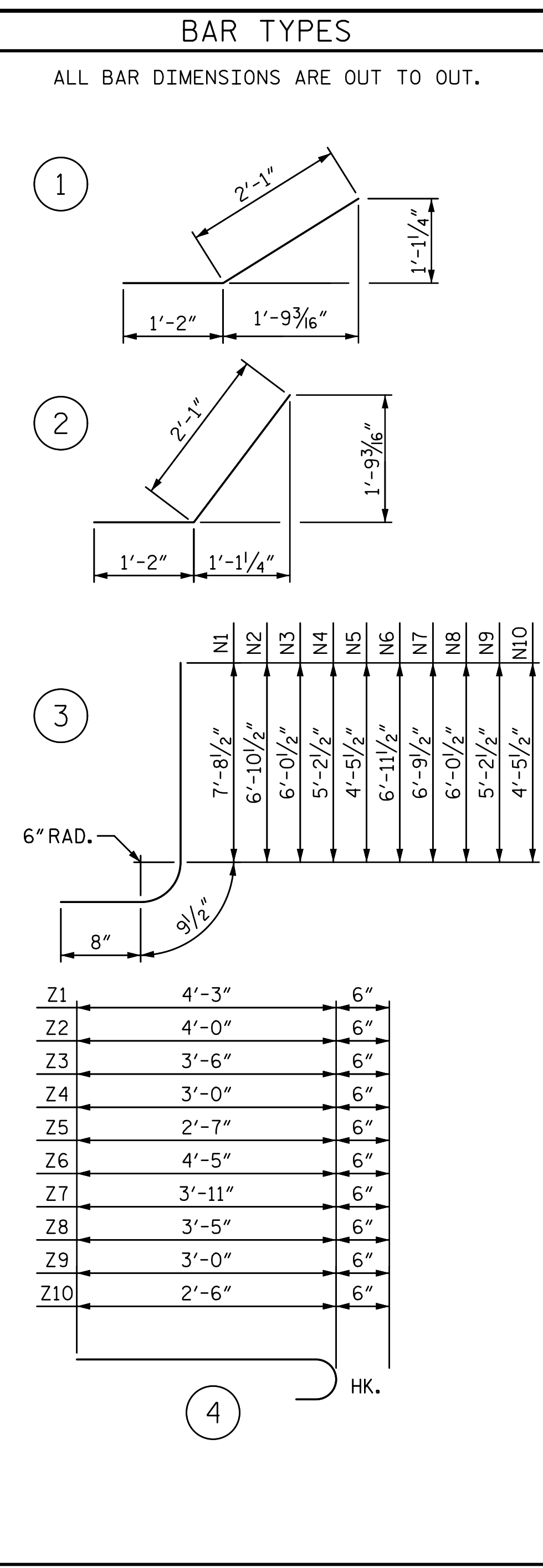
PLAN W1



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

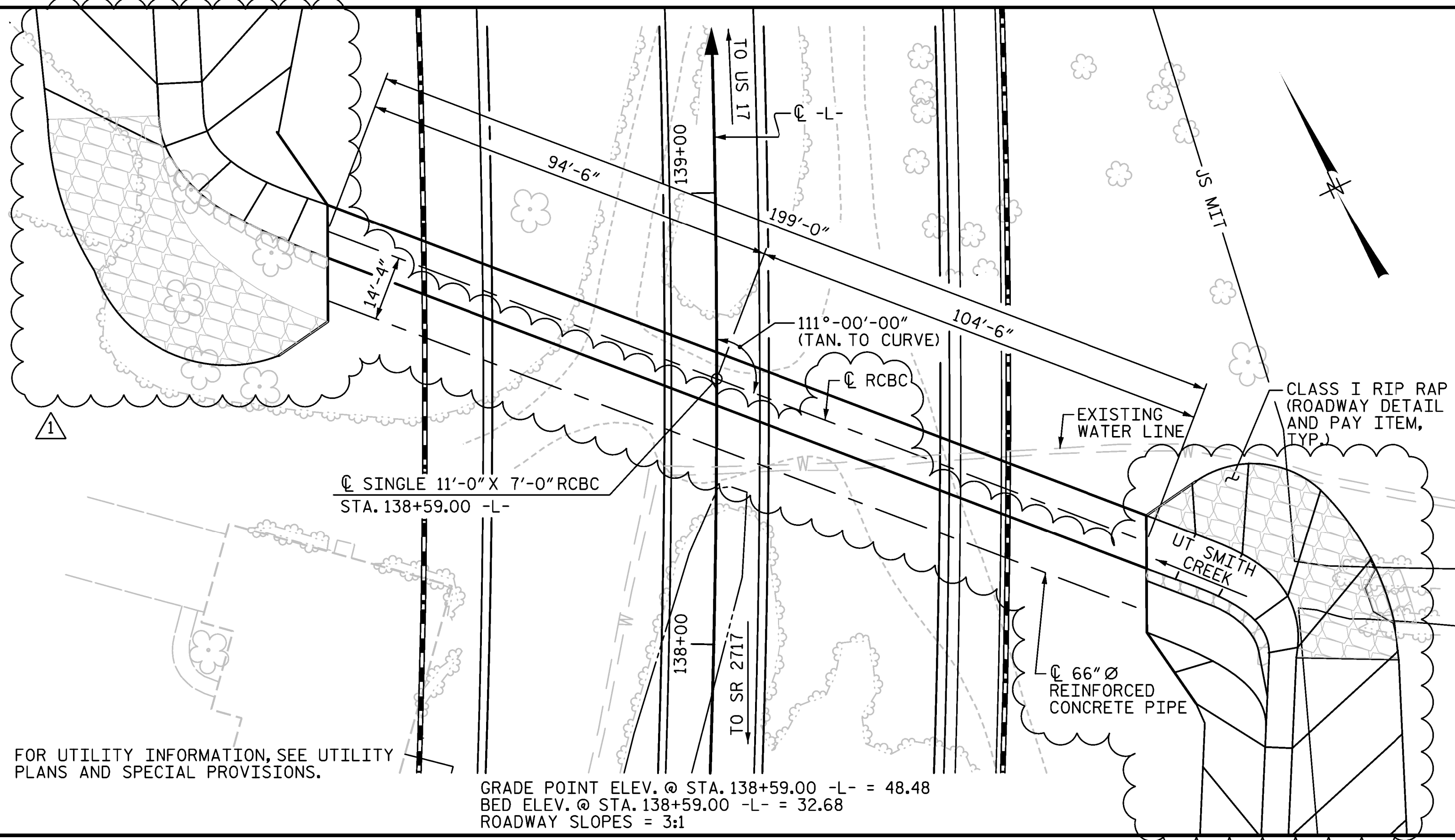
WINGS FOR CONCRETE BOX CULVERT  
 H = 7'-0" SLOPE = 3:1  
 116°-00'-00" SKEW

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



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

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, BOX CULVERT	235 TONS
CLASS A CONCRETE	
BARREL @ 1.149 CU.YDS./FT.	228.7 CU.YDS.
WINGS, ENDWALL, ETC.	50.9 CU.YDS.
TOTAL	279.6 CU.YDS.
REINFORCING STEEL	
BARREL	39,822 LBS.
WINGS, ENDWALL, ETC.	3,114 LBS.
TOTAL	42,936 LBS.
PLACEMENT OF NATURAL STREAM BED MATERIAL	LUMP SUM
FOUNDATION CONDITIONING GEOTEXTILE	235 SQ. YDS.
FOUNDATION CONDITIONING MATERIAL, MINOR STRUCTURES	150 TONS

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 SHEETS (SHEETS 4 & 5 OF 5).  
 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.

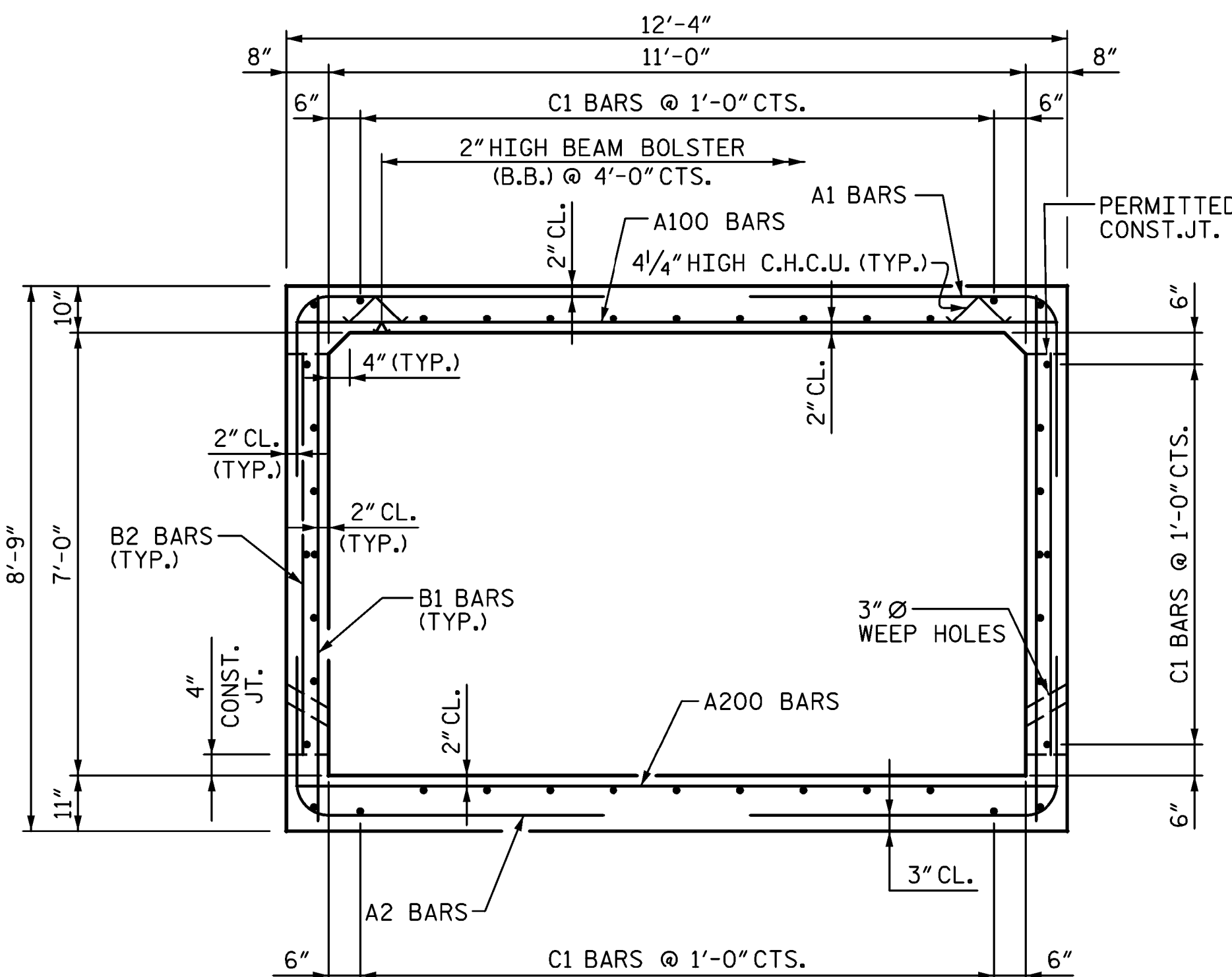
AT THE CONTRACTOR'S OPTION HE MAY SUBMIT, TO THE ENGINEER FOR APPROVAL, DESIGN AND DETAIL DRAWINGS FOR A PRECAST REINFORCED CONCRETE BOX CULVERT IN LIEU OF THE CAST-IN-PLACE CULVERT SHOWN ON THE PLANS. THE DESIGN SHALL PROVIDE THE SAME SIZE AND NUMBER OF BARRELS AS USED ON THE CAST-IN-PLACE DESIGN. FOR 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 AND ENDWALL/BARREL INTERSECTION COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.

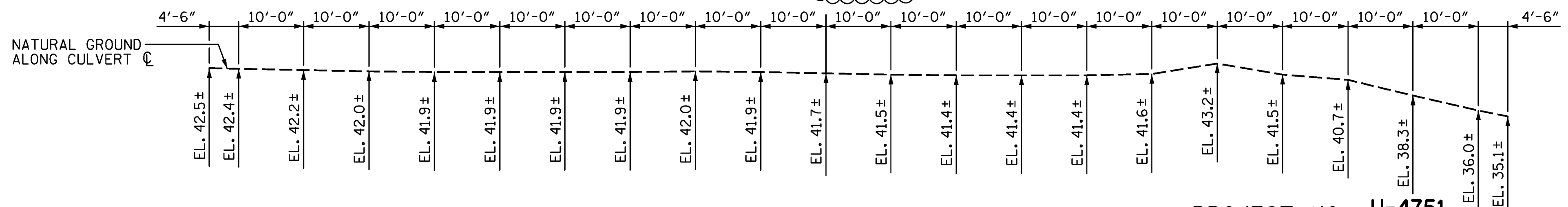
FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.  
 FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.  
 FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.  
 FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOUNDATION CONDITIONING MATERIAL AND FOUNDATION CONDITIONING GEOTEXTILE SHALL BE PLACED UNDER THE 66" Ø REINFORCED CONCRETE PIPE IN ACCORDANCE WITH SECTION 300 OF THE NCDOT STANDARD SPECIFICATIONS.



RIGHT ANGLE SECTION OF BARREL

THERE ARE 42 "C" BARS IN SECTION OF BARREL  
 ADJACENT 66" Ø PIPE NOT SHOWN FOR CLARITY.



PROFILE ALONG CULVERT

PROJECT NO. U-4751  
 NEW HANOVER COUNTY

STATION: 138+59.00 -L-

SHEET 1 OF 5

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
SINGLE 11'-0" X 7'-0" CONCRETE BOX CULVERT 111°-00'-00" SKEW					
STV 100 years STV ENGINEERS, INC. 900 West Trade St., Suite 715 Charlotte, NC 28202 NC License Number F-5991					
ENGINEER BRIAN M. CURRY 2/19/2020					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1	BMC	02-20	3		
2			4		
SHEET NO. C2-1					
TOTAL SHEETS 5					

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.

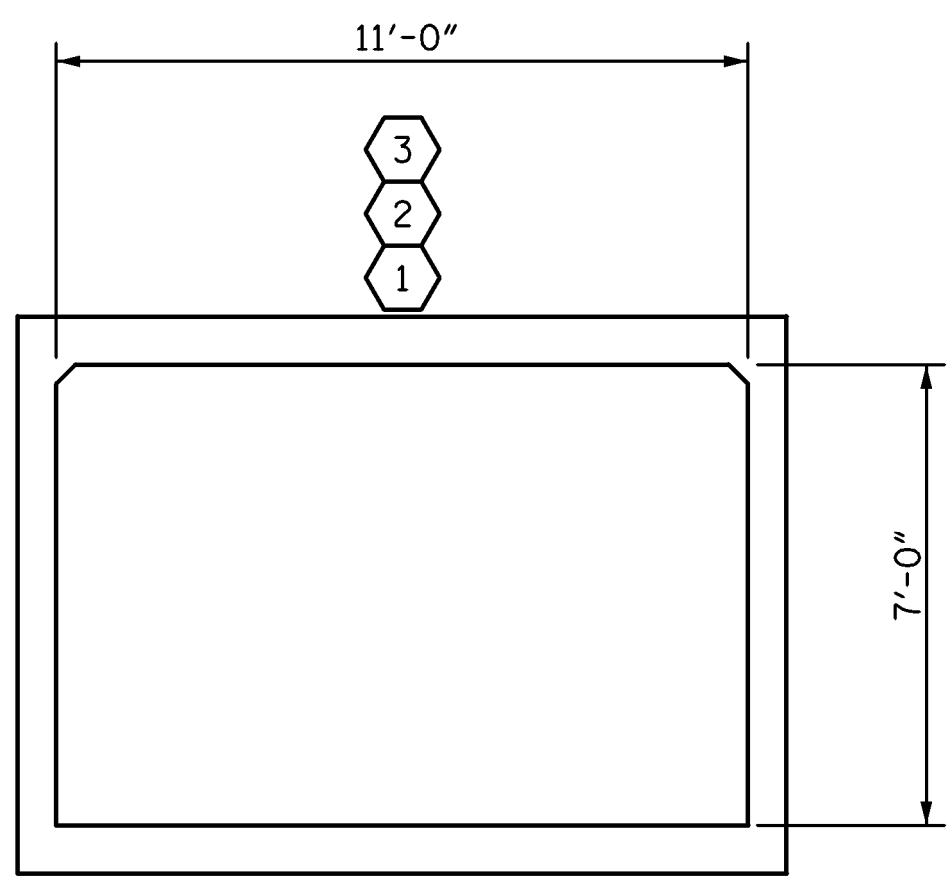
# CONTROLLING LOAD RATING

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 5

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STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

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

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	BMC	02-20	3		
2			4		

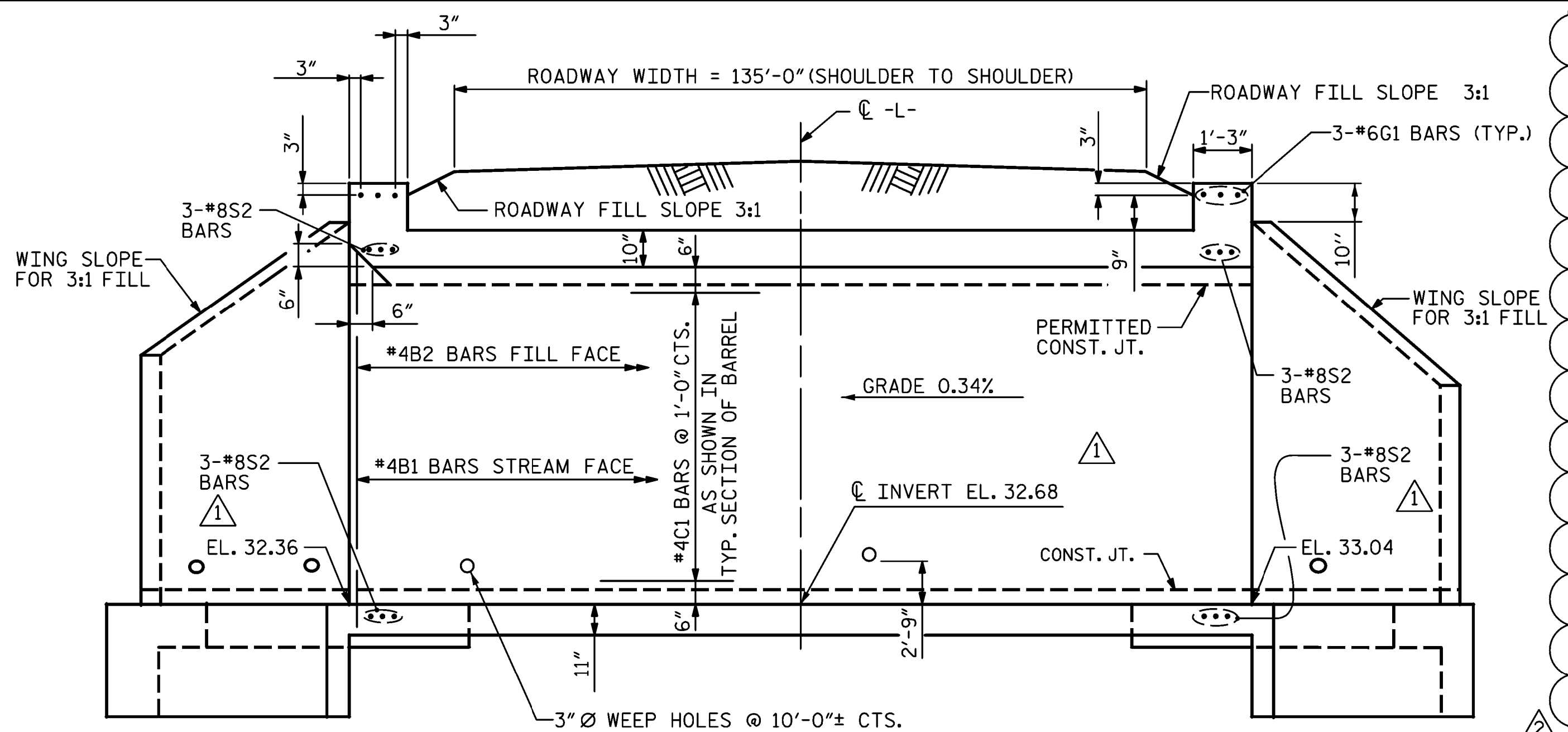
SHEET NO.  
C2-2

TOTAL SHEETS  
5

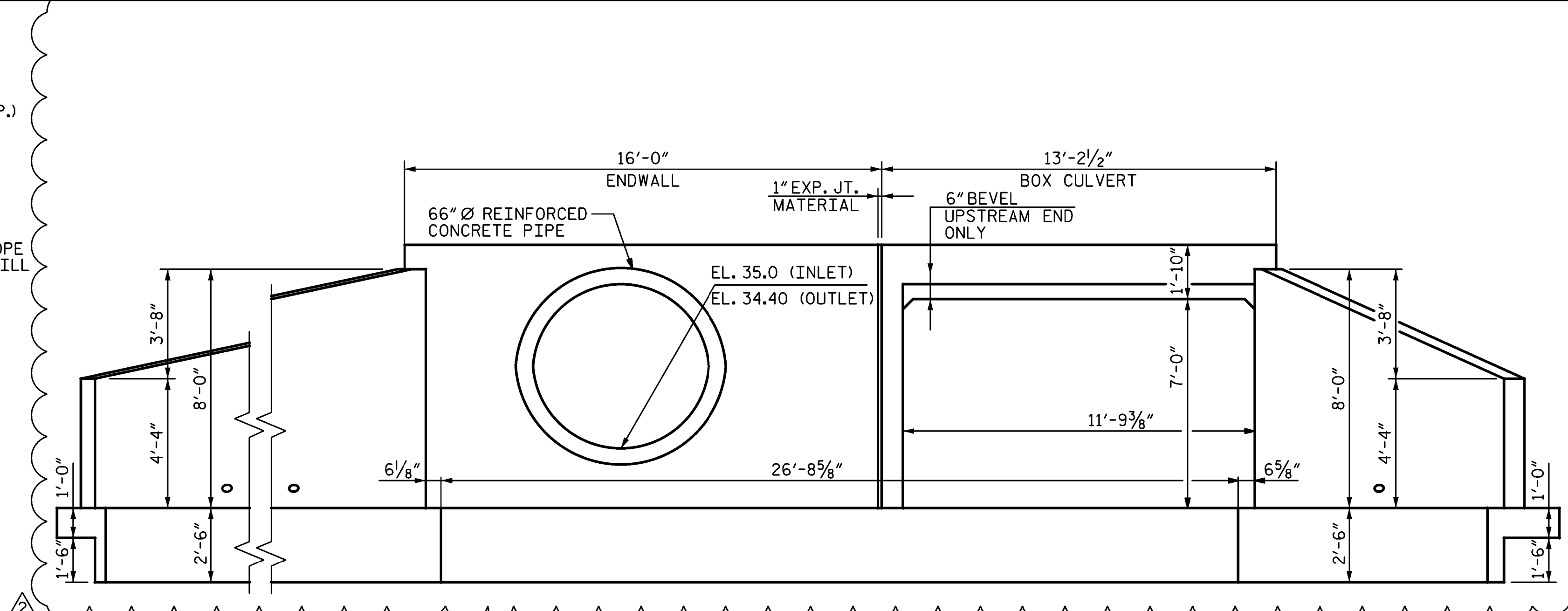
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 DESIGN ENGINEER OF RECORD: J. JONES DATE: 5-17



