

**TIP PROJECT: R-5808**

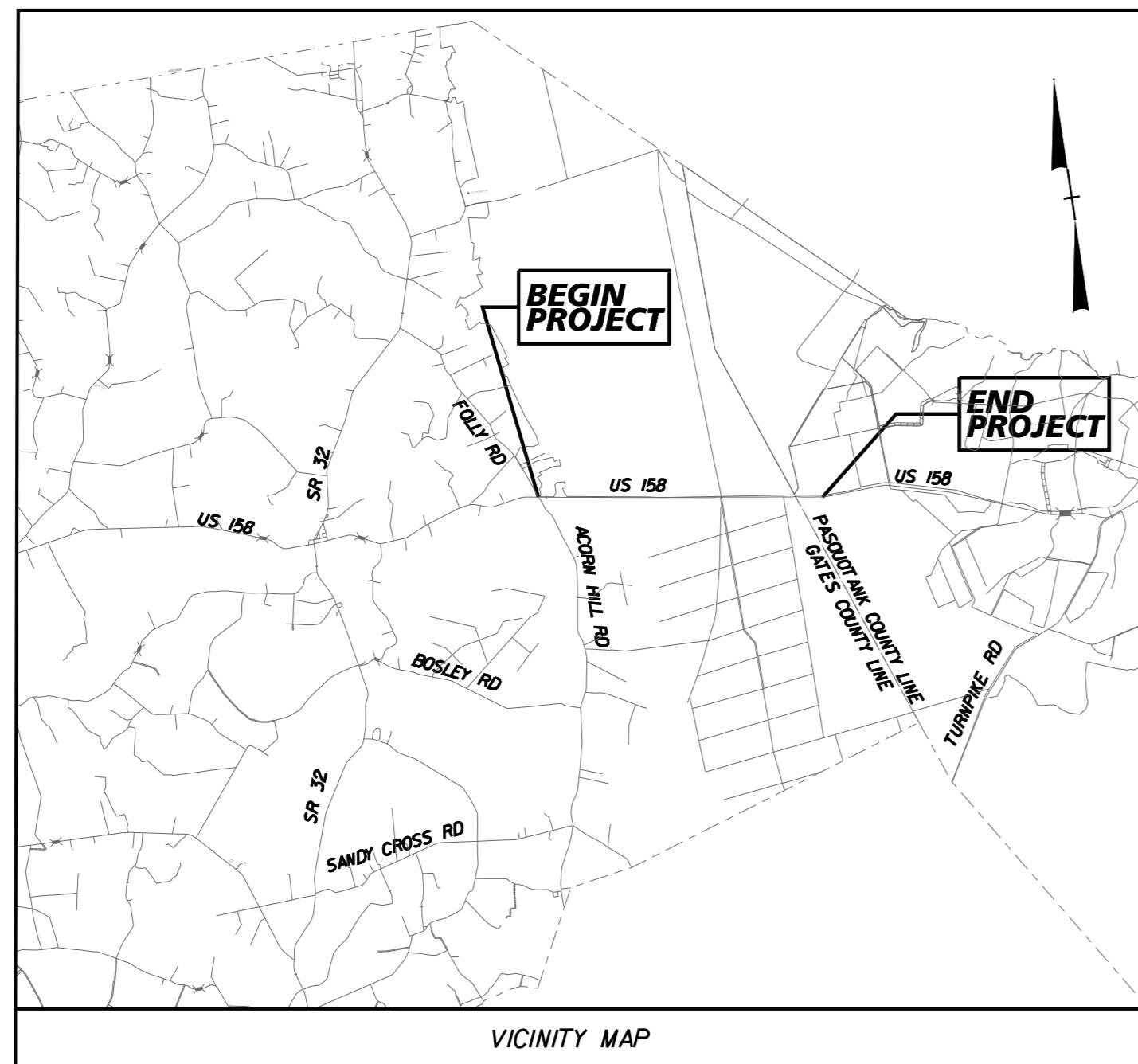
**CONTRACT: C204854**

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**GATES AND PASQUOTANK COUNTY**

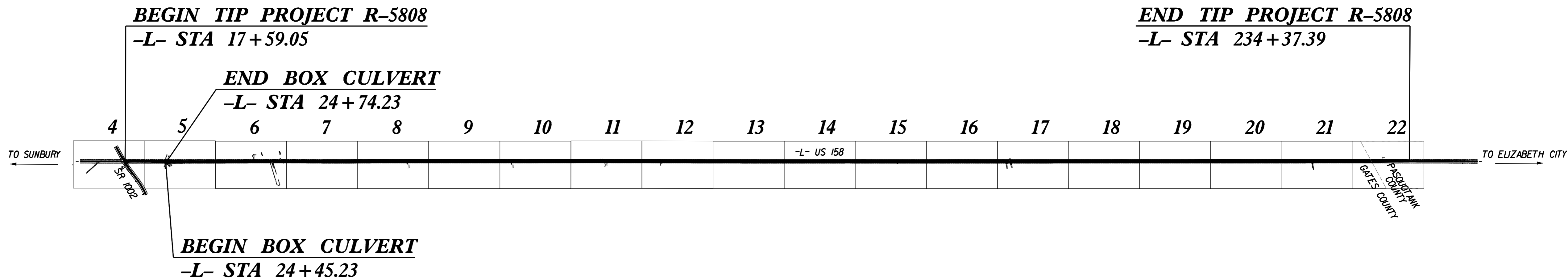
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-5808	1	
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
46972.1.2	NHP-0158(076)	PE	
46972.2.1	0158076	R/W	
46972.2.2	0158076	UTIL.	
46972.3.1	0158076	CONSTR.	

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**LOCATION: US 158 FROM THE INTERSECTION OF SR 1002  
(ACORN HILL ROAD) AND US 158 TO THE PASQUOTANK COUNTY LINE**

**TYPE OF WORK: GRADING, DRAINAGE, PAVING, WIDENING, AND CULVERT**



**STRUCTURES**

**DESIGN DATA**

ADT 2023	=	4,300
ADT 2043	=	6,200
K	=	10%
D	=	55%
T	=	12%
V	=	60 MPH

CLASSIFICATION:  
OTHER PRINCIPAL ARTERIAL  
\* 7% TTST 5% DUAL STATEWIDE TIER

**PROJECT LENGTH**

LENGTH ROADWAY TIP PROJECT R-5808	=	4.101 MILES
LENGTH OF STRUCTURE TIP PROJECT R-5808	=	.005 MILES
TOTAL LENGTH TIP PROJECT R-5808	=	4.106 MILES

Prepared in the Office of:

**Kimley»Horn**

2024 STANDARD SPECIFICATIONS

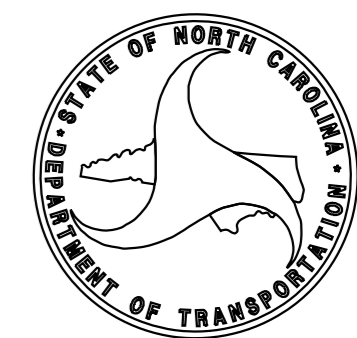
**RIGHT OF WAY DATE:**  
AUGUST 23, 2022

**LETTING DATE:**  
DECEMBER 17, 2024

**VINCENT RICCIO, PE**  
PROJECT ENGINEER

**ANDREW PHILLIPS, P.E.**  
PROJECT DESIGN ENGINEER

**RYAN SHOOK**  
PROJECT MANAGER  
NCDOT HIGHWAY DIVISION



BENCHMARK: STA. 22+55.69 -L-, 19.85' LT. ROD & CAP IN GROUND, EL. 26.07', N 988979 E 2722075 NAD 83

F.A. PROJECT NO. NHP-0158 (076)

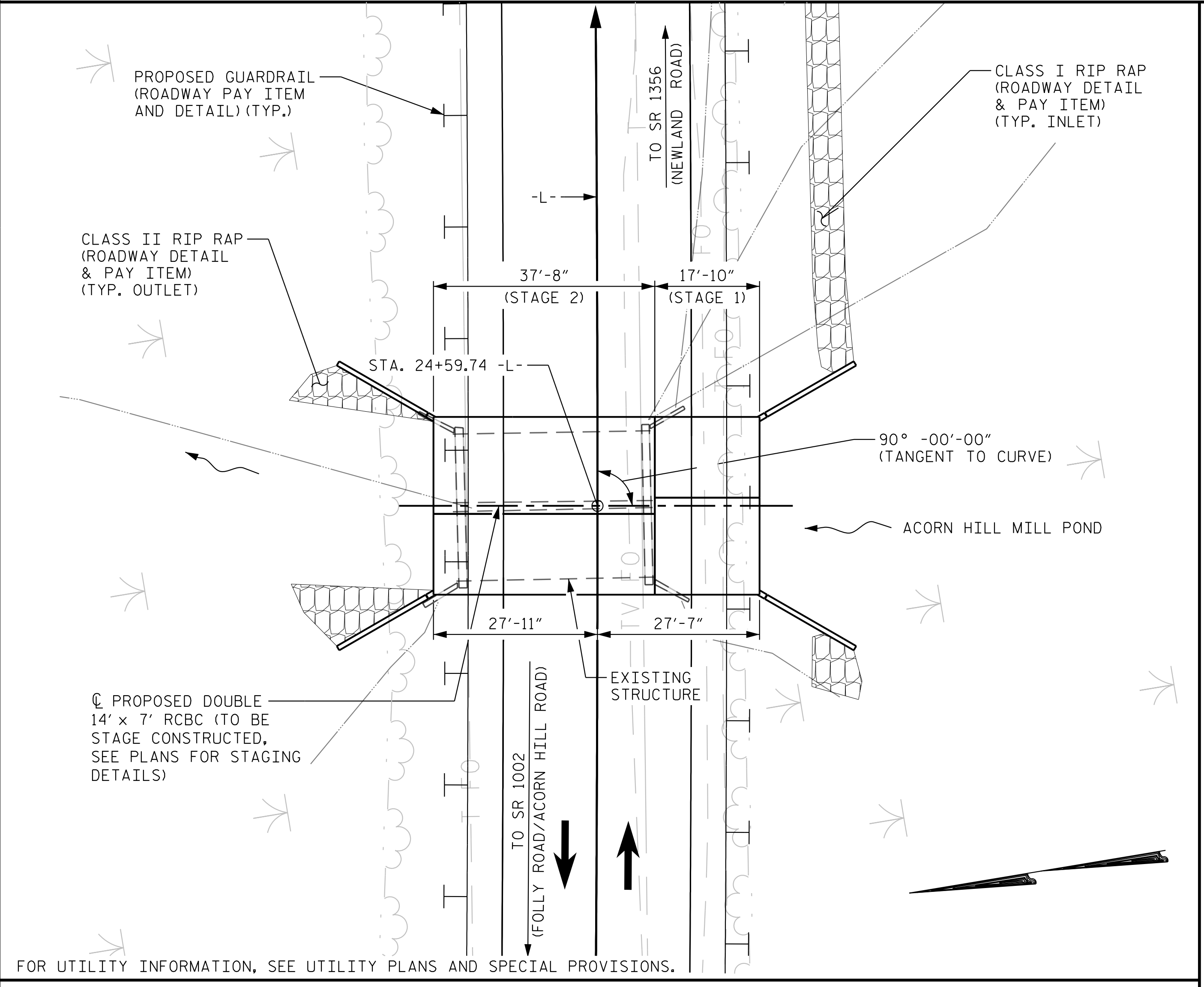
NOTES

ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.  
 DESIGN FILL = 1.99 FT.  
 FOR OTHER DESIGN DATA AND GENERAL NOTES, SEE SHEET SN.  
 3"Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.  
 FOR POURING SEQUENCE OF CONCRETE IN CULVERT, SEE "STAGING DETAILS", SHEET C1-2.  
 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.  
 AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACES OF THE EXTERIOR WALLS 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 THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.  
 THE REINFORCED CONCRETE BOX CULVERT SHALL BE PLACED ON THE STANDARD 1.0 FT. BLANKET OF FOUNDATION CONDITIONING MATERIAL. SEE SECTION 414 OF THE STANDARD SPECIFICATIONS.  
 FOR LIMITS OF TEMPORARY SHORING FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS.  
 FOR PAY ITEM FOR TEMPORARY SHORING FOR MAINTENANCE OF TRAFFIC, SEE ROADWAY PLANS.  
 TRAFFIC ON US 158 SHALL BE MAINTAINED. IN ORDER TO MAINTAIN TRAFFIC THE CULVERT SHALL BE CONSTRUCTED IN SECTIONS AS SHOWN ON THESE PLANS AS DIRECTED BY THE ENGINEER.  
 AFTER SERVING AS A TEMPORARY STRUCTURE, THE EXISTING STRUCTURE CONSISTING OF 2 @ 12' X 6' RCBC; 33' ALONG CENTERLINE OF CULVERT WITH 22' CLEAR ROADWAY WITH WINGWALLS AND LOCATED AT THE SITE SHALL BE REMOVED. THE EXISTING BRIDGE IS PRESENTLY NOT POSTED FOR LOAD LIMIT. SHOULD THE STRUCTURAL INTEGRITY OF THE BRIDGE DETERIORATE DURING CONSTRUCTION OF THE PROPOSED STRUCTURE, A LOAD LIMIT MAY BE POSTED AND MAY BE REDUCED AS FOUND NECESSARY DURING THE LIFE OF THE PROJECT.  
 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 CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.  
 FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.  
 NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.  
 SEE SECTION 414 OF THE STANDARD SPECIFICATIONS FOR CULVERT EXCAVATION AND BACKFILLING.  
 EXCAVATE 1 FOOT BELOW CULVERT AND FOOTING, AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS.  
 CULVERT BARREL SHOULD BE BACK FILLED WITH NATIVE MATERIAL TO BURY DEPTH (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.

SAMPLE BAR REPLACEMENT	
SIZE	LENGTH
#3	6'-2"
#4	7'-4"
#5	8'-6"
#6	9'-8"
#7	10'-10"
#8	12'-0"
#9	13'-2"
#10	14'-6"
#11	15'-10"

NOTE:  
 SAMPLE BAR REPLACEMENT LENGTHS BASED ON 30" (SAMPLE LENGTH) PLUS TWO SPLICE LENGTHS AND fy = 60 KSI.

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS.



