

LOCATION SKETCH

**HYDRAULIC DATA:**

DESIGN DISCHARGE	= 1400 CFS
FREQUENCY OF DESIGN FLOOD	= 100 YEAR
DESIGN HIGH WATER ELEVATION	= 2081.80
DRAINAGE AREA	= 3.43 SQ. MI.
BASE DISCHARGE (Q 100)	= 1400 CFS
BASE HIGH WATER ELEVATION	= 2081.80

**OVERTOPPING FLOOD DATA:**

OVERTOPPING DISCHARGE	= 1900+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YEAR
OVERTOPPING FLOOD ELEVATION	= 2097.10 **
** OVERTOPPING OCCURS AT EL. 2097.1 ± INTO NEXT DRAINAGE AREA AT STA. 64+50.00 -Y- RT.	

**HORIZONTAL CURVE DATA**

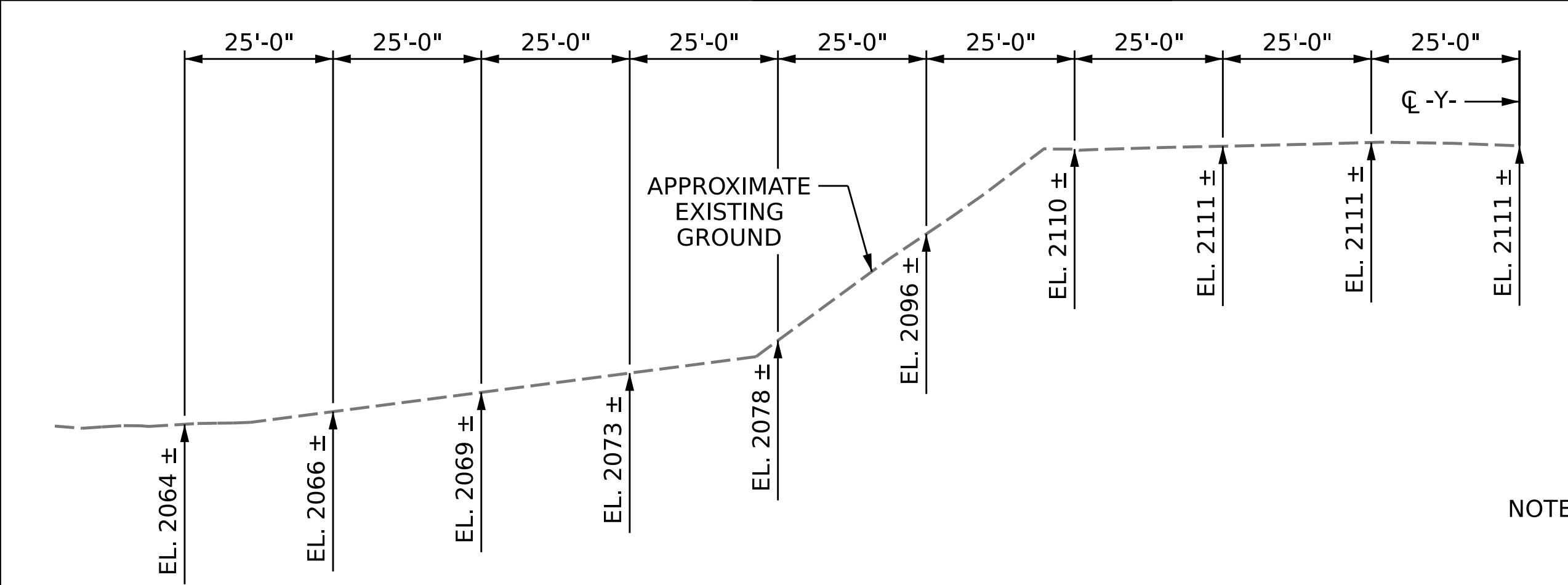
PI STA. 18+02.20 -Y5RPA-
Δ = 4°-44'-02.6 (LT.)
D = 0°-40'-26.6"
L = 702.31'
T = 351.35'
R = 8500.00'

**GRADE DATA:**

GRADE POINT EL. @ STA. 15+15.43 -Y5RPA- = EL. 2107.53
BED EL. @ STA. 15+15.43 -Y5RPA- = EL. 2065.45
ROADWAY SLOPE 2:1

**TOTAL STRUCTURE QUANTITIES**

CLASS A CONCRETE	
BARREL @ 3.603 CY/FT	345.0 C.Y.
HEADWALL, EDGE BEAMS	2.9 C.Y.
SILL	0.5 C.Y.
WINGS, CURTAIN WALL	20.8 C.Y.
TOTAL	369.2 C.Y.
REINFORCING STEEL	
BARRELS, ETC.	42,952 LBS.
WINGS, ETC.	1,373 LBS.
TOTAL	44,325 LBS.
BOX CULVERT EXCAVATION	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	191 TONS



PROFILE ALONG CL CULVERT

**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.

FOUNDATION NOTES:

EXCAVATE FOUNDATION A MINIMUM OF 12" BELOW CULVERT BEARING ELEVATION. PLACE 12" OF CLASS VI FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.

OVEREXCAVATE ADDITIONAL LOOSE/SOFT OR ORGANIC MATERIAL IF PRESENT TO SUITABLE BEARING MATERIALS AND REPLACE WITH ADDITIONAL CLASS IV FOUNDATION CONDITIONING MATERIAL.

WRAP TYPE 4 GEOTEXTILE AROUND THE COLD JOINT BETWEEN THE EXISTING AND NEW CULVERT. OVERLAP GEOTEXTILE A MINIMUM OF 1 FOOT IN BOTH DIRECTIONS FROM JOINT.

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

DRAWN BY : S.D. COOPER DATE : 5-23  
 CHECKED BY : J.A. BATTS DATE : 5-23  
 DESIGN ENGINEER OF RECORD: J.A. BATTS DATE : 5-23

NOTES:

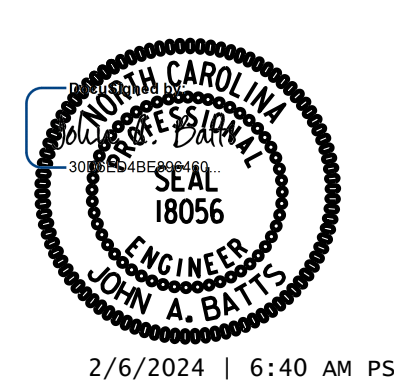
- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- DESIGN FILL ----- 35'-0"
- FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTES SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
  - EDGE BEAM AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
  - THE REMAINING PORTIONS OF THE WALLS FULL HEIGHT FOLLOWED BY ROOF SLAB, HEADWALL AND EDGE BEAM.
- THE ENGINEER SHALL CHECK THE LENGTH OF THE CULVERT EXTENSION BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF 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 THE JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- 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.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF 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 THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- 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.
- CULVERT MUST BE CAST-IN-PLACE; PRECAST OPTION WILL NOT BE ALLOWED.
- DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.
- IF APPROVED BY THE ENGINEER, THE CONTRACTOR MAY USE THE EXISTING WINGS AS TEMPORARY SHORING FOR THE CONSTRUCTION OF THE CULVERT EXTENSION. IN THIS CASE, THE BOTTOM SLAB OF THE EXTENSION SHALL BE POURED AT LEAST 72 HOURS PRIOR TO CUTTING THE WINGS. THE WINGS MAY BE CUT EARLIER PROVIDED THE SLAB CONCRETE STRENGTH HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI.
- THE ENTIRE COST OF WORK REQUIRED TO PLACE EXCAVATED OR SUPPLEMENTAL MATERIAL AS SHOWN ON THE PLANS SHALL BE INCLUDED IN THE LUMP SUM PRICE FOR CULVERT EXCAVATION.
- 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.
- 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 SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 59+50.00 -Y-

SHEET 1 OF 7 EXTENDS CULVERT #100320

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

TRIPLE 7 FT. X 9 FT. CONCRETE BOX CULVERT



LICENSURE NO. C-4434

2/6/2024 6:40 AM PST

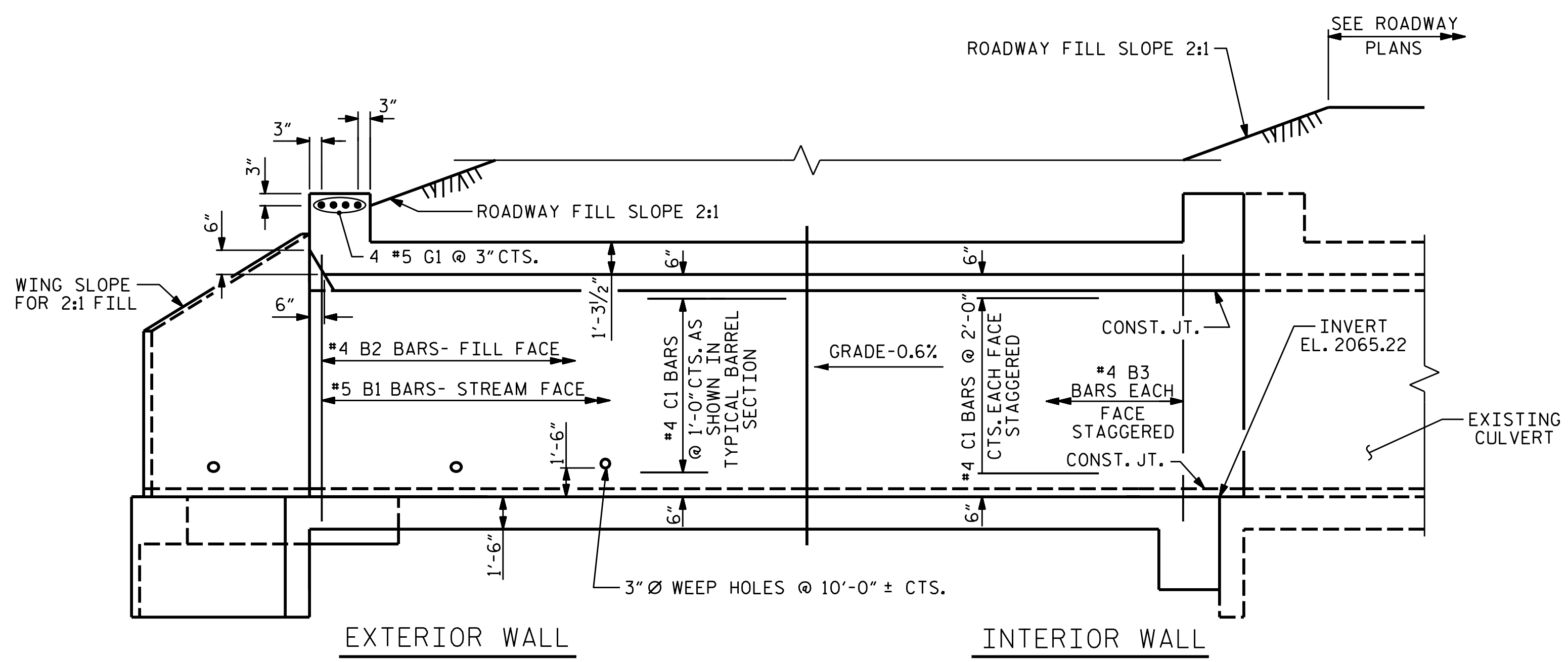
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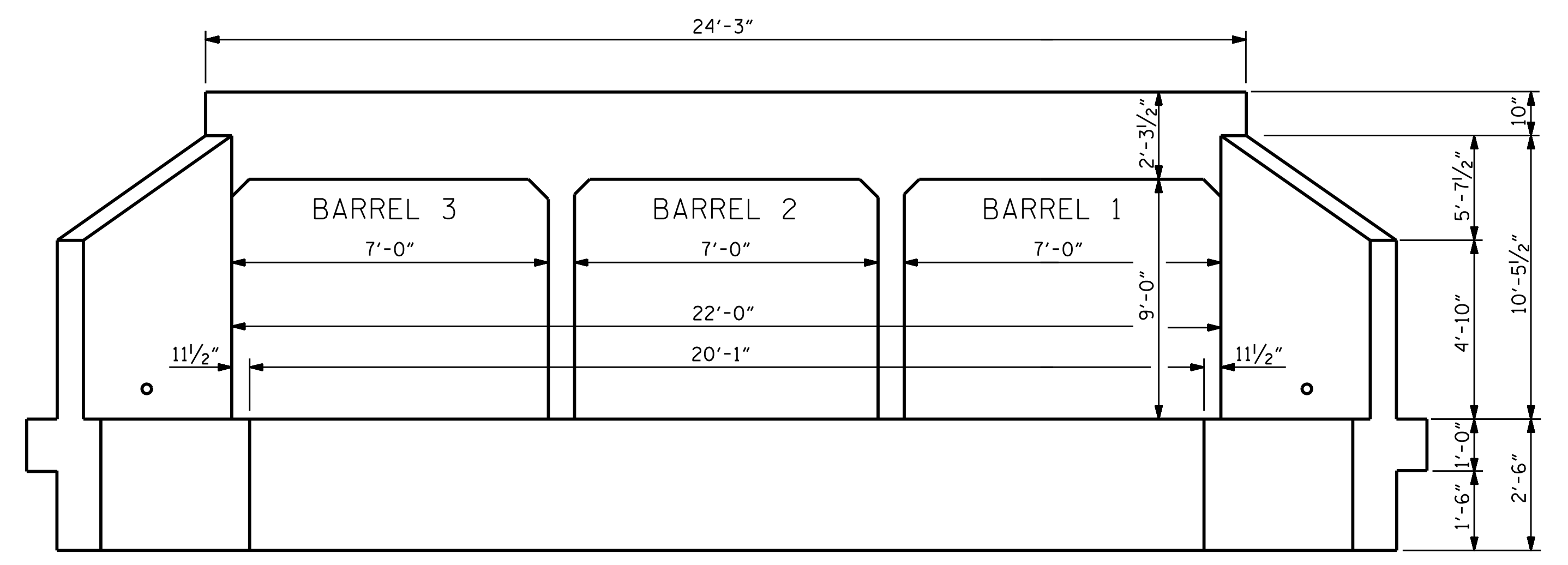
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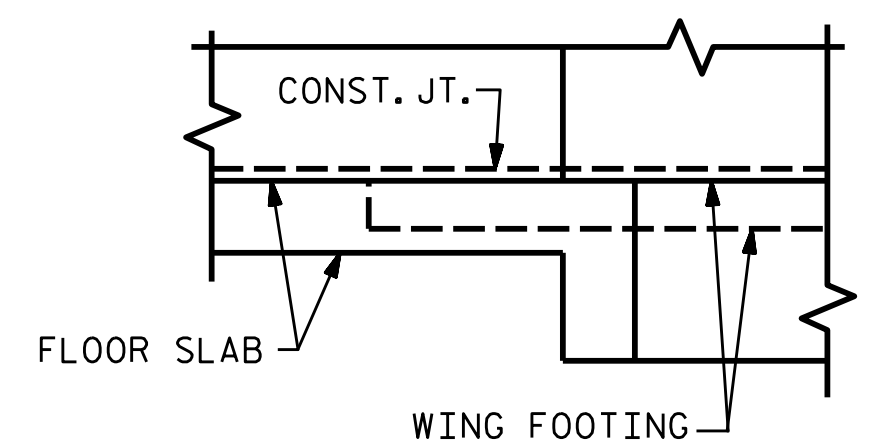
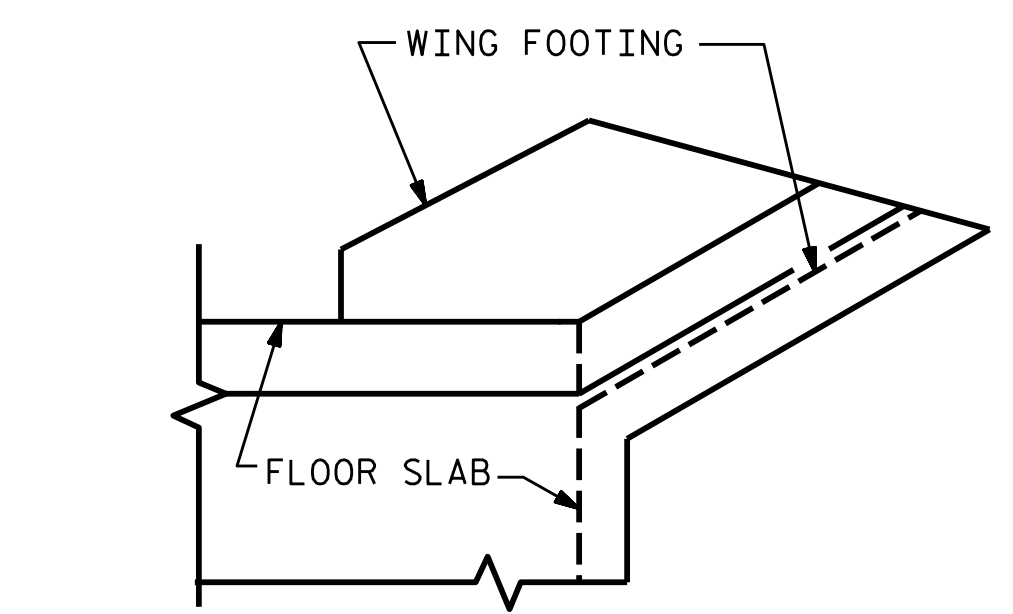