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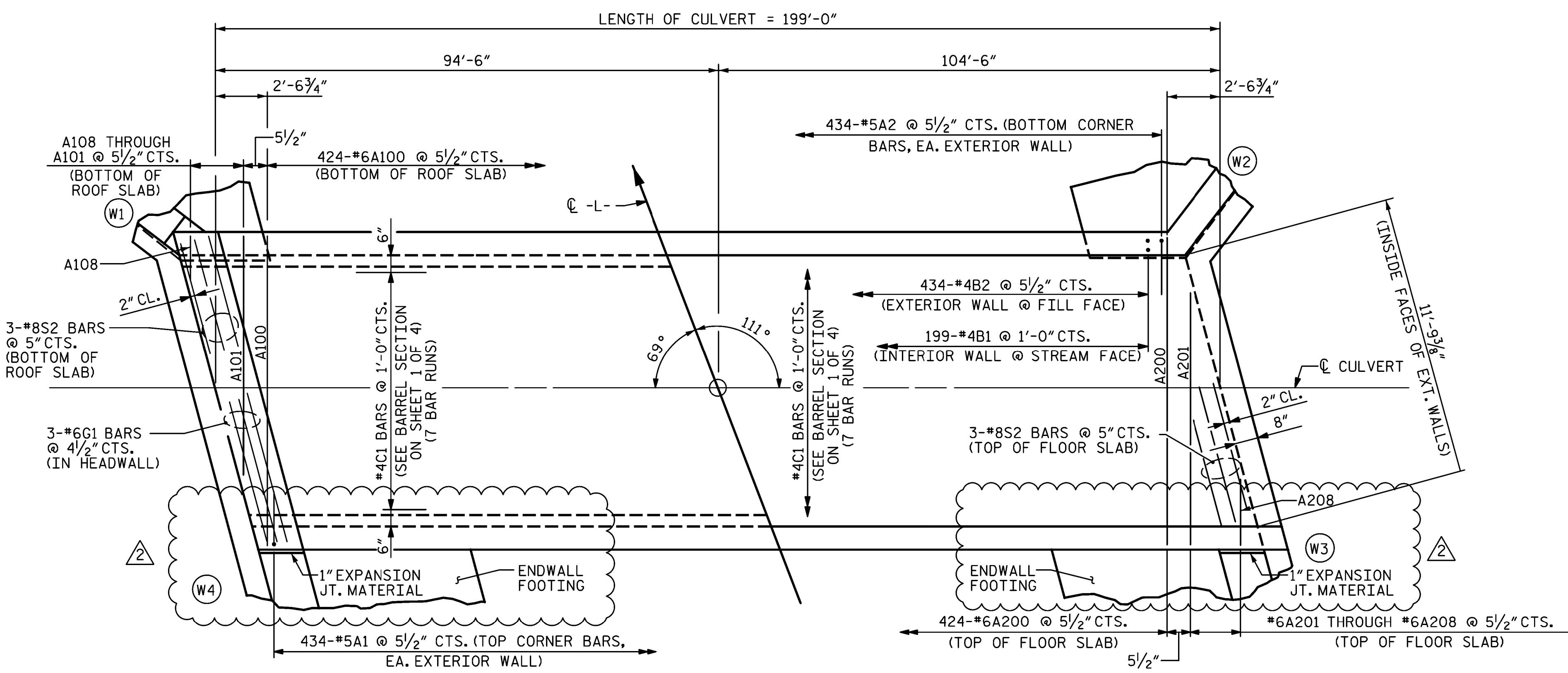


**CULVERT SECTION NORMAL TO ROADWAY**



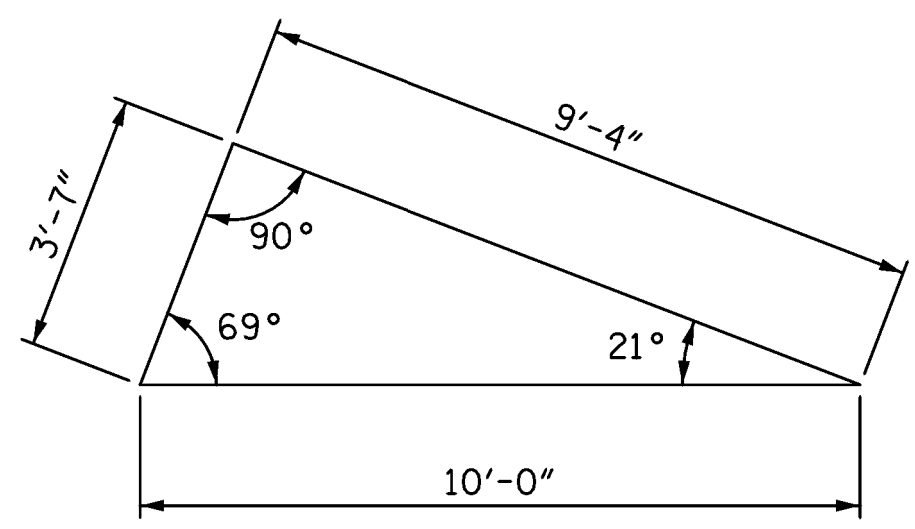
**END ELEVATION NORMAL TO SKEW**

(INLET END SHOWN, OUTLET END SIMILAR)



**PART PLAN - ROOF SLAB**

**PART PLAN - FLOOR SLAB**

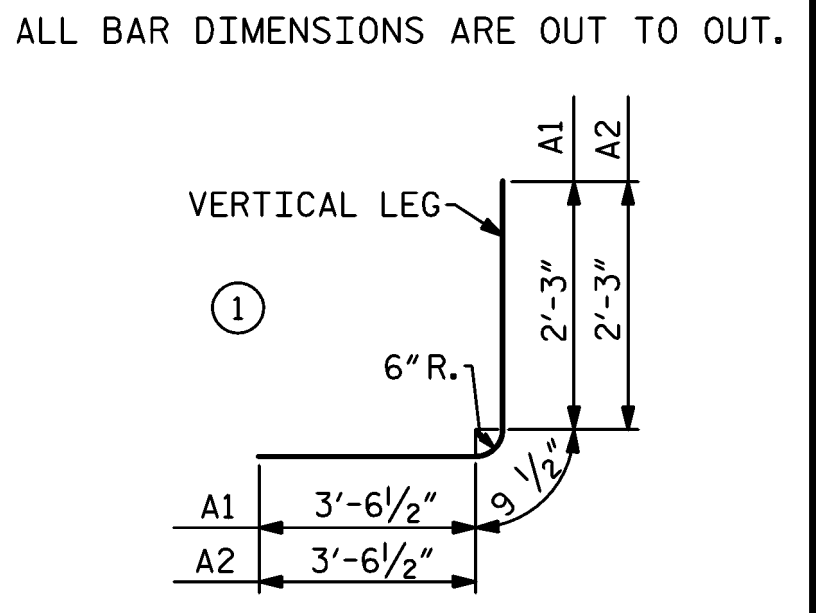


**SKEW TRIANGLE**

**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**



**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 5

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 UNLESS ALL SIGNATURES COMPLETED

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

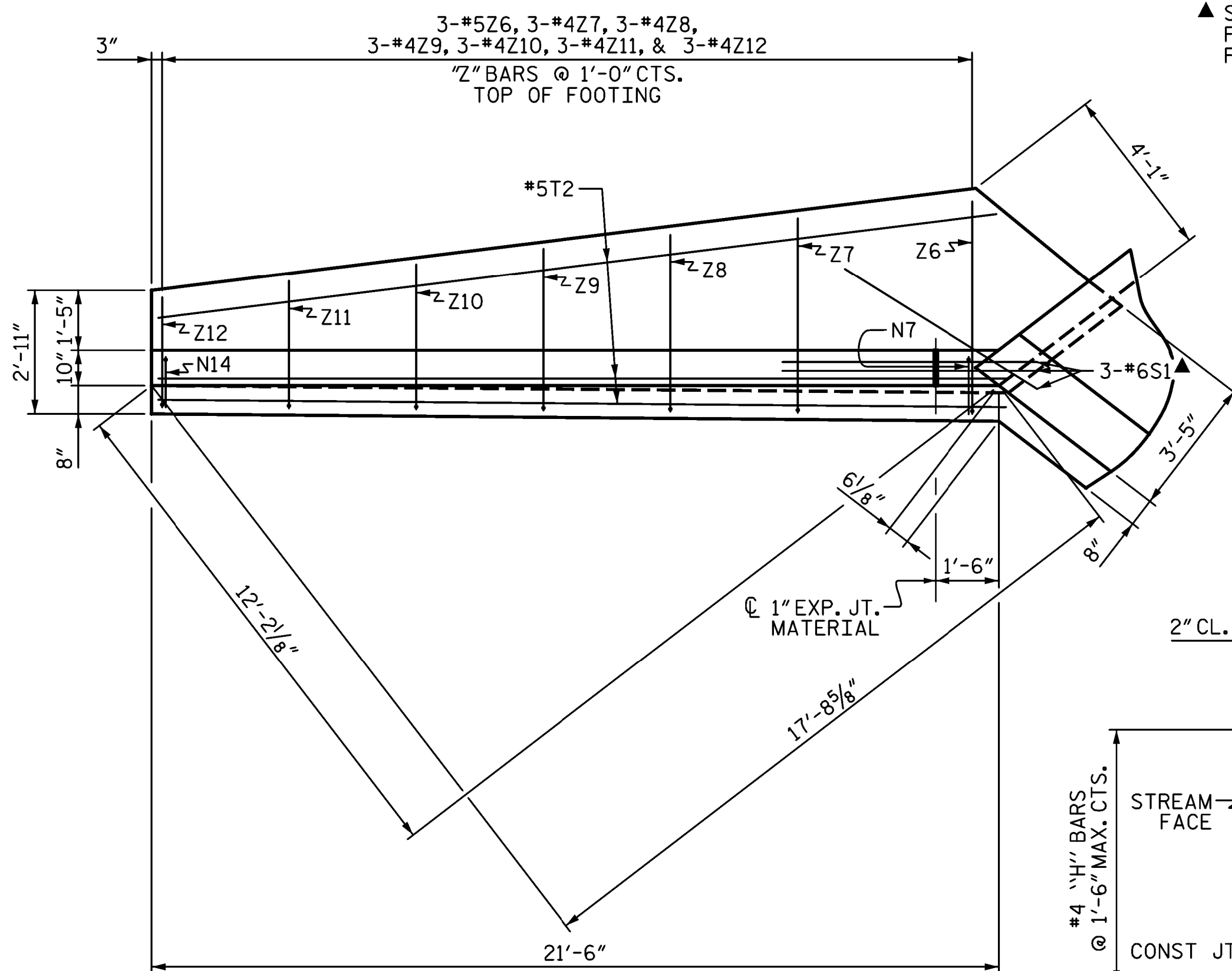
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

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

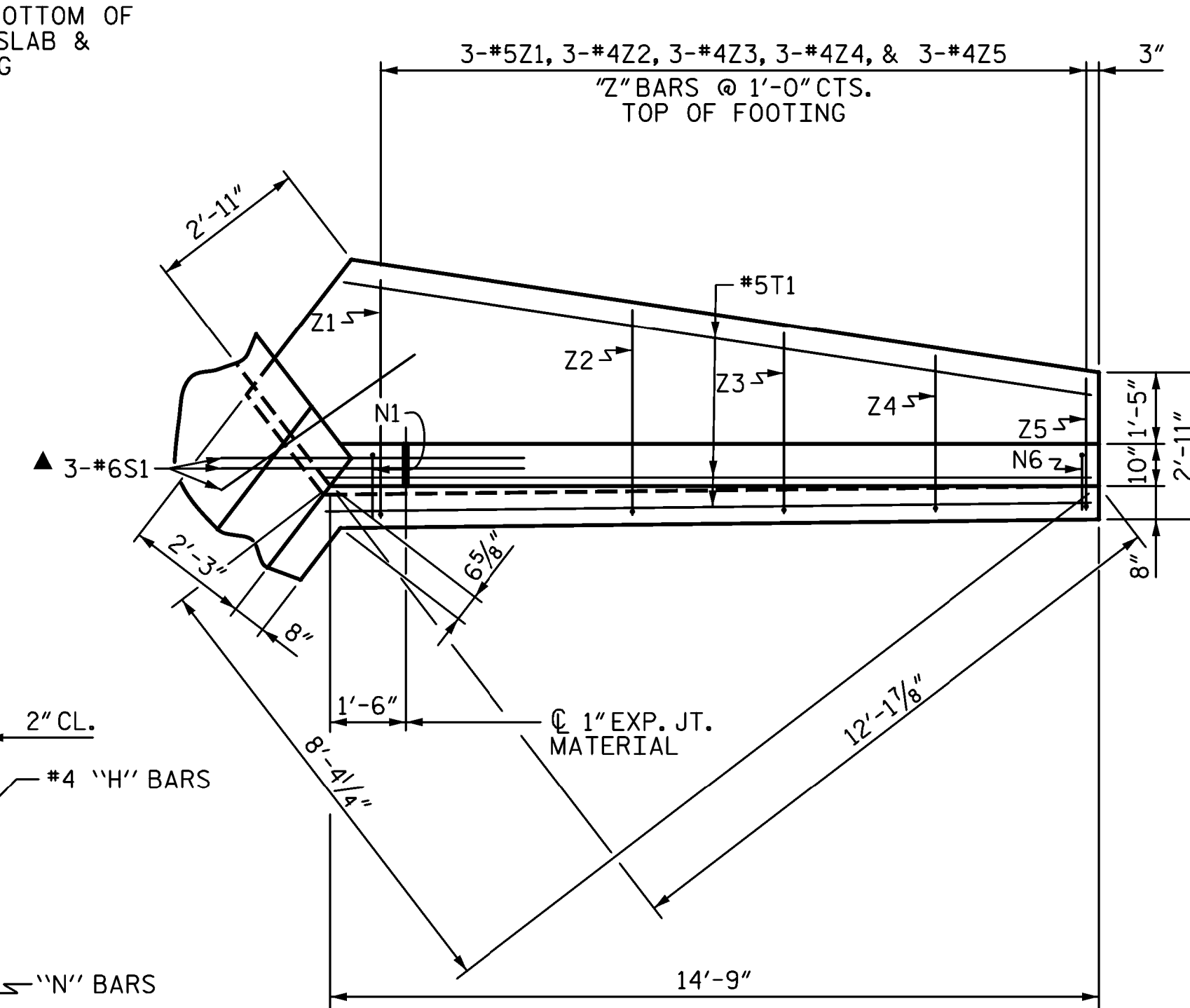
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-3
1	BMC	9-19	3			TOTAL SHEETS 2
2	BMC	02-20	4			5

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

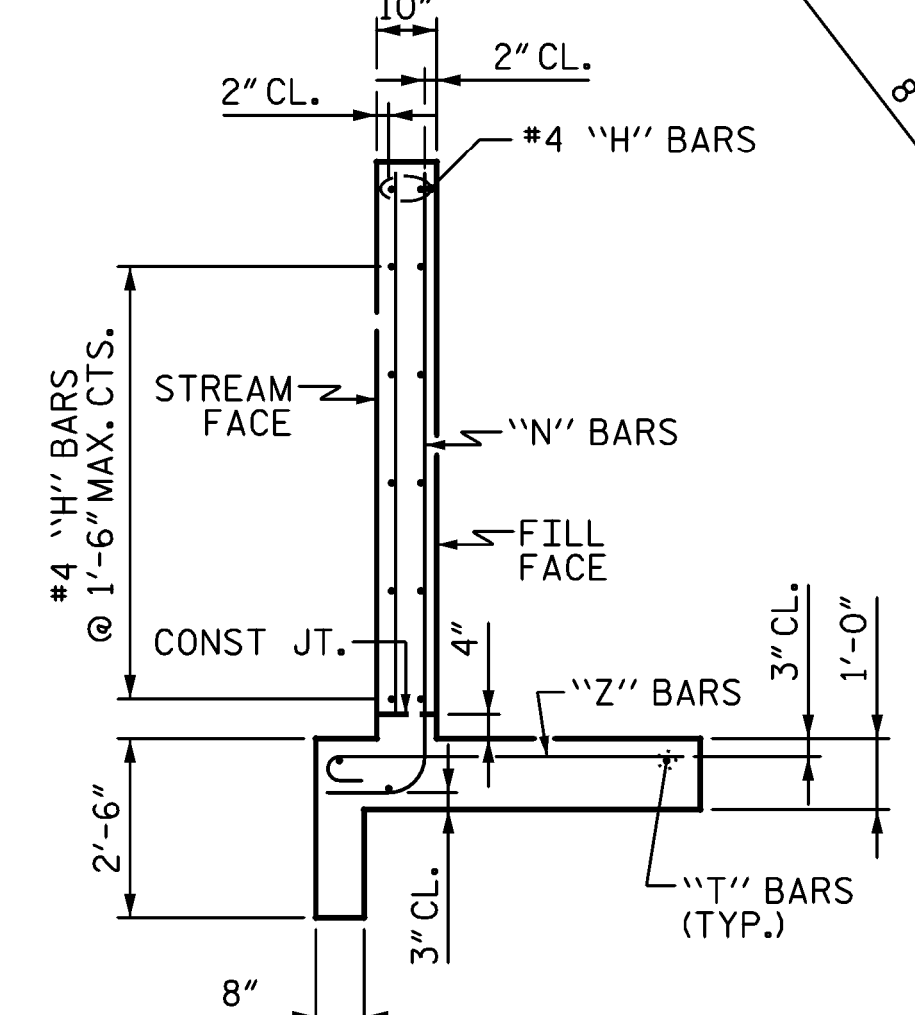
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PLAN W1



PLAN W2



TYPICAL WING SECTION

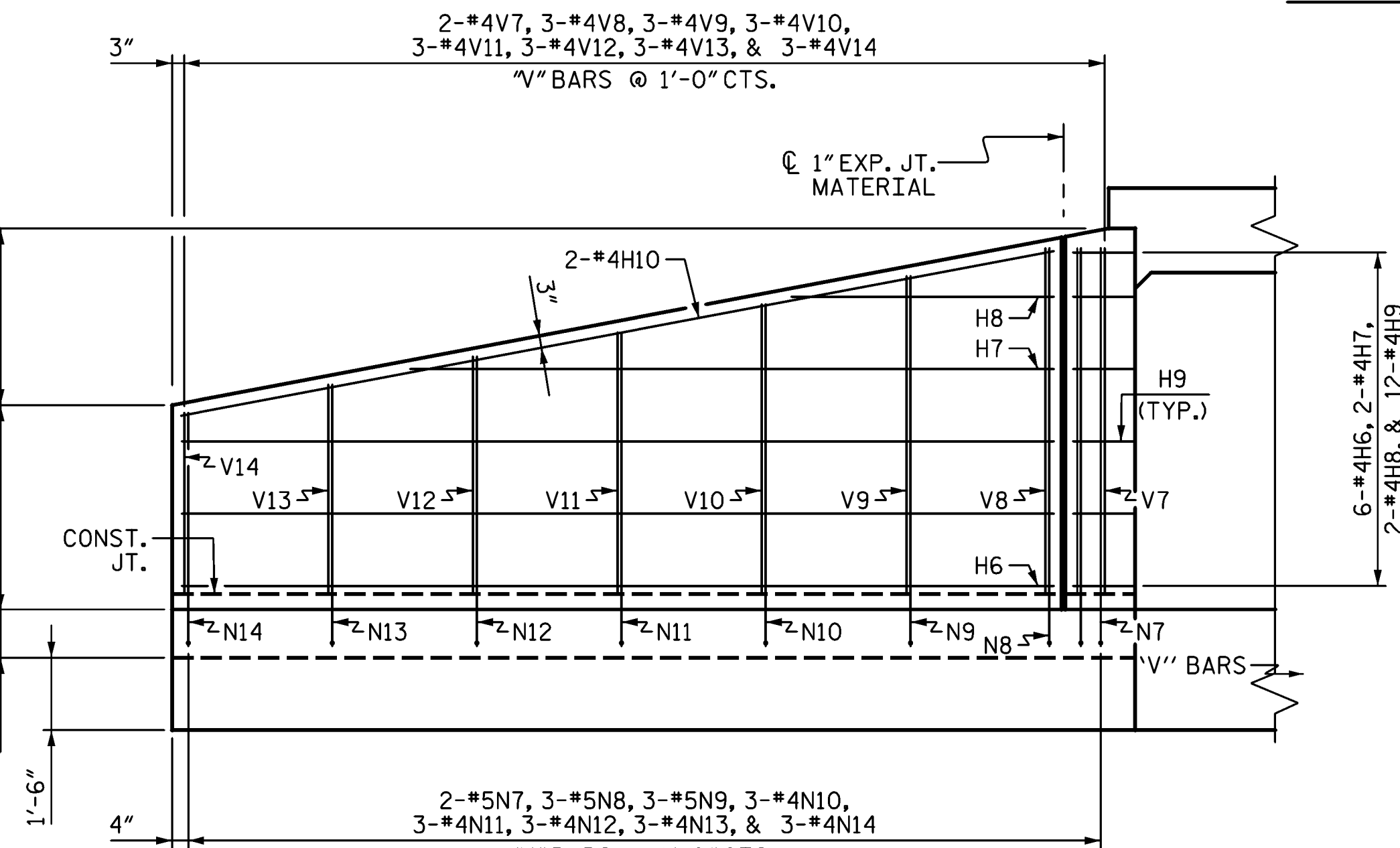
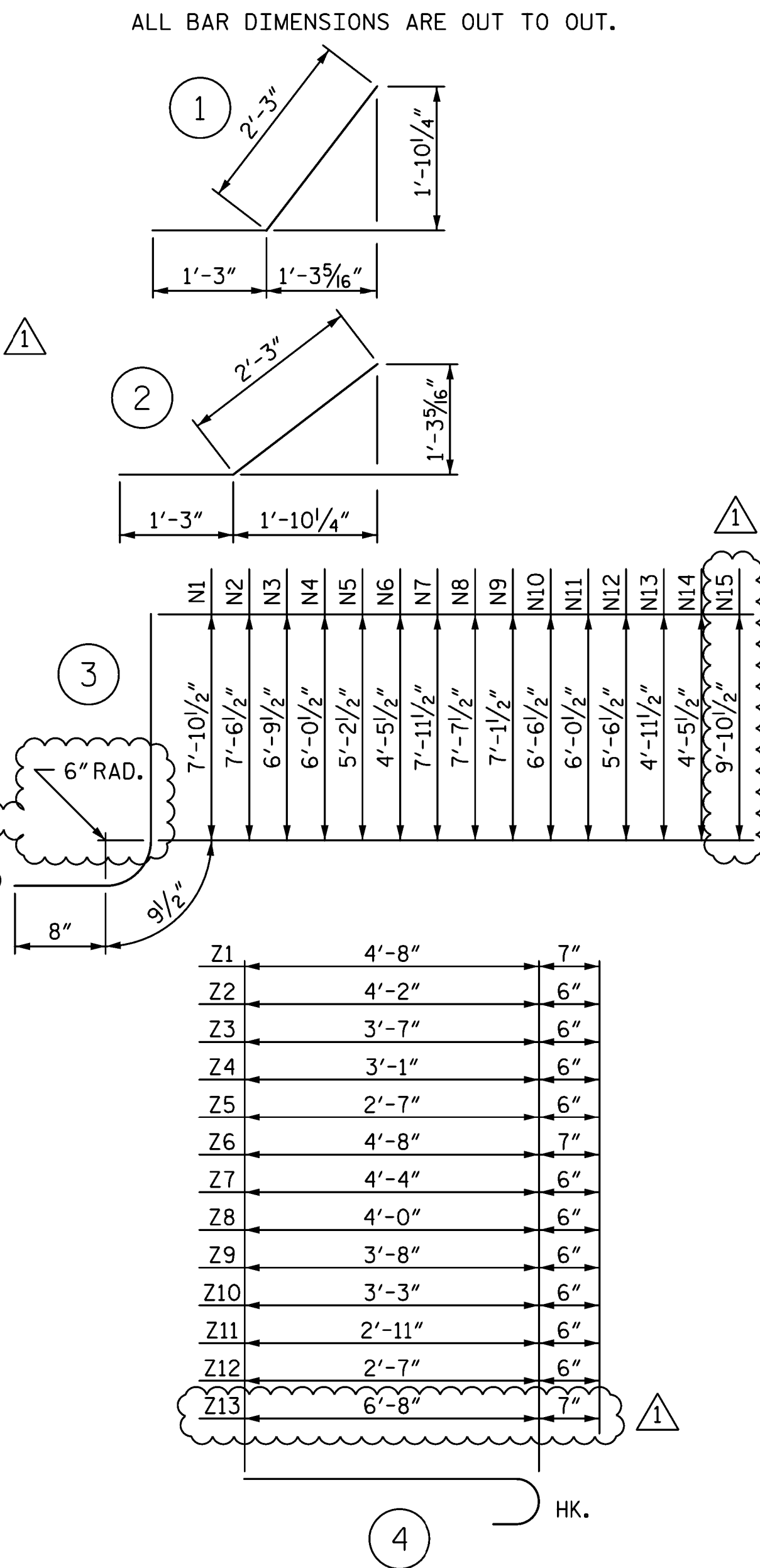
QUANTITIES	
REINFORCING STEEL FOR 4 WINGS & ENDWALL 3,114	
CLASS A CONCRETE	
4 WINGS	13.0 CY
2 HEADWALLS	1.2 CY
2 END CURTAIN WALLS	27.5 CY
2 ENDWALLS	9.2 CY
<b>TOTAL</b>	<b>50.9 CY</b>

