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BENCHMARK #11: RR SPIKE IN BASE OF 30" POPLAR, STA. 213+81.00 -BL-, 278' LT.; STA. 205+33.57 -L-, 277.01' LT., EL. 601.79

F.A. PROJECT NO.: STP-0119(11)

NOTES

ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.

DESIGN FILL----- 14.02'

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 ROOF SLAB AND HEADWALLS.

THE BOTTOM OF THE CULVERT WILL BE AT OR NEAR THE ROCK LINE. UP TO 1 FT. OF ROCK EXCAVATION WILL BE REQUIRED BENEATH THE PROPOSED CULVERT. USE A 12 IN. BLANKET OF FOUNDATION CONDITIONING MATERIAL BELOW THE PROPOSED CULVERT. SEE SECTION 414 OF THE STANDARD SPECIFICATIONS.

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.

TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE 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 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.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE BARS FROM WHICH THE SAMPLES ARE TAKEN MUST THEN BE SPLICED WITH REPLACEMENT BARS OF THE SIZE AND LENGTH OF THE SAMPLE, PLUS A MINIMUM LAP SPLICE OF THIRTY BAR DIAMETERS. PAYMENT FOR THE SAMPLES OF REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

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.

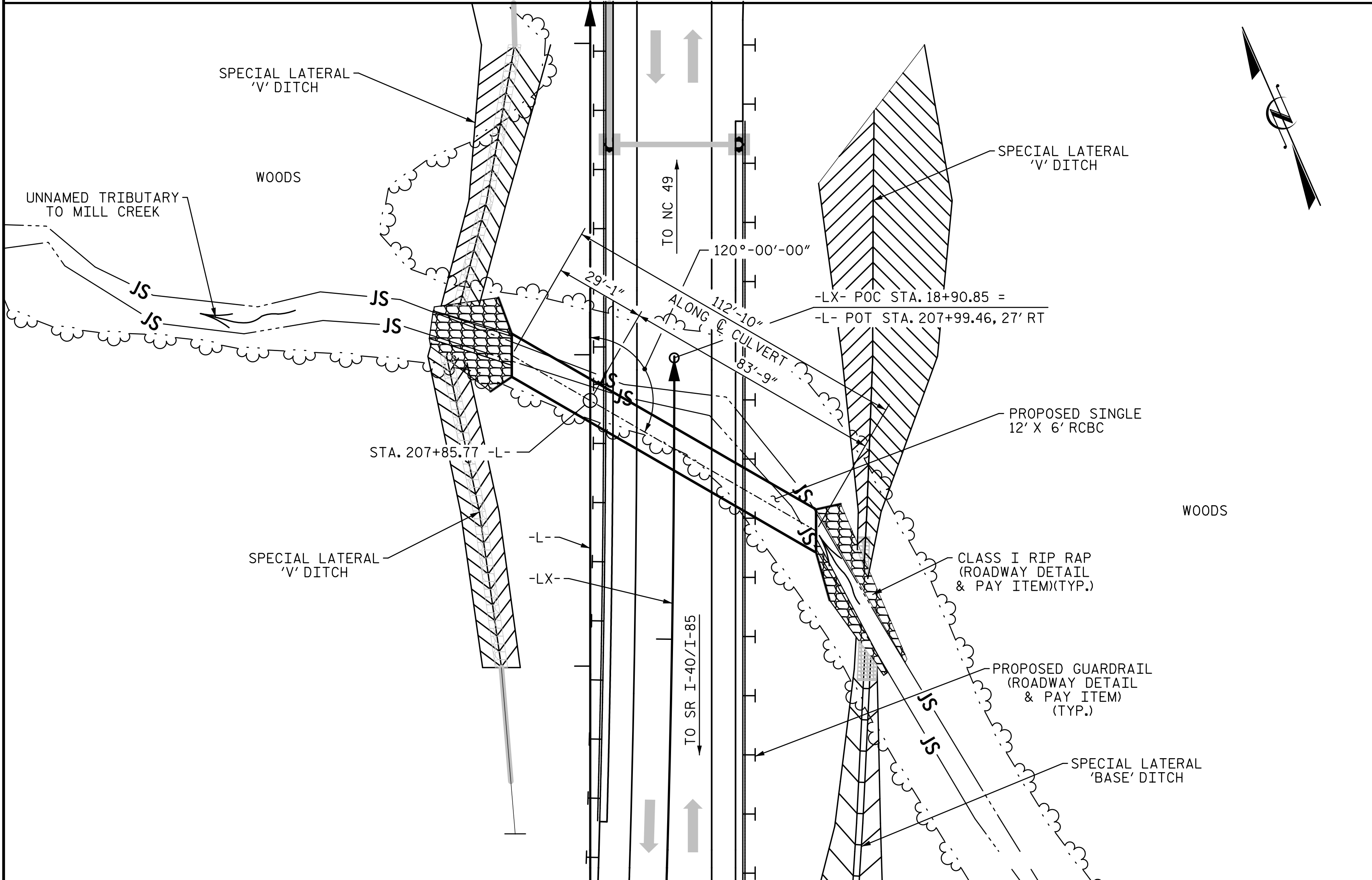
FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

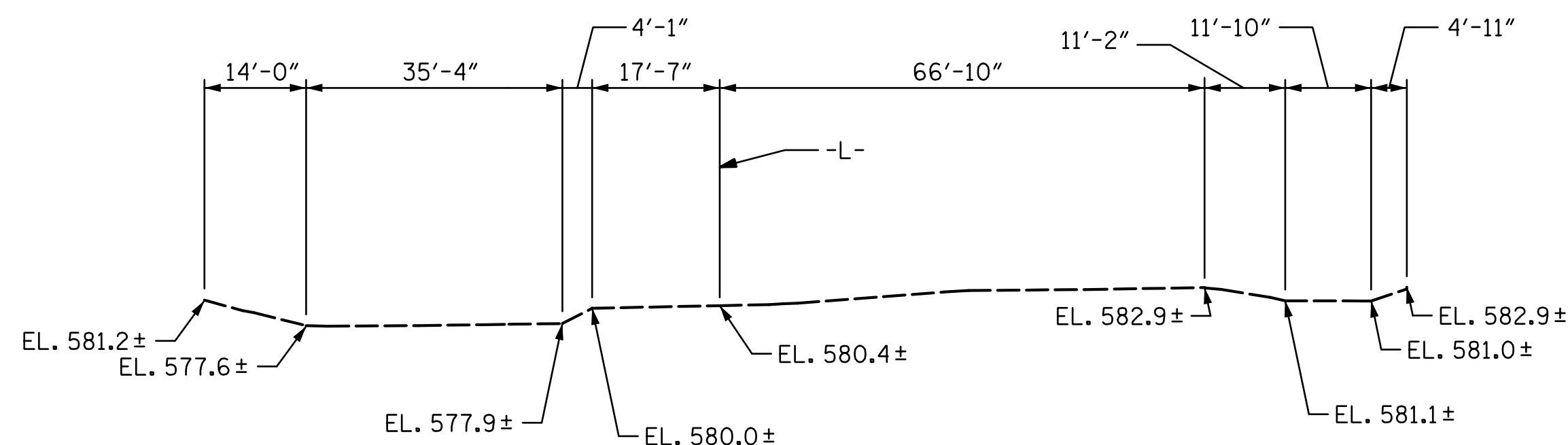
FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.



LOCATION SKETCH



PROFILE ALONG CULVERT

HYDRAULIC DATA

DESIGN DISCHARGE	= 420 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YEARS
DESIGN HIGH WATER ELEVATION	= 586.0
DRAINAGE AREA	= 0.47 SQ. MI.
BASE DISCHARGE(Q100)	= 470 CFS
BASE HIGH WATER ELEVATION	= 586.50

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= N/A
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 595.2

ROADWAY GRADE DATA

GRADE POINT ELEV. (15' RT.) @ STA. 207+85.77 -L-	= 597.27'
BED ELEV. @ STA. 207+85.77 -L-	= 577.73'
ROADWAY SLOPES	= 2:1

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE	
BARREL @ 1.471 CY/FT	166.0 C.Y.
WING ETC.	18.5 C.Y.
SILLS AND BAFFLES	3.6 C.Y.
TOTAL	188.1 C.Y.
REINFORCING STEEL	
BARREL	38,485 LBS.
WINGS ETC.	1,050 LBS.
TOTAL	39,535 LBS.
FOUNDATION COND. MAT'L.	141 TONS
CULVERT EXCAVATION	LUMP SUM

PROJECT NO. U-3109B  
 ALAMANCE COUNTY  
 STATION: 207+85.77 -L-

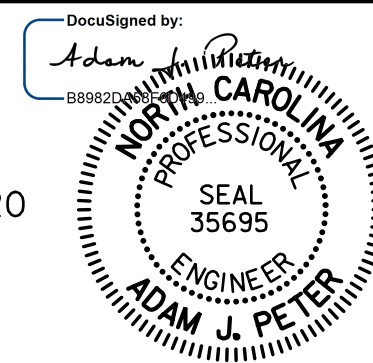
SHEET 1 OF 5

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 BARREL STANDARD  
 SINGLE 12 FT. X 6 FT.  
 CONCRETE BOX CULVERT  
 120° SKEW