CULVERT SECTION NORMAL TO -Y-



END ELEVATION



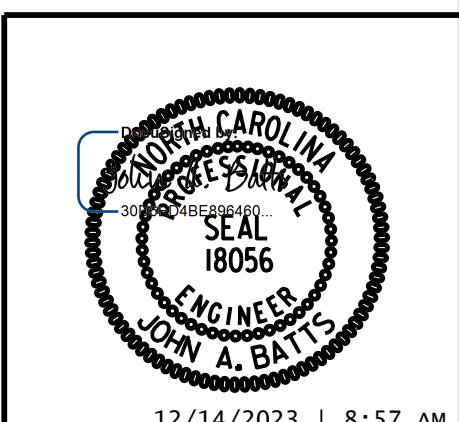
DETAIL  
CONNECTION OF WING FOOTING AND FLOOR SLAB WHEN SLAB IS THICKER THAN FOOTING

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 59+50.00 -Y-

SHEET 2 OF 7

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**TRIPLE 7 FT. X 9 FT. CONCRETE BOX CULVERT**



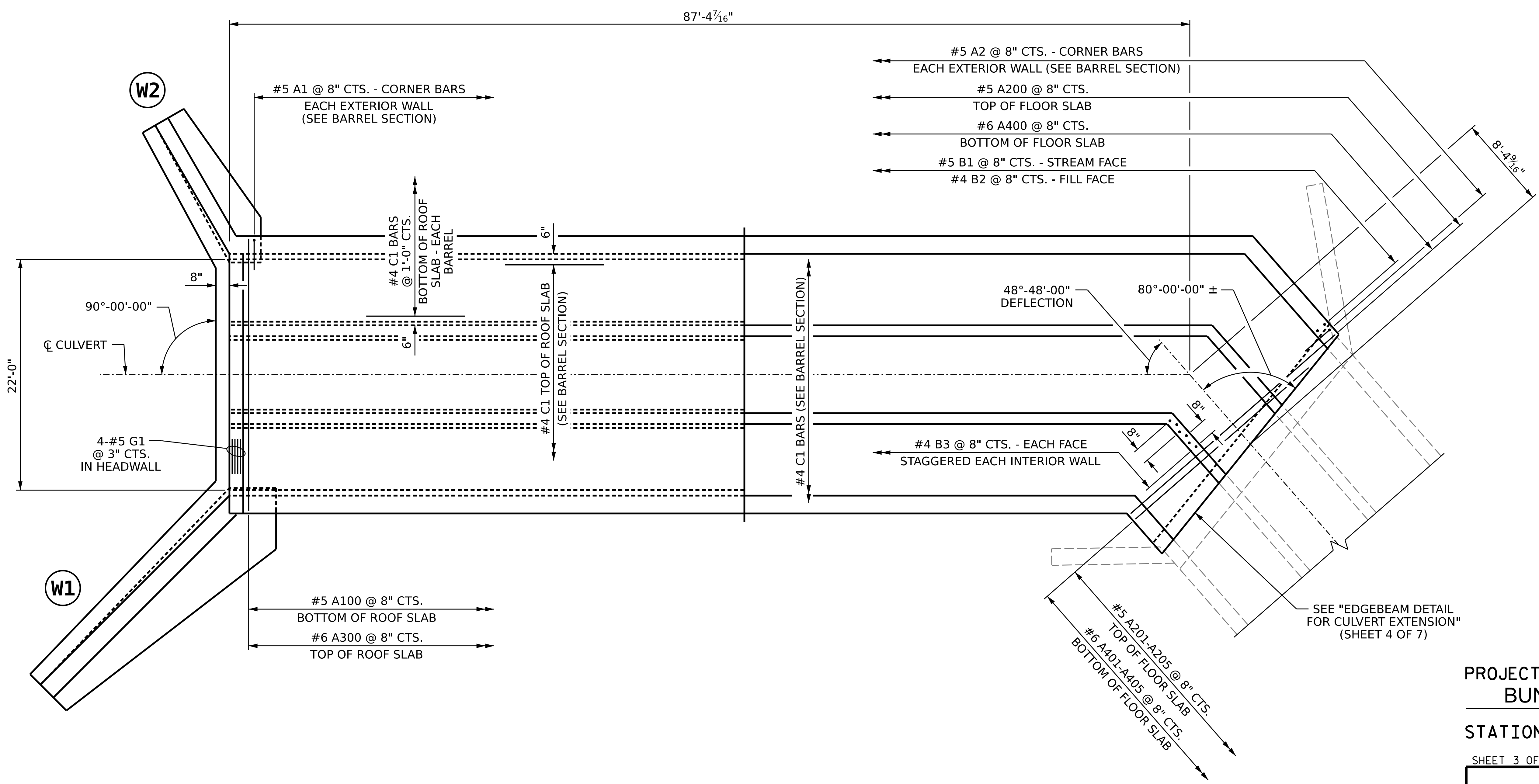
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 12/14/2023 | 8:57 AM  
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2			4			7

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**PART PLAN - ROOF SLAB**

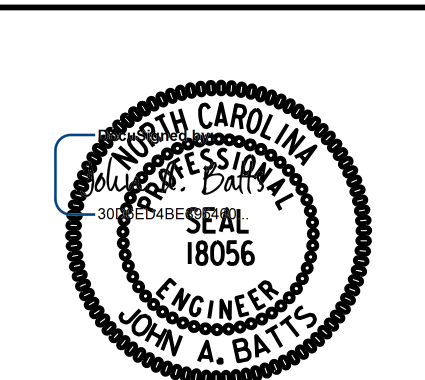
**PART PLAN - FLOOR SLAB**

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 59+50.00 -Y-

SHEET 3 OF 7

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**TRIPLE 7 FT. X 9 FT.  
 CONCRETE BOX CULVERT**



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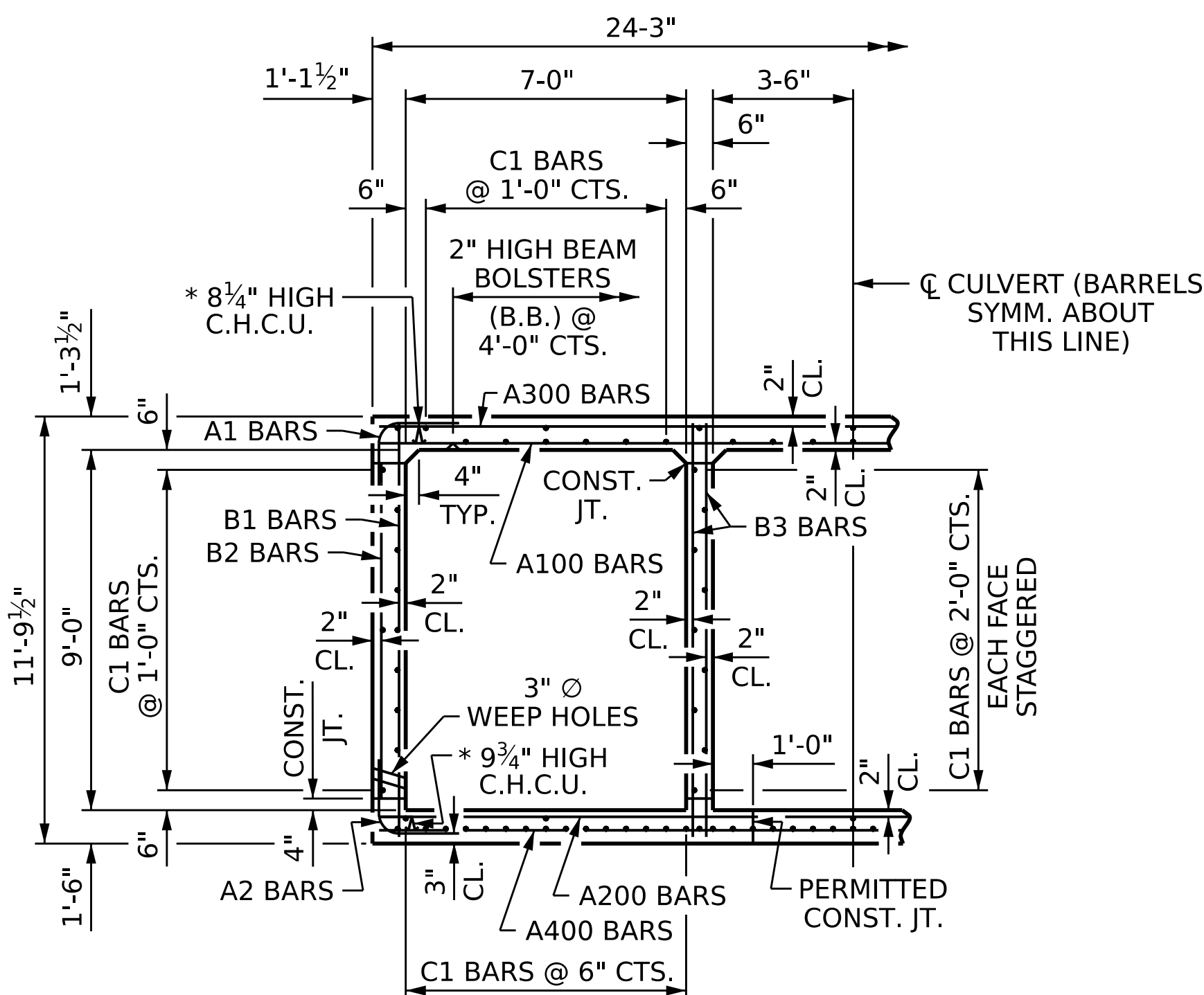
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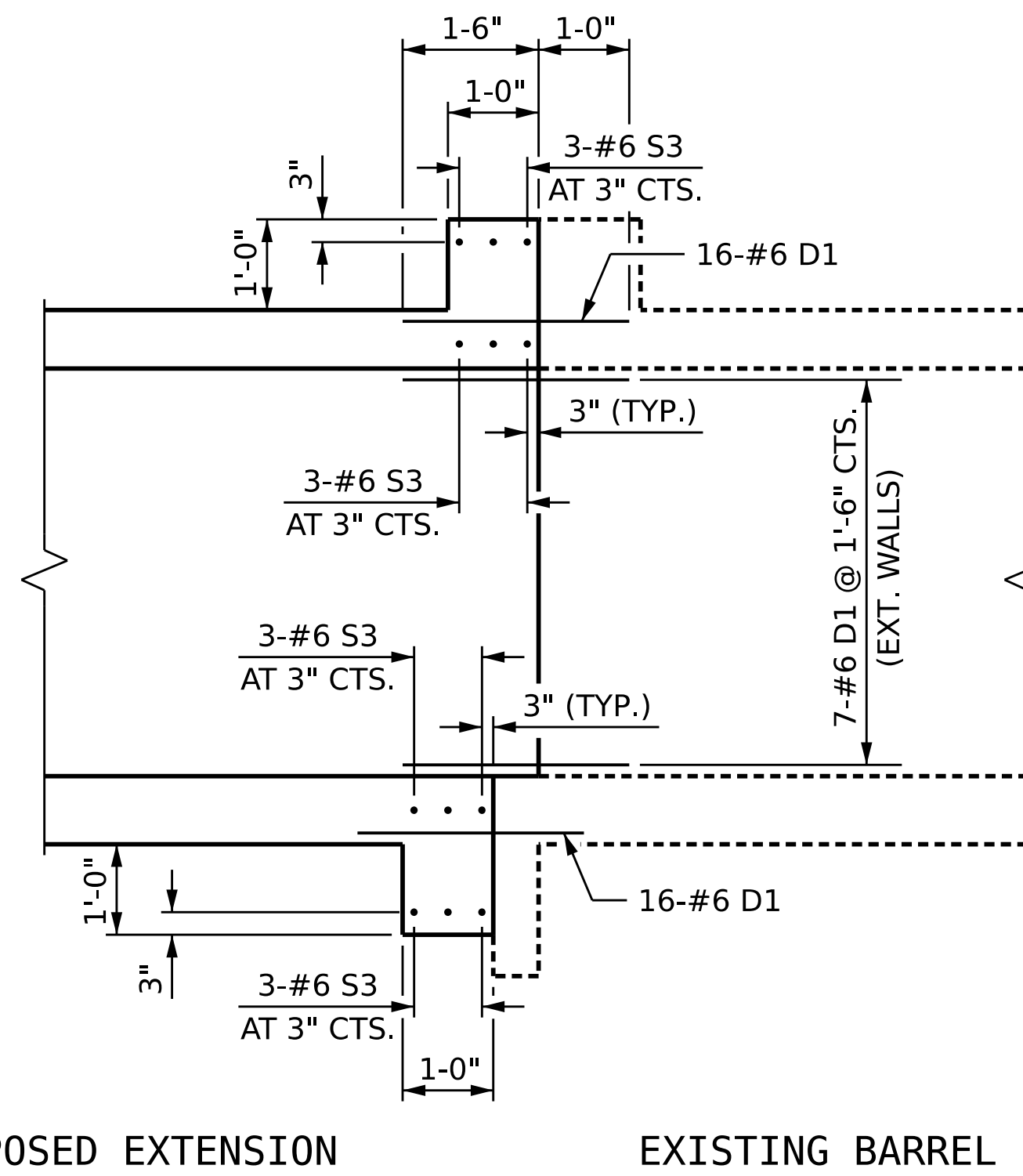
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\* ALL CONTINUOUS HIGH CHAIR UPPER (C.H.C.U.) @ 3'-0" CTS.