◆ INCLUDES WING & ENDWALL FOOTINGS

BILL OF MATERIAL

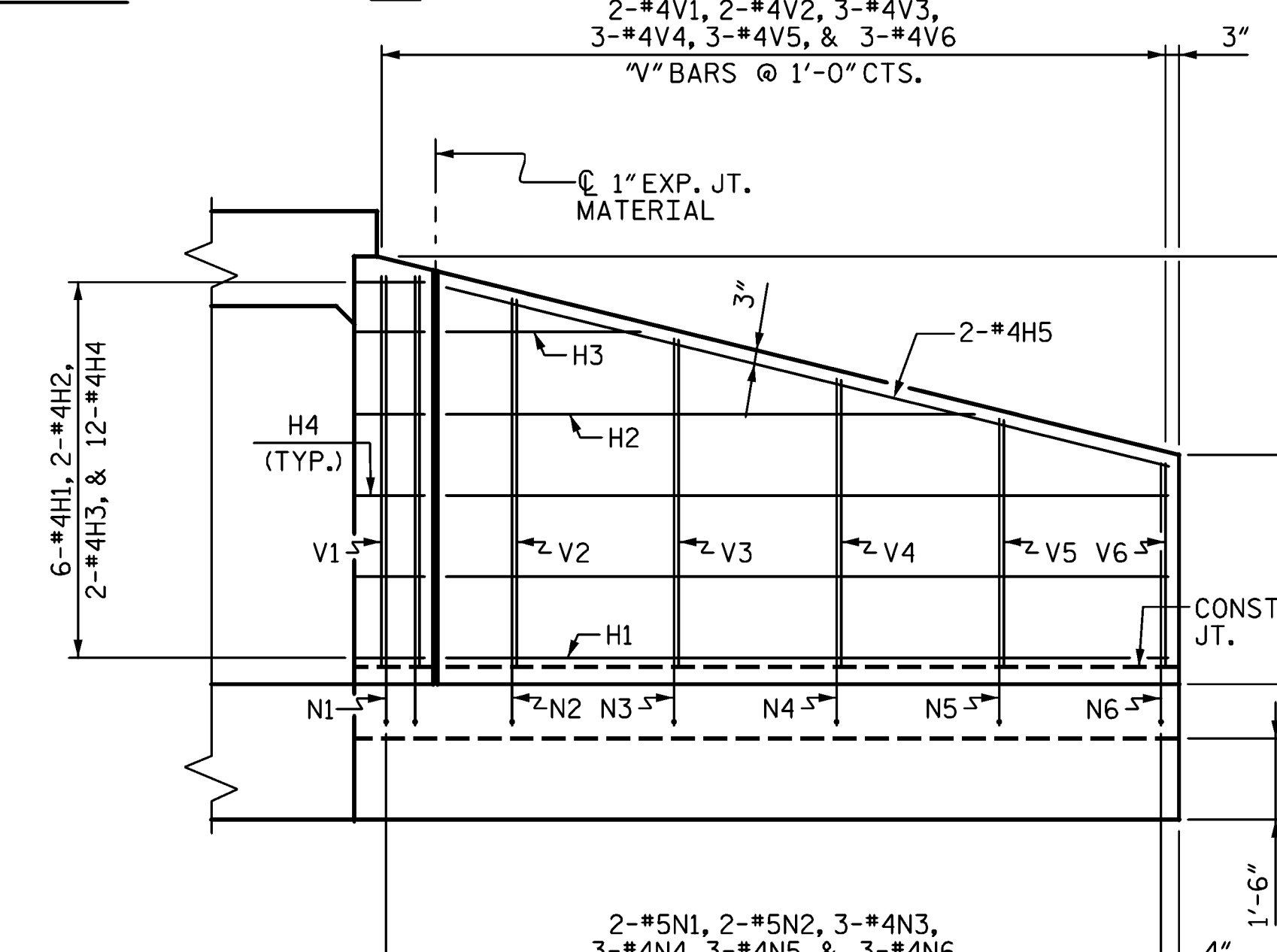
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H2	4	#4	STR	9'-9"	26
H3	4	#4	STR	3'-10"	10
H4	24	#4	①	3'-6"	56
H5	4	#4	STR	13'-3"	35
H6	12	#4	STR	19'-7"	157
H7	4	#4	STR	15'-0"	40
H8	4	#4	STR	6'-5"	17
H9	24	#4	②	3'-6"	56
H10	4	#4	STR	19'-11"	53
H11	32	#4	STR	15'-6"	331
N1	4	#5	③	9'-4"	39
N2	4	#5	③	9'-0"	38
N3	6	#4	③	8'-3"	33
N4	6	#4	③	7'-6"	30
N5	6	#4	③	6'-8"	27
N6	6	#4	③	5'-11"	24
N7	4	#5	③	9'-5"	39
N8	6	#5	③	9'-1"	57
N9	6	#5	③	8'-7"	54
N10	6	#4	③	8'-0"	32
N11	6	#4	③	7'-6"	30
N12	6	#4	③	7'-0"	28
N13	6	#4	③	6'-5"	26
N14	6	#4	③	5'-11"	24
N15	32	#5	③	10'-4"	345
S1	18	#6	STR	6'-0"	162
T1	6	#4	STR	14'-5"	58
T2	6	#4	STR	21'-5"	86
T3	16	#4	STR	15'-7"	167
V1	4	#4	STR	7'-3"	19
V2	4	#4	STR	6'-11"	18
V3	6	#4	STR	6'-2"	25
V4	6	#4	STR	5'-5"	22
V5	6	#4	STR	4'-7"	18
V6	6	#4	STR	3'-10"	15
V7	4	#4	STR	7'-4"	20
V8	6	#4	STR	7'-0"	28
V9	6	#4	STR	6'-6"	26
V10	6	#4	STR	5'-11"	24
V11	6	#4	STR	5'-5"	22
V12	6	#4	STR	4'-11"	20
V13	6	#4	STR	4'-4"	17
V14	6	#4	STR	3'-10"	15
V15	32	#4	STR	8'-4"	178
Z1	6	#5	④	5'-3"	33
Z2	6	#4	④	4'-8"	19
Z3	6	#4	④	4'-1"	16
Z4	6	#4	④	3'-7"	14
Z5	6	#4	④	3'-1"	12
Z6	6	#5	④	5'-3"	33
Z7	6	#4	④	4'-10"	19
Z8	6	#4	④	4'-6"	18
Z9	6	#4	④	4'-2"	17
Z10	6	#4	④	3'-9"	15
Z11	6	#4	④	3'-5"	14
Z12	6	#4	④	3'-1"	12
Z13	32	#5	④	7'-3"	242

BAR TYPES



ELEVATION W1

WINGWALL W3 DIMENSIONS AND REINFORCEMENT SIMILAR



ELEVATION W2

WINGWALL W4 DIMENSIONS AND REINFORCEMENT SIMILAR

PROJECT NO. U-4751  
 NEW HANOVER COUNTY  
 STATION: 138+59.00 -L-  
 SHEET 4 OF 5

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

WINGS FOR CONCRETE BOX CULVERT  
 H = 7'-0" SLOPE = 3:1  
 111°-00'-00" SKEW

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

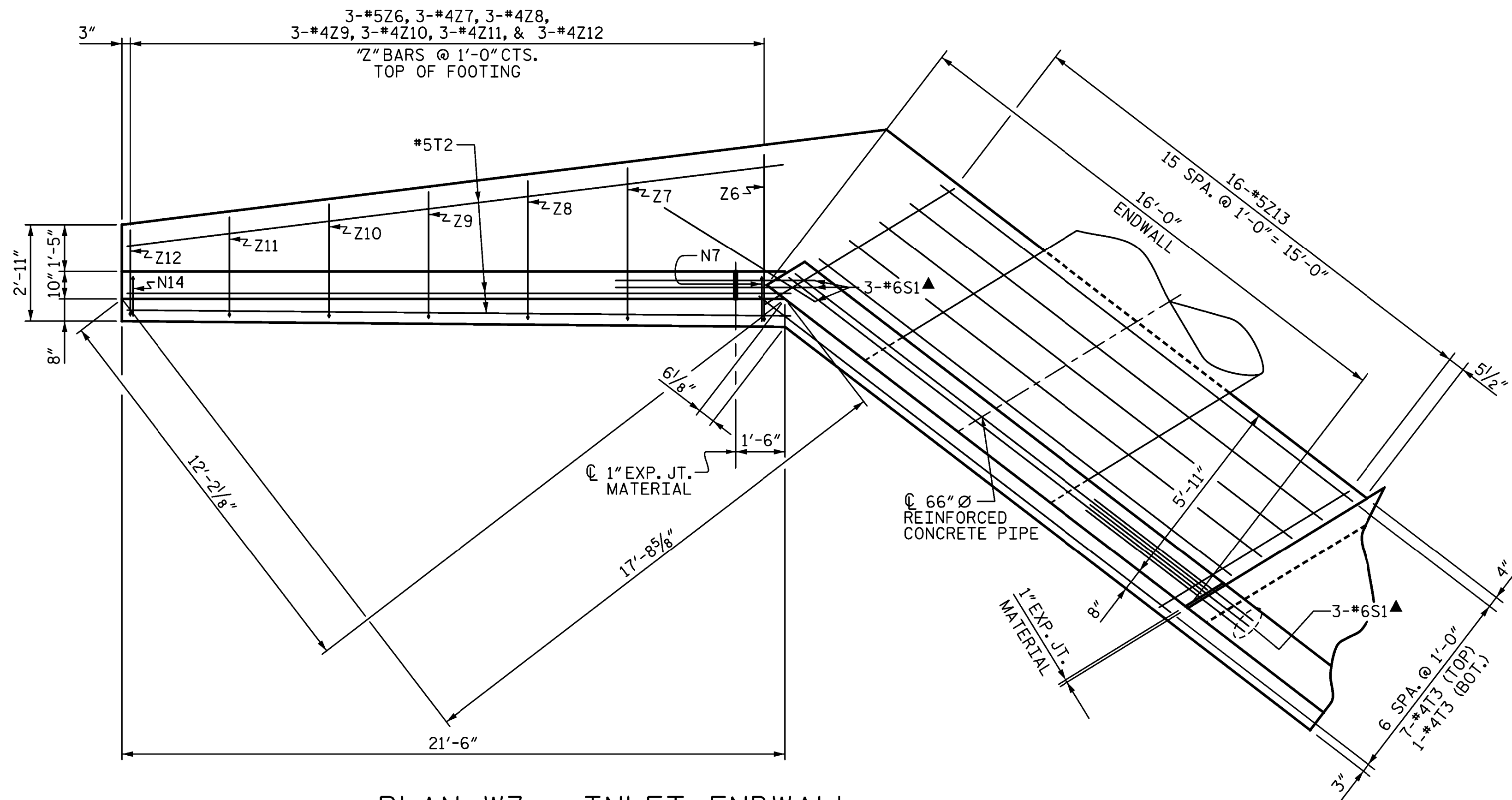
ENGINEER  
 BRIAN M. CURRY  
 2/19/2020

REVISIONS				SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:
1	BMC	02-20	3		
2			4		

TOTAL SHEETS 5

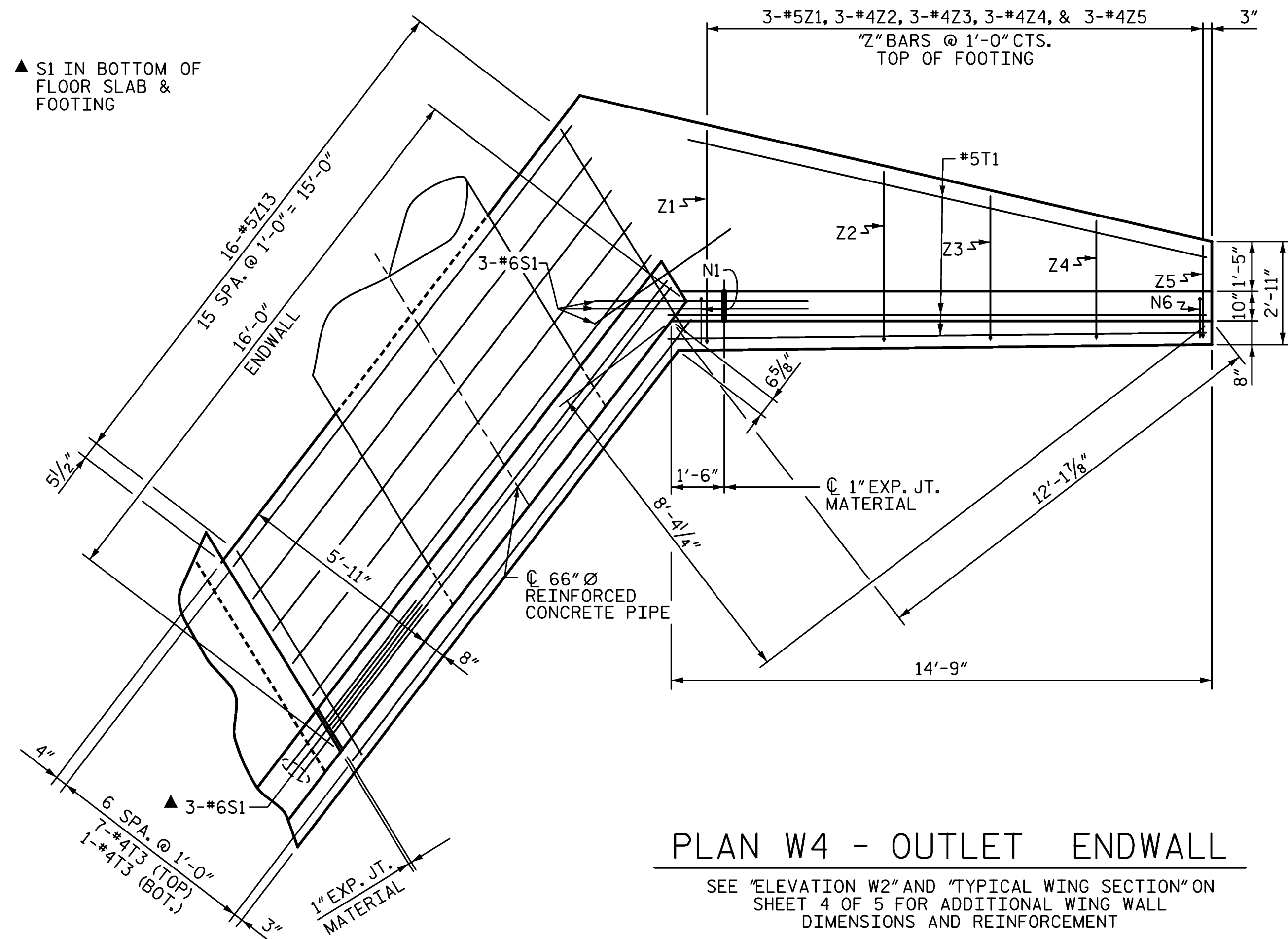
DRAWN BY: JWJ DATE: 5-17  
 CHECKED BY: MLO DATE: 5-17  
 DESIGN ENGINEER OF RECORD: J. JONES DATE: 5-17

2/19/2020 3:33:33 PM I:\Projects\4016617\4016617\_000\50\_Deliverables & Submittals\U-4751\Structures\Culverts\CL #2\410\_009\U4751\_SML CL 005 640002.dgn



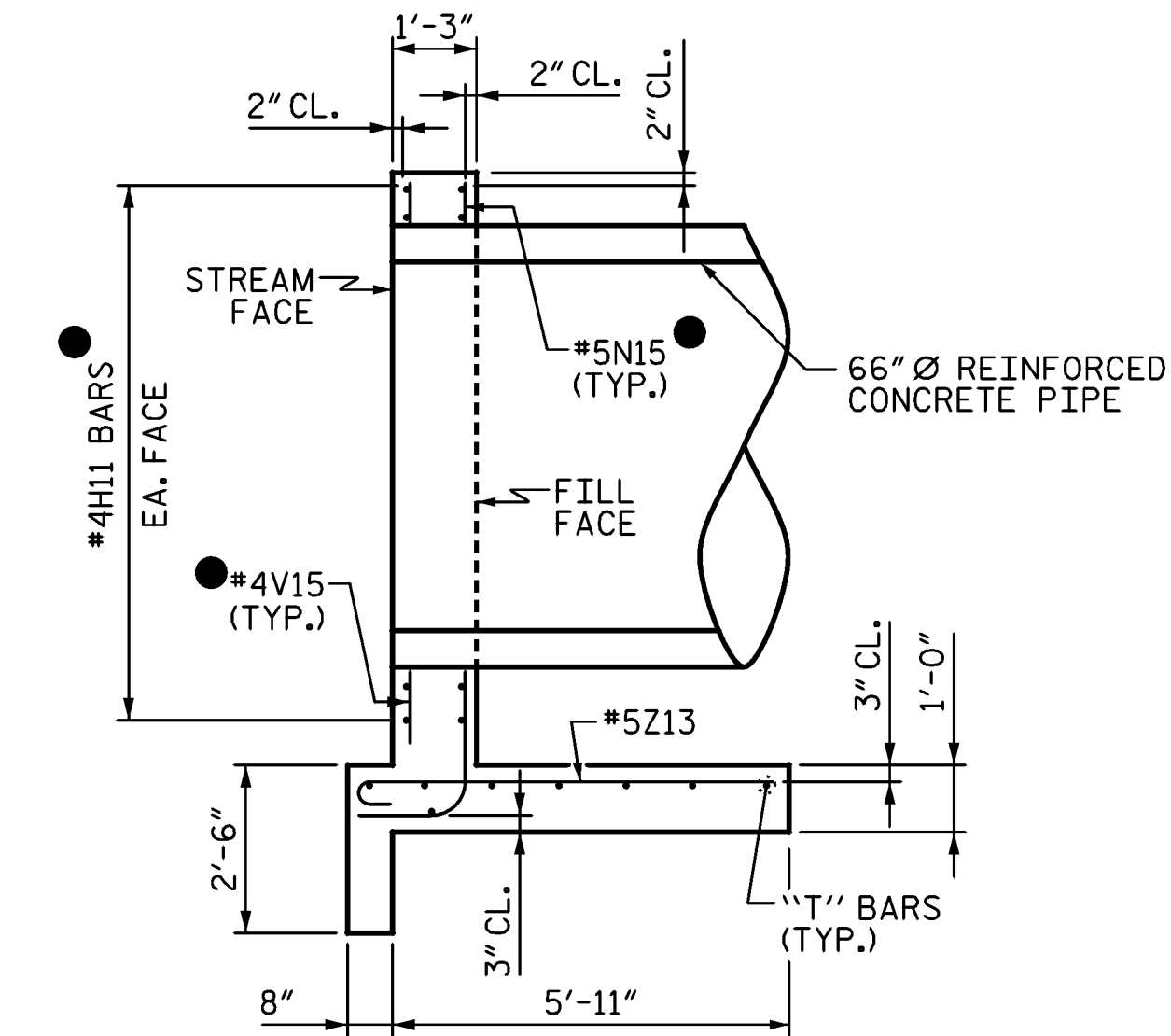
**PLAN W3 - INLET ENDWALL**

SEE "ELEVATION W1" AND "TYPICAL WING SECTION" ON SHEET 4 OF 5 FOR ADDITIONAL WING WALL DIMENSIONS AND REINFORCEMENT



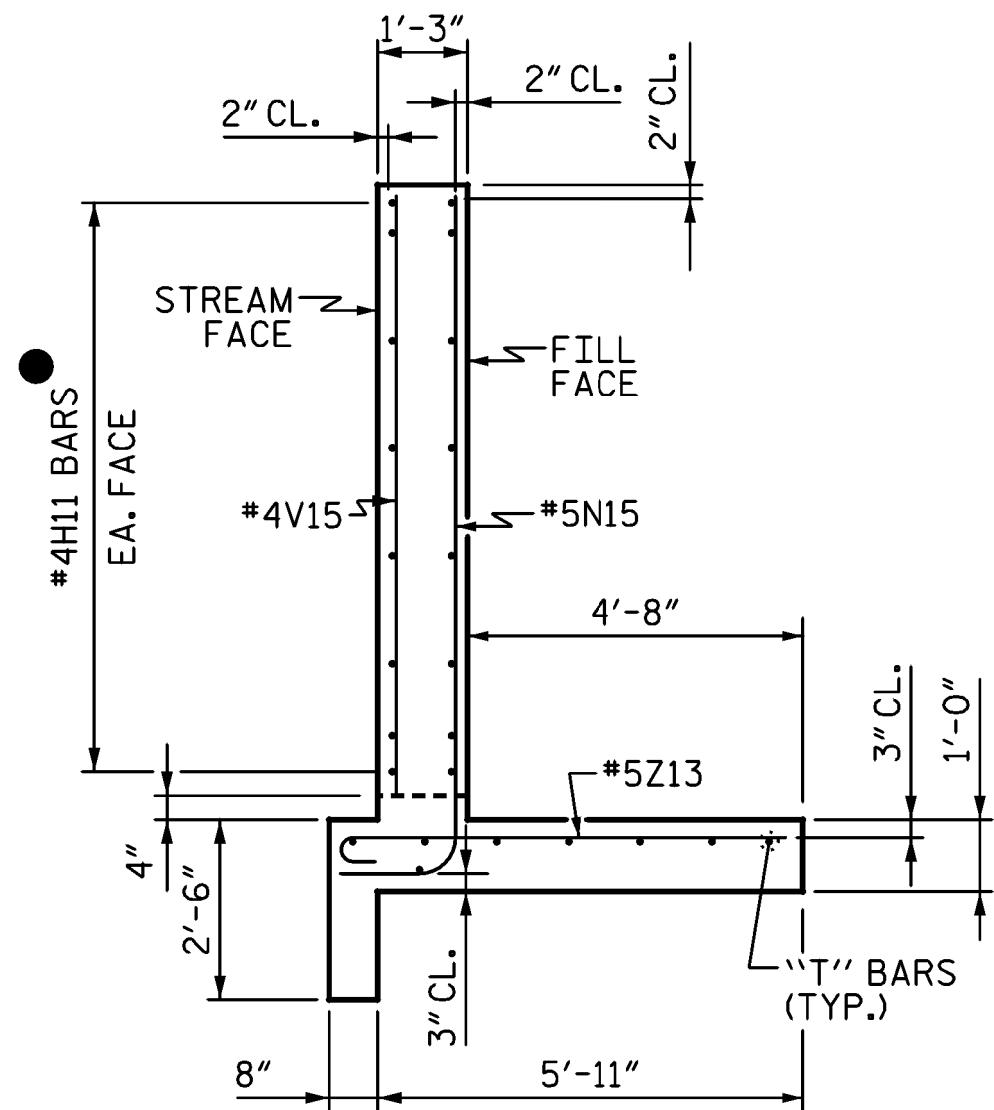
**PLAN W4 - OUTLET ENDWALL**

SEE "ELEVATION W2" AND "TYPICAL WING SECTION" ON SHEET 4 OF 5 FOR ADDITIONAL WING WALL DIMENSIONS AND REINFORCEMENT

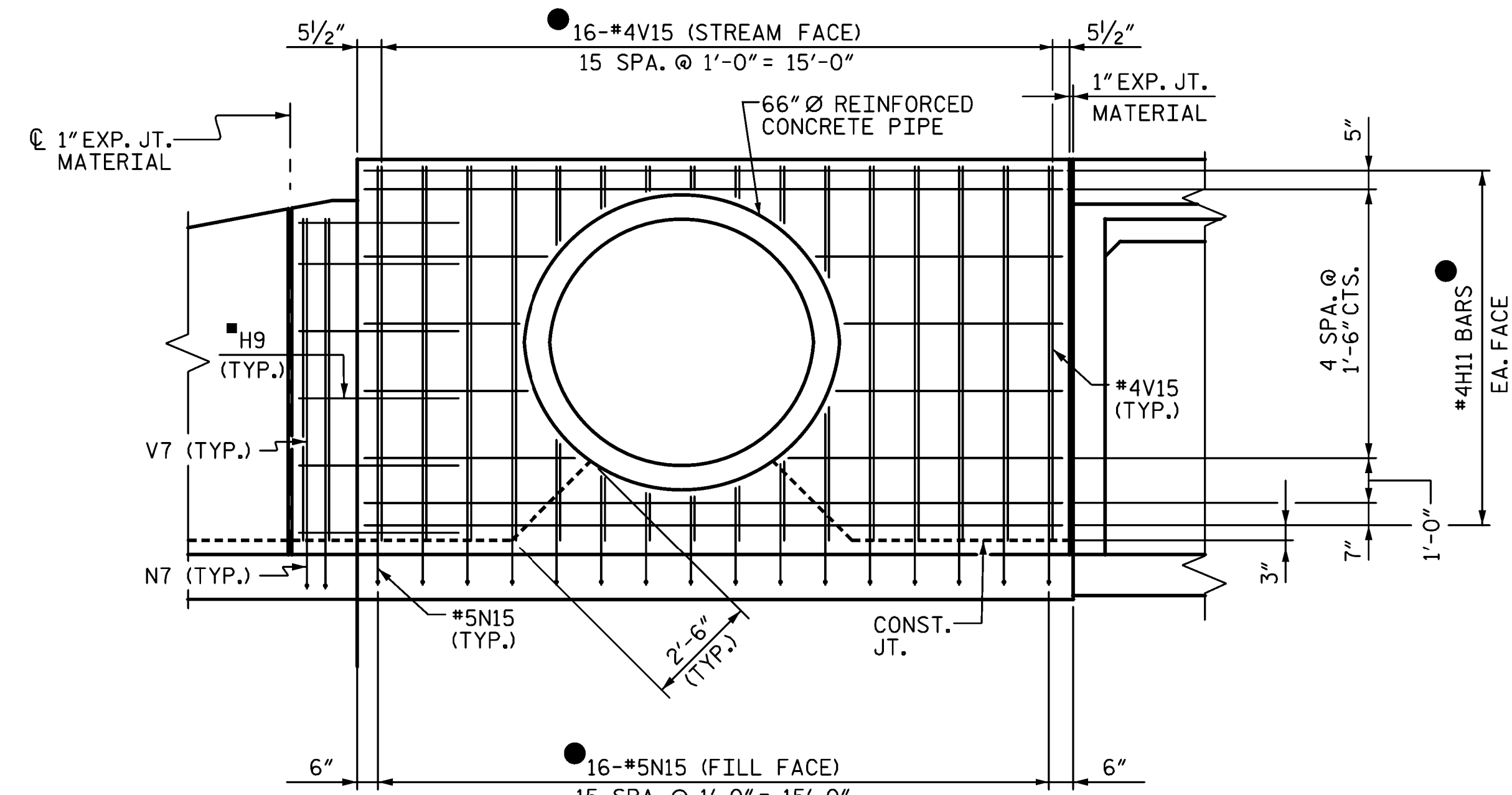


**TYPICAL ENDWALL SECTION THRU PIPE**

REINFORCEMENT MAY BE SLIGHTLY SHIFTED OR CUT FOR PLACEMENT OF THE 66" Ø REINFORCED CONCRETE PIPE.



