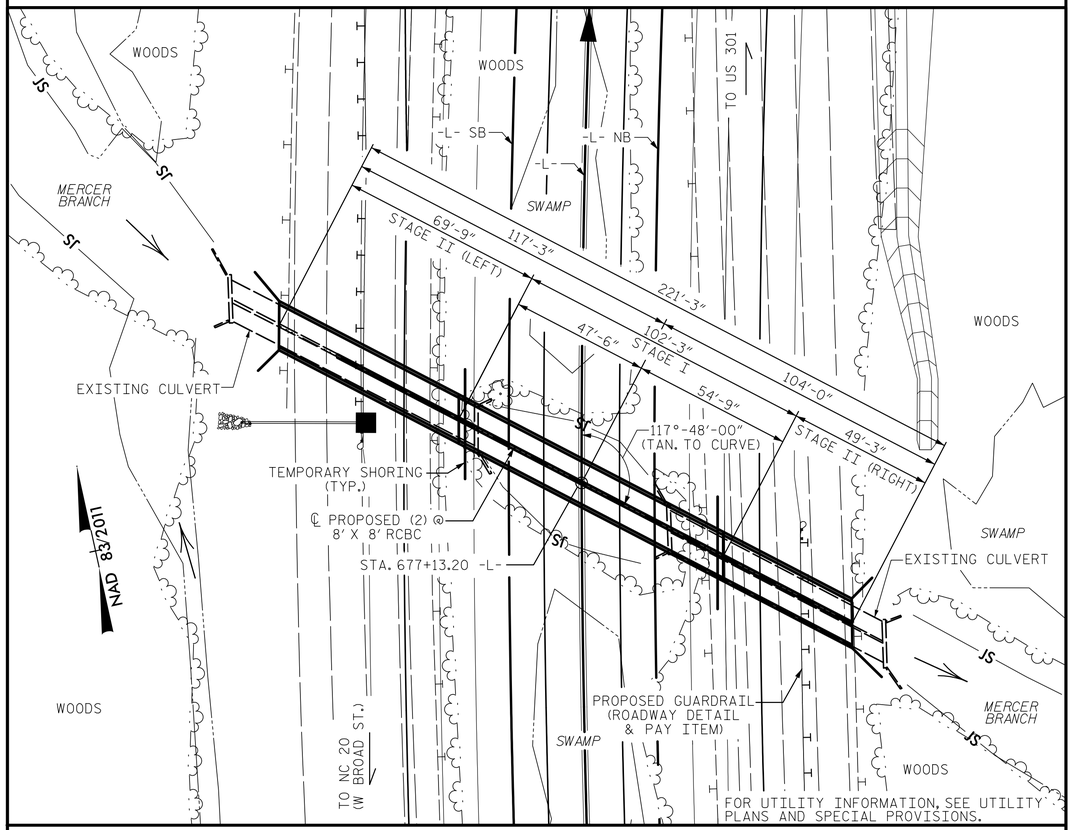
BENCH MARK #54: TIE SPIKE SET IN 19" OAK; STA. 681+81.49 -L-; 121.90' RT.; ELEV. 170.46'



LOCATION SKETCH

NOTES:

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

DESIGN FILL---------- 9.14 FT.

FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTES SHEET.

3"Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.

CONCRETE IN EACH STAGE TO BE POURED IN THE FOLLOWING ORDER:

1. PHASE I WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF OF ALL VERTICAL WALLS.
2. THE REMAINING PORTIONS OF PHASE I WALLS AND PHASE I WINGS FULL HEIGHT.
3. PHASE II WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF PHASE II VERTICAL WALLS.
4. THE REMAINING PORTIONS OF PHASE II WALLS AND PHASE II WINGS FULL HEIGHT.
5. 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.

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.

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

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

FOR TRAFFIC PHASING, SEE TRAFFIC CONTROL PLANS.

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.

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

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.

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.

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

AT THE CONTRACTOR'S OPTION, USE ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL FOR FILL BENEATH CULVERT BEARING ELEVATION.

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

ENCAPSULATE ALL FOUNDATION CONDITIONING MATERIAL IN TYPE 4 GEOTEXTILE. FOR FOUNDATION CONDITIONING GEOTEXTILE, SEE BOX CULVERT EXCAVATION SPECIAL PROVISION.

ROADWAY DATA

G.P. ELEV. @ STA. 677+26.38 -L- SB	= 172.90'
G.P. ELEV. @ STA. 677+00.02 -L- NB	= 171.85'
BED ELEV. @ STA. 677+13.20 -L-	= 156.50'
ROADWAY SLOPES	= 3 : 1

HYDRAULIC DATA

DESIGN DISCHARGE	= 670 CFS
FREQUENCY OF DESIGN FLOOD	= 100 YRS
DESIGN HIGH WATER ELEVATION	= 165.7'
DRAINAGE AREA	= 2.1 SQ. MI.
BASE DISCHARGE (Q100)	= 670 CFS
BASE HIGH WATER ELEVATION	= 165.7'

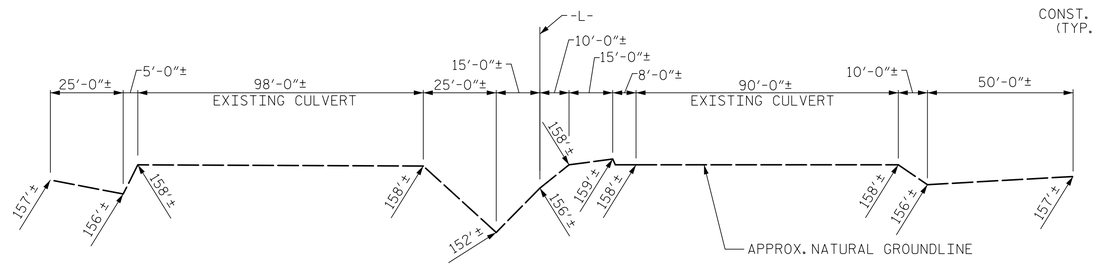
OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 1000 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS
OVERTOPPING FLOOD ELEVATION	= 168.0'

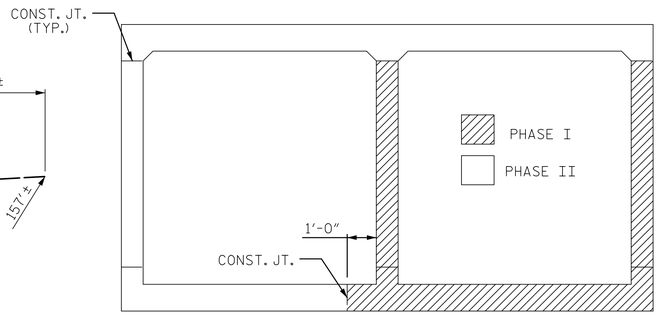
TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		REINFORCING STEEL		FOUNDATION COND. MAT'L.		FOUNDATION COND. GEOTEXTILE	
STAGE I	198.4 C.Y.	STAGE I	24,373 LBS.	STAGE I	160 TONS	STAGE I	530 SQ. YDS.
STAGE II (LEFT)	158.1 C.Y.	STAGE II (LEFT)	18,102 LBS.	STAGE II (LEFT)	110 TONS	STAGE II (LEFT)	380 SQ. YDS.
STAGE II (RIGHT)	119.0 C.Y.	STAGE II (RIGHT)	13,349 LBS.	STAGE II (RIGHT)	78 TONS	STAGE II (RIGHT)	270 SQ. YDS.
TOTAL	475.5 C.Y.	TOTAL	55,824 LBS.	TOTAL	348 TONS	TOTAL	1,180 SQ. YDS.

REMOVAL OF EXISTING STRUCTURES	LUMP SUM
CULVERT EXCAVATION	LUMP SUM



PROFILE ALONG ℄ CULVERT



CONSTRUCTION PHASING

(LOOKING DOWNSTREAM)

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

SEAL

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 1 OF 13 STRUCTURE #770569

DRAWN BY : ZCS DATE : 5/21

CHECKED BY : MGC DATE : 9/21

DESIGN ENGINEER OF RECORD: ZCS DATE : 9/21

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARGARET G. CHEEK JR.

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4/12/2022 | 10:34 AM EDT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

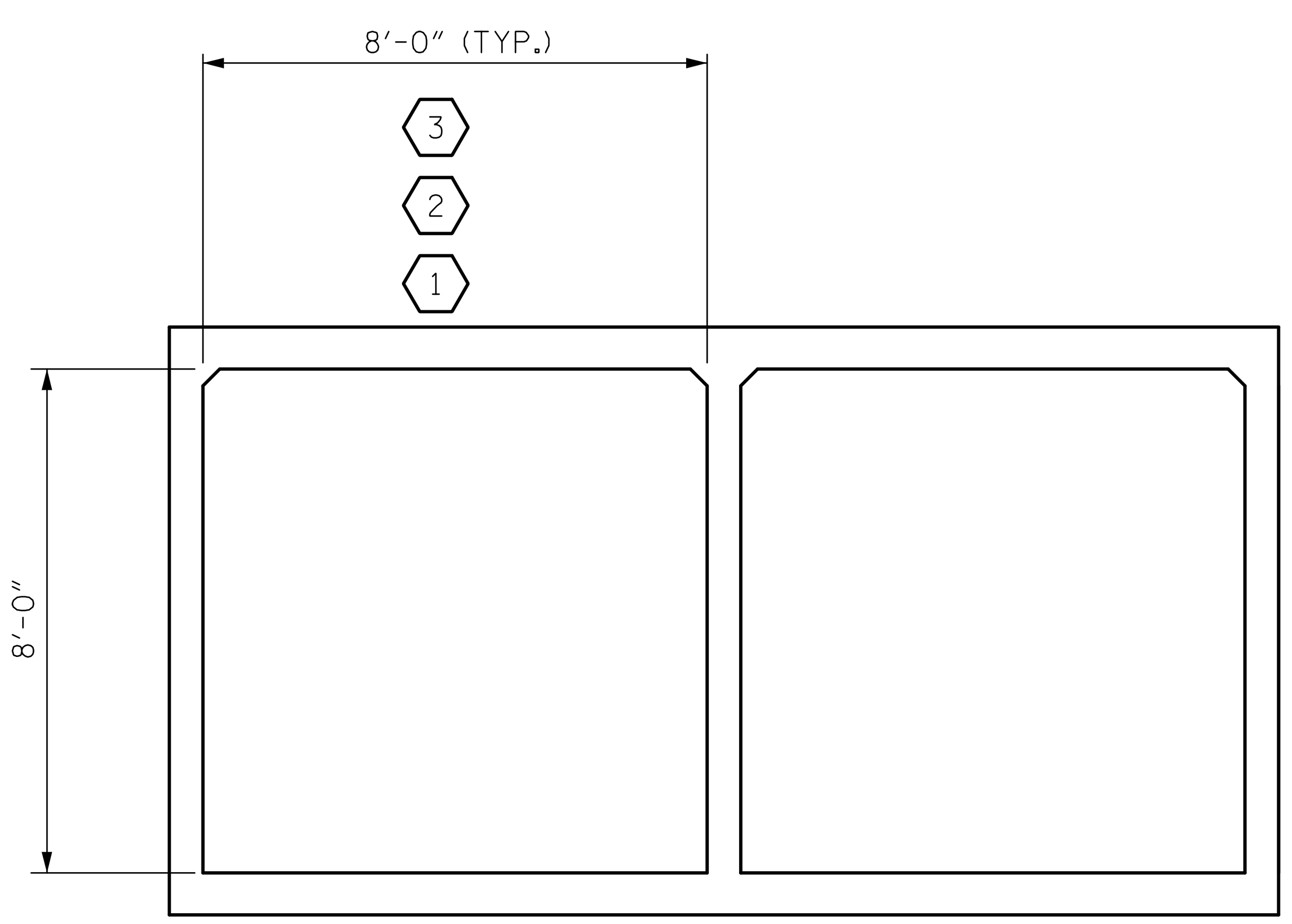
DOUBLE 8 FT. X 8 FT. CAST-IN-PLACE CONCRETE BOX CULVERT 117°-48'-00" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-1
1			3			TOTAL SHEETS
2			4			13

FILE NAME: 411_001_I-5987B_Site_15_SMU_CU_001.dgn SITE 15

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: LIVE-LOAD FACTORS (γ_{LL})	MOMENT: RATING FACTOR	MOMENT: BOX NO.	MOMENT: ELEMENT TYPE	MOMENT: DISTANCE FROM LEFT END OF ELEMENT (ft)	SHEAR: RATING FACTOR	SHEAR: BOX NO.	SHEAR: ELEMENT TYPE	SHEAR: DISTANCE FROM LEFT END OF ELEMENT (ft)	COMMENT NUMBER
DESIGN LOAD RATING		HL-93 (INVENTORY)	N/A	(1)	1.14	--	1.75	1.14	1	TOP SLAB	4.75	1.33	2	BOTTOM SLAB	17.50	-
		HL-93 (OPERATING)	N/A		1.48	--	1.35	1.48	1	TOP SLAB	4.75	1.72	2	BOTTOM SLAB	17.50	-
		HS-20 (INVENTORY)	36.000	(2)	1.23	44.28	1.75	1.23	1	TOP SLAB	4.75	1.55	2	BOTTOM SLAB	17.50	-
		HS-20 (OPERATING)	36.000		1.60	57.60	1.35	1.60	1	TOP SLAB	4.75	2.01	2	BOTTOM SLAB	17.50	-
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SH	12.500	(3)	2.47	3.71	1.40	2.47	1	TOP SLAB	4.75	3.10	2	BOTTOM SLAB	17.50	-
		S3C	21.500		2.60	55.9	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		S3A	22.750		2.60	59.15	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		S4A	26.750		2.60	69.55	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		S5A	30.500		2.60	79.30	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		S6A	34.500		2.60	89.7	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		S7B	38.500		2.60	100.10	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		S7A	40.000		2.60	104.00	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
	TRUCK TRACTOR SEMI-TRAILER (TTST)	T4A	28.250		2.60	73.45	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		T5B	32.000		2.60	83.20	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		T6A	36.000		2.60	93.60	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		T7A	40.000		2.60	104.00	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-
		T7B	40.000		2.60	104.00	1.40	2.60	1	TOP SLAB	4.75	3.27	2	BOTTOM SLAB	17.50	-



LRFR SUMMARY

(LOOKING DOWNSTREAM)

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. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 2 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL C. CHEEK, JR.

4/12/2022 | 10:34 AM EDT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
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SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

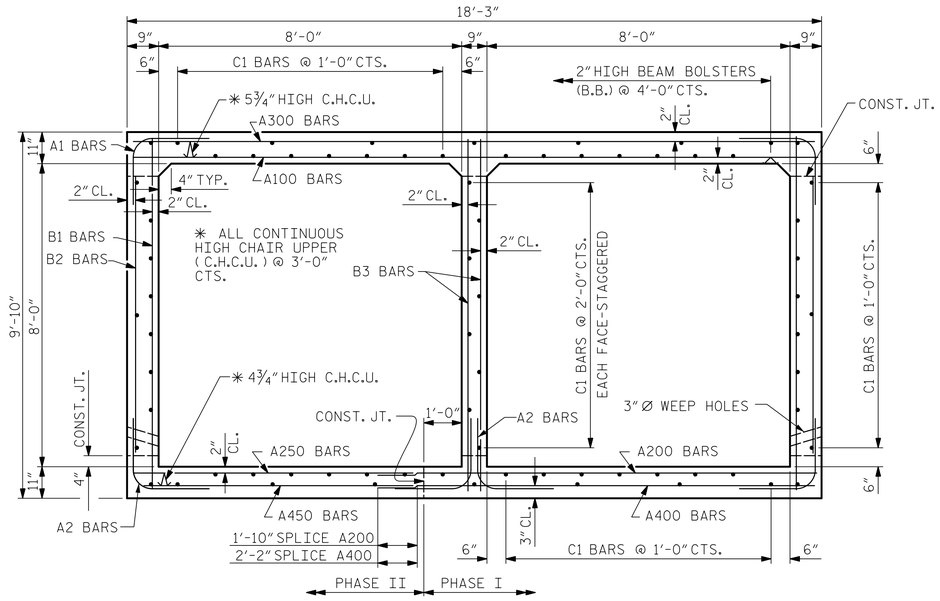
LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-2
1			3			TOTAL SHEETS 13
2			4			

ASSEMBLED BY : ZCS	DATE : 5/21		
CHECKED BY : MGC	DATE : 10/21		
DRAWN BY : WMC 7/11	REV. 10/1/11	MAA/GM	
CHECKED BY : GM 7/11	REV. 12/17	MAA/THC	

FILE NAME: 411_003_I-5987B_Site_15_SMU_CU_002.dgn

SITE 15



RIGHT ANGLE SECTION OF BARREL

THERE ARE 72 "C" BARS IN SECTION OF BARREL.
(LOOKING DOWNSTREAM)

STAGE I BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	139	#4	STR	17′-11″	1664
A101	2	#4	STR	17′-1″	23
A102	2	#4	STR	15′-10″	21
A103	2	#4	STR	14′-7″	19
A104	2	#4	STR	13′-4″	18
A105	2	#4	STR	12′-0″	16
A106	2	#4	STR	10′-9″	14
A107	2	#4	STR	9′-6″	13
A108	2	#4	STR	8′-3″	11
A109	2	#4	STR	7′-0″	9
A110	2	#4	STR	5′-9″	8
A111	2	#4	STR	4′-5″	6
A112	2	#4	STR	3′-2″	4
A200	143	#4	STR	12′-5″	1186
A201	1	#4	STR	11′-5″	8
A202	1	#4	STR	10′-2″	7
A203	1	#4	STR	8′-11″	6
A204	1	#4	STR	7′-8″	5
A205	1	#4	STR	6′-4″	4
A206	1	#4	STR	5′-1″	3
A207	1	#4	STR	3′-10″	3
A208	1	#4	STR	2′-7″	2
A209	1	#4	STR	12′-0″	8
A210	1	#4	STR	10′-9″	7
A211	1	#4	STR	9′-6″	6
A212	1	#4	STR	8′-3″	6
A213	1	#4	STR	7′-0″	5
A214	1	#4	STR	5′-9″	4
A215	1	#4	STR	4′-5″	3
A216	1	#4	STR	3′-2″	2

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A250	147	#4	STR	7′-6″	736
A251	1	#4	STR	7′-0″	5
A252	1	#4	STR	5′-9″	4
A253	1	#4	STR	4′-5″	3
A254	1	#4	STR	3′-2″	2
A255	1	#4	STR	6′-9″	5
A256	1	#4	STR	5′-6″	4
A257	1	#4	STR	4′-3″	3
A258	1	#4	STR	3′-0″	2
A300	159	#5	STR	17′-11″	2971
A301	2	#5	STR	17′-1″	36
A302	2	#5	STR	16′-0″	33
A303	2	#5	STR	14′-11″	31
A304	2	#5	STR	13′-9″	29
A305	2	#5	STR	12′-8″	26
A306	2	#5	STR	11′-7″	24
A307	2	#5	STR	10′-5″	22
A308	2	#5	STR	9′-4″	19
A309	2	#5	STR	8′-3″	17
A310	2	#5	STR	7′-2″	15
A311	2	#5	STR	6′-0″	13
A312	2	#5	STR	4′-11″	10
A313	2	#5	STR	3′-10″	8
A314	2	#5	STR	2′-9″	6

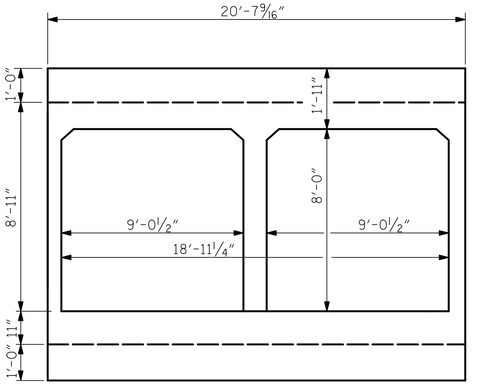
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A400	164	#5	STR	12′-8″	2167
A401	1	#5	STR	11′-9″	12
A402	1	#5	STR	10′-8″	11
A403	1	#5	STR	9′-7″	10
A404	1	#5	STR	8′-5″	9
A405	1	#5	STR	7′-4″	8
A406	1	#5	STR	6′-3″	7
A407	1	#5	STR	5′-1″	5
A408	1	#5	STR	4′-0″	4
A409	1	#5	STR	2′-11″	3
A410	1	#5	STR	11′-7″	12
A411	1	#5	STR	10′-5″	11
A412	1	#5	STR	9′-4″	10
A413	1	#5	STR	8′-3″	9
A414	1	#5	STR	7′-2″	7
A415	1	#5	STR	6′-0″	6
A416	1	#5	STR	4′-11″	5
A417	1	#5	STR	3′-10″	4
A418	1	#5	STR	2′-9″	3
A450	168	#5	STR	7′-6″	1314
A451	1	#5	STR	7′-2″	7
A452	1	#5	STR	6′-0″	6
A453	1	#5	STR	4′-11″	5
A454	1	#5	STR	3′-10″	4
A455	1	#5	STR	2′-9″	3
A456	1	#5	STR	6′-9″	7
A457	1	#5	STR	5′-8″	6
A458	1	#5	STR	4′-7″	5
A459	1	#5	STR	3′-5″	4

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	350	#4	1	6′-0″	1403
A2	554	#4	1	5′-7″	2066
B1	204	#4	STR	9′-4″	1272
B2	350	#4	STR	7′-4″	1715
B3	204	#4	STR	9′-4″	1272
C1	216	#4	STR	35′-3″	5086
S2	12	#6	STR	14′-7″	263
S3	12	#6	STR	8′-5″	152
S4	12	#6	STR	20′-3″	365

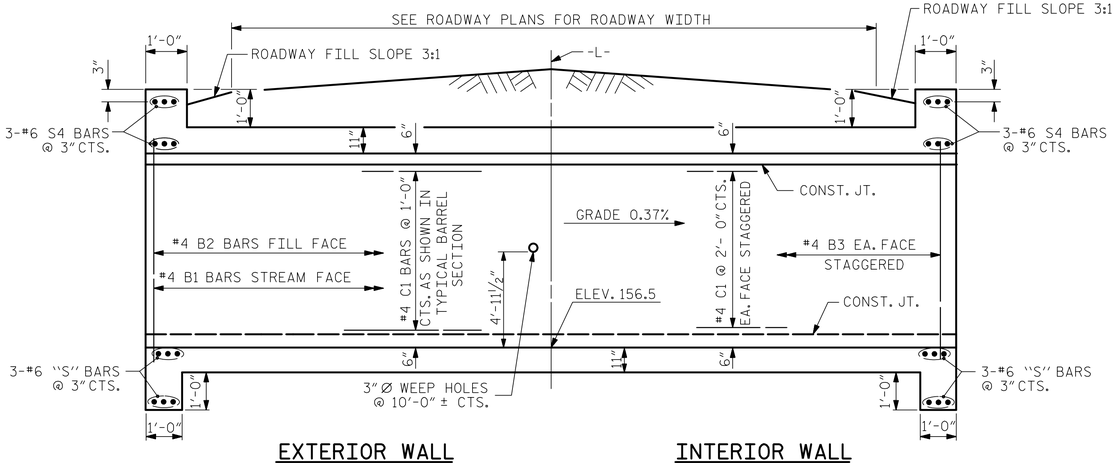
REINFORCING STEEL 24,373 LBS

STAGE I QUANTITIES

CLASS A CONCRETE		
BARREL @ 1.91 CY/FT	195.3	C.Y.
4 EDGE BEAMS	3.1	C.Y.
TOTAL	198.4	C.Y.
REINFORCING STEEL		
BARREL	24,373	LBS.
TOTAL	24,373	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	160 TONS	
FOUNDATION COND. GEOTEXTILE	530 SQ. YDS.	



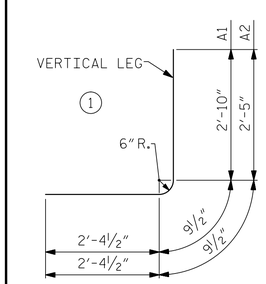
END ELEVATION NORMAL TO SKEW



EXTERIOR WALL INTERIOR WALL

STAGE I - CULVERT SECTION NORMAL TO ROADWAY

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1′-10″
C1	#4	1′-10″
A200	#4	1′-10″
A400	#5	2′-2″
"S"	#6	2′-9″

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 677+13.20 -L-

SHEET 3 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
5FBCC2F3A4DC413...
4/12/2022 | 10:34 AM EDT

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TGS ENGINEERS
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CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE I

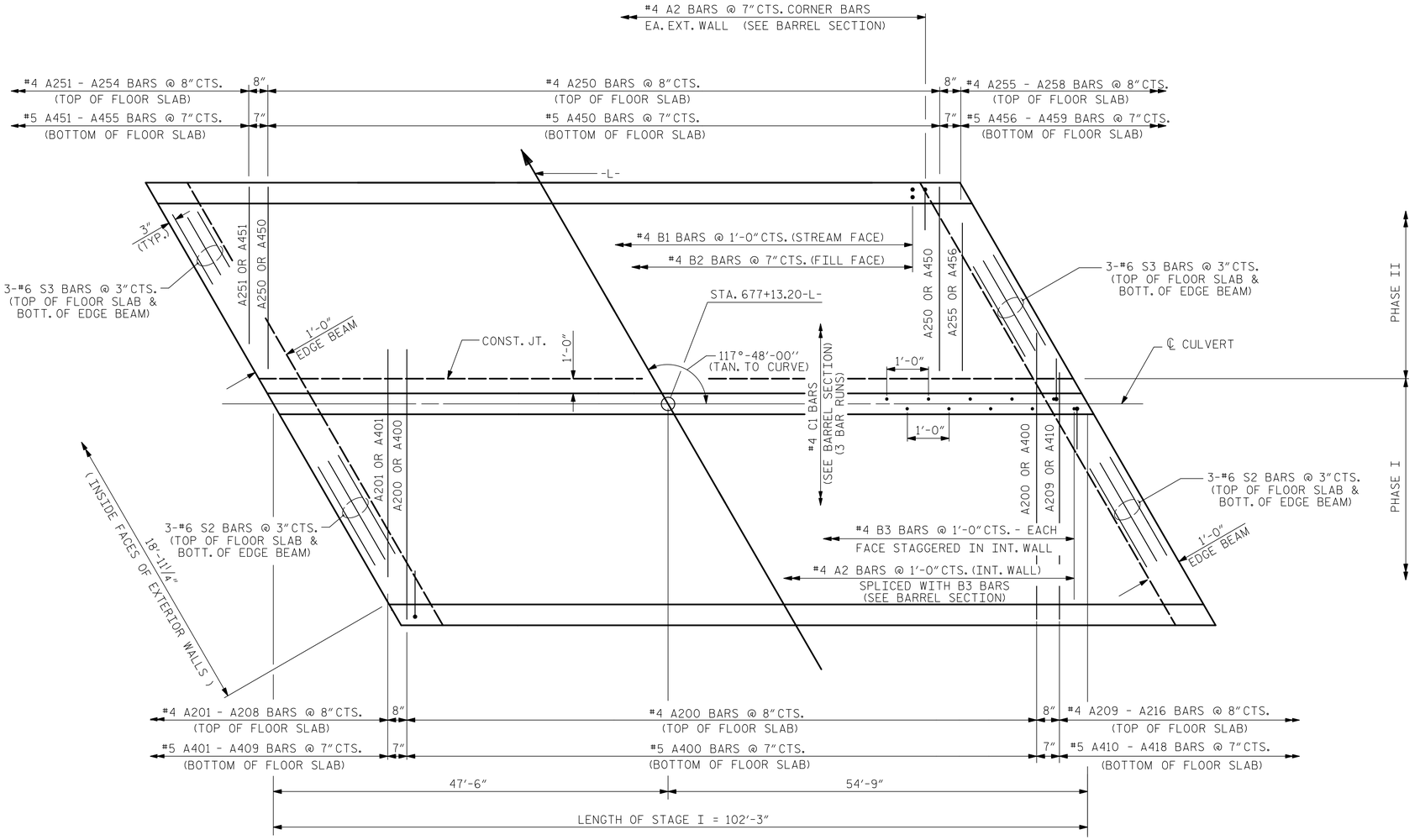
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. C15-3
TOTAL SHEETS 13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

FILE NAME: 411_005_I-5987B_Site 15_SMU_CU_003.dgn

SITE 15



PLAN - FLOOR SLAB

NOTE: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 4 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Document by: Marshall G. Cheek, Jr.

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4/12/2022 | 10:34 AM EDT

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CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE I

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-4
1			3			TOTAL SHEETS
2			4			13

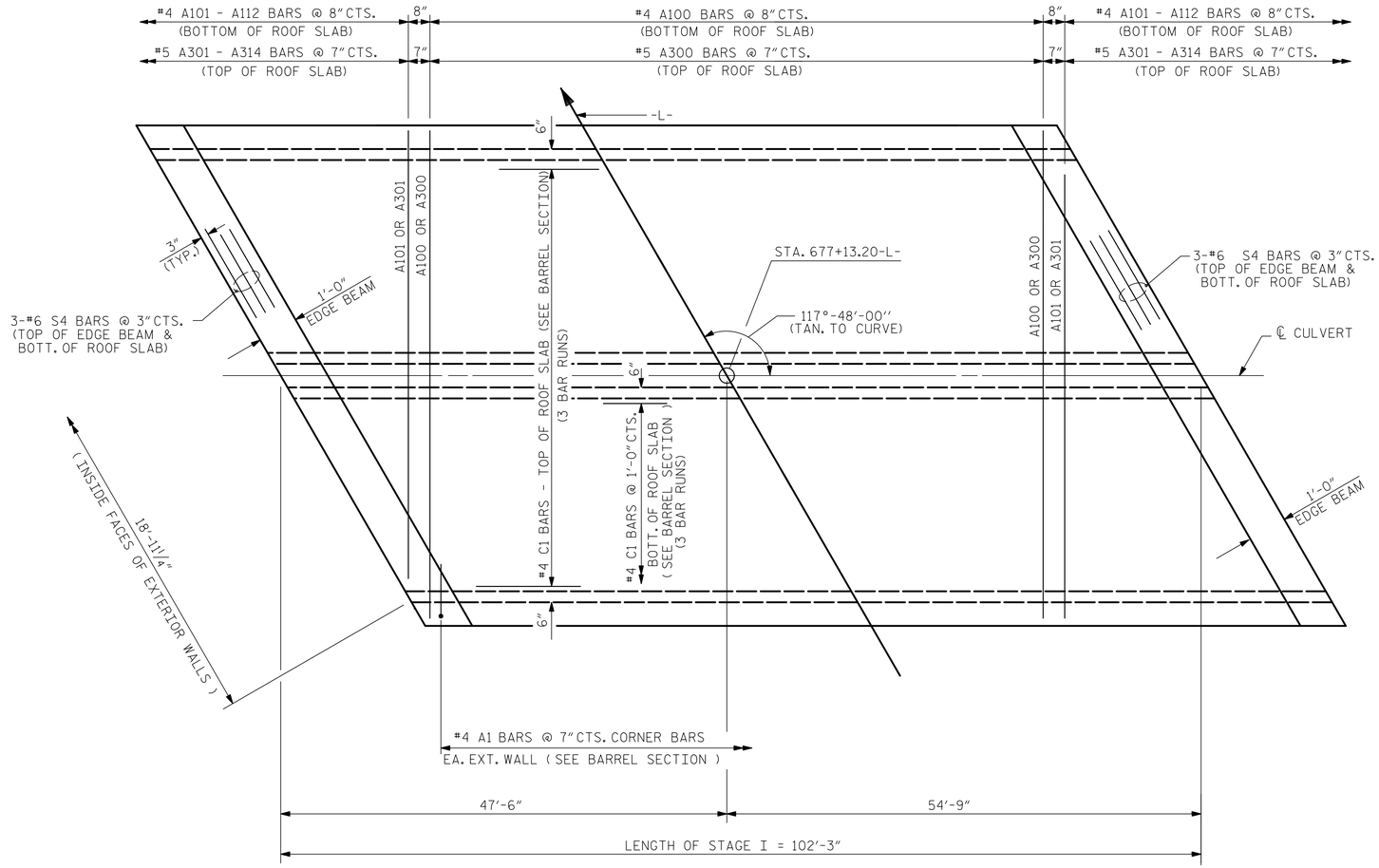
DRAWN BY : ZCS DATE : 9/21

CHECKED BY : MGC DATE : 10/21

DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

FILE NAME: 411_007_I-5987B_Site 15_SMU_CU_004.dgn

SITE 15



PLAN - ROOF SLAB

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 5 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Document ID: 5FBCC2F3A4DC413...
Marshall G. Cheek, Jr.
4/12/2022 | 10:34 AM EDT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

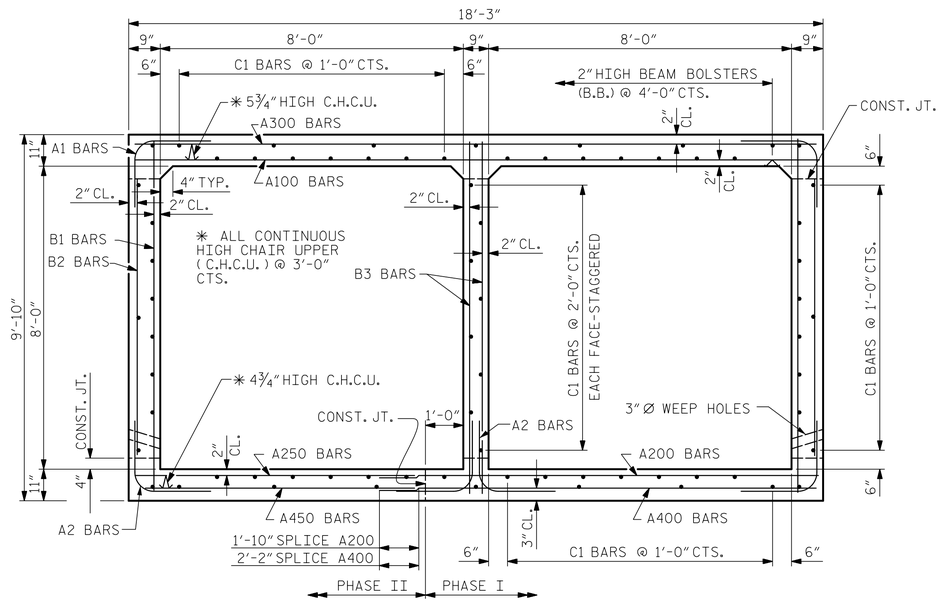
DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE I

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-5
1			3			TOTAL SHEETS
2			4			13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

FILE NAME: 411_009_I-5987B_Site 15_SMU_CU_005.dgn

SITE 15



RIGHT ANGLE SECTION OF BARREL

THERE ARE 72 "C" BARS IN SECTION OF BARREL.
(LOOKING DOWNSTREAM)

STAGE II (LEFT) BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	91	#4	STR	17'-11"	1089
A101	2	#4	STR	16'-11"	23
A102	2	#4	STR	15'-8"	21
A103	2	#4	STR	14'-5"	19
A104	2	#4	STR	13'-2"	18
A105	2	#4	STR	11'-11"	16
A106	2	#4	STR	10'-7"	14
A107	2	#4	STR	9'-4"	12
A108	2	#4	STR	8'-1"	11
A109	2	#4	STR	6'-10"	9
A110	2	#4	STR	5'-7"	7
A111	2	#4	STR	4'-4"	6
A112	2	#4	STR	3'-0"	4
A200	95	#4	STR	12'-5"	788
A201	1	#4	STR	11'-4"	8
A202	1	#4	STR	10'-1"	7
A203	1	#4	STR	8'-10"	6
A204	1	#4	STR	7'-7"	5
A205	1	#4	STR	6'-4"	4
A206	1	#4	STR	5'-0"	3
A207	1	#4	STR	3'-9"	3
A208	1	#4	STR	11-11"	8
A209	1	#4	STR	10'-7"	7
A210	1	#4	STR	9'-4"	6
A211	1	#4	STR	8'-1"	5
A212	1	#4	STR	6'-10"	5
A213	1	#4	STR	5'-7"	4
A214	1	#4	STR	4'-4"	3
A215	1	#4	STR	3'-0"	2

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A250	99	#4	STR	7'-6"	496
A251	1	#4	STR	6'-10"	5
A252	1	#4	STR	5'-7"	4
A253	1	#4	STR	4'-4"	3
A254	1	#4	STR	3'-0"	2
A255	1	#4	STR	6'-7"	4
A256	1	#4	STR	5'-4"	4
A257	1	#4	STR	4'-1"	3
A258	1	#4	STR	2'-10"	2
A300	103	#5	STR	17'-11"	1925
A301	2	#5	STR	17'-3"	36
A302	2	#5	STR	16'-2"	34
A303	2	#5	STR	15'-1"	31
A304	2	#5	STR	13'-11"	29
A305	2	#5	STR	12'-10"	27
A306	2	#5	STR	11'-9"	25
A307	2	#5	STR	10'-7"	22
A308	2	#5	STR	9'-6"	20
A309	2	#5	STR	8'-5"	18
A310	2	#5	STR	7'-4"	15
A311	2	#5	STR	6'-2"	13
A312	2	#5	STR	5'-1"	11
A313	2	#5	STR	4'-0"	8
A314	2	#5	STR	2'-10"	6

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A400	108	#5	STR	12'-8"	1427
A401	1	#5	STR	11'-11"	12
A402	1	#5	STR	10'-10"	11
A403	1	#5	STR	9'-9"	10
A404	1	#5	STR	8'-7"	9
A405	1	#5	STR	7'-6"	8
A406	1	#5	STR	6'-5"	7
A407	1	#5	STR	5'-3"	5
A408	1	#5	STR	4'-2"	4
A409	1	#5	STR	11'-9"	12
A410	1	#5	STR	10'-7"	11
A411	1	#5	STR	9'-6"	10
A412	1	#5	STR	8'-5"	9
A413	1	#5	STR	7'-4"	8
A414	1	#5	STR	6'-2"	6
A415	1	#5	STR	5'-1"	5
A416	1	#5	STR	4'-0"	4
A417	1	#5	STR	2'-10"	3
A450	112	#5	STR	7'-6"	876
A451	1	#5	STR	7'-4"	8
A452	1	#5	STR	5'-1"	5
A453	1	#5	STR	4'-0"	4
A454	1	#5	STR	2'-10"	3
A455	1	#5	STR	6'-11"	7
A456	1	#5	STR	5'-10"	6
A457	1	#5	STR	4'-8"	5
A458	1	#5	STR	3'-7"	4
A459	1	#5	STR	2'-6"	3

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	238	#4	1	6'-0"	954
A2	378	#4	1	5'-7"	1410
B1	140	#4	STR	9'-4"	873
B2	238	#4	STR	7'-4"	1166
B3	140	#4	STR	9'-4"	873
C1	144	#4	STR	35'-8"	3431
S2	9	#6	STR	14'-7"	197
S3	9	#6	STR	8'-5"	114
S4	9	#6	STR	20'-3"	274
G1	4	#5	STR	20'-3"	84
D1	38	#6	STR	2'-6"	143
D2	6	#6	STR	1'-6"	14

REINFORCING STEEL 16,871 LBS

STAGE II (LEFT) QUANTITIES

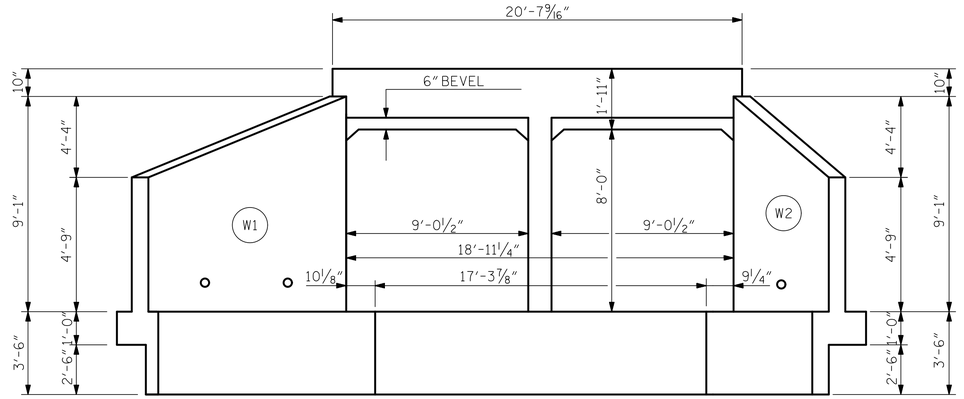
CLASS A CONCRETE

BARREL @ 1.91 CY/FT	133.2	C.Y.
WINGS, ETC.	22.8	C.Y.
2 EDGE BEAMS	1.5	C.Y.
SILLS	0.6	C.Y.
TOTAL	158.1	C.Y.