5950 FAIRVIEW ROAD, SUITE 320  
 CHARLOTTE, NC 28210  
 (704) 332-2289

NC LICENSE NO. C-2213



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

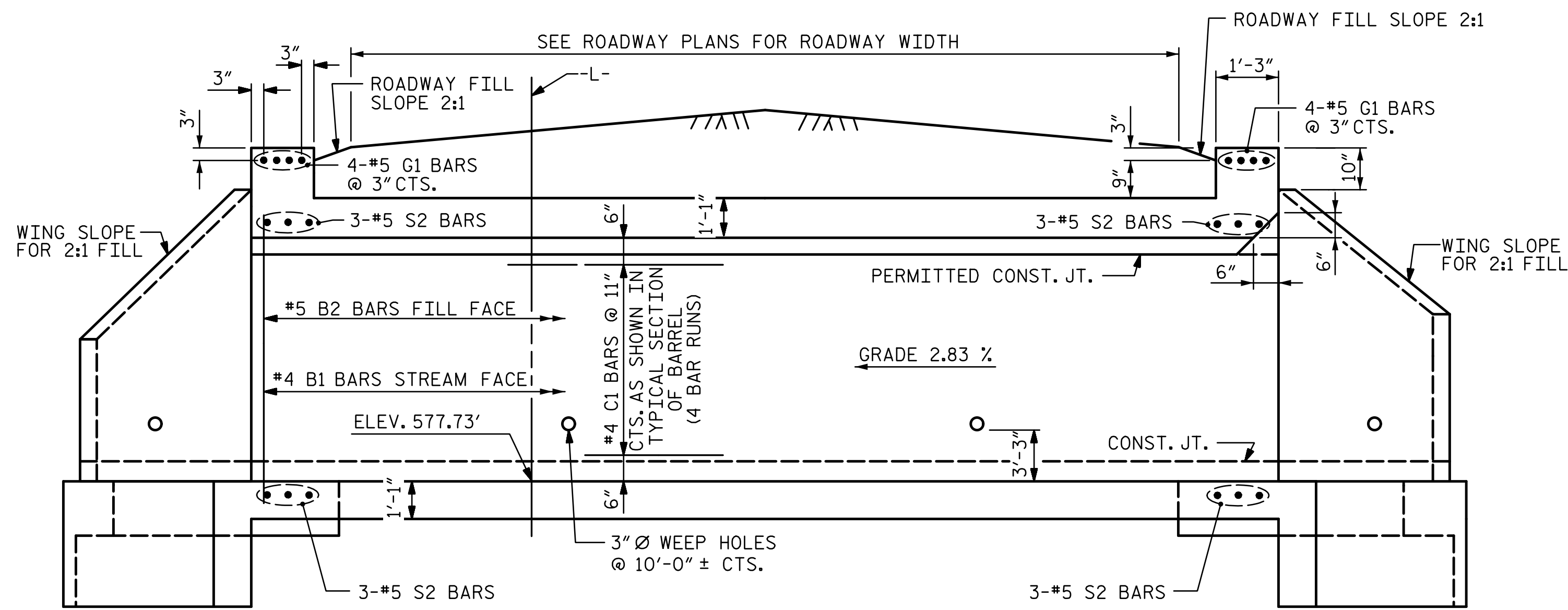
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STD. NO. CB331A

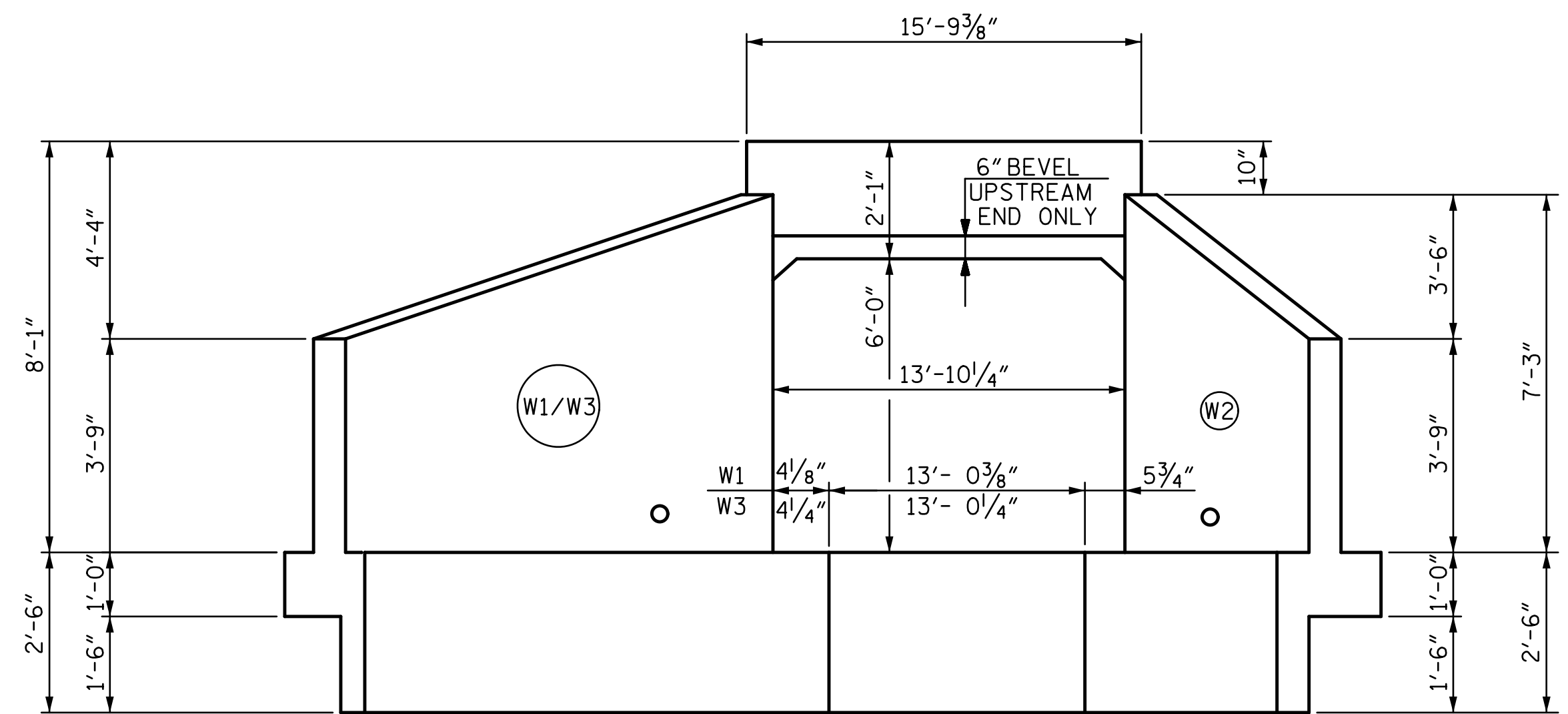
DRAWN BY: B.M. MEYERS	DATE: AUG. 1989	STANDARD
CHECKED BY: A.R. BISSETTE	DATE: AUG. 1989	
DRAWN BY: CANDY A. BUNDY, P.E.	DATE: 05/2018	DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED
CHECKED BY: ADAM J. PETER, P.E.	DATE: 05/2018	
DESIGN ENGINEER OF RECORD: ADAM J. PETER, P.E.	DATE: 05/2018	

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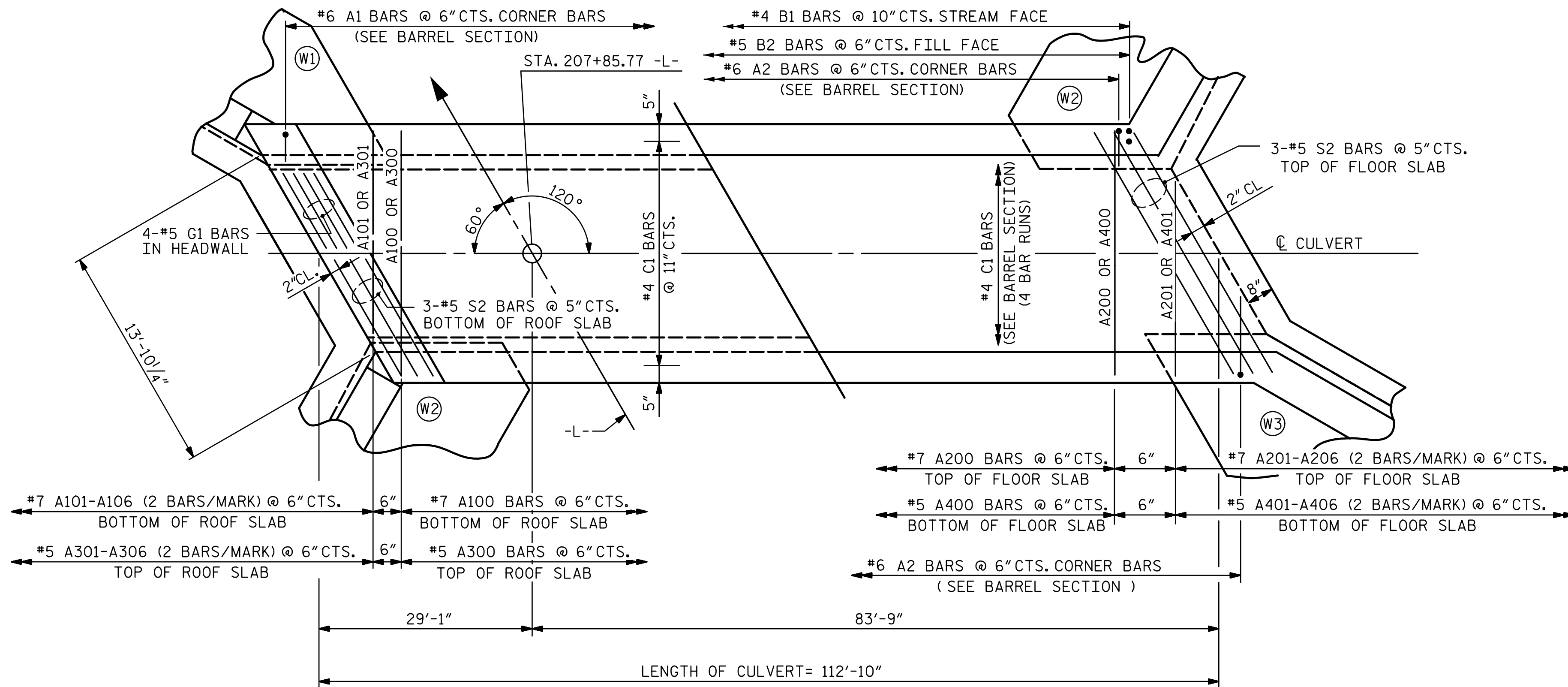
REVISED 11-13-91 BY E.L.R. CHECKED BY G.R.P.  
 ADDED 8-22-89