LOCATION SKETCH

HYDRAULIC DATA	
DESIGN DISCHARGE	-----600 CFS
FREQUENCY OF DESIGN FLOOD	-----50 YR.
DESIGN HIGH WATER ELEVATION	-----22.9
DRAINAGE AREA	-----3.1 SQ. MI.
BASE DISCHARGE (Q100)	-----1290 CFS
BASE HIGH WATER ELEVATION	-----25.1

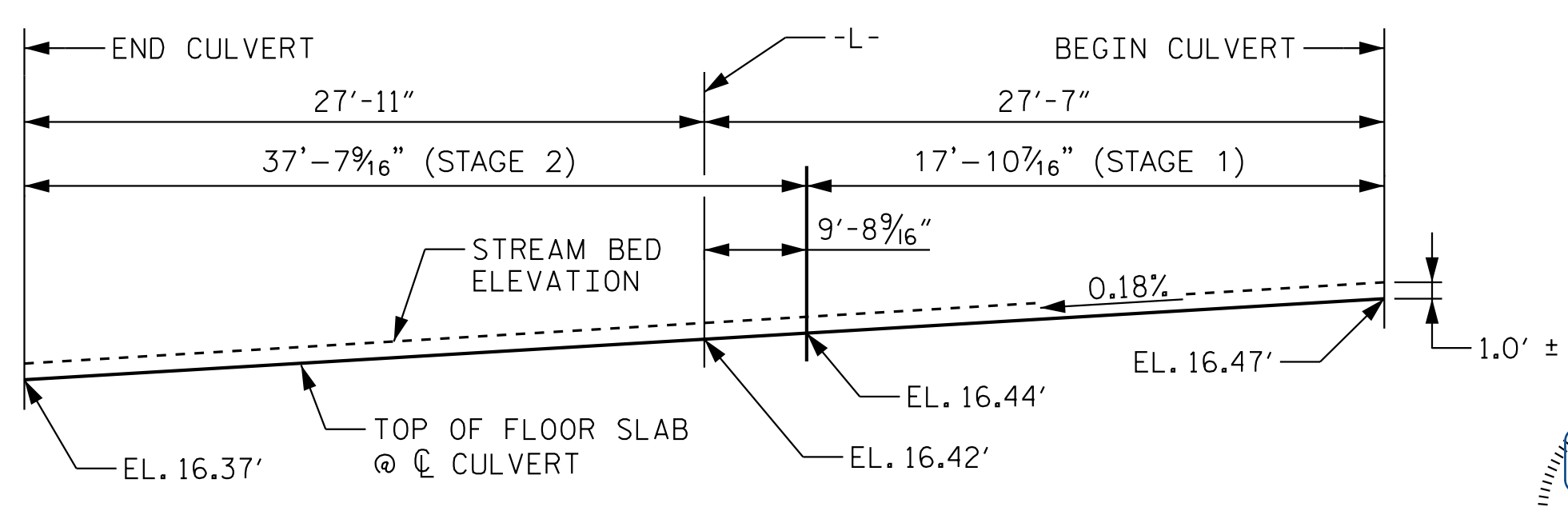
  

OVERTOPPING FLOOD DATA	
OVERTOPPING DISCHARGE	-----1800 CFS
FREQUENCY OF OVERTOPPING FLOOD	--->500 YR.
OVERTOPPING FLOOD ELEVATION	-----26.9 *
* OVERTOPPING WILL OCCUR AT STA. 24+53.40 -L-	

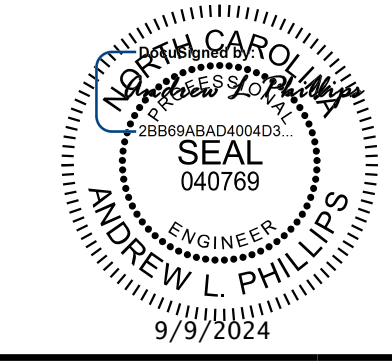
TOTAL STRUCTURE QUANTITIES	
CLASS A CONCRETE	
STAGE 1	76.2 C.Y.
STAGE 2	141.7 C.Y.
TOTAL	217.9 C.Y.
REINFORCING STEEL	
STAGE 1	12,431 LBS.
STAGE 2	23,971 LBS.
TOTAL	36,402 LBS.
CULVERT EXCAVATION LUMP SUM	
FOUNDATION CONDITIONING MATERIAL	
STAGE 1	44 TONS
STAGE 2	91 TONS
TOTAL	135 TONS

ROADWAY DATA	
GRADE POINT EL. @ STA. 24+59.74 -L-	= 26.91'
INVERT ELEVATION @ STA. 24+59.74 -L-	= 16.42'
ROADWAY SLOPES 3 : 1	

-L- HORIZONTAL CURVE DATA	
PI STA.	24+74.63
Δ	1°-32'-44.9" (LT)
D	0°-29'-53.6"
L	310.26'
T	155.14'
R	11,500.00'



PROFILE ALONG CULVERT



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 Phone (919) 677-2000 NC LICENSE # F-0102

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PROJECT NO. R-5808  
                     GATES                      COUNTY  
 STATION: 24+59.74 -L-

SHEET 1 OF 10 REPLACES BRIDGE NO. 31

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**DOUBLE 14 FT. X 7 FT. CONCRETE BOX CULVERT**  
 90° SKEW

REVISIONS						SHEET NO. C1-1
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS
2			4			10

CULVERT 41C001

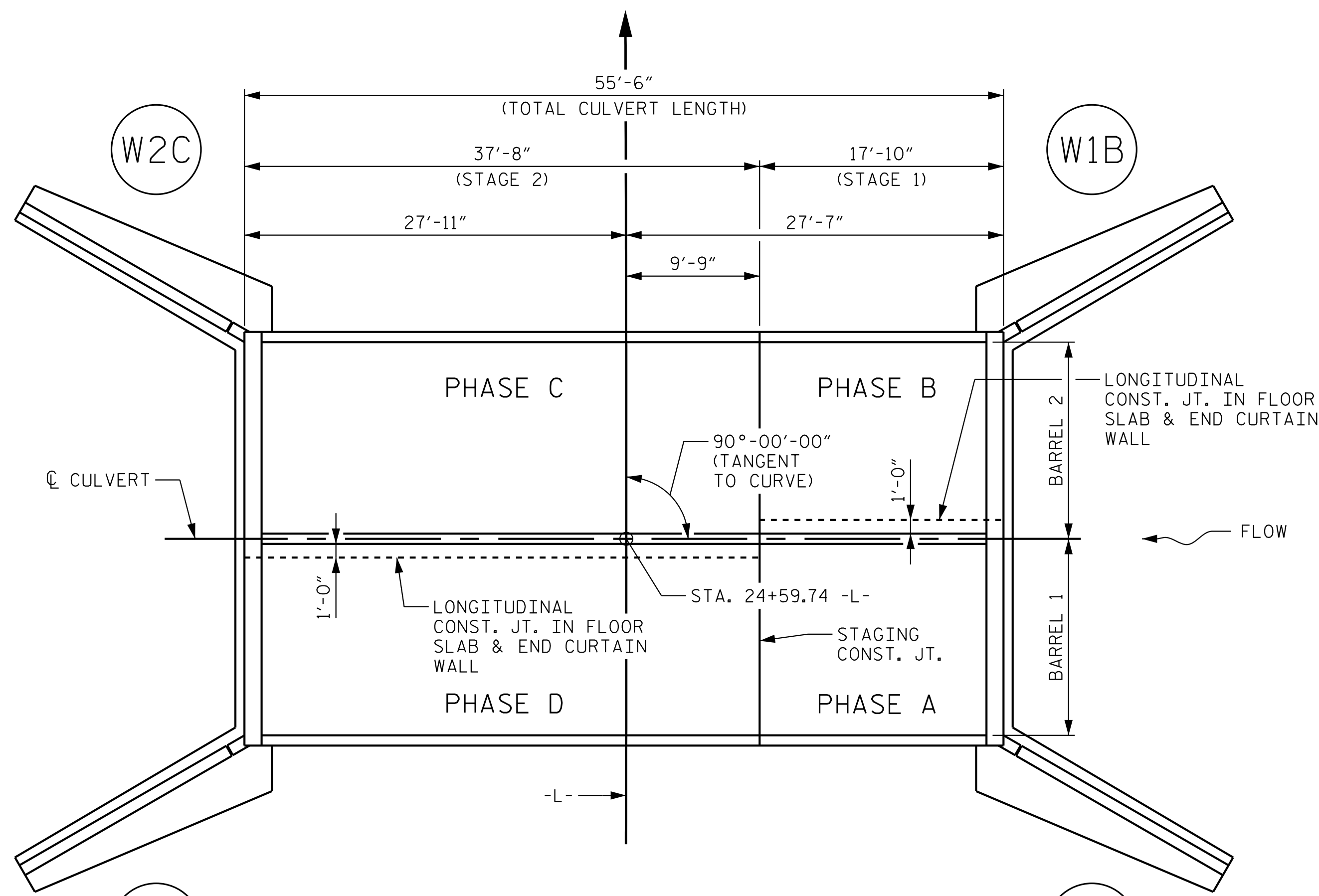
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 9/9/2024

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 CHECKED BY: T. H. ORR DATE: 08/2023  
 DESIGN ENGINEER OF RECORD: A. L. PHILLIPS DATE: 08/2023

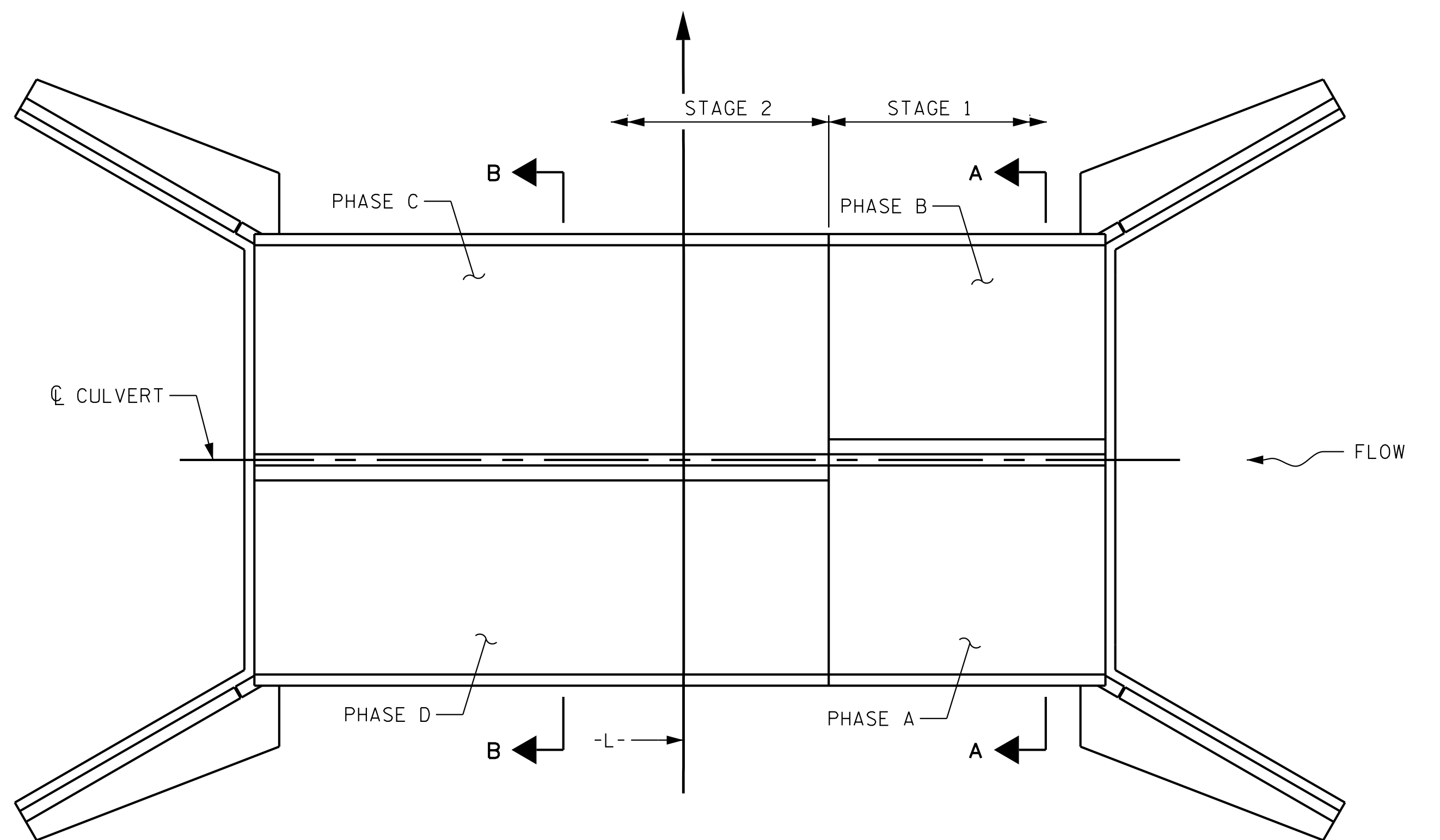
### NOTES

CONCRETE IN CULVERT TO BE POURED IN THE FOLLOWING ORDER:

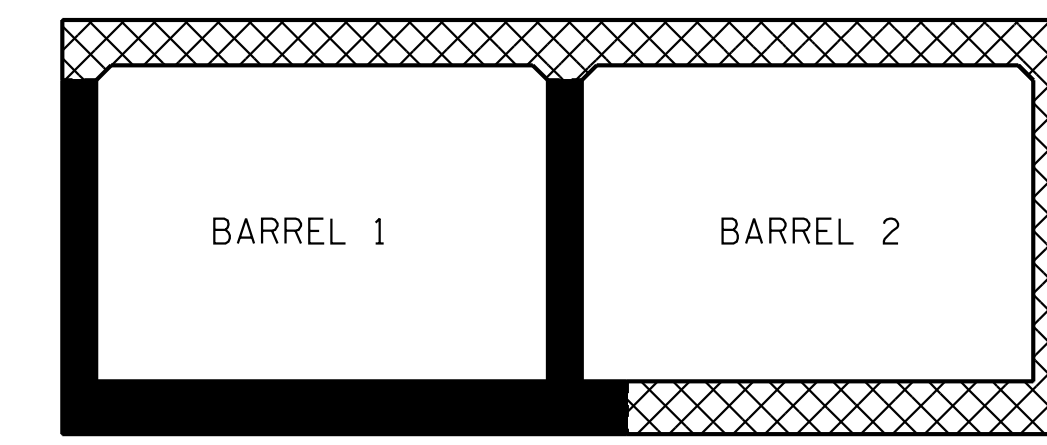
- STAGE 1:
  - PHASE A  
INLET WING W1A FOOTING; BARREL 1 FLOOR SLAB, INCLUDING 4" OF BARREL 1 WALLS (EXTERIOR & INTERIOR). REMAINING PORTION OF BARREL 1 WALLS (EXTERIOR AND INTERIOR) AND INTLET WING W1A FULL HEIGHT.
  - PHASE B  
INLET WING W1B FOOTING; BARREL 2 FLOOR SLAB, INCLUDING 4" OF BARREL 2 WALLS (EXTERIOR & INTERIOR). REMAINING PORTION OF BARREL 2 WALL (EXTERIOR) AND INTLET WING W1B FULL HEIGHT. ROOF SLAB AND HEADWALL AT OUTLET END.
- STAGE 2:
  - PHASE C  
OUTLET WING W2C FOOTING; BARREL 2 FLOOR SLAB, INCLUDING 4" OF BARREL 2 WALLS (EXTERIOR & INTERIOR). REMAINING PORTION OF BARREL 2 WALLS (EXTERIOR AND INTERIOR) AND OUTLET WING W2C FULL HEIGHT.
  - PHASE D  
OUTLET WING W2D FOOTING; BARREL 1 FLOOR SLAB, INCLUDING 4" OF BARREL 1 WALLS (EXTERIOR & INTERIOR). REMAINING PORTION OF BARREL 1 WALL (EXTERIOR) AND OUTLET WING W2D FULL HEIGHT. ROOF SLAB AND HEADWALL AT INLET END.