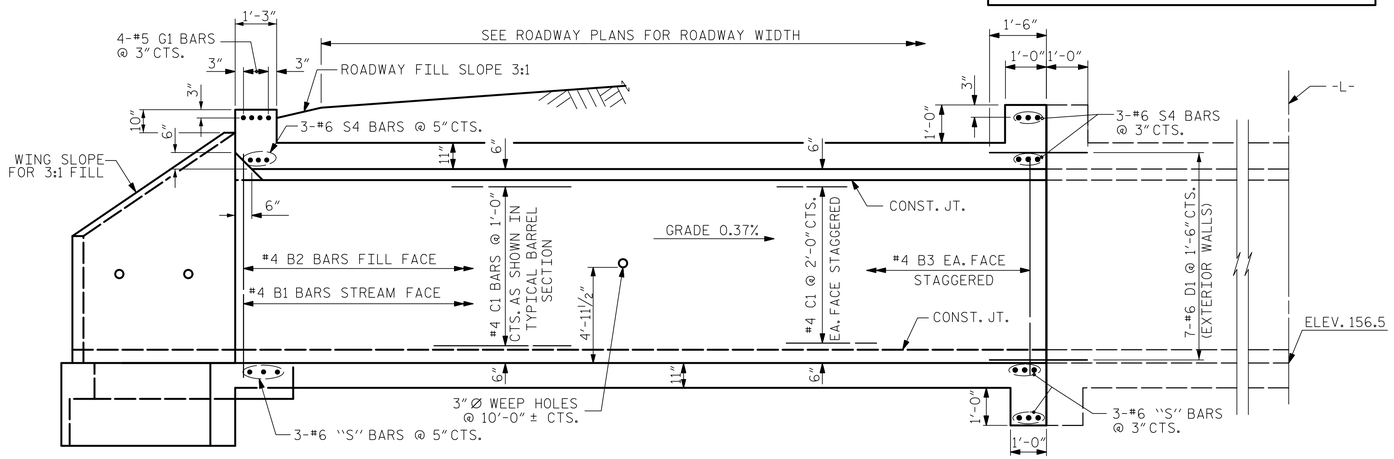
REINFORCING STEEL

BARREL & SILLS	16,871	LBS.
WINGS, ETC.	1,231	LBS.
TOTAL	18,102	LBS.

CULVERT EXCAVATION	LUMP SUM
FOUNDATION COND. MAT'L.	110 TONS
FOUNDATION COND. GEOTEXTILE	380 SQ. YDS.



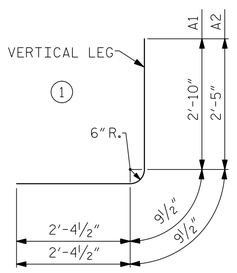
END ELEVATION NORMAL TO SKEW



EXTERIOR WALL INTERIOR WALL

STAGE II (LEFT) - CULVERT SECTION NORMAL TO ROADWAY

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-10"
C1	#4	1'-10"
A200	#4	1'-10"
A400	#5	2'-2"
"S"	#6	2'-9"

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 677+13.20 -L-

SHEET 6 OF 13

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II (LEFT)

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER
DocuSigned by: G. CHECK, JR.
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SUITE 200
RALEIGH, NC 27603
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CORP. LICENSE NO.: C-0275

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

SHEET NO. C15-6
TOTAL SHEETS 13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

3/16/2022
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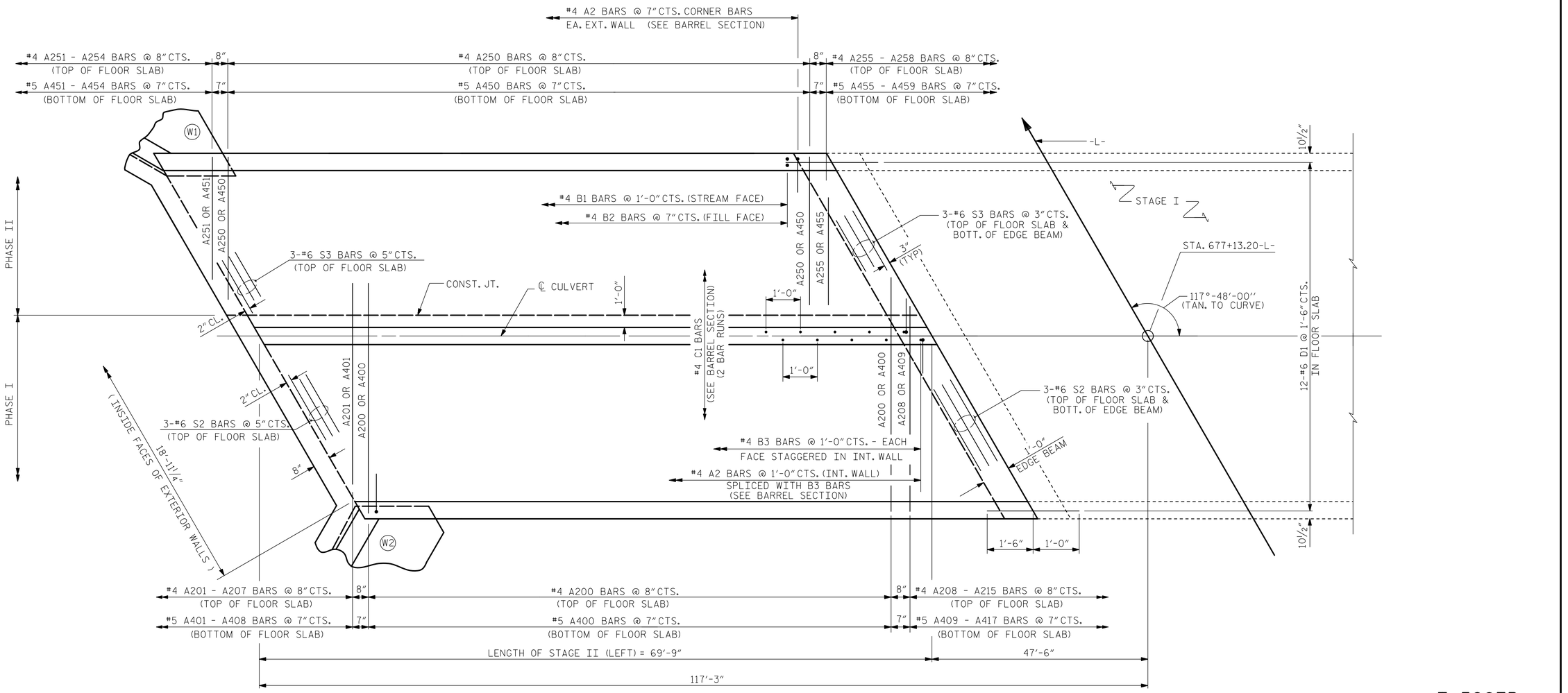
User:zsmith

FILE NAME: 411_011_I-5987B_Site 15_SMU_CU_006.dgn

SITE 15



PLAN - FLOOR SLAB

NOTE: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.
FOR D1 DOWELS IN EXTERIOR WALLS, SEE SHEET 6 OF 13.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 7 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Marshall G. Cheek, Jr.

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

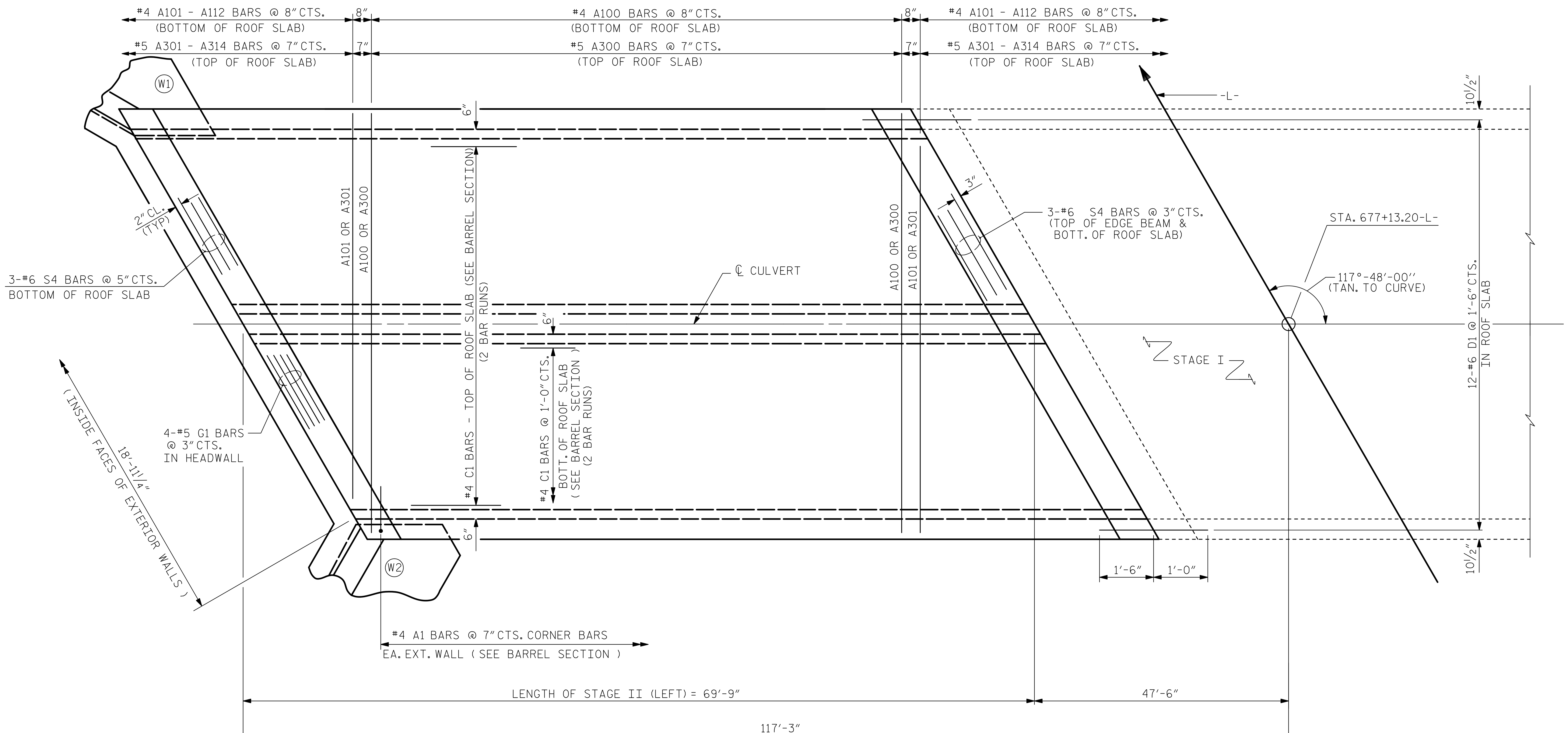
DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II (LEFT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-7
1			3			TOTAL SHEETS
2			4			13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

FILE NAME: 411_013_I-5987B_Site 15_SMU_CU_007.dgn

SITE 15



PLAN - ROOF SLAB

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 8 OF 13

SEAL 20125 — NORTH CAROLINA PROFESSIONAL ENGINEER — MARSHALL G. CHEEK, JR.

DocuSigned by: Marshall G. Cheek, Jr.

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SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II (LEFT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-8
1			3			TOTAL SHEETS
2			4			13

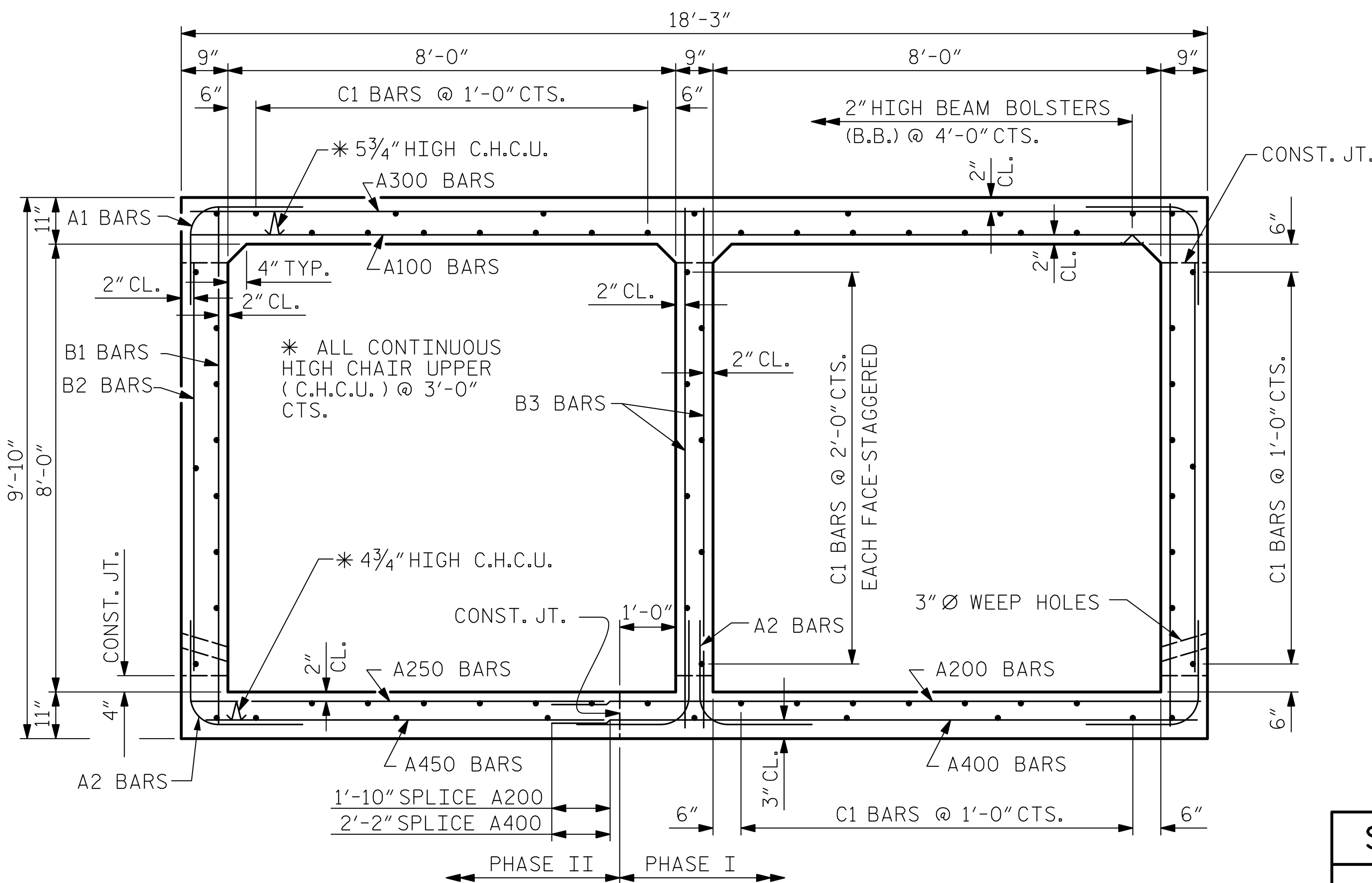
DRAWN BY :	ZCS	DATE :	9/21
CHECKED BY :	MGC	DATE :	10/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE :	10/21

FILE NAME: 411_015_I-5987B_Site 15_SMU_CU_008.dgn

SITE 15

STAGE II (RIGHT) BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	60	#4	STR	17′-11″	718	A250	68	#4	STR	7′-6″	341	A400	73	#5	STR	12′-8″	964	A1	168	#4	1	6′-0″	673
A101	2	#4	STR	16′-10″	22	A251	1	#4	STR	6′-9″	5	A401	1	#5	STR	11′-7″	12	A2	266	#4	1	5′-7″	992
A102	2	#4	STR	15′-7″	21	A252	1	#4	STR	5′-6″	4	A402	1	#5	STR	10′-6″	11						
A103	2	#4	STR	14′-4″	19	A253	1	#4	STR	4′-3″	3	A403	1	#5	STR	9′-5″	10	B1	98	#4	STR	9′-4″	611
A104	2	#4	STR	13′-1″	17	A254	1	#4	STR	2′-11″	2	A404	1	#5	STR	8′-3″	9	B2	168	#4	STR	7′-4″	823
A105	2	#4	STR	11′-10″	16	A255	1	#4	STR	6′-6″	4	A405	1	#5	STR	7′-2″	7	B3	98	#4	STR	9′-4″	611
A106	2	#4	STR	10′-6″	14	A256	1	#4	STR	5′-3″	4	A406	1	#5	STR	6′-1″	6						
A107	2	#4	STR	9′-3″	12	A257	1	#4	STR	4′-0″	3	A407	1	#5	STR	5′-0″	5	C1	144	#4	STR	25′-5″	2445
A108	2	#4	STR	8′-0″	11	A258	1	#4	STR	2′-9″	2	A408	1	#5	STR	3′-10″	4						
A109	2	#4	STR	6′-9″	9							A409	1	#5	STR	11′-5″	12	S2	9	#6	STR	14′-7″	197
A110	2	#4	STR	5′-6″	7	A300	68	#5	STR	17′-11″	1271	A410	1	#5	STR	10′-4″	11	S3	9	#6	STR	8′-5″	114
A111	2	#4	STR	4′-3″	6	A301	2	#5	STR	16′-11″	35	A411	1	#5	STR	9′-2″	10	S4	9	#6	STR	20′-3″	274
A112	2	#4	STR	2′-11″	4	A302	2	#5	STR	15′-10″	33	A412	1	#5	STR	8′-1″	8						
						A303	2	#5	STR	14′-9″	31	A413	1	#5	STR	7′-0″	7	G1	4	#5	STR	20′-3″	84
A200	64	#4	STR	12′-5″	531	A304	2	#5	STR	13′-7″	28	A414	1	#5	STR	5′-10″	6						
A201	1	#4	STR	11′-3″	8	A305	2	#5	STR	12′-6″	26	A415	1	#5	STR	4′-9″	5	D1	38	#6	STR	2′-6″	143
A202	1	#4	STR	10′-0″	7	A306	2	#5	STR	11′-5″	24	A416	1	#5	STR	3′-8″	4	D2	6	#6	STR	1′-6″	14
A203	1	#4	STR	8′-9″	6	A307	2	#5	STR	10′-4″	22												
A204	1	#4	STR	7′-6″	5	A308	2	#5	STR	9′-2″	19	A450	77	#5	STR	7′-6″	602						
A205	1	#4	STR	6′-3″	4	A309	2	#5	STR	8′-1″	17	A451	1	#5	STR	7′-0″	7						
A206	1	#4	STR	4′-11″	3	A310	2	#5	STR	7′-0″	15	A452	1	#5	STR	5′-10″	6						
A207	1	#4	STR	3′-8″	2	A311	2	#5	STR	5′-10″	12	A453	1	#5	STR	4′-9″	5						
A208	1	#4	STR	11′-10″	8	A312	2	#5	STR	4′-9″	10	A454	1	#5	STR	3′-8″	4						
A209	1	#4	STR	10′-6″	7	A313	2	#5	STR	3′-8″	8	A455	1	#5	STR	6′-7″	7						
A210	1	#4	STR	9′-3″	6							A456	1	#5	STR	5′-6″	6						
A211	1	#4	STR	8′-0″	5							A457	1	#5	STR	4′-5″	5						
A212	1	#4	STR	6′-9″	5							A458	1	#5	STR	3′-3″	3						
A213	1	#4	STR	5′-6″	4																		
A214	1	#4	STR	4′-3″	3																		
A215	1	#4	STR	2′-11″	2													REINFORCING STEEL					12,118 LBS

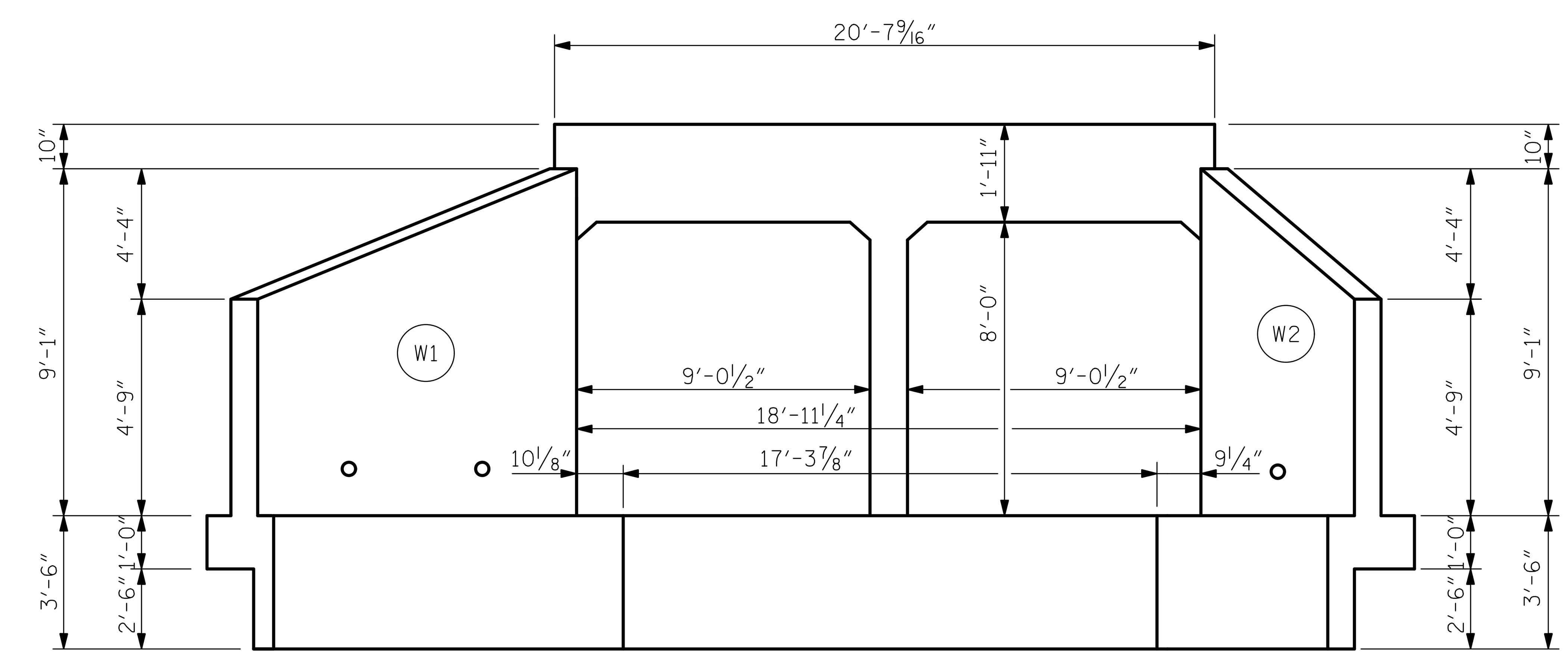


RIGHT ANGLE SECTION OF BARREL

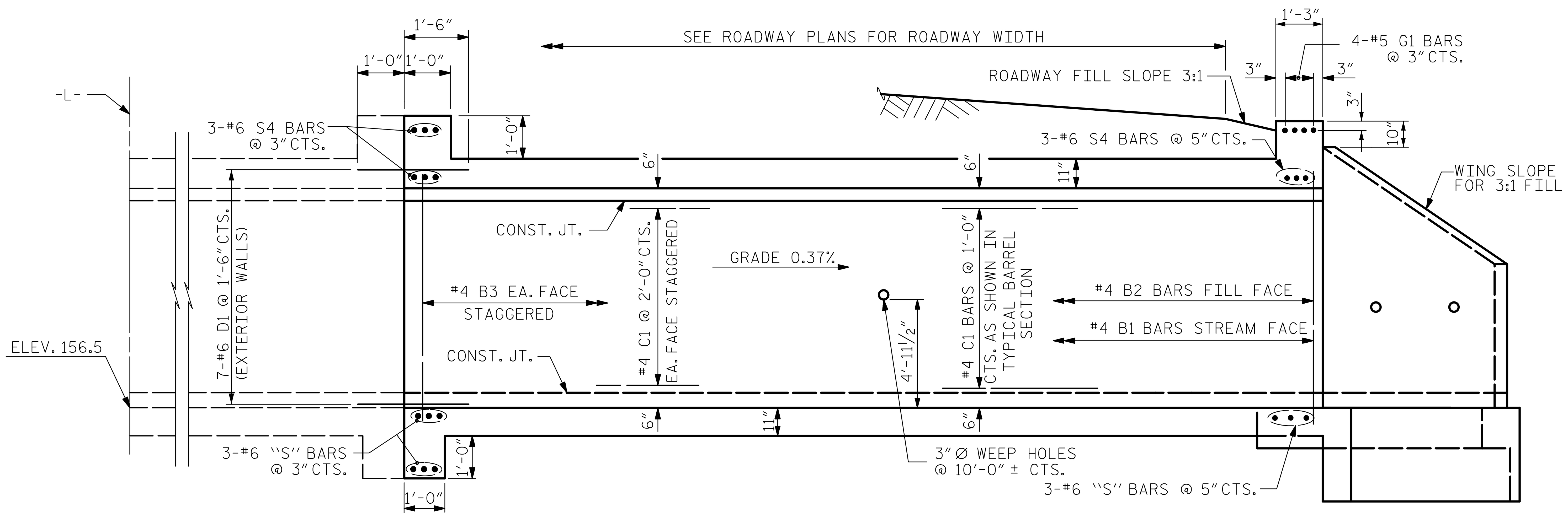
THERE ARE 72 "C" BARS IN SECTION OF BARREL.
(LOOKING DOWNSTREAM)

STAGE II (RIGHT) QUANTITIES

CLASS A CONCRETE		
BARREL @ 1.91 CY/FT	94.1	C.Y.
WINGS, ETC.	22.8	C.Y.
2 EDGE BEAMS	1.5	C.Y.
SILLS	0.6	C.Y.
TOTAL	119.0	C.Y.
REINFORCING STEEL		
BARREL & SILLS	12,118	LBS.
WINGS, ETC.	1,231	LBS.
TOTAL	13,349	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	78 TONS	
FOUNDATION COND. GEOTEXTILE	270 SQ. YDS.	

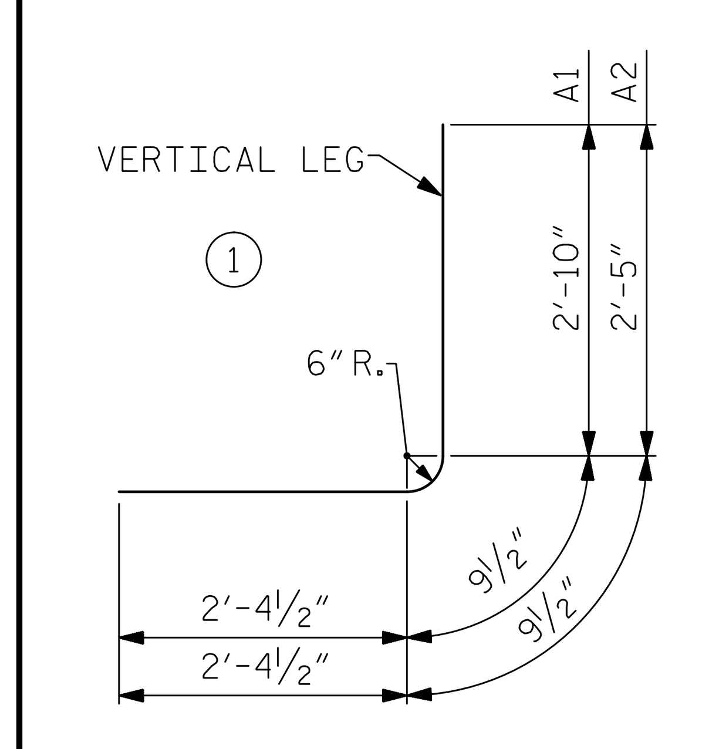


END ELEVATION NORMAL TO SKEW



STAGE II (RIGHT) - CULVERT SECTION NORMAL TO ROADWAY

BAR TYPE



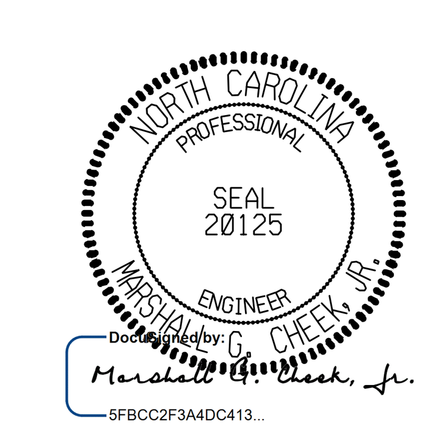
DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1′-10″
C1	#4	1′-10″
A200	#4	1′-10″
A400	#5	2′-2″
"S"	#6	2′-9″

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 677+13.20 -L-

SHEET 9 OF 13



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RALEIGH

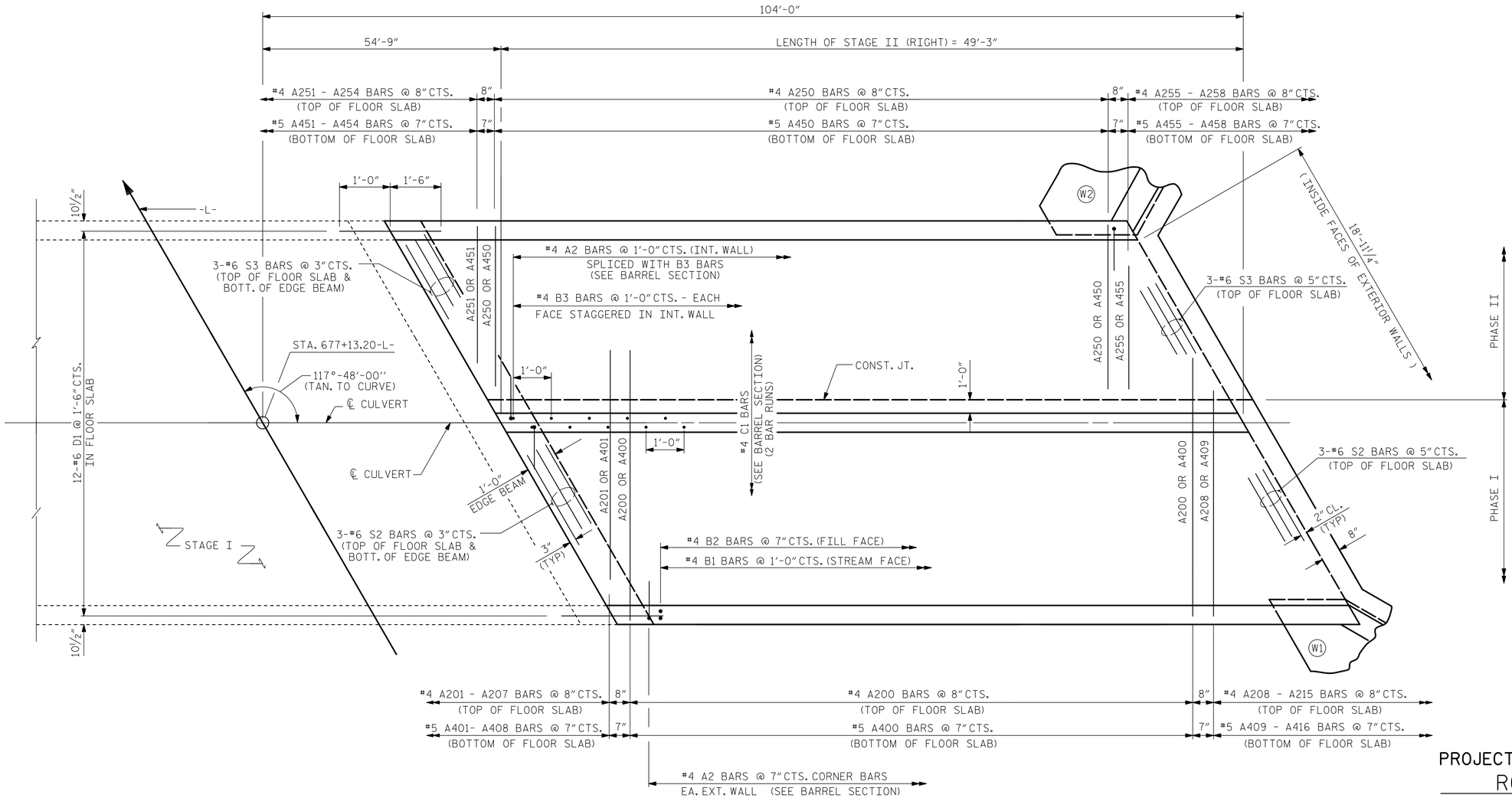
DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II (RIGHT)

REVISIONS							SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:		C15-9
1			3				TOTAL SHEETS
2			4				13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

FILE NAME: 411_0017_I-5987B_Site 15_SMU_CU_009.dgn

SITE 15



PLAN - FLOOR SLAB

NOTE: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.
FOR D1 DOWELS IN EXTERIOR WALLS, SEE SHEET 9 OF 13.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 10 OF 13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Docusigned by: Marshall G. Cheek, Jr. 5FBCC2F3A4DC413...