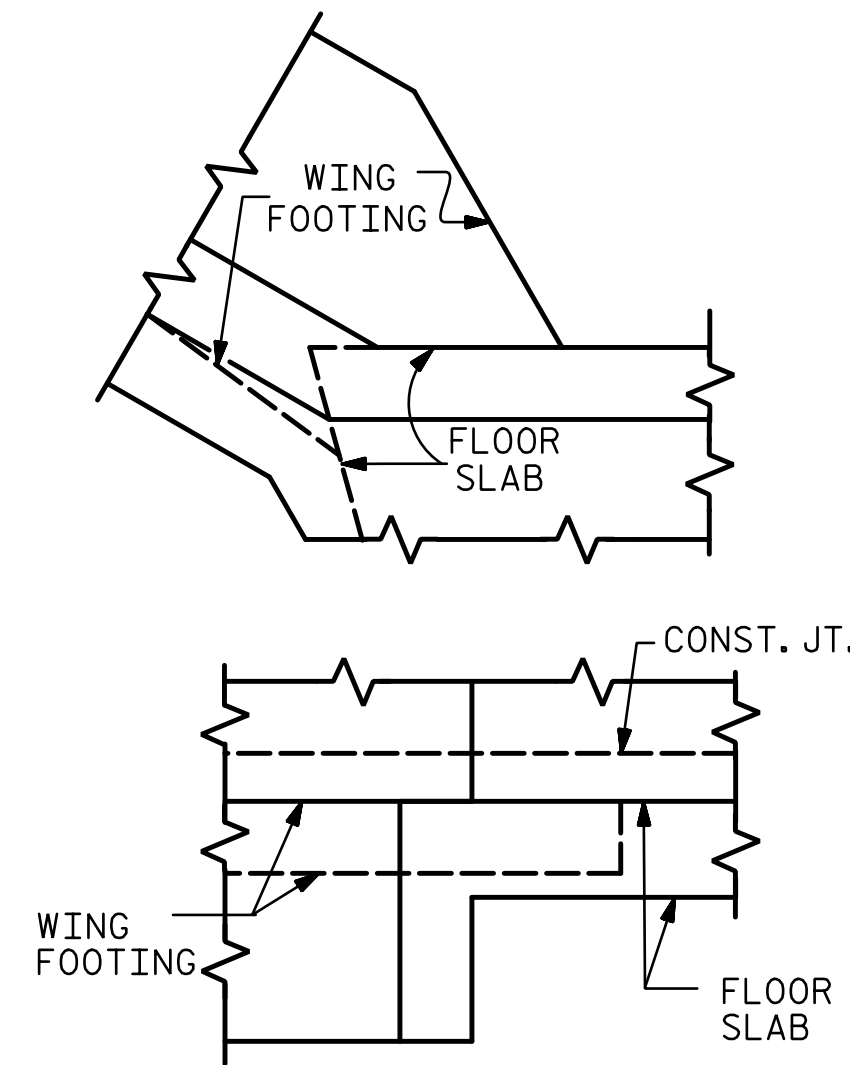
**CULVERT SECTION NORMAL TO ROADWAY**



**END ELEVATION NORMAL TO SKEW**



**PART PLAN - ROOF SLAB      PART PLAN - FLOOR SLAB**



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

PROJECT NO. U-3109B  
ALAMANCE COUNTY  
 STATION: 207+85.77 -L-

SHEET 2 OF 5

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 BARREL STANDARD  
 SINGLE 12 FT. X 6 FT.  
 CONCRETE BOX CULVERT  
 120° SKEW

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

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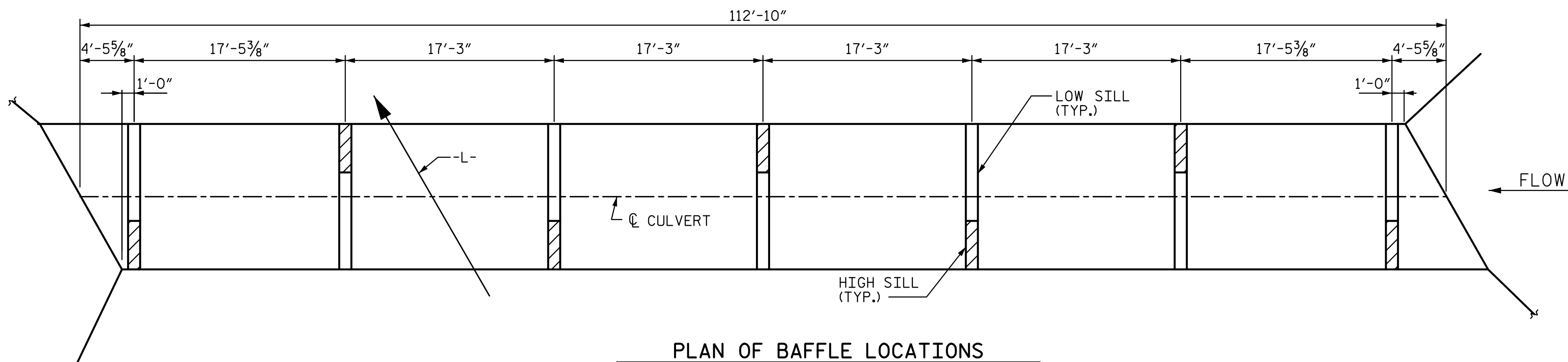
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 DESIGN ENGINEER OF RECORD: ADAM J. PETER, P.E.      DATE : 05/2018