**CULVERT LAYOUT**  
WING DESIGNATIONS ARE FOR STAGING SEQUENCE ONLY

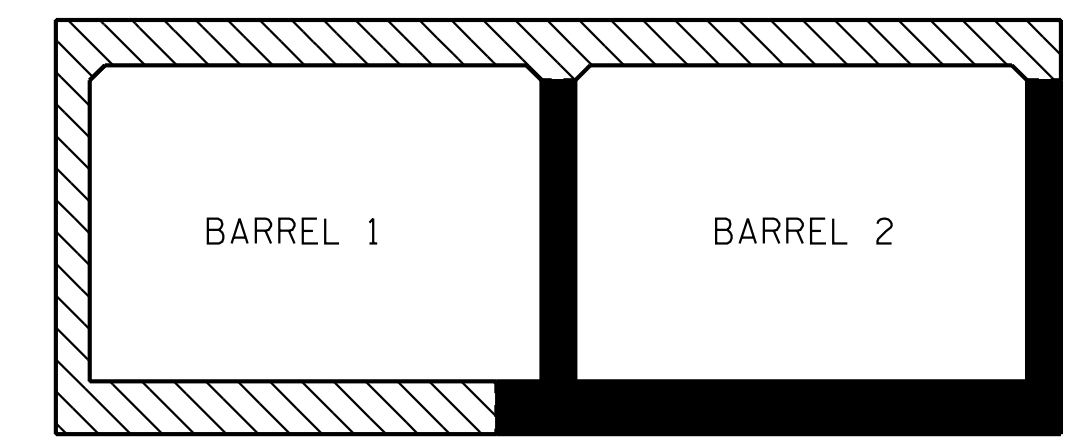


**PLAN OF FLOOR SLAB**



**SECTION A-A**

- STAGE 1 (PHASE A)
- ▨ STAGE 1 (PHASE B)

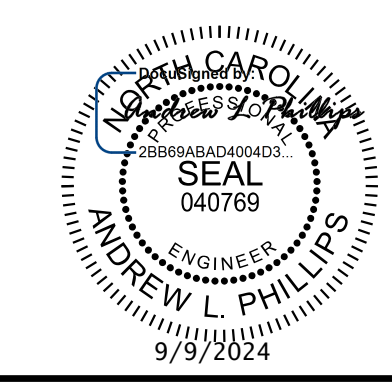


**SECTION B-B**

- STAGE 2 (PHASE C)
- ▨ STAGE 2 (PHASE D)

PROJECT NO. R-5808  
                   GATES                    COUNTY  
 STATION: 24+59.74 -L-

SHEET 2 OF 10



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 RALEIGH

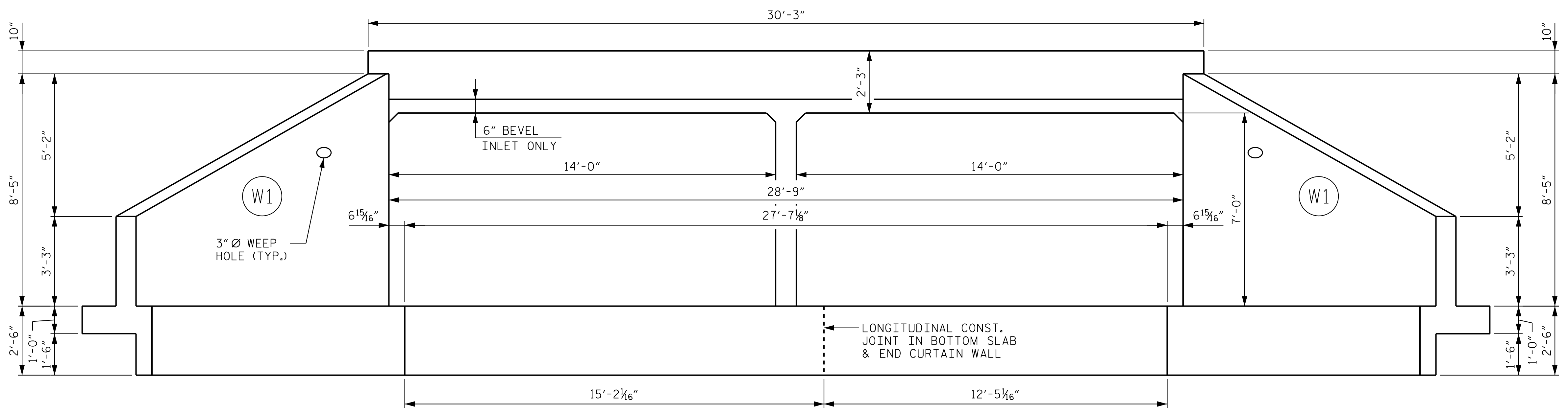
### STAGING DETAILS

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-2
1			3			TOTAL SHEETS
2			4			10

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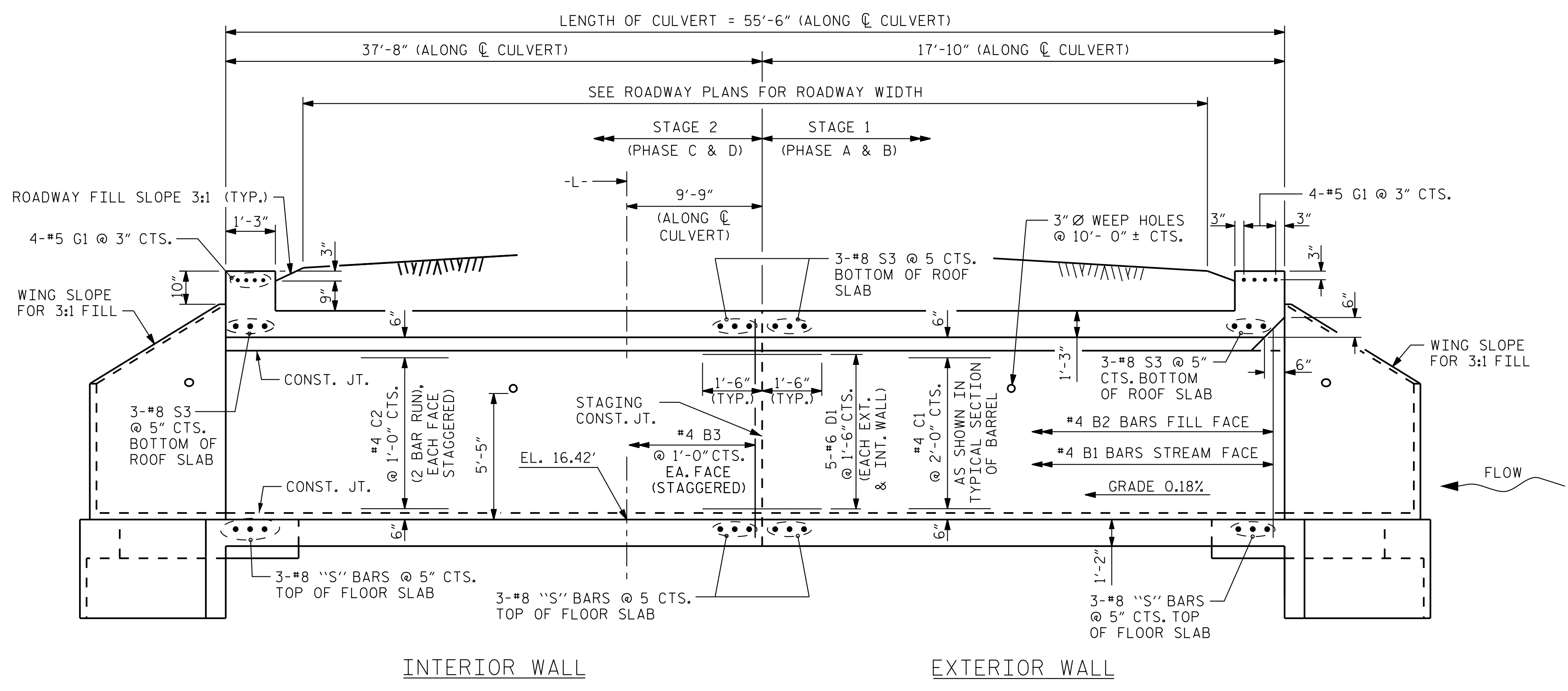
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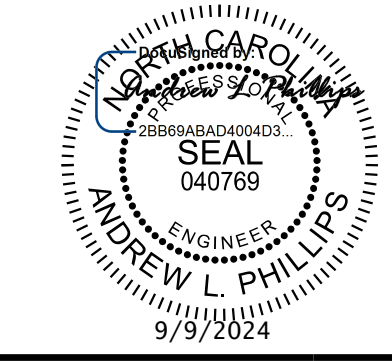
**INLET END ELEVATION NORMAL TO SKEW**  
(OUTLET SIMILAR)

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS.



**CULVERT SECTION NORMAL TO ROADWAY**

\*6 D1 DOWEL BARS IN THE SLABS NOT SHOWN FOR CLARITY, SEE SHEETS C1-5 & C1-7 FOR SLAB DOWEL DETAILS.



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PROJECT NO. R-5808  
GATES COUNTY  
STATION: 24+59.74 -L-

SHEET 3 OF 10  
STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
**DOUBLE 14 FT. X 7 FT. CONCRETE BOX CULVERT  
90° SKEW**