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RALEIGH

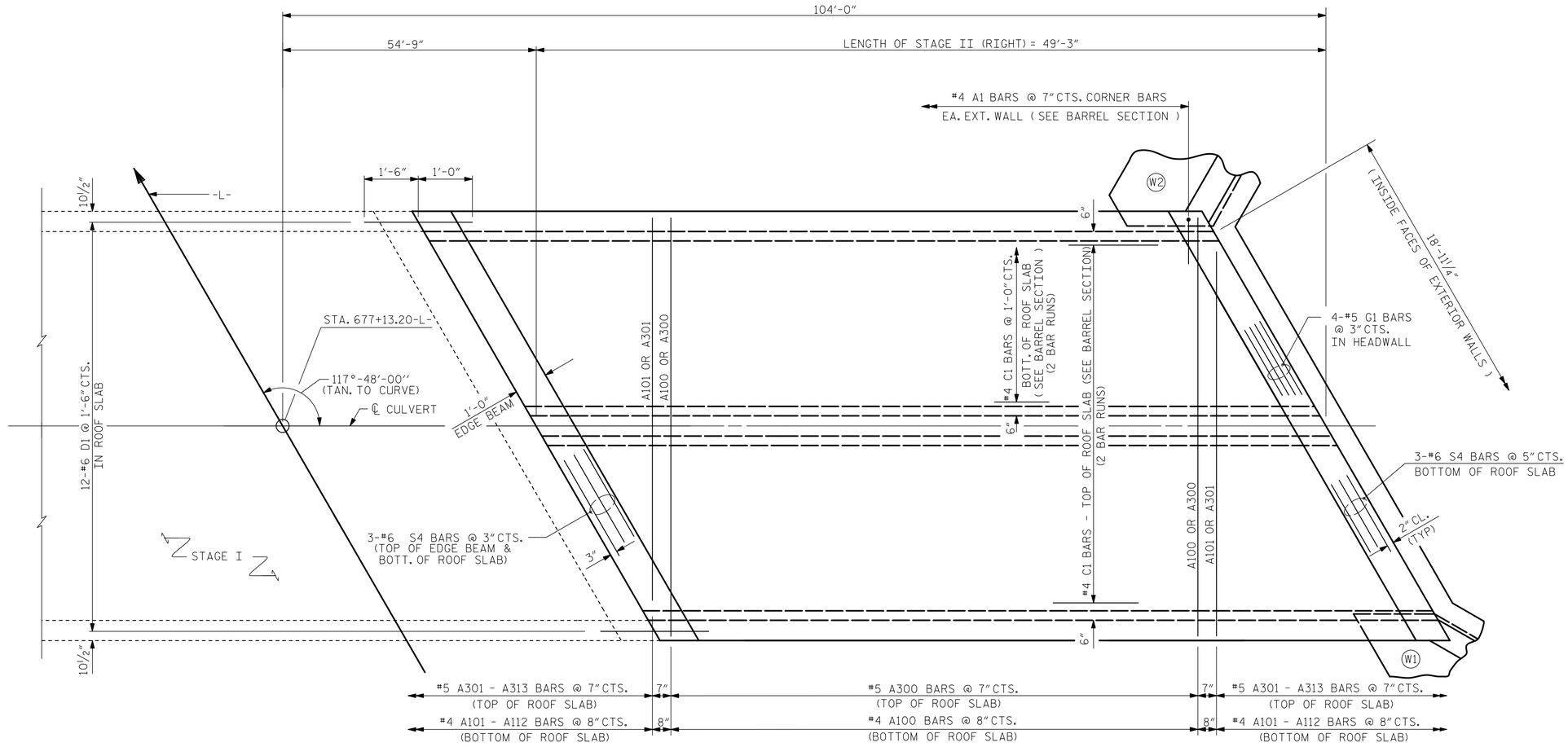
DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II (RIGHT)

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

SHEET NO. C15-10
TOTAL SHEETS 13

FILE NAME: 411_019_I-5987B_Site 15_SMU_CU_010.dgn

SITE 15



PLAN - ROOF SLAB

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 11 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER
MARSHALL G. CHEEK, JR.
5FBCC2F3A4DC413...
4/12/2022 | 10:34 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II (RIGHT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-11
1			3			TOTAL SHEETS
2			4			13

DRAWN BY : ZCS DATE : 9/21
CHECKED BY : MGC DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 10/21

FILE NAME: 411_021_I-5987B_Site 15_SMU_CU_011.dgn

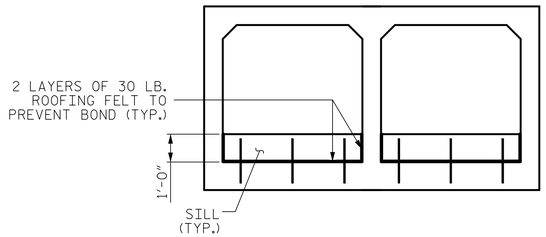
SITE 15

NOTES

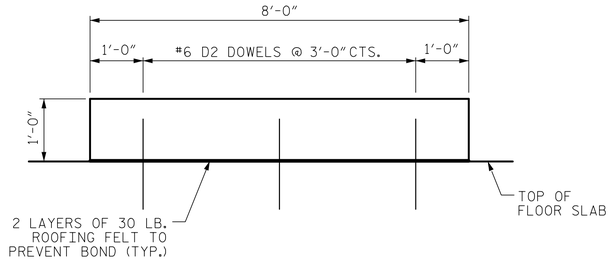
NATIVE MATERIAL BETWEEN SILLS IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM OR FLOODPLAIN AT THE PROJECT SITE DURING CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE THE LOW FLOW 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 THE APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

THE ENTIRE COST OF WORK REQUIRED TO PLACE EXCAVATED MATERIAL OR SUPPLEMENTAL MATERIAL AS SHOWN ON THE PLANS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE BID FOR CULVERT EXCAVATION.

THE ENTIRE COST OF WORK REQUIRED TO CONSTRUCT THE SILLS SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS.



INLET ELEVATION



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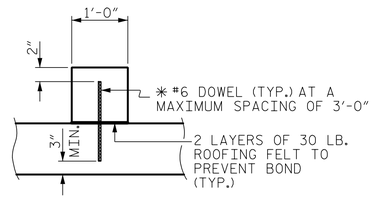

SECTION THROUGH SILL

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

SILL DETAILS

PLAN OF FLOOR SILL LAYOUT

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 677+13.20 -L-

SHEET 12 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Document Id: Marshall G. Cheek, Jr.
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

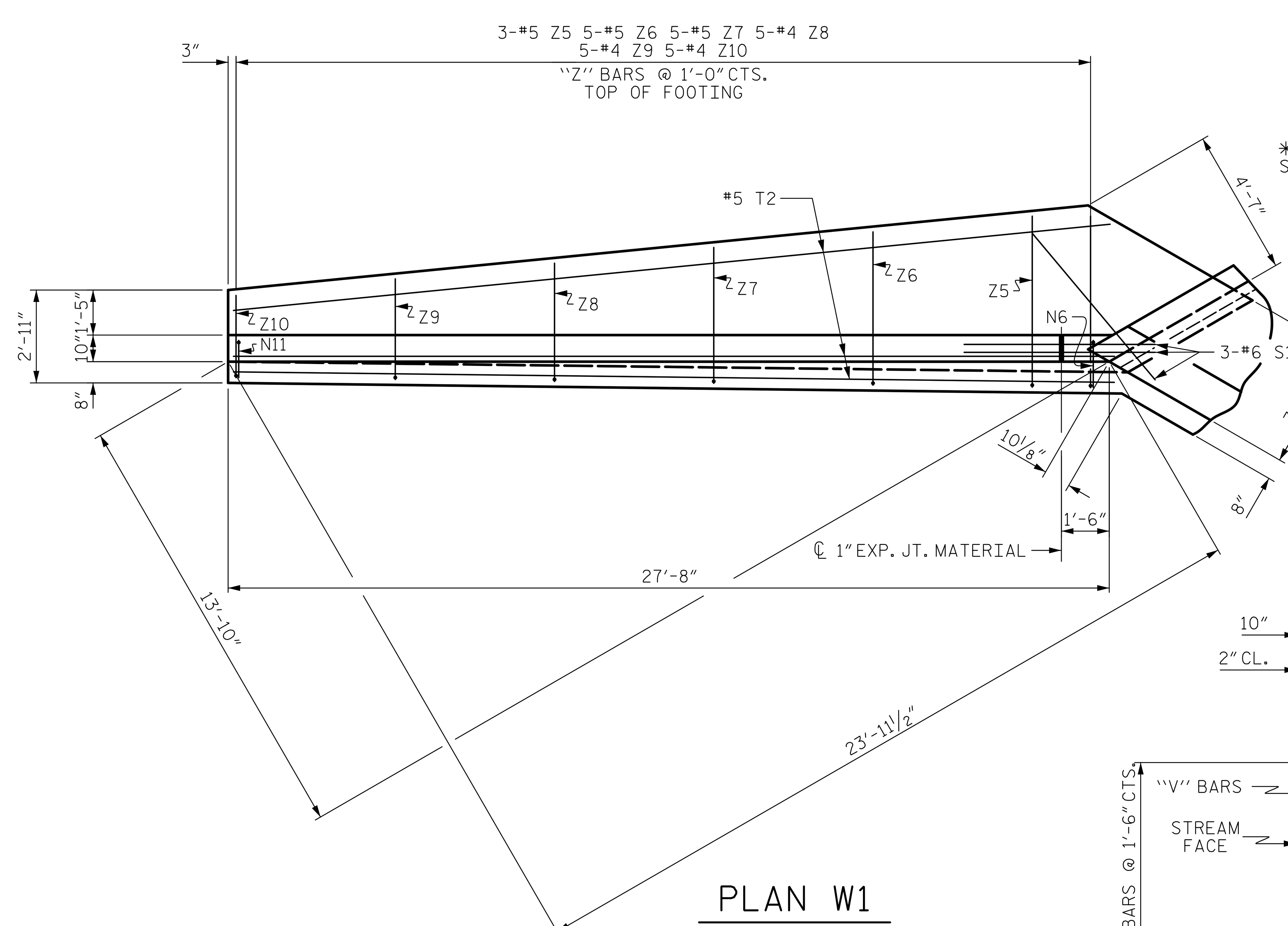
DOUBLE 8 FT. X 8 FT. CONCRETE BOX CULVERT 117°-48'-00" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C15-12
1			3			TOTAL SHEETS
2			4			13

DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 10/21

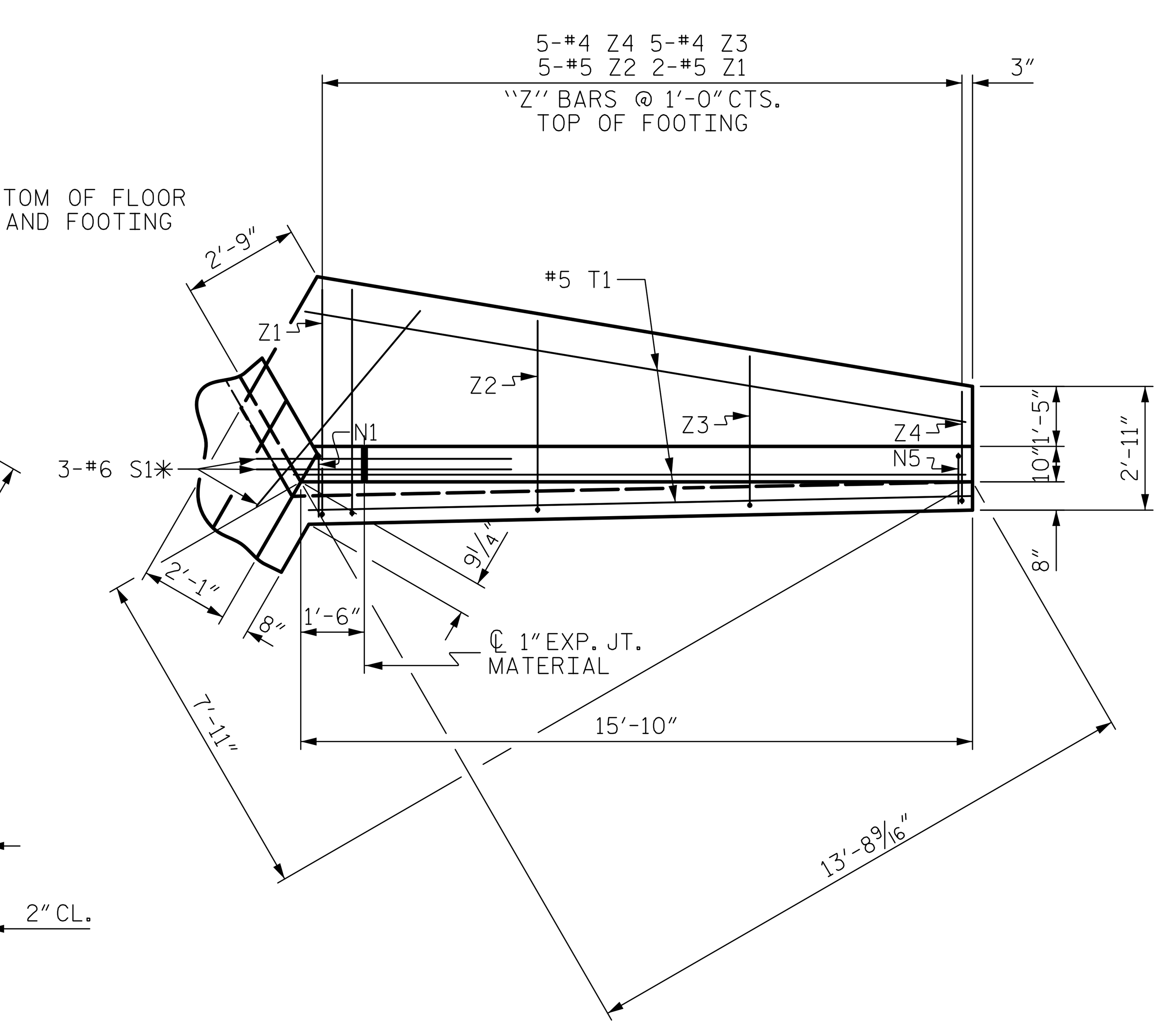
FILE NAME: 411_023_I-5987B_Site 15_SMU_CU_012.dgn

SITE 15

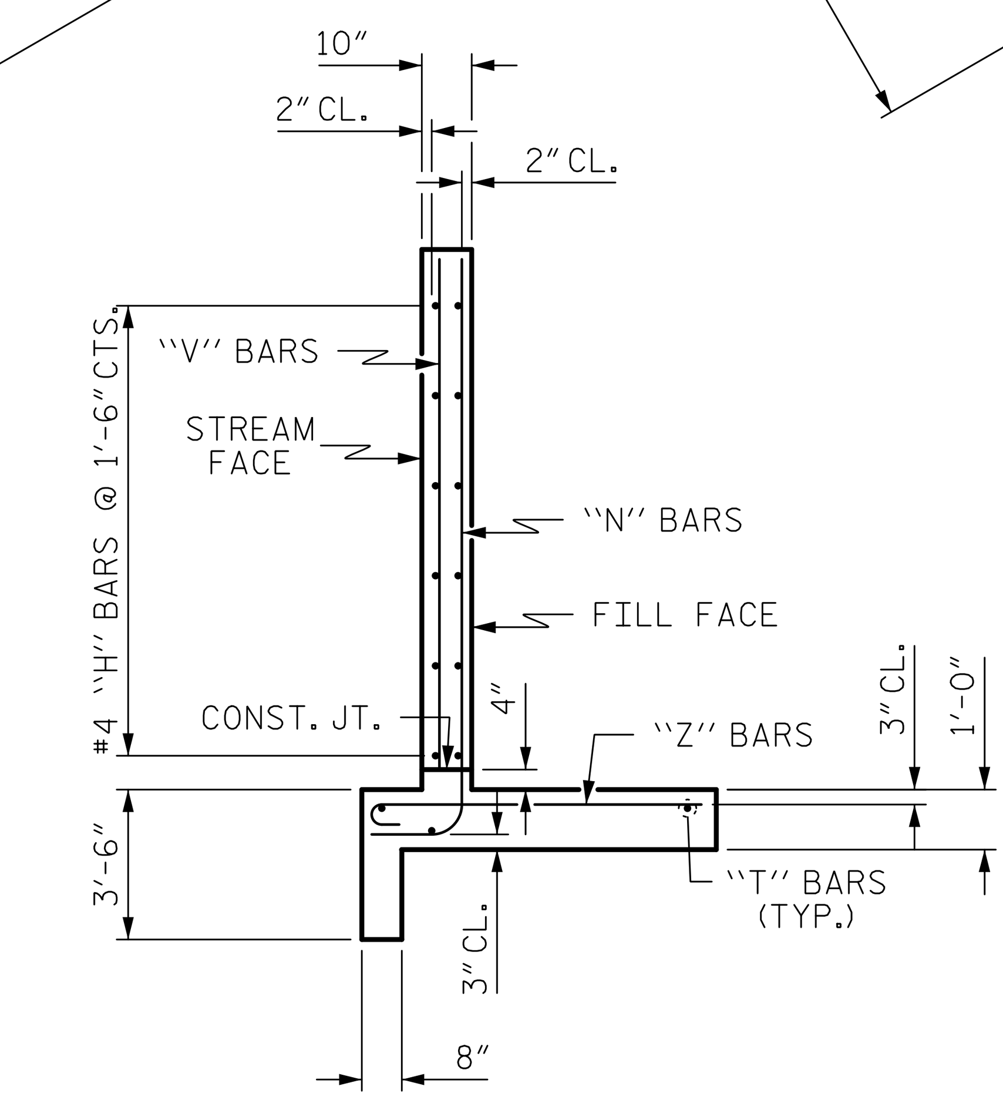


PLAN W1

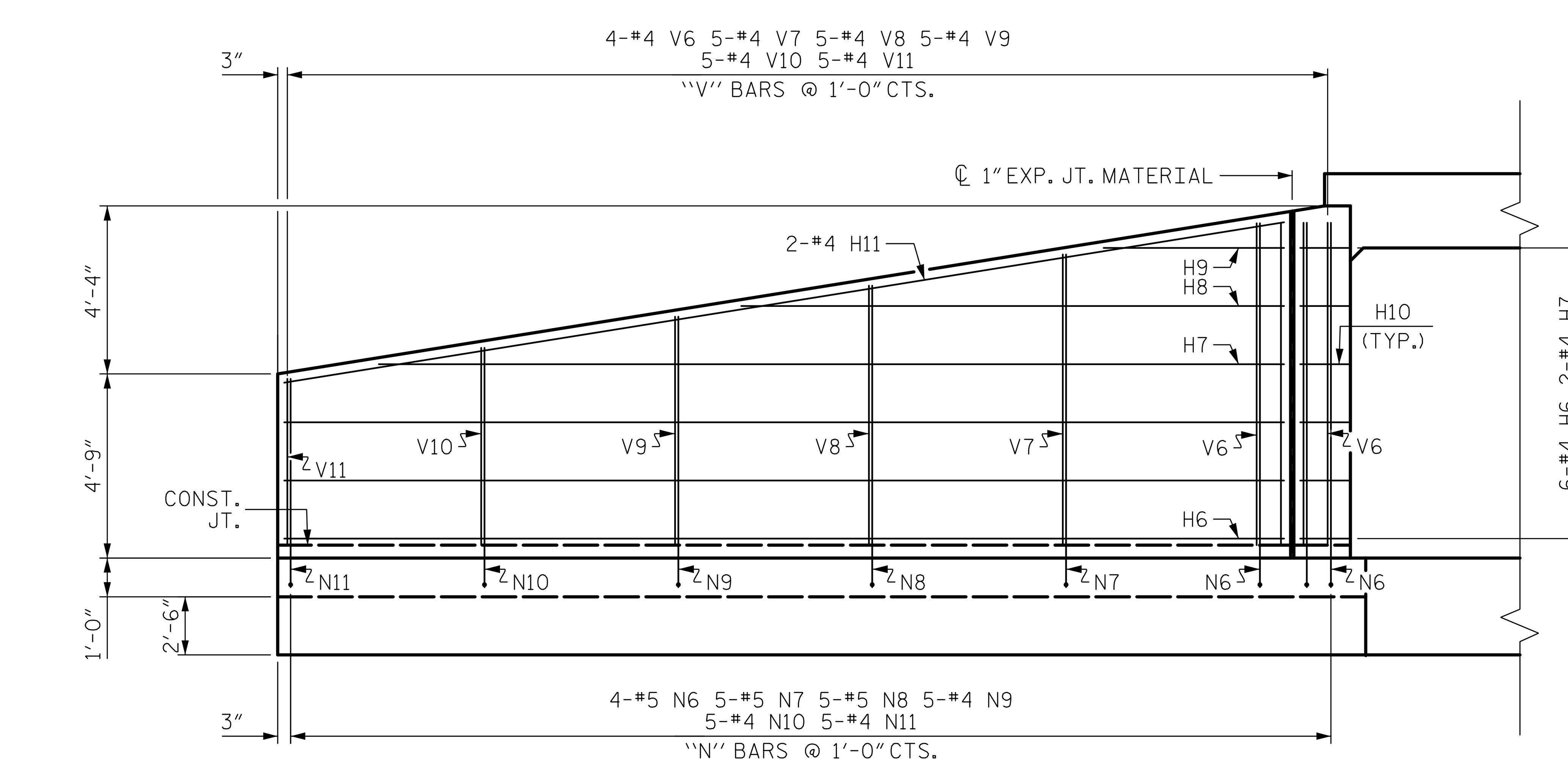
✻ BOTTOM OF FLOOR SLAB AND FOOTING



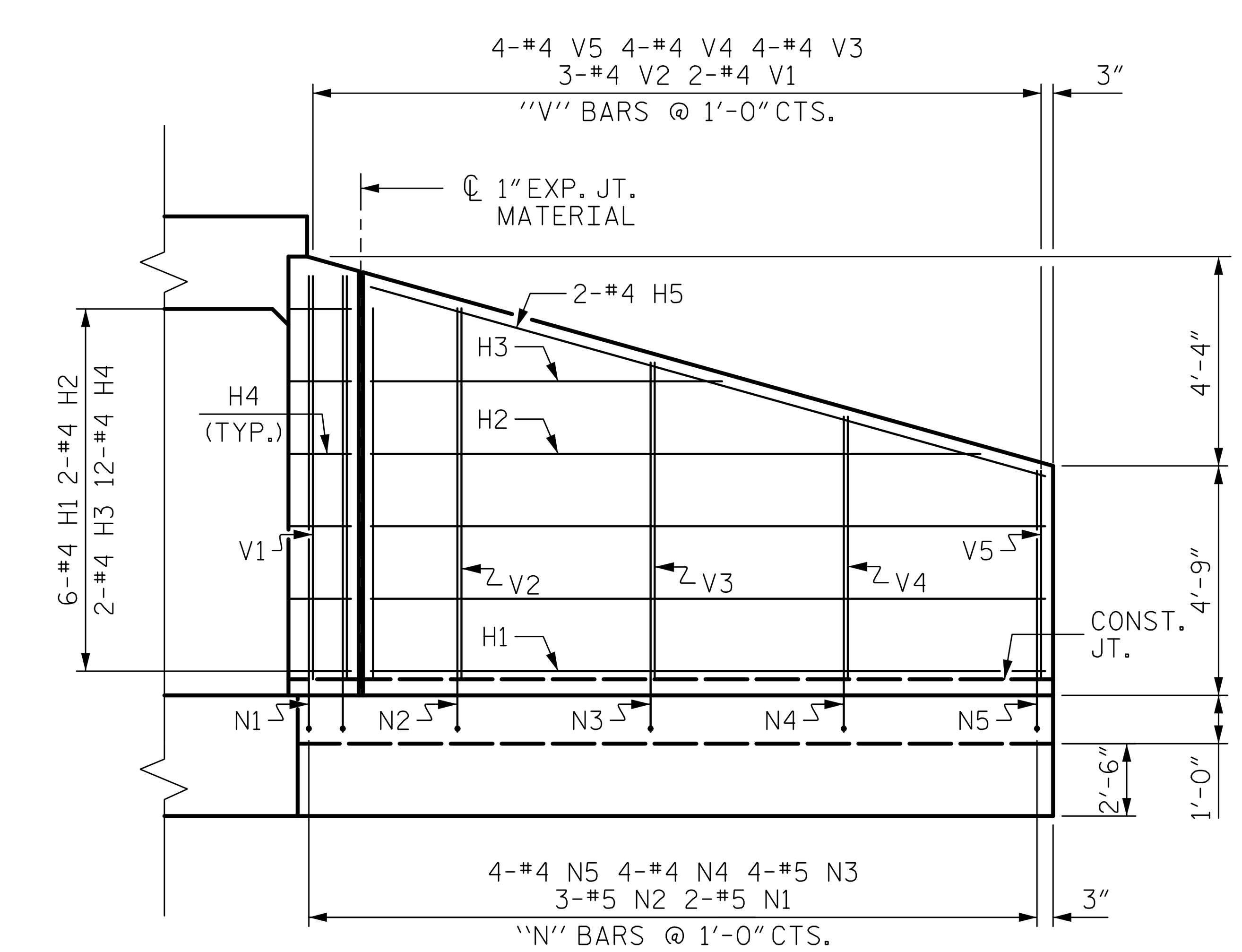
PLAN W2



TYPICAL WING SECTION

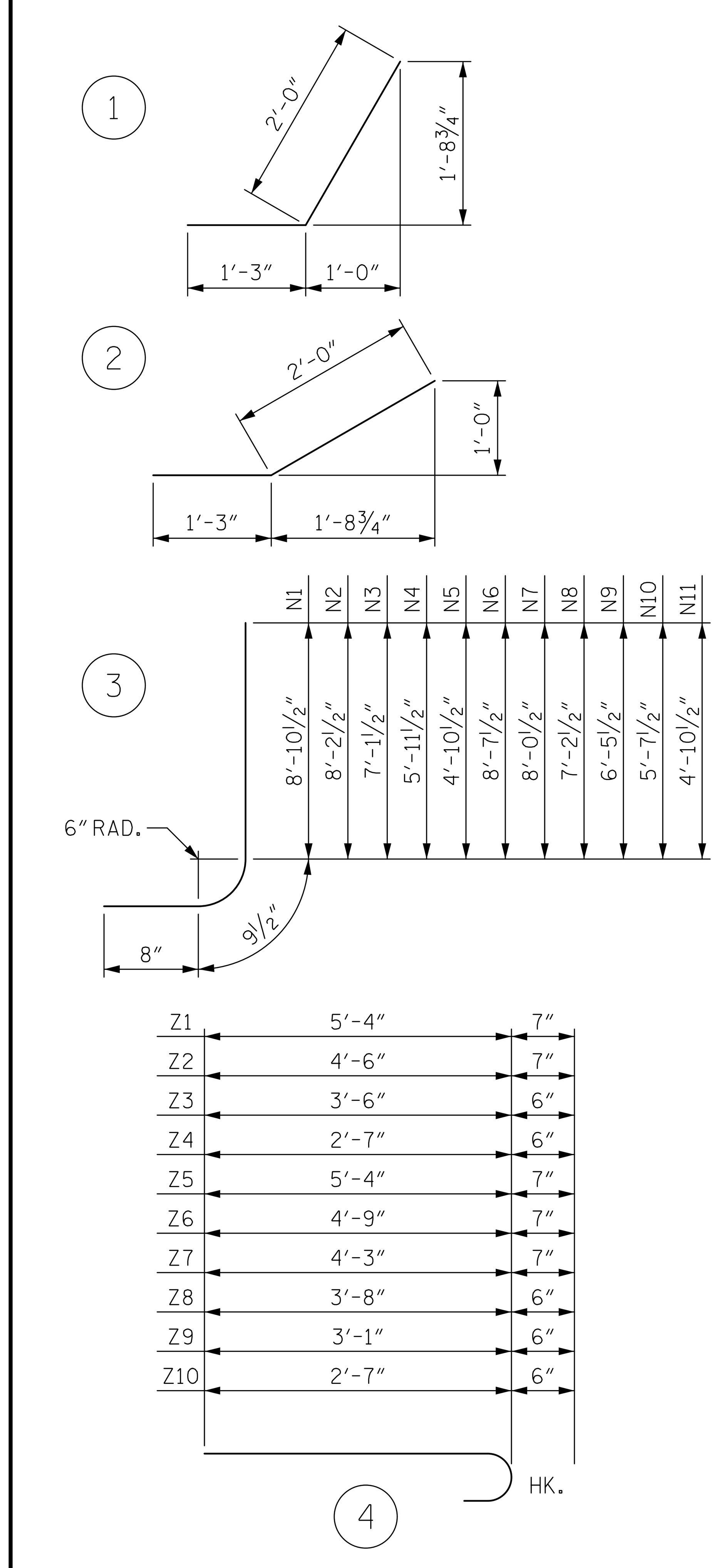


ELEVATION W1



ELEVATION W2

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	14'-0"	112
H2	4	#4	STR	13'-1"	35
H3	4	#4	STR	7'-7"	20
H4	24	#4	1	3'-3"	52
H5	4	#4	STR	14'-5"	39
H6	12	#4	STR	25'-10"	207
H7	4	#4	STR	24'-0"	64
H8	4	#4	STR	14'-6"	39
H9	4	#4	STR	4'-10"	13
H10	24	#4	2	3'-3"	52
H11	4	#4	STR	26'-3"	70
N1	4	#5	3	10'-4"	43
N2	6	#5	3	9'-8"	61
N3	8	#5	3	8'-7"	72
N4	8	#4	3	7'-5"	40
N5	8	#4	3	6'-4"	34
N6	8	#5	3	10'-1"	84
N7	10	#5	3	9'-6"	99
N8	10	#5	3	8'-8"	90
N9	10	#4	3	7'-11"	53
N10	10	#4	3	7'-1"	47
N11	10	#4	3	6'-4"	42
S1	12	#6	STR	6'-0"	108
T1	6	#5	STR	15'-10"	99
T2	6	#5	STR	27'-8"	173
V1	4	#4	STR	8'-4"	22
V2	6	#4	STR	7'-6"	30
V3	8	#4	STR	6'-5"	34
V4	8	#4	STR	5'-4"	29
V5	8	#4	STR	4'-3"	23
V6	8	#4	STR	8'-1"	43
V7	10	#4	STR	7'-4"	49
V8	10	#4	STR	6'-6"	43
V9	10	#4	STR	5'-9"	38
V10	10	#4	STR	5'-0"	33
V11	10	#4	STR	4'-2"	28
Z1	4	#5	4	5'-11"	25
Z2	10	#5	4	5'-1"	53
Z3	10	#4	4	4'-0"	27
Z4	10	#4	4	3'-1"	21
Z5	6	#5	4	5'-11"	37
Z6	10	#5	4	5'-4"	56
Z7	10	#5	4	4'-10"	50
Z8	10	#4	4	4'-2"	28
Z9	10	#4	4	3'-7"	24
Z10	10	#4	4	3'-1"	21

REINFORCING STEEL FOR 4 WINGS 2462 LBS

CLASS A CONCRETE
4 WINGS 40.7 CY
2 HEADWALLS 1.9 CY
2 END CURTAIN WALLS 3.0 CY
TOTAL 45.6 CY

NOTES:

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.

G1 BARS IN HEADWALL ARE INCLUDED WITH THE BARREL REINFORCING STEEL.

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 677+13.20 -L-

SHEET 13 OF 13

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
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DEPARTMENT OF TRANSPORTATION
RALEIGH

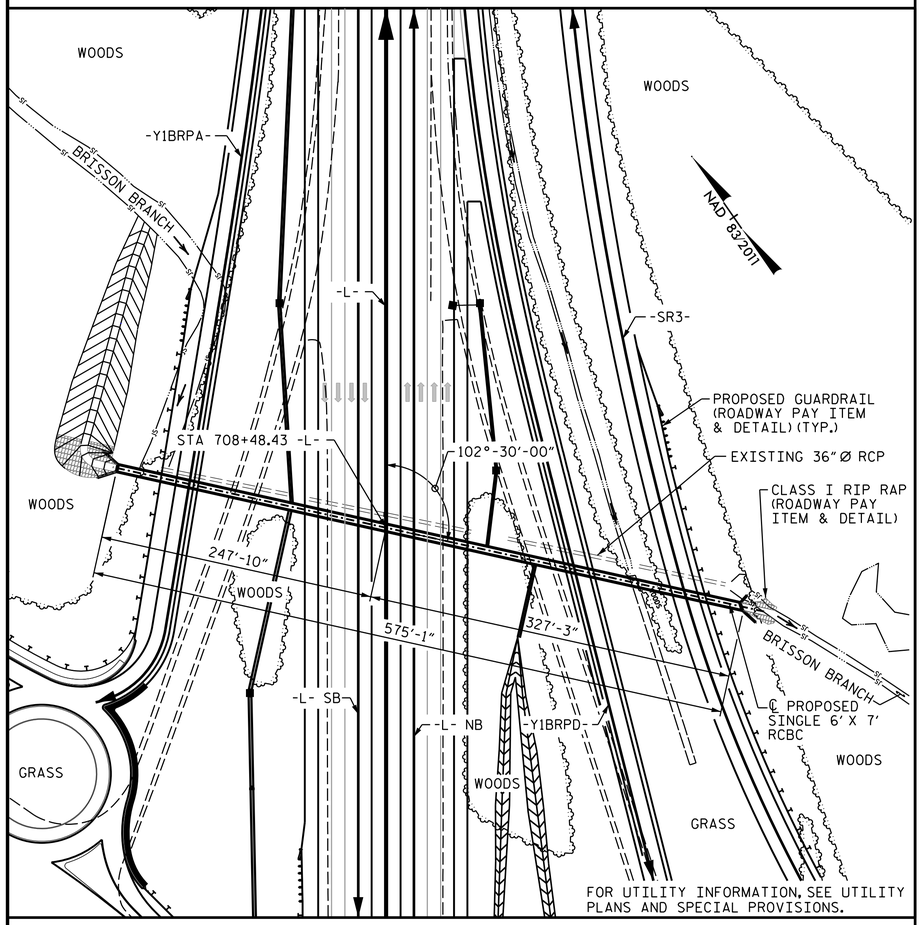
WINGS FOR CONCRETE BOX CULVERT

H = 8'-0" SLOPE = 3:1

REVISIONS						
NO.	BY:	DATE:	NO.	BY:	DATE:	SHEET NO. C15-13
1			3			TOTAL SHEETS 13
2			4			

DRAWN BY :	ZCS	DATE :	2/21
CHECKED BY :	MGC	DATE :	10/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE :	10/21

BENCH MARK #55; STA. 714+34.81 -L- 193' RT.;
TIE SPIKE SET IN 20"OAK; ELEV 173.31



LOCATION SKETCH

ROADWAY DATA

GRADE POINT ELEV. @ STA. 708+53.98 -L- SB	= 174.34
GRADE POINT ELEV. @ STA. 708+42.89 -L- NB	= 174.02
BED ELEV. @ STA. 708+48.43 -L-	= 161.08
ROADWAY SLOPES	= 3 : 1

HYDROGRAPHIC DATA

DESIGN DISCHARGE	= 150 CFS
FREQUENCY OF DESIGN FLOOD	= 100 YRS
DESIGN HIGH WATER ELEVATION	= 168.2'
DRAINAGE AREA	= 0.2 SQ. MI.
BASE DISCHARGE (Q100)	= 150 CFS
BASE HIGH WATER ELEVATION	= 168.2'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 360 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS
OVERTOPPING FLOOD ELEVATION	= 176.2'

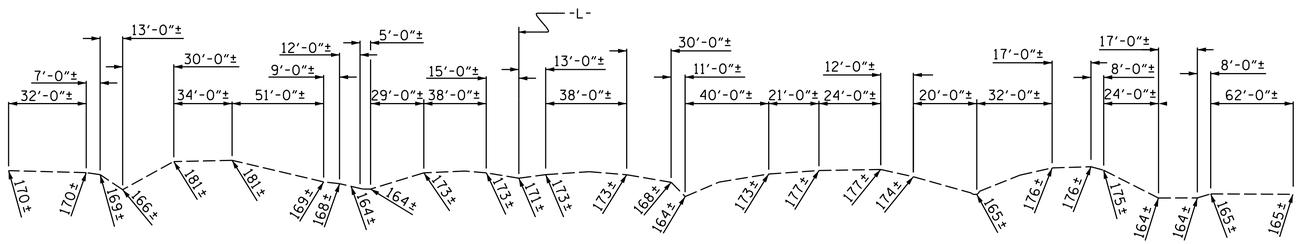
TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE			REINFORCING STEEL		
STAGE 1 (LEFT)	85.6	C.Y.	STAGE 1 (LEFT)	8,610	LBS
STAGE 1 (RIGHT)	151.9	C.Y.	STAGE 1 (RIGHT)	15,596	LBS
STAGE 2	66.0	C.Y.	STAGE 2	7,104	LBS
STAGE 3 (LEFT)	94.7	C.Y.	STAGE 3 (LEFT)	10,448	LBS
STAGE 3 (RIGHT)	96.1	C.Y.	STAGE 3 (RIGHT)	10,606	LBS
TOTAL	494.3	C.Y.	TOTAL	52,364	LBS

CULVERT EXCAVATION	LUMP SUM

FOUNDATION COND. MAT'L.		
STAGE 1 (LEFT)	72	TONS
STAGE 1 (RIGHT)	135	TONS
STAGE 2	65	TONS
STAGE 3 (LEFT)	94	TONS
STAGE 3 (RIGHT)	95	TONS
TOTAL	461	TONS

FOUNDATION COND. GEOTEXTILE		
STAGE 1 (LEFT)	245	S.Y.
STAGE 1 (RIGHT)	465	S.Y.
STAGE 2	225	S.Y.
STAGE 3 (LEFT)	340	S.Y.
STAGE 3 (RIGHT)	345	S.Y.
TOTAL	1620	S.Y.