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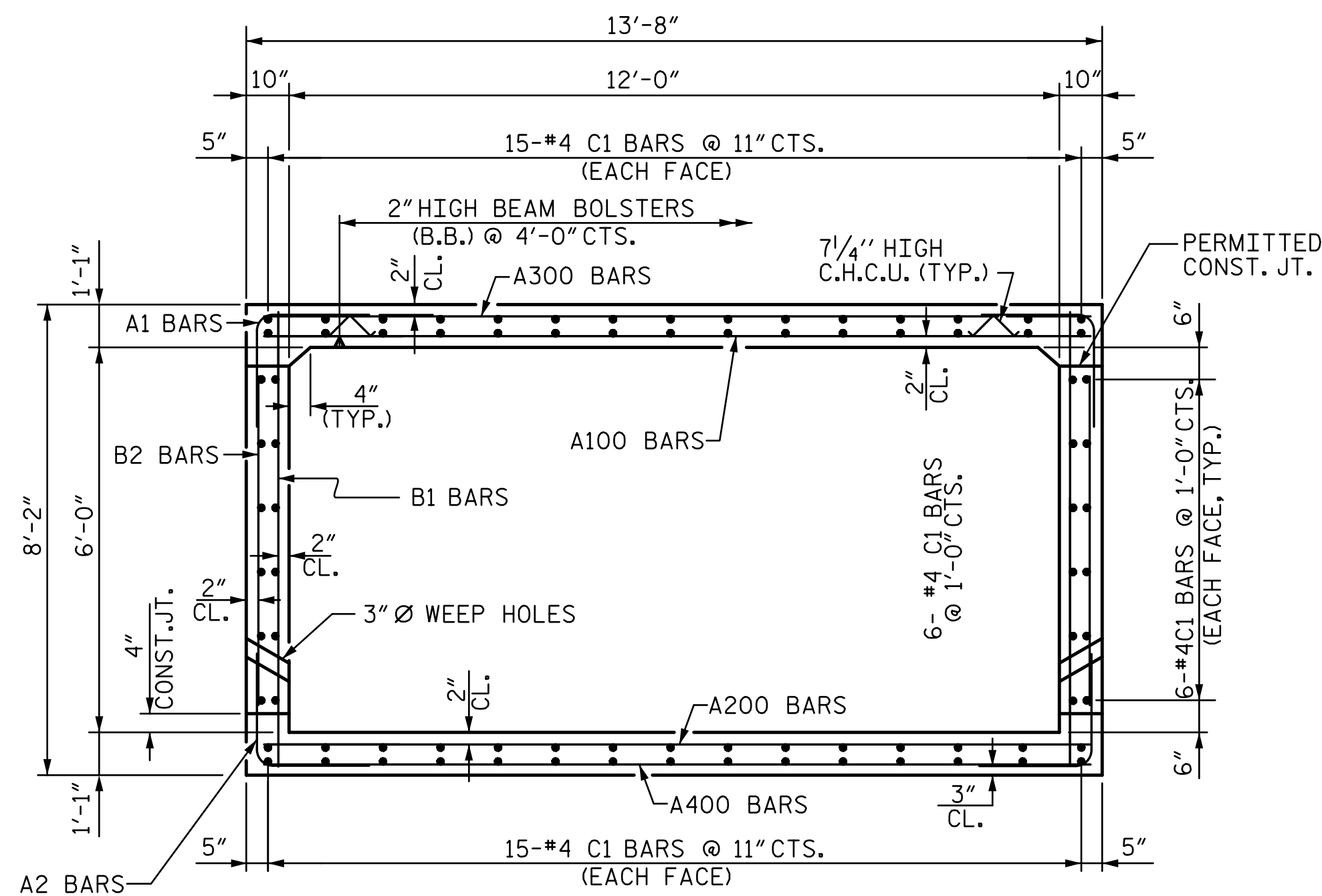
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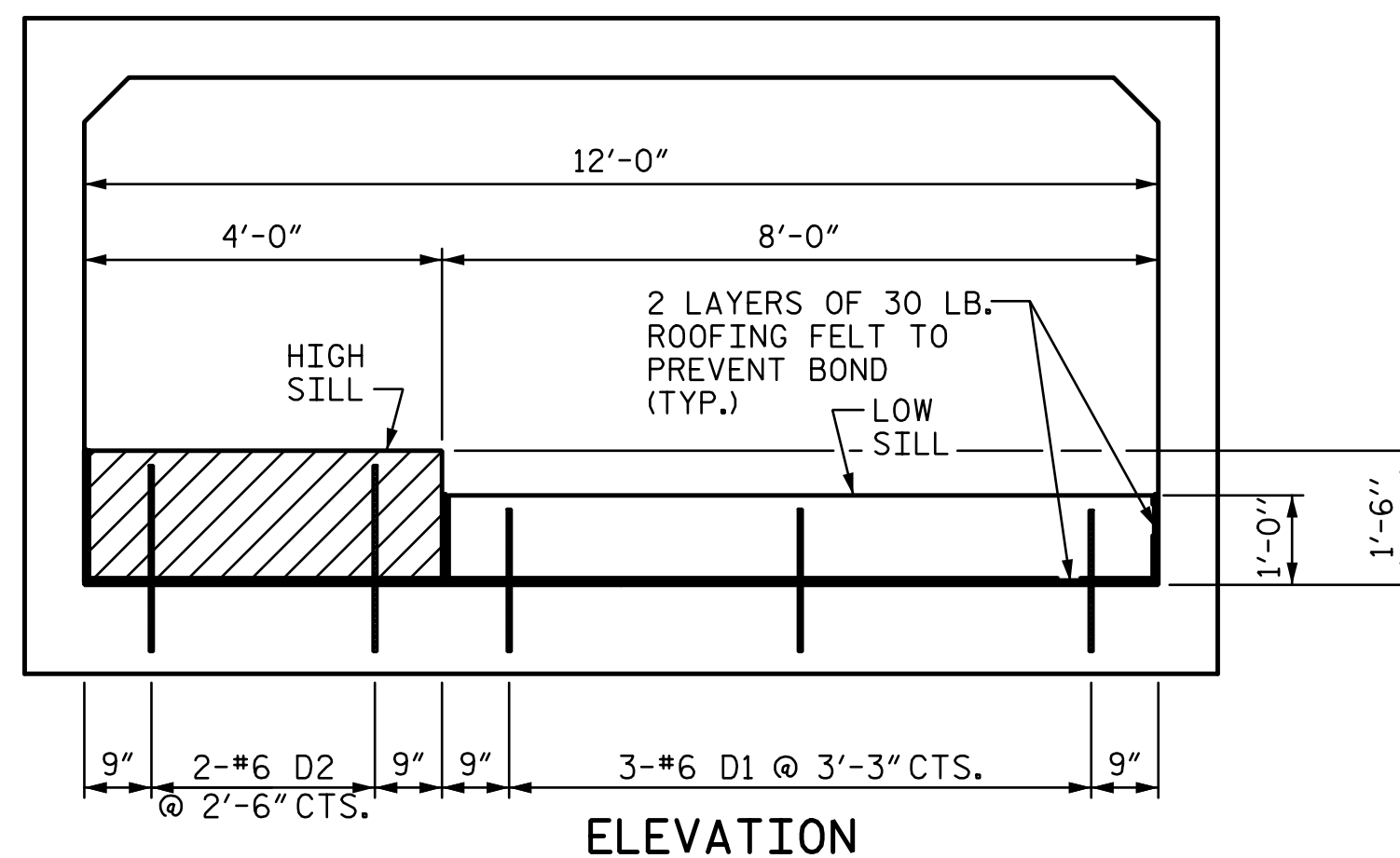
STD. NO. CB331



PLAN OF BAFFLE LOCATIONS



RIGHT ANGLE SECTION OF BARREL  
THERE ARE 84 C1 BARS IN SECTION OF BARREL  
(4 BAR RUNS)



ELEVATION

CULVERT BAFFLE DETAILS

ALTERNATE HIGH SIDE OF BAFFLE ALONG CULVERT LENGTH, BEGIN AT UPSTREAM OPENING.

NOTES:

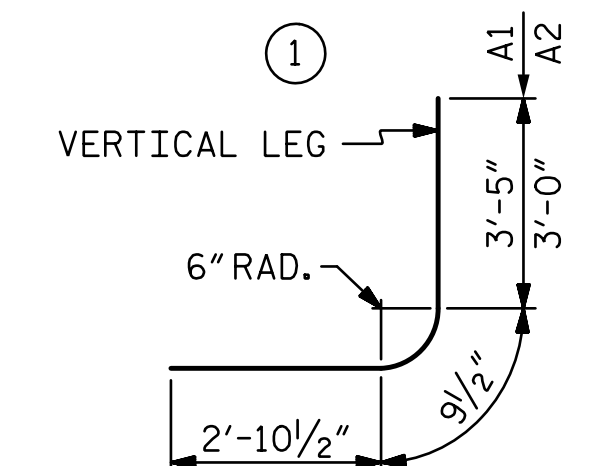
BED MATERIAL BETWEEN BAFFLES IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL.

THE BED MATERIAL SHALL BE NATIVE MATERIAL WHICH 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 MAYBE SUBJECT TO PERMIT CONDITIONS.

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

CLASS B RIP RAP MAY BE USED TO SUPPLEMENT NATIVE MATERIAL. NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE.