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-3
1			3			TOTAL SHEETS
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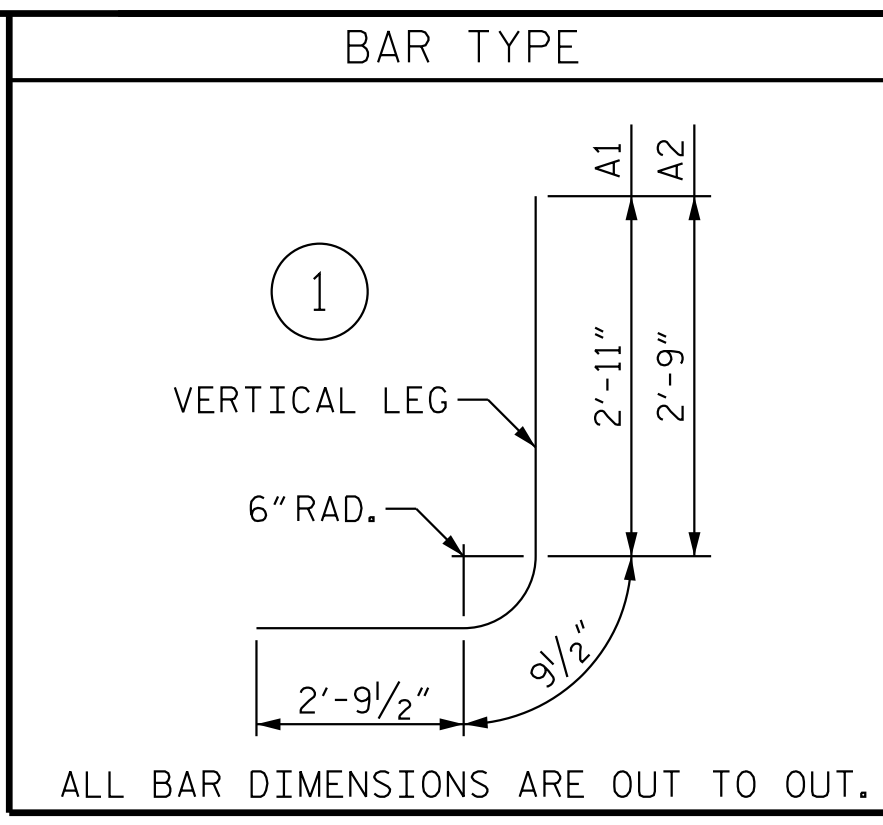
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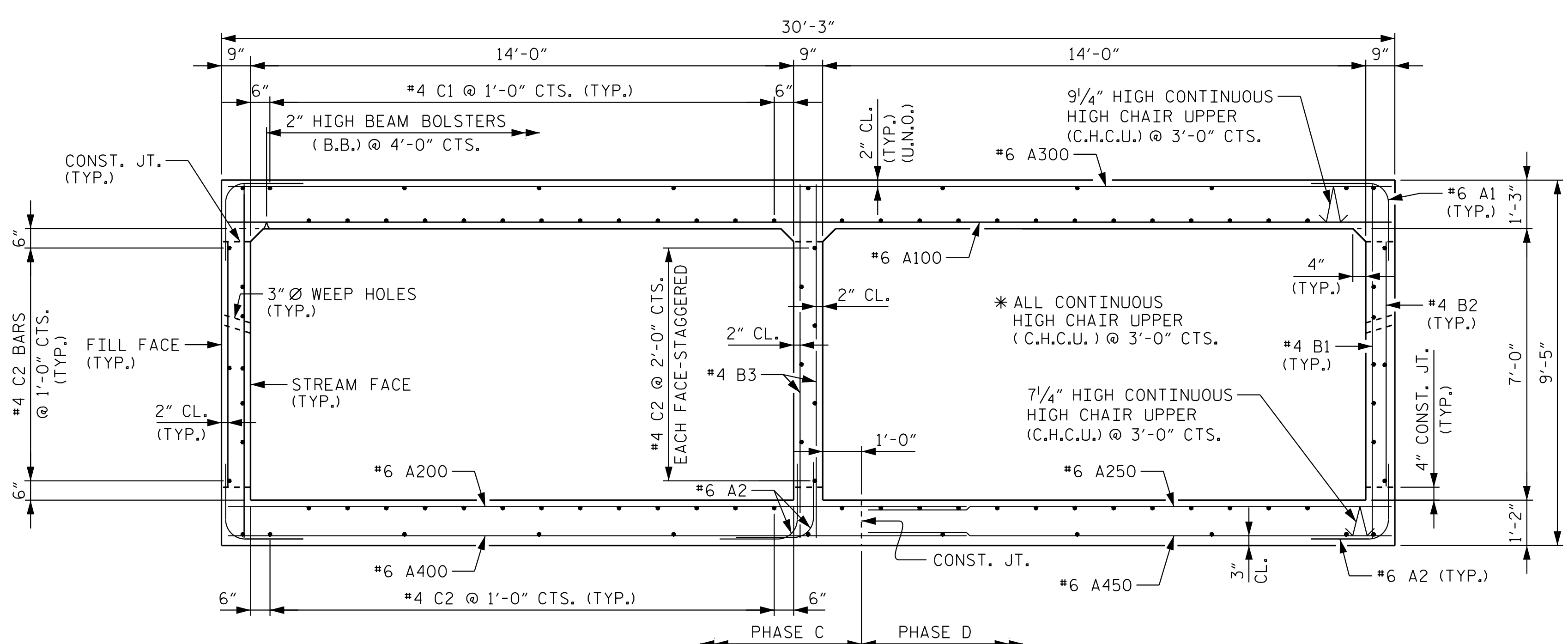
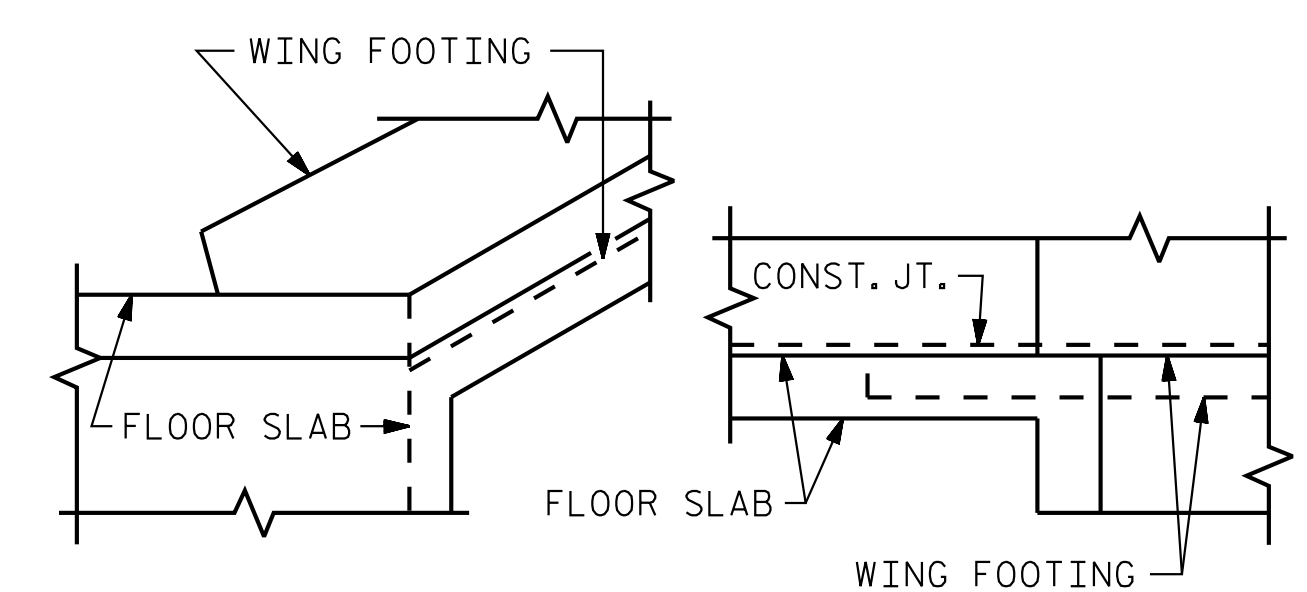
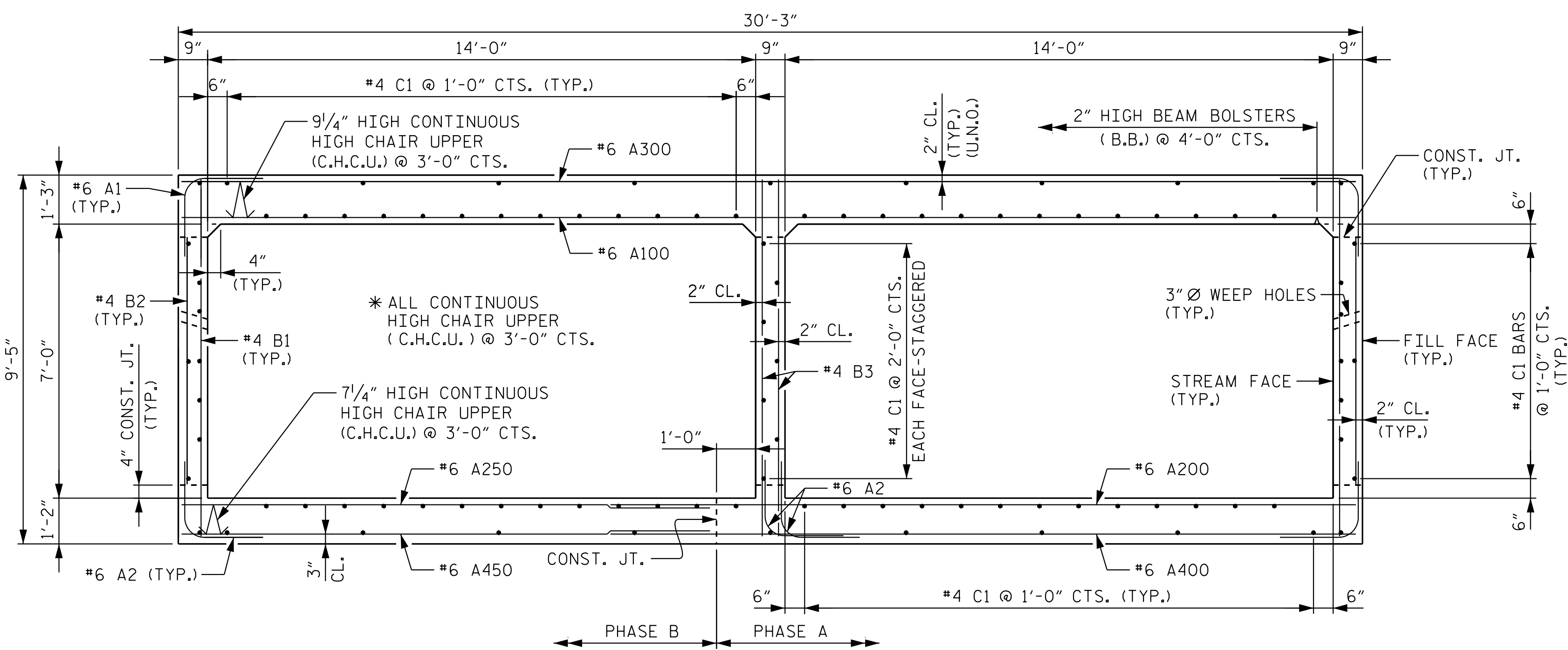
CULVERT 41C001

STAGE 1 QUANTITIES			STAGE 2 QUANTITIES		
CLASS A CONCRETE			CLASS A CONCRETE		
BARREL @ 3.299 C.Y./FT.	58.8 C.Y.		BARREL @ 3.299 C.Y./FT.	124.3 C.Y.	
WINGS, ETC.	17.4 C.Y.		WINGS, ETC.	17.4 C.Y.	
TOTAL	76.2 C.Y.		TOTAL	141.7 C.Y.	
REINFORCING STEEL			REINFORCING STEEL		
BARREL	11,476 LBS.		BARREL	23,016 LBS.	
WINGS, ETC.	955 LBS.		WINGS, ETC.	955 LBS.	
TOTAL	12,431 LBS.		TOTAL	23,971 LBS.	
CULVERT EXCAVATION LUMP SUM			CULVERT EXCAVATION LUMP SUM		
FOUNDATION COND. MATERIAL 44 TONS			FOUNDATION COND. MATERIAL 91 TONS		

SPLICE CHART		
BAR	SIZE	SPLICE LENGTH
A200, A400	#6	2'-9"
B1, B3	#4	1'-10"
C1	#4	2'-5"
S1	#8	4'-9"



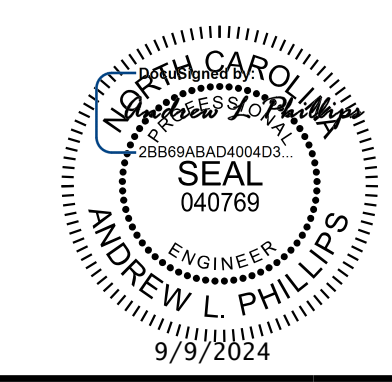
BILL OF MATERIAL (STAGE 1)						BILL OF MATERIAL (STAGE 2)					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	72	6	1	6'-6"	703	A1	152	6	1	6'-6"	1,484
A2	108	6	1	6'-4"	1,027	A2	228	6	1	6'-4"	2,169
A100	36	6	STR	29'-11"	1,618	A100	76	6	STR	29'-11"	3,415
A200	36	6	STR	19'-3"	1,041	A200	76	6	STR	19'-3"	2,197
A250	36	6	STR	13'-5"	725	A250	76	6	STR	13'-5"	1,532
A300	36	6	STR	29'-11"	1,618	A300	76	6	STR	29'-11"	3,415
A400	36	6	STR	19'-3"	1,041	A400	76	6	STR	19'-3"	2,197
A450	36	6	STR	13'-5"	725	A450	76	6	STR	13'-5"	1,532
B1	72	4	STR	9'-0"	433	B1	152	4	STR	9'-0"	914
B2	72	4	STR	6'-4"	305	B2	152	4	STR	6'-4"	643
B3	36	4	STR	9'-0"	216	B3	76	4	STR	9'-0"	457
C1	97	4	STR	17'-6"	1,134	C2	97	4	STR	37'-4"	2,419
D1	55	6	STR	3'-0"	248	G1	4	5	STR	29'-11"	125
G1	4	5	STR	29'-11"	125	S1	3	8	STR	21'-3"	170
S1	3	8	STR	21'-3"	170	S2	3	8	STR	13'-5"	107
S2	3	8	STR	13'-5"	107	S3	3	8	STR	29'-11"	240
S3	3	8	STR	29'-11"	240						
REINFORCING STEEL LBS.					11,476	REINFORCING STEEL LBS.					23,016



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

PROJECT NO. R-5808  
GATES COUNTY  
 STATION: 24+59.74 -L-

SHEET 4 OF 10



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 RALEIGH  
**DOUBLE 14 FT. X 7 FT. CONCRETE BOX CULVERT  
 90° SKEW**

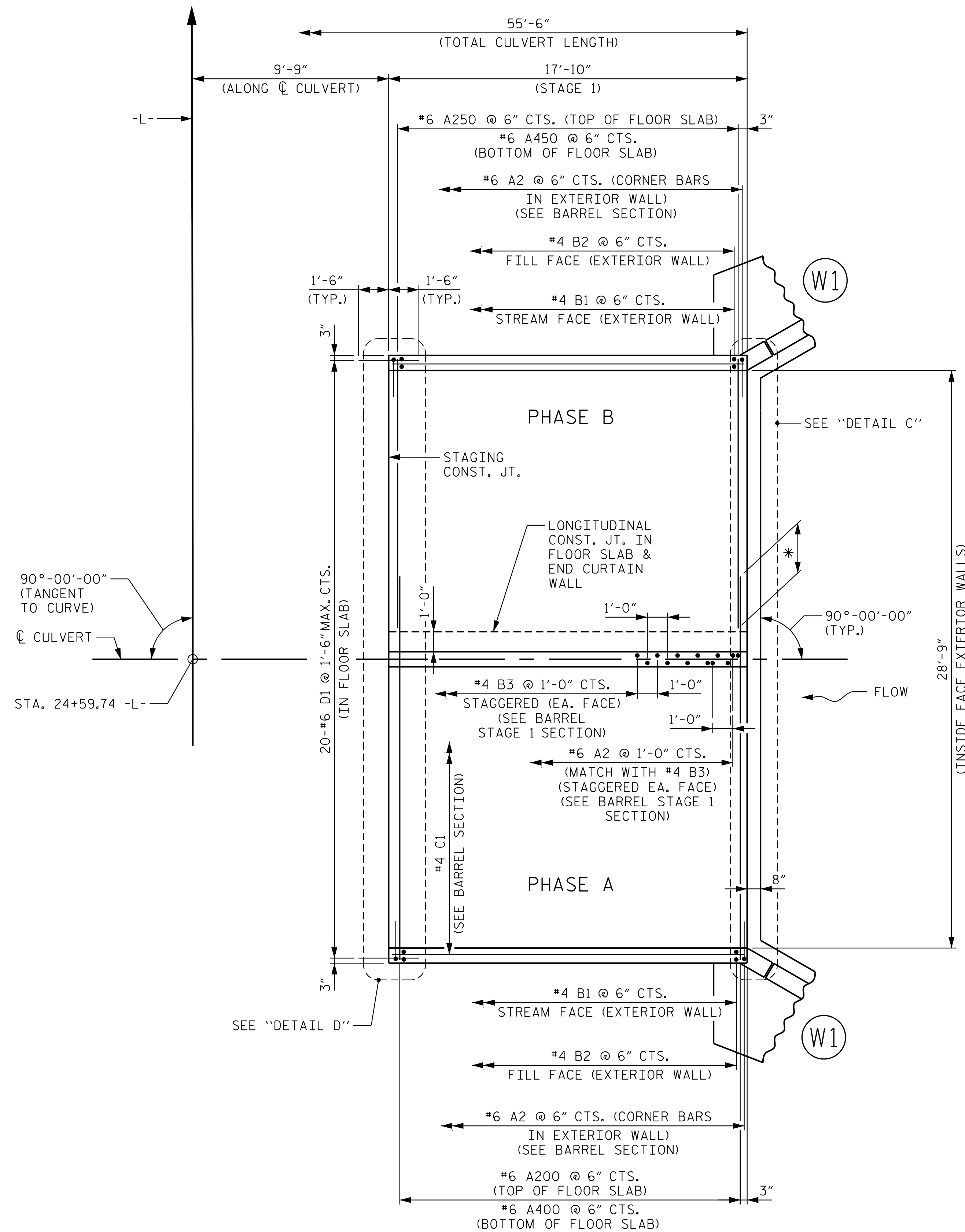
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1			3			TOTAL SHEETS	
2			4			10	