PROFILE ALONG ℄ CULVERT

DRAWN BY : STM DATE : 09/21
CHECKED BY : MGC DATE : 03/22
DESIGN ENGINEER OF RECORD: STM DATE : 03/22

3/16/2022
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NOTES:

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

DESIGN FILL---------- 14.6'.

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:

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 SHEETS.

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.

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

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

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 TRAFFIC PHASING, SEE TRAFFIC CONTROL PLANS.

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

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.

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 VI FOUNDATION CONDITIONING MATERIAL.

ENCAPSULATE ALL FOUNDATION CONDITIONING MATERIAL IN TYPE 4 GEOTEXTILE. FOR FOUNDATION CONDITIONING GEOTEXTILE, SEE BOX CULVERT EXCAVATION SPECIAL PROVISION.

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 708+48.43 -L-

SHEET 1 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
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RALEIGH, NC 27603
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CORP. LICENSE NO.: C-0275

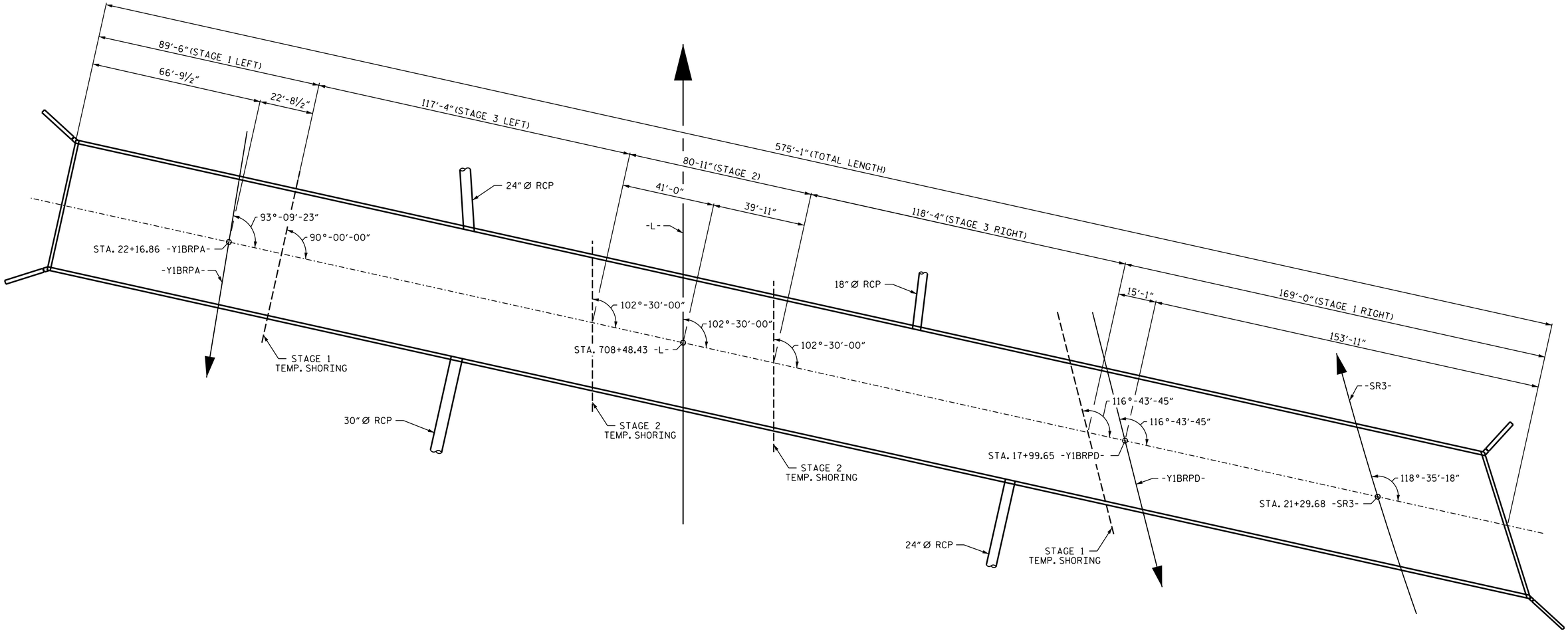
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-1
1			3			TOTAL SHEETS
2			4			20

FILE NAME: 412_001_I-5987B_Site 16_SMU_CU_001.dgn

SITE 16



CULVERT STAGING LAYOUT

NOT DRAWN TO SCALE.
ALL PIPES TO BE LOCATED BY THE ENGINEER.

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 708+48.43 -L-

SHEET 2 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL C. CHEEK, JR.
Docusigned by: Marshall C. Cheek, Jr.
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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGES 1-3

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-2
1			3			TOTAL SHEETS
2			4			20

DRAWN BY : STM DATE : 09/21
CHECKED BY : MGC DATE : 03/22
DESIGN ENGINEER OF RECORD: STM DATE : 03/22

3/16/2022
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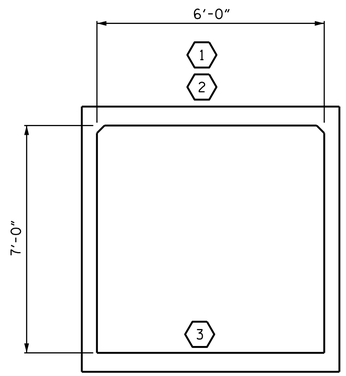
FILE NAME: 412_003_I-5987B_Site 16_SMU_CU_002.dgn

SITE 16

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_{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⟩	1.83	--	1.75	1.83	1	TOP SLAB	3.00	3.03	1	EXTERIOR WALL	0.67	
		HL-93 (OPERATING)	N/A		2.37	--	1.35	2.37	1	TOP SLAB	3.00	3.93	1	EXTERIOR WALL	0.67	
		HS-20 (INVENTORY)	36.000	⟨2⟩	1.97	70.92	1.75	1.97	1	TOP SLAB	3.00	3.05	1	EXTERIOR WALL	0.67	
		HS-20 (OPERATING)	36.000		2.55	91.80	1.35	2.55	1	TOP SLAB	3.00	3.96	1	EXTERIOR WALL	0.67	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SH	12.500		3.93	49.13	1.40	3.93	1	TOP SLAB	3.00	3.86	1	EXTERIOR WALL	0.67	
		S3C	21.500		3.30	70.95	1.40	3.30	1	BOTTOM SLAB	3.00	3.82	1	EXTERIOR WALL	0.67	
		S3A	22.750		3.30	75.08	1.40	3.30	1	BOTTOM SLAB	3.00	3.82	1	EXTERIOR WALL	0.67	
		S4A	26.750		3.23	86.40	1.40	3.23	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
		S5A	30.500		3.82	116.51	1.40	4.11	1	BOTTOM SLAB	3.00	3.82	1	EXTERIOR WALL	0.67	
		S6A	34.500	⟨3⟩	3.17	109.37	1.40	3.17	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
		S7B	38.500		3.17	122.05	1.40	3.17	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
		S7A	40.000		3.17	126.80	1.40	3.17	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	T4A	28.250		3.30	93.23	1.40	3.30	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
		T5B	32.000		3.30	105.60	1.40	3.30	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
		T6A	36.000		3.23	116.28	1.40	3.23	1	BOTTOM SLAB	3.00	3.82	1	EXTERIOR WALL	0.67	
		T7A	40.000		3.23	129.20	1.40	3.23	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	
		T7B	40.000		3.18	127.20	1.40	3.18	1	BOTTOM SLAB	3.00	3.81	1	EXTERIOR WALL	0.67	



BOX 1

LRFR SUMMARY

(LOOKING DOWNSTREAM)

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. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 3 OF 20

ASSEMBLED BY :	STM	DATE :	09/21
CHECKED BY :	MGC	DATE :	03/22
DRAWN BY : WMC	7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM	7/11	REV. 12/17	MAA/THC

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL D. CHEEK, JR.

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

(INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-3
1			3			TOTAL SHEETS
2			4			20

3/16/2022
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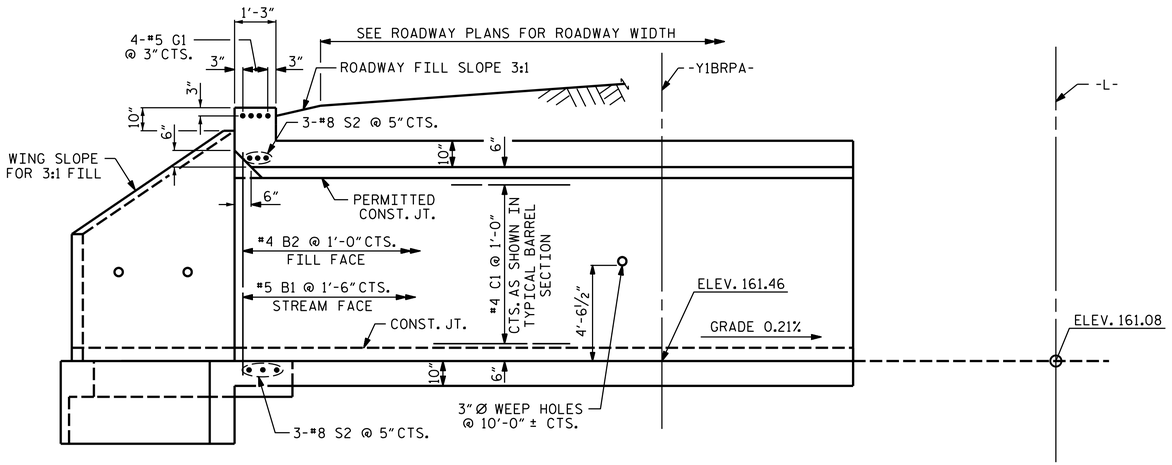
User:smassinople

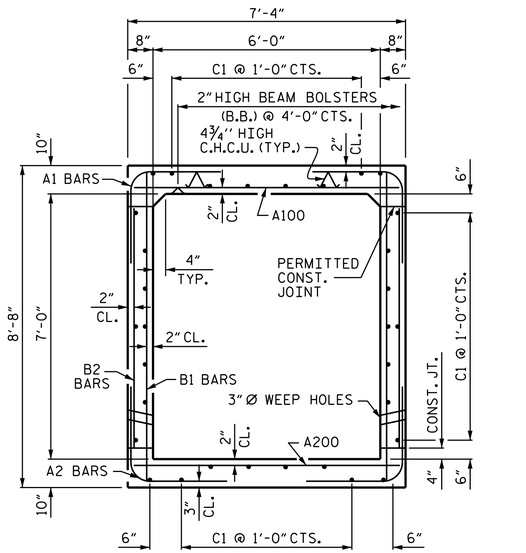
FILE NAME: 412_005_I-5987B_Site 16_SMU_CU_003.dgn

SITE 16

STD. NO. LRFR6



CULVERT SECTION NORMAL TO ROADWAY

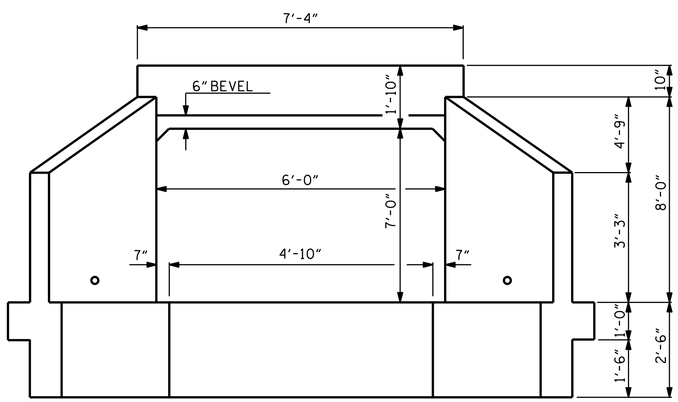


RIGHT ANGLE SECTION OF BARREL

THERE ARE 32 C1 IN SECTION OF BARREL

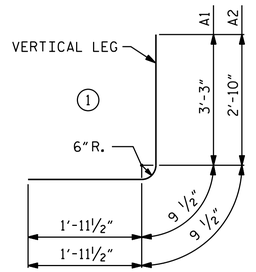
STAGE 1 (LEFT) QUANTITIES

CLASS A CONCRETE		
BARREL @ 0.802 CY/FT	71.8	C.Y.
WINGS, ETC.	13.8	C.Y.
TOTAL	85.6	C.Y.
REINFORCING STEEL		
BARREL	7,761	LBS.
WINGS	849	LBS.
TOTAL	8,610	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	72 TONS	
FOUNDATION COND. GEOTEXTILE	245 S.Y.	



INLET END ELEVATION

BAR TYPE



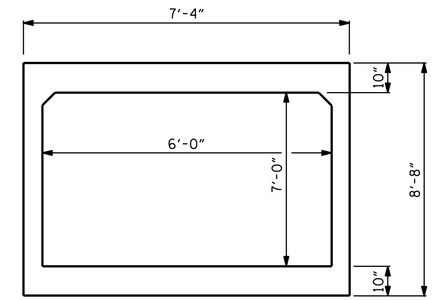
DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-10"
C1	#4	1'-10"

STAGE 1 (LEFT) BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	179	#4	STR	6'-11"	827
A200	119	#5	STR	6'-11"	858
A1	180	#5	1	6'-0"	1126
A2	180	#5	1	5'-7"	1048
B1	120	#5	STR	8'-1"	1012
B2	180	#4	STR	6'-4"	762
C1	96	#4	STR	31'-0"	1988
G1	4	#5	STR	6'-11"	29
S2	6	#8	STR	6'-11"	111
REINFORCING STEEL					7,761 LBS



RIGHT END ELEVATION

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 4 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 1 (LEFT)

REVISIONS						SHEET NO.
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1			3			TOTAL SHEETS
2			4			20

DRAWN BY :	STM	DATE :	09/21
CHECKED BY :	MGC	DATE :	03/22
DESIGN ENGINEER OF RECORD:	STM	DATE :	03/22

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User:smassinople

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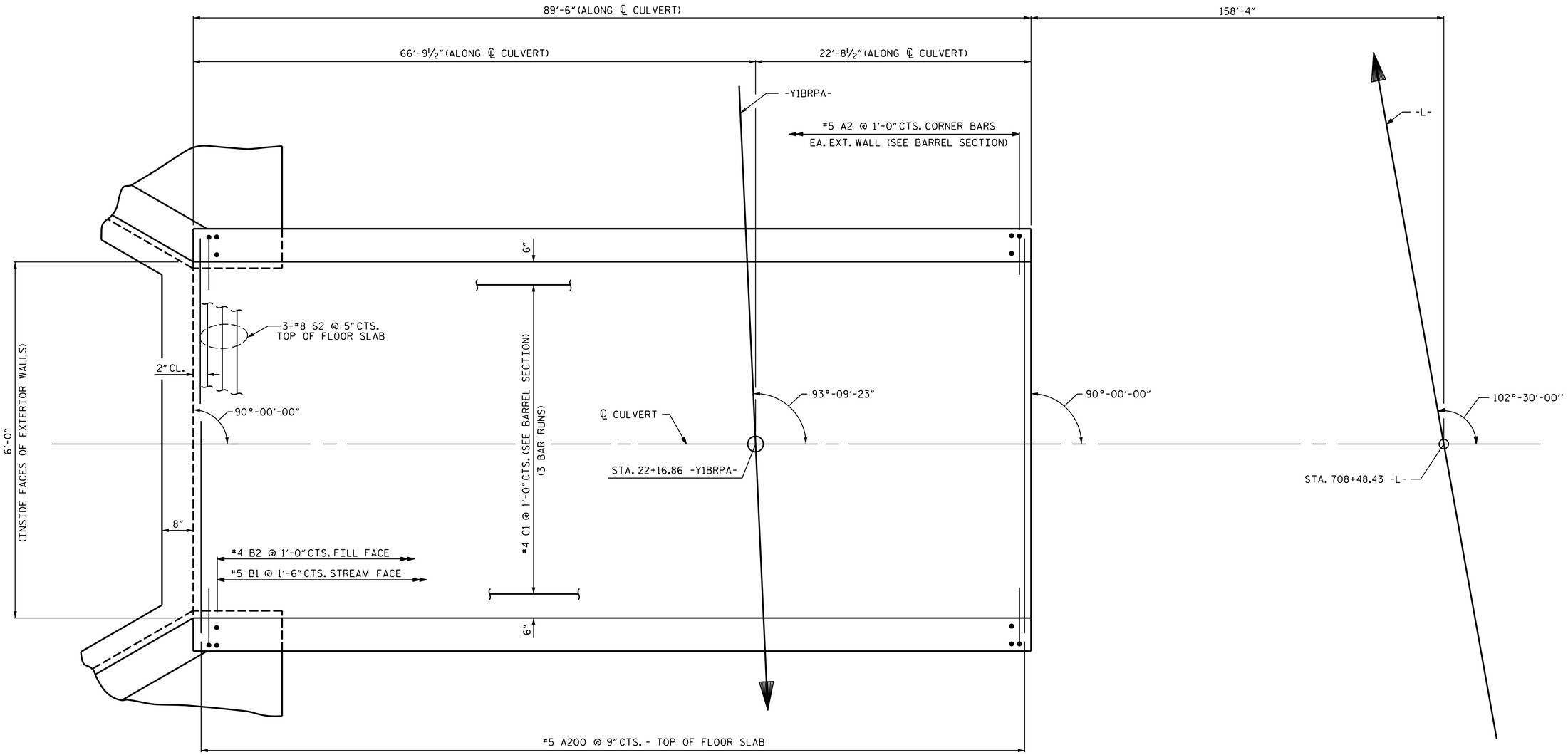

PLAN - FLOOR SLAB

STAGE 1 (LEFT)

NOTE: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 5 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

DocuSigned by: Marshall G. Cheek, Jr.

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SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 1 (LEFT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-5
1			3			TOTAL SHEETS
2			4			20

DRAWN BY : STM DATE : 09/21
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DESIGN ENGINEER OF RECORD: STM DATE : 03/22

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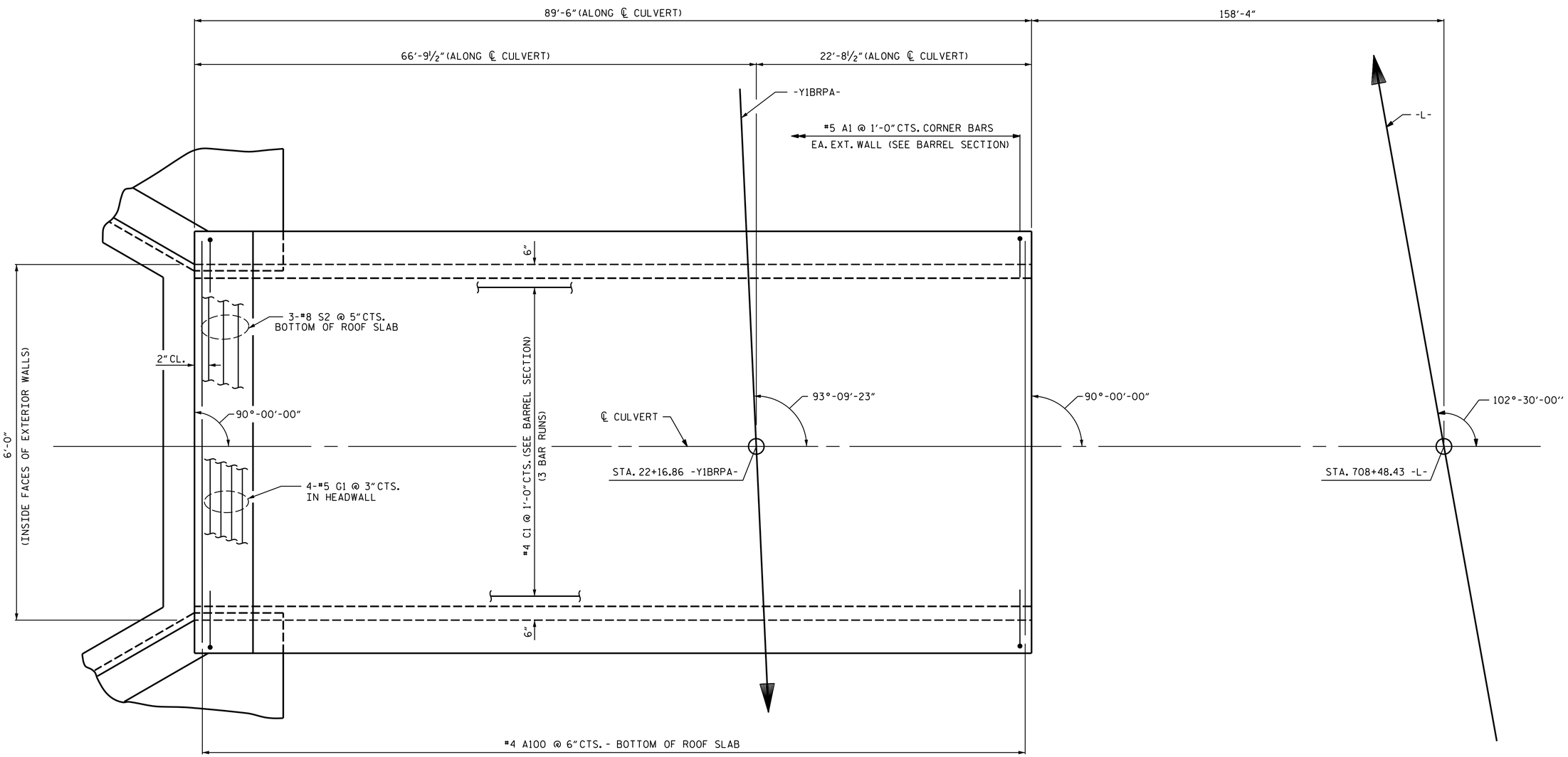

PLAN - ROOF SLAB

STAGE 1 (LEFT)

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 6 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARGARET G. CHECK, JR.

Docusigned by: Margaret G. Check, Jr. 5FBCC2F3A4DC413...

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 1 (LEFT)

REVISIONS						SHEET NO.
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1			3			TOTAL SHEETS
2			4			20

DRAWN BY : STM DATE : 09/21
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3/16/2022
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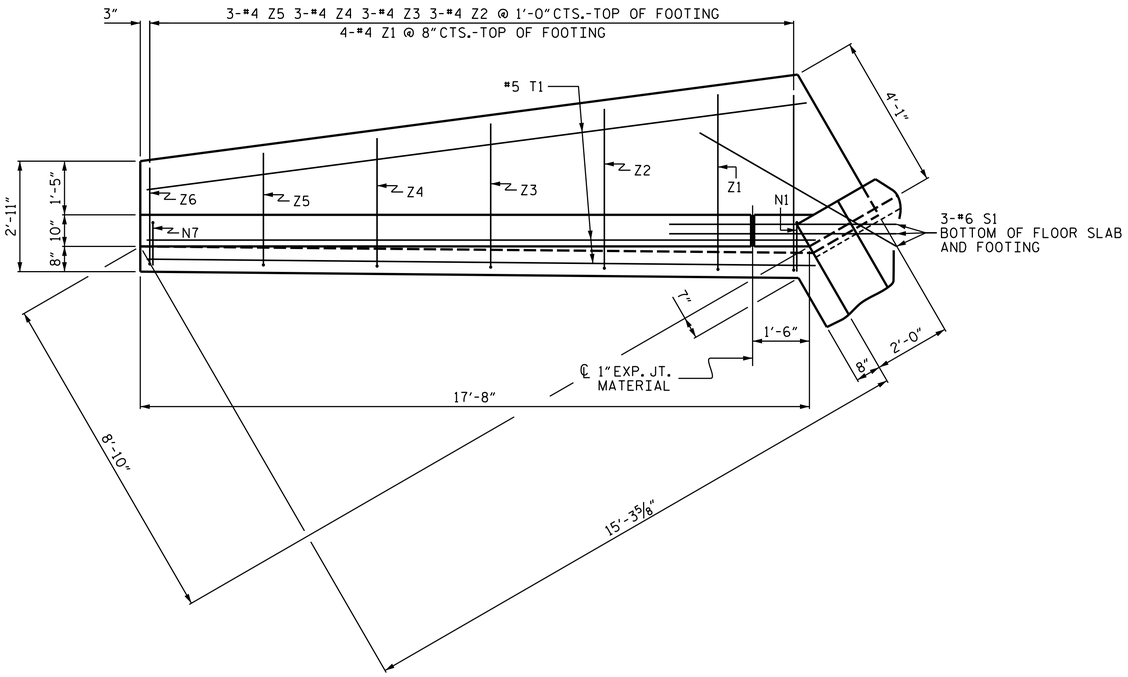
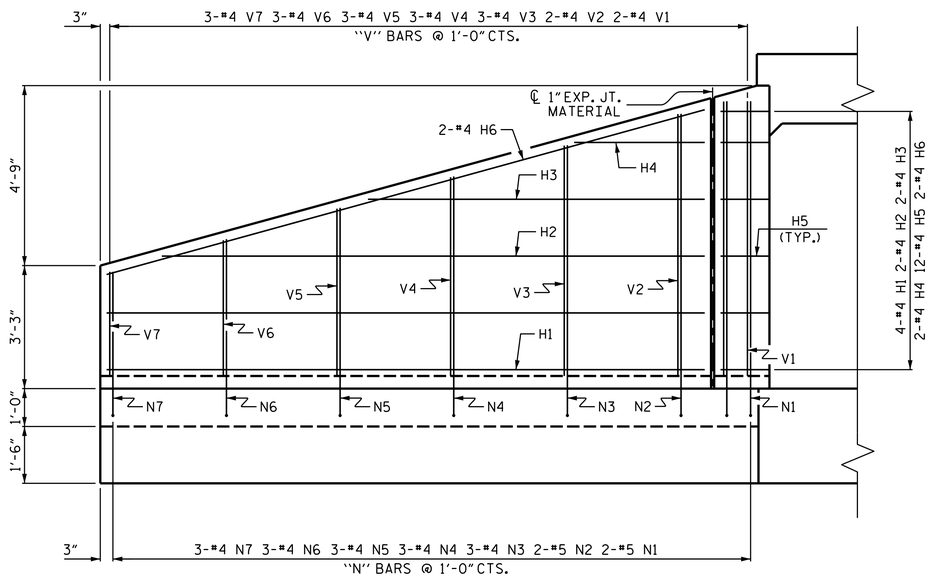
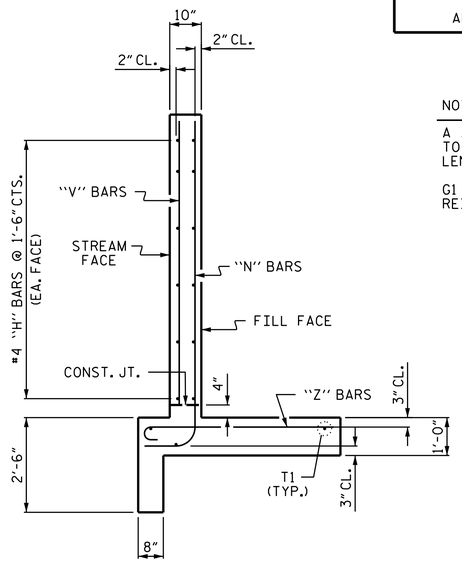


PLAN

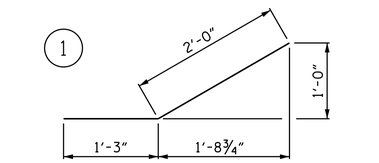


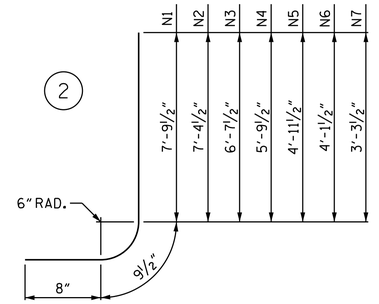
ELEVATION

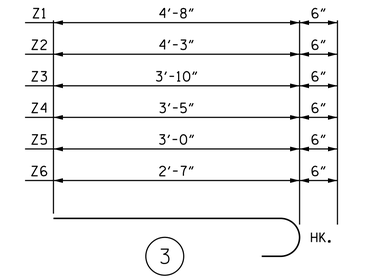


TYPICAL WING SECTION

BAR TYPES







ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	8	#4	STR	15'-9"	84
H2	4	#4	STR	14'-4"	38
H3	4	#4	STR	8'-10"	24
H4	4	#4	STR	3'-5"	9
H5	24	#4	1	3'-3"	52
H6	4	#4	STR	16'-4"	44
N1	4	#5	2	9'-3"	39
N2	4	#5	2	8'-10"	37
N3	6	#4	2	8'-1"	32
N4	6	#4	2	7'-3"	29
N5	6	#4	2	6'-5"	26
N6	6	#4	2	5'-7"	22
N7	6	#4	2	4'-9"	19
S1	6	#6	STR	6'-0"	54
T1	6	#5	STR	17'-6"	110
V1	4	#4	STR	7'-3"	19
V2	4	#4	STR	6'-9"	18
V3	6	#4	STR	5'-11"	24
V4	6	#4	STR	5'-2"	21
V5	6	#4	STR	4'-4"	17
V6	6	#4	STR	3'-6"	14
V7	6	#4	STR	2'-9"	11
Z1	8	#4	3	5'-2"	28
Z2	6	#4	3	4'-9"	19
Z3	6	#4	3	4'-4"	17
Z4	6	#4	3	3'-11"	16
Z5	6	#4	3	3'-6"	14
Z6	6	#4	3	3'-1"	12

TOTAL REINFORCING STEEL FOR 2 WINGS 849 LBS

CLASS A CONCRETE
2 WINGS 13.2 CY
1 HEADWALL 0.3 CY
1 END CURTAIN WALL 0.3 CY
TOTAL 13.8 CY

NOTES

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.

G1 BARS IN HEADWALL ARE INCLUDED WITH THE BARREL REINFORCING STEEL.

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 708+48.43 -L-

SHEET 7 OF 20

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User:smassinople

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL C. CHEEK, JR.
Marshall C. Cheek, Jr.
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STATE OF NORTH CAROLINA
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RALEIGH

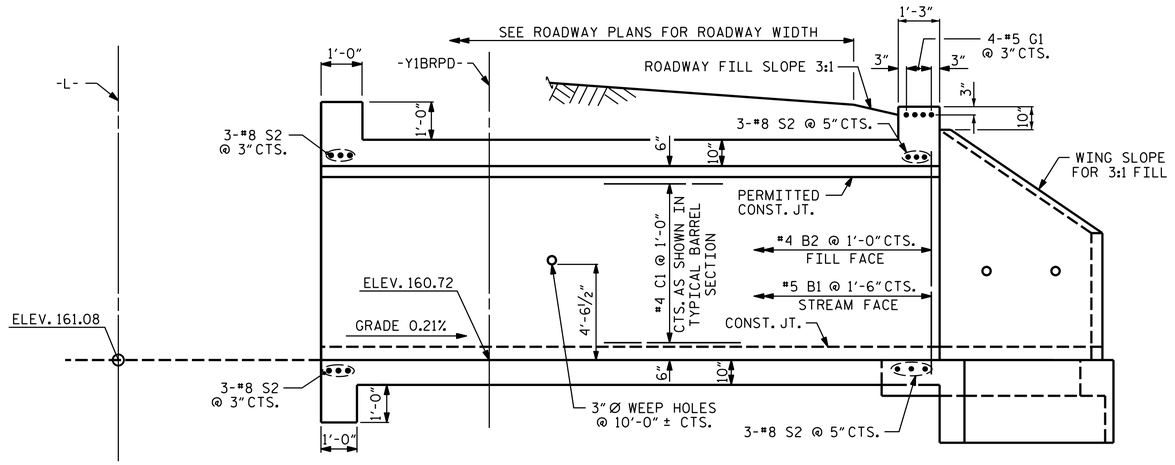
WINGS FOR CONCRETE BOX CULVERT STAGE 1 (LEFT SIDE)

H = 7'-0" SLOPE = 3:1
90° SKEW

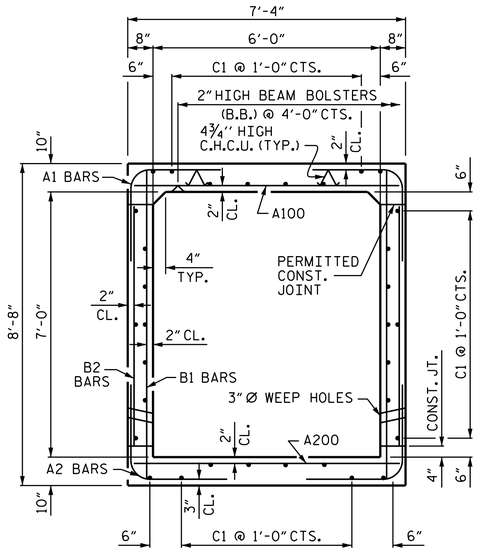
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-7
1			3			TOTAL SHEETS
2			4			20

FILE NAME: 412_013_I-5987B_Site 16_SMU_CU_007.dgn

SITE 16



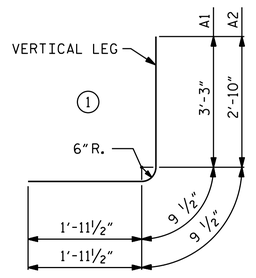
CULVERT SECTION NORMAL TO ROADWAY



RIGHT ANGLE SECTION OF BARREL

THERE ARE 32 C1 IN SECTION OF BARREL

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

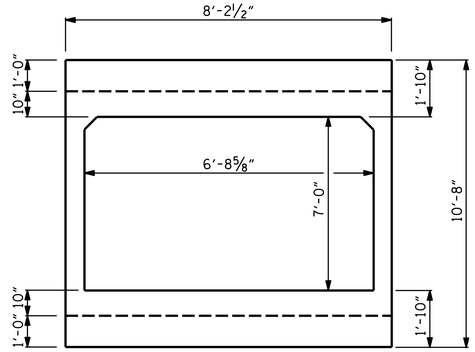
BAR	SIZE	SPLICE LENGTH
B1	#4	1'-10"
C1	#4	1'-10"

STAGE 1 (RIGHT) BAR SCHEDULE

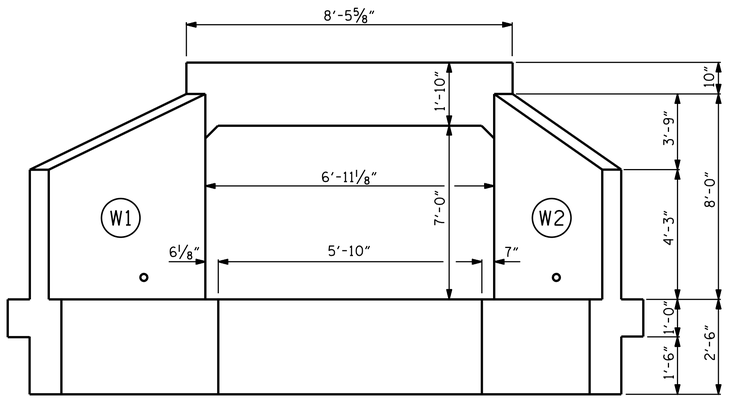
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	330	#4	STR	6'-11"	1525
A101	1	#4	STR	6'-5"	4
A102	1	#4	STR	5'-6"	4
A103	1	#4	STR	4'-8"	3
A104	1	#4	STR	3'-10"	3
A105	1	#4	STR	2'-11"	2
A106	1	#4	STR	2'-1"	1
A107	1	#4	STR	6'-4"	4
A108	1	#4	STR	5'-4"	4
A109	1	#4	STR	4'-4"	3
A110	1	#4	STR	3'-4"	2
A111	1	#4	STR	2'-4"	2
A200	220	#5	STR	6'-11"	1587
A201	1	#5	STR	6'-5"	7
A202	1	#5	STR	5'-1"	5
A203	1	#5	STR	3'-10"	4
A204	1	#5	STR	2'-6"	3
A205	1	#5	STR	5'-10"	6
A206	1	#5	STR	4'-4"	5
A207	1	#5	STR	2'-10"	3
A1	338	#5	1	6'-0"	2115
A2	338	#5	1	5'-7"	1968
B1	226	#5	STR	8'-1"	1905
B2	338	#4	STR	6'-4"	1430
C1	160	#4	STR	35'-3"	3768
G1	4	#5	STR	8'-0"	33
S2	12	#8	STR	7'-10"	251
REINFORCING STEEL					14,647 LBS

STAGE 1 (RIGHT) QUANTITIES

CLASS A CONCRETE		
BARREL @ 0.802 CY/FT	135.5	C.Y.
WINGS, ETC.	15.8	C.Y.
EDGE BEAMS	0.6	C.Y.
TOTAL	151.9	C.Y.
REINFORCING STEEL		
BARREL	14,647	LBS.
WINGS, ETC.	949	LBS.
TOTAL	15,596	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	135 TONS	
FOUNDATION COND. GEOTEXTILE	465 S.Y.	