**RIGHT ANGLE SECTION OF BARREL**

THERE ARE 118 "C" BARS IN SECTION OF BARREL



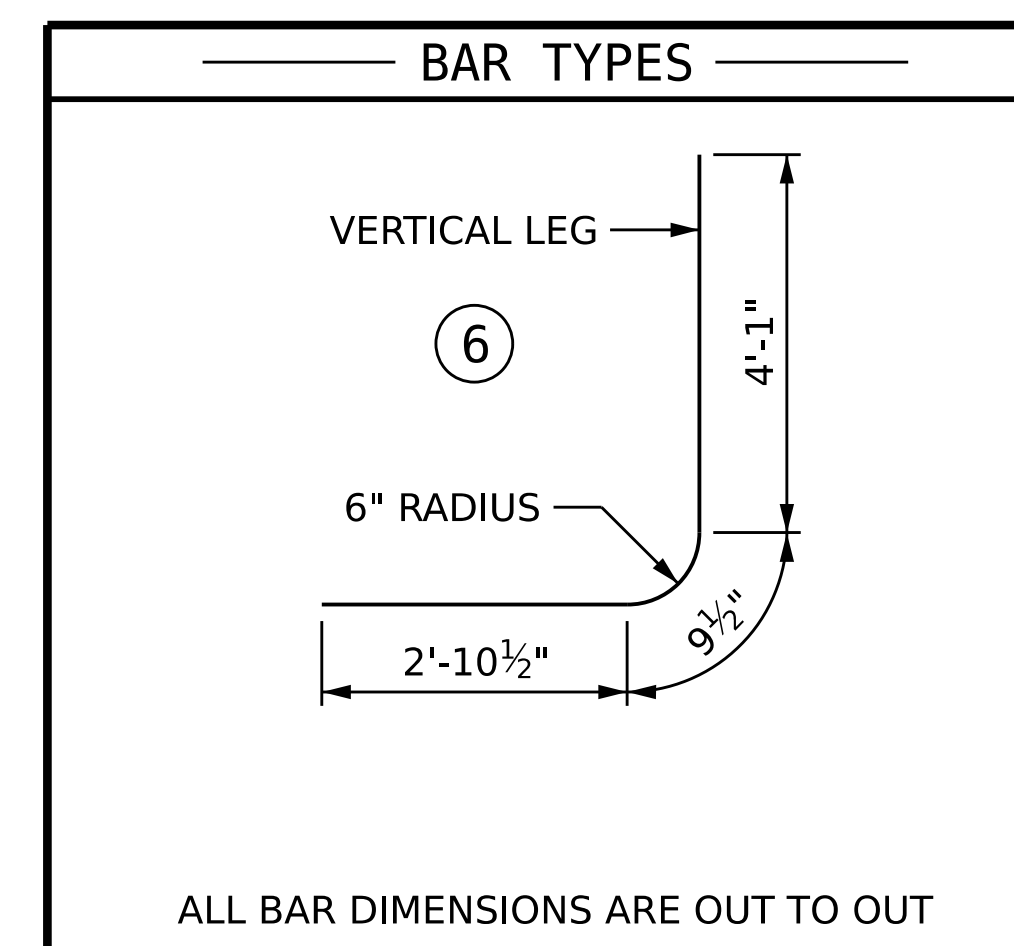
**EDGE BEAM DETAIL FOR CULVERT EXTENSION**

BILL OF MATERIAL						BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	154	5	STR	23'-11"	3842	A400	154	6	STR	23'-11"	5532
A101	1	5	STR	19'-4"	20	A401	1	6	STR	19'-4"	29
A102	1	5	STR	15'-7"	16	A402	1	6	STR	15'-7"	23
A103	1	5	STR	11'-10"	12	A403	1	6	STR	11'-10"	18
A104	1	5	STR	8'-0"	8	A404	1	6	STR	8'-0"	12
A105	1	5	STR	4'-3"	4	A405	1	6	STR	4'-3"	6
A200	154	5	STR	23'-11"	3842	A1	314	5	6	7'-9"	2538
A201	1	5	STR	19'-4"	20	A2	314	5	6	7'-9"	2538
A202	1	5	STR	15'-7"	16	B1	314	5	STR	11'-4"	3712
A203	1	5	STR	11'-10"	12	B2	314	4	STR	8'-4"	1748
A204	1	5	STR	8'-0"	8	B3	628	4	STR	11'-4"	4754
A205	1	5	STR	4'-3"	4	C1	354	4	STR	33'-9"	7981
A300	154	6	STR	23'-11"	5532	D1	15	6	STR	2'-6"	56
A301	1	6	STR	19'-4"	29	D2	10	6	STR	3'-0"	45
A302	1	6	STR	15'-7"	23	G1	4	5	STR	23'-11"	100
A303	1	6	STR	11'-10"	18	S3	12	6	STR	24'-2"	436
A304	1	6	STR	8'-0"	12						
A305	1	6	STR	4'-3"	6						

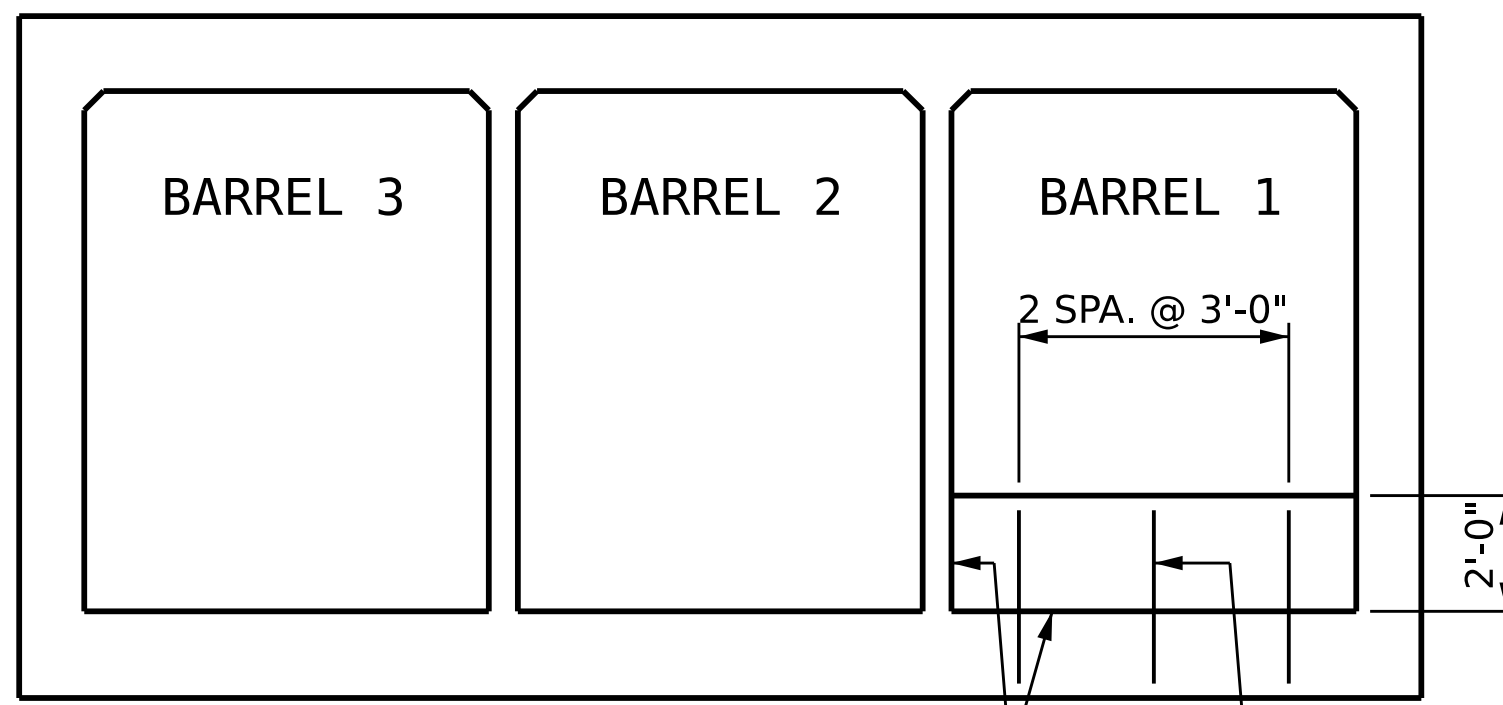
\* INDICATES EPOXY COATED REINFORCING STEEL

REINFORCING STEEL	LBS	42952
<b>CLASS A CONCRETE BREAKDOWN</b>		
BARREL	CY	345
HEADWALL	CY	1.1
EDGE BEAMS	CY	1.8
SILL	CY	0.5
<b>TOTAL CLASS A CONCRETE</b>	<b>CY</b>	<b>348.4</b>

\* INDICATES EPOXY COATED REINFORCING STEEL



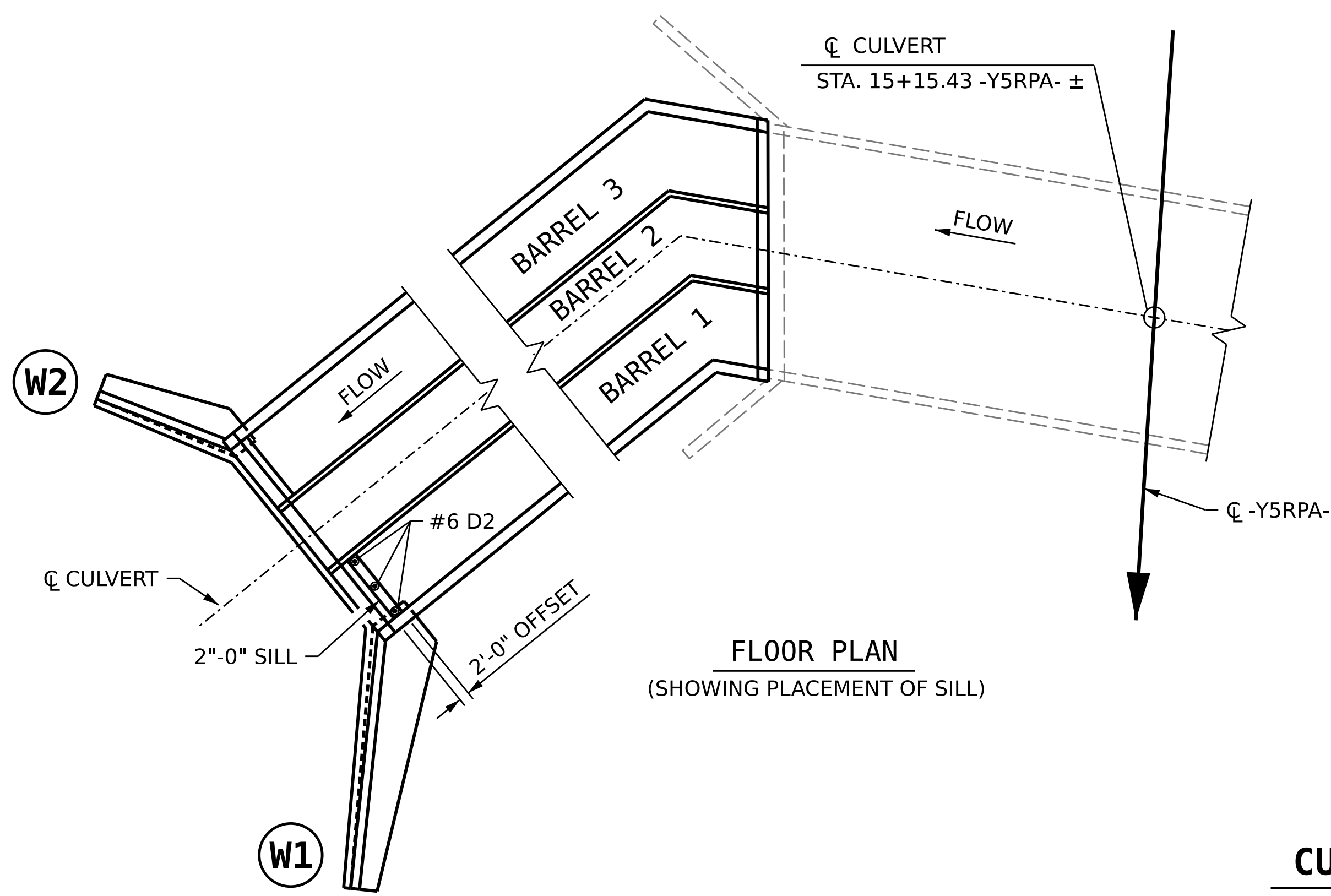
ALL BAR DIMENSIONS ARE OUT TO OUT



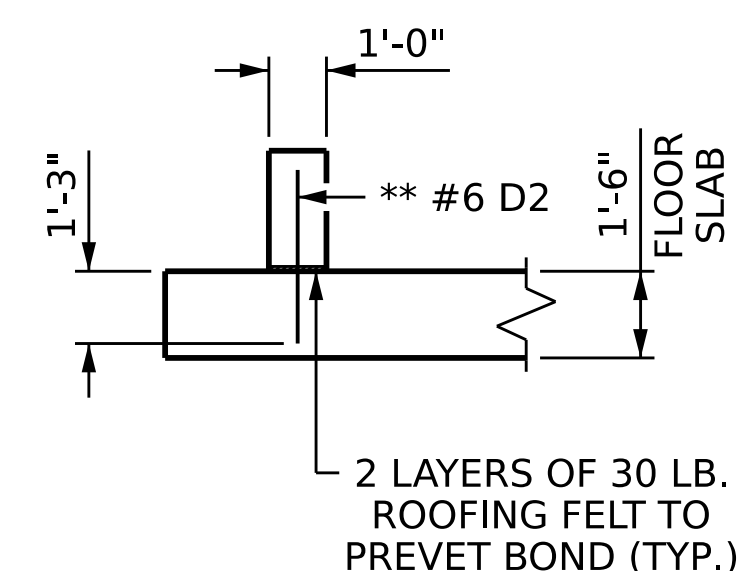
**ELEVATION - OUTLET END LOOKING UPSTREAM**

2 LAYERS OF 30 LB. ROOFING FELT TO PREVENT BOND (TYP.)  
#6 D2 (TYP.)

SPLICE CHART	
#5 B1	SPLICE LENGTH = 2'-4"
#4 B3	SPLICE LENGTH = 1'-11"
#4 C1	SPLICE LENGTH = 2'-5"
#5 A200	SPLICE LENGTH = 2'-4"
#6 A400	SPLICE LENGTH = 3'-7"



**FLOOR PLAN (SHOWING PLACEMENT OF SILL)**



**SECTION THROUGH SILL**

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

**CULVERT SILL DETAILS**

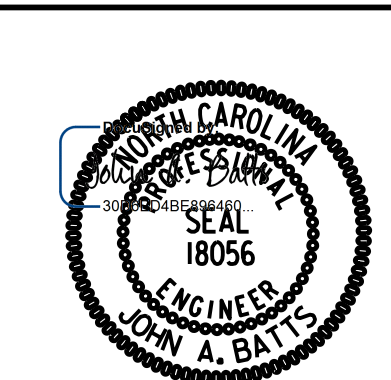
BACKFILL BARREL 1 WITH 2'-0" OF NATIVE MATERIALS (SEE CULVERT SURVEY AND HYDRAULIC DESIGN REPORT FOR DESCRIPTION OF AND PLACEMENT OF NATIVE MATERIAL)