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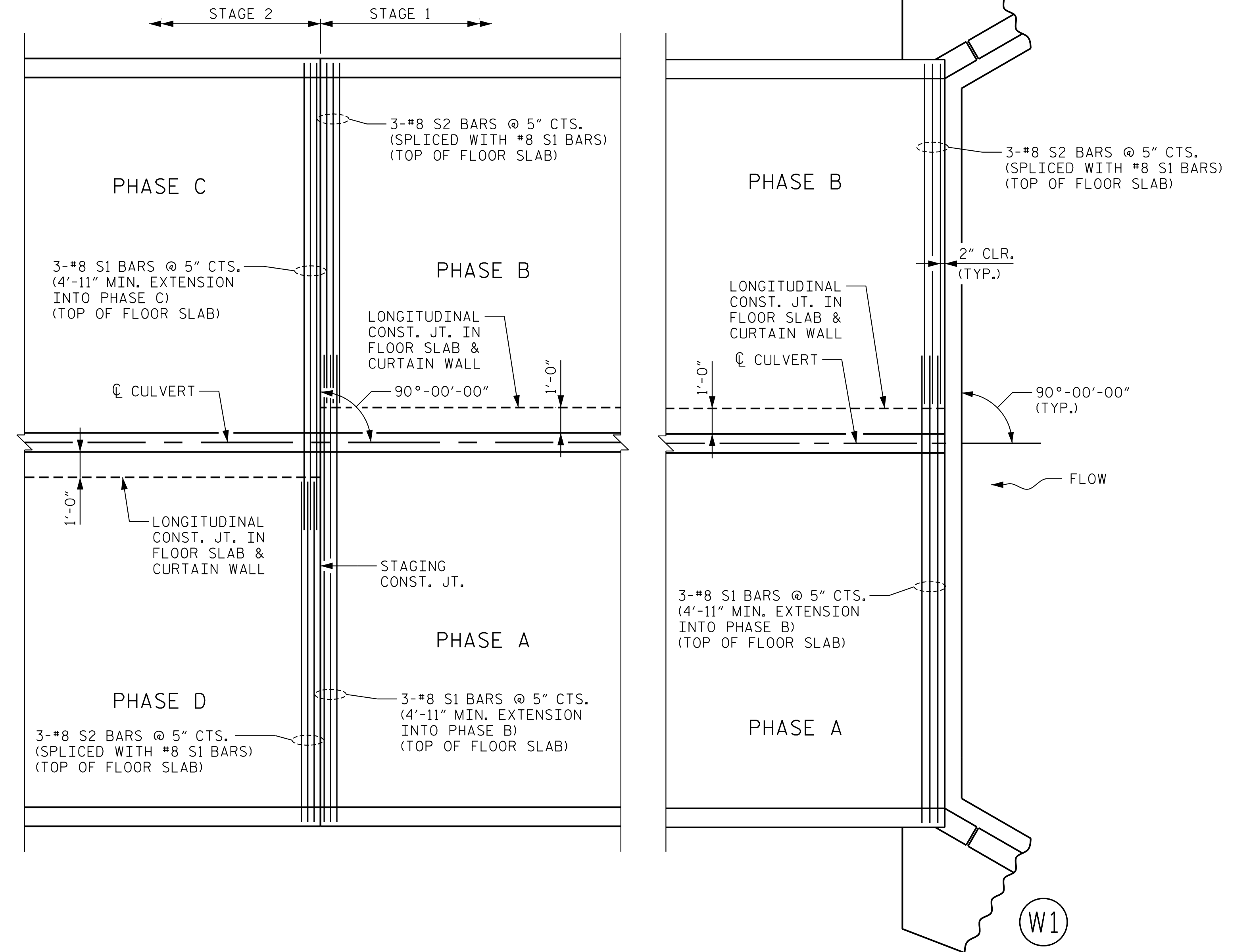
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CULVERT 41C001



**FLOOR SLAB PLAN - STAGE 1**

\* EXTEND #6 A200 2'-11" INTO PHASE B IN TOP OF FLOOR SLAB  
 \* EXTEND #6 A400 2'-11" INTO PHASE B IN BOTTOM OF FLOOR SLAB



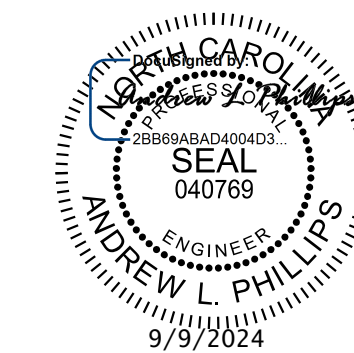
**DETAIL D**

#6-D1 NOT SHOWN FOR CLARITY

**DETAIL C**

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                   GATES                    COUNTY  
 STATION: 24+59.74 -L-

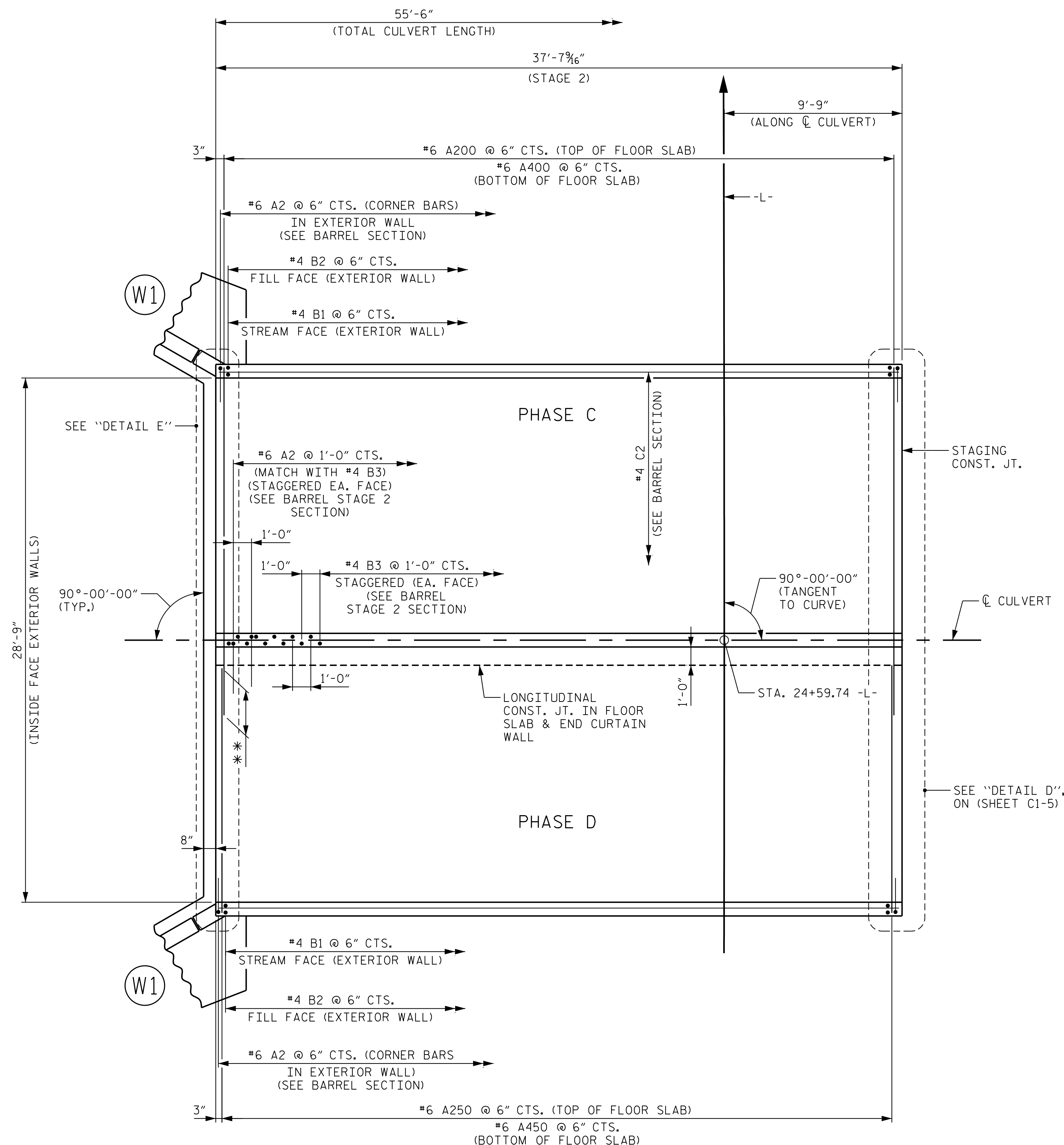
SHEET 5 OF 10

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**DOUBLE 14 FT. X 7 FT.  
 CONCRETE BOX CULVERT  
 90° SKEW  
 (STAGE 1)**

REVISIONS						SHEET NO. C1-5
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 10
2			4			

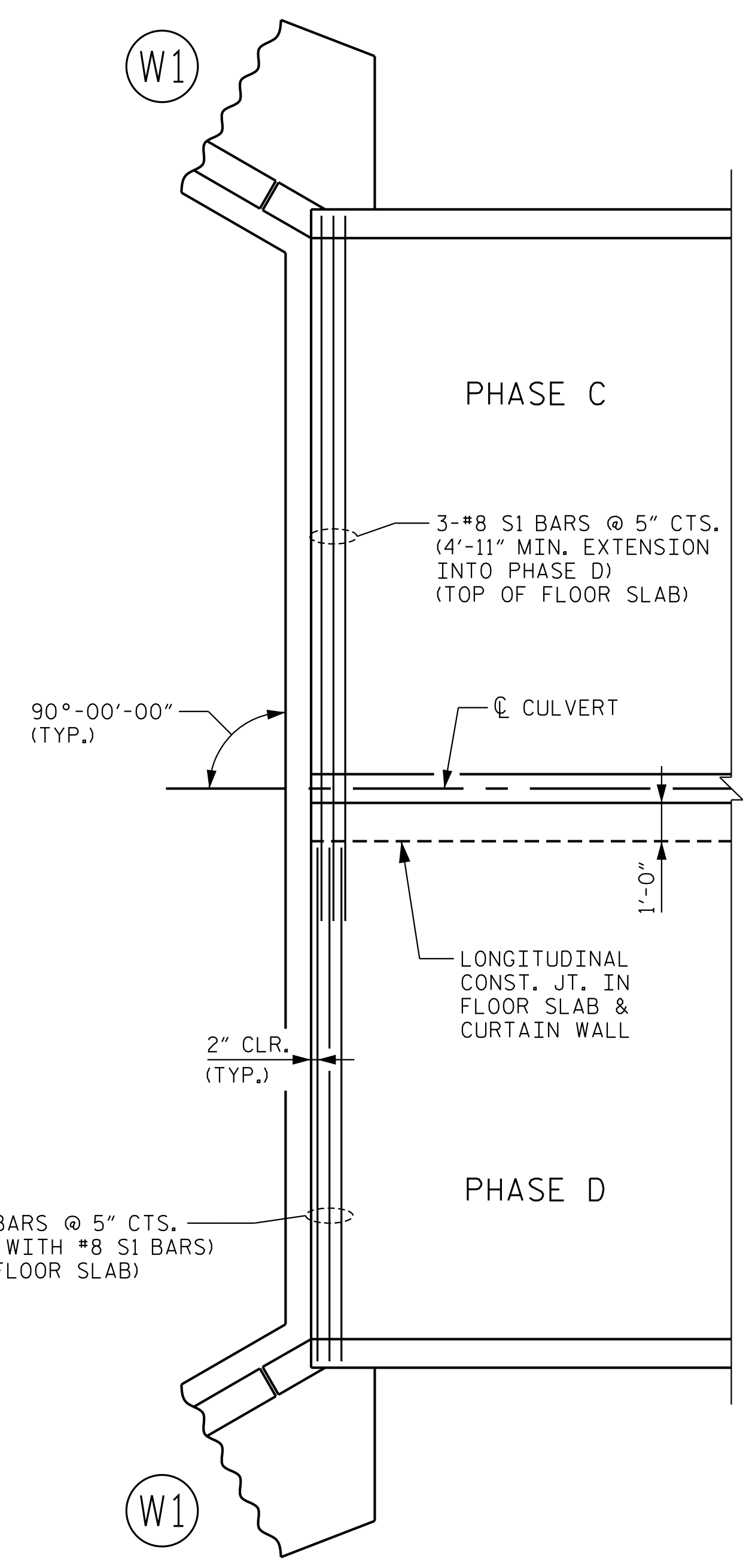
CULVERT 41C001

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### FLOOR SLAB PLAN - STAGE 2

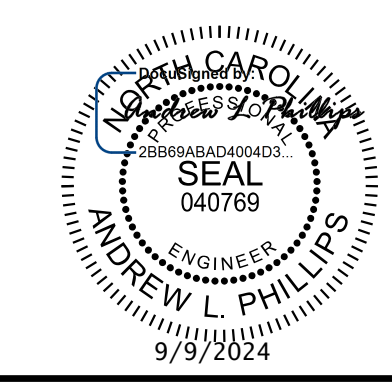
\*\* EXTEND #6 A200 2'-11" INTO PHASE D IN TOP OF FLOOR SLAB  
EXTEND #6 A400 2'-11" INTO PHASE D IN BOTTOM OF FLOOR SLAB



### DETAIL E

PROJECT NO. R-5808  
GATES COUNTY  
STATION: 24+59.74 -L-

SHEET 6 OF 10



**Kimley»Horn**  
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Raleigh, NC 27601-1772  
Phone (919) 677-2000 NC LICENSE # F-0102

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
DOUBLE 14 FT. X 7 FT.  
CONCRETE BOX CULVERT  
90° SKEW  
(STAGE 2)