**TYPICAL ENDWALL SECTION**



**ENDWALL ELEVATION**

INLET ENDWALL SHOWN, OUTLET ENDWALL SIMILAR

USE H4 BARS FOR OUTLET WING. SEE ELEVATION W1 AND ELEVATION W2 ON SHEET 4 OF 5 FOR ADDITIONAL DETAILS.

PROJECT NO. U-4751  
 NEW HANOVER COUNTY

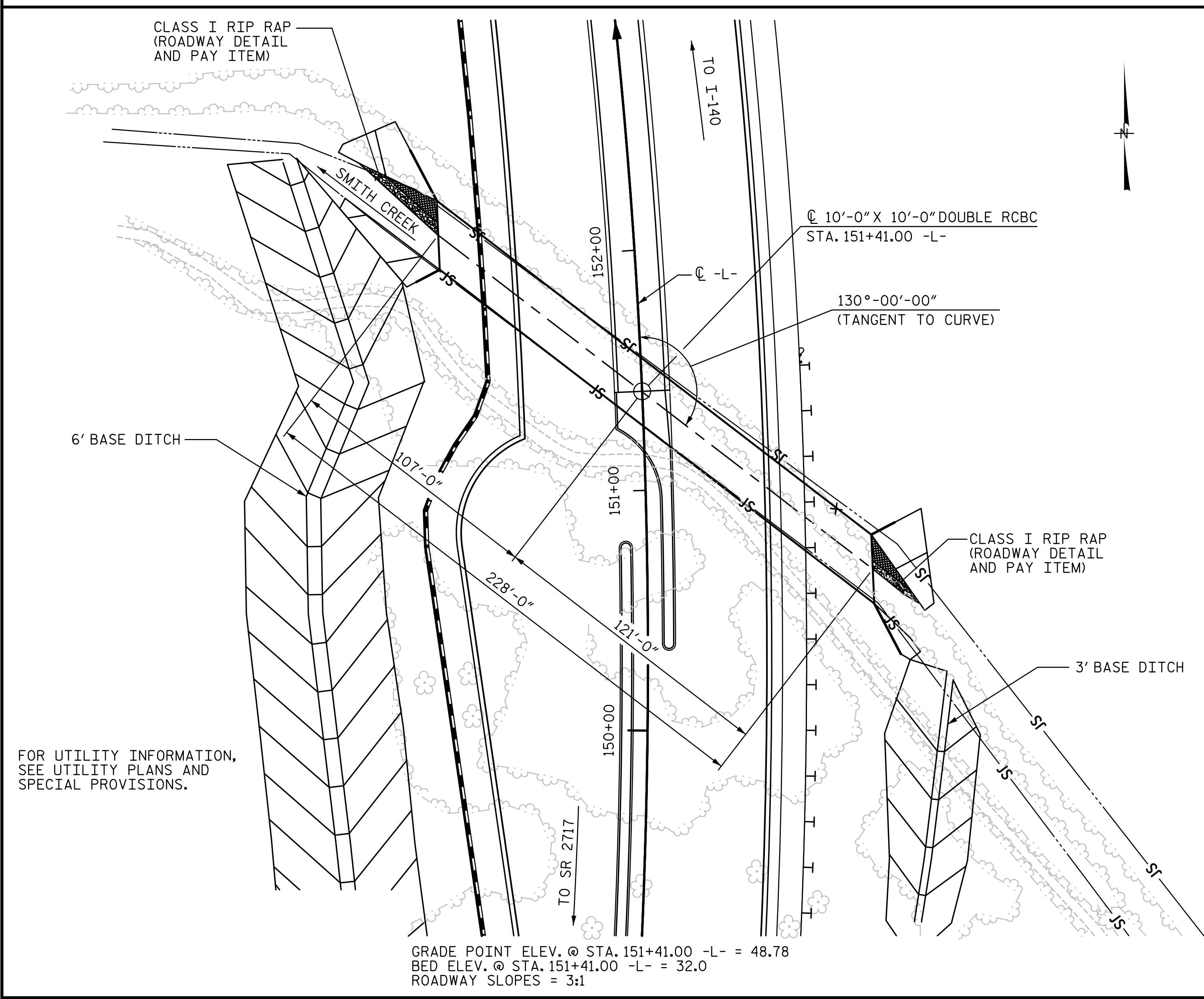
STATION: 138+59.00 -L-

SHEET 5 OF 5

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH		<b>ENDWALL &amp; WINGS FOR CONCRETE BOX CULVERT</b> H = 7'-0" SLOPE = 3:1 111°-00'-00" SKEW
		REVISIONS NO. BY: DATE: NO. BY: DATE:		
		STV ENGINEERS, INC. 900 West Trade St., Suite 715 Charlotte, NC 28202 NC License Number F-5991		
DRAWN BY: <u>BMC</u> DATE: <u>02-20</u> CHECKED BY: <u>MLO</u> DATE: <u>02-20</u>	DESIGN ENGINEER OF RECORD: <u>B. CURRY</u> DATE: <u>02-20</u>	SHEET NO. <u>C2-5</u> TOTAL SHEETS <u>5</u>		

DRAWN BY: BMC DATE: 02-20  
 CHECKED BY: MLO DATE: 02-20  
 DESIGN ENGINEER OF RECORD: B. CURRY DATE: 02-20

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



GRADE POINT ELEV. @ STA. 151+41.00 -L- = 48.78  
 BED ELEV. @ STA. 151+41.00 -L- = 32.0  
 ROADWAY SLOPES = 3:1

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

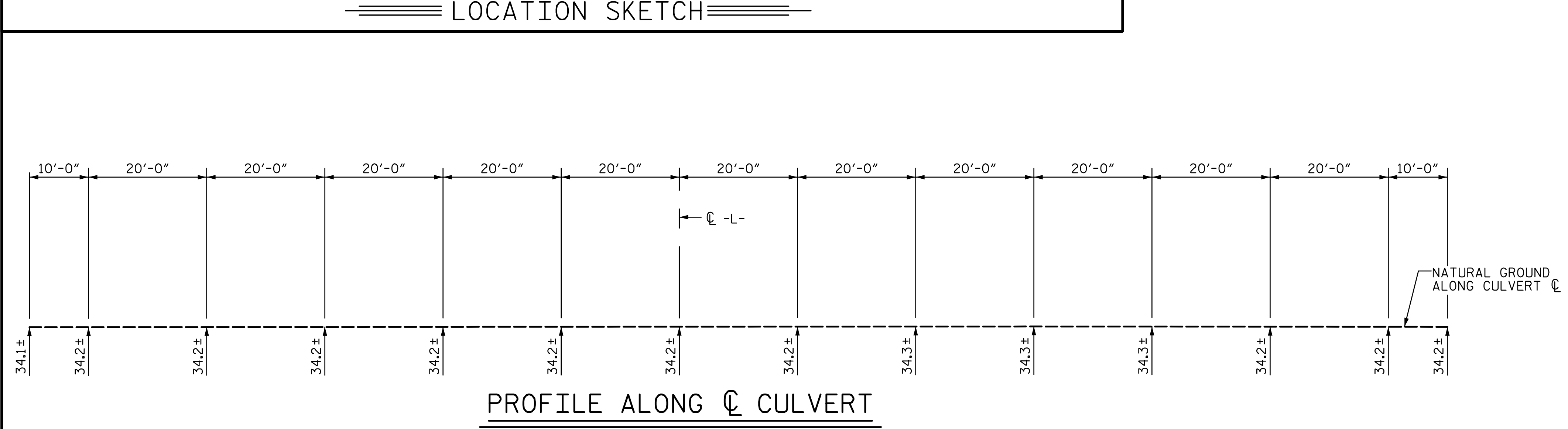
PI STA. = 146+07.40 -L-  
 $\Delta = 58^{\circ}-00'-14.91"$  (LT)  
 RADIUS = 2,610'  
 TANGENT = 1,446.87'  
 LENGTH = 2,642.27'

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.



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				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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## 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'	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	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'	
		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	--

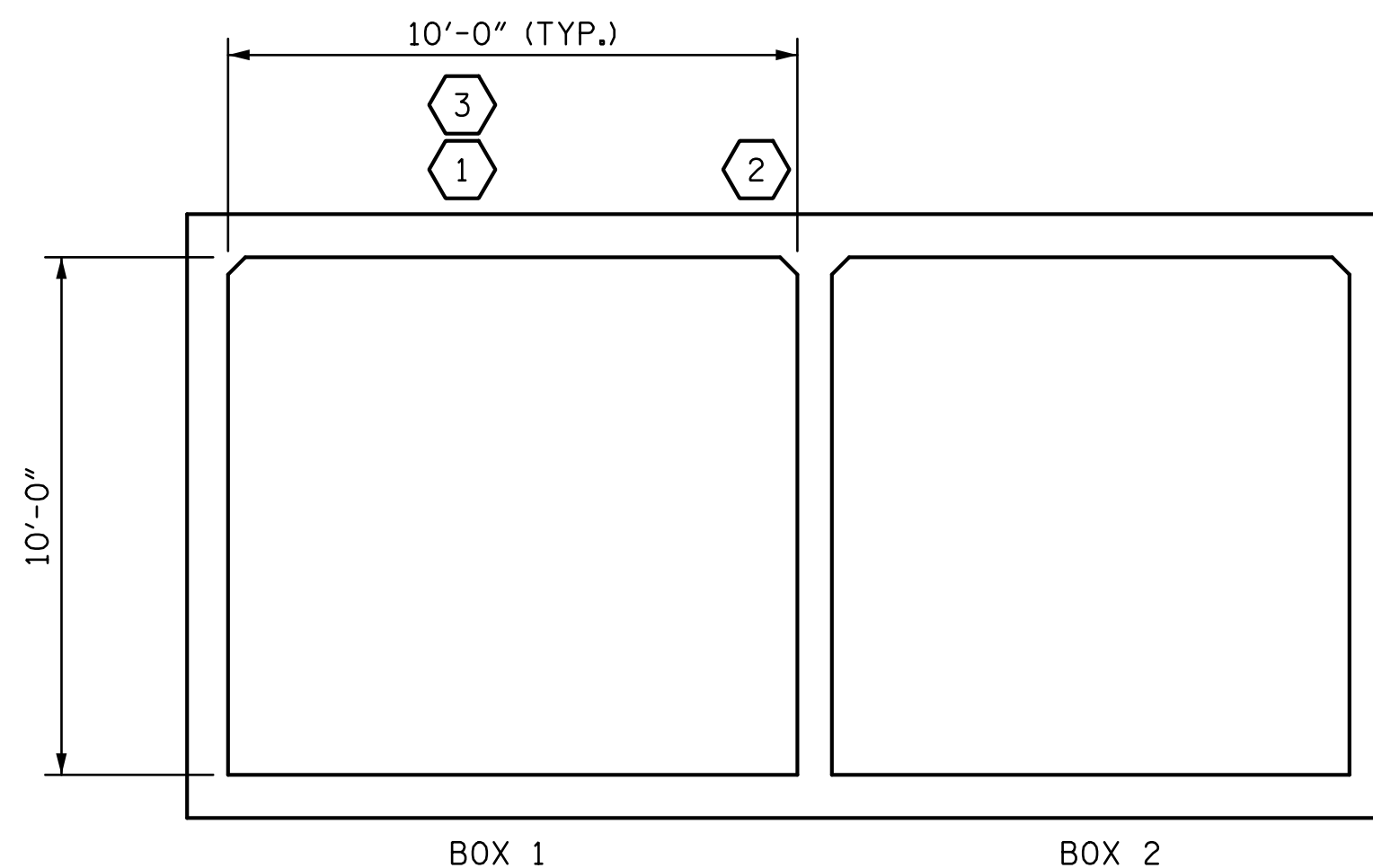
### NOTE:

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

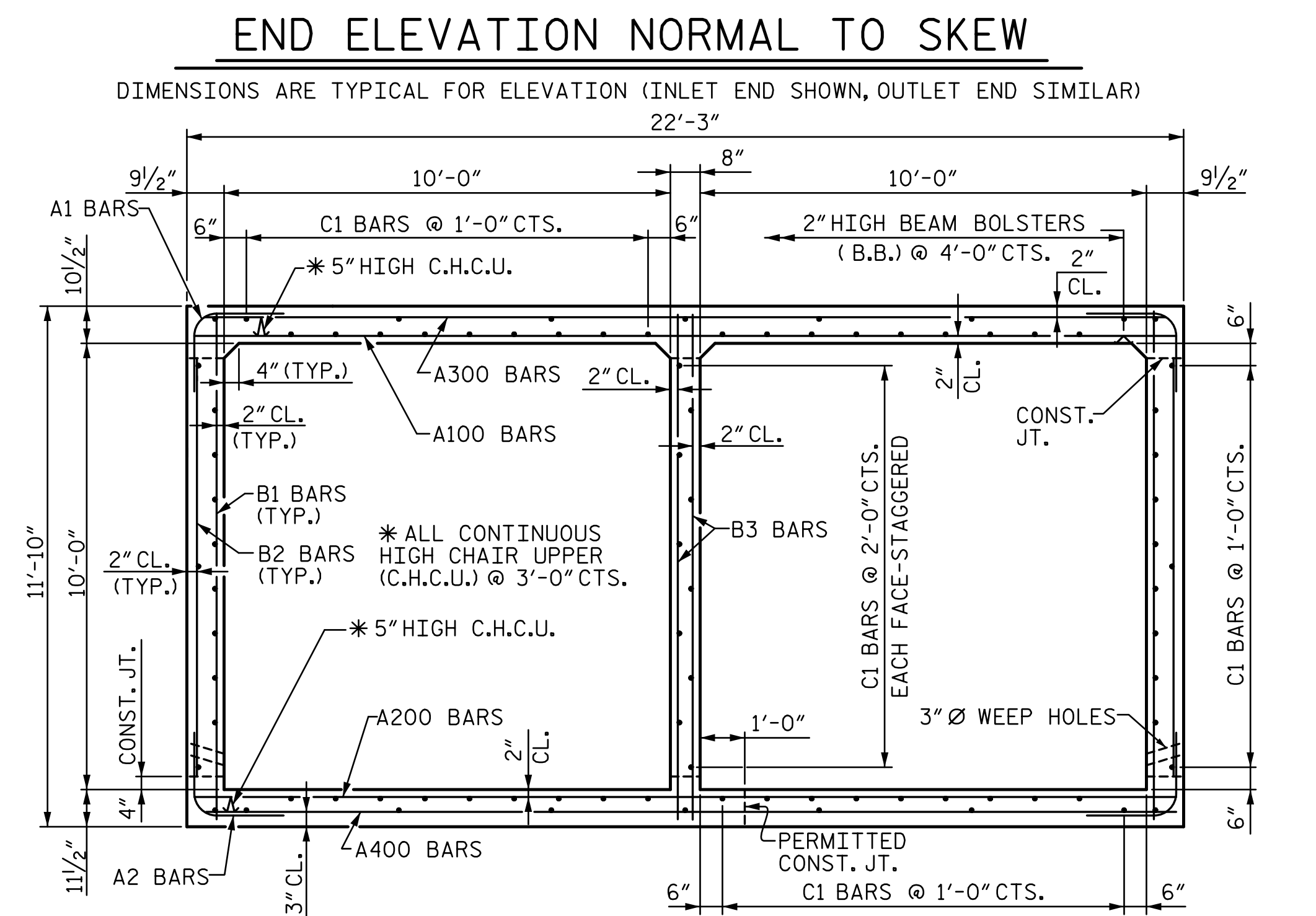
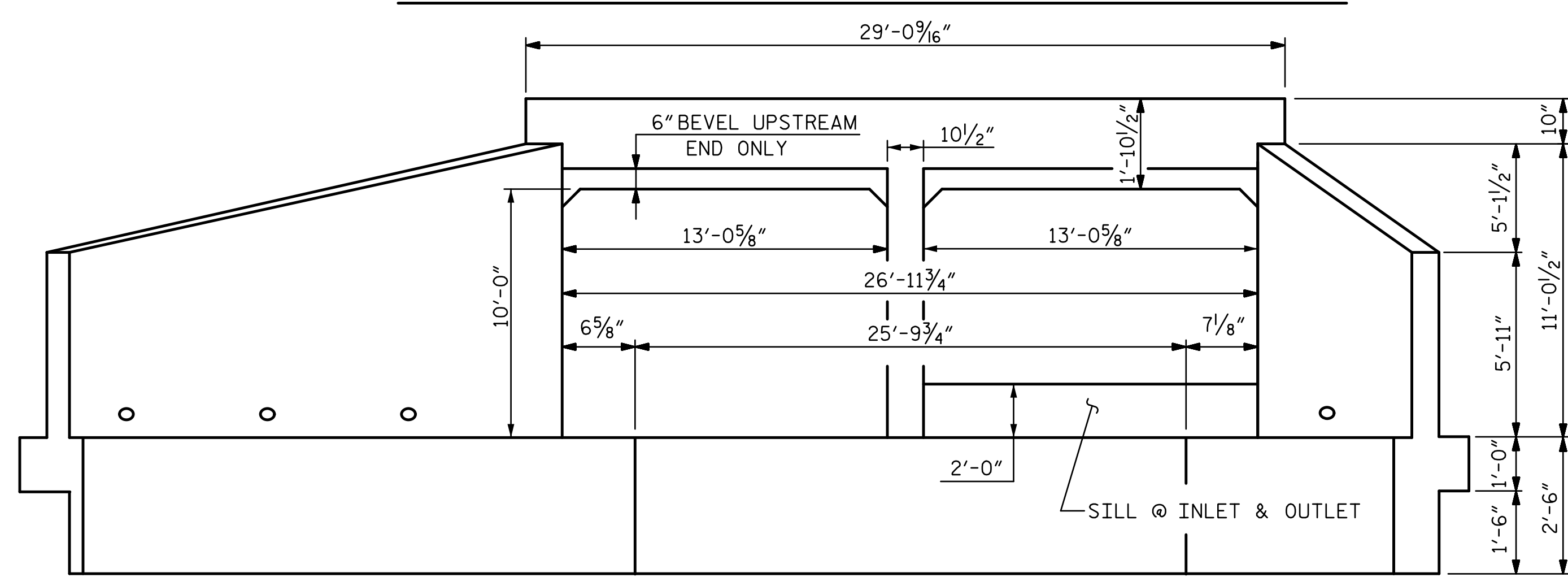
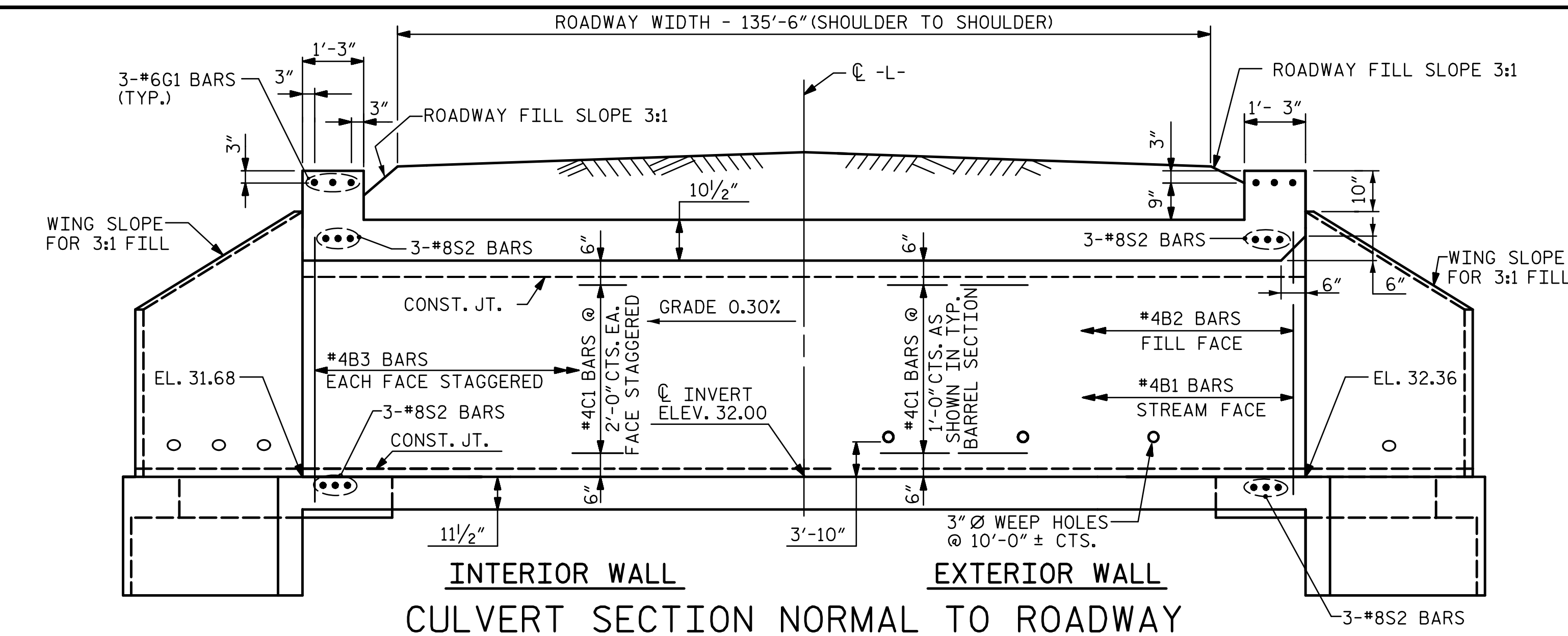
STATION: 151+41.00 -L-

SHEET 2 OF 7

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH  <b>STANDARD LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)</b>				
	REVISIONS					
	NO. 1 2	BY:	DATE:	NO. 3 4	BY:	DATE:

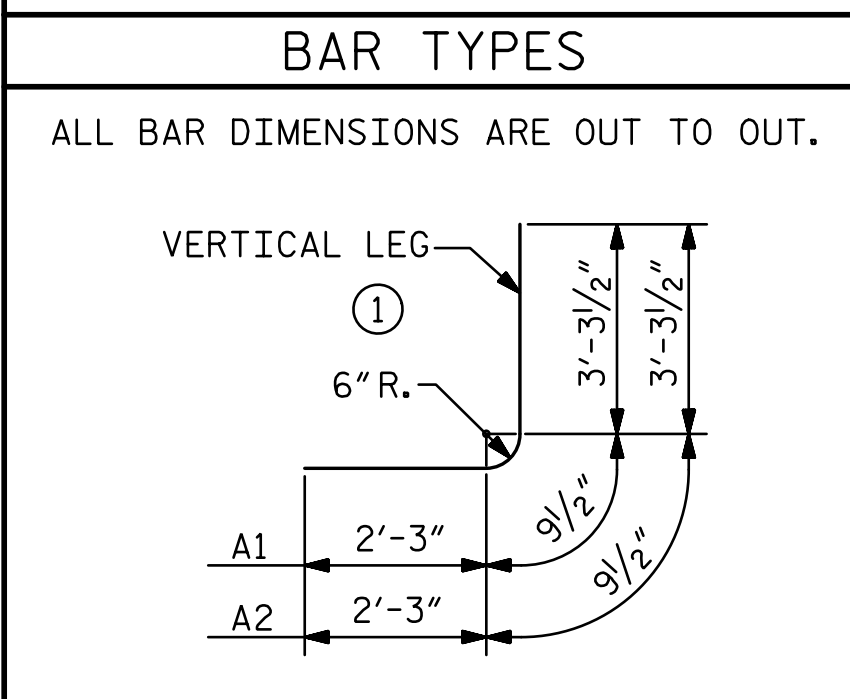
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 CHECKED BY : JWJ DATE : 5-17  
 DESIGN ENGINEER OF RECORD: B. CURRY DATE : 5-17

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BILL OF REINFORCING FOR 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	
A220	2	#4	STR	21'-11"	6,134	A414	2	#6	STR	13'-8"	18	A415	2	#6	STR	13'-1"	17	
A400	419	#6	STR	21'-11"	6,134	A416	2	#6	STR	12'-5"	17	A417	2	#6	STR	11'-10"	16	
A401	2	#6	STR	21'-5"	29	A418	2	#6	STR	11'-3"	15	A419	2	#6	STR	10'-8"	14	
A410	2	#6	STR	16'-0"	21	A420	2	#6	STR	10'-1"	13	A421	2	#6	STR	9'-6"	13	
A411	2	#6	STR	15'-5"	21	A422	2	#6	STR	8'-10"	12	A423	2	#6	STR	8'-3"	11	
A419	2	#4	STR	10'-8"	14	A424	2	#6	STR	7'-8"	10	A425	2	#6	STR	7'-1"	9	
A420	2	#4	STR	10'-0"	13	A426	2	#6	STR	6'-6"	9	A427	2	#6	STR	5'-11"	8	
A421	2	#4	STR	9'-5"	13	A428	2	#6	STR	5'-4"	7	A429	2	#6	STR	4'-8"	6	
A422	2	#4	STR	8'-10"	12	A430	2	#6	STR	4'-1"	5	A431	2	#6	STR	3'-6"	5	
A423	2	#4	STR	7'-8"	10	A432	2	#6	STR	2'-11"	4	A433	2	#6	STR	2'-4"	3	
A424	2	#4	STR	7'-1"	9	A433	2	#6	STR	2'-4"	3	A434	2	#6	STR	1'-9"	2	
A425	2	#4	STR	6'-6"	9	A434	2	#6	STR	1'-9"	2							
A426	2	#4	STR	6'-6"	9													
A427	2	#4	STR	5'-11"	8													
A428	2	#4	STR	5'-4"	7													
A429	2	#4	STR	4'-8"	6													
A430	2	#4	STR	4'-1"	5													
A431	2	#4	STR	3'-6"	5													
A432	2	#4	STR	2'-11"	4													
A433	2	#4	STR	2'-4"	3													
A434	2	#4	STR	1'-9"	2													
B1	456	#4	STR	11'-5"	3,478													
B2	994	#4	STR	9'-4"	6,197													
B3	458	#4	STR	11'-5"	3,493													
C1	688	#4	STR	30'-0"	13,788													
D1	6	#6	STR	2'-5"	22													
G1	6	#6	STR	28'-7"	258													
S2	12	#8	STR	28'-7"	916													
TOTAL BARREL REINFORCING STEEL = 89,168 LBS.																		