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
STATION: 59+50.00 -Y-

SHEET 4 OF 7

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

**TRIPLE 7FT. X 9FT. CONCRETE BOX CULVERT**

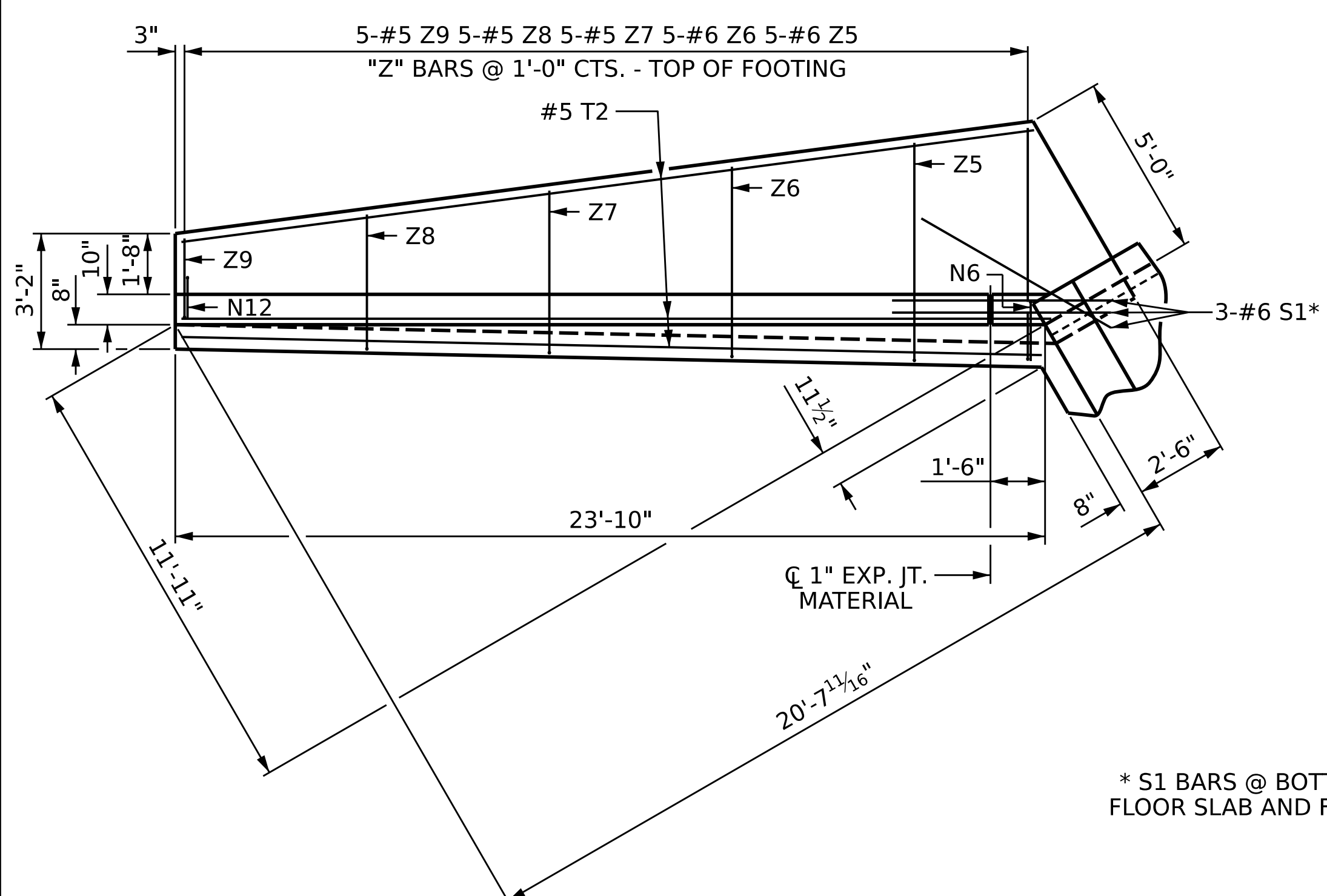


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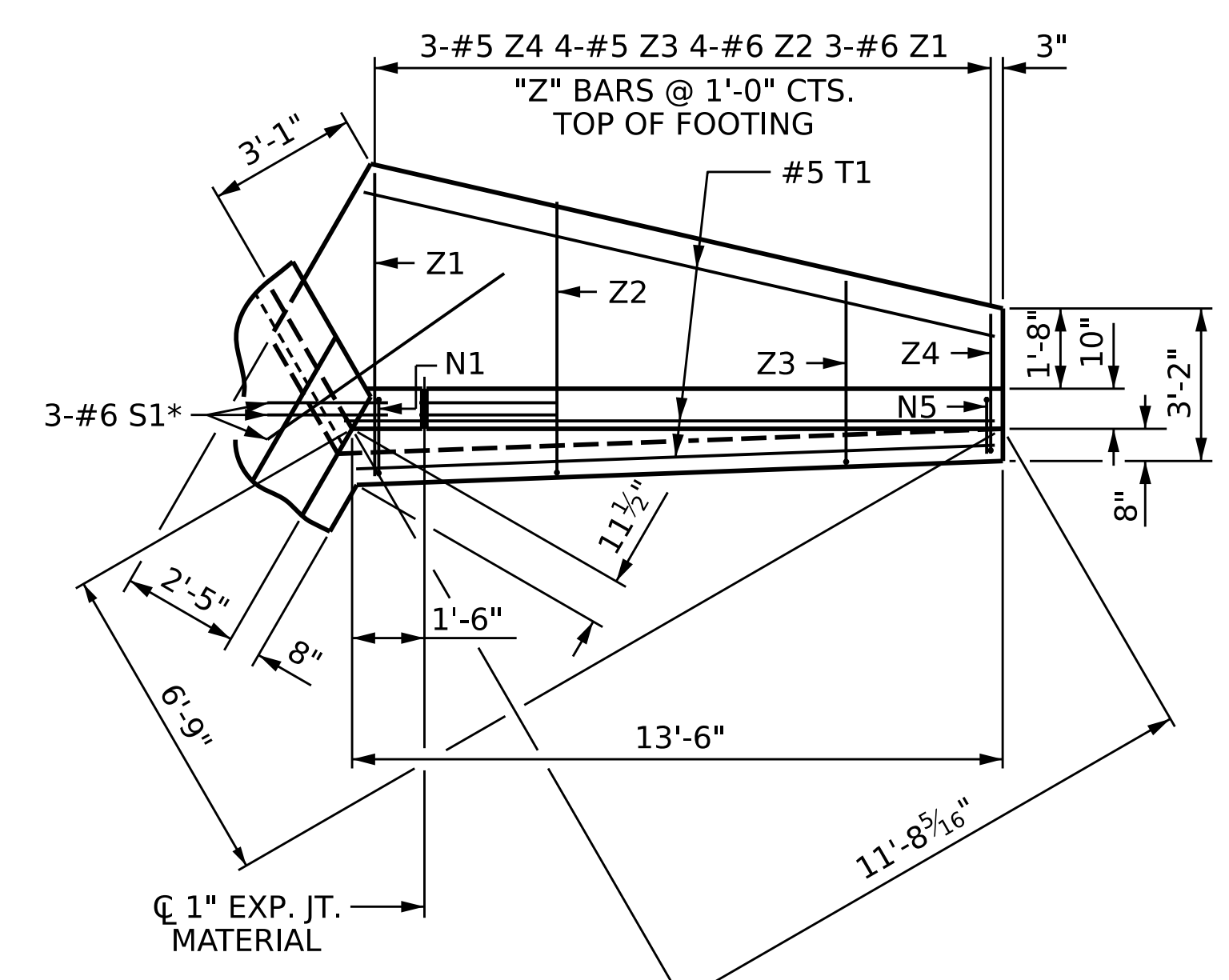
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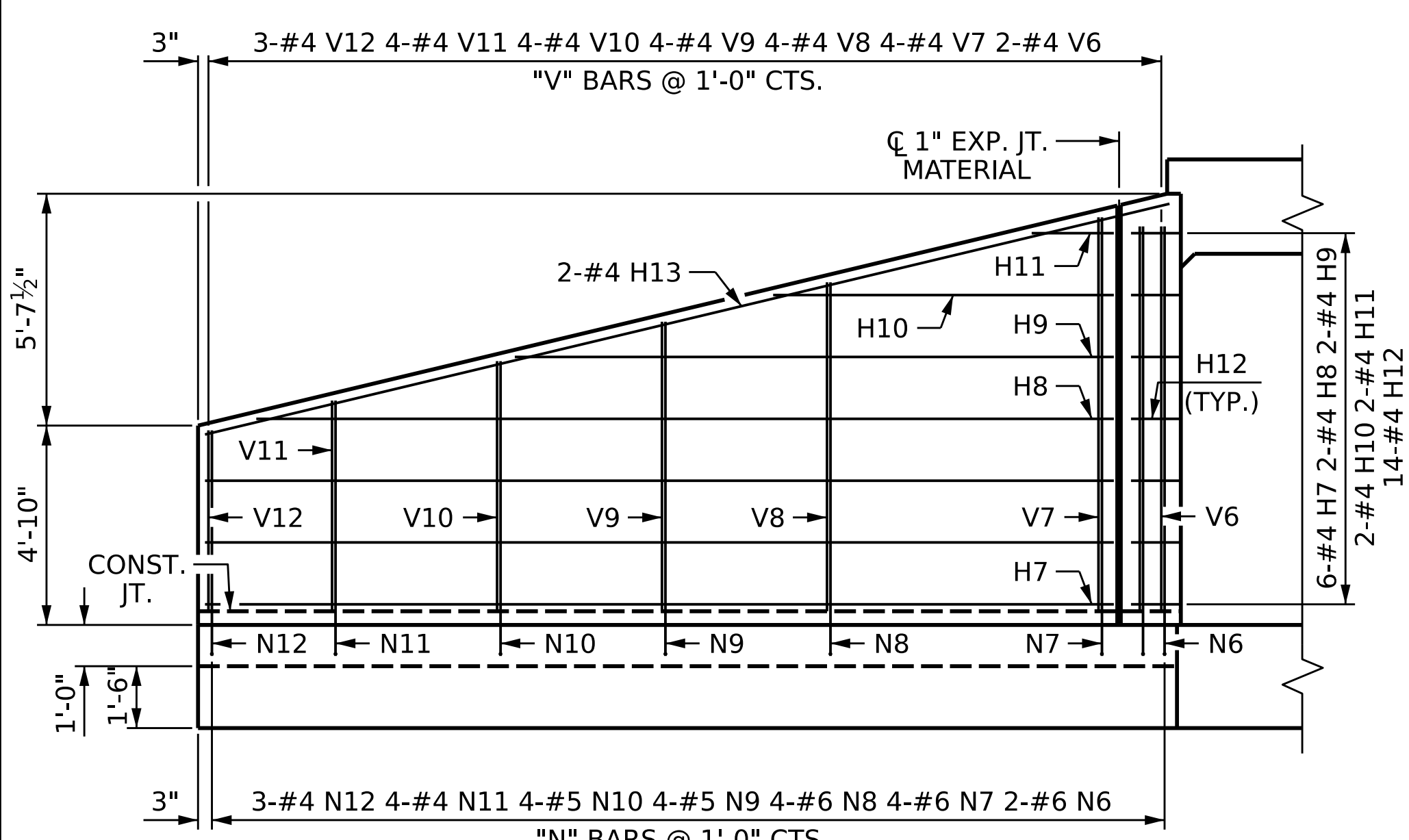
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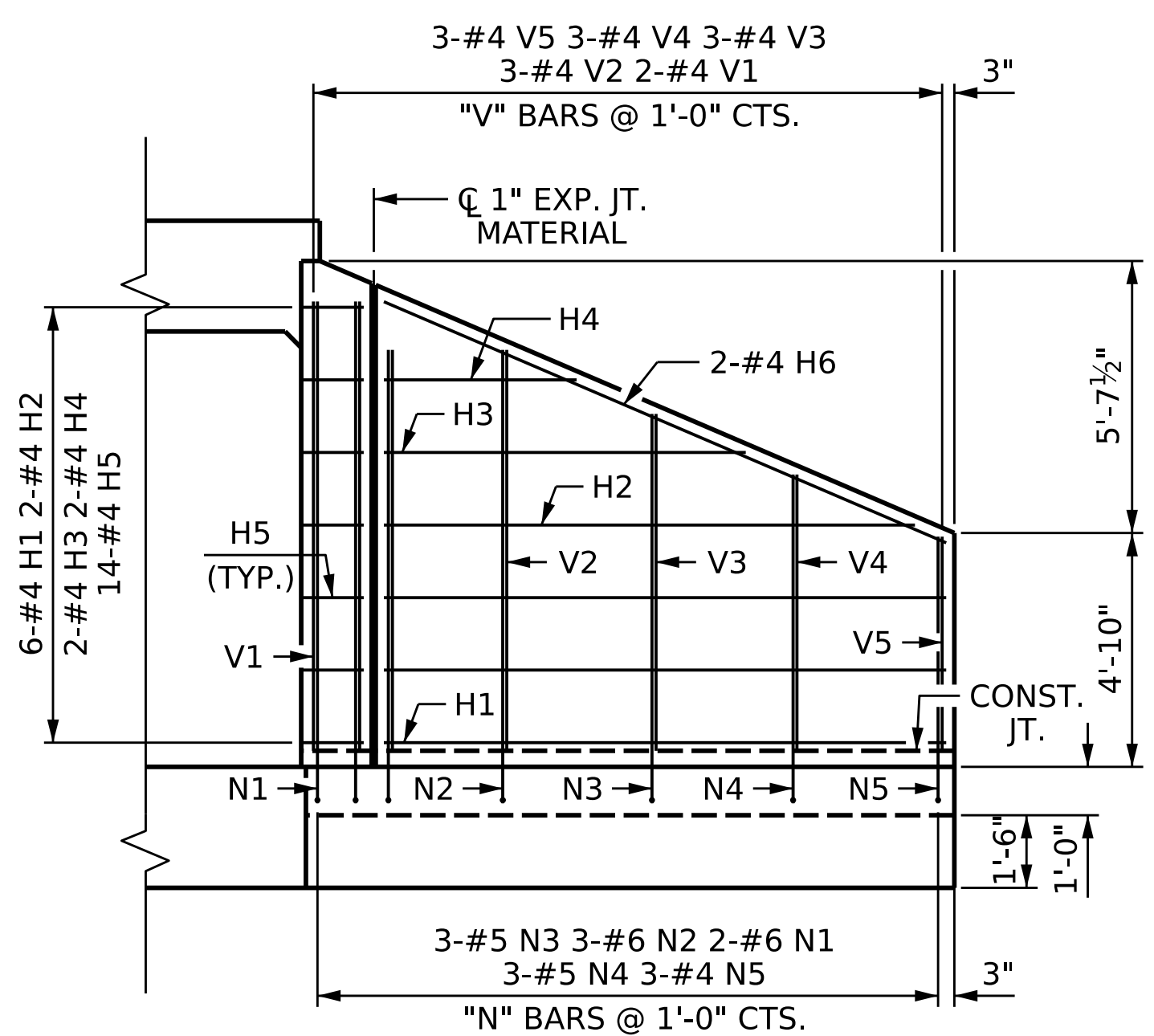
**PLAN OF WING W1**



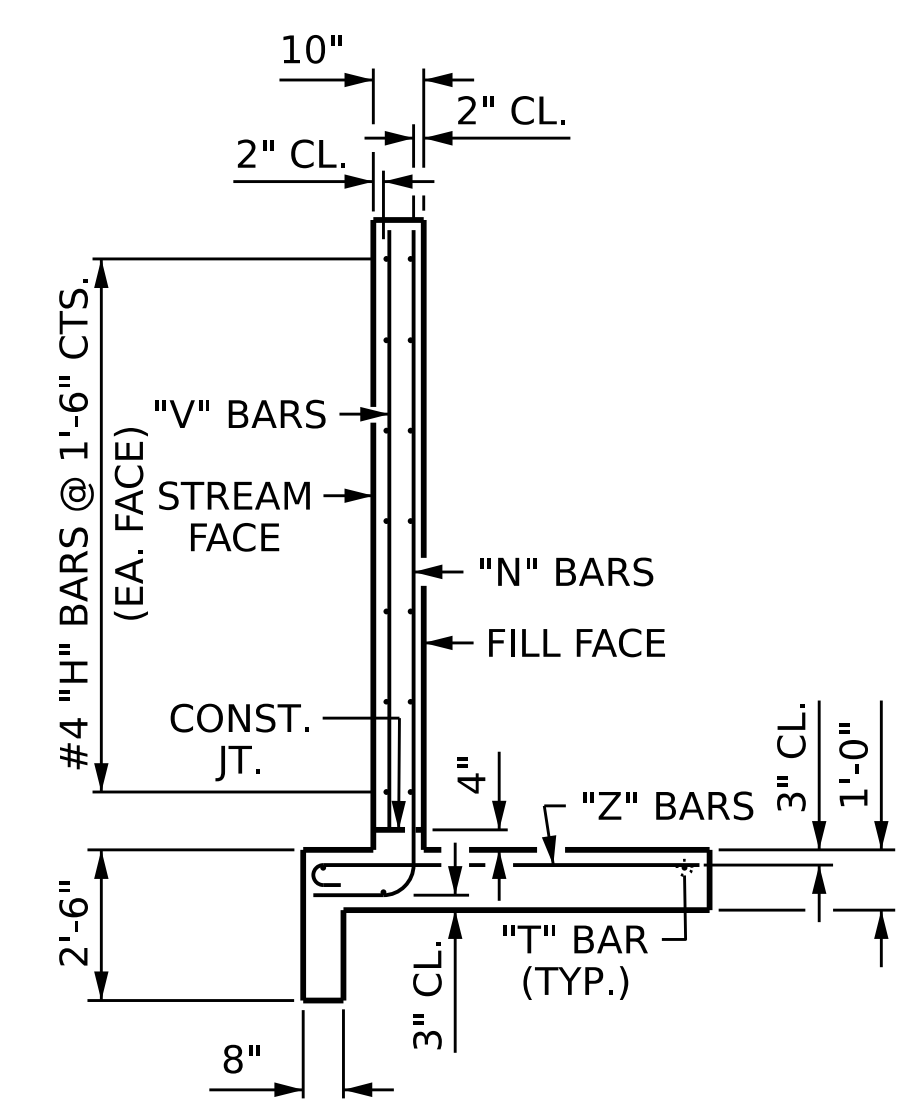
**PLAN OF WING W2**



**ELEVATION OF WING W1**



**ELEVATION OF WING W2**



**TYPICAL WING SECTION**

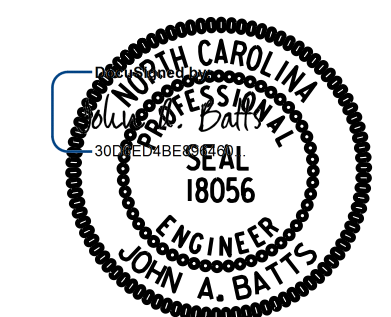
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SHEET 5 OF 7