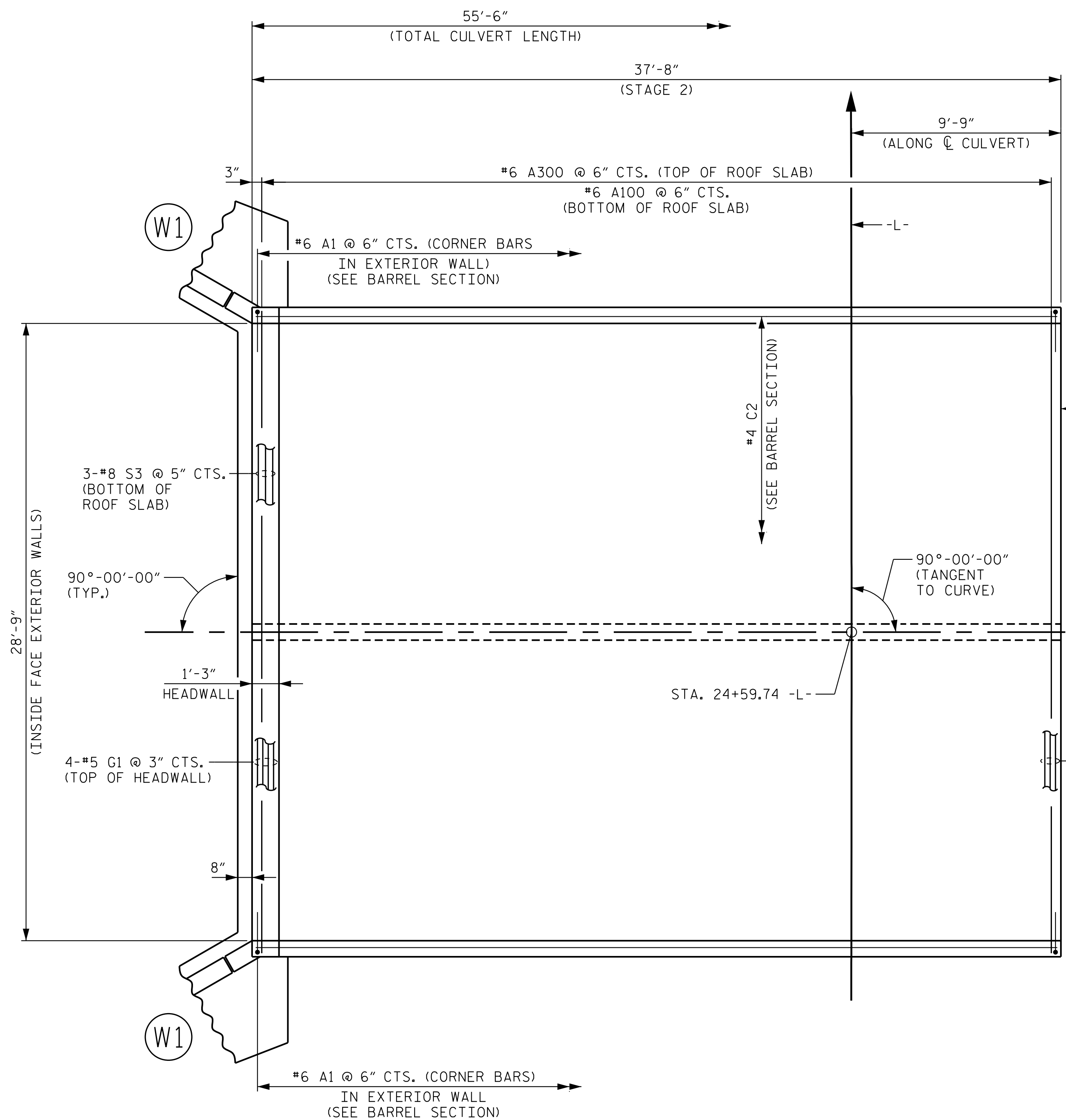
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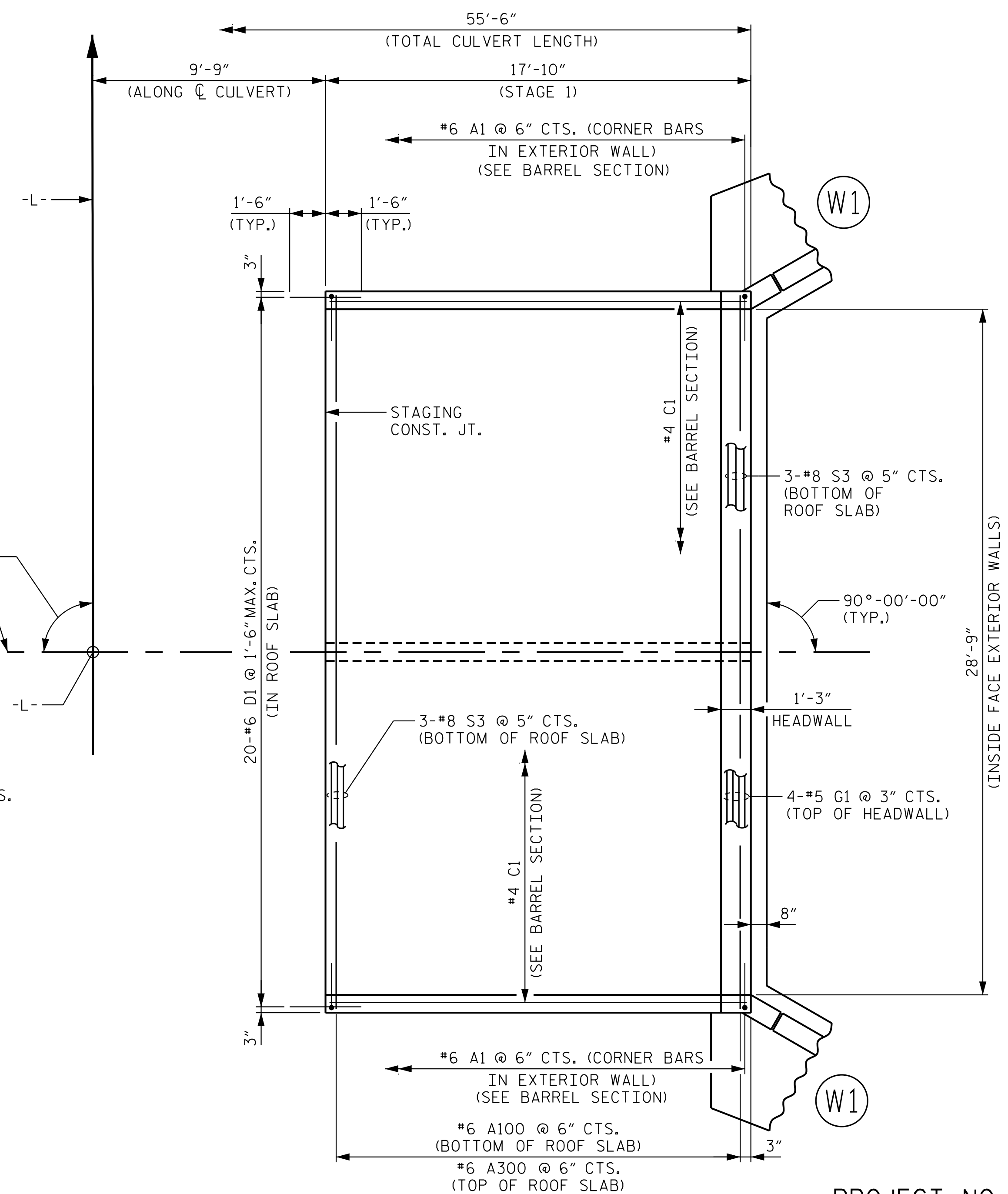
9/9/2024  
DRAWN BY: D. D. LOWERY DATE: 08/2023  
CHECKED BY: T. H. ORR DATE: 08/2023  
DESIGN ENGINEER OF RECORD: A. L. PHILLIPS DATE: 08/2023

CULVERT 41C001

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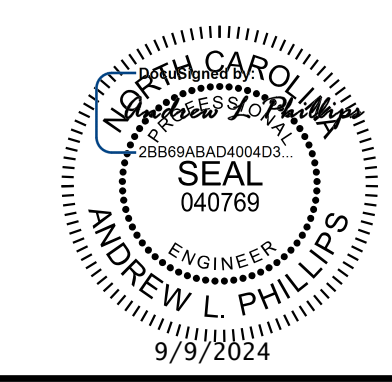
ROOF SLAB PLAN - STAGE 2



ROOF SLAB PLAN - STAGE 1

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SHEET 7 OF 10



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STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
DOUBLE 14 FT. X 7 FT.  
CONCRETE BOX CULVERT  
90° SKEW  
(STAGE 1 & 2)

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CHECKED BY: T. H. ORR DATE: 08/2023  
DESIGN ENGINEER OF RECORD: A. L. PHILLIPS DATE: 08/2023

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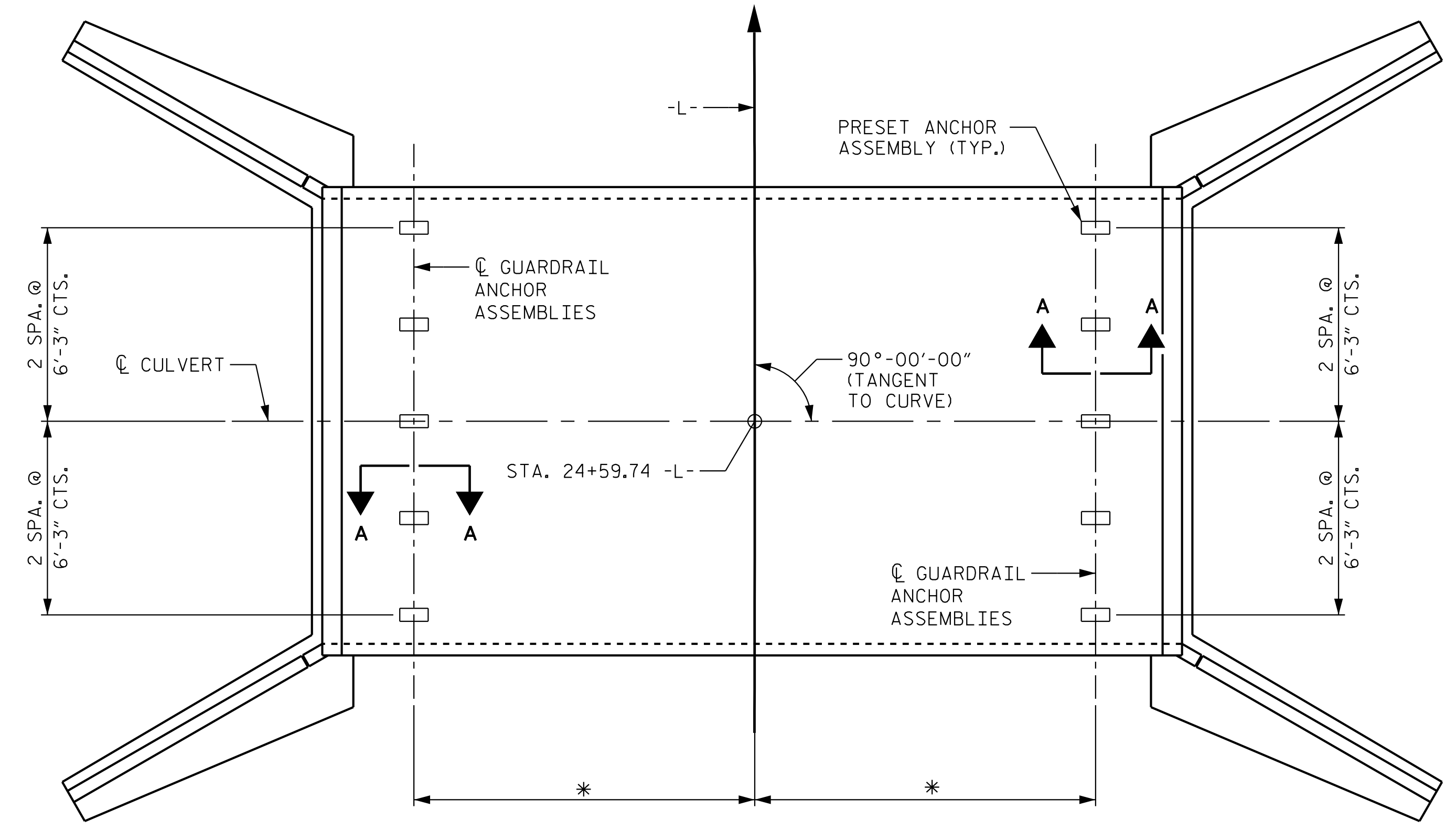
CULVERT 41C001