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

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

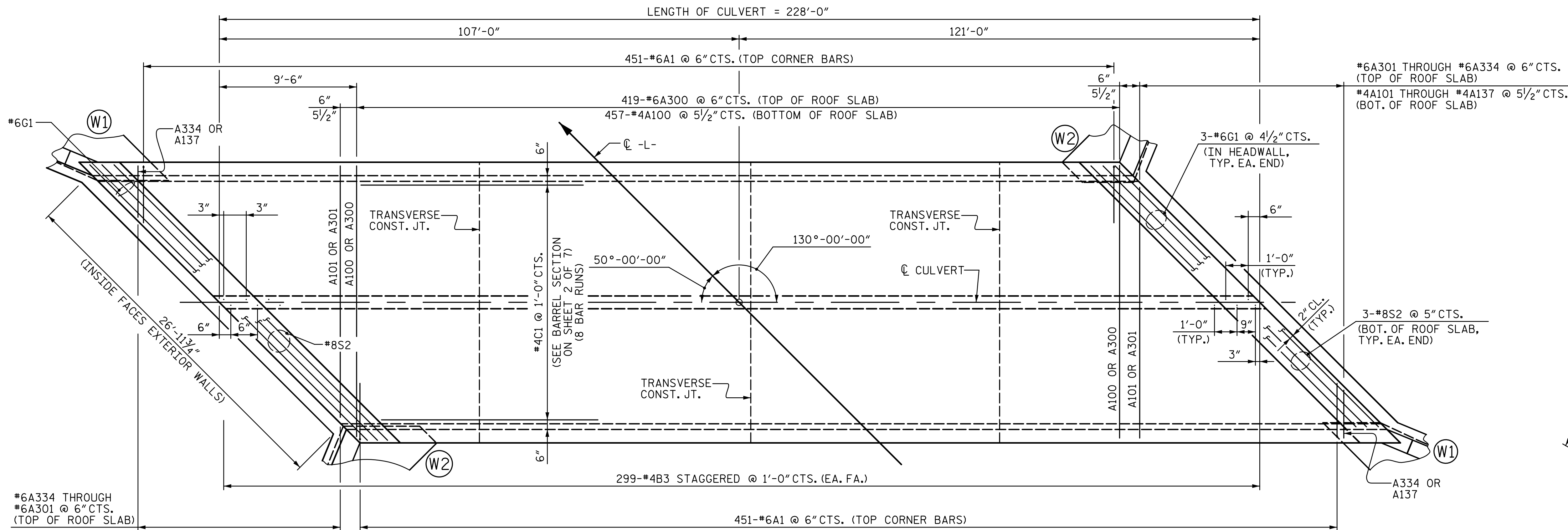
REVISIONS

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

SHEET NO. C3-3  
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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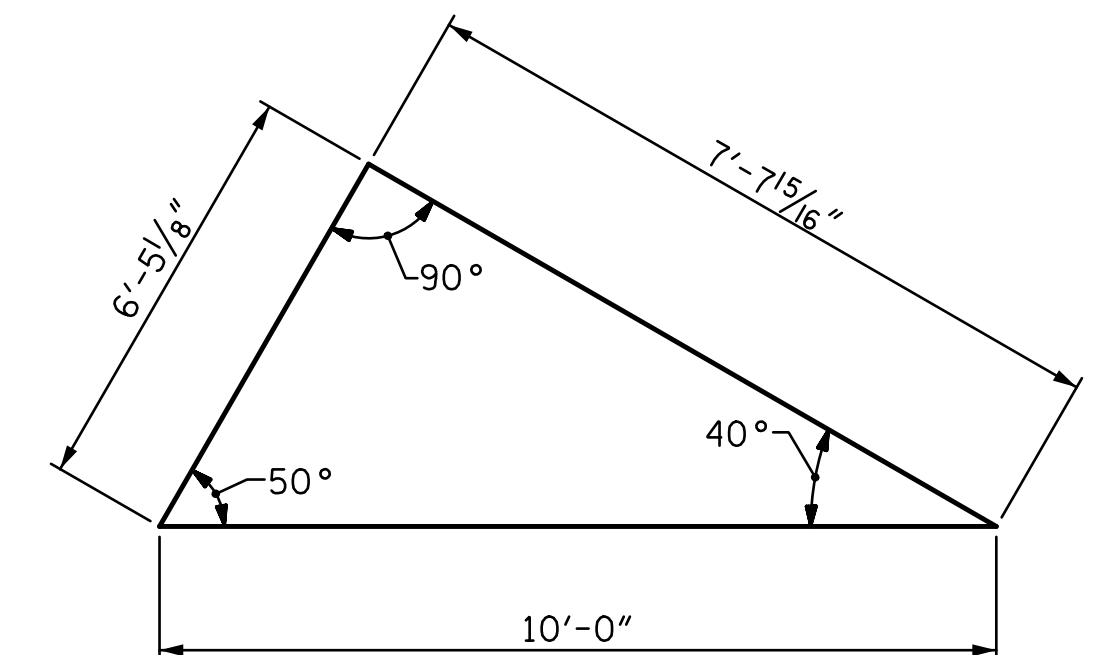


**ROOF SLAB**

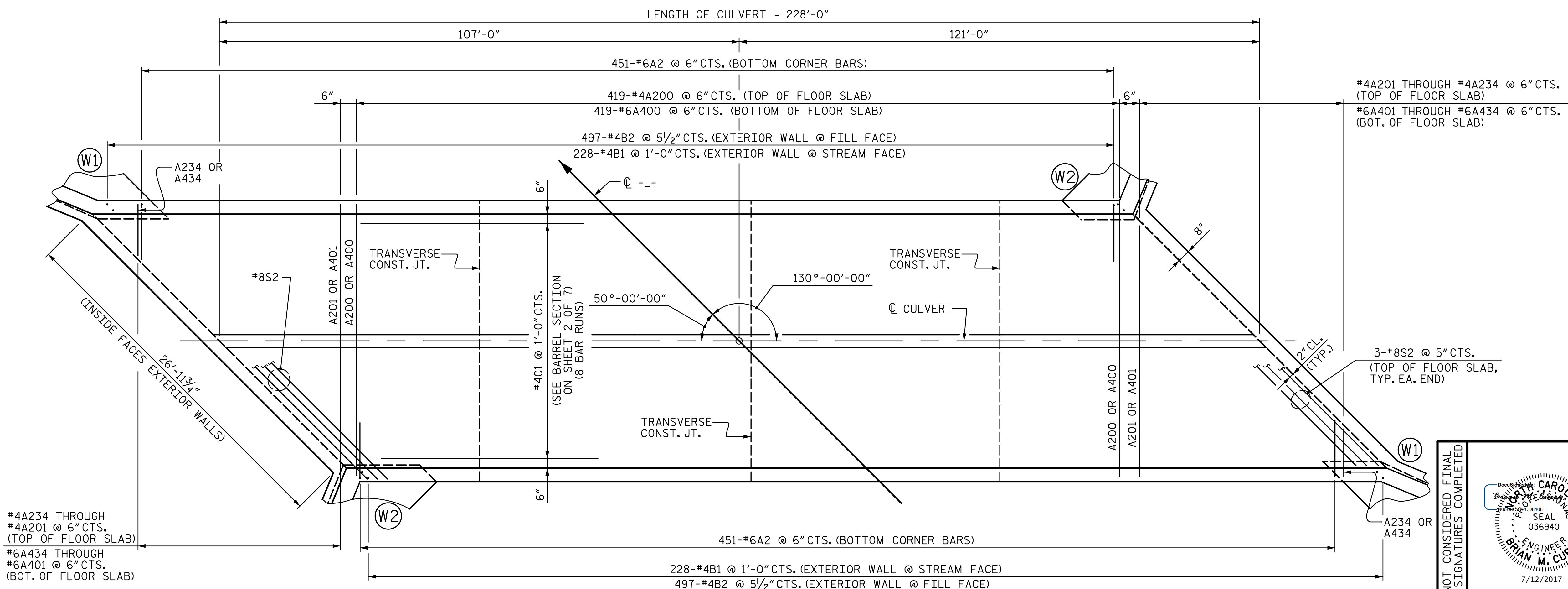
(SEE FLOOR PLAN FOR B1 & B2 IN EXTERIOR WALLS)

#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)



**SKIEW TRIANGLE**



**FLOOR SLAB**

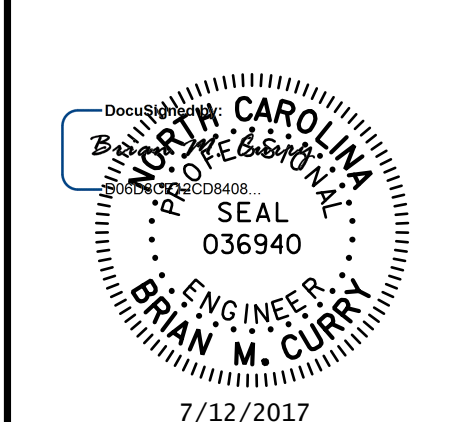
(SEE ROOF PLAN FOR B3 BARS IN INTERIOR WALL)  
 (SILLS NOT SHOWN, SEE SHEET 5 OF 7)

#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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



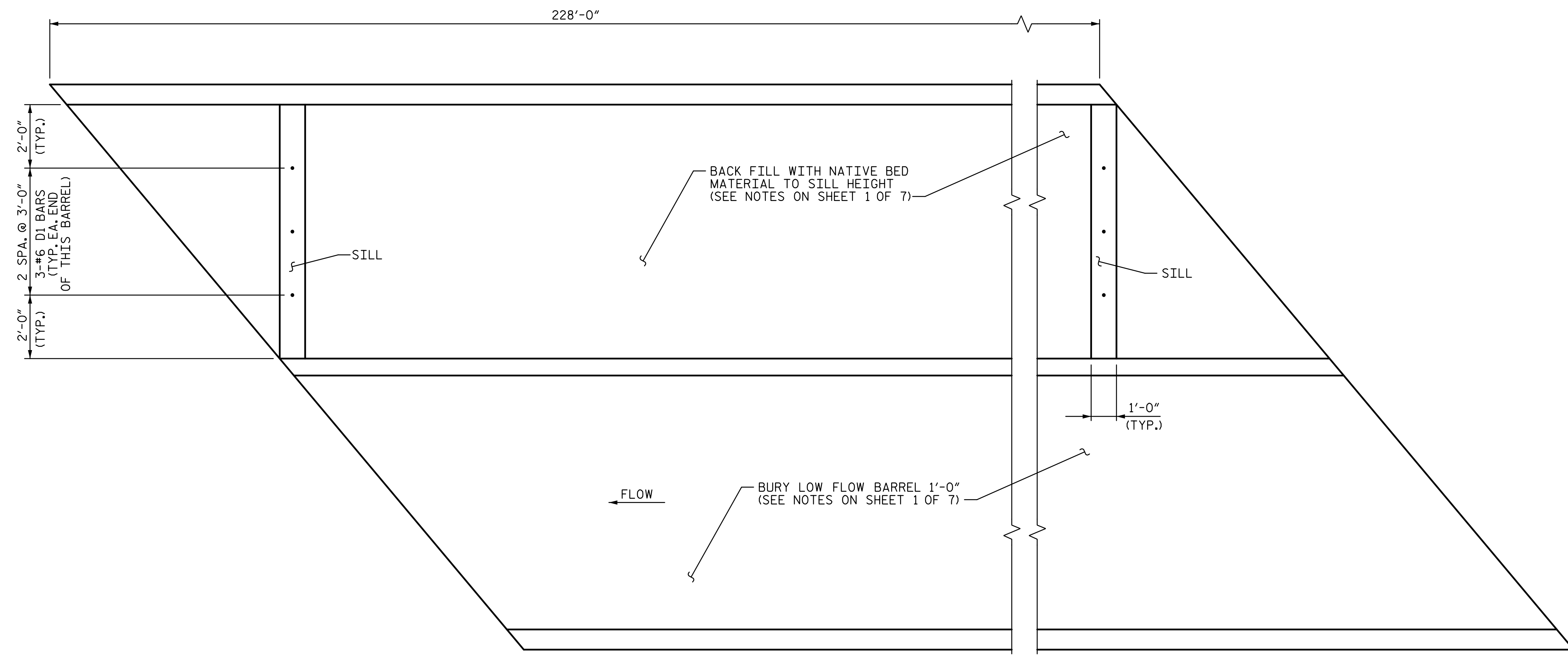
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**DOUBLE 10'-0" X 10'-0" CONCRETE BOX CULVERT**  
**130°-00'-00" SKEW**

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

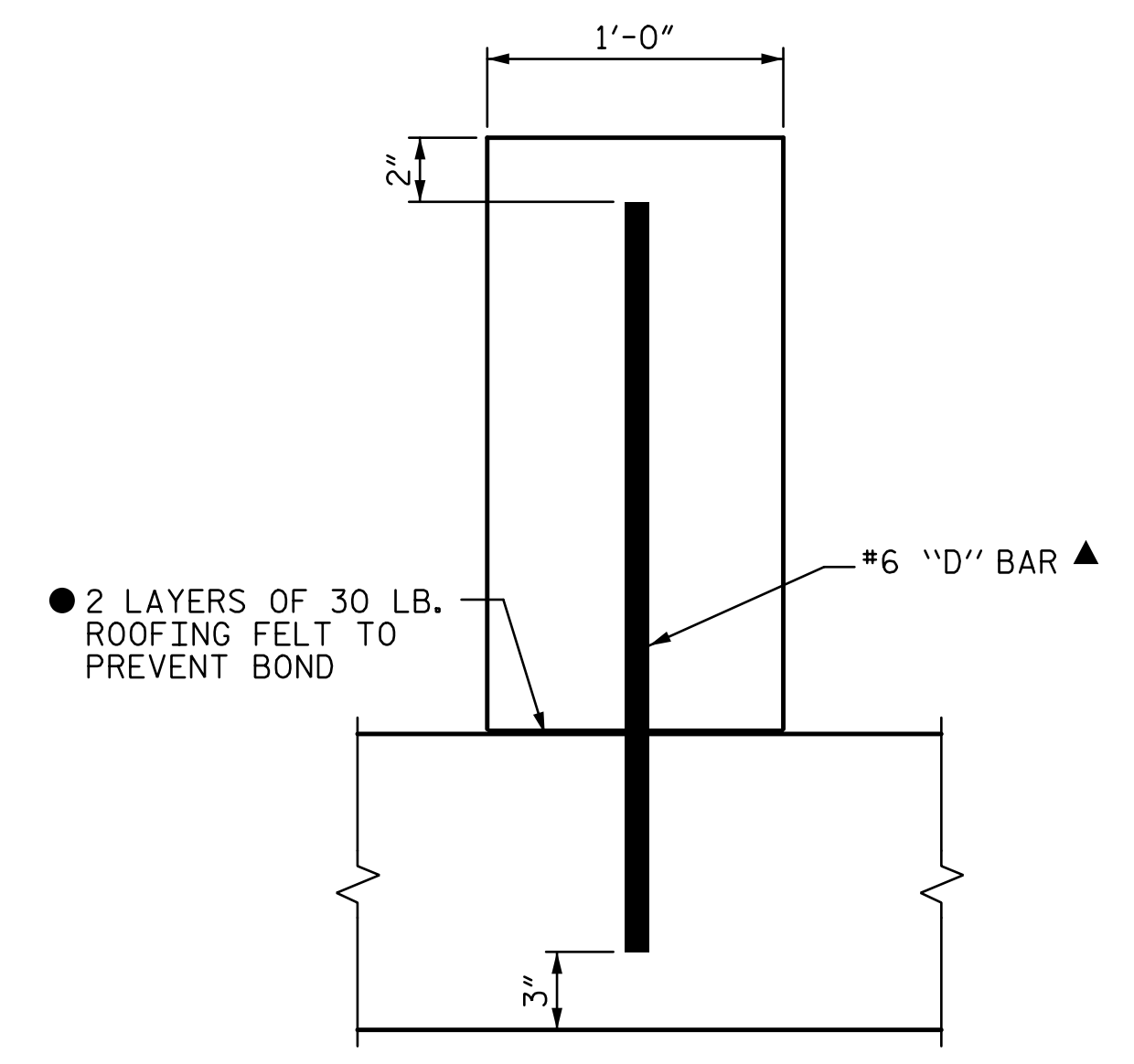
REVISIONS				SHEET NO.
NO.	BY:	DATE:	NO.	DATE:
1			3	
2			4	

C3-4
TOTAL SHEETS
7

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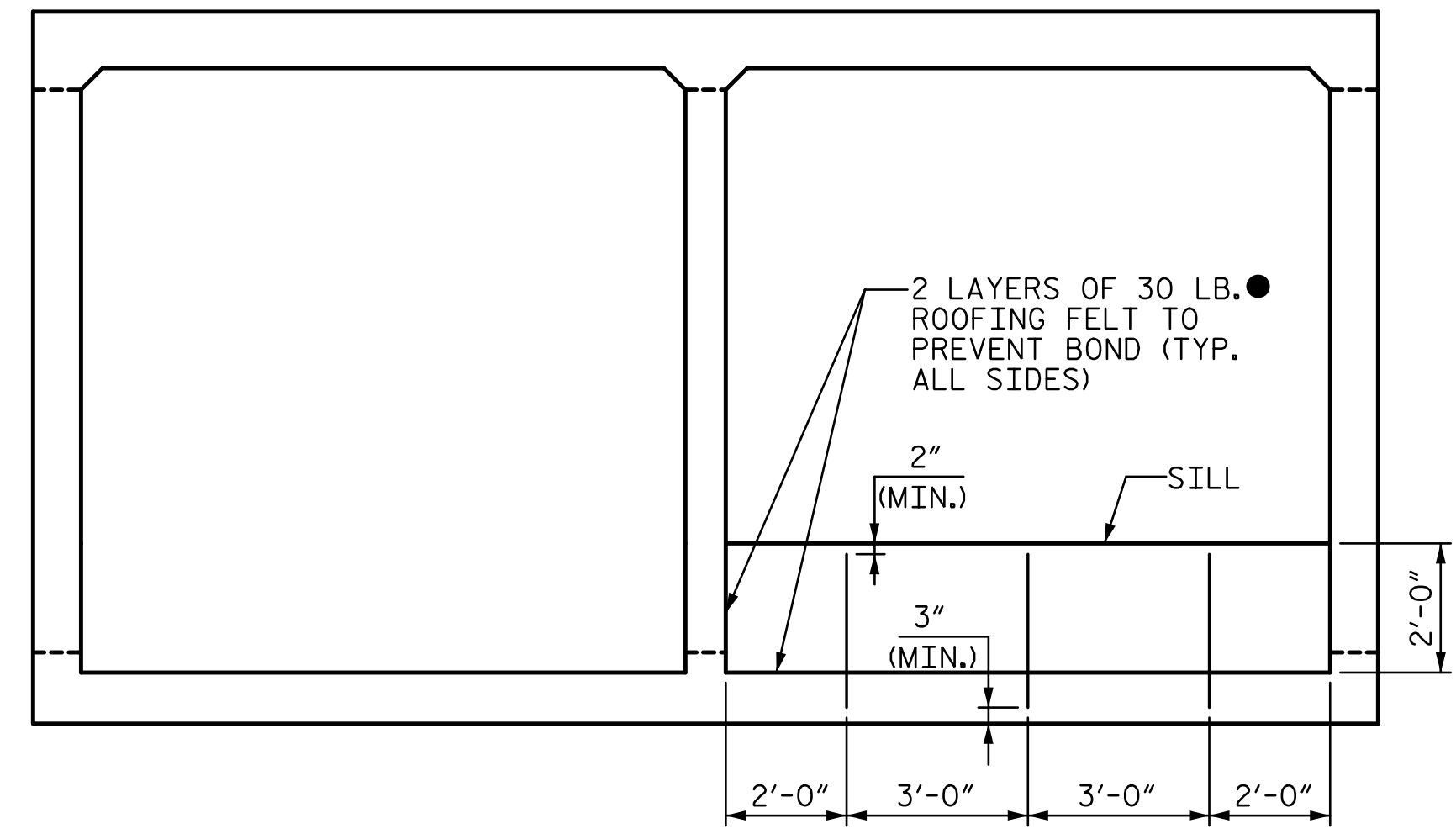


PLAN VIEW - LOCATION OF SILLS



▲ 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

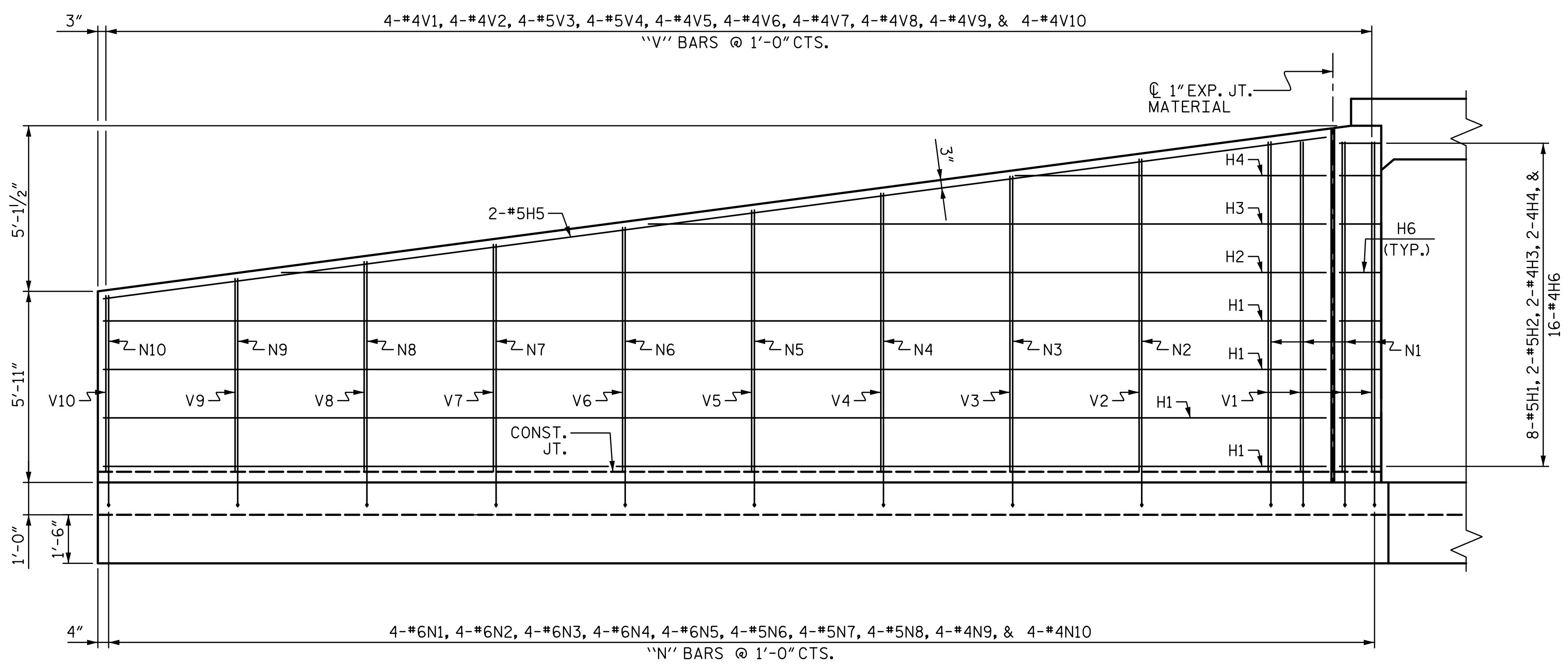
PROJECT NO. U-4751  
NEW HANOVER COUNTY  
 STATION: 151+41.00 -L-  
 SHEET 5 OF 7