STATE OF NORTH CAROLINA  
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**WINGS FOR  
 CONCRETE BOX CULVERT**  
 H = 9' - 0" SLOPE = 2:1

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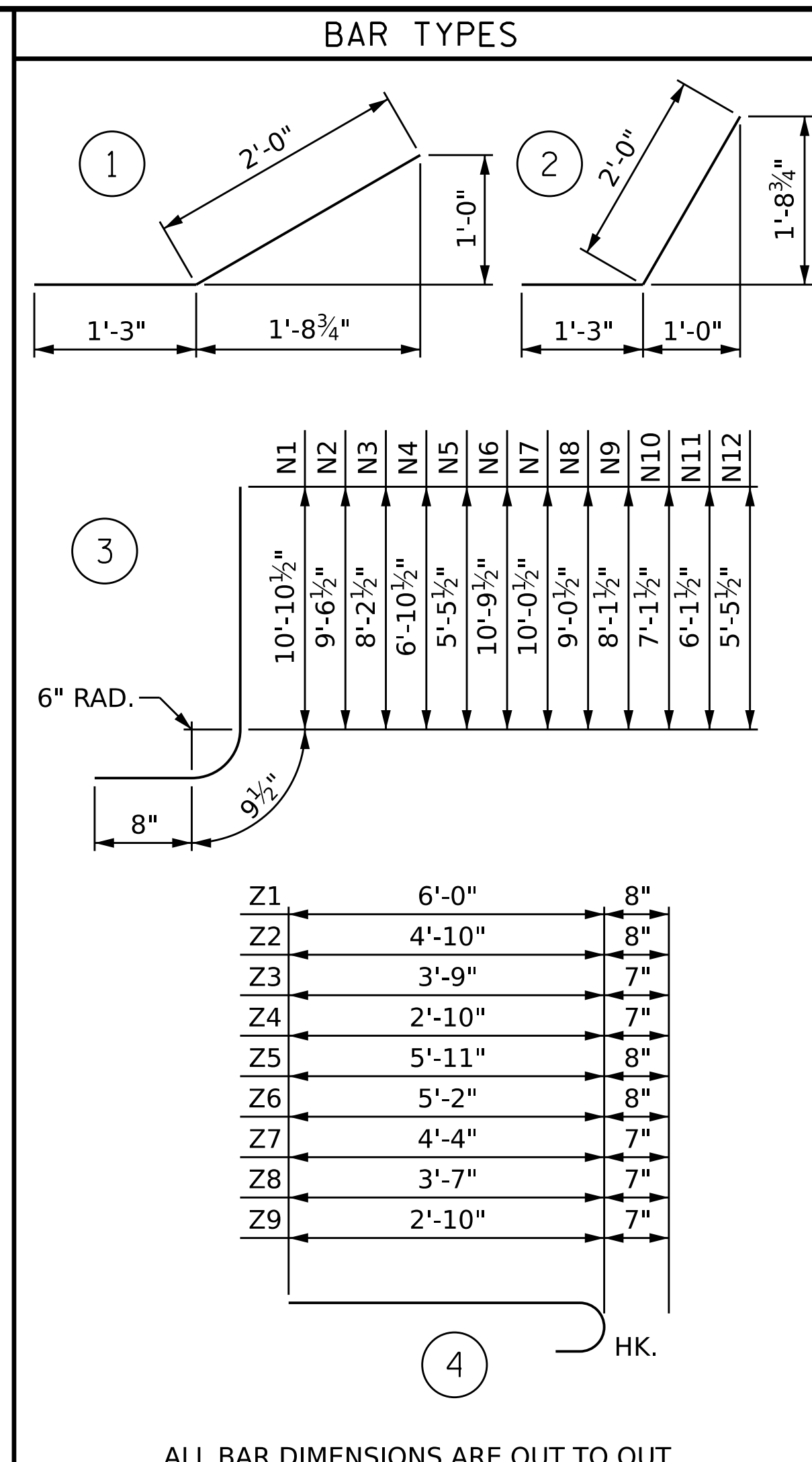
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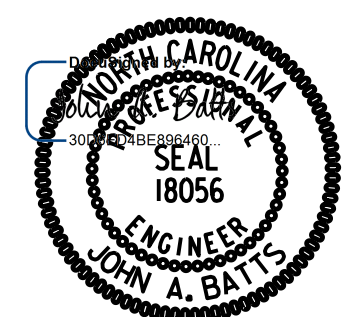


ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	4	STR	11'-8"	47
H2	2	4	STR	11'-1"	15
H3	2	4	STR	7'-9"	10
H4	2	4	STR	4'-4"	6
H5	14	4	2	3'-3"	30
H6	2	4	STR	12'-9"	17
H7	6	4	STR	22'-0"	88
H8	2	4	STR	20'-9"	28
H9	2	4	STR	14'-6"	19
H10	2	4	STR	8'-4"	11
H11	2	4	STR	2'-2"	3
H12	14	4	1	3'-3"	30
H13	2	4	STR	22'-7"	30
N1	2	6	3	12'-4"	37
N2	3	6	3	11'-0"	50
N3	3	5	3	9'-8"	30
N4	3	5	3	8'-4"	26
N5	3	4	3	6'-11"	14
N6	2	6	3	12'-3"	37
N7	4	6	3	11'-6"	69
N8	4	6	3	10'-6"	63
N9	4	5	3	9'-7"	40
N10	4	5	3	8'-7"	36
N11	4	4	3	7'-7"	20
N12	3	4	3	6'-11"	14
S1	6	6	STR	6'-0"	54
T1	3	5	STR	13'-6"	42
T2	3	5	STR	23'-10"	75

BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
V1	2	4	STR	9'-9"	13
V2	3	4	STR	8'-5"	17
V3	3	4	STR	7'-1"	14
V4	3	4	STR	5'-9"	12
V5	3	4	STR	4'-5"	9
V6	2	4	STR	9'-9"	13
V7	4	4	STR	8'-11"	24
V8	4	4	STR	8'-0"	21
V9	4	4	STR	7'-0"	19
V10	4	4	STR	6'-1"	16
V11	4	4	STR	5'-1"	14
V12	3	4	STR	4'-4"	9
Z1	3	6	4	6'-8"	30
Z2	4	6	4	5'-6"	33
Z3	4	5	4	4'-4"	18
Z4	3	5	4	3'-5"	11
Z5	5	6	4	6'-7"	49
Z6	5	6	4	5'-10"	44
Z7	5	5	4	4'-11"	26
Z8	5	5	4	4'-2"	22
Z9	5	5	4	3'-5"	18
REINFORCING STEEL					1373 LBS
FOR 2 WINGS					
3000 PSI CONCRETE					
2 WINGS					17.1 CY
1 END CURTAIN WALL					3.7 CY
TOTAL					20.8 CY

DRAWN BY : S.D. COOPER DATE : 5-23  
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PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
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SHEET 6 OF 7

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**WINGS FOR  
 CONCRETE BOX CULVERT**  
 H = 9'-0" SLOPE 2:1

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1			3			TOTAL SHEETS
2			4			7

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PERMANENT LOAD 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
WA	1.00	--

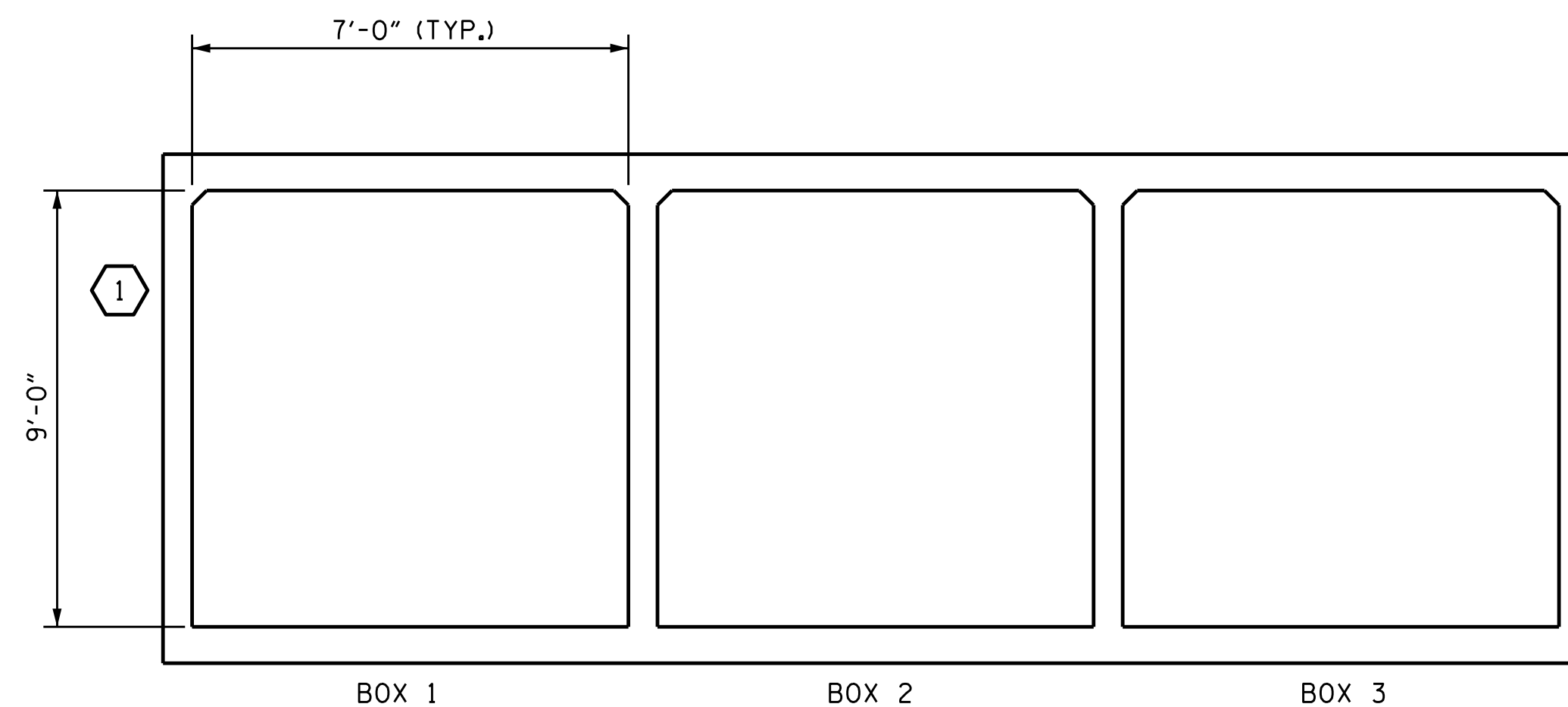
LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS										
	CONTROLLING LOAD RATING	MINIMUM RATING FACTOR (RF)	STRENGTH I LIMIT STATE							
			MOMENT				SHEAR			
			RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)
PERMANENT LOAD RATING	①	1.01	1.39	1	ROOF SLAB	3.9	1.01	1	EXTERIOR WALL	8.2

NOTES:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

THE EFFECTS OF LIVE LOAD ON DESIGN AND LOAD RATING MAY BE NEGLECTED FOR CULVERTS WITH CERTAIN FILL DEPTHS DESCRIBED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

CULVERTS WITH NEGLIGIBLE LIVE LOAD SHOULD BE LOAD RATED FOR PERMANENT LOADS ONLY IN ACCORDANCE WITH THE AASHTO MANUAL FOR BRIDGE EVALUATION.



LRFR SUMMARY

(LOOKING DOWNSTREAM)

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 59+50.00 -Y-

SHEET 7 OF 7

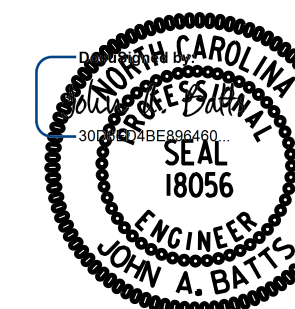
STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

LRFR SUMMARY FOR  
 REINFORCED CONCRETE  
 BOX CULVERTS  
 (DEEP FILLS)  
 (INTERSTATE TRAFFIC)



5640 Dillard Drive, Suite 200  
 Cary, NC 27518

LICENSURE NO. C-4434



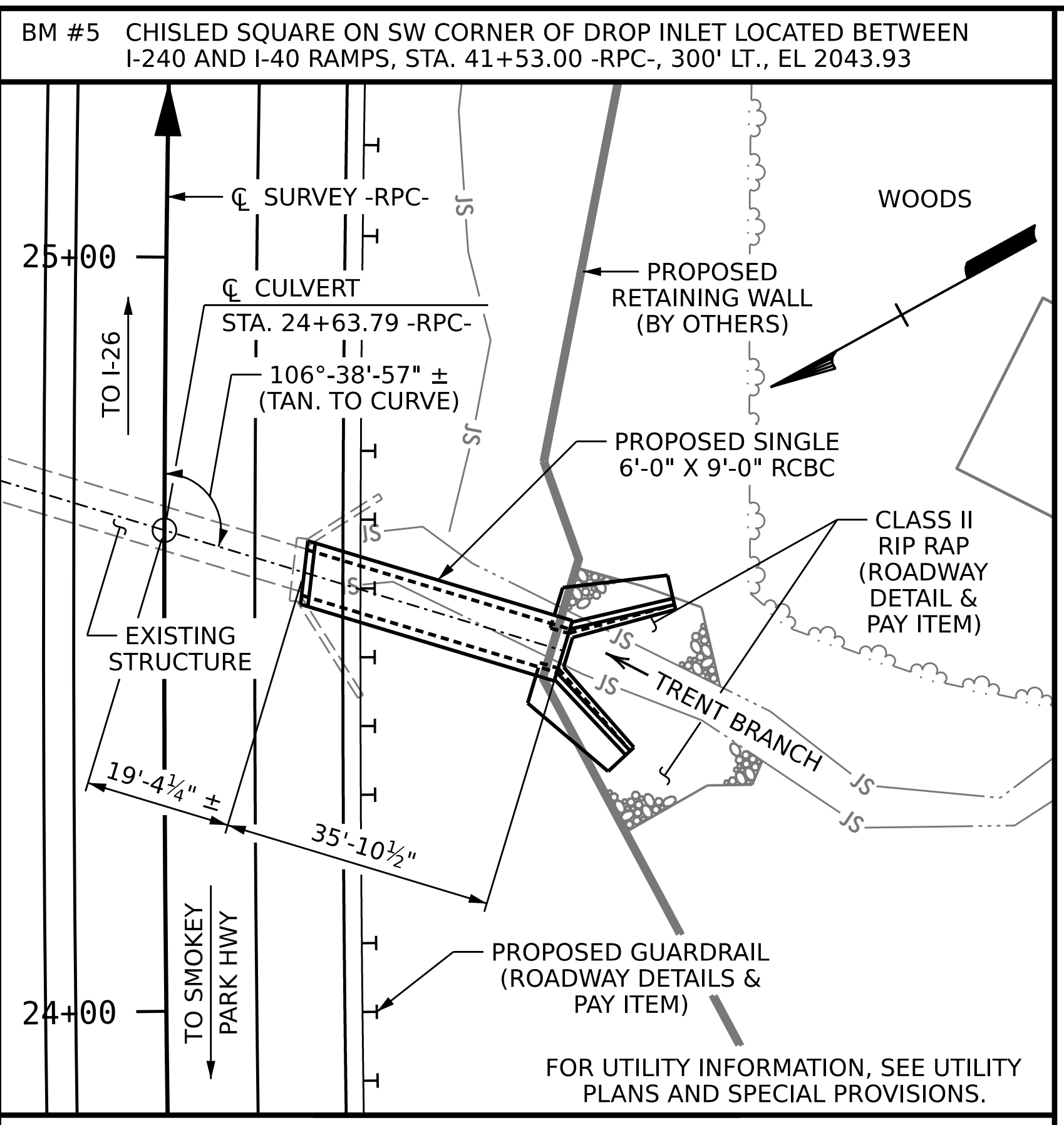
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DRAWN BY : S.D. COOPER DATE : 5-23  
 CHECKED BY : J.A. BATTS DATE : 5-23  
 DESIGN ENGINEER OF RECORD: J.A. BATTS DATE : 5-23

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REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-7
1			3			TOTAL SHEETS
2			4			7





LOCATION SKETCH

**HYDRAULIC DATA:**

DESIGN DISCHARGE	= 600 CFS
FREQUENCY OF DESIGN FLOOD	= 100 YEAR
DESIGN HIGH WATER ELEVATION	= 2017.80
DRAINAGE AREA	= 0.38 SQ. MI.
BASE DISCHARGE (Q 100)	= 600 CFS
BASE HIGH WATER ELEVATION	= 2017.80

**OVERTOPPING FLOOD DATA:**

OVERTOPPING DISCHARGE	= 1521 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YEAR
OVERTOPPING FLOOD ELEVATION	= 2055.70 **
** OVERTOPPING OCCURS AT HIGH SIDE OF SUPER AT SAG STA. 22+26.00 -RPC-	

**HORIZONTAL CURVE DATA**

PI STA. 34+57.05 -RPC-
Δ = 32°-41'-04.6 (RT.)
D = 1°-15'-33.3"
L = 2595.57'
T = 1334.16'
R = 4550.00'

**GRADE DATA:**

GRADE POINT EL. @ STA. 24+63.79 -RPC- = EL. 2056.96
INVERT EL. @ END OF EXISTING CULVERT = EL. 2007.6
ROADWAY SLOPE 2:1

**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.

**NOTES:**

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

DESIGN FILL ----- 35'-0"

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, EDGE BEAM AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
2. THE REMAINING PORTIONS OF THE WINGS AND WALLS FULL HEIGHT FOLLOWED BY ROOF SLAB, HEADWALL AND EDGE BEAM.