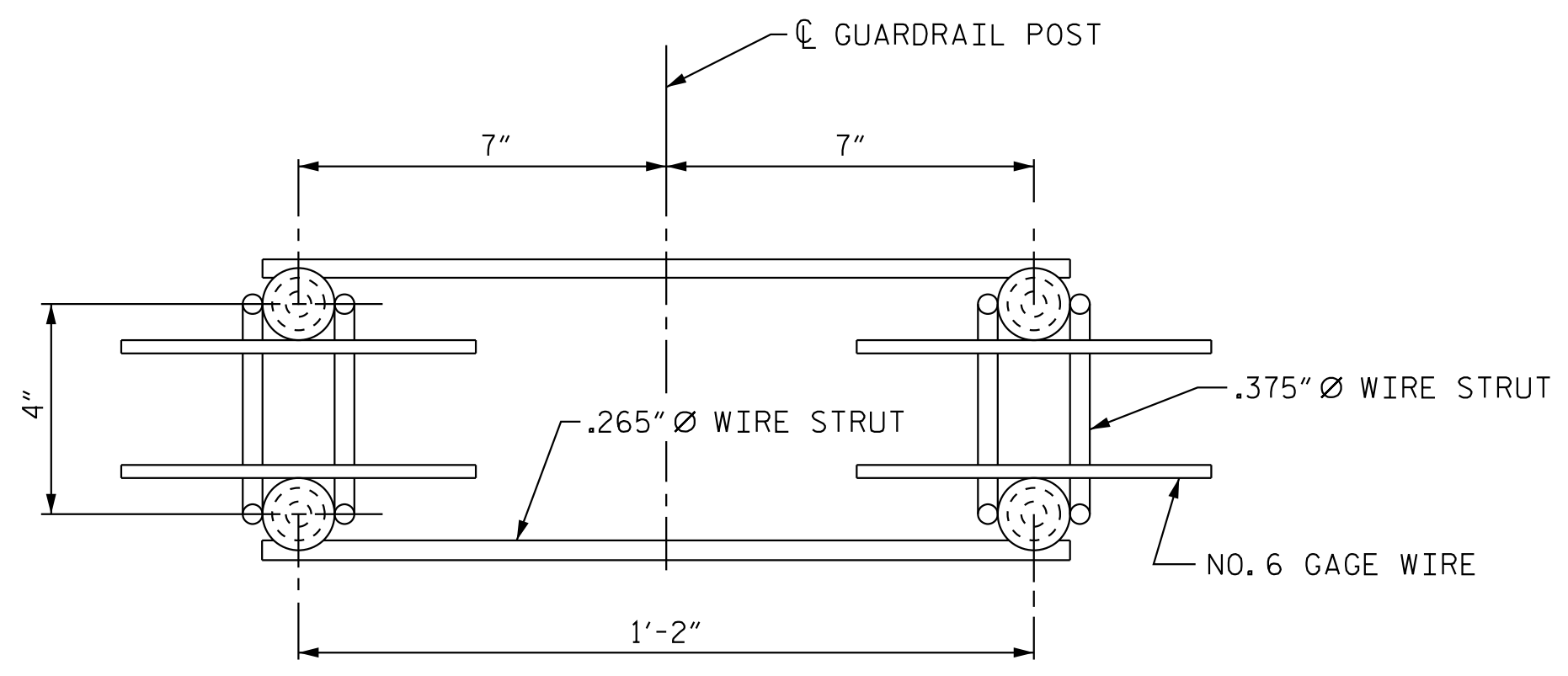
NOTES

- THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS SHALL CONSIST OF THE FOLLOWING COMPONENTS :
- A. FERRULES SHALL BE MADE FROM STEEL MEETING THE REQUIREMENTS OF AASHTO M169, GRADE 12L14 AND SHALL HAVE A MINIMUM LENGTH OF THREADS OF 2 1/2".
  - B. 4 - 1" X 2 1/4" BOLTS WITH WASHERS, BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307. BOLTS AND WASHERS SHALL BE GALVANIZED. (AT THE CONTRACTOR'S OPTION, STAINLESS STEEL BOLTS AND WASHERS MAY BE USED AS AN ALTERNATE FOR THE 1" X 2 1/4" GALVANIZED BOLTS AND WASHERS. THEY SHALL CONFORM TO OR EXCEED THE MECHANICAL REQUIREMENTS OF ASTM A307. THE USE OF THIS ALTERNATE SHALL BE APPROVED BY THE ENGINEER.)
  - C. WIRE STRUTS SHOWN IN THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS DETAIL ARE MINIMUM ALLOWABLE SIZE AND SHALL HAVE A MINIMUM TENSILE STRENGTH OF 100,000 P.S.I. AS AN OPTION, A 7/16" WIRE STRUT WITH A MINIMUM TENSILE STRENGTH OF 90,000 PSI IS ACCEPTABLE.
- GUARDRAIL ANCHOR ASSEMBLY WITH BOLTS SHALL BE ASSEMBLED IN THE SHOP. BOLT THREADS MAY BE RECUT AS NECESSARY TO INSURE FIT.
- THE COST OF THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS COMPLETE IN PLACE, SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR CLASS "A" CONCRETE.
- FERRULES TO BE PLUGGED DURING POURING OF SLAB AS RECOMMENDED BY THE MANUFACTURER.
- AT THE CONTRACTOR'S OPTION, FERRULES WITH OPEN OR CLOSED ENDS MAY BE USED.
- PAYMENT FOR GUARDRAIL, POSTS, AND POST BASE PLATES IS INCLUDED IN ROADWAY PAY ITEMS.
- SLAB REINFORCING STEEL MAY BE SHIFTED AS NECESSARY TO CLEAR GUARDRAIL ANCHOR ASSEMBLY. CARE SHOULD BE TAKEN TO KEEP THE SHIFTING OF REINFORCING STEEL TO A MINIMUM.
- THE CONTRACTOR MAY USE ADHESIVELY ANCHORED ANCHOR BOLTS IN PLACE OF GUARDRAIL ANCHOR ASSEMBLY. LEVEL TWO FIELD TESTING IS REQUIRED, AND THE YIELD LOAD OF THE 1" BOLT IS 21.8 KIPS. FOR ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS, SEE STANDARD SPECIFICATIONS.

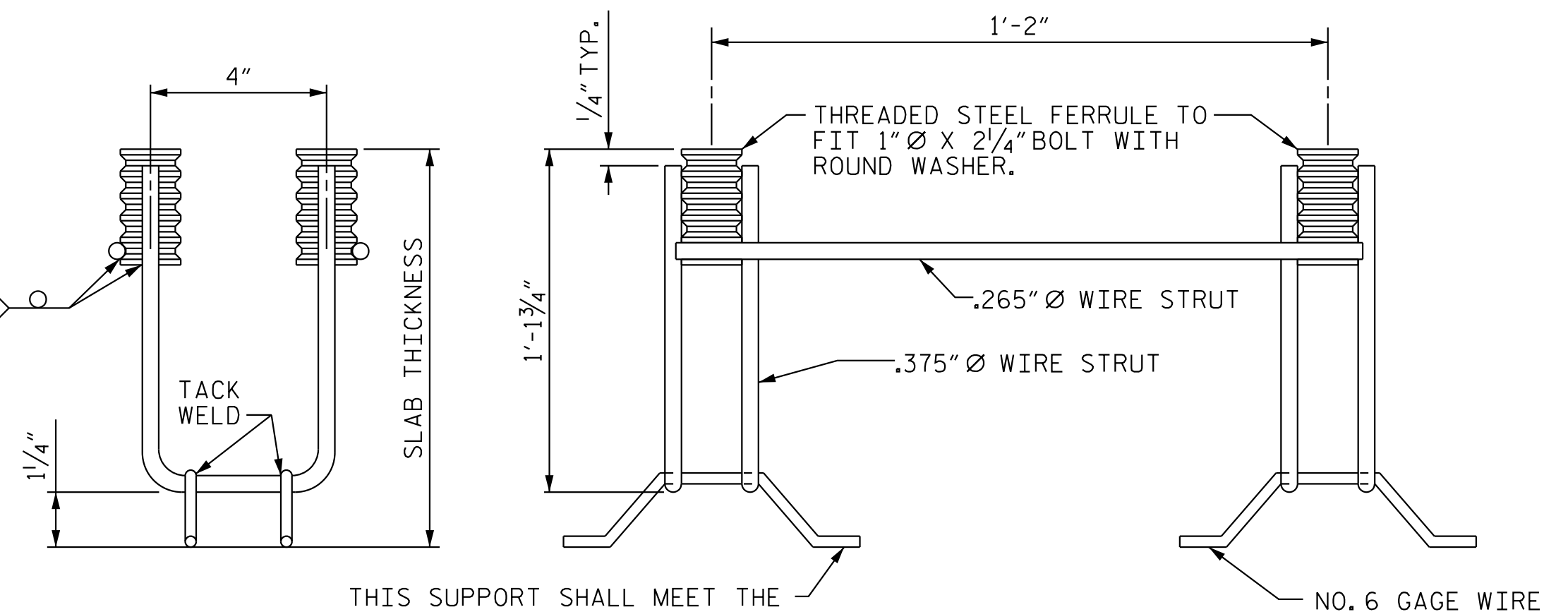


PLAN OF CULVERT GUARDRAIL ANCHOR ASSEMBLY SPACING

THE LOCATION OF THE GUARDRAIL ANCHORAGE ASSEMBLIES SHALL BE VERIFIED BY THE ENGINEER.  
 \* THESE DIMENSIONS TO BE DETERMINED BY THE ENGINEER.



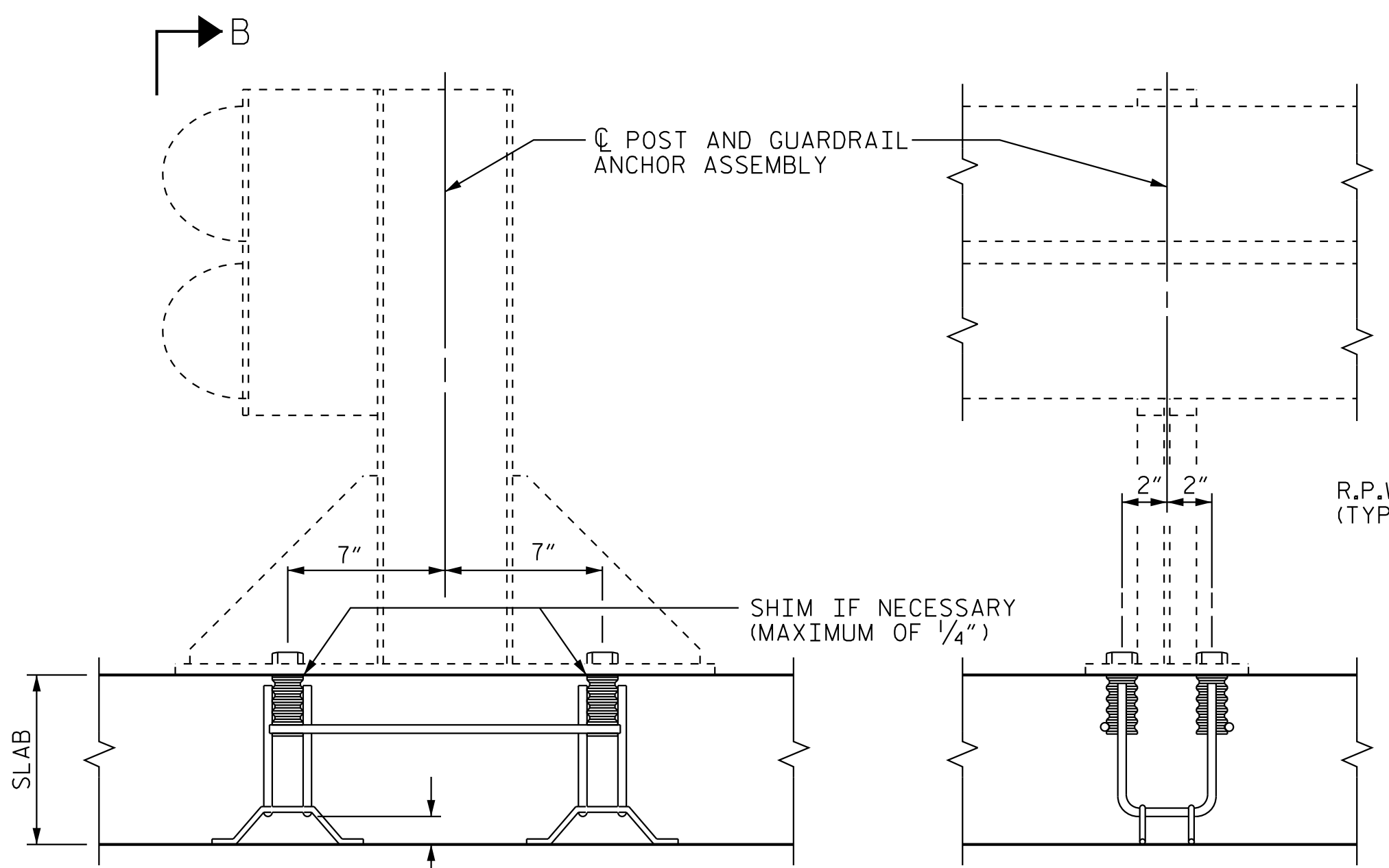
PLAN



ELEVATION

SIDE VIEW

GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS



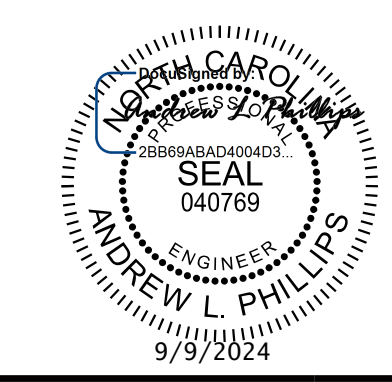
SECTION A-A

SECTION B-B

PROJECT NO. R-5808  
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SHEET 9 OF 10

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



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ASSEMBLED BY : D. D. LOWERY	DATE : 08/2023
CHECKED BY : A. L. PHILLIPS	DATE : 08/2023
DRAWN BY : FCJ 6/88	REV. 10/17/11 MAA/GM
CHECKED BY : ARB 6/88	REV. 12/17 MAA/THC
	REV. 6/19 MAA/THC

LOAD FACTORS: \_\_\_\_\_

### LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

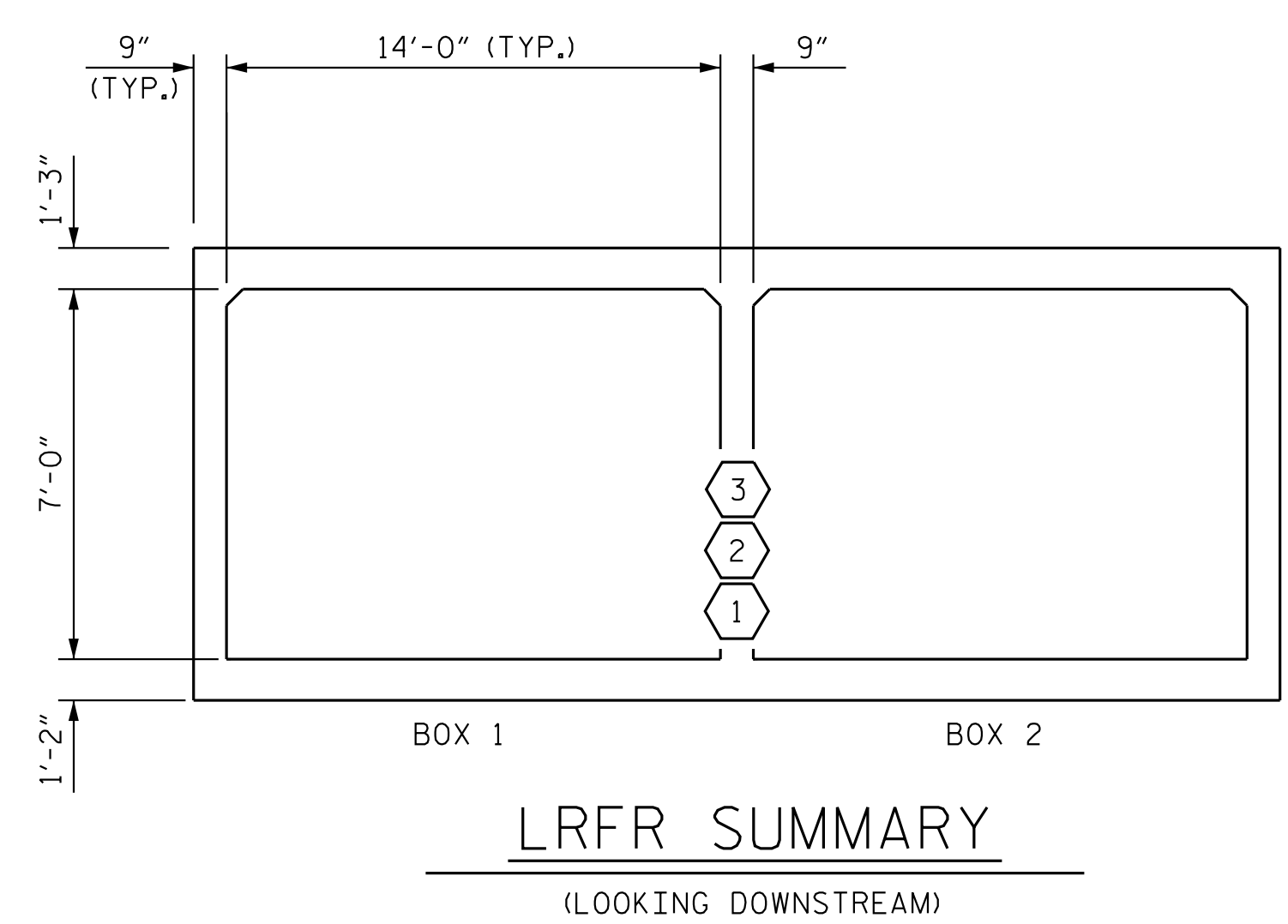
#### DESIGN LOAD RATING FACTORS

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.  
DISTANCE FROM LEFT END OF ELEMENT IS GIVEN FROM THE EXTERIOR EDGE OF EXTERIOR WALL.