LEFT END ELEVATION



OUTLET END ELEVATION

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 8 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Digitally signed by Marshall G. Cheek, Jr.

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 1 (RIGHT)

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NO.	BY:	DATE:	NO.	BY:	DATE:	C16-8
1			3			TOTAL SHEETS
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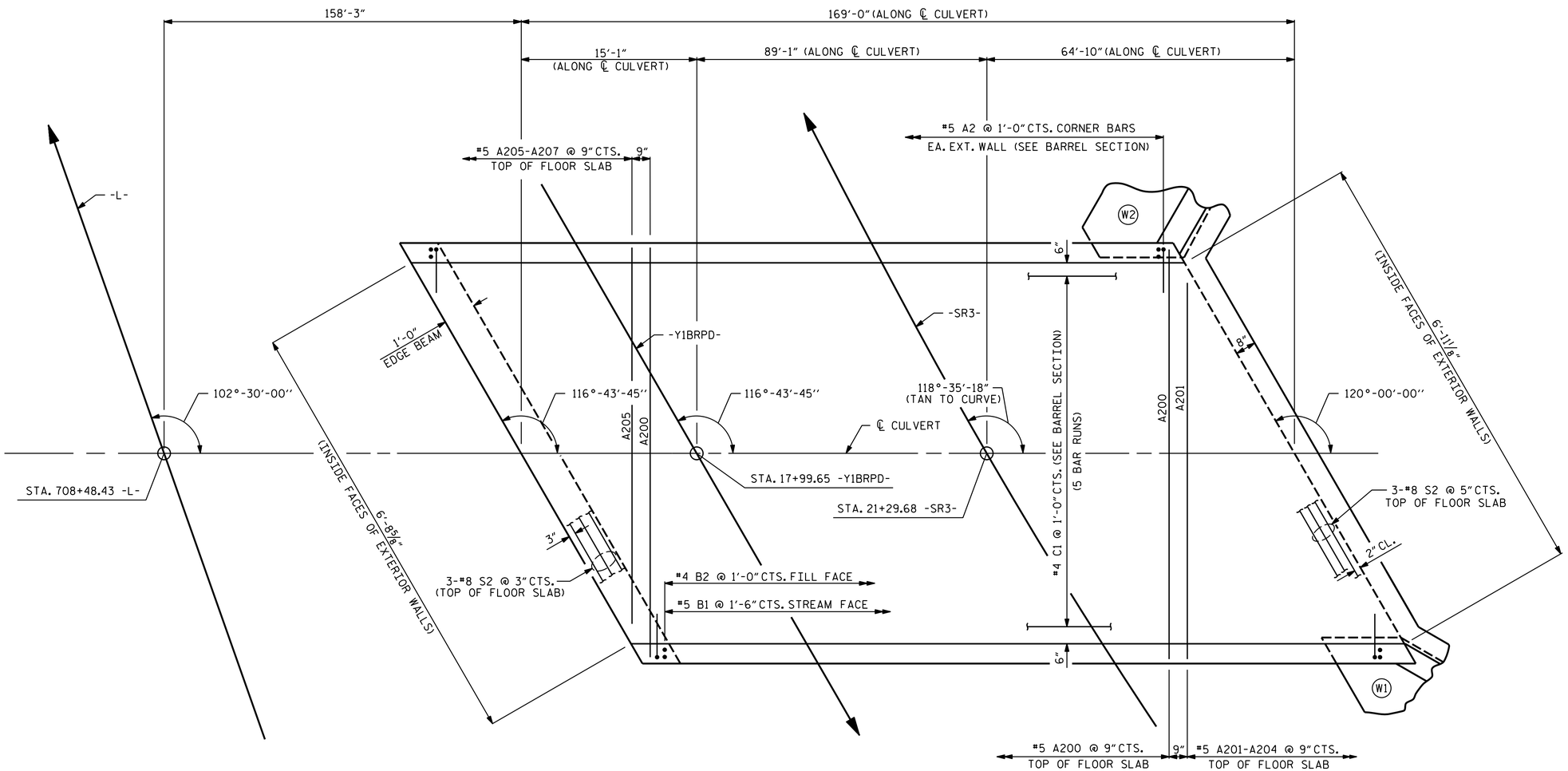

PLAN - FLOOR SLAB

STAGE 1 (RIGHT)

NOTE: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 9 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

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SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 1 (RIGHT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-9
1			3			TOTAL SHEETS
2			4			20

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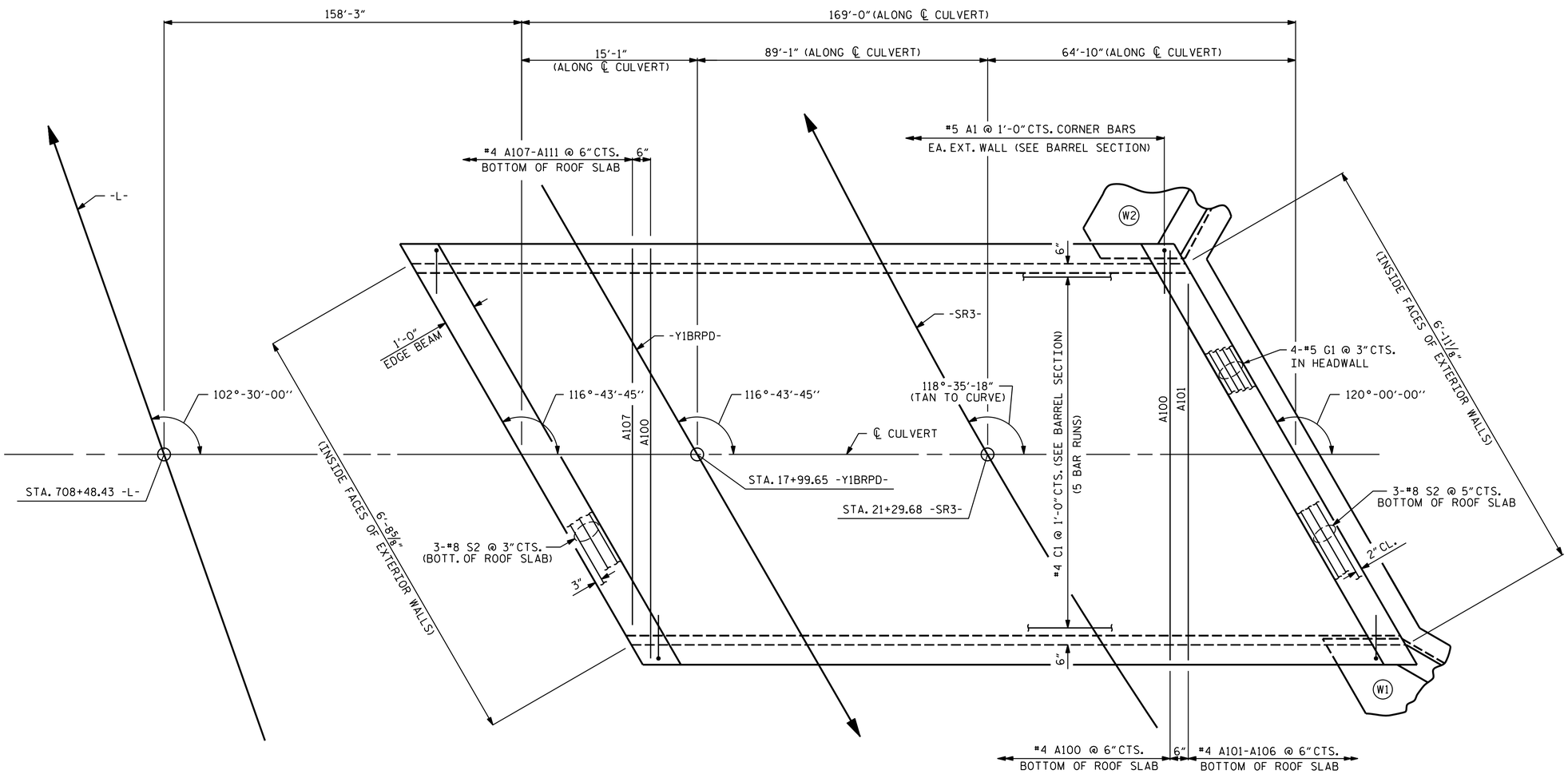
SITE 16



PLAN - ROOF SLAB

STAGE 1 (RIGHT)

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 10 OF 20

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DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 1 (RIGHT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-10
1			3			TOTAL SHEETS
2			4			20

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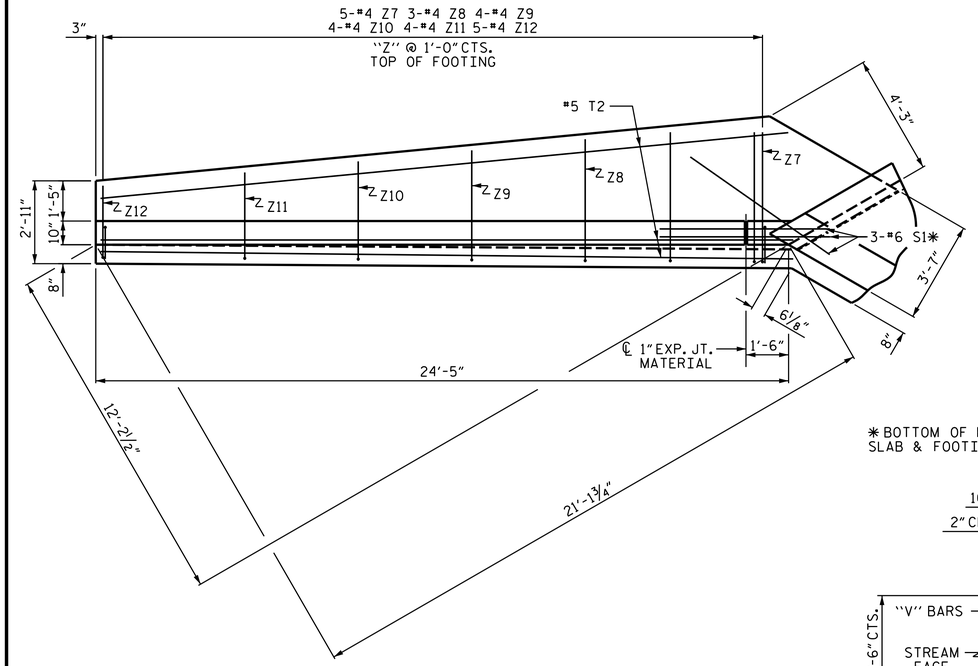
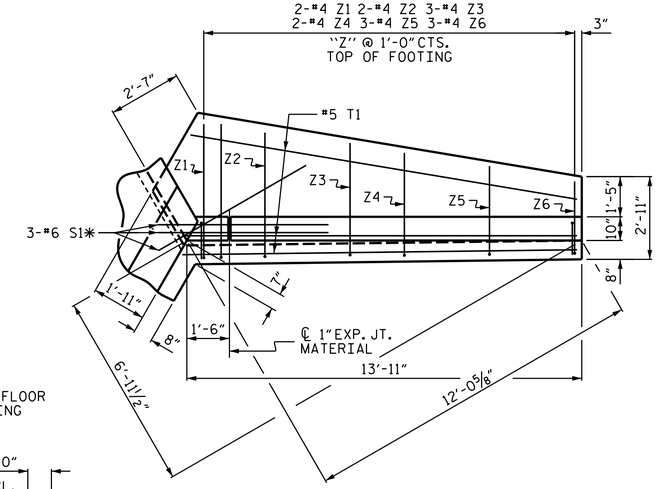
SITE 16

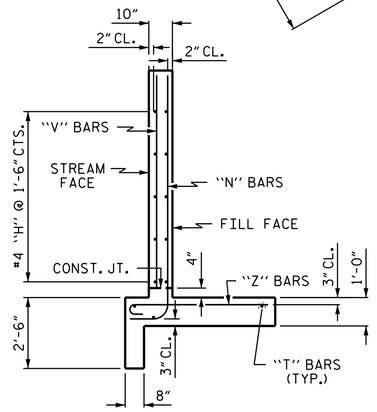


PLAN W1

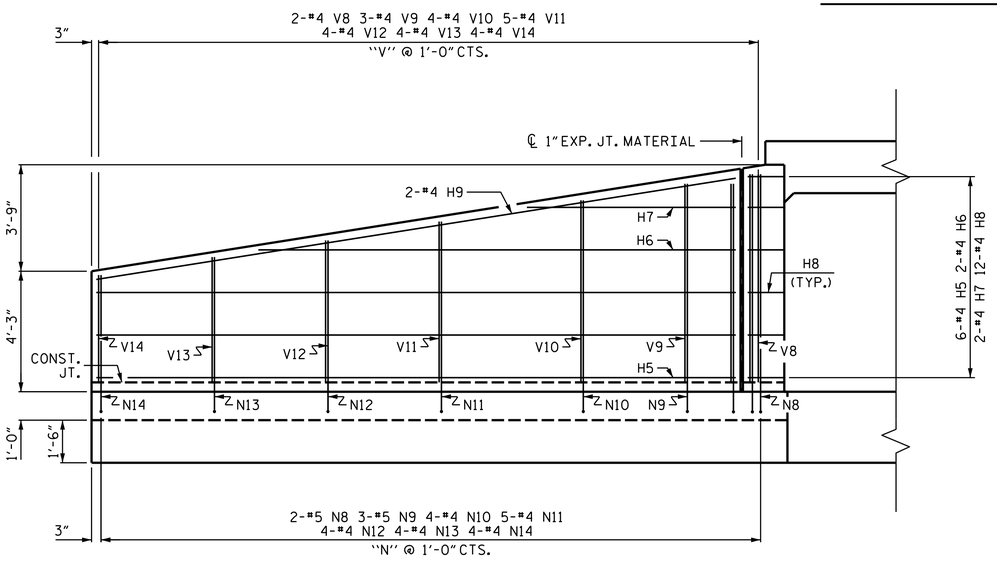


PLAN W2

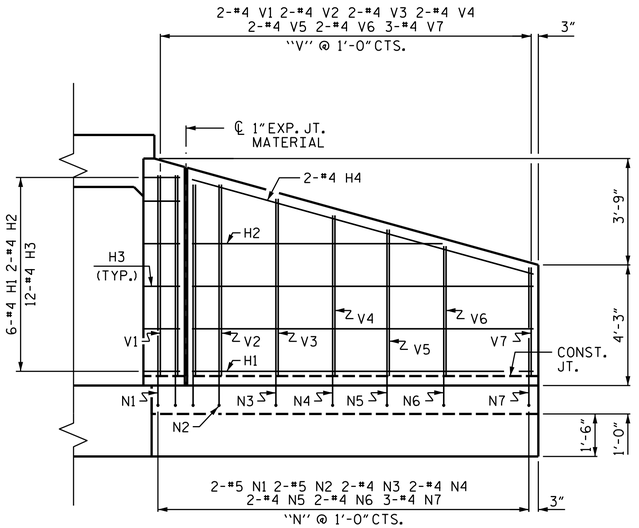
* BOTTOM OF FLOOR SLAB & FOOTING



TYPICAL WING SECTION

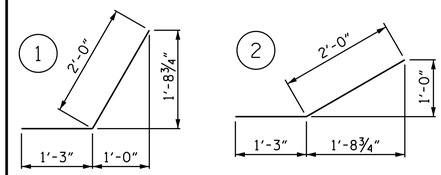


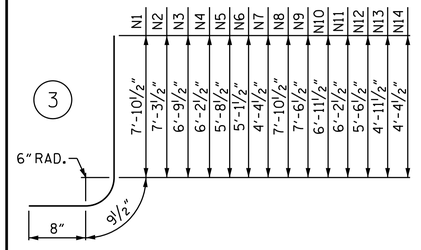
ELEVATION W1



ELEVATION W2

BAR TYPES





Z1	4'-9"	6"
Z2	4'-5"	6"
Z3	4'-0"	6"
Z4	3'-8"	6"
Z5	3'-2"	6"
Z6	2'-7"	6"
Z7	4'-8"	6"
Z8	4'-4"	6"
Z9	3'-11"	6"
Z10	3'-6"	6"
Z11	3'-1"	6"
Z12	2'-7"	6"

HK.

4

ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	12'-0"	48
H2	2	#4	STR	8'-10"	12
H3	12	#4	1	3'-3"	26
H4	2	#4	STR	12'-6"	17
H5	6	#4	STR	22'-5"	90
H6	2	#4	STR	16'-10"	22
H7	2	#4	STR	7'-4"	10
H8	12	#4	2	3'-3"	26
H9	2	#4	STR	22'-10"	31
N1	2	#5	3	9'-4"	19
N2	2	#5	3	8'-9"	18
N3	2	#4	3	8'-3"	11
N4	2	#4	3	7'-8"	10
N5	2	#4	3	7'-2"	10
N6	2	#4	3	6'-7"	9
N7	3	#4	3	5'-10"	12
N8	2	#5	3	9'-4"	19
N9	3	#5	3	9'-0"	28
N10	4	#4	3	8'-5"	22
N11	5	#4	3	7'-8"	26
N12	4	#4	3	7'-0"	19
N13	4	#4	3	6'-5"	17
N14	4	#4	3	5'-10"	16
S1	6	#6	STR	6'-0"	54
T1	3	#5	STR	13'-9"	43
T2	3	#5	STR	24'-4"	76
V1	2	#4	STR	7'-1"	9
V2	2	#4	STR	6'-8"	9
V3	2	#4	STR	6'-2"	8
V4	2	#4	STR	5'-7"	7
V5	2	#4	STR	5'-1"	7
V6	2	#4	STR	4'-6"	6
V7	3	#4	STR	3'-8"	7
V8	2	#4	STR	7'-4"	10
V9	3	#4	STR	6'-10"	14
V10	4	#4	STR	6'-3"	17
V11	5	#4	STR	5'-6"	18
V12	4	#4	STR	4'-11"	13
V13	4	#4	STR	4'-3"	11
V14	4	#4	STR	3'-8"	10
Z1	2	#4	4	5'-3"	7
Z2	2	#4	4	4'-11"	7
Z3	3	#4	4	4'-6"	9
Z4	2	#4	4	4'-2"	6
Z5	3	#4	4	3'-8"	7
Z6	3	#4	4	3'-1"	6
Z7	5	#4	4	5'-2"	17
Z8	3	#4	4	4'-10"	10
Z9	4	#4	4	4'-5"	12
Z10	4	#4	4	4'-0"	11
Z11	4	#4	4	3-7"	10
Z12	5	#4	4	3'-1"	10

REINFORCING STEEL FOR 2 WINGS	949 LBS
CLASS A CONCRETE	
2 WINGS	15.0 CY
1 HEADWALL	0.4 CY
1 END CURTAIN WALL	0.4 CY
TOTAL	15.8 CY

NOTES

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.

G1 BARS IN HEADWALL ARE INCLUDED WITH THE BARREL REINFORCING STEEL.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 11 OF 20

ASSEMBLED BY :	STM	DATE :	09/21
CHECKED BY :	MGC	DATE :	03/22
DESIGN ENGINEER OF RECORD :	MGC	DATE :	03/22

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARVIN G. CHEEK, JR.

4/12/2022 | 10:44 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

WINGS FOR CONCRETE BOX CULVERT STAGE 1 (RIGHT SIDE)

H = 7'-0" SLOPE = 3:1

120° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-11
1			3			TOTAL SHEETS
2			4			20

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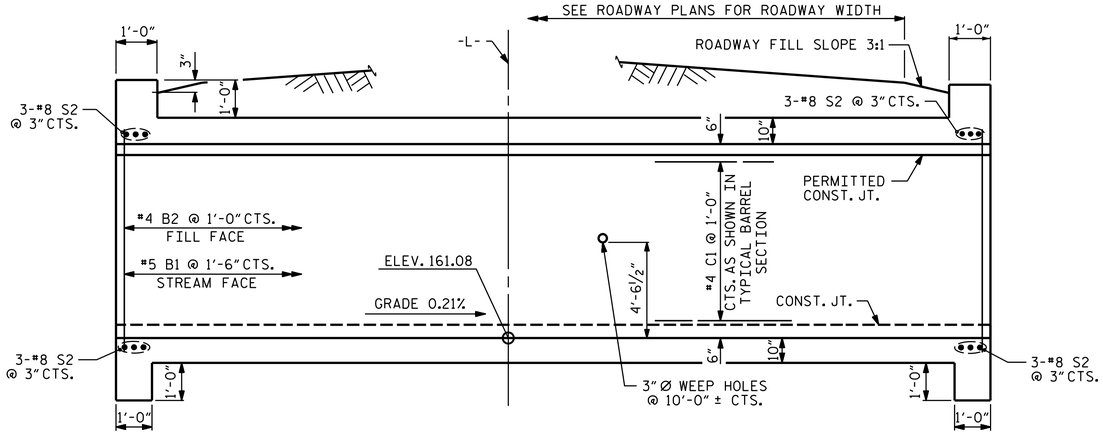
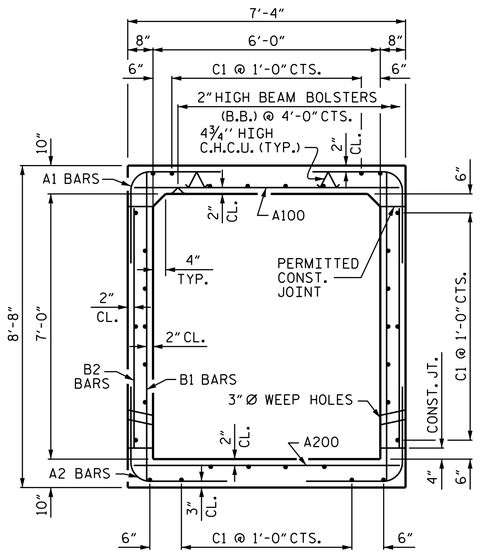
SITE 16

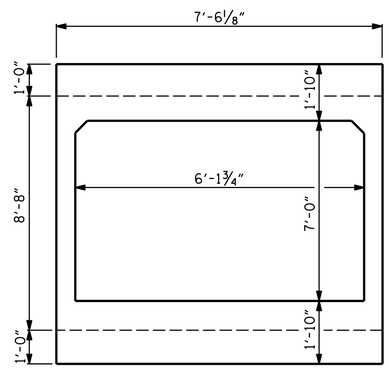


CULVERT SECTION NORMAL TO ROADWAY



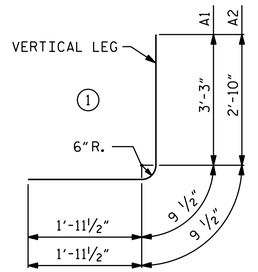
RIGHT ANGLE SECTION OF BARREL

THERE ARE 32 C1 IN SECTION OF BARREL



END ELEVATION

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-10"
C1	#4	1'-10"

STAGE 2 BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	159	#4	STR	6'-11"	735
A101	2	#4	STR	5'-3"	7
A102	2	#4	STR	3'-0"	4
A200	106	#5	STR	6'-11"	765
A201	2	#5	STR	4'-6"	9
A1	162	#5	1	6'-0"	1014
A2	162	#5	1	5'-7"	943
B1	108	#5	STR	8'-1"	911
B2	162	#4	STR	6'-4"	685
C1	96	#4	STR	28'-1"	1801
S2	12	#8	STR	7'-2"	230
REINFORCING STEEL					7,104 LBS

STAGE 2 QUANTITIES

CLASS A CONCRETE		
BARREL @ 0.802 CY/FT	64.9	C.Y.
EDGE BEAMS	1.1	C.Y.
TOTAL	66.0	C.Y.
REINFORCING STEEL		
BARREL	7,104	LBS.
TOTAL	7,104	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	65 TONS	
FOUNDATION COND. GEOTEXTILE	225 S.Y.	

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 12 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

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SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 2

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-12
1			3			TOTAL SHEETS
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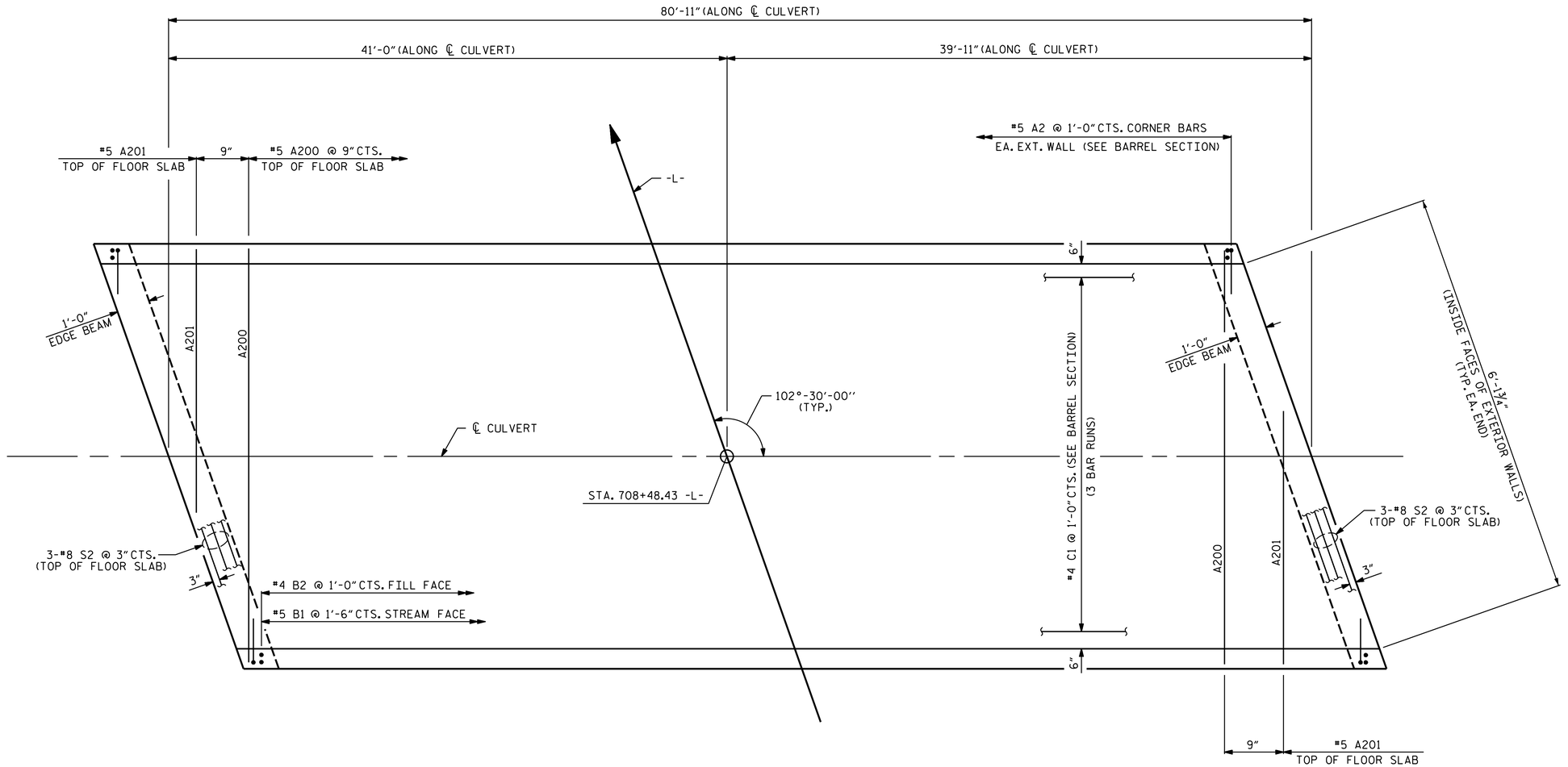
FILE NAME: 412_023_I-5987B_Site 16_SMU_CU_012.dgn

SITE 16



PLAN - FLOOR SLAB

STAGE 2

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 13 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

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SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 2

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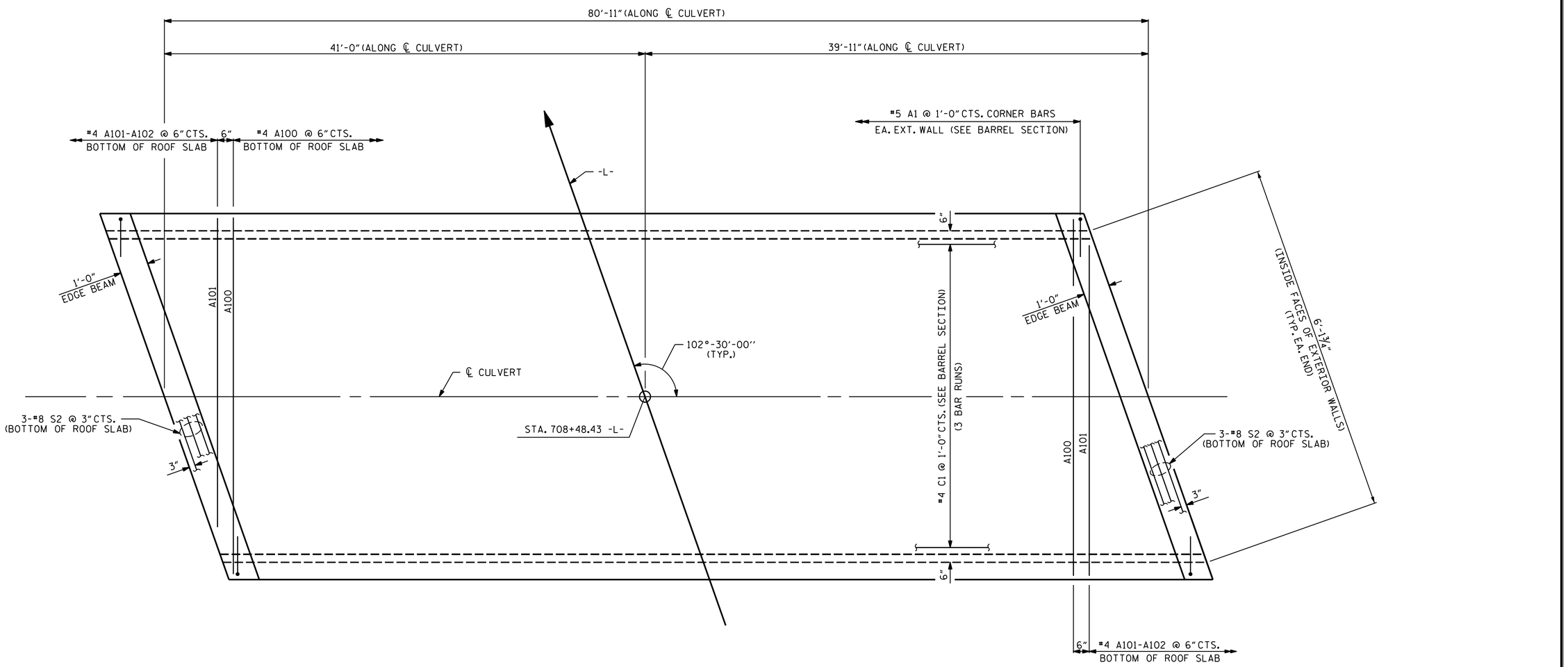

PART PLAN - ROOF SLAB

STAGE 2

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 14 OF 20

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 2

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER
MARSHALL G. CHEEK, JR.
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2			4			20

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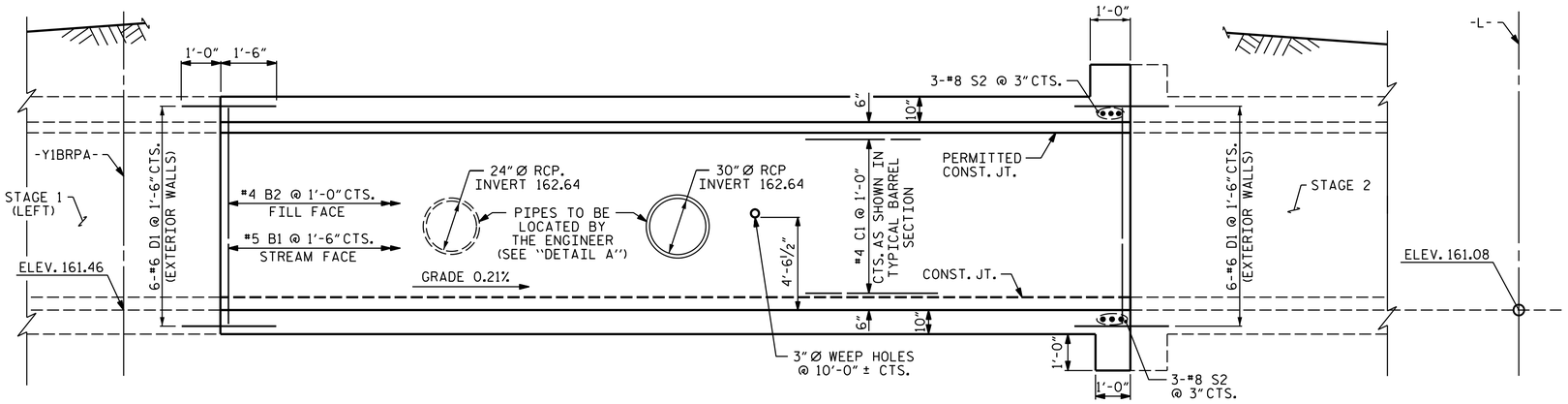
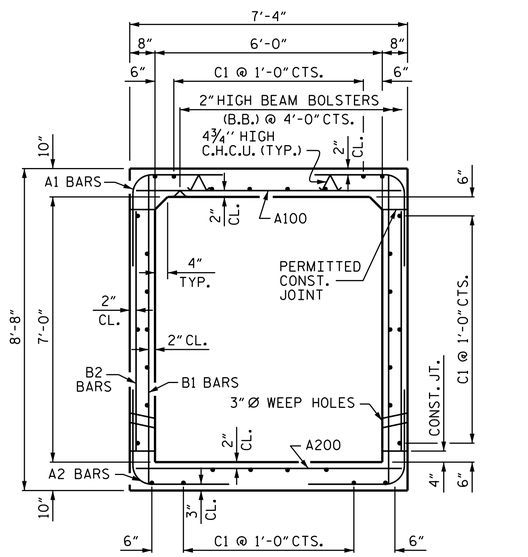
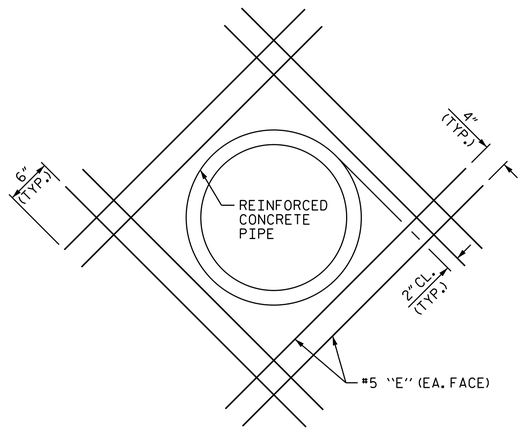


CULVERT SECTION NORMAL TO ROADWAY



RIGHT ANGLE SECTION OF BARREL

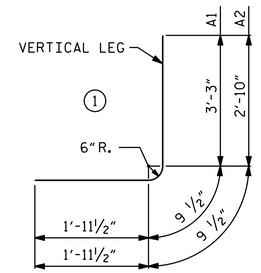
THERE ARE 32 C1 IN SECTION OF BARREL



DETAIL A

THE PIPES THROUGH THE WALL OF THE CULVERT WILL BE LOCATED BY THE ENGINEER.
REINFORCING STEEL MAY BE FIELD CUT & FIELD BENT AS NECESSARY TO CLEAR THE PIPE.