THE ENGINEER SHALL CHECK THE LENGTH OF THE CULVERT EXTENSION BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF FILL.

AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR 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.

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

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

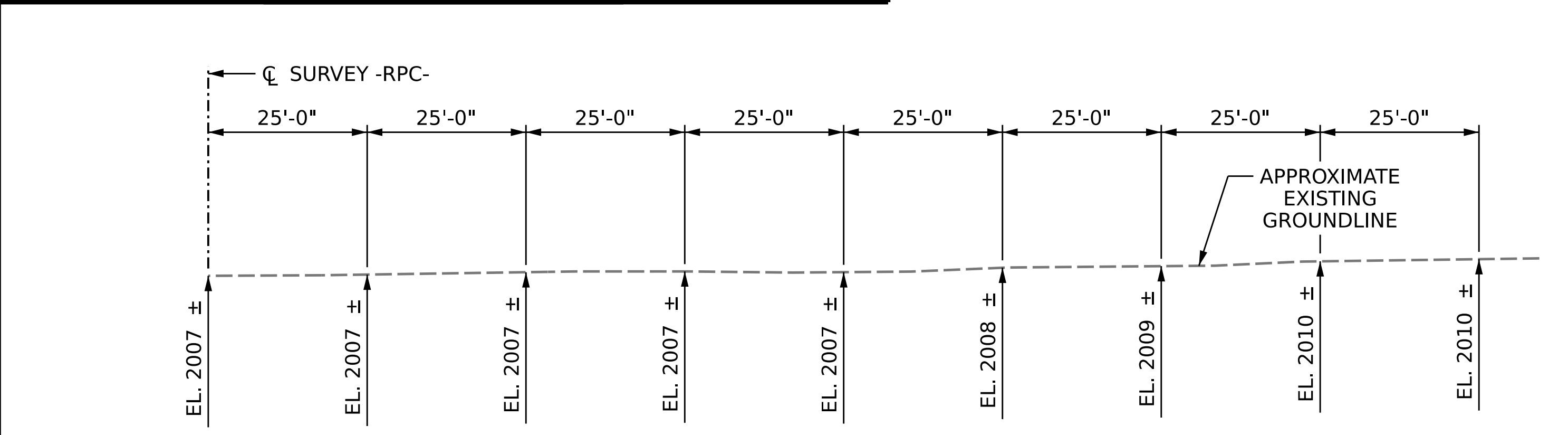
FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

CULVERT MUST BE CAST-IN-PLACE; PRECAST OPTION WILL NOT BE ALLOWED.

DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.

IF APPROVED BY THE ENGINEER, THE CONTRACTOR MAY USE THE EXISTING WINGS AS TEMPORARY SHORING FOR THE CONSTRUCTION OF THE CULVERT EXTENSION. IN THIS CASE, THE BOTTOM SLAB OF THE EXTENSION SHALL BE POURED AT LEAST 72 HOURS PRIOR TO CUTTING THE WINGS. THE WINGS MAY BE CUT EARLIER PROVIDED THE SLAB CONCRETE STRENGTH HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 1500 PSI.

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 SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.



PROFILE ALONG CL CULVERT

**TOTAL STRUCTURE QUANTITIES**

CLASS A CONCRETE		
BARREL @ 1.352 CY/FT		48.4 C.Y.
HEADWALL, CURTAIN WALL, WINGS, EDGE BEAMS	14.8	C.Y.
TOTAL	63.2	C.Y.
REINFORCING STEEL		
BARREL, HEADWALL, EDGE BEAMS	6,793	LBS.
WINGS	2,866	LBS.
TOTAL	9,659	LBS.
BOX CULVERT EXCAVATION		LUMP SUM
FOUNDATION CONDITIONING MATERIAL	31	TONS

**FOUNDATION NOTES:**

EXCAVATE FOUNDATION A MINIMUM OF 12" BELOW CULVERT BEARING ELEVATION. PLACE 12" OF CLASS VI FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.

OVEREXCAVATE ADDITIONAL LOOSE/SOFT OR ORGANIC MATERIAL IF PRESENT TO SUITABLE BEARING MATERIALS AND REPLACE WITH ADDITIONAL CLASS IV FOUNDATION CONDITIONING MATERIAL.

WRAP TYPE 4 GEOTEXTILE AROUND THE COLD JOINT BETWEEN THE EXISTING AND NEW CULVERT. OVERLAP GEOTEXTILE A MINIMUM OF 1 FOOT IN BOTH DIRECTIONS FROM JOINT.

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

**WVGI**  
 5640 Dillard Drive, Suite 200  
 Cary, NC 27518  
 LICENSURE NO. C-4434

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 ENGINEER  
 JOHN A. BATTS  
 SEAL 18056  
 2/6/2024 | 6:40 AM PS

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 24+63.79 -RPC-

SHEET 1 OF 6 EXTENDS CULVERT #104007

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**SINGLE 6 FT. X 9 FT. CONCRETE BOX CULVERT**  
 90° SKEW

DRAWN BY : T. BANKOVICH DATE : 4-23  
 CHECKED BY : J.A. BATTS DATE : 4-23  
 DESIGN ENGINEER OF RECORD: J.A. BATTS DATE : 4-23

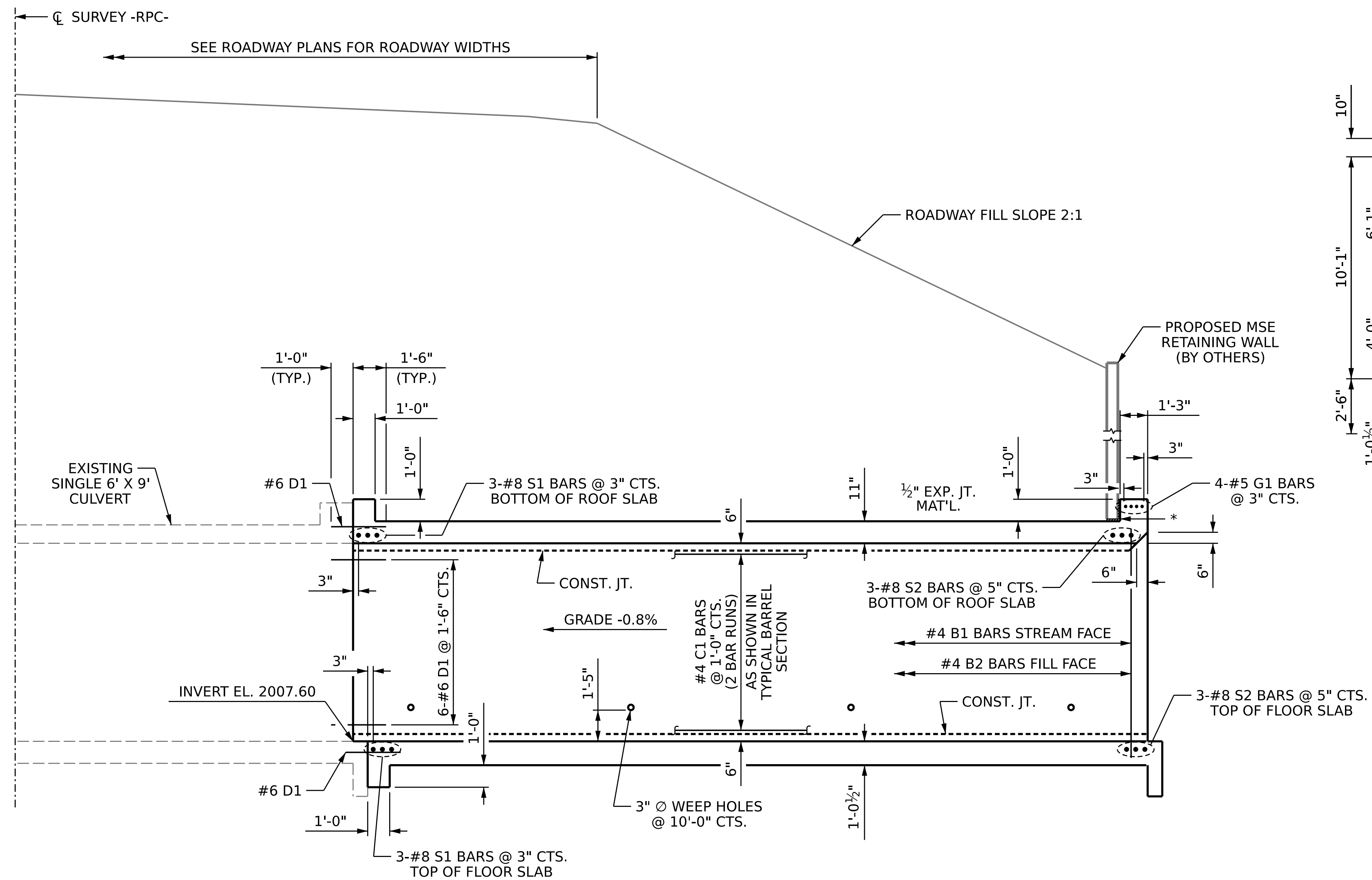
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NO.	BY:	DATE:	NO.	BY:	DATE:	C2-1
1			3			TOTAL SHEETS
2			4			6

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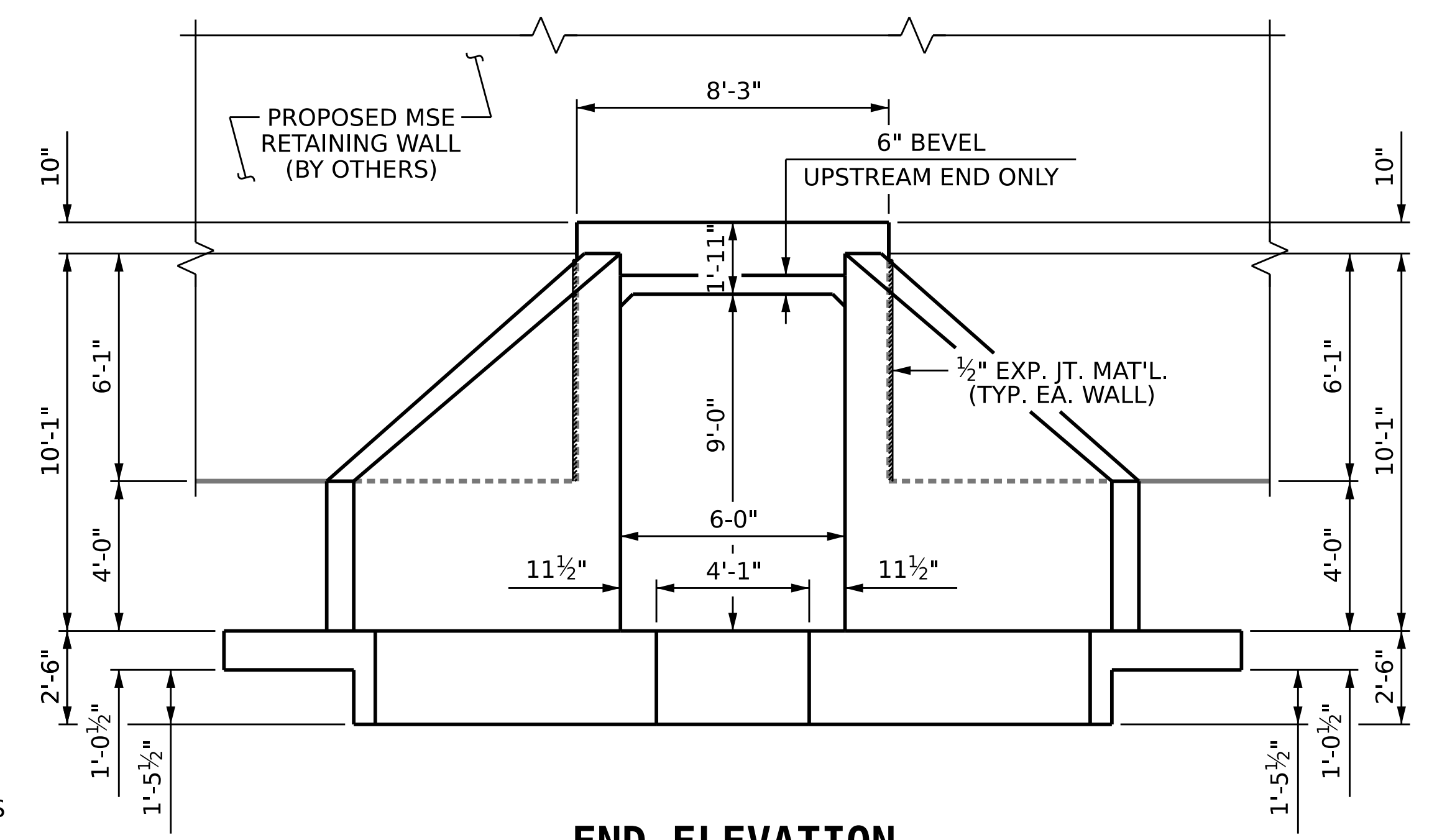
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12/14/2023 11:16:58 AM c:\pwworking\cecom\_ds21\_na\_2020\d0131628\I-2513AA\_SMU\_CU2\_104007.dgn



**CULVERT SECTION NORMAL TO ROADWAY**



**END ELEVATION**

\* 1/2" EXP. JT. MAT'L. BETWEEN MSE WALL AND CULVERT HEADWALL, ROOF SLAB, AND WALLS.