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	1.18	--	1.75	1.28	2	BOTTOM SLAB	15.50	1.18	2	TOP SLAB	15.50		
	HL-93 (OPERATING)	N/A		1.53	--	1.35	1.66	2	BOTTOM SLAB	15.50	1.53	2	TOP SLAB	15.50		
	HS-20 (INVENTORY)	36.000	②	1.41	50.76	1.75	1.56	1	BOTTOM SLAB	14.75	1.41	2	TOP SLAB	15.50		
	HS-20 (OPERATING)	36.000		1.82	65.52	1.35	2.03	1	BOTTOM SLAB	14.75	1.82	2	TOP SLAB	15.50		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		3.91	52.79	1.40	3.91	1	TOP SLAB	15.13	4.41	2	TOP SLAB	15.50		
		SNGARBS2	20.000		3.66	73.20	1.40	3.66	1	TOP SLAB	15.13	3.85	2	TOP SLAB	15.50	
		SNAGRIS2	22.000		3.67	80.74	1.40	3.67	1	TOP SLAB	15.50	4.04	2	TOP SLAB	15.50	
		SNCOTTS3	27.250		1.86	50.69	1.40	2.33	1	TOP SLAB	15.50	1.86	2	TOP SLAB	15.50	
		SNAGGRS4	34.925		2.09	72.99	1.40	2.21	2	BOTTOM SLAB	15.50	2.09	2	TOP SLAB	15.50	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	SNS5A	35.550		1.98	70.39	1.40	2.16	2	BOTTOM SLAB	15.50	1.98	2	TOP SLAB	15.50	
		SNS6A	39.950		1.94	77.50	1.40	1.94	2	BOTTOM SLAB	15.50	1.98	2	TOP SLAB	15.50	
		SNS7B	42.000		1.96	82.32	1.40	2.04	2	BOTTOM SLAB	15.50	1.96	2	TOP SLAB	15.50	
		TNAGRIT3	33.000		2.51	82.83	1.40	2.51	2	BOTTOM SLAB	15.13	2.84	2	TOP SLAB	15.50	
		TNT4A	33.075		2.24	74.09	1.40	2.36	2	BOTTOM SLAB	15.50	2.24	2	TOP SLAB	15.50	
		TNT6A	41.600		1.98	82.37	1.40	2.20	2	BOTTOM SLAB	15.50	1.98	2	TOP SLAB	15.50	
		TNT7A	42.000		2.01	84.42	1.40	2.01	2	BOTTOM SLAB	15.50	2.05	2	TOP SLAB	15.50	
		TNT7B	42.000		1.95	81.90	1.40	1.95	2	BOTTOM SLAB	15.50	2.06	2	TOP SLAB	15.50	
		TNAGRIT4	43.000		1.88	80.84	1.40	1.88	2	BOTTOM SLAB	15.50	2.10	2	TOP SLAB	15.50	
		TNAGT5A	45.000		1.84	82.80	1.40	1.84	2	BOTTOM SLAB	15.50	2.07	2	BOTTOM SLAB	15.50	
TNAGT5B	45.000		1.81	81.45	1.40	1.81	2	BOTTOM SLAB	15.50	1.97	2	TOP SLAB	15.50			
EMERGENCY VEHICLE (EV)	EV2	28.750		2.70	77.63	1.30	2.76	1	TOP SLAB	15.13	2.70	2	TOP SLAB	15.50		
	EV3	43.000	③	1.47	63.21	1.30	1.90	2	BOTTOM SLAB	15.50	1.47	2	TOP SLAB	15.50		

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

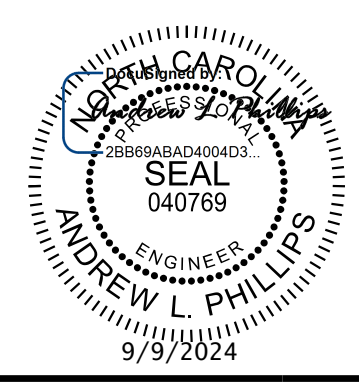


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 STATION: 24+59.74 -L-

SHEET 10 OF 10

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

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



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ASSEMBLED BY : D. D. LOWERY	DATE : 08/2023
CHECKED BY : A. L. PHILLIPS	DATE : 08/2023
DRAWN BY : WMC 7/11	REV. 10/1/11 MAA/GM
CHECKED BY : GM 7/11	REV. 12/17 MAA/THC
	REV. 04/23 BNB/AAI

## STANDARD NOTES

### DESIGN DATA:

SPECIFICATIONS .....	AASHTO (CURRENT)
LIVE LOAD .....	SEE PLANS
IMPACT ALLOWANCE .....	SEE AASHTO
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 AASHTO
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 2024 "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES" OF THE N. C. DEPARTMENT OF TRANSPORTATION.

STEEL SHEET PILING FOR PERMANENT OR TEMPORARY APPLICATIONS SHALL BE HOT ROLLED.

### CONCRETE:

UNLESS OTHERWISE REQUIRED ON PLANS, CLASS A CONCRETE SHALL BE USED FOR ALL PORTIONS OF ALL STRUCTURES WITH THE EXCEPTION THAT: CLASS AA CONCRETE SHALL BE USED IN BRIDGE SUPERSTRUCTURES, ABUTMENT BACKWALLS, AND APPROACH SLABS; AND CLASS B CONCRETE SHALL BE USED FOR SLOPE PROTECTION AND RIP RAP.

### CONCRETE CHAMFERS:

UNLESS OTHERWISE NOTED ON THE PLANS, ALL EXPOSED CORNERS ON STRUCTURES SHALL BE CHAMFERED  $\frac{3}{4}$ " WITH THE FOLLOWING EXCEPTIONS: TOP CORNERS OF CURBS MAY BE ROUNDED TO  $1\frac{1}{2}$ " RADIUS WHICH IS BUILT INTO CURB FORMS; CORNERS OF TRANSVERSE FLOOR EXPANSION JOINTS SHALL BE ROUNDED WITH A  $\frac{1}{4}$ " FINISHING TOOL UNLESS OTHERWISE REQUIRED ON PLANS; AND CORNERS OF EXPANSION JOINTS IN THE ROADWAY FACES AND TOPS OF CURBS AND SIDEWALKS SHALL BE ROUNDED TO A  $\frac{1}{4}$ " RADIUS WITH A FINISHING STONE OR TOOL UNLESS OTHERWISE REQUIRED ON PLANS.

### DOWELS:

DOWELS WHEN INDICATED ON PLANS AS FOR CULVERT EXTENSIONS, SHALL BE EMBEDDED AT LEAST 12" INTO THE OLD CONCRETE AND GROUTED INTO PLACE WITH 1:2 CEMENT MORTAR.

### ALLOWANCE FOR DEAD LOAD DEFLECTION, SETTLEMENT, ETC. IN CASTING SUPERSTRUCTURES:

BRIDGES SHALL BE BUILT ON THE GRADE OR VERTICAL CURVE SHOWN ON PLANS. SLABS, CURBS AND PARAPETS SHALL CONFORM TO THE GRADE OR CURVE.

ALL DIMENSIONS WHICH ARE GIVEN IN SECTION AND ARE AFFECTED BY DEAD LOAD DEFLECTIONS ARE DIMENSIONS AT CENTER LINE OF BEARING UNLESS OTHERWISE NOTED ON PLANS. IN SETTING FORMS FOR STEEL BEAM BRIDGES AND PRESTRESSED CONCRETE GIRDER BRIDGES, ADJUSTMENTS SHALL BE MADE DUE TO THE DEAD LOAD DEFLECTIONS FOR THE ELEVATIONS SHOWN. WHERE BLOCKS ARE SHOWN OVER BEAMS FOR BUILDING UP TO THE SLAB, THE VERTICAL DIMENSIONS OF THE BLOCKS SHALL BE ADJUSTED BETWEEN BEARINGS TO COMPENSATE FOR DEAD LOAD DEFLECTIONS, VERTICAL CURVE ORDINATE, AND ACTUAL BEAM CAMBER. WHERE BOTTOM OF SLAB IS IN LINE WITH BOTTOM OF TOP FLANGES, DEPTH OF SLAB BETWEEN BEARINGS SHALL BE ADJUSTED TO COMPENSATE FOR DEAD LOAD DEFLECTION, VERTICAL CURVE ORDINATE, AND ACTUAL BEAM CAMBER.

IN SETTING FALSEWORK AND FORMS FOR REINFORCED CONCRETE SPANS, AN ALLOWANCE SHALL BE MADE FOR DEAD LOAD DEFLECTIONS, SETTLEMENT OF FALSEWORK, AND PERMANENT CAMBER WHICH SHALL BE PROVIDED FOR IN ADDITION TO THE ELEVATIONS SHOWN. AFTER REMOVAL OF THE FALSEWORK, THE FINISHED STRUCTURES SHALL CONFORM TO THE PROFILE AND ELEVATIONS SHOWN ON THE PLANS AND CONSTRUCTION ELEVATIONS FURNISHED BY THE ENGINEER.

DETAILED DRAWINGS FOR FALSEWORK OR FORMS FOR BRIDGE SUPERSTRUCTURE AND ANY STRUCTURE OR PARTS OF A STRUCTURE AS NOTED ON THE PLANS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL BEFORE CONSTRUCTION OF THE FALSEWORK OR FORMS IS STARTED.

### REINFORCING STEEL:

ALL REINFORCING STEEL SHALL BE DEFORMED. DIMENSIONS RELATIVE TO PLACEMENT OF REINFORCING ARE TO CENTERS OF BARS UNLESS OTHERWISE INDICATED IN THE PLANS. DIMENSIONS ON BAR DETAILS ARE TO CENTERS OF BARS OR ARE OUT TO OUT AS INDICATED ON PLANS.

WIRE BAR SUPPORTS SHALL BE PROVIDED FOR REINFORCING STEEL WHERE INDICATED ON THE PLANS. WHEN BAR SUPPORT PIECES ARE PLACED IN CONTINUOUS LINES, THEY SHALL BE SO PLACED THAT THE ENDS OF THE SUPPORTING WIRES SHALL BE LAPPED TO LOCK LEGS ON ADJOINING PIECES.

### STRUCTURAL STEEL:

AT THE CONTRACTOR'S OPTION, HE MAY SUBSTITUTE  $\frac{7}{8}$ "  $\emptyset$  SHEAR STUDS FOR THE  $\frac{3}{4}$ "  $\emptyset$  STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 -  $\frac{7}{8}$ "  $\emptyset$  STUDS FOR 4 -  $\frac{3}{4}$ "  $\emptyset$  STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF  $\frac{7}{8}$ "  $\emptyset$  STUDS ALONG THE BEAM AS SHOWN FOR  $\frac{3}{4}$ "  $\emptyset$  STUDS BASED ON THE RATIO OF 3 -  $\frac{7}{8}$ "  $\emptyset$  STUDS FOR 4 -  $\frac{3}{4}$ "  $\emptyset$  STUDS. STUDS OF THE LENGTH SPECIFIED ON THE PLANS MUST BE PROVIDED. THE MAXIMUM SPACING SHALL BE 2'-0".

EXCEPT AT THE INTERIOR SUPPORTS OF CONTINUOUS BEAMS WHERE THE COVER PLATE IS IN CONTACT WITH BEARING PLATE, THE CONTRACTOR MAY, AT HIS OPTION, SUBSTITUTE FOR THE COVER PLATES DESIGNATED ON THE PLANS COVER PLATES OF THE EQUIVALENT AREA PROVIDED THESE PLATES ARE AT LEAST  $\frac{5}{16}$ " IN THICKNESS AND DO NOT EXCEED A WIDTH EQUAL TO THE FLANGE WIDTH LESS 2" OR A THICKNESS EQUAL TO 2 TIMES THE FLANGE THICKNESS. THE SIZE OF FILLET WELDS SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT ANSI/AASHTO/AWS "BRIDGE WELDING CODE". ELECTROSLAG WELDING WILL NOT BE PERMITTED.

WITH THE SOLE EXCEPTION OF EDGES AT SURFACES WHICH BEAR ON OTHER SURFACES, ALL SHARP EDGES AND ENDS OF SHAPES AND PLATES SHALL BE SLIGHTLY ROUNDED BY SUITABLE MEANS TO A RADIUS OF APPROXIMATELY  $\frac{1}{16}$ " 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.