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-10"
C1	#4	1'-10"

STAGE 3 (LEFT) BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	233	#4	STR	6'-11"	1077
A101	1	#4	STR	5'-9"	4
A102	1	#4	STR	3'-6"	2
A200	155	#5	STR	6'-11"	1118
A201	1	#5	STR	5'-4"	6
A202	1	#5	STR	2'-5"	3
A1	235	#5	1	6'-0"	1471
A2	235	#5	1	5'-7"	1369
B1	157	#5	STR	8'-1"	1324
B2	235	#4	STR	6'-4"	994
C1	128	#4	STR	30'-10"	2636
D1	44	#6	STR	2'-6"	165
E2	16	#5	STR	4'-8"	78
E3	16	#5	STR	5'-2"	86
S2	6	#8	STR	7'-2"	115
REINFORCING STEEL					10,448 LBS

STAGE 3 (LEFT) QUANTITIES

CLASS A CONCRETE			
BARREL @	0.802	CY/FT	94.1 C.Y.
EDGE BEAMS			0.6 C.Y.
TOTAL			94.7 C.Y.
REINFORCING STEEL			
BARREL			10,448 LBS.
TOTAL			10,448 LBS.
CULVERT EXCAVATION			LUMP SUM
FOUNDATION COND. MAT'L.			94 TONS
FOUNDATION COND. GEOTEXTILE			340 S.Y.

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 708+48.43 -L-

SHEET 15 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MICHAEL G. CHEEK, JR.
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CORP. LICENSE NO.: C-0275

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SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 3 (LEFT)

REVISIONS						SHEET NO.
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1			3			TOTAL SHEETS
2			4			20

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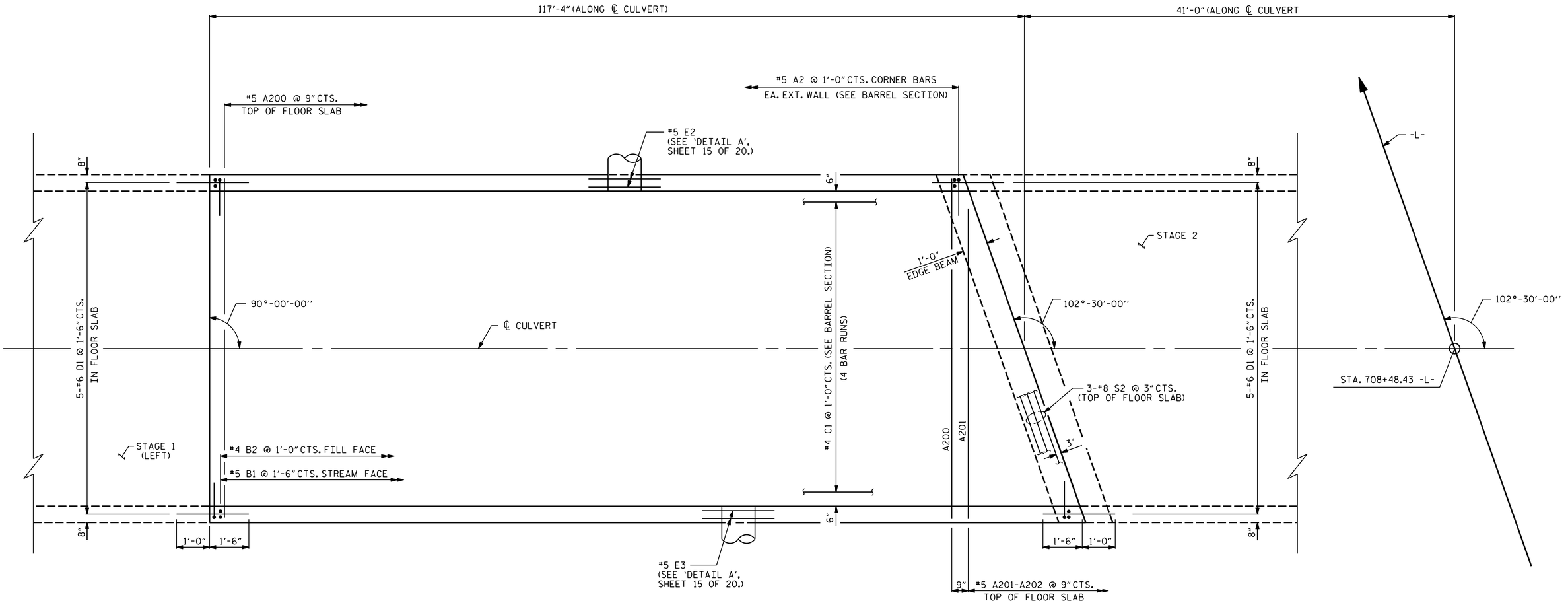
SITE 16



PLAN - FLOOR SLAB

STAGE 3 (LEFT)

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 16 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL D. SMITH, JR.

Digitally signed by Marshall D. Smith, Jr.
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STATE OF NORTH CAROLINA
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SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 3 (LEFT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-16
1			3			TOTAL SHEETS
2			4			20

DRAWN BY : STM DATE : 10/21
CHECKED BY : MGC DATE : 03/22
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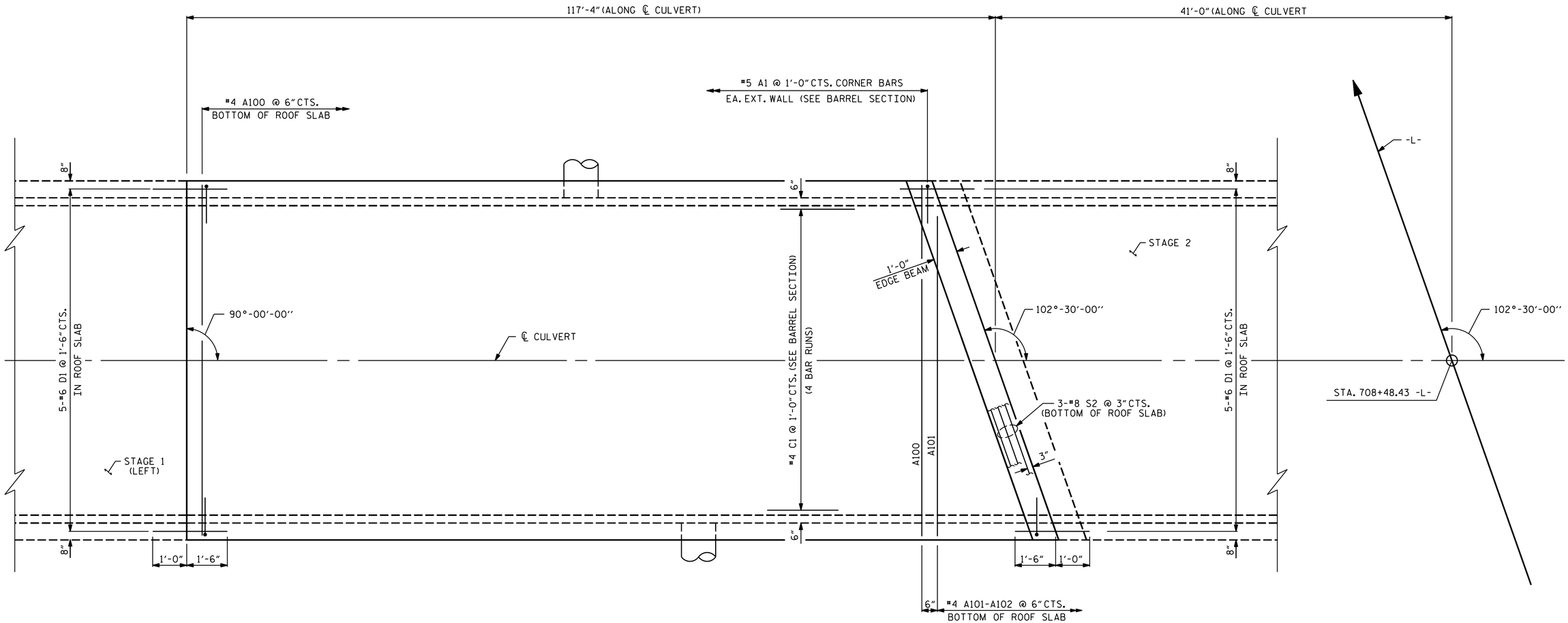
SITE 16



PLAN - ROOF SLAB

STAGE 3 (LEFT)

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 17 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

Marshall G. Cheek, Jr.

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STATE OF NORTH CAROLINA
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RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 3 (LEFT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-17
1			3			TOTAL SHEETS
2			4			20

DRAWN BY :	STM	DATE :	10/21
CHECKED BY :	MGC	DATE :	03/22
DESIGN ENGINEER OF RECORD:	STM	DATE :	03/22

3/16/2022
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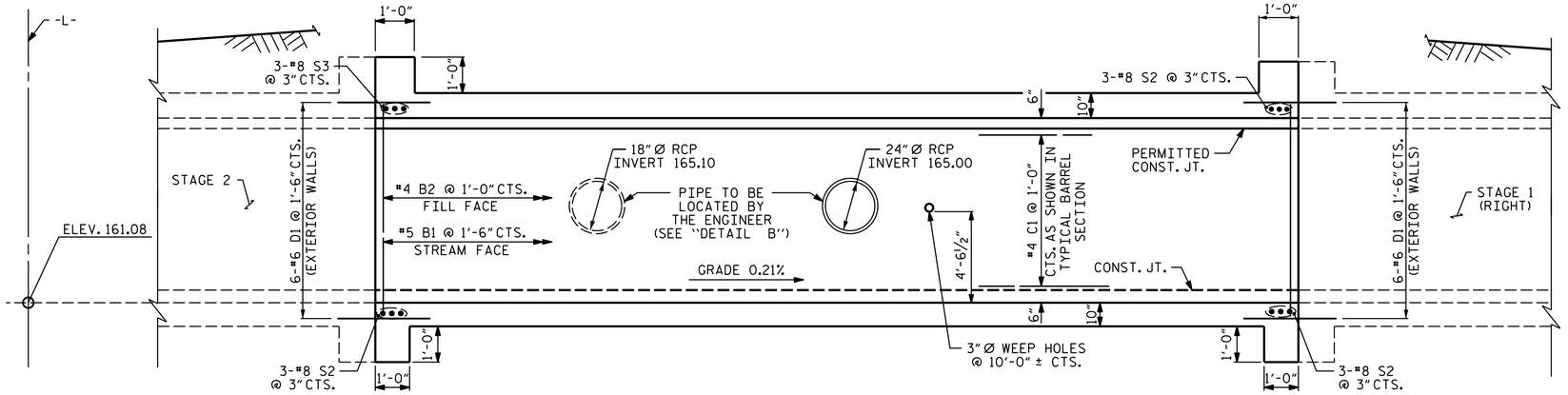
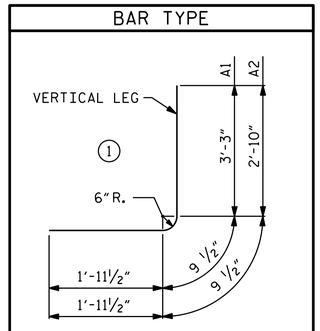
SITE 16



CULVERT SECTION NORMAL TO ROADWAY



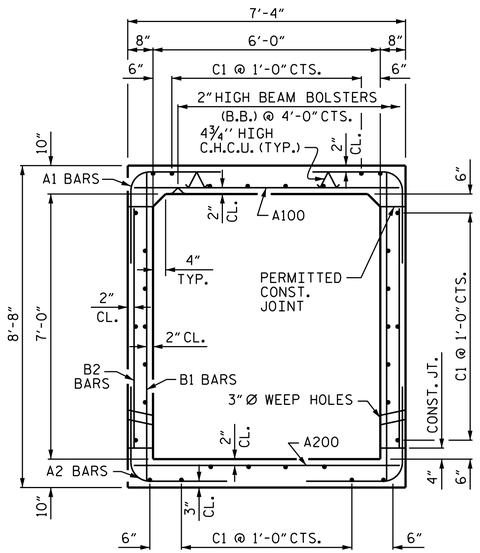
DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-10"
C1	#4	1'-10"

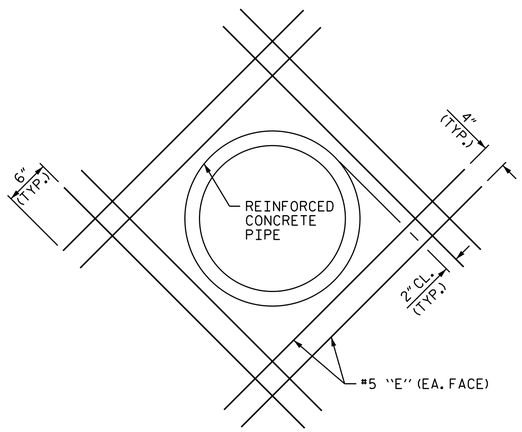
STAGE 3 (RIGHT)
BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	231	#4	STR	6'-11"	1067
A101	1	#4	STR	5'-9"	4
A102	1	#4	STR	3'-6"	2
A103	1	#4	STR	6'-5"	4
A104	1	#4	STR	5'-5"	4
A105	1	#4	STR	4'-5"	3
A106	1	#4	STR	3'-5"	2
A107	1	#4	STR	2'-5"	2
A200	154	#5	STR	6'-11"	1111
A201	1	#5	STR	5'-11"	6
A202	1	#5	STR	2'-7"	3
A203	1	#5	STR	5'-10"	6
A204	1	#5	STR	4'-4"	5
A205	1	#5	STR	2'-10"	3
A1	235	#5	1	6'-0"	1471
A2	235	#5	1	5'-7"	1369
B1	158	#5	STR	8'-1"	1332
B2	235	#4	STR	6'-4"	994
C1	128	#4	STR	31'-2"	2665
D1	44	#6	STR	2'-6"	165
E1	16	#5	STR	4'-8"	78
E4	16	#5	STR	4'-2"	70
S2	6	#8	STR	7'-10"	125
S3	6	#8	STR	7'-2"	115
REINFORCING STEEL					10,606 LBS



RIGHT ANGLE SECTION OF BARREL

THERE ARE 32 C1 IN SECTION OF BARREL



DETAIL B

THE PIPES THROUGH THE WALL OF THE CULVERT WILL BE LOCATED BY THE ENGINEER.
REINFORCING STEEL MAY BE FIELD CUT & FIELD BENT AS NECESSARY TO CLEAR THE PIPE.

STAGE 3 (RIGHT) QUANTITIES

CLASS A CONCRETE		
BARREL @ 0.802 CY/FT	94.9	C.Y.
EDGE BEAMS	1.2	C.Y.
TOTAL	96.1	C.Y.
REINFORCING STEEL		
BARREL	10,606	LBS.
TOTAL	10,606	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	95 TONS	
FOUNDATION COND. GEOTEXTILE	345 S.Y.	

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 18 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

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4/12/2022 | 10:44 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 3 (RIGHT)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C16-18
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2			4			20

DRAWN BY : STM DATE : 10/21
CHECKED BY : MGC DATE : 03/22
DESIGN ENGINEER OF RECORD: STM DATE : 03/22

3/16/2022
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User:smassinople

FILE NAME: 412_035_I-5987B_Site 16_SMU_CU_018.dgn

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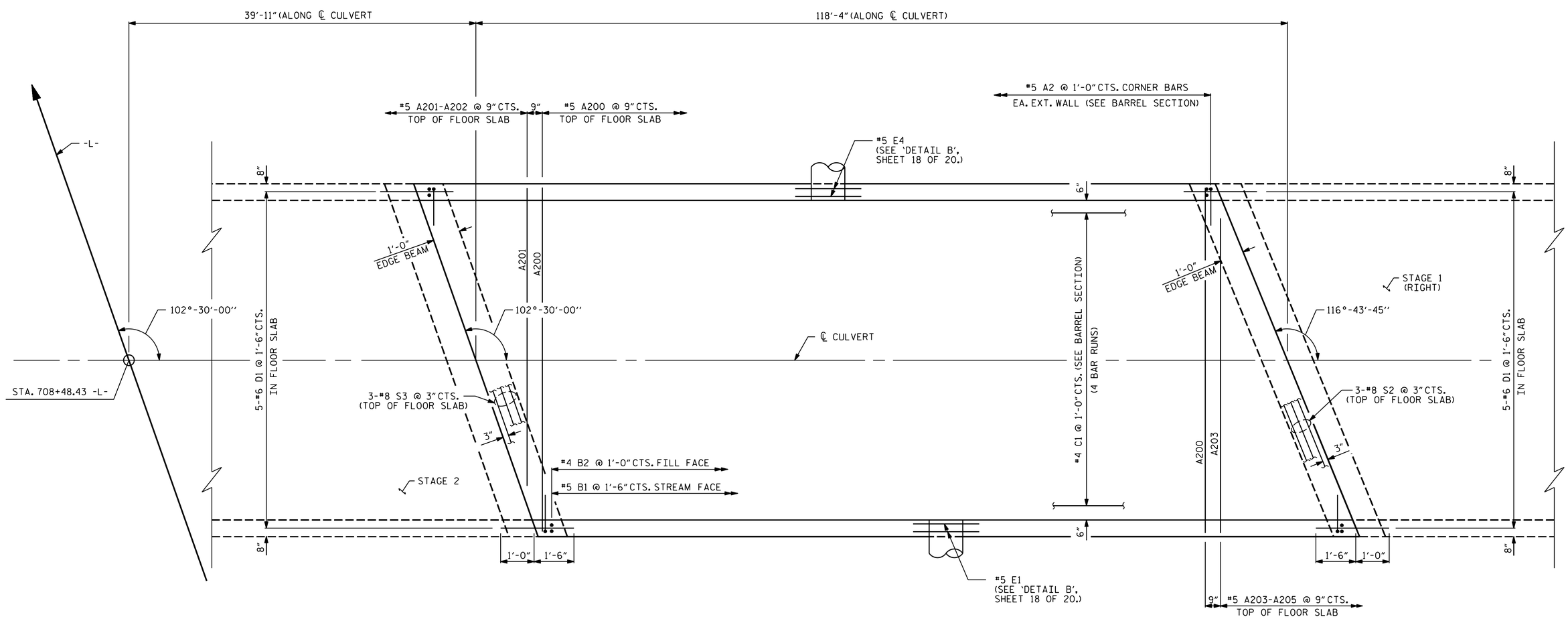

PLAN - FLOOR SLAB

STAGE 3 (RIGHT)

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 19 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 3 (RIGHT)

REVISIONS						SHEET NO.
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1			3			TOTAL SHEETS
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3/16/2022
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User:smossinople

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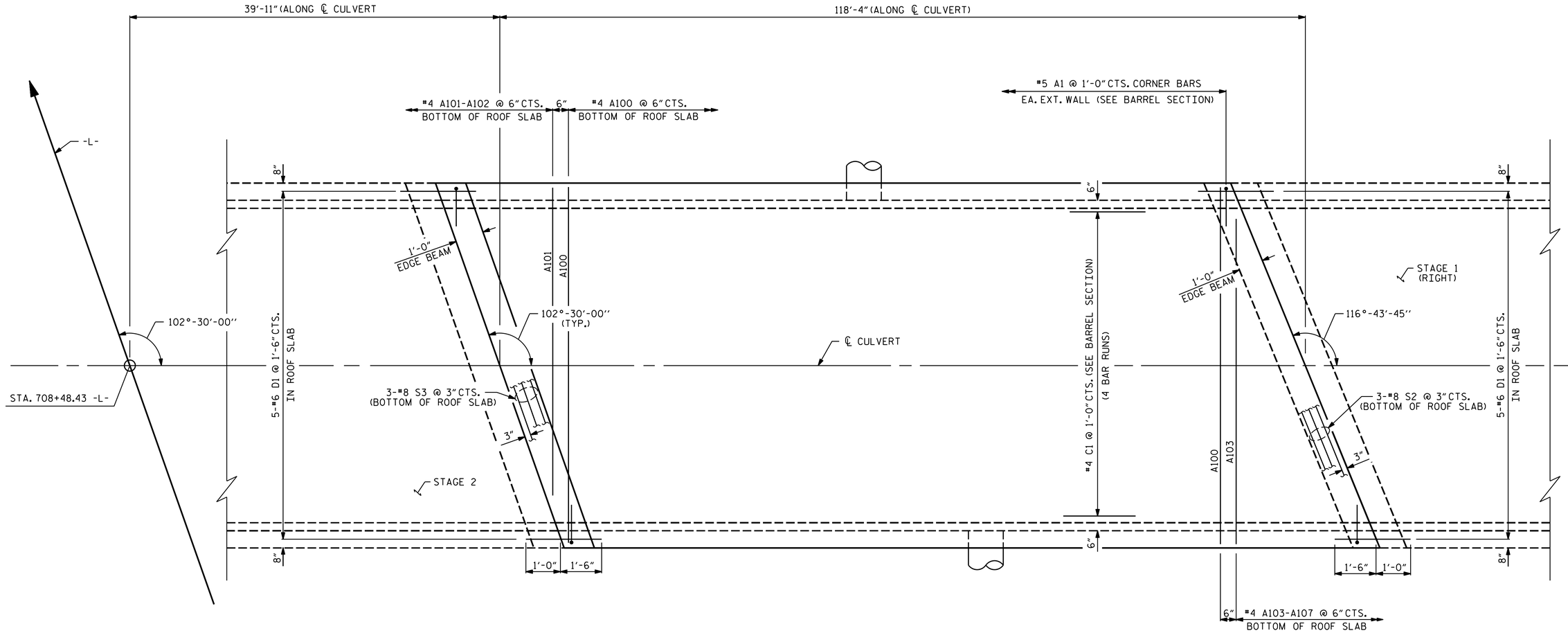
SITE 16



PLAN - ROOF SLAB

STAGE 3 (RIGHT)

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 708+48.43 -L-

SHEET 20 OF 20

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CREEK, JR.

Docusigned by: Marshall G. Creek, Jr.

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4/12/2022 | 10:44 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGE 3 (RIGHT)

REVISIONS						SHEET NO.
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CHECKED BY : MGC DATE : 03/22
DESIGN ENGINEER OF RECORD: STM DATE : 03/22

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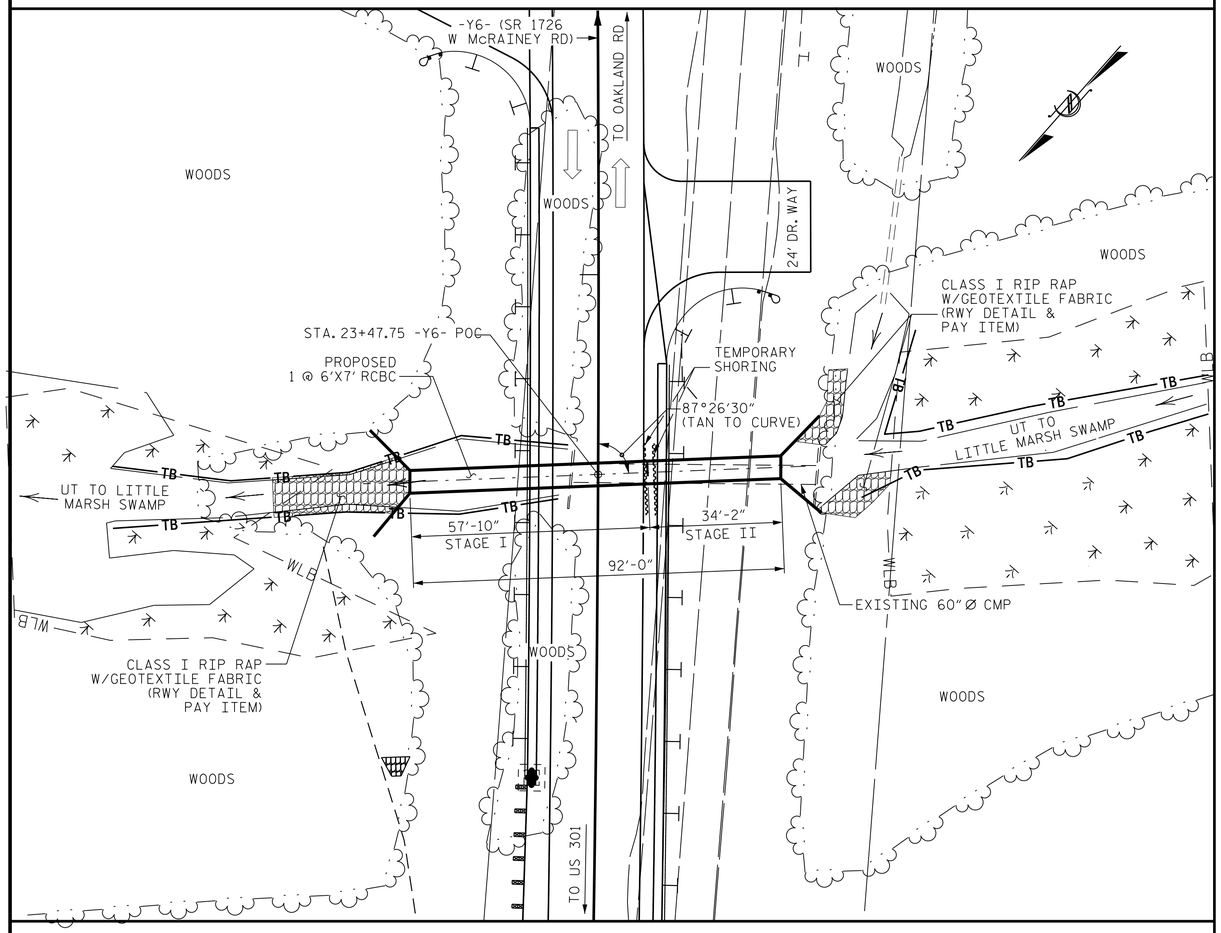
User:smassinople

FILE NAME: 412_039_I-5987B_Site 16_SMU_CU_020.dgn

SITE 16

BM 65: -Y6- STA. 8+66.00; 105.17' LT.; TIE SPIKE SET IN 36" PECAN, EL. 171.21'



LOCATION SKETCH

ROADWAY DATA

GRADE PT. EL. @ STA. 23+47.75 -Y6-	= 172.79'
BED ELEV. @ STA. 23+47.75 -Y6-	= 155.51'
ROADWAY SLOPE (LEFT)	= 3 : 1
ROADWAY SLOPE (RIGHT)	= 3 : 1

HORIZONTAL CURVE DATA

P.I. STA. = 20+25.89 -Y6-
Δ = 4°-58'-32.9" (LT.)
D = 0°-30'-58.2"
L = 963.97'
T = 482.29'
R = 11,000.00'

HYDRAULIC DATA

DESIGN DISCHARGE	= 230 CFS
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= 162.8'
DRAINAGE AREA	= 0.63 SQ. MI.
BASE DISCHARGE (Q100)	= 310 CFS
BASE HIGH WATER ELEVATION	= 164.1'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 400+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 167.0' *

* AT SAG STA. 19+81.00 -Y6-

TOTAL STRUCTURE QUANTITIES

CULVERT EXCAVATION	LUMP SUM
FOUNDATION COND. MATERIAL	
STAGE I	46 TONS
STAGE II	27 TONS
TOTAL	73 TONS
CLASS A CONCRETE	
STAGE I	59.7 C.Y.
STAGE II	40.7 C.Y.
TOTAL	100.4 C.Y.
REINFORCING STEEL	
STAGE I	6,833 LBS.
STAGE II	4,391 LBS.
TOTAL	11,224 LBS.

NOTES

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

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

FOR CONSTRUCTION SEQUENCE, EROSION CONTROL AND MEASURES, SEE EROSION CONTROL PLANS.

DESIGN FILL---------- 9.48'

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:

STAGE I - CONSTRUCT RCBC NORTH SIDE SECTION (OUTLET END).

1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF BOTH VERTICAL WALLS.
2. FILL WITH NATIVE MATERIAL BACKFILL.
3. FOLLOWED BY THE WING WALLS FULL HEIGHT. ROOF SLAB AND HEADWALL.

STAGE II - CONSTRUCT RCBC REMAINING SECTION (INLET END).

1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF BOTH VERTICAL WALLS.
2. FILL WITH NATIVE MATERIAL BACKFILL.
3. FOLLOWED BY THE WING WALLS FULL HEIGHT. ROOF SLAB AND HEADWALL.

THE CONTRACTOR 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 FEET. LOCATION OF 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 CONTRACTOR.

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.

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.

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 SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

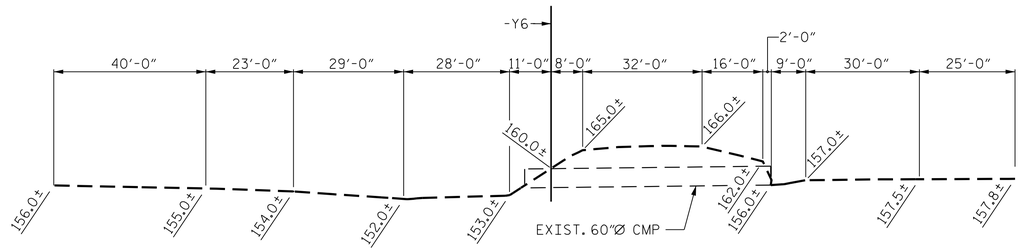
FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR TRAFFIC PHASING, LIMITS OF TEMPORARY SHORING, SEE TRAFFIC CONTROL PLANS.

FOR PAY ITEM FOR TEMPORARY SHORING, SEE ROADWAY PLANS.



PROFILE ALONG ℄ CULVERT

FOUNDATION NOTES

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

FOR AREAS WITH NEW FILL BELOW CULVERT BEARING ELEVATION, PLACE A MINIMUM OF 12" OF CLASS VI FOUNDATION CONDITIONING MATERIAL ENCAPSULATED IN TYPE II GEOTEXTILE IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.

AT THE CONTRACTOR'S OPTION, USE ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL FOR FILL BENEATH CULVERT BEARING ELEVATION. ENCAPSULATE ALL CLASS VI FOUNDATION CONDITIONING MATERIAL IN TYPE II GEOTEXTILE IN ACCORDANCE WITH SECTION 414 OF THE STANDARD SPECIFICATIONS.

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

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 23+47.75-Y6-POC

SHEET 1 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BARREL STANDARD

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT 87°-26'-30" SKEW

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CDM Smith
CDM SMITH
5400 Glenwood Ave, Suite 400
Raleigh, NC 27612-3228
NC COA No. F-1255

DRAWN BY :	JJR	DATE :	4/21
CHECKED BY :	THF	DATE :	5/21
DESIGN ENGINEER :	VDK	DATE :	6/21

DWG. No.

NORTH CAROLINA PROFESSIONAL SEAL 16301 ENGINEER TING-HSIUNG FANG
Ting Fang
4/4/2022

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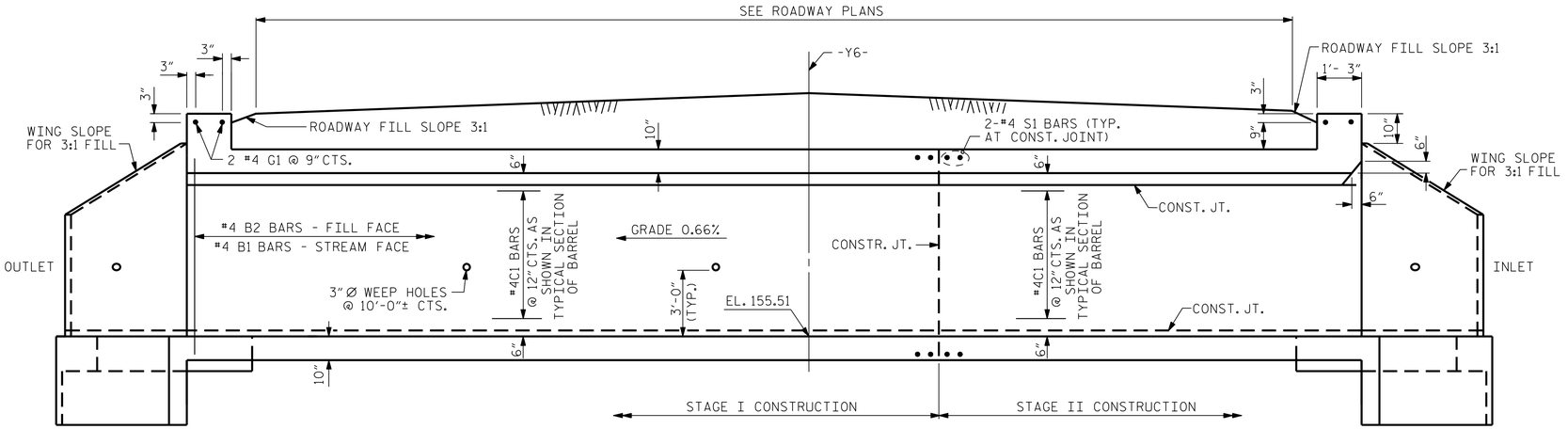
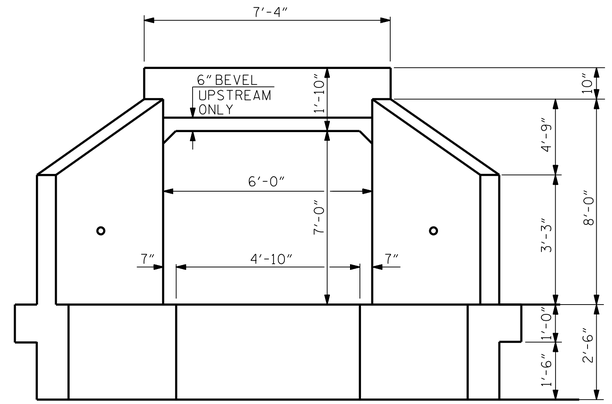
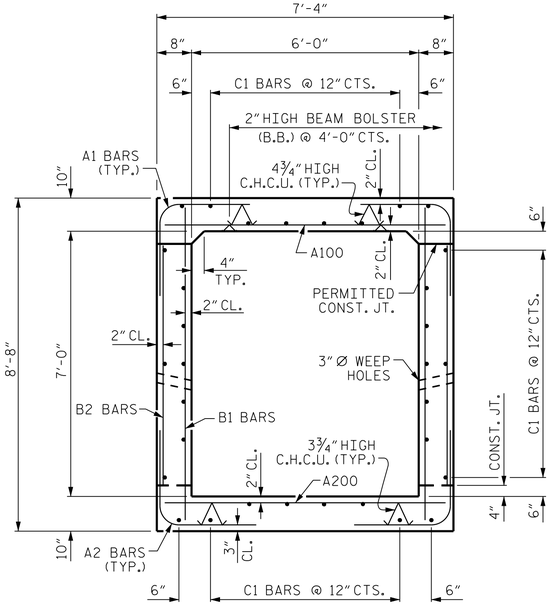
SITE 17



CULVERT SECTION NORMAL TO ROADWAY



END ELEVATION



RIGHT ANGLE SECTION OF BARREL

THERE ARE 32 C1 BARS IN SECTION OF BARREL

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 23+47.75-Y6-POC

SHEET 2 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BARREL STANDARD

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT

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CDM Smith
CDM SMITH
5400 Glenwood Ave, Suite 400
Raleigh, NC 27612-3228
NC COA No. F-1255

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CHECKED BY : THF DATE : 5/21
DESIGN ENGINEER : VDK DATE : 6/21

DWG. No.