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 24+63.79 -RPC-

SHEET 2 OF 6

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**SINGLE 6 FT. X 9 FT. CONCRETE BOX CULVERT**

90° SKEW

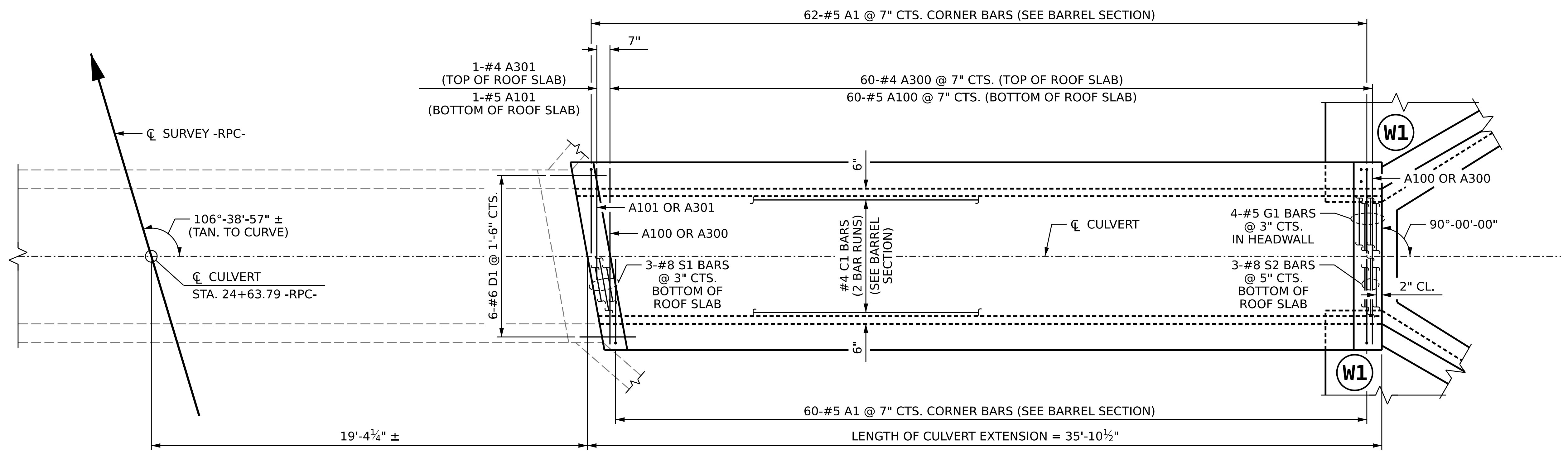
**W WGI**  
 5640 Dillard Drive, Suite 200  
 Cary, NC 27518  
 LICENSURE NO. C-4434

STATE OF NORTH CAROLINA  
 PROFESSIONAL SEAL  
 18056  
 ENGINEER  
 JOHN A. BATTIS  
 12/14/2023 | 8:58 AM

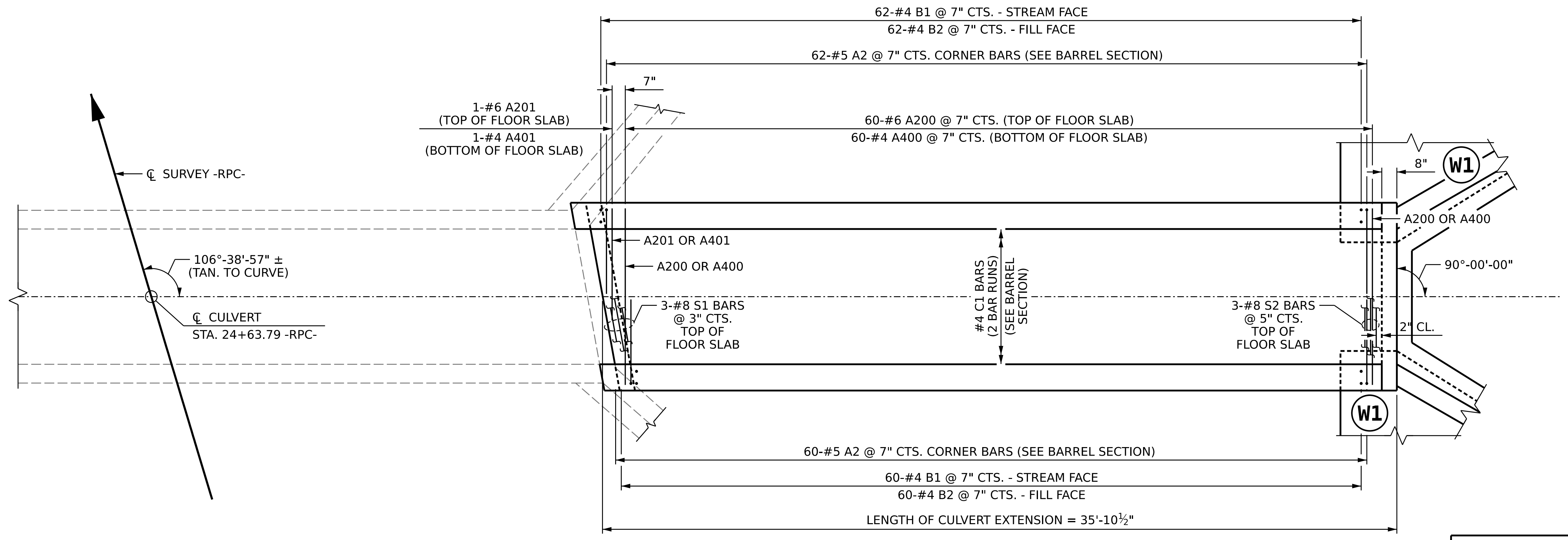
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 CHECKED BY : J.A. BATTIS DATE : 4-23  
 DESIGN ENGINEER OF RECORD: J.A. BATTIS DATE : 4-23

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-2
1			3			TOTAL SHEETS
2			4			6

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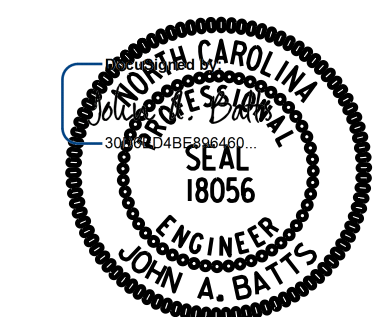
**PLAN OF ROOF SLAB**



**PLAN OF FLOOR SLAB**

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 24+63.79 -RPC-  
 SHEET 3 OF 6

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**SINGLE 6 FT. X 9 FT.  
 CONCRETE BOX CULVERT**  
 90° SKEW



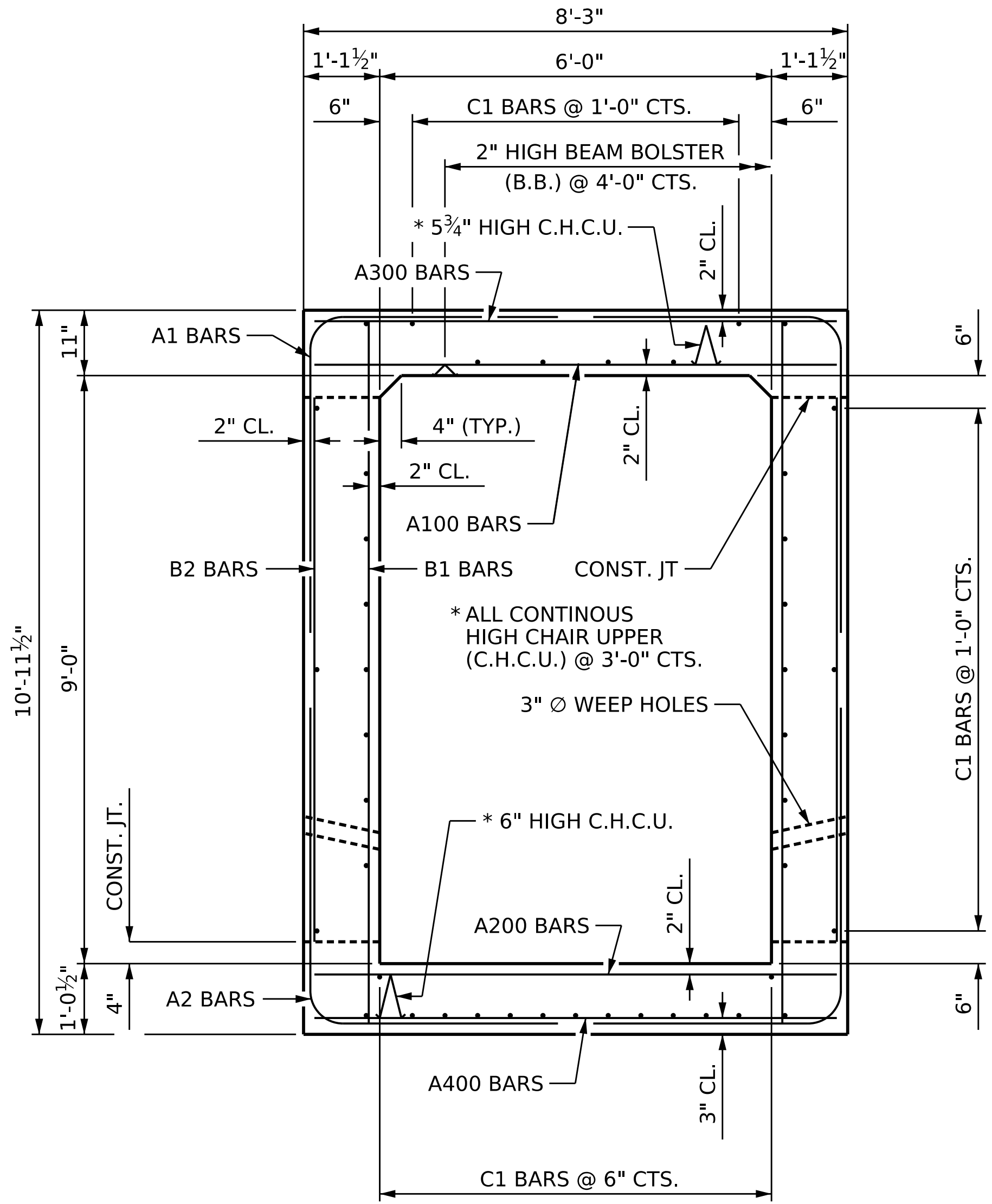
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-3
1			3			TOTAL SHEETS
2			4			6

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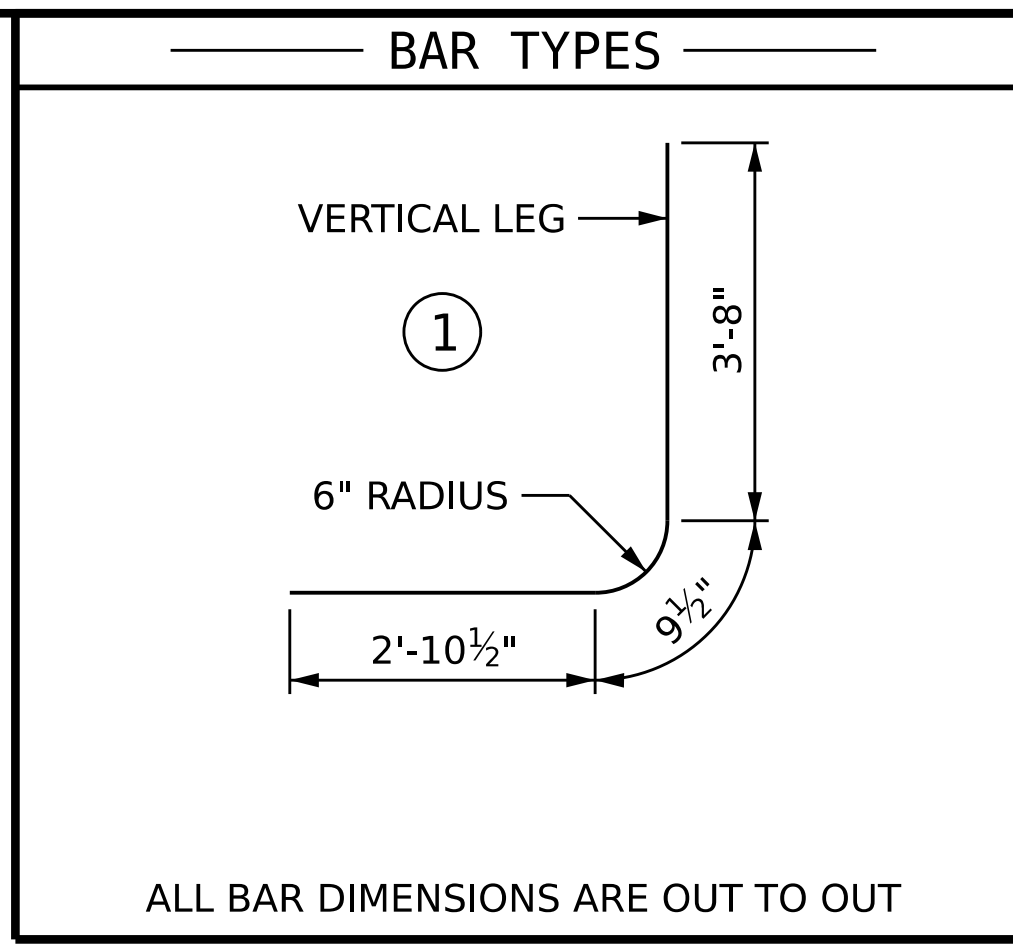
DRAWN BY : T. BANKOVICH DATE : 4-23  
 CHECKED BY : J.A. BATTS DATE : 4-23  
 DESIGN ENGINEER OF RECORD: J.A. BATTS DATE : 4-23

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**RIGHT ANGLE SECTION OF BARREL**  
(THERE ARE 44 "C" BARS IN SECTION OF BARREL)



ALL BAR DIMENSIONS ARE OUT TO OUT

SPLICE CHART	
#4 B1	SPLICE LENGTH = 1'-10"
#4 C1	SPLICE LENGTH = 2'-5"

BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	122	#5	1	7'-4"	933
A2	122	#5	1	7'-4"	933
A100	60	#5	STR	7'-11"	495
A101	1	#5	STR	3'-11"	4
A200	60	#6	STR	7'-11"	713
A201	1	#6	STR	3'-11"	6
A300	60	#4	STR	7'-11"	317
A301	1	#4	STR	3'-11"	3
A400	60	#4	STR	7'-11"	317
A401	1	#4	STR	3'-11"	3
B1	122	#4	STR	10'-7"	862
B2	122	#4	STR	8'-4"	679
C1	88	#4	STR	19'-6"	1146
D1	24	#6	STR	2'-6"	90
G1	4	#5	STR	7'-11"	33
S1	6	#8	STR	8'-3"	132
S2	6	#8	STR	7'-11"	127
TOTAL REINFORCING STEEL					6793 LB
CLASS A CONCRETE BREAKDOWN					
BARREL					48.4 CY

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DRAWN BY : T. BANKOVICH DATE : 4-23  
 CHECKED BY : J.A. BATTS DATE : 4-23  
 DESIGN ENGINEER OF RECORD: J.A. BATTS DATE : 4-23



PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 24+63.79 -RPC-

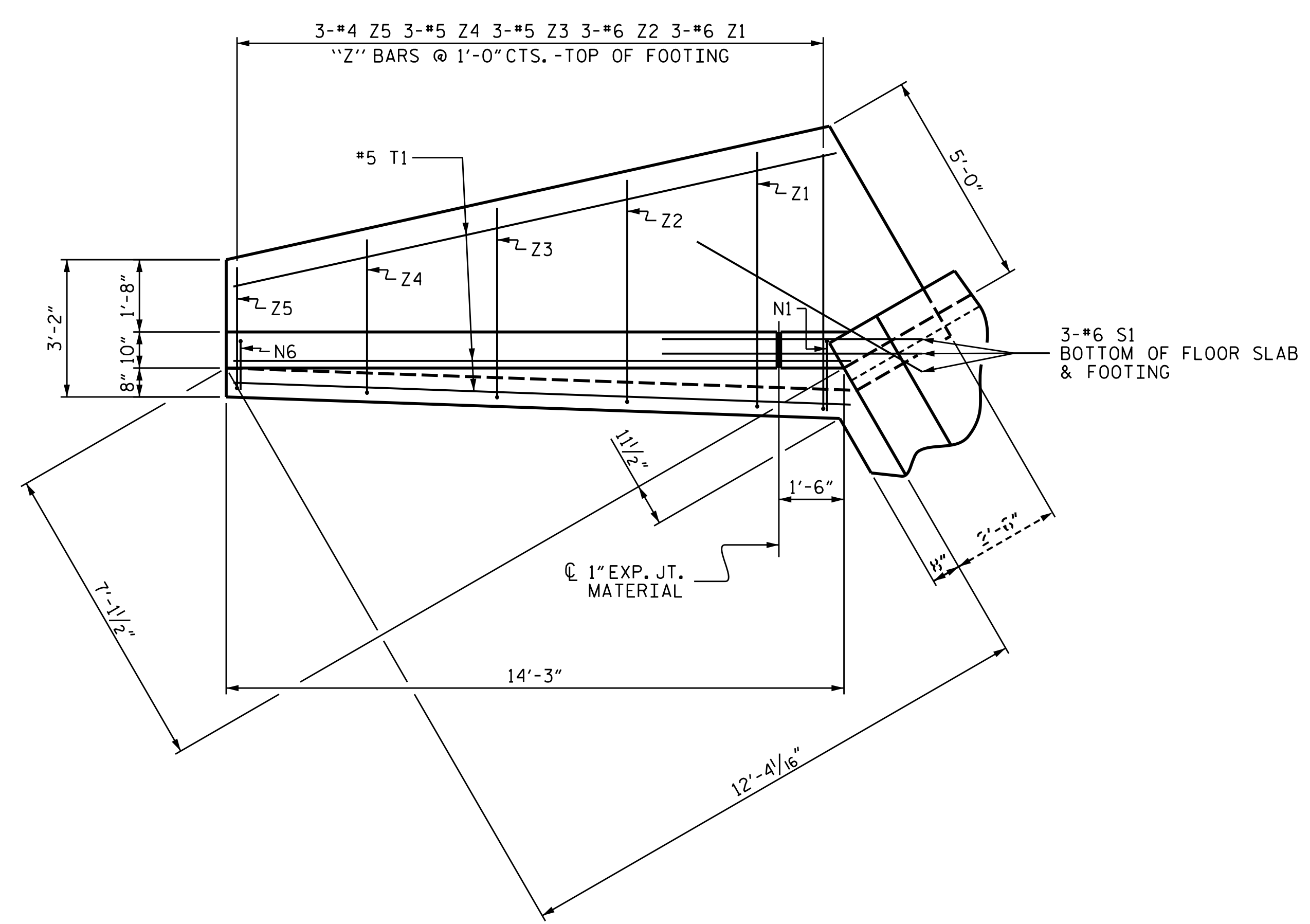
SHEET 4 OF 6  
 STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
**SINGLE 6 FT. X 9 FT. CONCRETE BOX CULVERT**  
 90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-4
1			3			TOTAL SHEETS
2			4			6