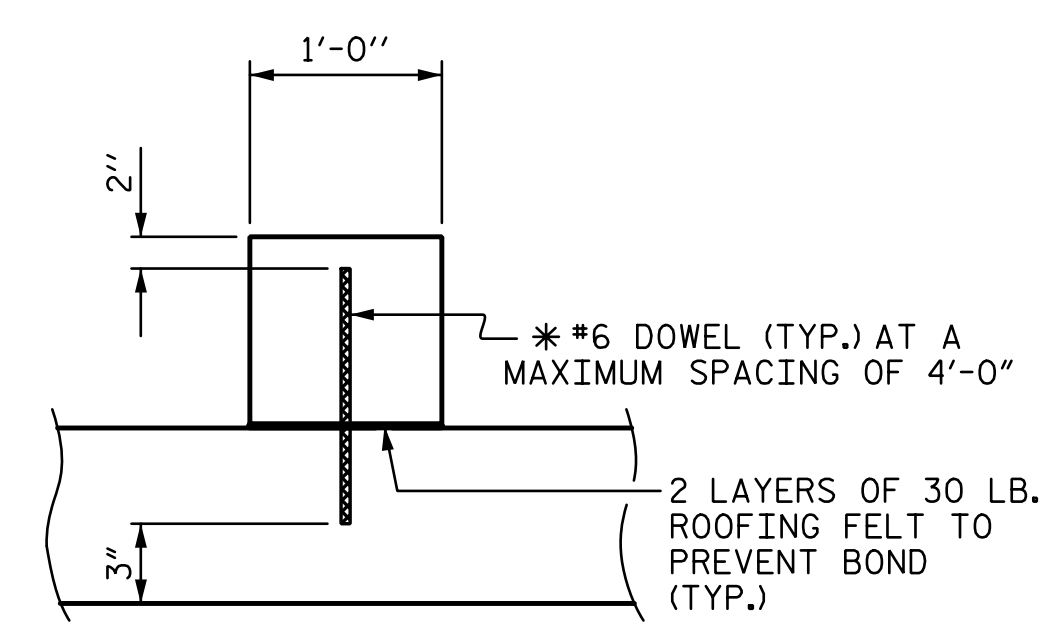
BAR TYPE		BAR SCHEDULE				
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	
A100	210	#7	STR	13'-3"	5,687	
A101	4	#7	STR	11'-5"	93	
A102	4	#7	STR	9'-8"	79	
A103	4	#7	STR	8'-0"	65	
A104	4	#7	STR	6'-3"	51	
A105	4	#7	STR	4'-6"	37	
A106	4	#7	STR	2'-9"	22	
A200	210	#7	STR	13'-3"	5,687	
A201	4	#7	STR	11'-5"	93	
A202	4	#7	STR	9'-8"	79	
A203	4	#7	STR	8'-0"	65	
A204	4	#7	STR	6'-3"	51	
A205	4	#7	STR	4'-6"	37	
A206	4	#7	STR	2'-9"	22	
A300	210	#5	STR	13'-3"	2,902	
A301	4	#5	STR	11'-5"	48	
A302	4	#5	STR	9'-8"	40	
A303	4	#5	STR	8'-0"	33	
A304	4	#5	STR	6'-3"	26	
A305	4	#5	STR	4'-6"	19	
A306	4	#5	STR	2'-9"	11	
A400	210	#5	STR	13'-3"	2,902	
A401	4	#5	STR	11'-5"	48	
A402	4	#5	STR	9'-8"	40	
A403	4	#5	STR	8'-0"	33	
A404	4	#5	STR	6'-3"	26	
A405	4	#5	STR	4'-6"	19	
A406	4	#5	STR	2'-9"	11	
A1	452	#6	1	7'-1"	4,809	
A2	452	#6	1	6'-8"	4,526	
B1	272	#4	STR	7'-9"	1,408	
B2	452	#5	STR	5'-2"	2,436	
C1	336	#4	STR	29'-8"	6,659	