NORTH CAROLINA PROFESSIONAL SEAL 16301 ENGINEER TING HSIUNG FANG
Ting Fang
60E433C8AEA80462...
4/4/2022

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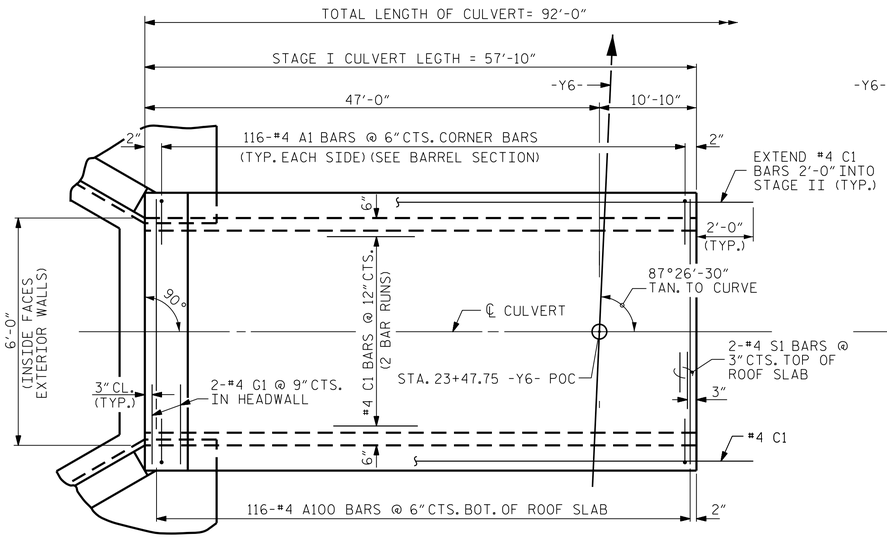
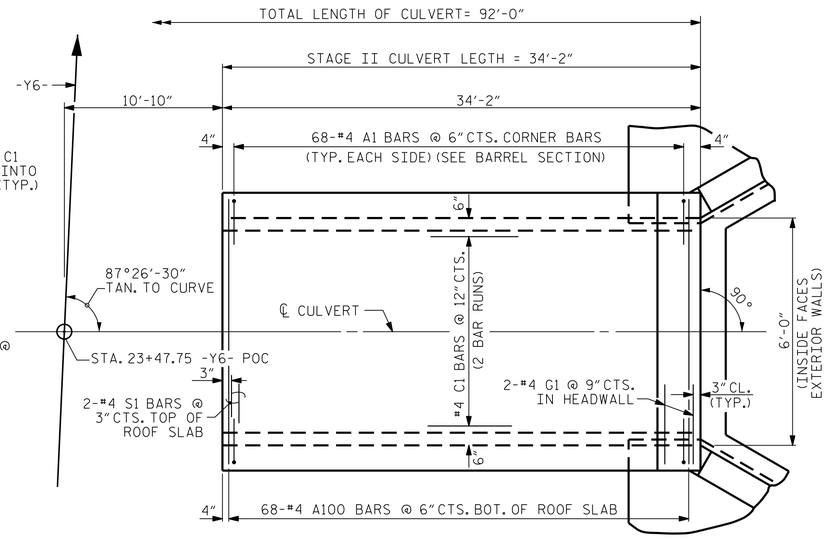
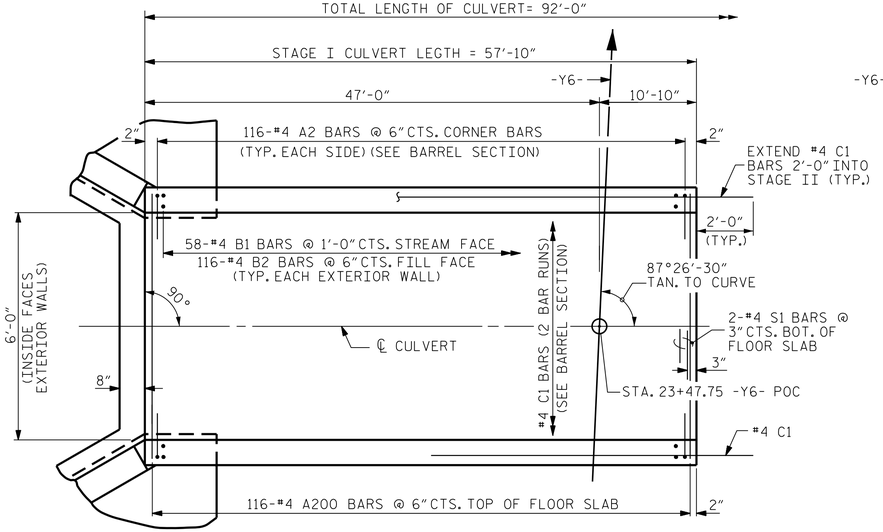
SITE 17



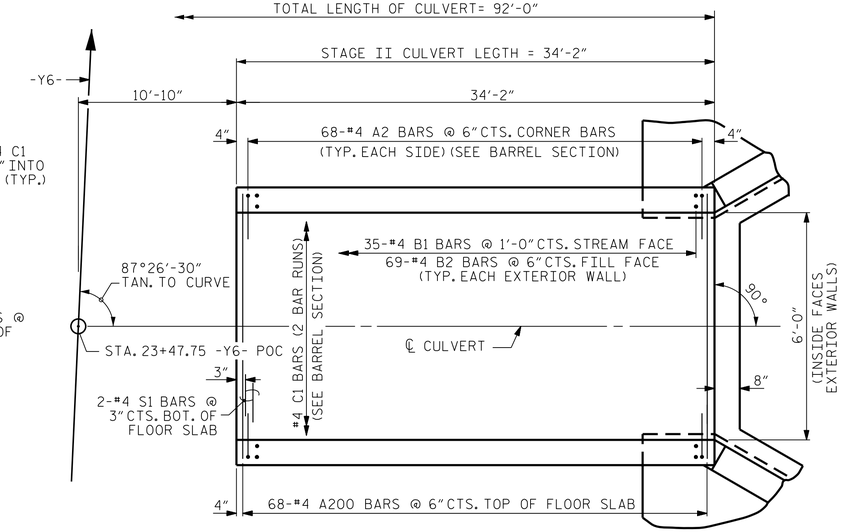
STAGE I - PLAN OF ROOF SLAB



STAGE II - PLAN OF ROOF SLAB



STAGE I - PLAN OF FLOOR SLAB



STAGE II - PLAN OF FLOOR SLAB

STAGE I CONSTRUCTION

STAGE II CONSTRUCTION

REINFORCING BAR SCHEDULE

STAGE I

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	232	#4	3	7'-0"	1085
A2	232	#4	3	6'-0"	930
A100	116	#4	STR	7'-0"	542
A200	116	#4	STR	7'-0"	542
B1	116	#4	STR	8'-3"	639
B2	232	#4	STR	6'-4"	982
C1	64	#4	STR	29'-8"	1268
G1	2	#4	STR	7'-0"	9
S1	4	#4	STR	7'-0"	19

REINFORCING STEEL LBS. 6,017

STAGE II

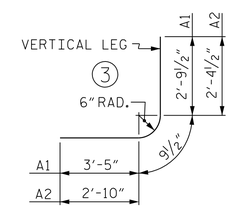
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	136	#4	3	7'-0"	636
A2	136	#4	3	6'-0"	545
A100	68	#4	STR	7'-0"	318
A200	68	#4	STR	7'-0"	318
B1	70	#4	STR	8'-3"	386
B2	138	#4	STR	6'-4"	584
C1	64	#4	STR	17'-10"	761
G1	2	#4	STR	7'-0"	9
S1	4	#4	STR	7'-0"	19

REINFORCING STEEL LBS. 3,575

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
C1	#4	1'-10"

BAR TYPE



BAR DIMENSIONS ARE OUT TO OUT

STRUCTURE QUANTITIES

STAGE I		STAGE II	
CULVERT EXCAVATION	LUMP SUM	CULVERT EXCAVATION	LUMP SUM
FOUNDATION COND. MAT'L	46 TONS	FOUNDATION COND. MAT'L	27 TONS
CLASS A CONCRETE		CLASS A CONCRETE	
BARREL @ 0.802 CY/FT	46.4 C.Y.	BARREL @ 0.802 CY/FT	27.4 C.Y.
HEADWALL	0.3 C.Y.	HEADWALL	0.3 C.Y.
WINGS & CURTAIN WALL	13.0 C.Y.	WINGS & CURTAIN WALL	13.0 C.Y.
TOTAL	59.7 C.Y.	TOTAL	40.7 C.Y.
REINFORCING STEEL		REINFORCING STEEL	
BARREL & HEADWALL	6,017 LBS.	BARREL & HEADWALL	3,575 LBS.
2 WINGS	816 LBS.	2 WINGS	816 LBS.
TOTAL	6,833 LBS.	TOTAL	4,391 LBS.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 23+47.75-Y6-POC

SHEET 3 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BARREL STANDARD

SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT STAGES I & II

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DRAWN BY : JJR DATE : 4/21
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DWG. No.

NORTH CAROLINA PROFESSIONAL SEAL 16301 ENGINEER TING-HSIUNG FANG
Ting Fang
60E43C0AEA60462...
4/4/2022

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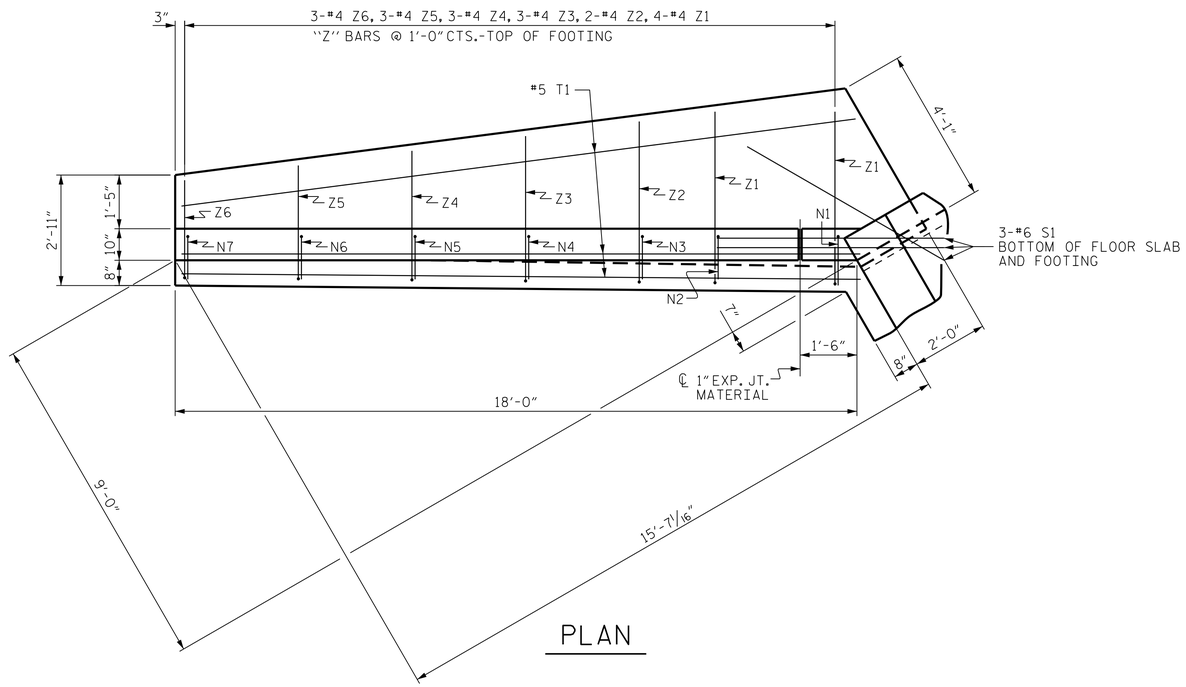
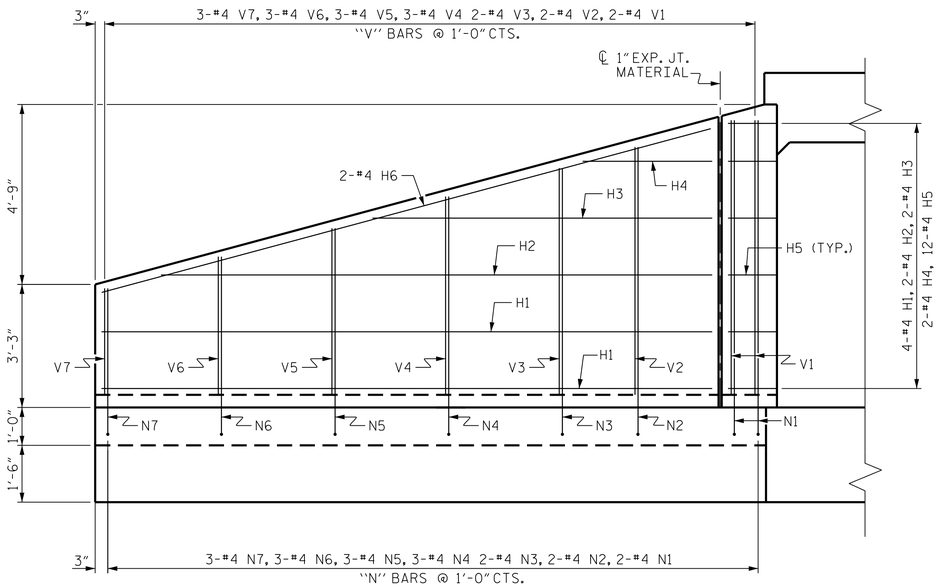
2			4			5

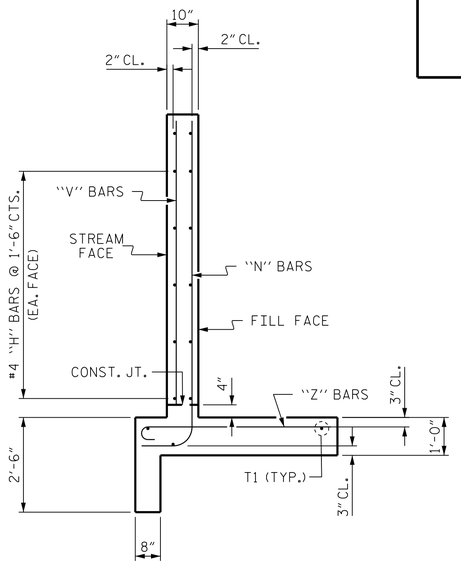
SITE 17



PLAN

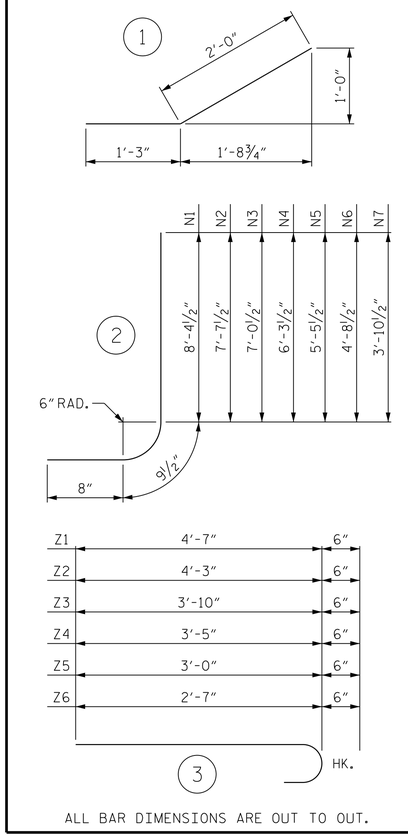


ELEVATION



TYPICAL WING SECTION

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	16	#4	STR	16'-1"	172
H2	8	#4	STR	14'-9"	78
H3	8	#4	STR	9'-0"	48
H4	8	#4	STR	3'-5"	18
H5	48	#4	1	3'-3"	104
H6	8	#4	STR	16'-8"	89
N1	8	#5	2	9'-10"	53
N2	8	#5	2	9'-1"	49
N3	8	#4	2	8'-6"	45
N4	12	#4	2	7'-9"	62
N5	12	#4	2	6'-11"	55
N6	12	#4	2	6'-2"	49
N7	12	#4	2	5'-4"	43
S1	12	#6	STR	6'-0"	108
T1	12	#5	STR	17'-11"	224
V1	8	#4	STR	7'-3"	39
V2	8	#4	STR	6'-7"	35
V3	8	#4	STR	6'-0"	32
V4	12	#4	STR	5'-3"	42
V5	12	#4	STR	4'-5"	35
V6	12	#4	STR	3'-8"	29
V7	12	#4	STR	2'-10"	23
Z1	16	#4	3	5'-1"	54
Z2	8	#4	3	4'-9"	25
Z3	12	#4	3	4'-4"	35
Z4	12	#4	3	3'-11"	31
Z5	12	#4	3	3'-6"	28
Z6	12	#4	3	3'-1"	25

TOTAL REINFORCING STEEL
FOR 4 WINGS 1,632 LBS

CLASS A CONCRETE

4 WINGS	25.3	CY
2 HEADWALLS	0.7	CY
2 END CURTAIN WALLS	0.6	CY
TOTAL	26.6	CY

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

CDM Smith
CDM SMITH
5400 Glenwood Ave, Suite 400
Raleigh, NC 27612-3228
NC COA No. F-1255

DRAWN BY : JJR DATE : 4/21
CHECKED BY : THF DATE : 5/21
DESIGN ENGINEER : VDK DATE : 6/21

DWG. No.

NORTH CAROLINA PROFESSIONAL SEAL 16301 ENGINEER TING-HSIUNG FANG
Ting Fang
60E43C9AEA60462...
4/4/2022

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 23+47.75-Y6-POC

SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD WINGS AT OUTLET END FOR CONCRETE BOX CULVERT

H = 7'-0" SLOPE = 3:1
90° SKEW

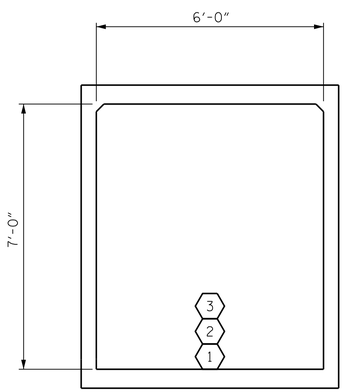
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. C17-4
TOTAL SHEETS 5

MODIFY STD. NO. CW9007 SITE 17

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_{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)	**2.03**	--	1.75	**2.03**	1	BOTTOM SLAB	3.92	5.95	1	EXTERIOR WALL	0.42	
		HL-93 (OPERATING)	N/A		2.63	--	1.35	2.63	1	BOTTOM SLAB	3.92	7.71	1	EXTERIOR WALL	0.42	
		HS-20 (INVENTORY)	36.000	(2)	**2.11**	387.61	1.75	**2.11**	1	BOTTOM SLAB	3.92	5.98	1	EXTERIOR WALL	0.42	
		HS-20 (OPERATING)	36.000		2.74	502.46	1.35	2.74	1	BOTTOM SLAB	3.92	7.75	1	EXTERIOR WALL	0.42	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		**3.29**	181.69	1.40	**3.29**	1	BOTTOM SLAB	3.92	7.50	1	EXTERIOR WALL	0.42	
		SNGARBS2	20.000		3.13	269.18	1.40	3.13	1	BOTTOM SLAB	3.92	7.47	1	EXTERIOR WALL	0.42	
		SNAGRIS2	22.000		3.29	296.09	1.40	3.29	1	BOTTOM SLAB	3.92	7.47	1	EXTERIOR WALL	0.42	
		SNCOTTS3	27.250		2.13	366.75	1.40	2.13	1	BOTTOM SLAB	3.92	7.41	1	BOTTOM SLAB	0.33	
		SNAGGRS4	34.925		1.78	470.05	1.40	1.78	1	BOTTOM SLAB	3.92	6.34	1	BOTTOM SLAB	7.00	
		SNS5A	35.550		1.86	478.46	1.40	1.86	1	BOTTOM SLAB	3.92	6.63	1	BOTTOM SLAB	0.33	
		SNS6A	39.950		1.86	537.68	1.40	1.86	1	BOTTOM SLAB	3.92	6.52	1	BOTTOM SLAB	0.33	
		SNS7B	42.000		1.86	565.27	1.40	1.86	1	BOTTOM SLAB	3.92	6.52	1	BOTTOM SLAB	0.33	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.33	444.14	1.40	2.33	1	BOTTOM SLAB	3.92	7.49	1	EXTERIOR WALL	0.42	
		TNT4A	33.075		2.17	445.15	1.40	2.17	1	BOTTOM SLAB	3.92	7.45	1	EXTERIOR WALL	0.42	
		TNT6A	41.600		1.91	559.89	1.40	1.91	1	BOTTOM SLAB	3.92	6.69	1	EXTERIOR WALL	0.33	
		TNT7A	42.000		2.04	565.27	1.40	2.04	1	BOTTOM SLAB	3.92	7.12	1	EXTERIOR WALL	0.33	
		TNT7B	42.000		1.87	565.27	1.40	1.87	1	BOTTOM SLAB	3.92	6.55	1	EXTERIOR WALL	0.33	
		TNAGRIT4	43.000		1.96	578.73	1.40	1.96	1	BOTTOM SLAB	3.92	7.33	1	BOTTOM SLAB	0.33	
		TNAGT5A	45.000		2.01	605.64	1.40	2.01	1	BOTTOM SLAB	3.92	7.45	1	EXTERIOR WALL	0.42	
		TNAGT5B	45.000	(3)	1.83	605.64	1.40	1.83	1	BOTTOM SLAB	3.92	6.95	1	BOTTOM SLAB	0.33	



LRFR SUMMARY

(LOOKING DOWNSTREAM)

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

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 23+47.75-Y6-POC

SHEET 5 OF 5

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

CDM Smith
CDM SMITH
5400 Glenwood Ave, Suite 400
Raleigh, NC 27612-3228
NC COA No. F-1255

DRAWN BY : JJR DATE : 4/21
CHECKED BY : THF DATE : 5/21
DESIGN ENGINEER : VDK DATE : 6/21

DWG. No.

NORTH CAROLINA PROFESSIONAL SEAL 16301 ENGINEER TING HSILING FANG
Ting Fang
60E43C9AEA60462...
4/4/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

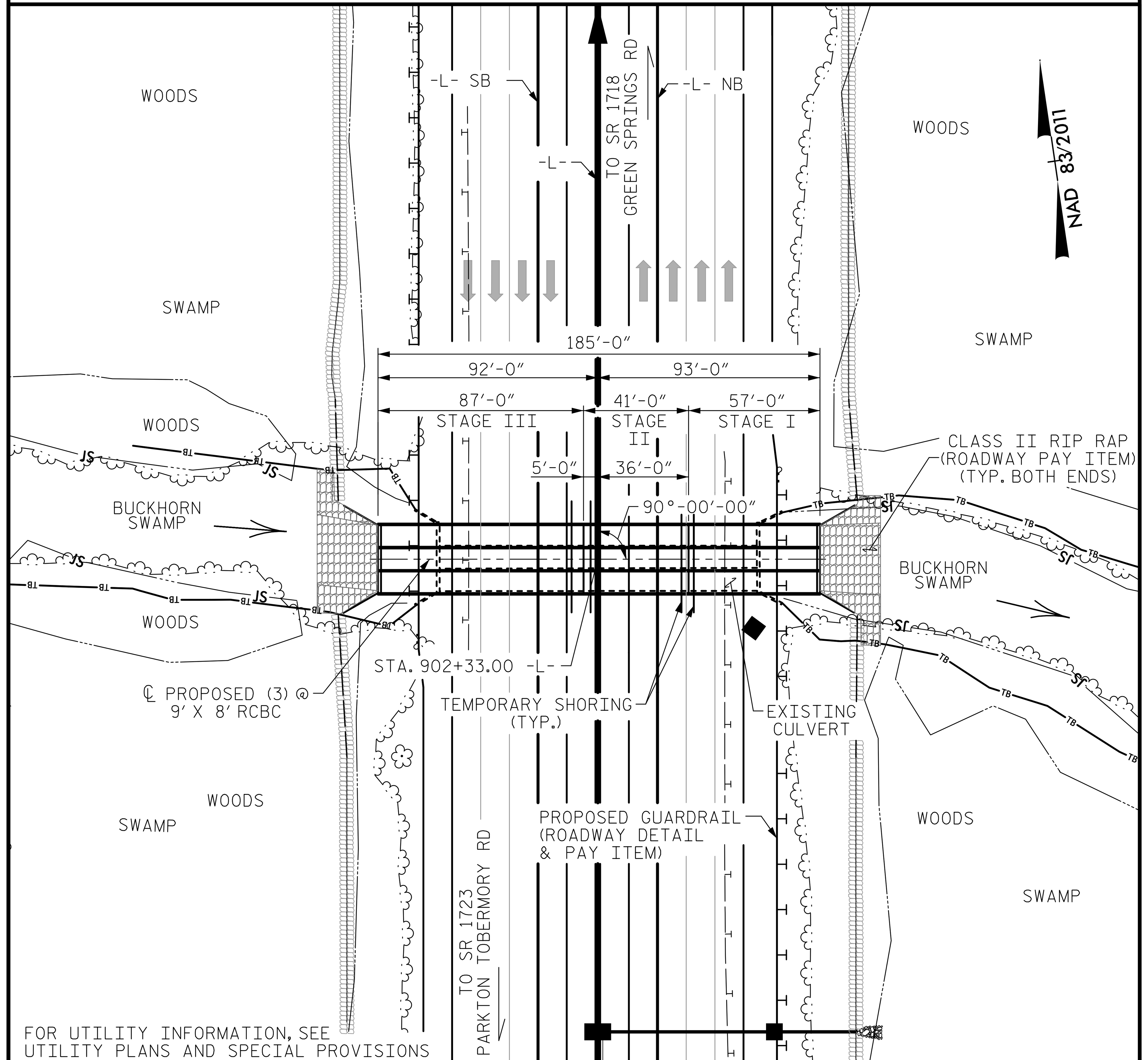
(NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C17-5
1			3			TOTAL SHEETS
2			4			5

STD. NO. LRFR5

SITE 17

BENCH MARK #60:
TIE SPIKE SET IN 20" OAK; STA. 885+19.68 -L-; 129.02' RT.; ELEV. 174.61



LOCATION SKETCH

NOTES:

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

DESIGN FILL----------------- 4.88' MIN. FILL AND 6.68' MAX. FILL.

FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTES SHEET.

3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.

CONCRETE IN EACH STAGE 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.

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.

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

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

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 TRAFFIC PHASING, SEE TRAFFIC CONTROL PLANS.

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.

DOWELS SHALL BE USED TO CONNECT THE STAGE II & STAGE III CULVERT TO STAGE I AND STAGE II, RESPECTIVELY, AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.

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.

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

AT THE CONTRACTOR'S OPTION, USE ADDITIONAL CLASS VI FOUNDATION CONDITIONING MATERIAL FOR FILL BENEATH CULVERT BEARING ELEVATION.

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

ENCAPSULATE ALL FOUNDATION CONDITIONING MATERIAL IN TYPE 4 GEOTEXTILE. FOR FOUNDATION CONDITIONING GEOTEXTILE, SEE BOX CULVERT EXCAVATION SPECIAL PROVISION.

ROADWAY DATA

GRADE POINT ELEV. @ STA. 902+33.00 -L- SB = 168.53'
GRADE POINT ELEV. @ STA. 902+33.00 -L- NB = 168.53'
BED ELEV. @ STA. 902+33.00 -L- = 153.10'
ROADWAY SLOPES = 3 : 1

HYDRAULIC DATA

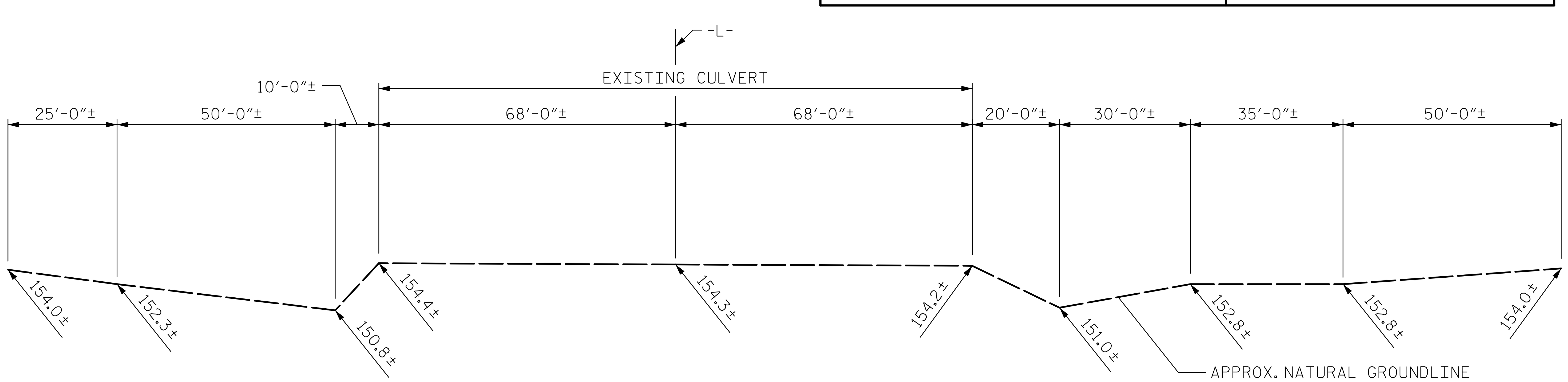
DESIGN DISCHARGE = 1100 CFS
FREQUENCY OF DESIGN FLOOD = 100 YRS
DESIGN HIGH WATER ELEVATION = 163.5'
DRAINAGE AREA = 5.3 SQ. MI.
BASE DISCHARGE (Q100) = 1100 CFS
BASE HIGH WATER ELEVATION = 163.5'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 1500+ CFS
FREQUENCY OF OVERTOPPING FLOOD = 500+ YRS
OVERTOPPING FLOOD ELEVATION = 171.0'

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		REINFORCING STEEL		FOUNDATION COND. MAT'L.		FOUNDATION COND. GEOTEXTILE	
STAGE I	175.5 C.Y.	STAGE I	19,340 LBS.	STAGE I	136 TONS	STAGE I	440 SQ. YDS.
STAGE II	110.4 C.Y.	STAGE II	13,286 LBS.	STAGE II	98 TONS	STAGE II	335 SQ. YDS.
STAGE III	256.3 C.Y.	STAGE III	29,133 LBS.	STAGE III	208 TONS	STAGE III	690 SQ. YDS.
TOTAL	542.2 C.Y.	TOTAL	61,759 LBS.	TOTAL	442 TONS	TOTAL	1,465 SQ. YDS.
REMOVAL OF EXISTING STRUCTURE	LUMP SUM	CULVERT EXCAVATION	LUMP SUM				



PROFILE ALONG ℄ CULVERT

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

SEAL

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
4/12/2022 | 10:50 AM EDT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 902+33.00 -L-

SHEET 1 OF 9 REPLACES CULVERT #770168

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW

DRAWN BY : ZCS	DATE : 10/21
CHECKED BY : MGC	DATE : 10/21
DESIGN ENGINEER OF RECORD: ZCS	DATE : 10/21

REVISIONS

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

SHEET NO. C18-1
TOTAL SHEETS 9

FILE NAME: 414_001_I-5987B_Site_18_SMU_CU_001.dgn

SITE 18

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	LIVE-LOAD FACTORS (γ_{LL})	STRENGTH I LIMIT STATE: MOMENT: RATING FACTOR	MOMENT: BOX NO.	MOMENT: ELEMENT TYPE	MOMENT: DISTANCE FROM LEFT END OF ELEMENT (ft)	SHEAR: RATING FACTOR	SHEAR: BOX NO.	SHEAR: ELEMENT TYPE	SHEAR: DISTANCE FROM LEFT END OF ELEMENT (ft)	COMMENT NUMBER
DESIGN LOAD RATING		HL-93 (INVENTORY)	N/A	1	1.17	--	1.75	1.17	1	TOP SLAB	4.50	1.53	1	BOTTOM SLAB	8.67	
		HL-93 (OPERATING)	N/A		1.52	--	1.35	1.52	1	TOP SLAB	4.50	1.98	1	BOTTOM SLAB	8.67	
		HS-20 (INVENTORY)	36.000	2	1.35	48.60	1.75	1.35	1	TOP SLAB	4.50	1.85	1	TOP SLAB	8.67	
		HS-20 (OPERATING)	36.000		1.76	63.36	1.35	1.76	1	TOP SLAB	4.50	2.39	1	TOP SLAB	8.67	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SH	12.500		2.76	34.50	1.40	2.76	1	TOP SLAB	4.50	3.75	1	TOP SLAB	8.67	
		S3C	21.500		2.14	46.01	1.40	2.14	1	TOP SLAB	4.50	2.95	1	TOP SLAB	8.67	
		S3A	22.750		2.14	48.69	1.40	2.14	1	TOP SLAB	4.50	2.89	1	TOP SLAB	8.67	
		S4A	26.750		2.02	54.04	1.40	2.02	1	TOP SLAB	4.50	2.72	1	TOP SLAB	8.67	
		S5A	30.500		2.13	64.97	1.40	2.13	1	BOTTOM SLAB	4.50	2.55	1	BOTTOM SLAB	8.67	
		S6A	34.500		1.96	67.62	1.40	1.96	1	BOTTOM SLAB	4.50	2.36	1	BOTTOM SLAB	8.67	
		S7B	38.500	3	1.79	68.92	1.40	1.79	1	BOTTOM SLAB	4.50	2.28	1	BOTTOM SLAB	8.67	
		S7A	40.000		1.95	78.00	1.40	1.95	1	BOTTOM SLAB	4.50	2.36	1	BOTTOM SLAB	8.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	T4A	28.250		2.14	60.46	1.40	2.14	1	TOP SLAB	4.50	2.82	1	BOTTOM SLAB	8.67	
		T5B	32.000		2.12	67.84	1.40	2.12	1	BOTTOM SLAB	4.50	2.58	1	BOTTOM SLAB	8.67	
		T6A	36.000		2.14	77.04	1.40	2.14	1	BOTTOM SLAB	4.50	2.54	1	BOTTOM SLAB	8.67	
		T7A	40.000		1.92	76.80	1.40	1.92	1	BOTTOM SLAB	4.50	2.33	1	BOTTOM SLAB	8.67	
		T7B	40.000		1.95	78.00	1.40	1.95	1	BOTTOM SLAB	4.50	2.48	1	BOTTOM SLAB	8.67	

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:

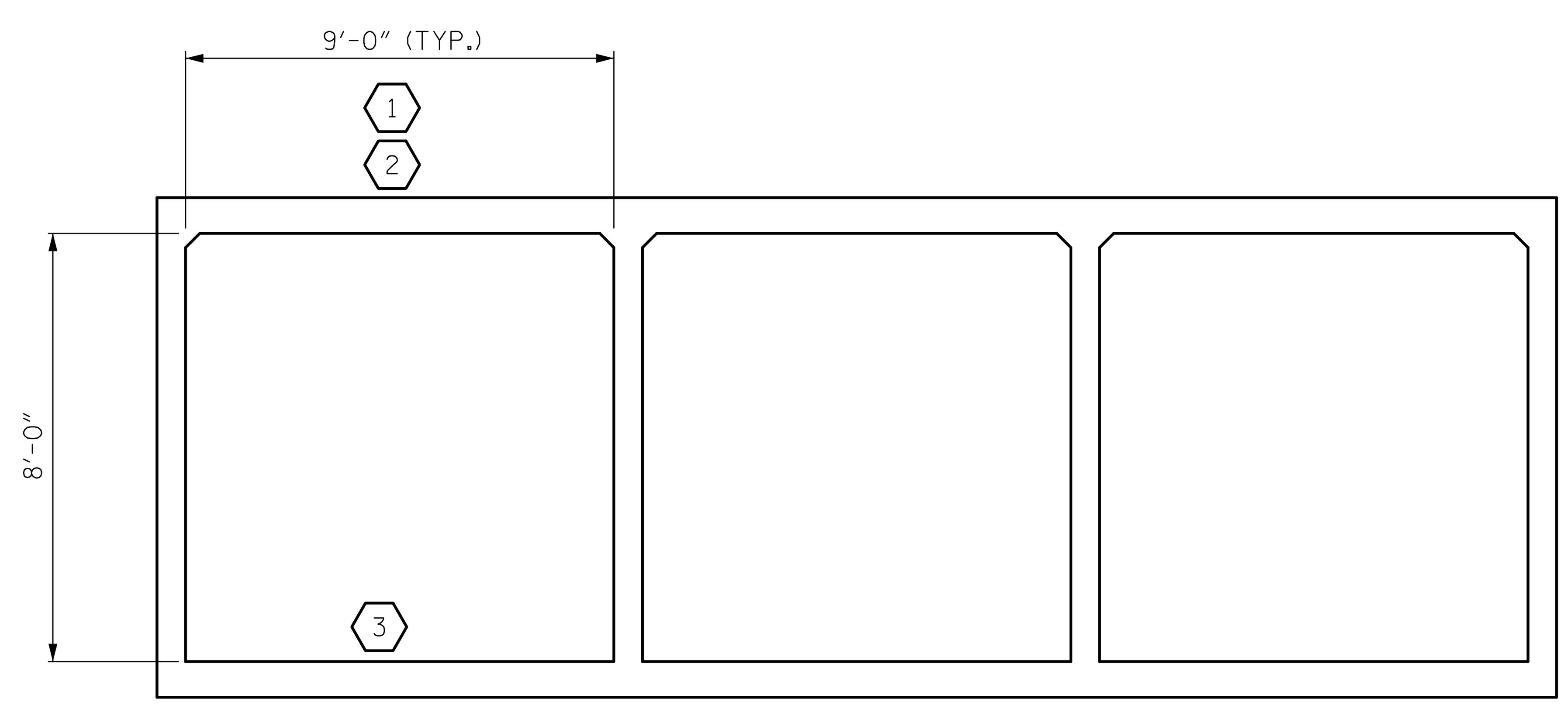
RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

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. I-5987B
ROBESON COUNTY
STATION: 902+33.00 -L-

SHEET 2 OF 9

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL E. CHECK, JR.
4/12/2022 | 10:50 AM EDT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