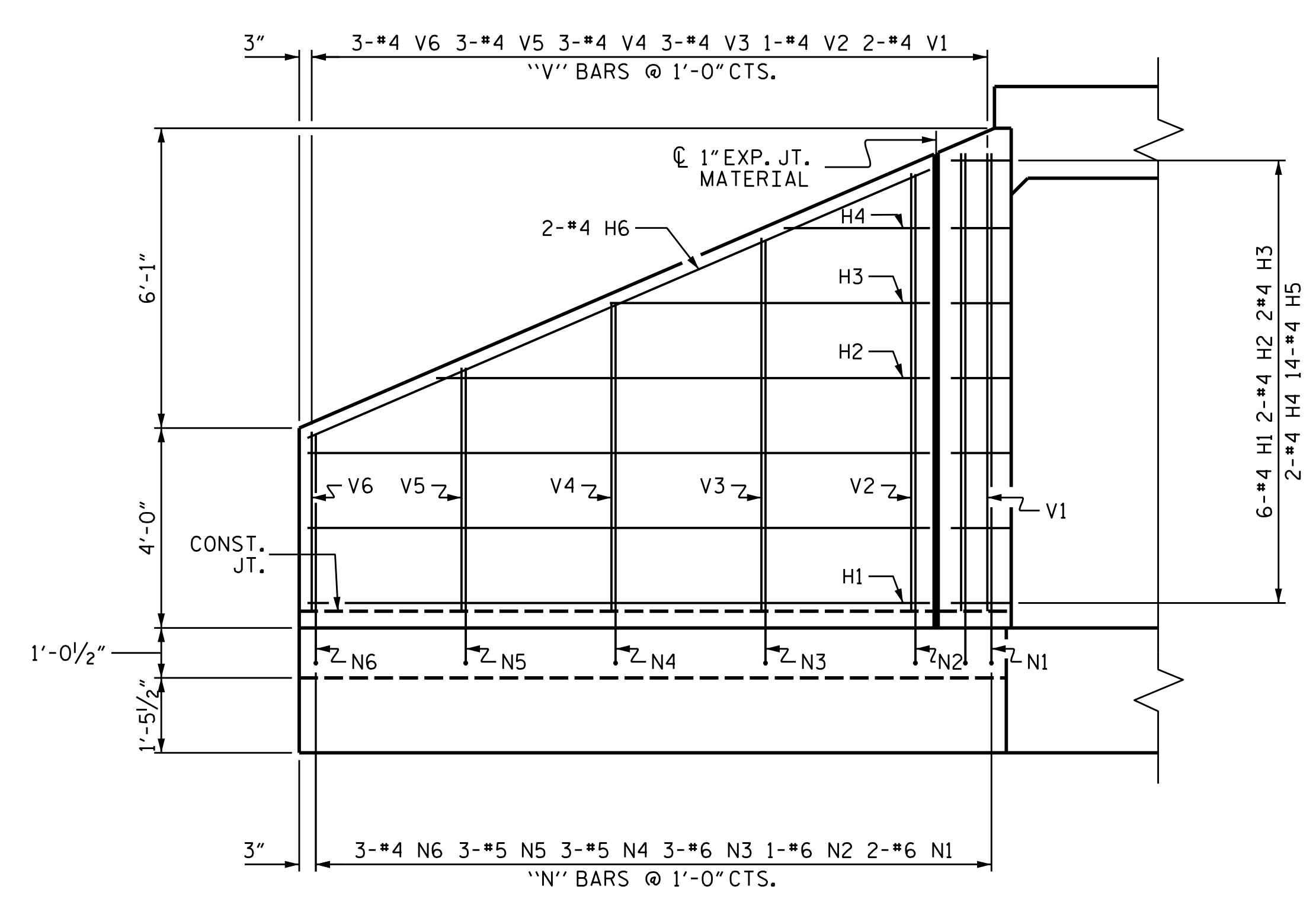
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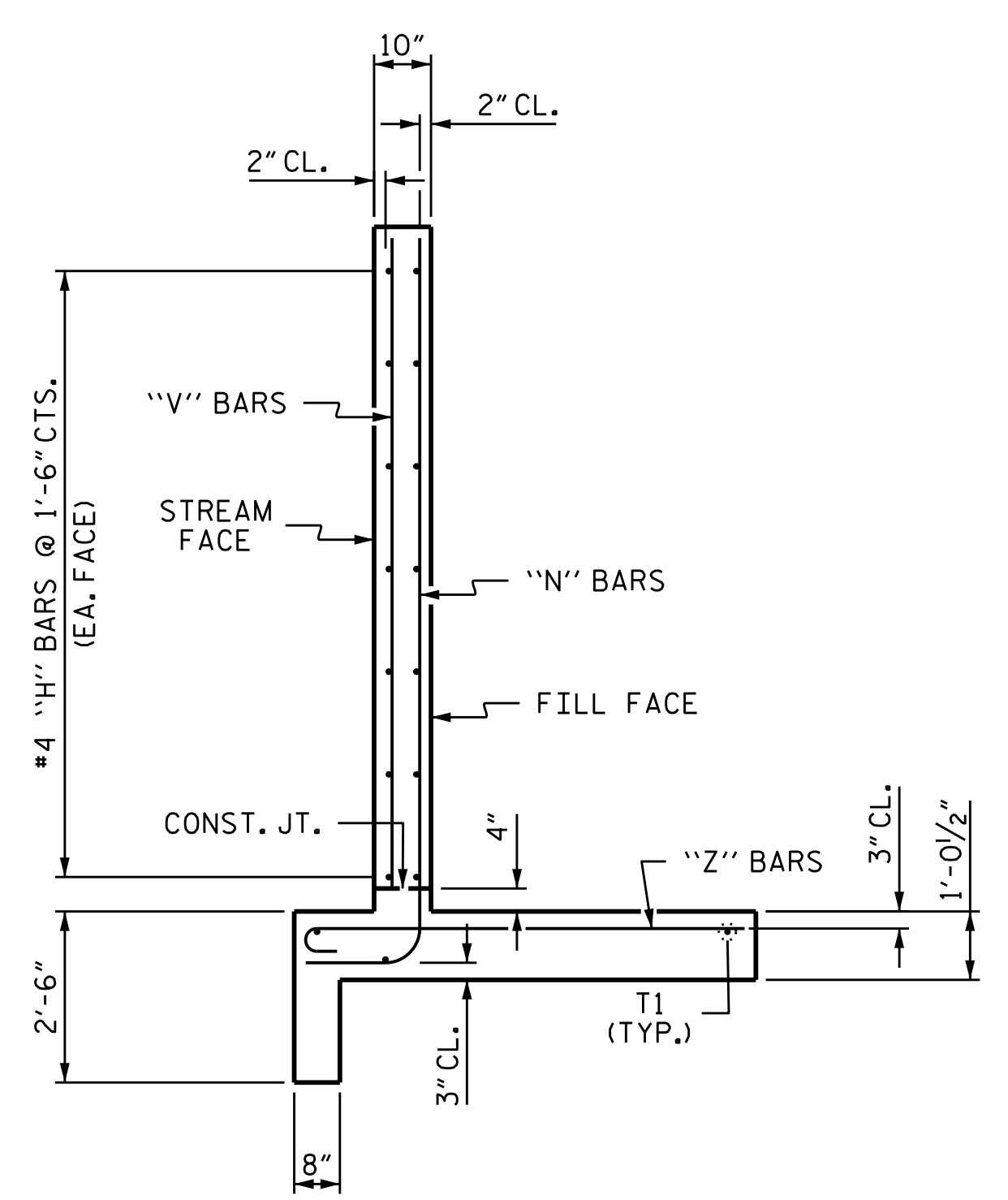
LICENSURE NO. C-4434



PLAN (W1)



ELEVATION (W1)



TYPICAL WING SECTION

**BAR TYPES**

ALL BAR DIMENSIONS ARE OUT TO OUT.

**BILL OF MATERIAL**

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	12'-5"	100
H2	4	#4	STR	9'-10"	26
H3	4	#4	STR	6'-5"	17
H4	4	#4	STR	2'-11"	8
H5	28	#4	1	3'-3"	61
H6	4	#4	STR	13'-6"	36
N1	4	#6	2	11'-2"	67
N2	2	#6	2	10'-10"	33
N3	6	#6	2	9'-6"	86
N4	6	#5	2	8'-3"	52
N5	6	#5	2	6'-11"	43
N6	6	#4	2	5'-7"	22
S1	6	#6	STR	6'-0"	54
T1	6	#5	STR	14'-3"	89
V1	4	#4	STR	9'-2"	24
V2	2	#4	STR	8'-9"	12
V3	6	#4	STR	7'-5"	30
V4	6	#4	STR	6'-2"	25
V5	6	#4	STR	4'-10"	19
V6	6	#4	STR	3'-7"	14
Z1	6	#6	3	6'-7"	59
Z2	6	#6	3	5'-10"	53
Z3	6	#5	3	5'-0"	31
Z4	6	#5	3	4'-2"	26
Z5	6	#4	3	3'-4"	13

REINFORCING STEEL FOR 2 WINGS 2866 LBS

CLASS A CONCRETE

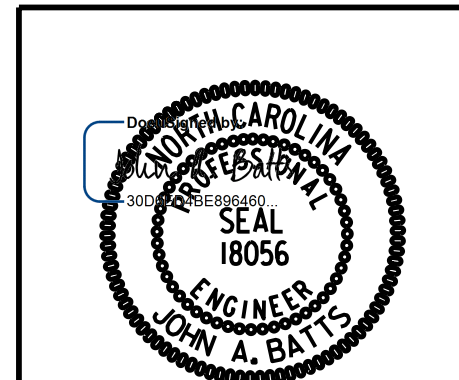
2 WINGS	13.3	CY
1 HEADWALL	0.4	CY
1 END CURTAIN WALL	0.5	CY
2 EDGEBEAMS	0.6	CY
<b>TOTAL</b>	<b>14.8</b>	<b>CY</b>

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 24+63.79 -RPC-

SHEET 5 OF 6

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

**WINGS FOR CULVERT BOX CULVERT**  
 H = 9'-0" SLOPE = 2:1  
 90° SKEW



REVISIONS

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1			3		
2			4		

SHEET NO. C2-5  
 TOTAL SHEETS 6

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 DESIGN ENGINEER OF RECORD: J.A. BATTS DATE : 4-23

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PERMANENT LOAD 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
WA	1.00	--

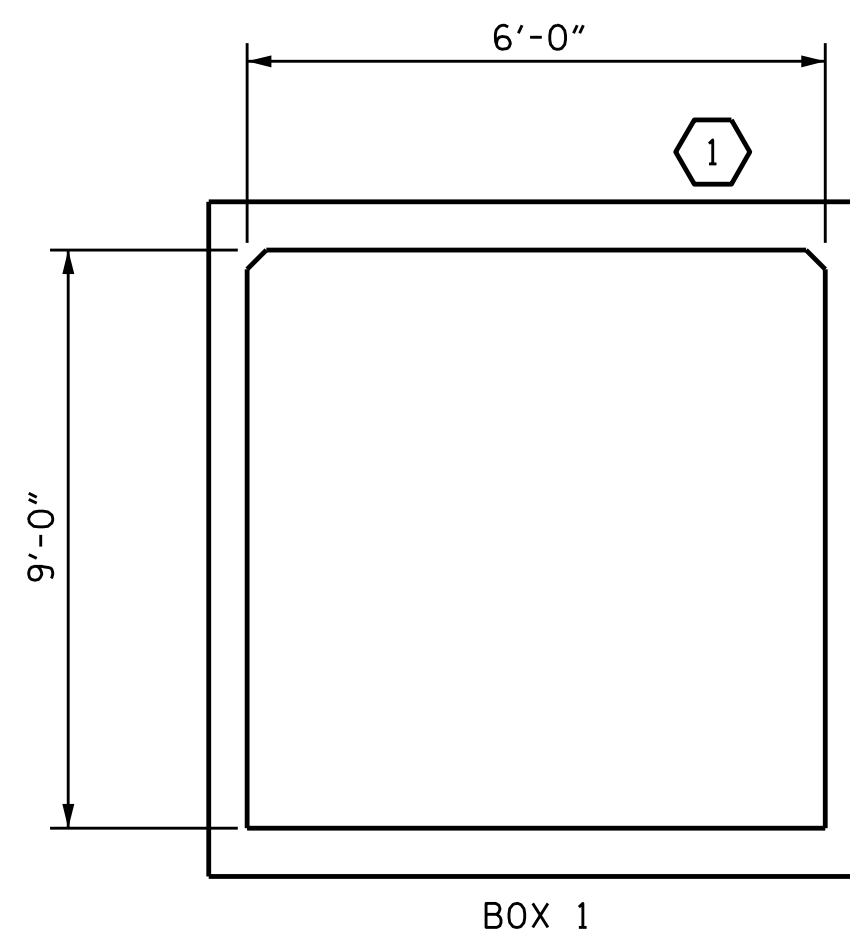
LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERT										
	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	STRENGTH I LIMIT STATE							
			MOMENT				SHEAR			
			RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF SPAN (ft)
PERMANENT LOAD RATING	①	1.02	1.19	1	ROOF SLAB	3.00	1.02	1	ROOF SLAB	4.78

NOTES:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

THE EFFECTS OF LIVE LOAD ON DESIGN AND LOAD RATING MAY BE NEGLECTED FOR CULVERTS WITH CERTAIN FILL DEPTHS DESCRIBED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

CULVERTS WITH NEGLIGIBLE LIVE LOAD SHOULD BE LOAD RATED FOR PERMANENT LOADS ONLY IN ACCORDANCE WITH THE AASHTO MANUAL FOR BRIDGE EVALUATION.



LRFR SUMMARY

(LOOKING DOWNSTREAM)

PROJECT NO. I-2513AA/AB  
BUNCOMBE COUNTY  
 STATION: 24+63.79 -RPC-

SHEET 6 OF 6

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

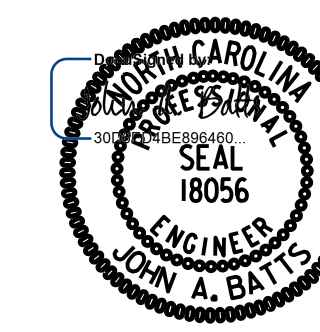
LRFR SUMMARY FOR  
 REINFORCED CONCRETE  
 BOX CULVERTS

(DEEP FILLS)



5640 Dillard Drive, Suite 200  
 Cary, NC 27518

LICENSURE NO. C-4434



12/14/2023 | 8:58 AM

REVISIONS

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

SHEET NO.

C2-6

TOTAL SHEETS

6

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12/14/2023 11:17:04 AM c:\pwworking\cecom\_ds21\_na\_2020\d0131628\I-2513AA\_SMU\_CU6\_104007.dgn

DRAWN BY :	T. BANKOVICH	DATE :	4-23
CHECKED BY :	J.A. BATTS	DATE :	4-23
DESIGN ENGINEER OF RECORD:	J.A. BATTS	DATE :	4-23