D1	21	#6	STR	1'-8"	53	
D2	14	#6	STR	2'-2"	46	
G1	8	#5	STR	15'-5"	129	
S2	12	#5	STR	15'-5"	193	
REINFORCING STEEL					38,485 LBS	



DIMENSIONS ARE OUT TO OUT

SPLICE CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-9"
C1	#4	1'-11"



SECTION THROUGH SILL

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

PROJECT NO. U-3109B  
ALAMANCE COUNTY  
STATION: 207+85.77 -L-

SHEET 3 OF 5

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
SINGLE 12 FT. X 6 FT.  
CONCRETE BOX CULVERT  
120° SKEW

REVISIONS

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

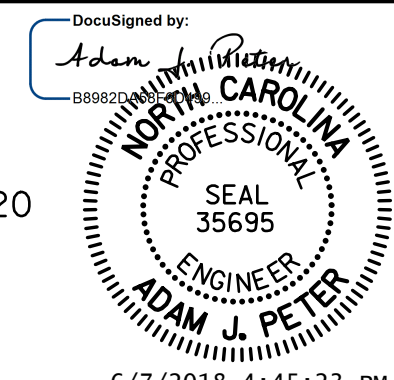
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TOTAL SHEETS 5



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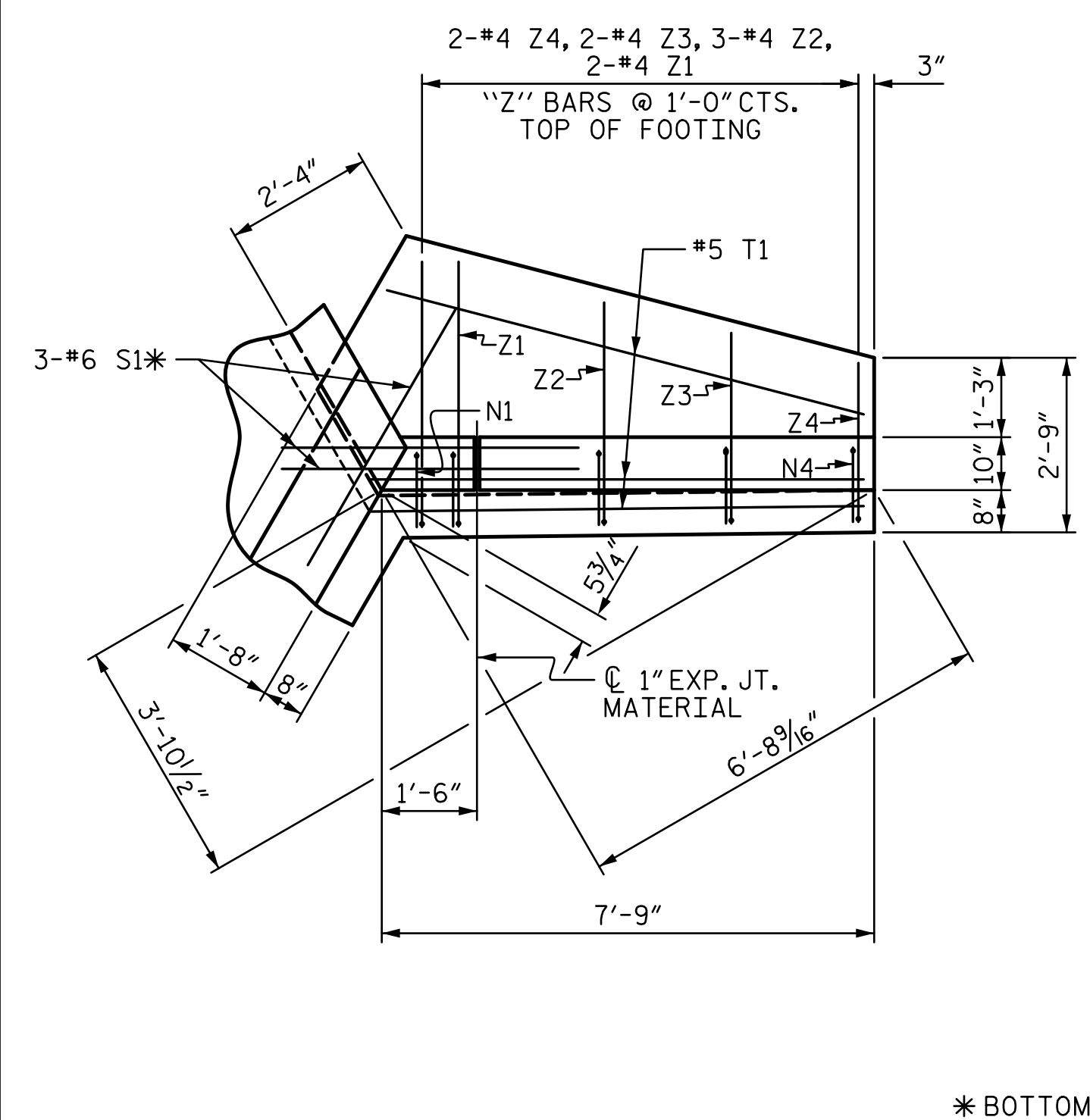
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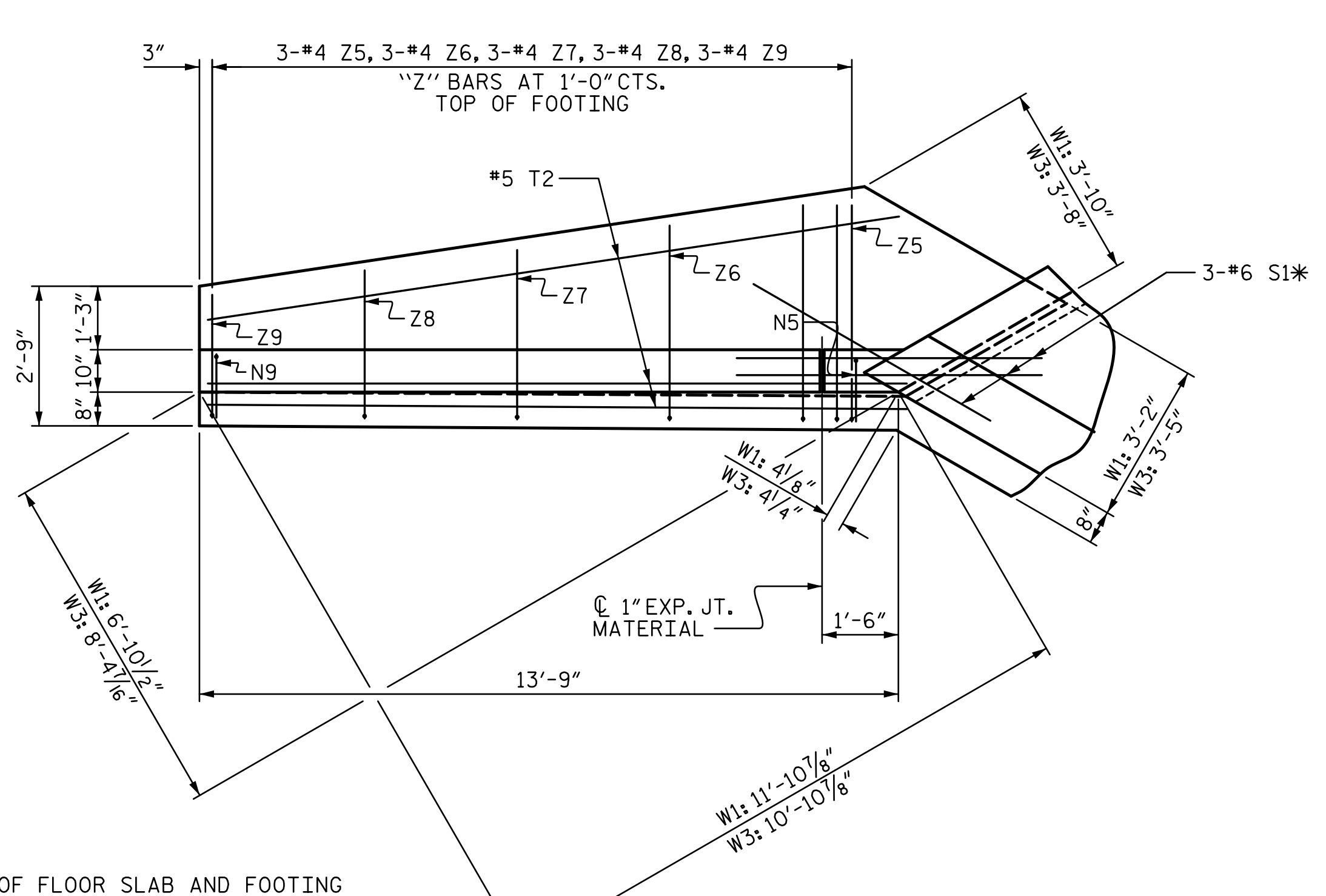
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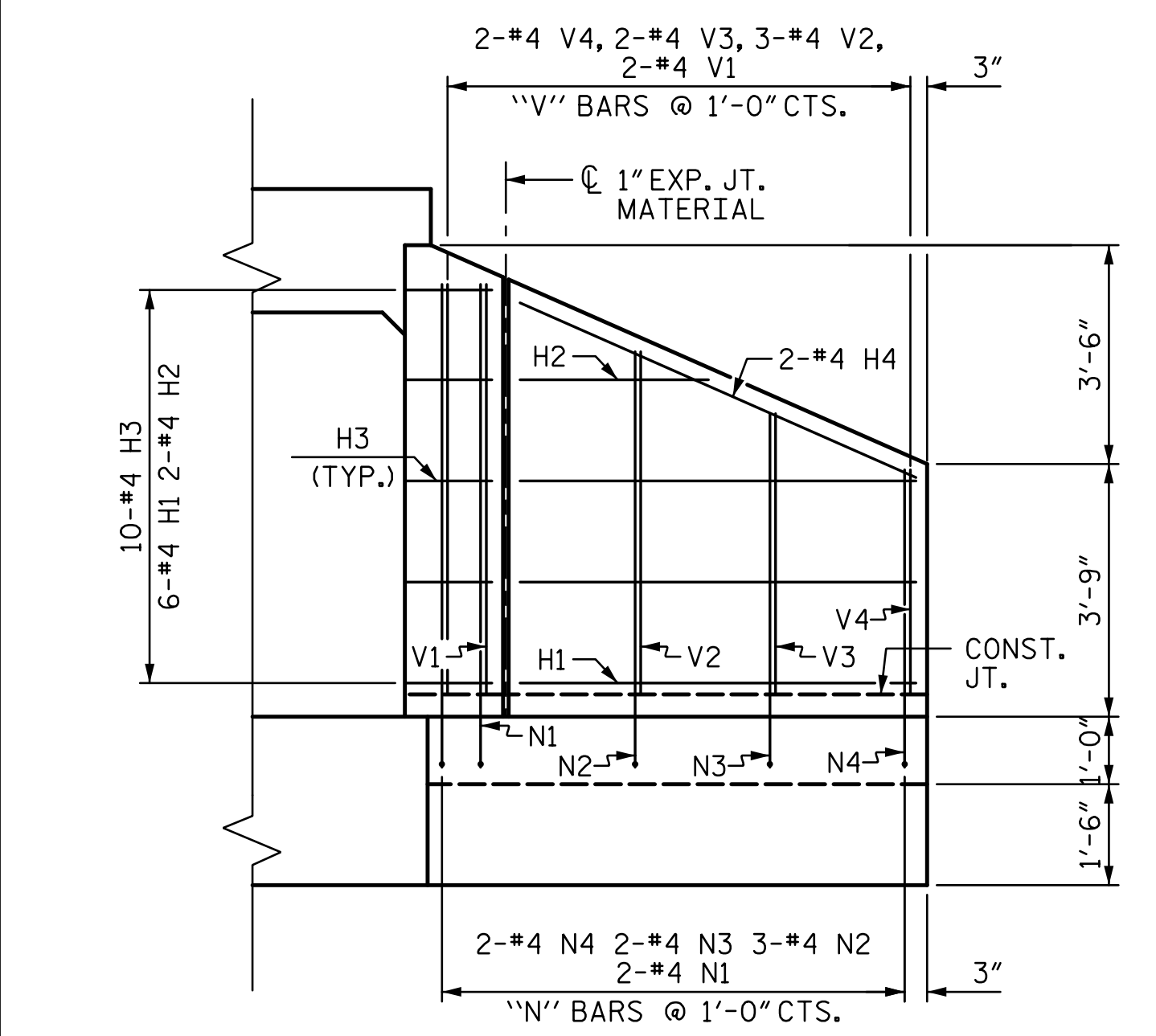