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED			STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH		SHEET NO. C3-5
	<h3>SILL DETAILS</h3>				TOTAL SHEETS 7
	REVISIONS				
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

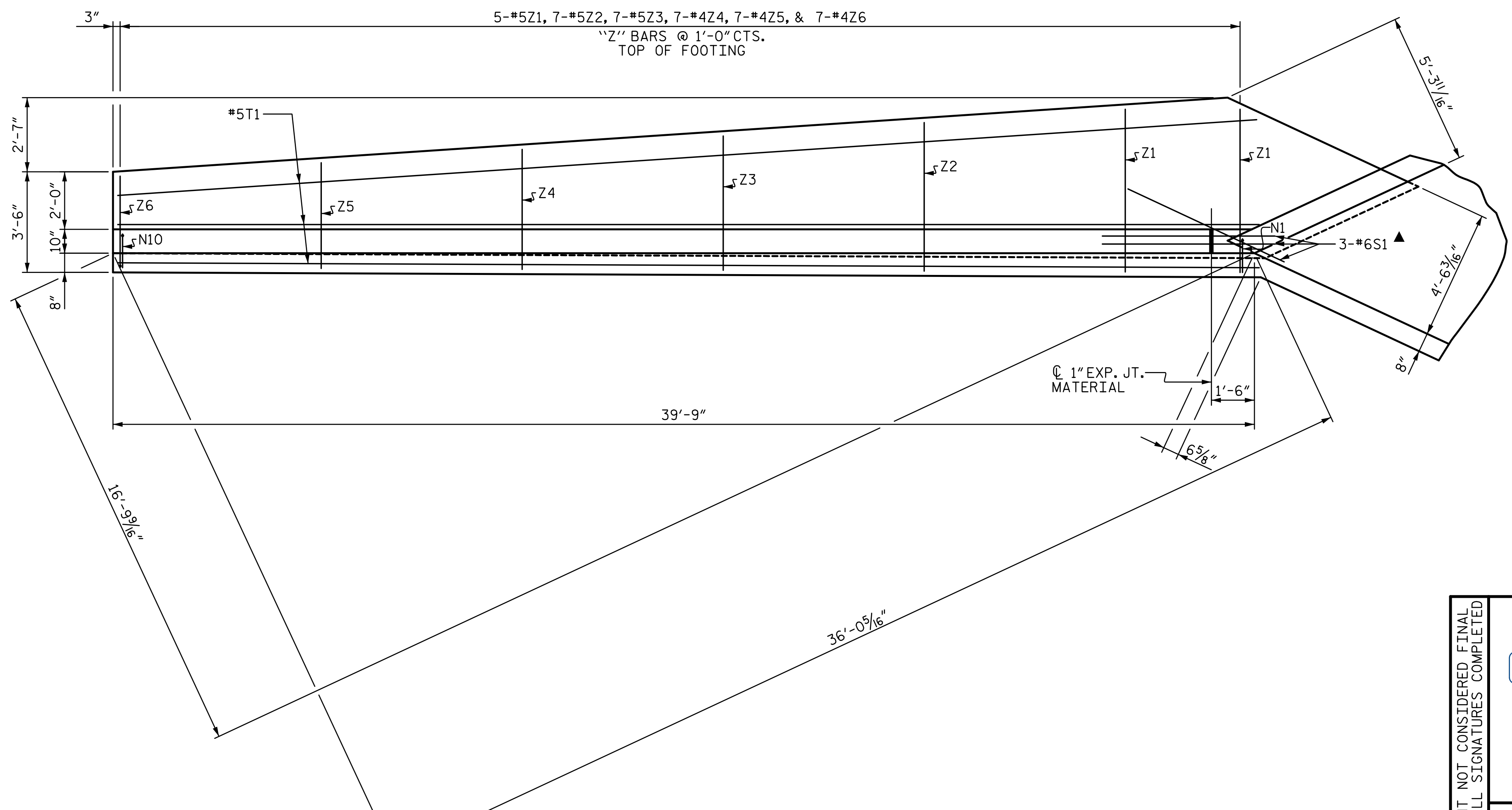
DRAWN BY : <u>BMC</u>	DATE : <u>5-17</u>	DESIGN ENGINEER OF RECORD: <u>B. CURRY</u>	DATE : <u>5-17</u>
CHECKED BY : <u>MLO</u>	DATE : <u>5-17</u>		



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7/11/2017  
bcurry



ELEVATION W1



PLAN W1

▲ S1 IN BOTTOM OF FLOOR SLAB AND FOOTING

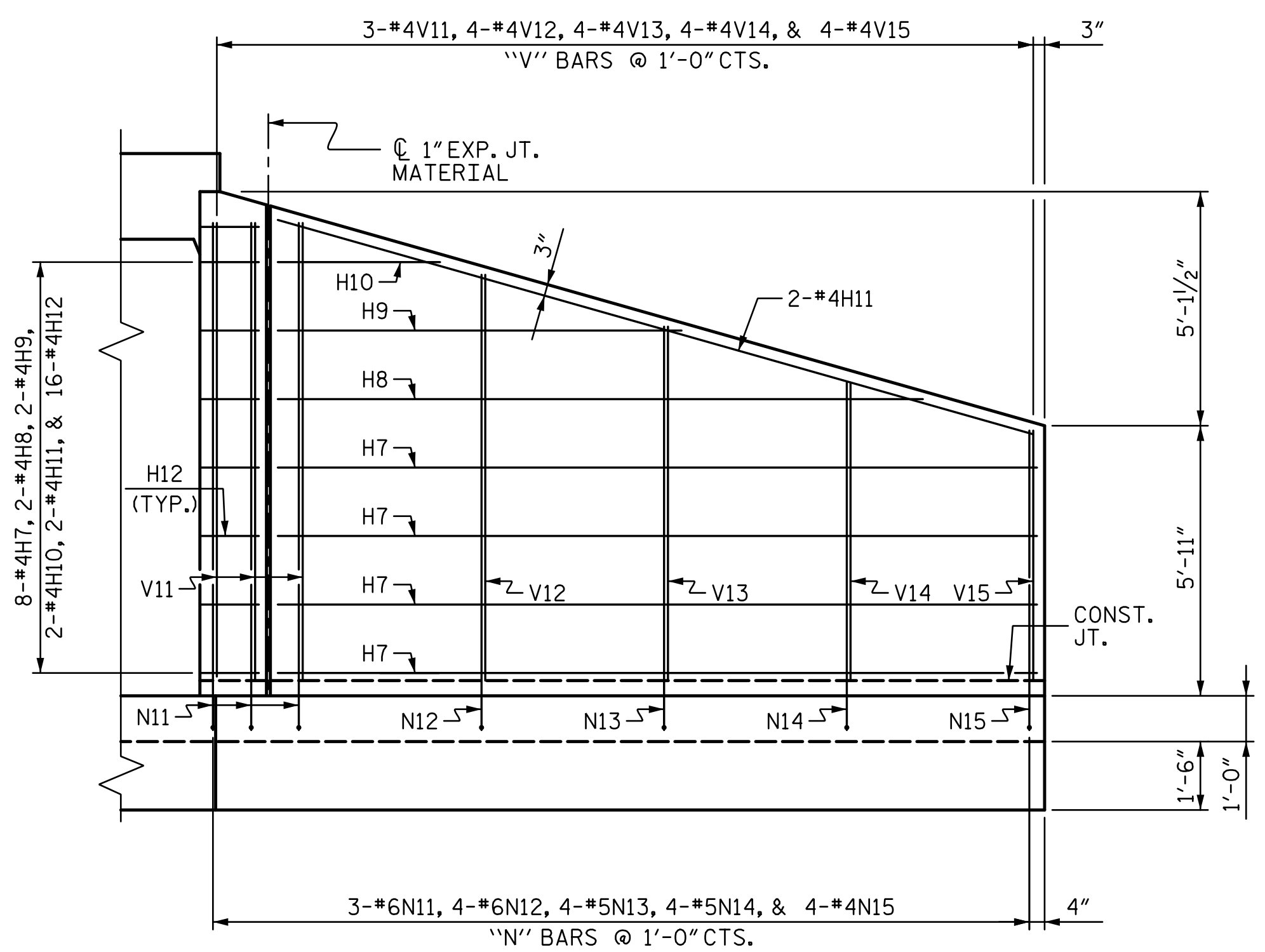
PROJECT NO. U-4751  
NEW HANOVER COUNTY  
 STATION: 151+41.00 -L-  
 SHEET 6 OF 7

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED			STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH  <b>WINGS FOR CONCRETE BOX CULVERT</b> H = 10'-0" SLOPE = 3:1 130°-00'-00" SKEW		SHEET NO. C3-6
	REVISIONS				TOTAL SHEETS
	NO.	BY:	DATE:	NO.	BY:
1			3		
2			4		

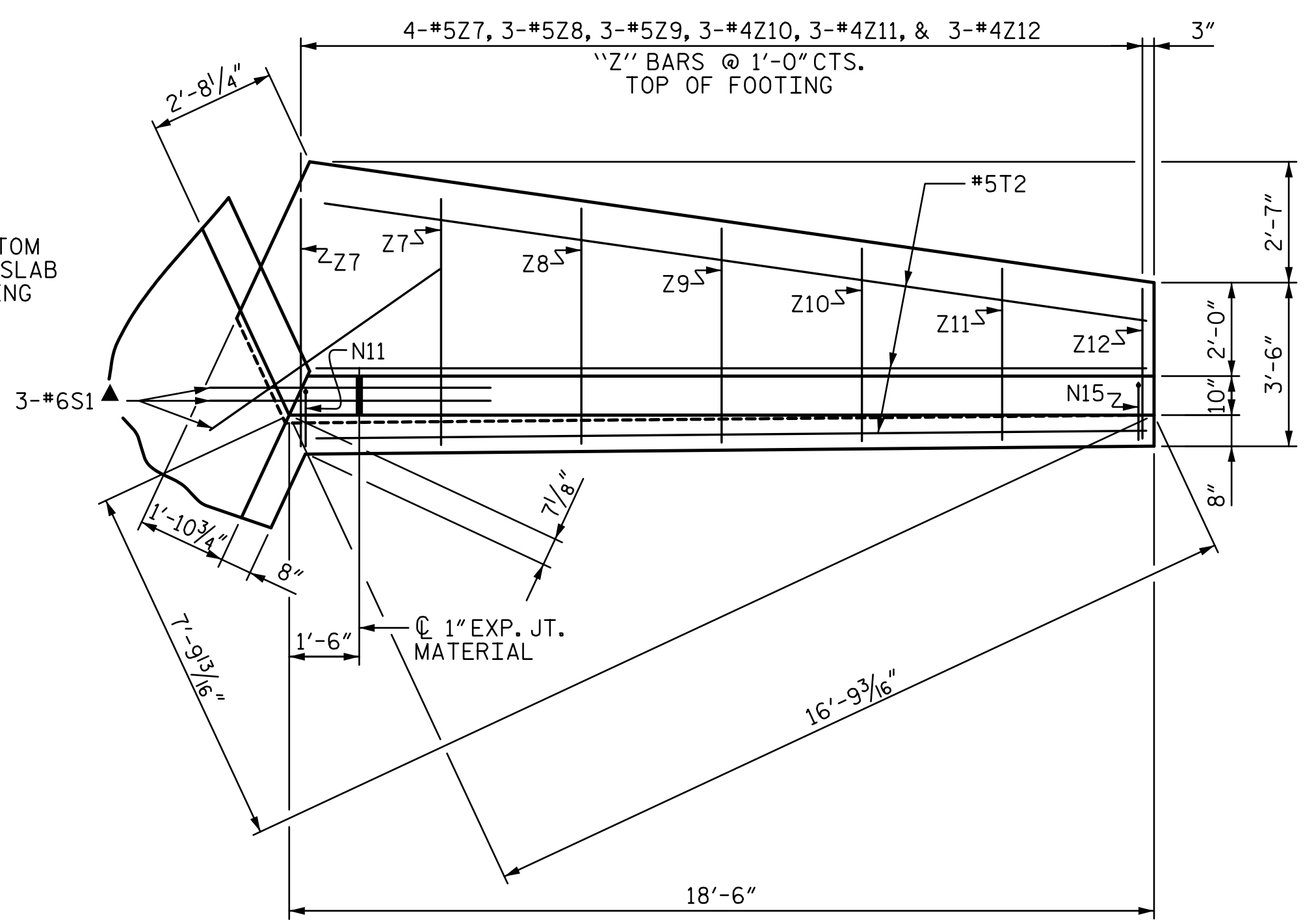
DRAWN BY : BMC DATE : 5-17  
 CHECKED BY : MLO DATE : 5-17  
 DESIGN ENGINEER OF RECORD: B. CURRY DATE : 5-17

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

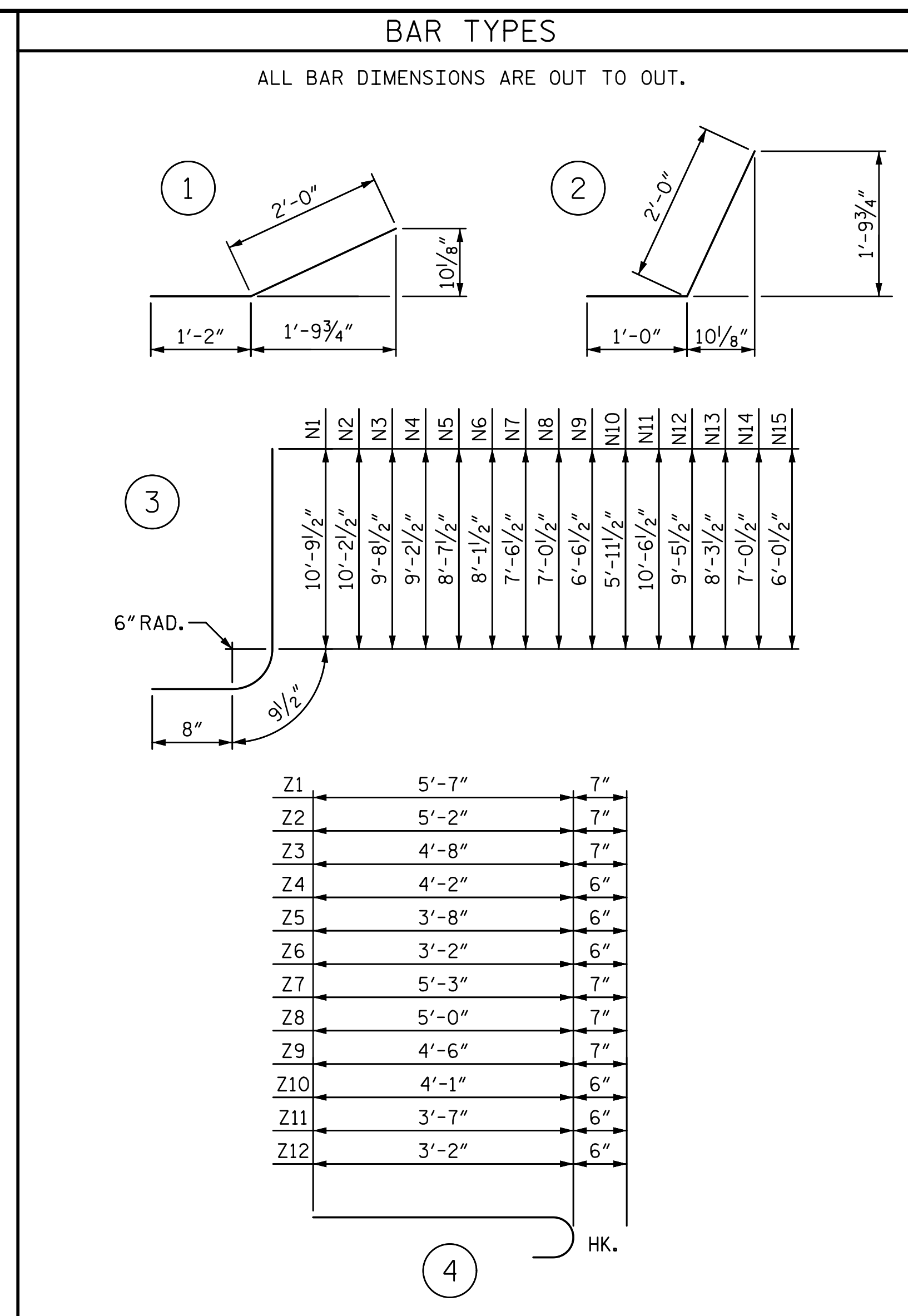
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ELEVATION W2



PLAN W2



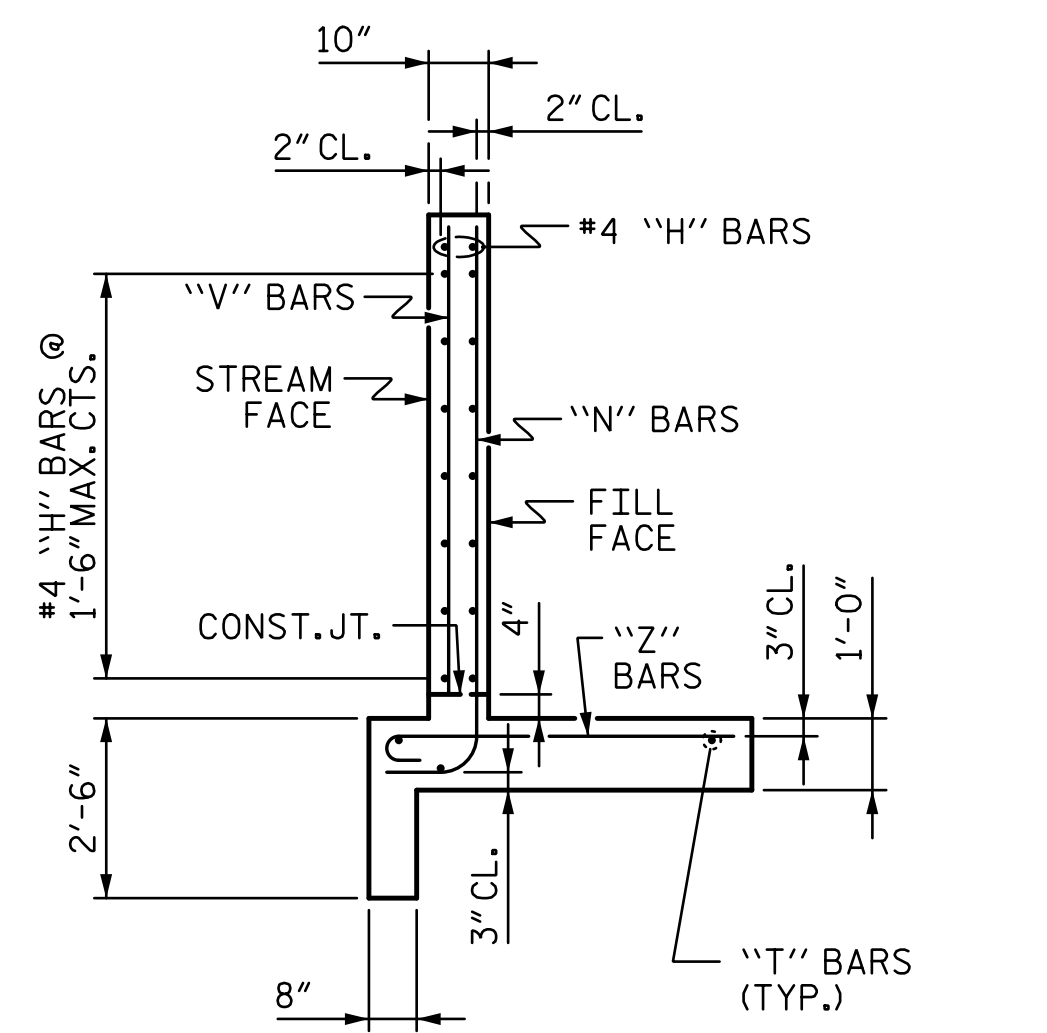
BAR TYPES

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	REINFORCING STEEL FOR 4 WINGS					4,419 LBS
T1	6	#5	STR	39'-9"	249	CLASS A CONCRETE					
T2	6	#5	STR	17'-9"	111	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

◆ INCLUDES WING FOOTINGS



TYPICAL WING SECTION

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

DOCUMENT NOT CONSIDERED FINAL  
 UNLESS ALL SIGNATURES COMPLETED

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

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

REVISIONS

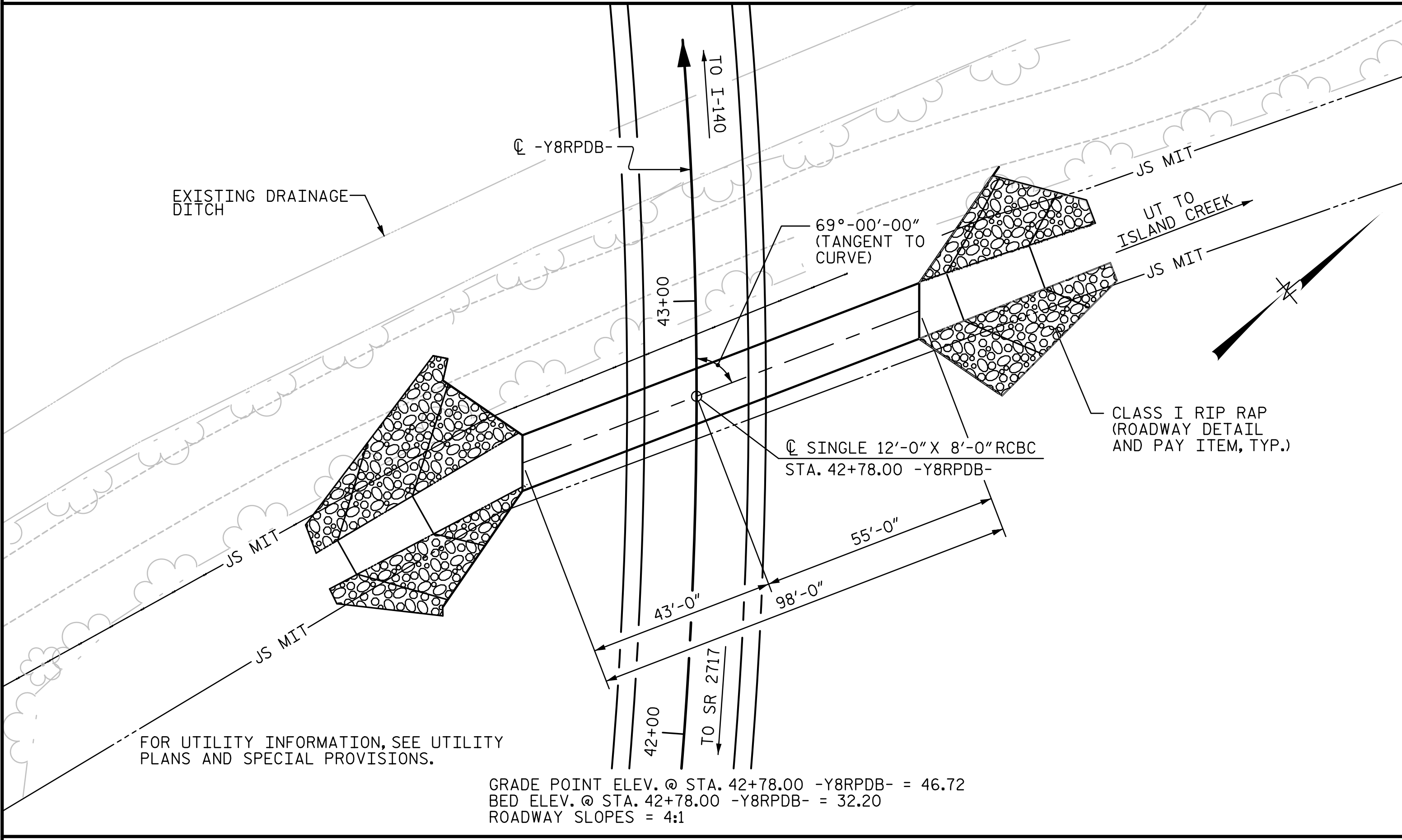
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SHEET NO.  
C3-7