PLAN W2

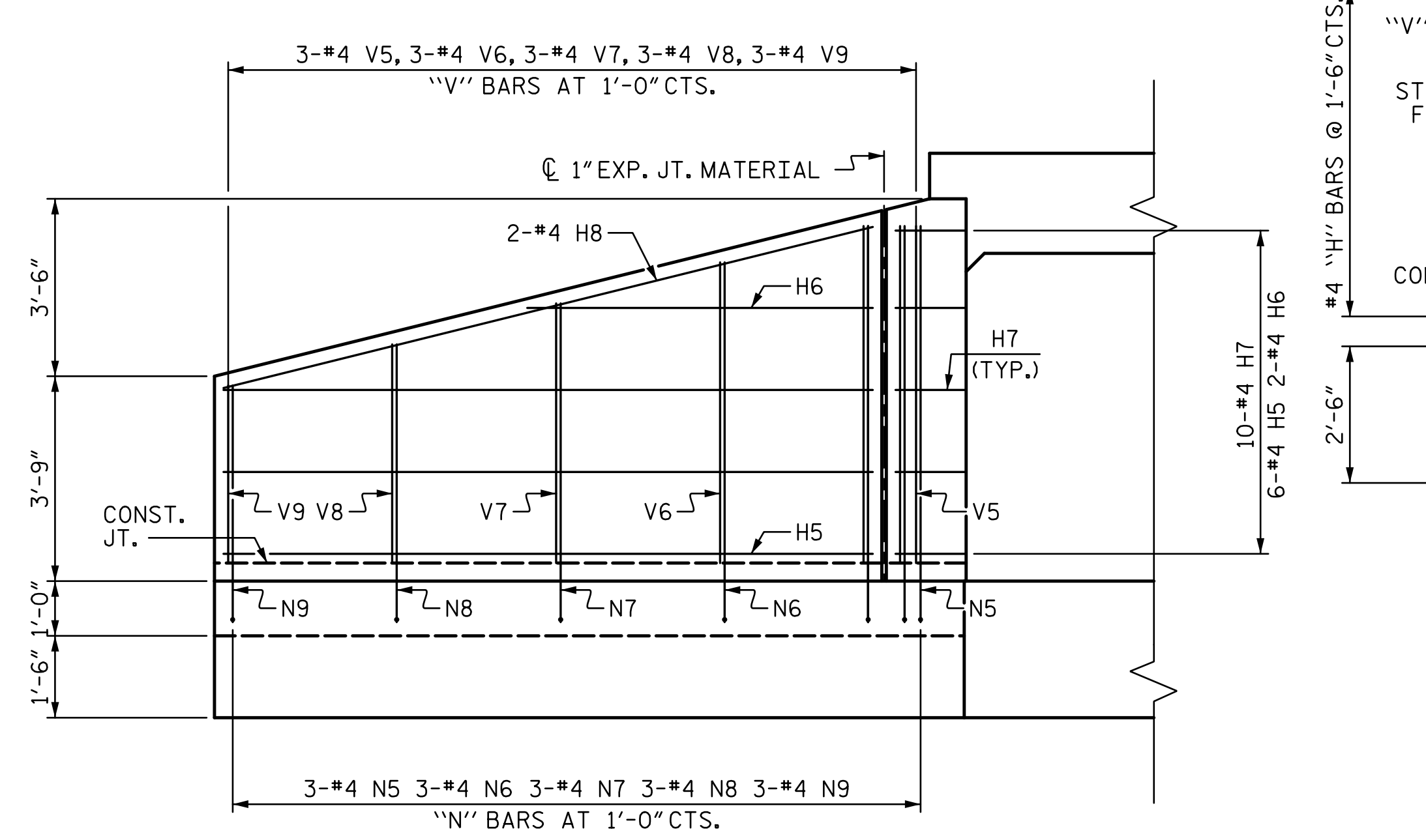


PLAN W1/W3

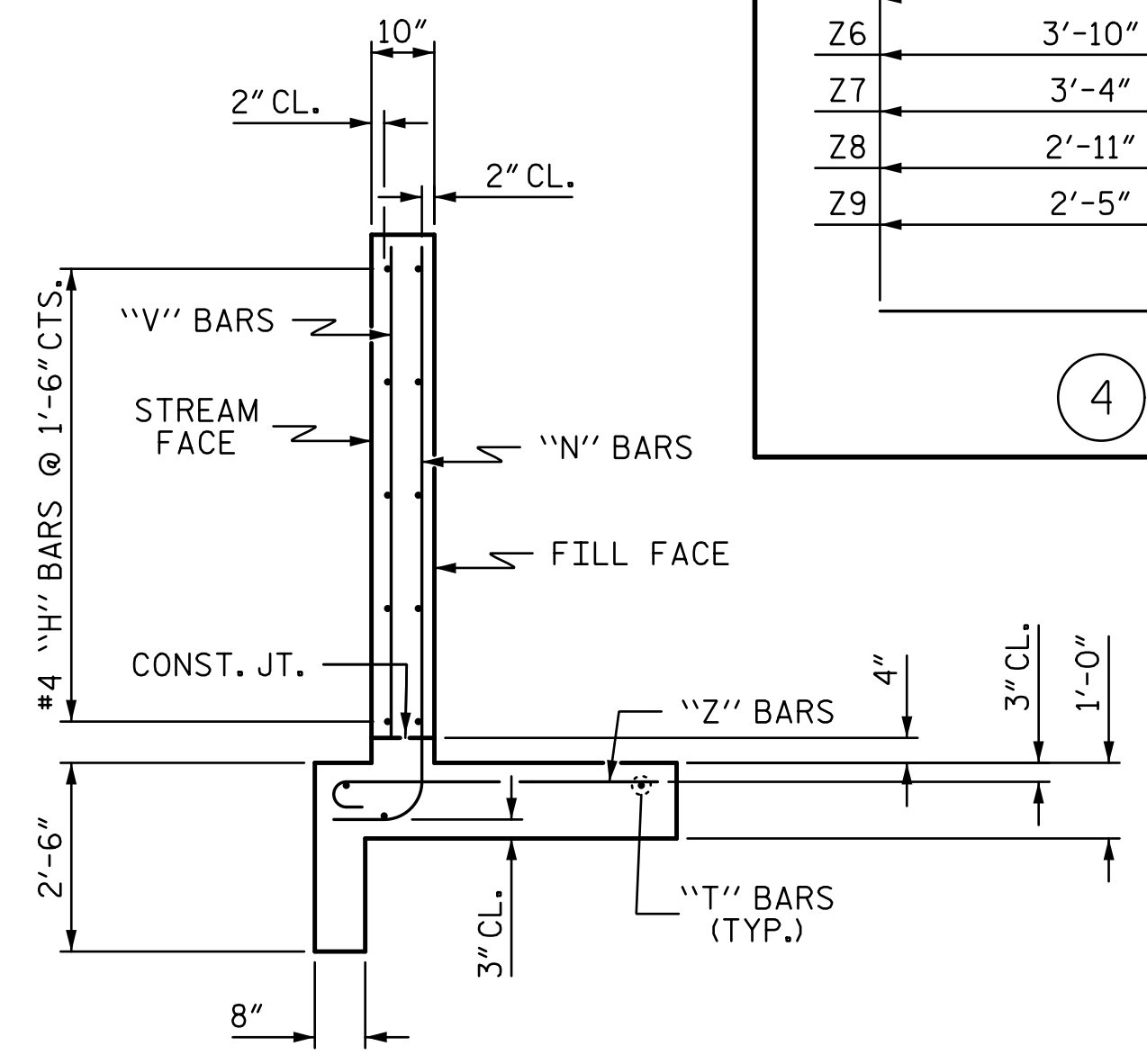
\*BOTTOM OF FLOOR SLAB AND FOOTING



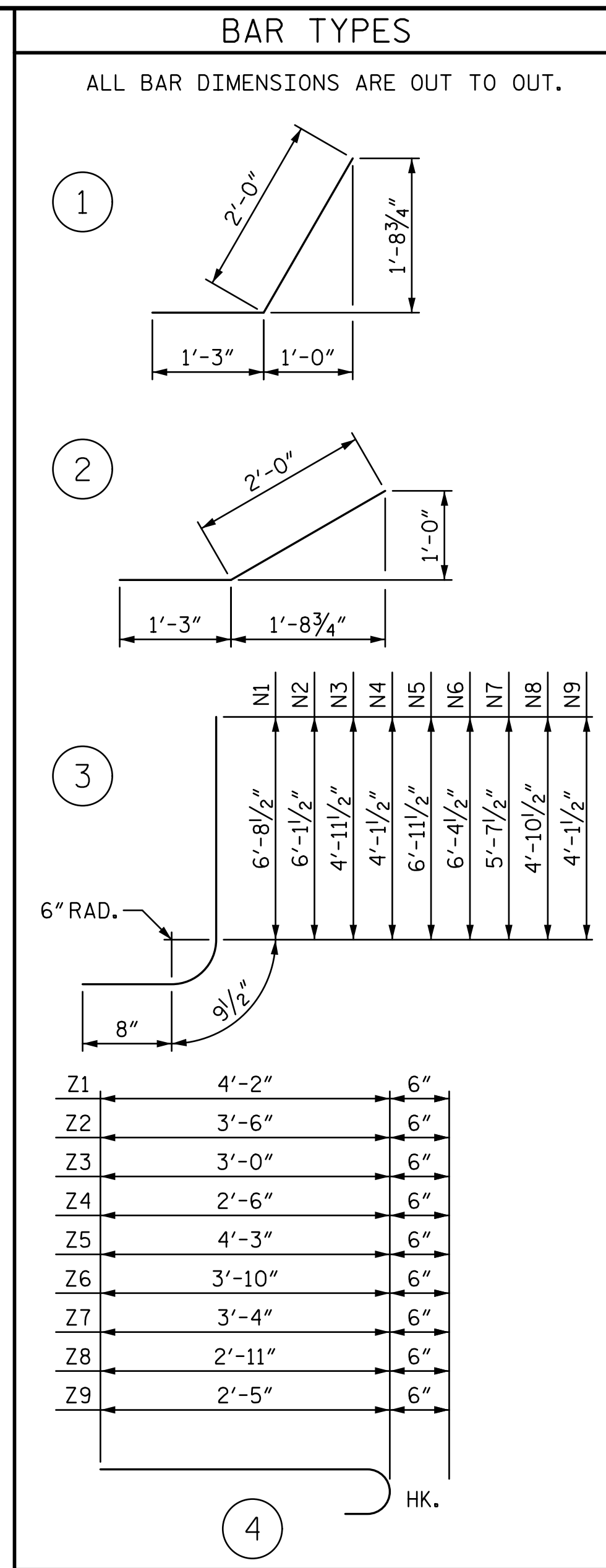
ELEVATION W2



ELEVATION W1/W3



TYPICAL WING SECTION



Z1	4'-2"	6"
Z2	3'-6"	6"
Z3	3'-0"	6"
Z4	2'-6"	6"
Z5	4'-3"	6"
Z6	3'-10"	6"
Z7	3'-4"	6"
Z8	2'-11"	6"
Z9	2'-5"	6"

BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	5'-10"	47
H2	4	#4	STR	2'-11"	8
H3	20	#4	1	3'-3"	43
H4	4	#4	STR	6'-5"	17
H5	12	#4	STR	11'-10"	95
H6	4	#4	STR	6'-6"	17
H7	20	#4	2	3'-3"	43
H8	4	#4	STR	12'-2"	33
N1	4	#4	3	8'-2"	22
N2	6	#4	3	7'-7"	30
N3	4	#4	3	6'-5"	17
N4	4	#4	3	5'-7"	15
N5	6	#4	3	8'-5"	34
N6	6	#4	3	7'-10"	31
N7	6	#4	3	7'-1"	28
N8	6	#4	3	6'-4"	25
N9	6	#4	3	5'-7"	22
S1	12	#6	STR	6'-0"	108
T1	6	#5	STR	7'-9"	48
T2	6	#5	STR	13'-9"	86
V1	4	#4	STR	6'-2"	16
V2	6	#4	STR	5'-6"	22
V3	4	#4	STR	4'-4"	12
V4	4	#4	STR	3'-6"	9
V5	6	#4	STR	6'-5"	26
V6	6	#4	STR	5'-9"	23
V7	6	#4	STR	5'-0"	20
V8	6	#4	STR	4'-3"	17
V9	6	#4	STR	3'-6"	14
Z1	4	#4	4	4'-8"	12
Z2	6	#4	4	4'-0"	16
Z3	4	#4	4	3'-6"	9
Z4	4	#4	4	3'-0"	8
Z5	6	#4	4	4'-9"	19
Z6	6	#4	4	4'-4"	17
Z7	6	#4	4	3'-10"	15
Z8	6	#4	4	3'-5"	14
Z9	6	#4	4	2'-11"	12
REINFORCING STEEL FOR 4 WINGS				1050 LBS	
CLASS A CONCRETE					
4 WINGS				14.4	CY
2 HEADWALLS				1.5	CY
2 END CURTAIN WALLS				2.6	CY
TOTAL				18.5	CY

NOTE: "N" AND "V" BARS SHALL BE FIELD CUT, AS NECESSARY, TO MAINTAIN A 2" CONCRETE CLEAR COVER.