TOTAL SHEETS  
7

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

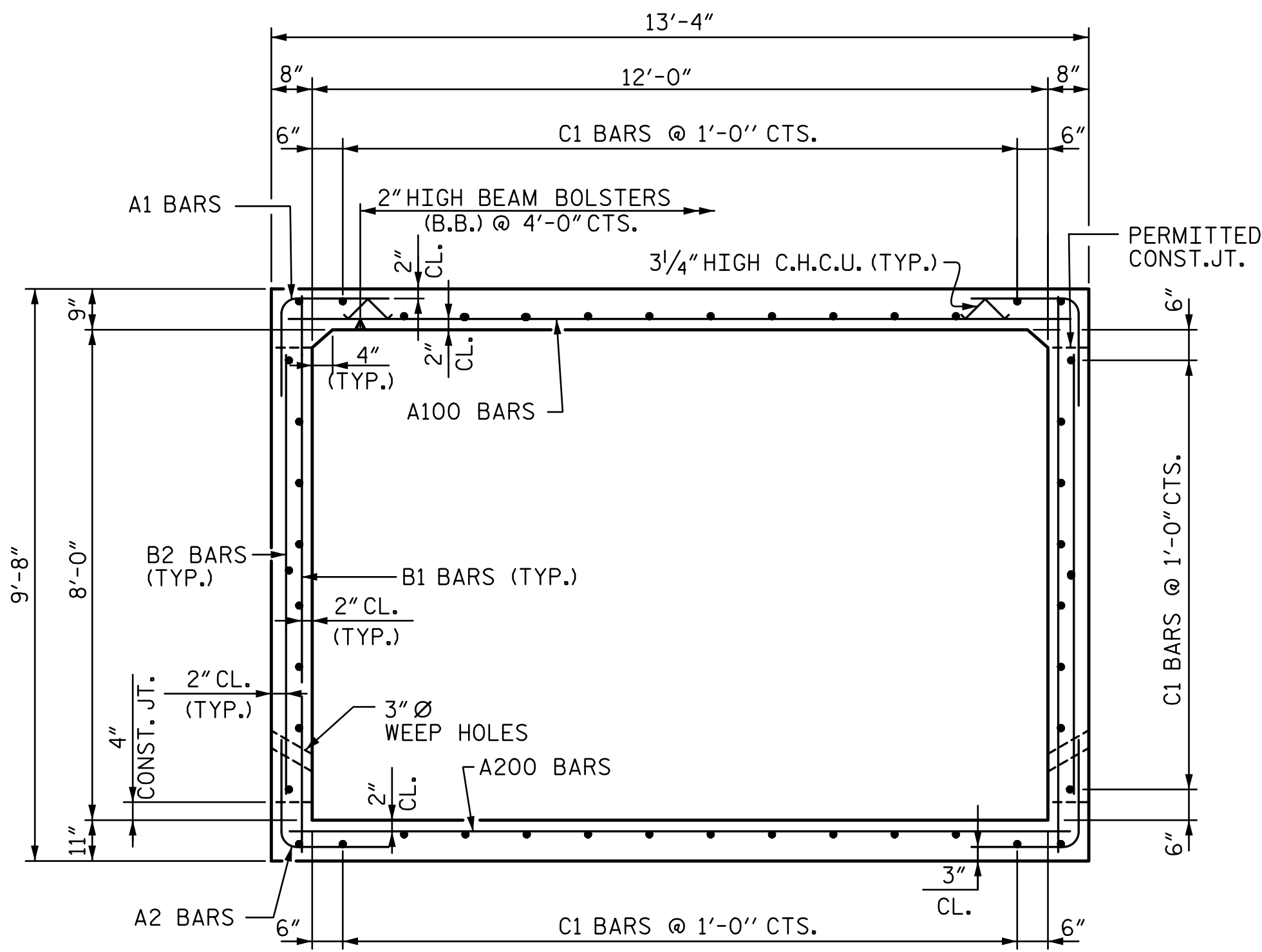
P.I. STA. = 50+39.08 -Y8RPDB-  
 $\Delta = 126^\circ-18'-36.03''$  (LT)  
 RADIUS = 1,060'  
 TANGENT = 2,094.35'  
 LENGTH = 2,336.80'

**TOTAL STRUCTURE QUANTITIES**

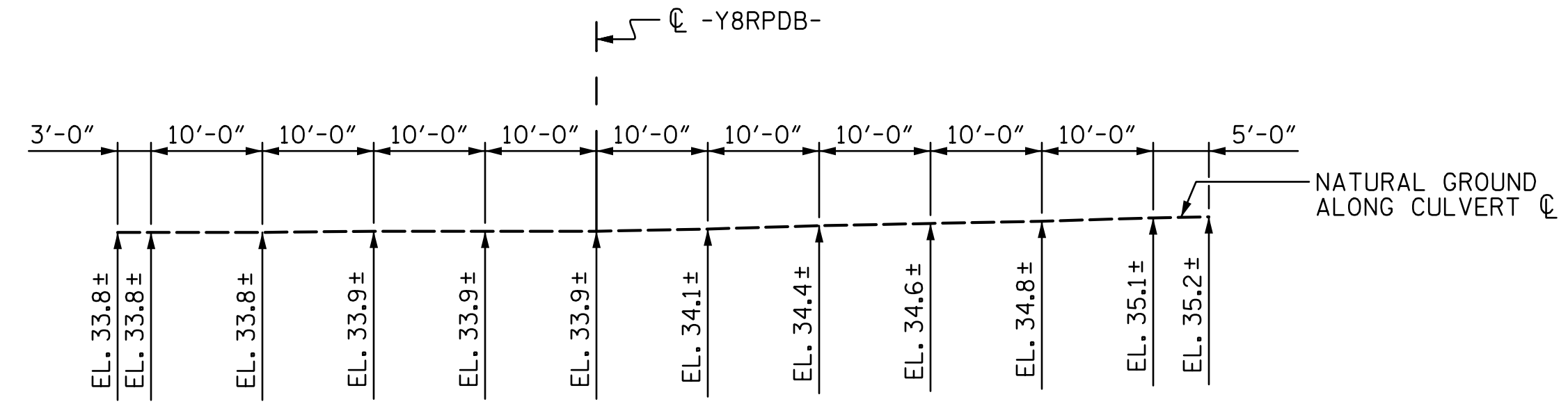
CULVERT EXCAVATION @ STA. 42+78.00 -Y8RPDB-	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	TOTAL: 125 TONS
CLASS A CONCRETE	
BARREL @ 1.222 CU.YDS./FT.	119.8 CU.YDS.
WINGS, ETC.	48.8 CU.YDS.
TOTAL	148.0 CU.YDS.
REINFORCING STEEL	
BARREL	21,906 LBS.
WINGS, ETC.	3,142 LBS.
TOTAL	25,048 LBS.
PLACEMENT OF NATURAL 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  <b>SINGLE 12'-0" X 8'-0" CONCRETE BOX CULVERT</b> 69°-00'-00" SKEW		SHEET NO. C4-1  TOTAL SHEETS 4		
	REVISIONS						
	NO.	BY:	DATE:	NO.		BY:	DATE:
	1			3			
			4				

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

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bcjrry

## 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	13.500		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:**

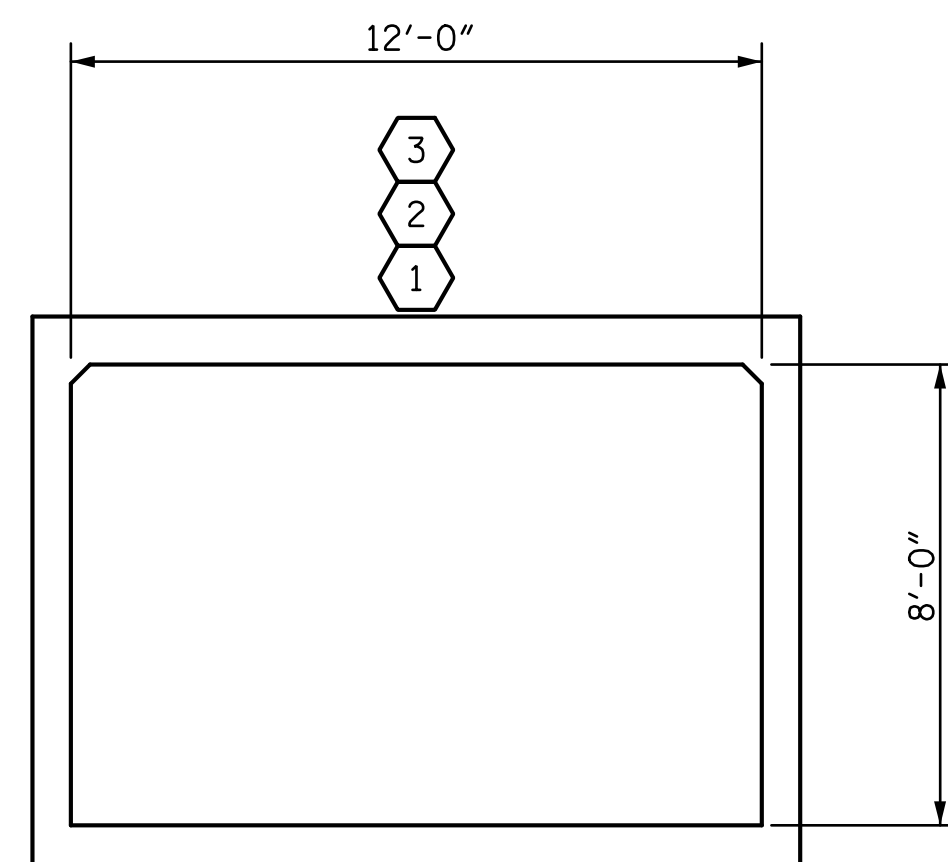
DESIGN LOAD RATING FACTORS

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-

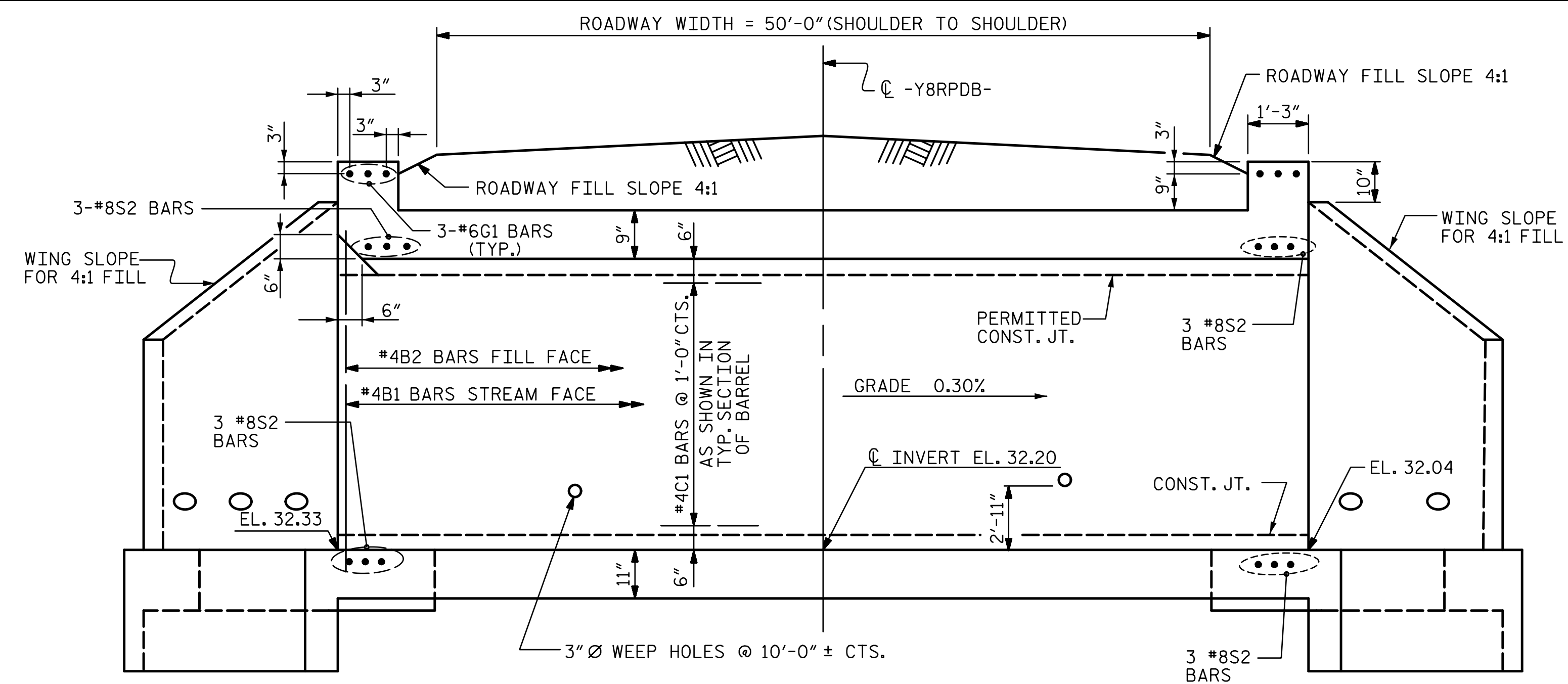
SHEET 2 OF 4

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH  <b>STANDARD LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)</b>																	
		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:														
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2			4																

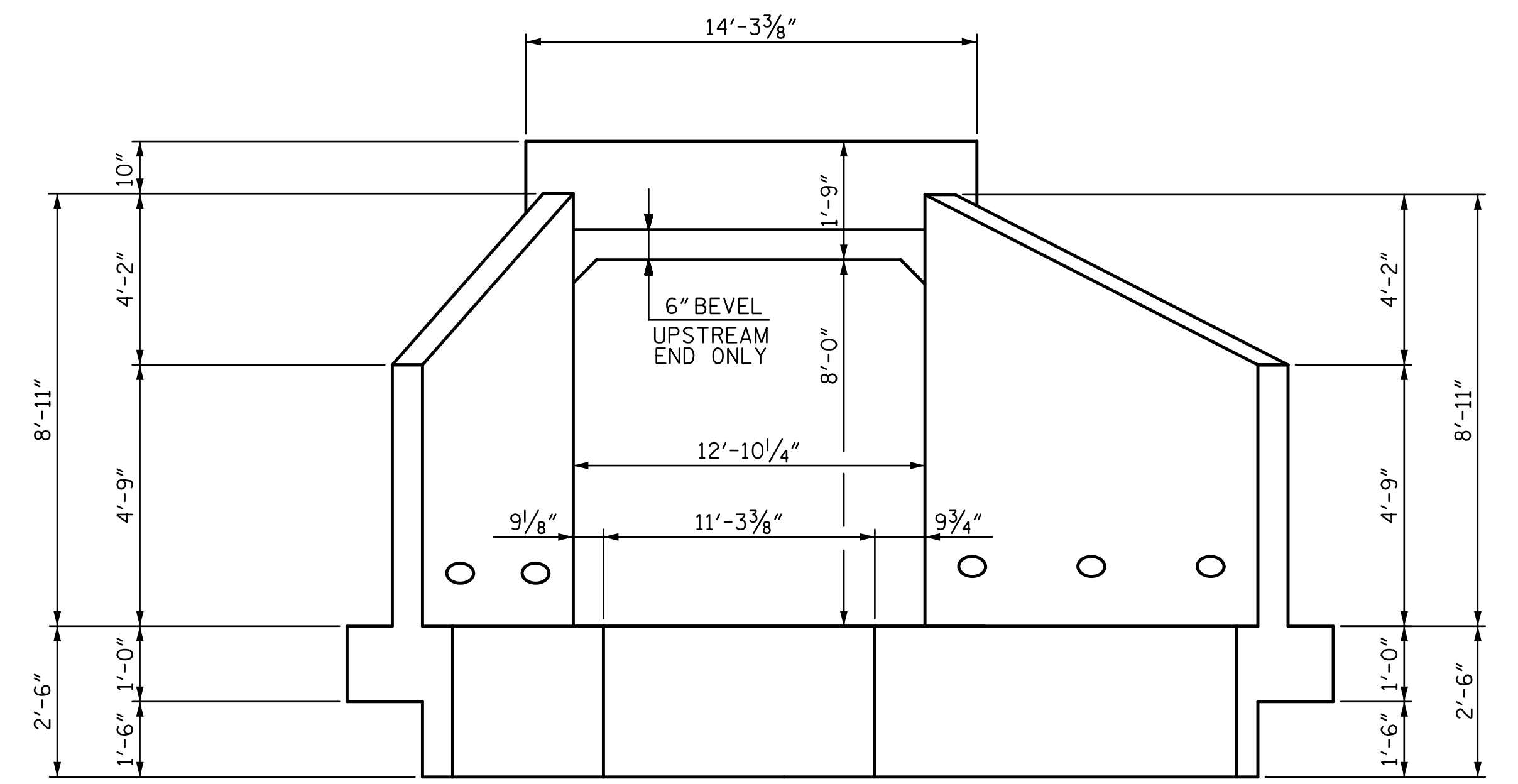
DRAWN BY : <u>LGH</u>	DATE : <u>5-17</u>	DESIGN ENGINEER OF RECORD: <u>J. JONES</u>
CHECKED BY : <u>BMC</u>	DATE : <u>5-17</u>	DATE : <u>5-17</u>

SHEET NO.  
C4-2  
TOTAL SHEETS  
4

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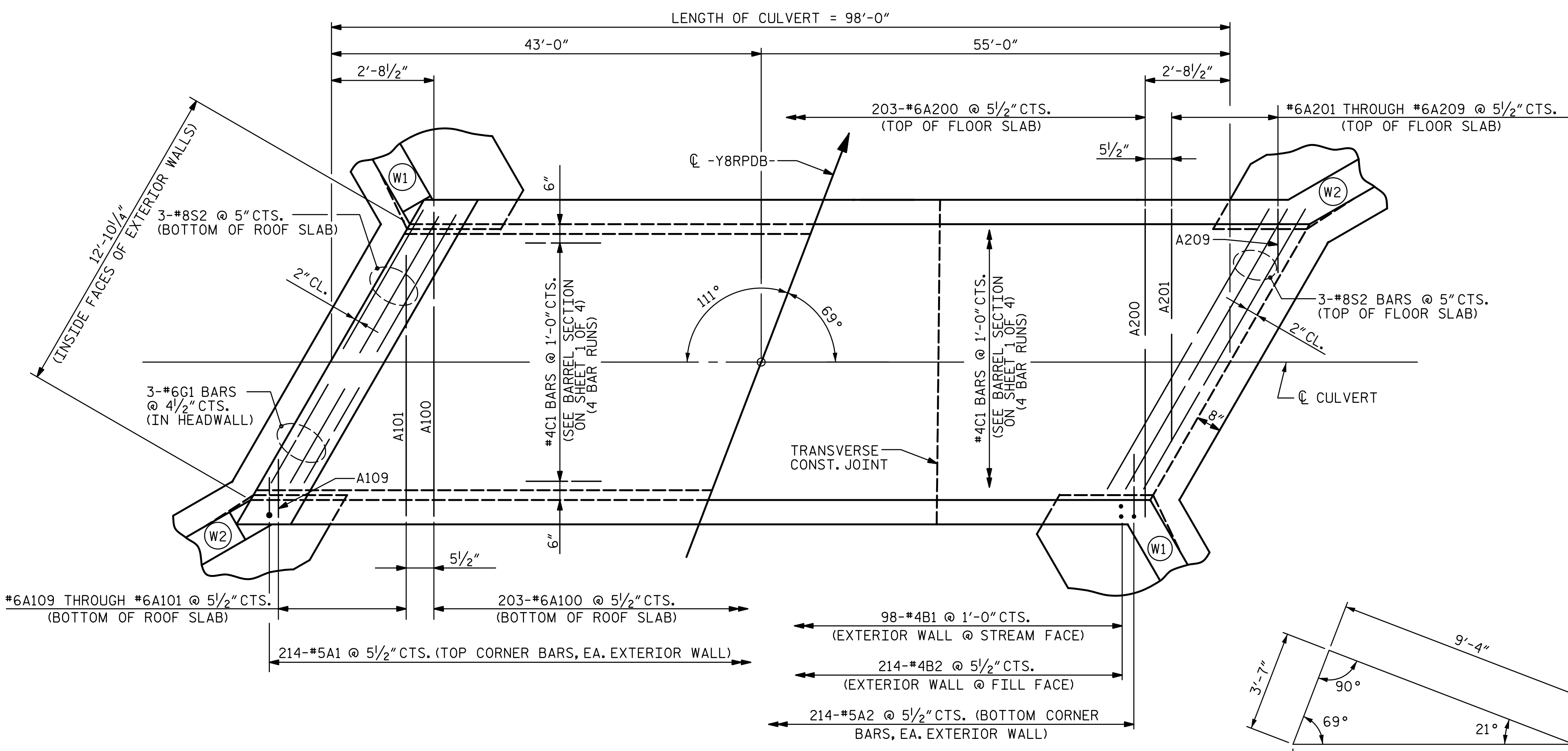


**CULVERT SECTION NORMAL TO ROADWAY**



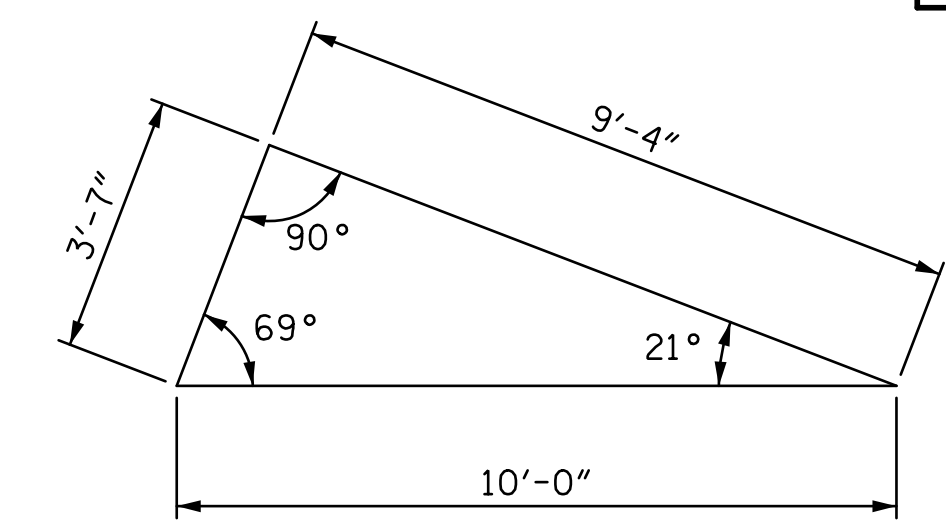
**END ELEVATION NORMAL TO SKEW**

(INLET END SHOWN, OUTLET END SIMILAR)



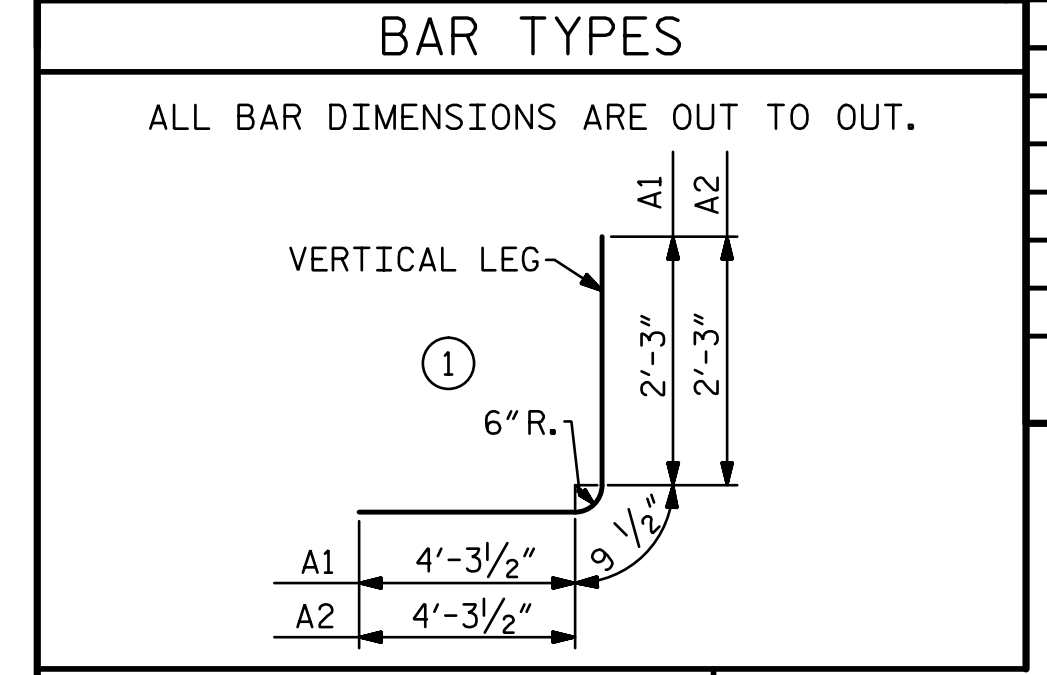
**PART PLAN - ROOF SLAB**

**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	①	7'-4"	3,274	A200	203	#6	STR	13'-0"	3,964
A2	428	#5	①	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
						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  
  
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 Charlotte, NC 28202  
 NC License Number F-5991

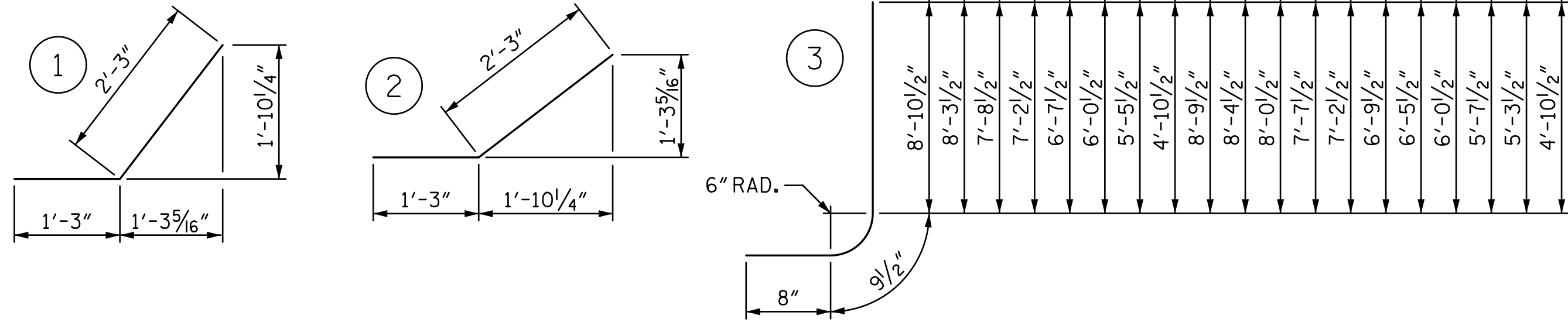
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
SINGLE 12'-0" X 8'-0" CONCRETE BOX CULVERT 69°-00'-00" SKEW					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO.	
C4-3	TOTAL SHEETS 4

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

### BAR TYPES

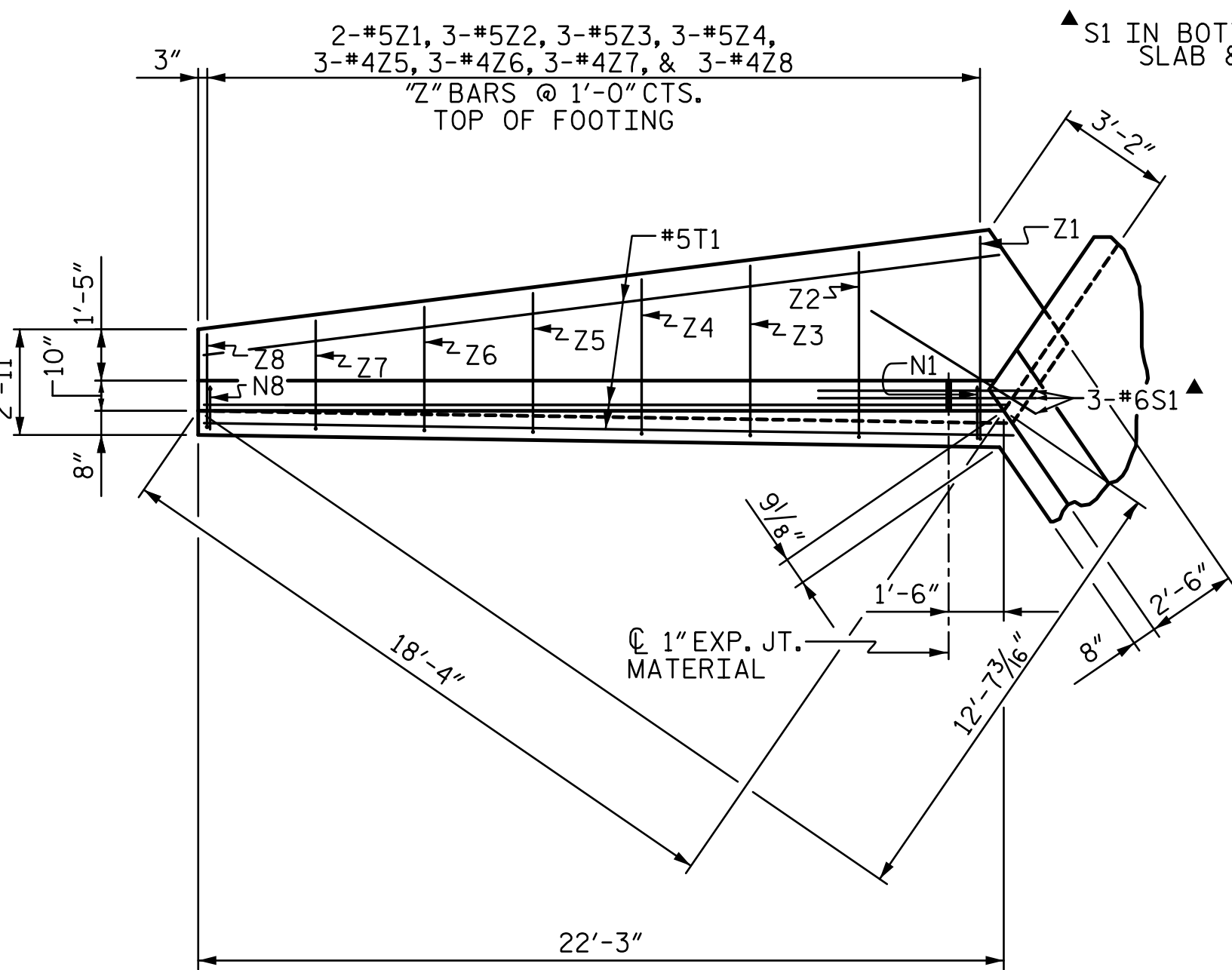
ALL BAR DIMENSIONS ARE OUT TO OUT.



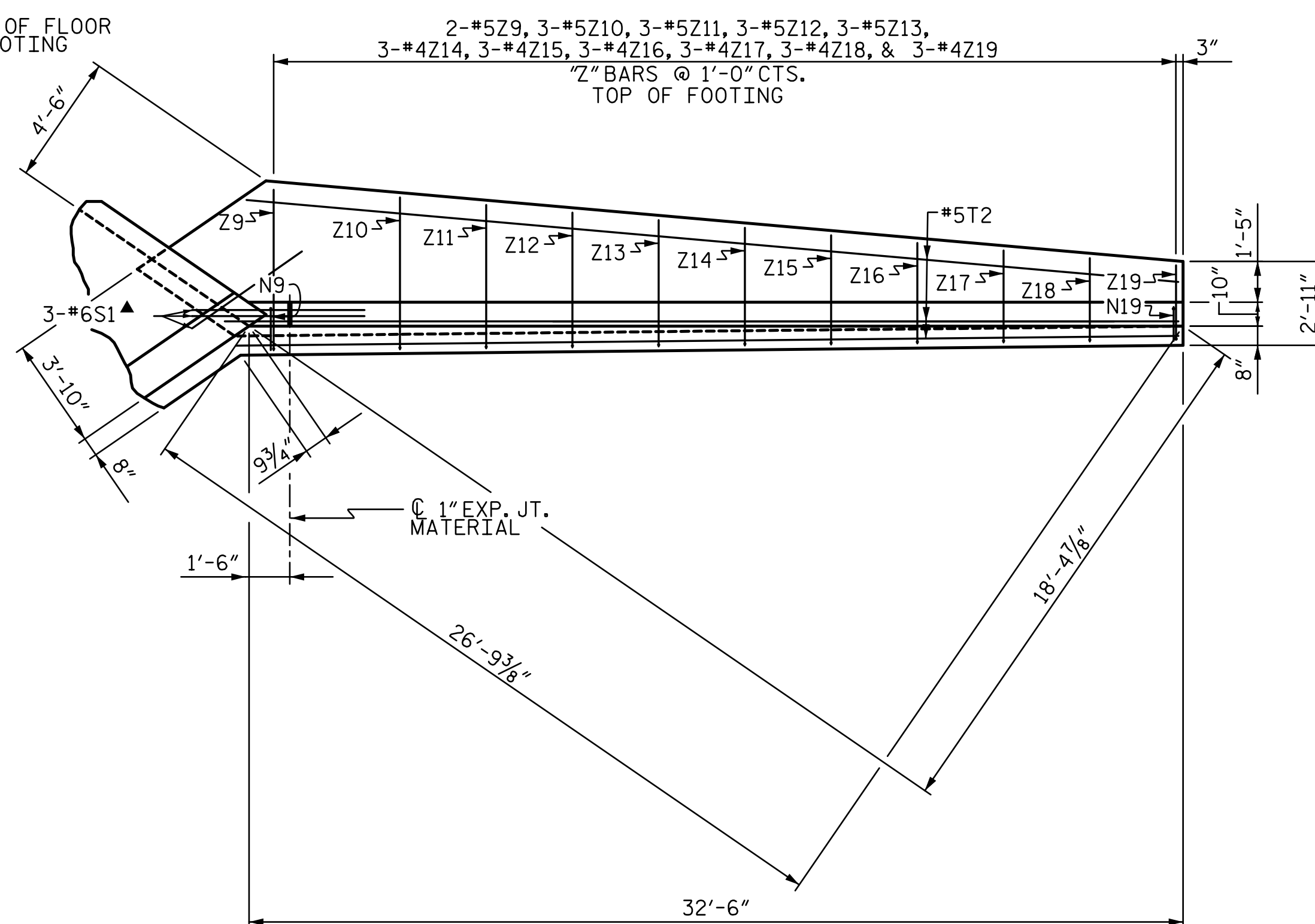
### BILL OF MATERIAL

BAR NO.	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	20'-4"	163
H2	4	#4	STR	18'-4"	49
H3	4	#4	STR	10'-5"	28
H4	24	#4	①	3'-6"	56
H5	4	#4	STR	20'-8"	55
H6	12	#5	STR	30'-7"	383
H7	4	#4	STR	27'-7"	74
H8	4	#4	STR	16'-1"	43
H9	4	#4	STR	4'-7"	12
H10	24	#4	②	3'-6"	56
H11	4	#5	STR	30'-10"	129
N1	4	#5	③	10'-4"	43
N2	6	#5	③	9'-9"	61
N3	6	#5	③	9'-2"	57
N4	6	#5	③	8'-8"	54
N5	6	#4	③	8'-1"	32
N6	6	#4	③	7'-6"	30
N7	6	#4	③	6'-11"	28
N8	6	#4	③	6'-4"	25
N9	6	#5	③	10'-3"	64
N10	6	#5	③	9'-10"	62
N11	6	#5	③	9'-6"	59
N12	6	#5	③	9'-1"	57
N13	6	#5	③	8'-8"	54
N14	6	#4	③	8'-3"	33
N15	6	#4	③	7'-11"	32
N16	6	#4	③	7'-6"	30
N17	6	#4	③	7'-1"	28
N18	6	#4	③	6'-9"	27
N19	6	#4	③	6'-4"	25
S1	12	#6	STR	6'-0"	108
T1	6	#4	STR	21'-11"	88
T2	6	#5	STR	32'-1"	201
V1	4	#4	STR	8'-3"	22
V2	6	#4	STR	7'-8"	31
V3	6	#4	STR	7'-1"	28
V4	6	#4	STR	6'-7"	26
V5	6	#4	STR	6'-0"	24
V6	6	#4	STR	5'-5"	22
V7	6	#4	STR	4'-10"	19
V8	6	#4	STR	4'-3"	17
V9	6	#4	STR	8'-2"	33
V10	6	#4	STR	7'-9"	31
V11	6	#4	STR	7'-5"	30
V12	6	#4	STR	7'-0"	28
V13	6	#4	STR	6'-7"	26
V14	6	#4	STR	6'-2"	25
V15	6	#4	STR	5'-10"	23
V16	6	#4	STR	5'-5"	22
V17	6	#4	STR	5'-0"	20
V18	6	#4	STR	4'-8"	19
V19	6	#4	STR	4'-3"	17
Z1	4	#5	④	6'-1"	25
Z2	6	#5	④	5'-8"	35
Z3	6	#5	④	5'-3"	33
Z4	6	#5	④	4'-10"	30
Z5	6	#4	④	4'-4"	17
Z6	6	#4	④	3'-11"	16
Z7	6	#4	④	3'-6"	14
Z8	6	#4	④	3'-1"	12
Z9	4	#5	④	6'-1"	25
Z10	6	#5	④	5'-10"	37
Z11	6	#5	④	5'-6"	34
Z12	6	#5	④	5'-3"	33
Z13	6	#5	④	4'-11"	31
Z14	6	#4	④	4'-7"	18
Z15	6	#4	④	4'-3"	17
Z16	6	#4	④	3'-11"	16
Z17	6	#4	④	3'-8"	15
Z18	6	#4	④	3'-4"	13
Z19	6	#4	④	3'-1"	12

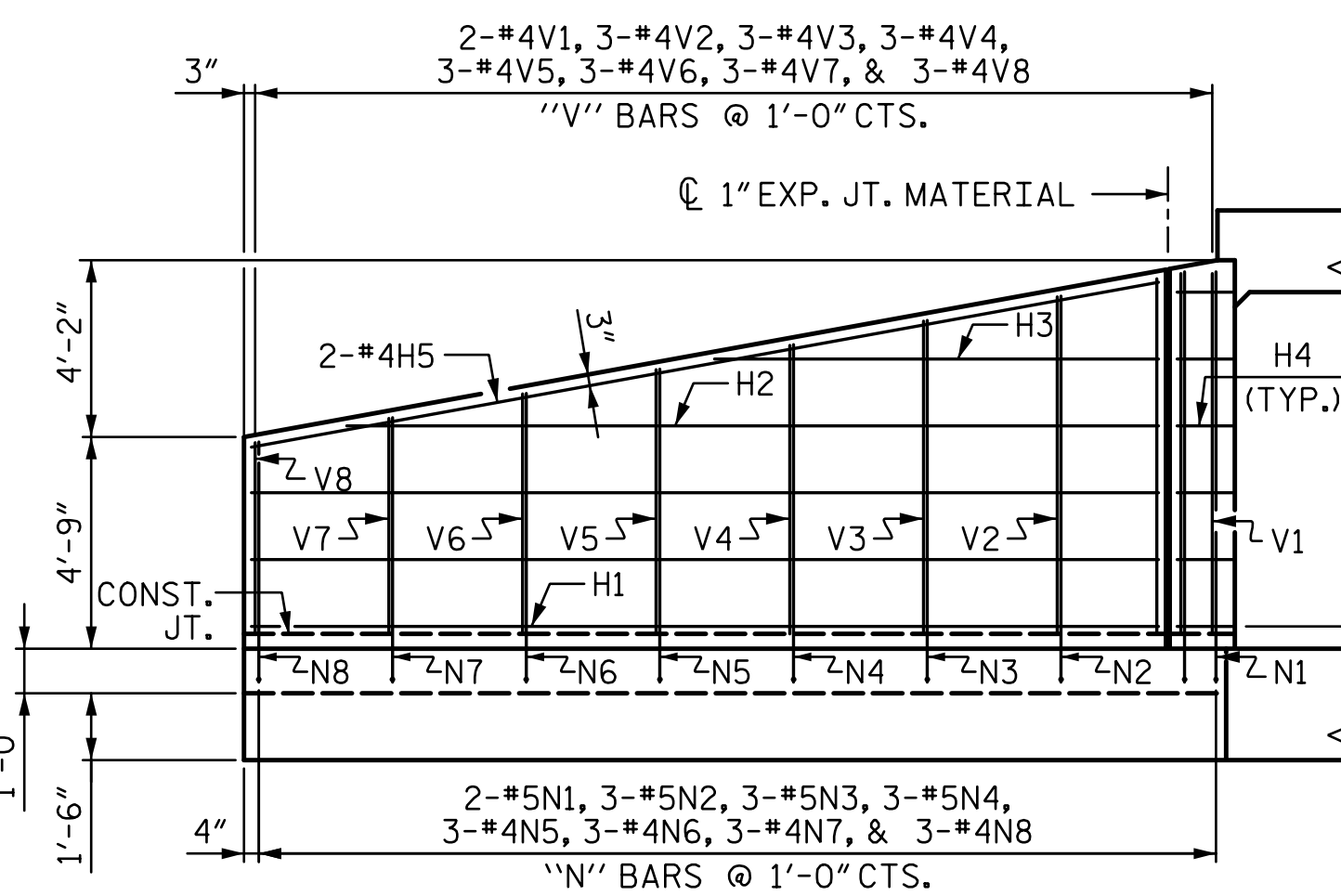
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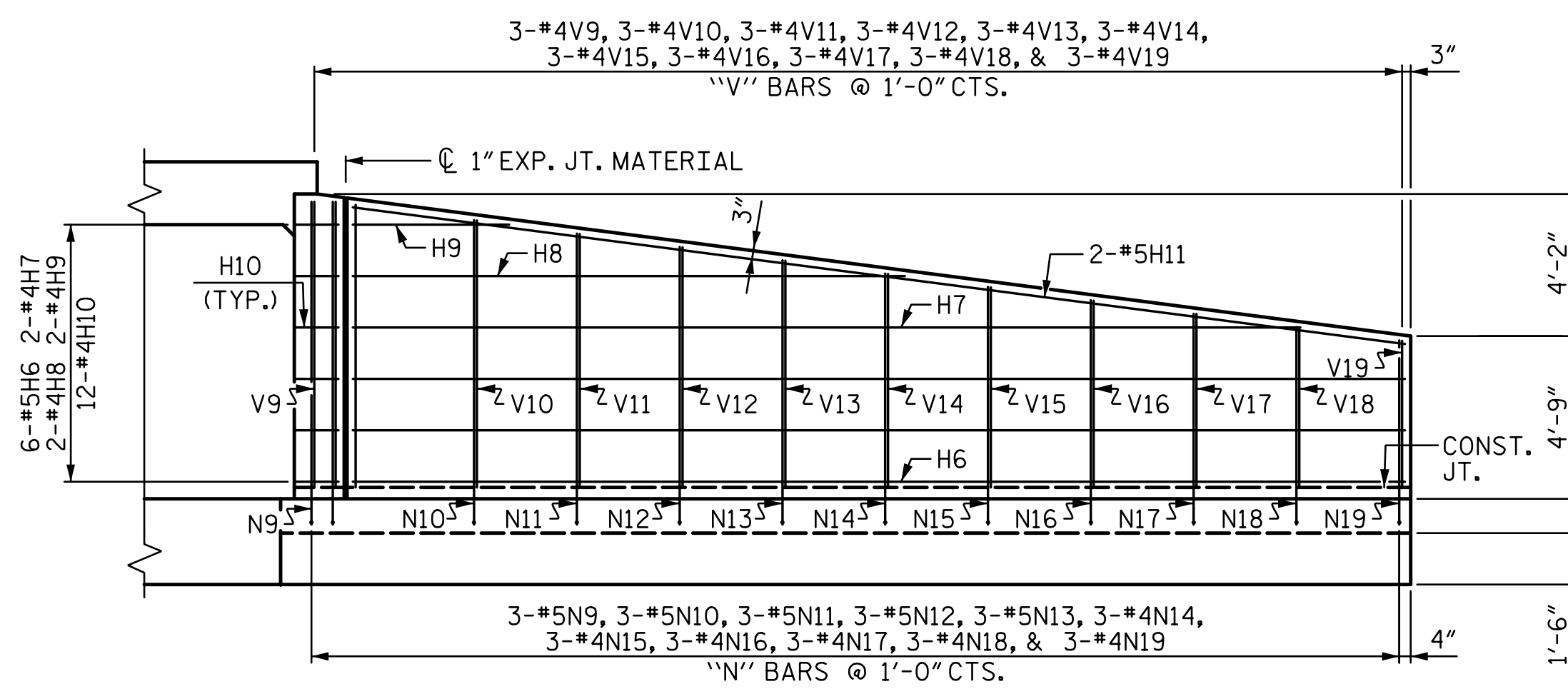
PLAN W1



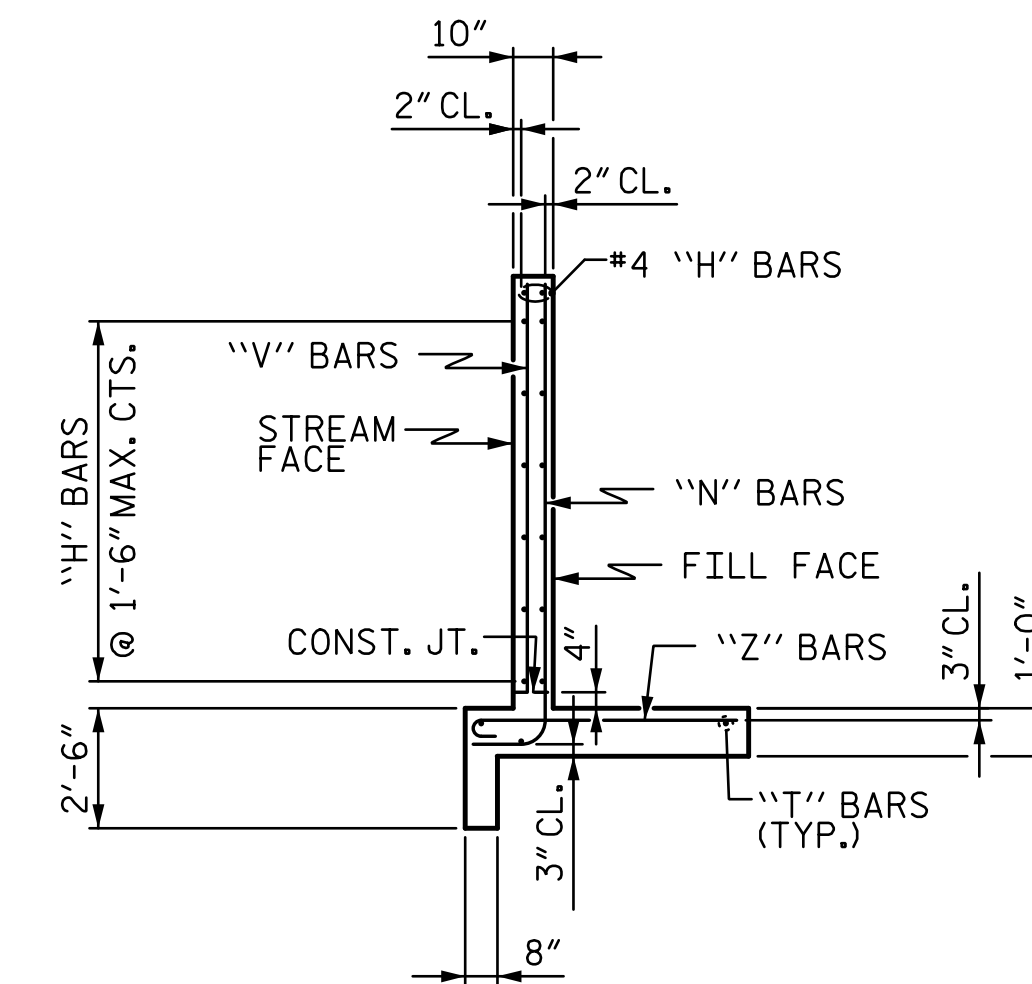
PLAN W2



ELEVATION W1



ELEVATION W2



TYPICAL WING SECTION

REINFORCING STEEL FOR 4 WINGS		3,142
CLASS A CONCRETE		
4 WINGS		22.0 CY
2 HEADWALLS		1.3 CY
2 END CURTAIN WALLS		25.5 CY
TOTAL		48.8 CY

◆ INCLUDES WING FOOTINGS

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

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

SINGLE 12'-0" X 8'-0" CONCRETE BOX CULVERT  
69°-00'-00" SKEW

7/12/2017

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

REVISIONS			
NO.	BY:	DATE:	DESCRIPTION:
1			
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SHEET NO. C4-4  
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