PROJECT NO. U-3109B  
 ALAMANCE COUNTY  
 STATION: 207+85.77 -L-

SHEET 4 OF 5

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**WINGS FOR CONCRETE BOX CULVERT**  
 H = 6'-0" SLOPE = 2:1  
 120° SKEW

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 CHECKED BY: ADAM J. PETER, P.E. DATE: 05/2018  
 DESIGN ENGINEER OF RECORD: ADAM J. PETER, P.E. DATE: 05/2018

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1			3			TOTAL SHEETS
2			4			5

## 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 (γ <sub>LL</sub> )	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	1.71	--	1.75	2.32	1	MID. TOP SLAB	6.42	1.71	1	LEFT BOT. SLAB	1.20		
	HL-93 (OPERATING)	N/A		2.21	--	1.35	3.01	1	MID. TOP SLAB	6.42	2.21	1	LEFT BOT. SLAB	1.20		
	HS-20 (INVENTORY)	36.000	②	2.60	93.60	1.75	3.25	1	MID. TOP SLAB	6.42	2.60	1	LEFT BOT. SLAB	1.20		
	HS-20 (OPERATING)	36.000		3.36	120.96	1.35	4.21	1	MID. TOP SLAB	6.42	3.36	1	LEFT BOT. SLAB	1.20		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		4.56	61.56	1.40	5.72	1	MID. TOP SLAB	6.42	4.56	1	LEFT BOT. SLAB	1.20	
		SNGARBS2	20.000		4.29	85.80	1.40	5.38	1	MID. TOP SLAB	6.42	4.29	1	LEFT BOT. SLAB	1.20	
		SNAGRIS2	22.000		4.56	100.32	1.40	5.72	1	MID. TOP SLAB	6.42	4.56	1	LEFT BOT. SLAB	1.20	
		SNCOTTS3	27.250		2.55	69.49	1.40	3.25	1	MID. TOP SLAB	6.42	2.55	1	LEFT BOT. SLAB	1.20	
		SNAGGRS4	34.925		2.26	78.93	1.40	2.65	1	MID. TOP SLAB	6.42	2.26	1	RIGHT BOT. SLAB	12.47	
		SNS5A	35.550		2.44	86.74	1.40	2.84	1	MID. TOP SLAB	6.42	2.44	1	LEFT TOP SLAB	1.20	
		SNS6A	39.950		2.18	87.09	1.40	2.69	1	MID. TOP SLAB	6.42	2.18	1	RIGHT BOT. SLAB	12.47	
		SNS7B	42.000		2.10	88.20	1.40	2.54	1	MID. TOP SLAB	6.42	2.10	1	LEFT BOT. SLAB	1.20	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.70	89.10	1.40	3.19	1	MID. TOP SLAB	6.42	2.70	1	RIGHT TOP SLAB	12.46	
		TNT4A	33.075		2.62	86.66	1.40	3.19	1	MID. TOP SLAB	6.42	2.62	1	LEFT TOP SLAB	1.20	
		TNT6A	41.600		2.32	96.51	1.40	2.87	1	MID. TOP SLAB	6.42	2.32	1	LEFT BOT. SLAB	1.20	
		TNT7A	42.000		2.45	102.90	1.40	3.04	1	MID. TOP SLAB	6.42	2.45	1	RIGHT BOT. SLAB	12.47	
		TNT7B	42.000		2.35	98.70	1.40	2.83	1	MID. TOP SLAB	6.42	2.35	1	LEFT BOT. SLAB	1.20	
		TNAGRIT4	43.000		2.22	95.46	1.40	2.62	1	MID. TOP SLAB	6.42	2.22	1	LEFT TOP SLAB	1.20	
	TNAGT5A	45.000		2.35	105.75	1.40	2.83	1	MID. TOP SLAB	6.42	2.35	1	LEFT TOP SLAB	1.20		
	TNAGT5B	45.000	③	2.05	92.25	1.40	2.38	1	MID. TOP SLAB	6.42	2.05	1	LEFT TOP SLAB	1.20		

**LOAD FACTORS:**

DESIGN LOAD RATING FACTORS

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

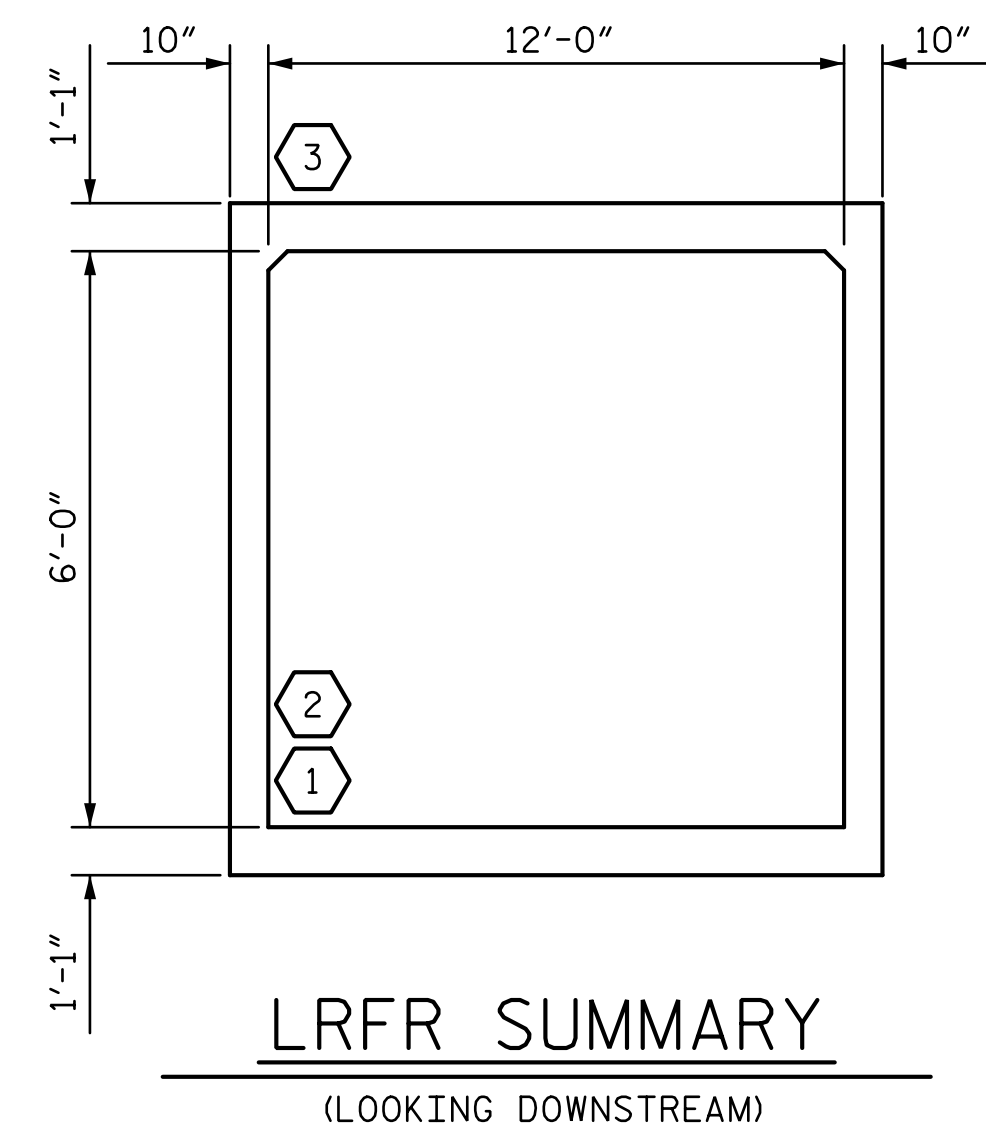
**NOTE:**

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

**COMMENTS:**

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

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



PROJECT NO. U-3109B  
ALAMANCE COUNTY  
 STATION: 207+85.77 -L-

SHEET 5 OF 5

**DRMP**  
 5950 FAIRVIEW ROAD, SUITE 320  
 CHARLOTTE, NC 28210  
 (704) 332-2289  
 NC LICENSE NO. C-2213

6/7/2018 4:45:23 PM EDT

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

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

DRAWN BY : <u>WMC</u> <u>JUL 2011</u>	REV. 10/2011 MAA/GM	<b>STANDARD</b>
CHECKED BY : <u>GM</u> <u>JUL 2011</u>	REV. 12/2017 MAA/THC	
DRAWN BY : <u>CANDY A. BUNDY, P.E.</u>	DATE : <u>05/2018</u>	<b>DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED</b>
CHECKED BY : <u>ADAM J. PETER, P.E.</u>	DATE : <u>05/2018</u>	
DESIGN ENGINEER OF RECORD: <u>ADAM J. PETER, P.E.</u>	DATE : <u>05/2018</u>	

\*USER\* \*DATE\* \*TIME\* \*FILE\*

DRMP JOB NUMBER: 15-0323.002

STD. NO. LRFR5