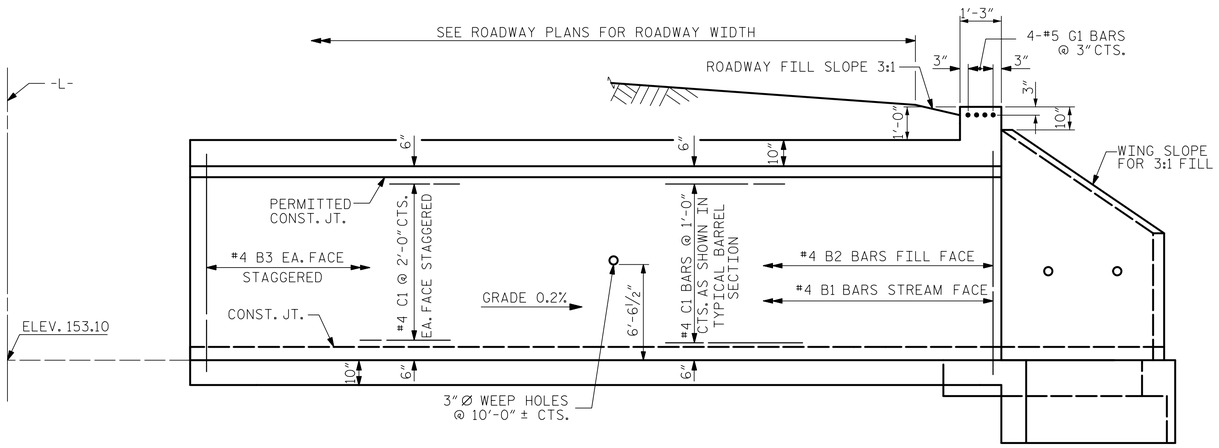
LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS
(INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-2
1			3			TOTAL SHEETS
2			4			9

ASSEMBLED BY : STM	DATE : 5/21		
CHECKED BY : ZCS	DATE : 10/21		
DRAWN BY : WMC 7/11	REV. 10/1/11	MAA/GM	
CHECKED BY : GM 7/11	REV. 12/17	MAA/THC	

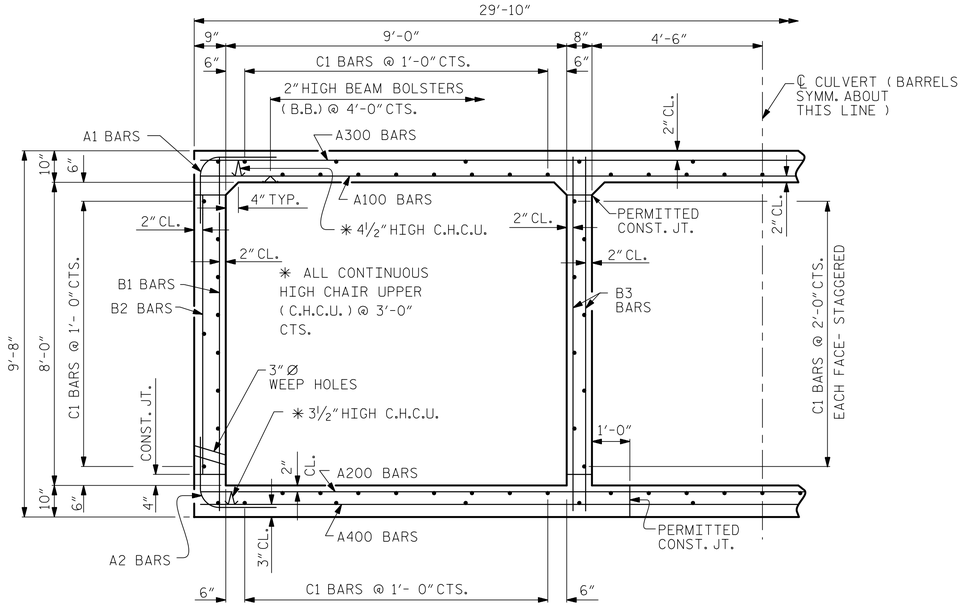
FILE NAME: 414_003_I-5987B_Site_18_SMU_CU_002.dgn

SITE 18



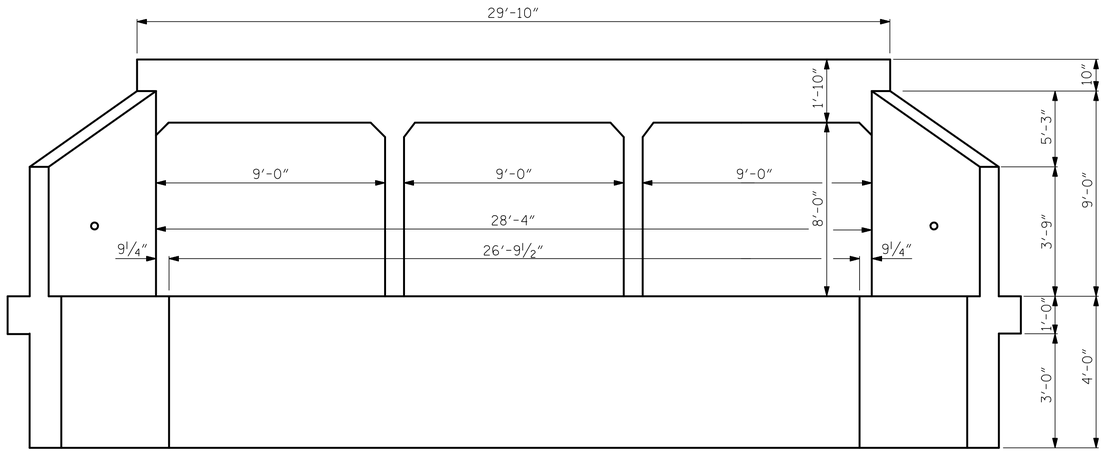
INTERIOR WALL EXTERIOR WALL

CULVERT SECTION NORMAL TO ROADWAY



RIGHT ANGLE SECTION OF BARREL

THERE ARE 108 "C" BARS IN SECTION OF BARREL.



END ELEVATION

STAGE I QUANTITIES

CLASS A CONCRETE		
BARREL @ 2.693 CY/FT	153.5	C.Y.
WINGS, ETC.	22.0	C.Y.
TOTAL	175.5	C.Y.
REINFORCING STEEL		
BARREL	18,312	LBS.
WINGS, ETC.	1,028	LBS.
TOTAL	19,340	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	136 TONS	
FOUNDATION COND. GEOTEXTILE	440 SQ. YDS.	

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 902+33.00 -L-

SHEET 3 OF 9

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CREEK, JR.

Docusigned by: SFBCC2F3A4DC413...

4/12/2022 | 10:50 AM EDT

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

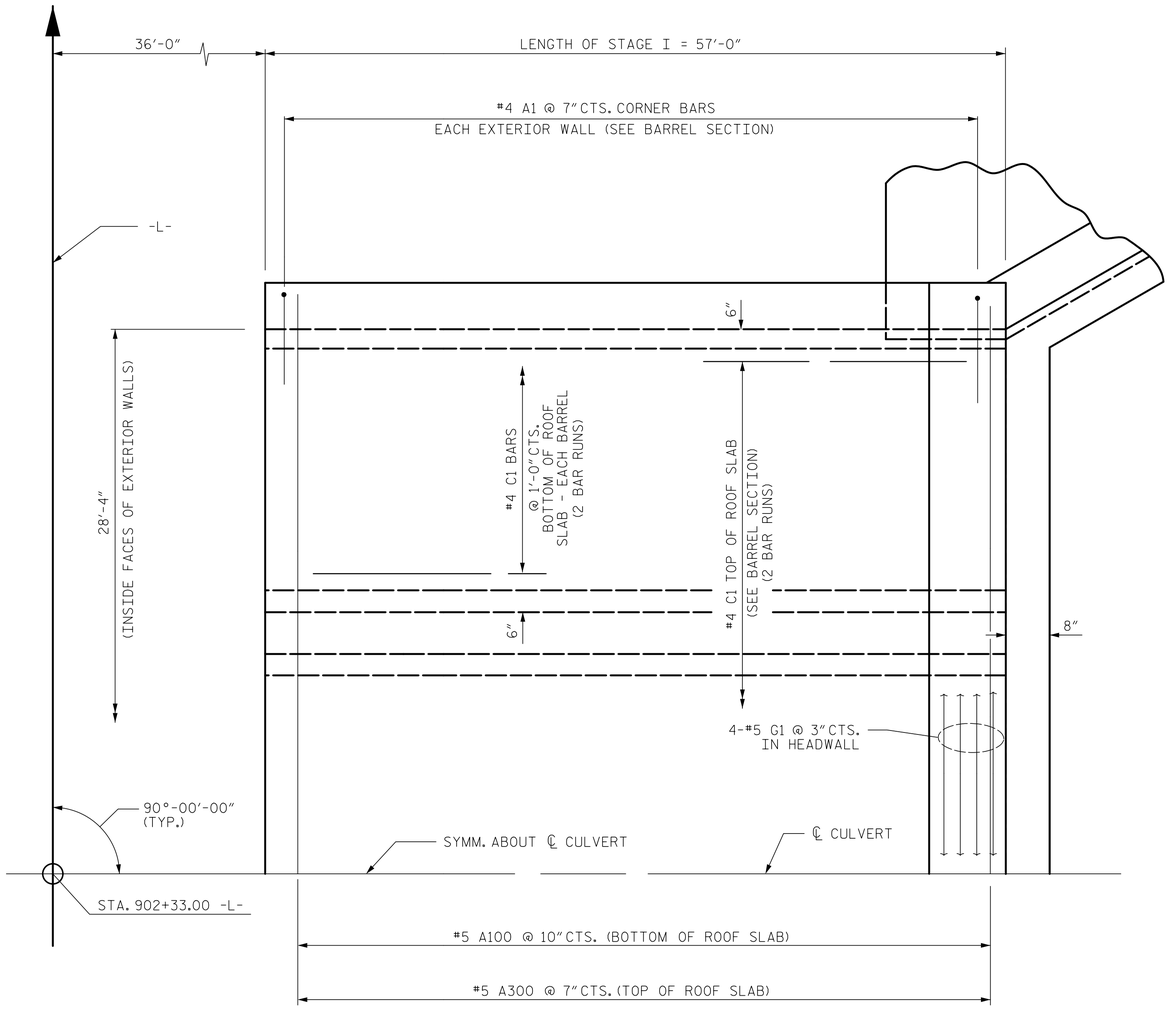
TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW STAGE I

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-3
1			3			TOTAL SHEETS
2			4			9

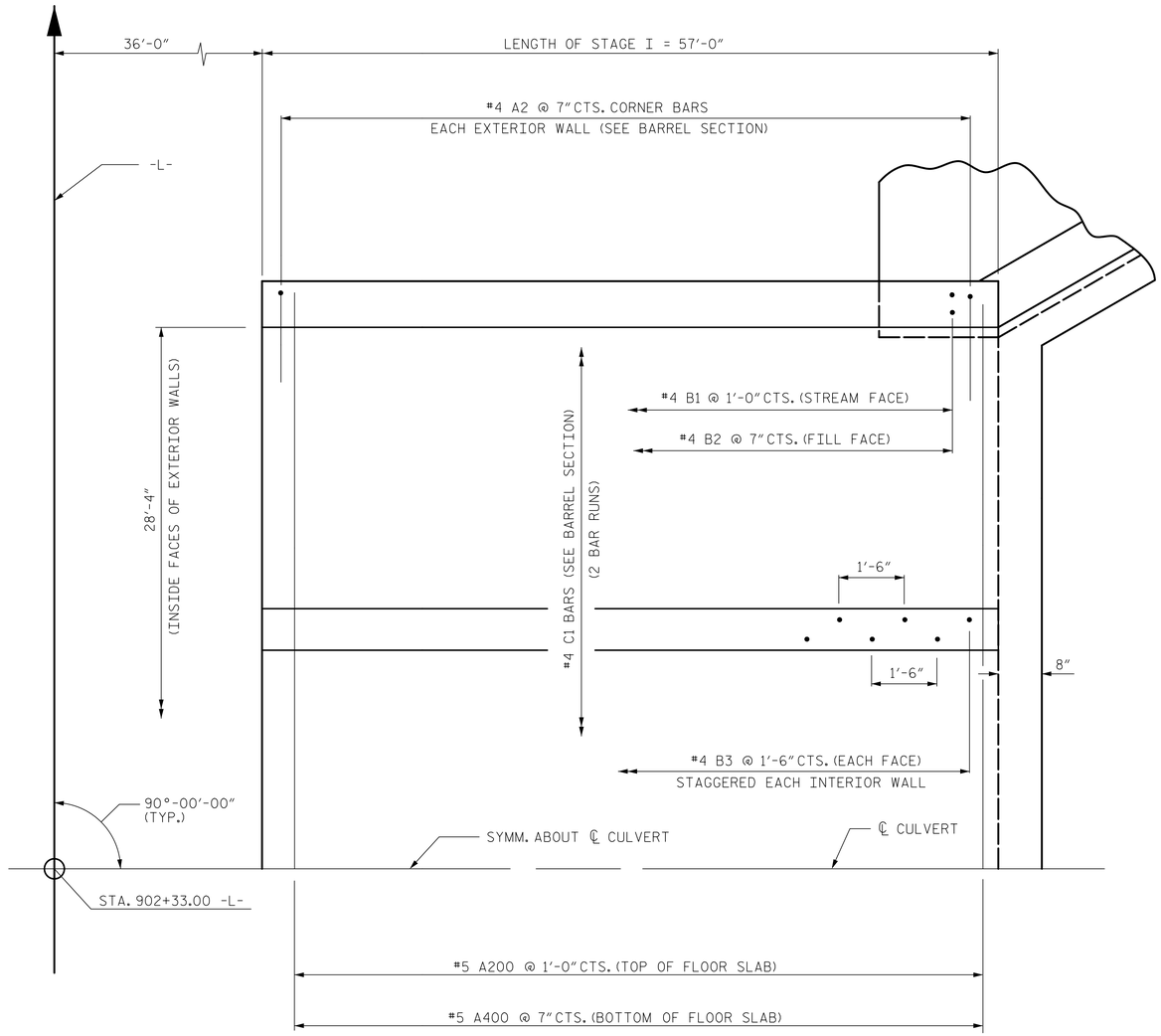
ASSEMBLED BY :	ZCS	DATE :	9/21
CHECKED BY :	MGC	DATE :	10/21
DRAWN BY : JEM	8/89	REV. 6/19	MAA/THC
CHECKED BY : ARB	8/89		

FILE NAME: 414_005_I-5987B_Site_18_SMU_CU_003.dgn

SITE 18



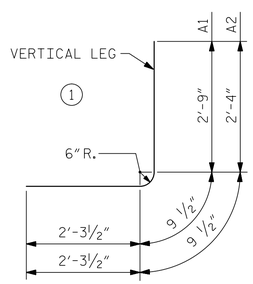
PART PLAN - ROOF SLAB



PART PLAN - FLOOR SLAB

NOTE: FOR S1 BARS IN FLOOR SLAB & FOOTING, SEE WING SHEET.

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
A200	#5	2'-4"
A400	#5	2'-4"
"B"	#4	1'-10"
"C"	#4	1'-10"

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	196	#4	1	5'-10"	764
A2	196	#4	1	5'-5"	709
A100	69	#5	STR	29'-6"	2123
A200	57	#5	STR	29'-6"	1754
A300	98	#5	STR	29'-6"	3015
A400	98	#5	STR	29'-6"	3015
B1	114	#4	STR	9'-2"	698
B2	196	#4	STR	7'-4"	960
B3	150	#4	STR	9'-2"	919
C1	216	#4	STR	29'-4"	4232
G1	4	#5	STR	29'-6"	123
REINFORCING STEEL					18,312 LBS

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 902+33.00 -L-

SHEET 4 OF 9

ASSEMBLED BY :	ZCS	DATE :	10/21
CHECKED BY :	MGC	DATE :	10/21
DRAWN BY : TSS	11/90	REV. 6/19	MAA/THC
CHECKED BY : ARB	11/90		

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT STAGE I

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
5FBCC2F3A4DC413...
4/12/2022 | 10:50 AM EDT

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SUITE 200
RALEIGH NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

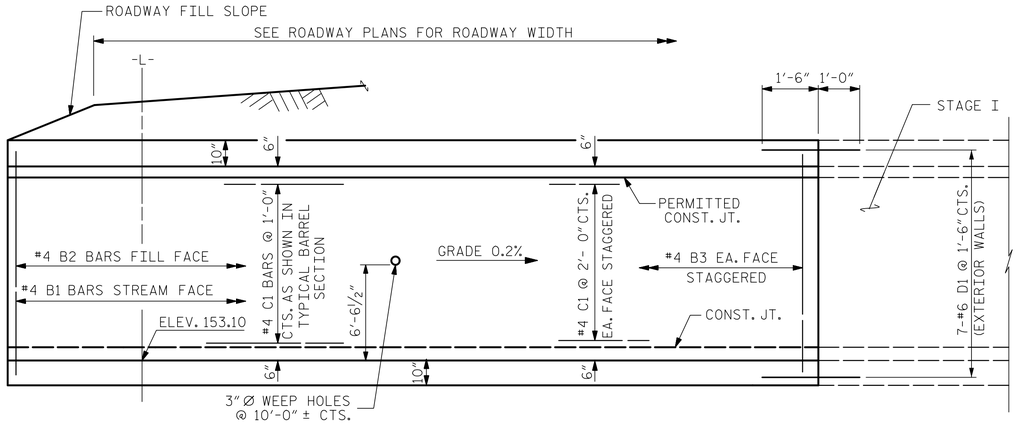
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

SHEET NO. C18-4

TOTAL SHEETS 9

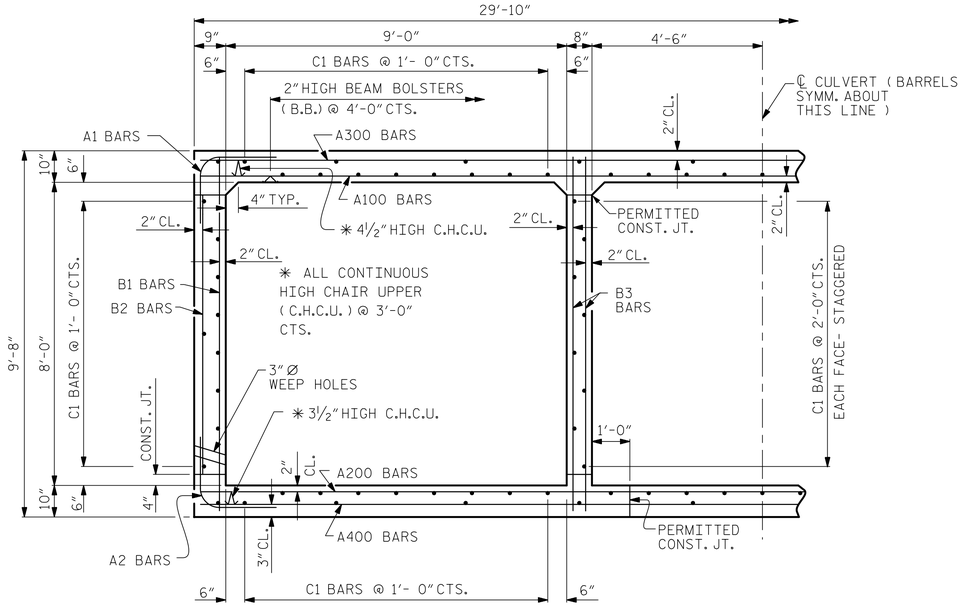
FILE NAME: 414_007_I-5987B_Site_18_SMU_CU_004.dgn

SITE 18



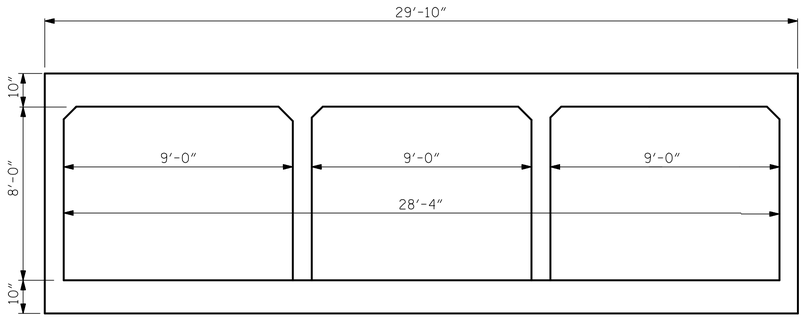
EXTERIOR WALL INTERIOR WALL

CULVERT SECTION NORMAL TO ROADWAY



RIGHT ANGLE SECTION OF BARREL

THERE ARE 108 "C" BARS IN SECTION OF BARREL.



END ELEVATION

STAGE II QUANTITIES

CLASS A CONCRETE		
BARREL @	2.693 CY/FT	110.4 C.Y.
TOTAL		110.4 C.Y.
REINFORCING STEEL		
BARREL		13,286 LBS.
TOTAL		13,286 LBS.
CULVERT EXCAVATION		LUMP SUM
FOUNDATION COND. MAT'L.		98 TONS
FOUNDATION COND. GEOTEXTILE		335 SQ. YDS.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 902+33.00 -L-

SHEET 5 OF 9

ASSEMBLED BY :	ZCS	DATE :	9/21
CHECKED BY :	MGC	DATE :	10/21
DRAWN BY : JEM	8/89	REV. 6/19	MAA/THC
CHECKED BY : ARB	8/89		

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CREEK, JR.

Digitally signed by M. G. Creek, Jr.

SFBCC2F3A4DC413...

4/12/2022 | 10:50 AM EDT

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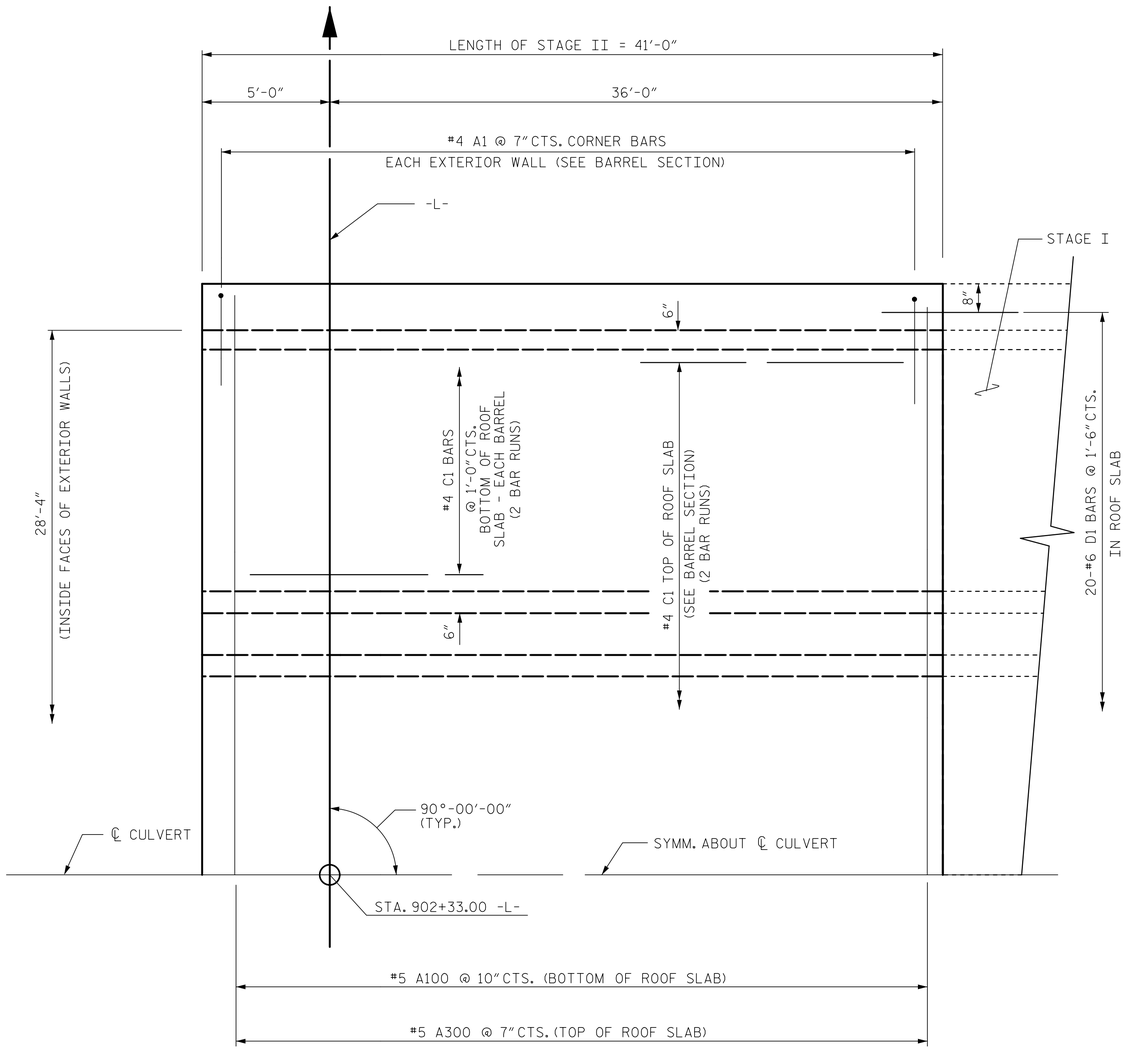
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

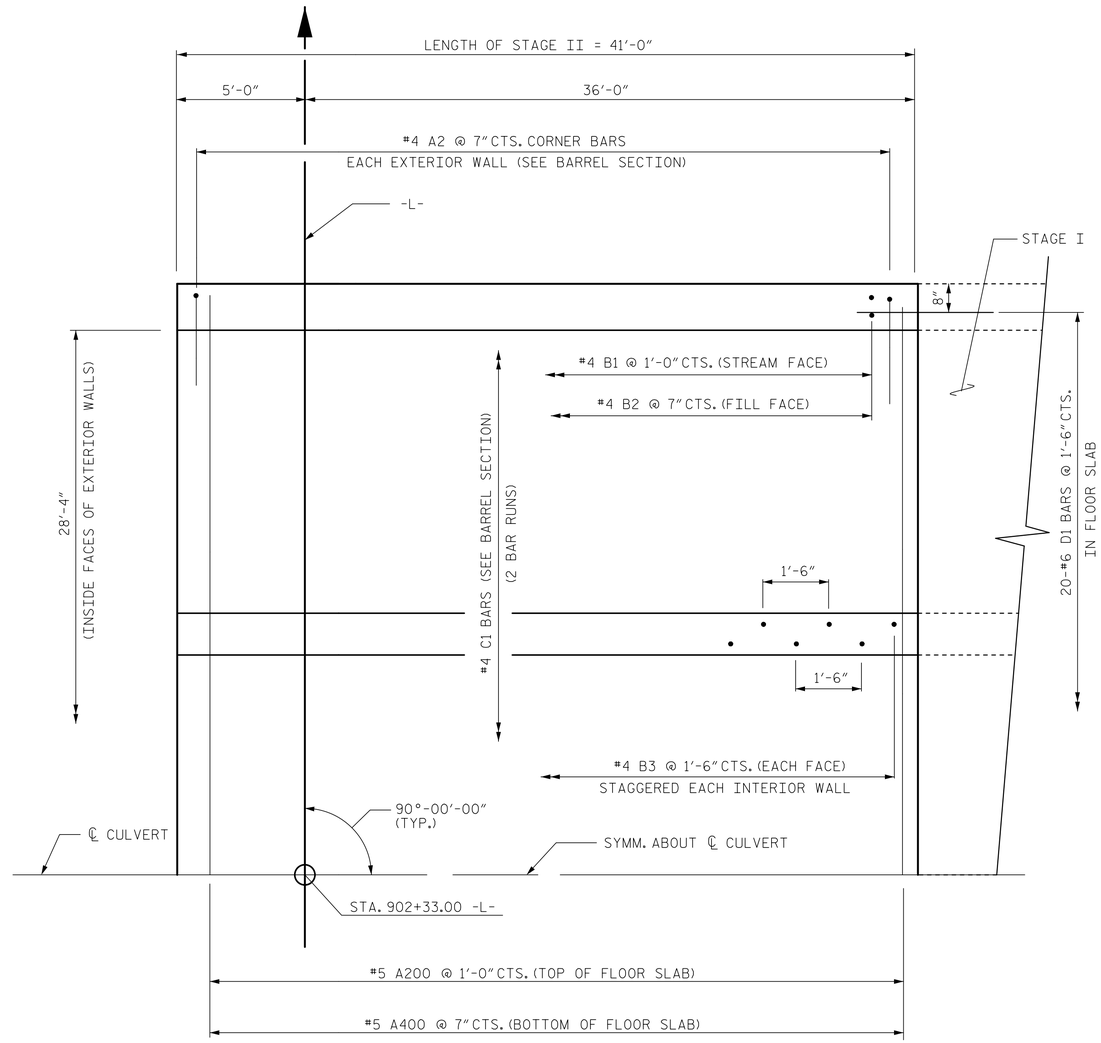
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW STAGE II

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-5
1			3			TOTAL SHEETS
2			4			9

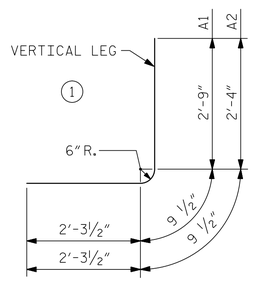


PART PLAN - ROOF SLAB



PART PLAN - FLOOR SLAB

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
A200	#5	2'-4"
A400	#5	2'-4"
"B"	#4	1'-10"
"C"	#4	1'-10"

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	140	#4	1	5'-10"	546
A2	140	#4	1	5'-5"	507
A100	49	#5	STR	29'-6"	1508
A200	41	#5	STR	29'-6"	1262
A300	70	#5	STR	29'-6"	2154
A400	70	#5	STR	29'-6"	2154
B1	82	#4	STR	9'-2"	502
B2	140	#4	STR	7'-4"	686
B3	112	#4	STR	9'-2"	686
C1	216	#4	STR	21'-4"	3078
D1	54	#6	STR	2'-6"	203
REINFORCING STEEL					13,286 LBS

PROJECT NO. I-5987B
ROBESON COUNTY
STATION: 902+33.00 -L-

SHEET 6 OF 9

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL C. CHEEK, JR.
Docusigned by: Marshall C. Cheek, Jr.
5FBCC2F3A4DC413...
4/12/2022 | 10:50 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

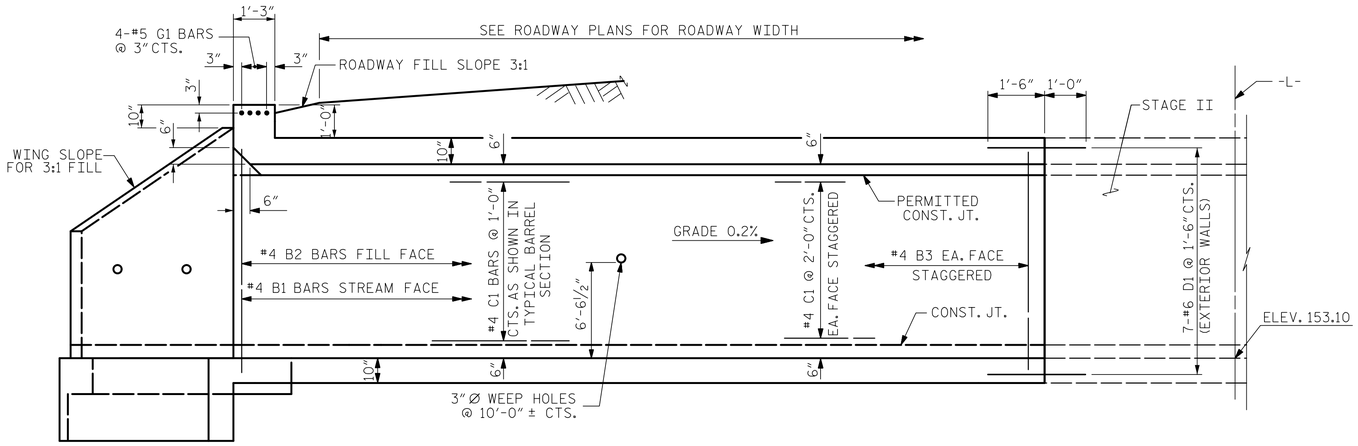
TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT STAGE II

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-6
1			3			TOTAL SHEETS
2			4			9

ASSEMBLED BY :	ZCS	DATE :	10/21
CHECKED BY :	MGC	DATE :	10/21
DRAWN BY : TSS	11/90	REV. 6/19	MAA/THC
CHECKED BY : ARB	11/90		

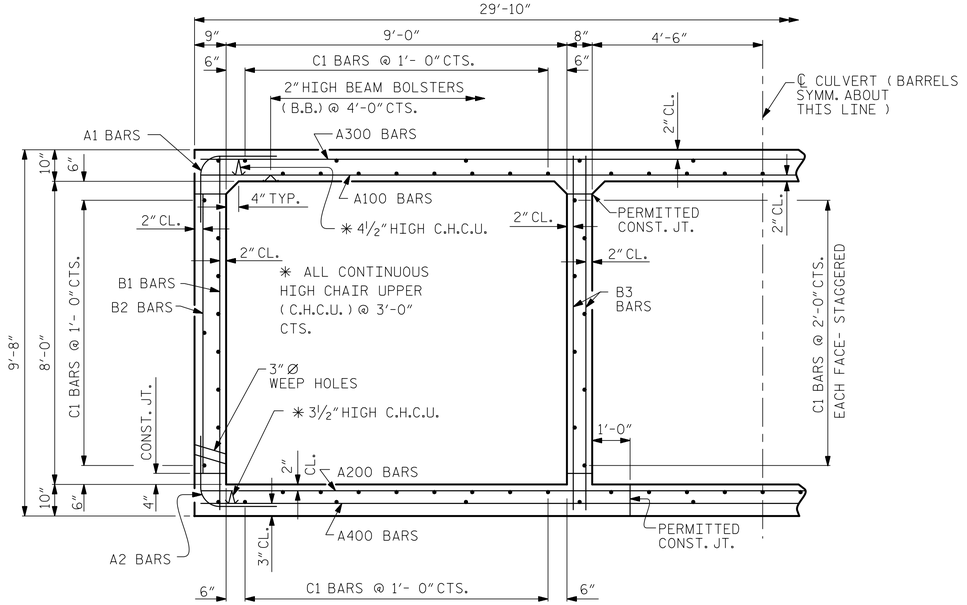
FILE NAME: 414_011_I-5987B_Site_18_SMU_CU_006.dgn

SITE 18



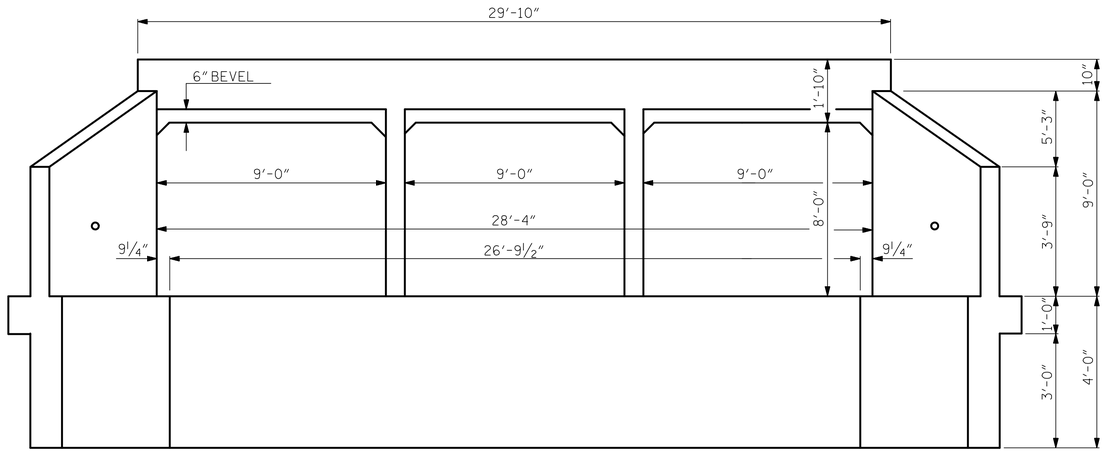
EXTERIOR WALL INTERIOR WALL

CULVERT SECTION NORMAL TO ROADWAY



RIGHT ANGLE SECTION OF BARREL

THERE ARE 108 "C" BARS IN SECTION OF BARREL.



END ELEVATION

STAGE III QUANTITIES		
CLASS A CONCRETE		
BARREL @ 2.693 CY/FT	234.3	C.Y.
WINGS, ETC.	22.0	C.Y.
TOTAL	256.3	C.Y.
REINFORCING STEEL		
BARREL	28,105	LBS.
WINGS, ETC.	1,028	LBS.
TOTAL	29,133	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	208 TONS	
FOUNDATION COND. GEOTEXTILE	690 SQ. YDS.	

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 902+33.00 -L-

SHEET 7 OF 9

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL C. GREEK, JR.

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

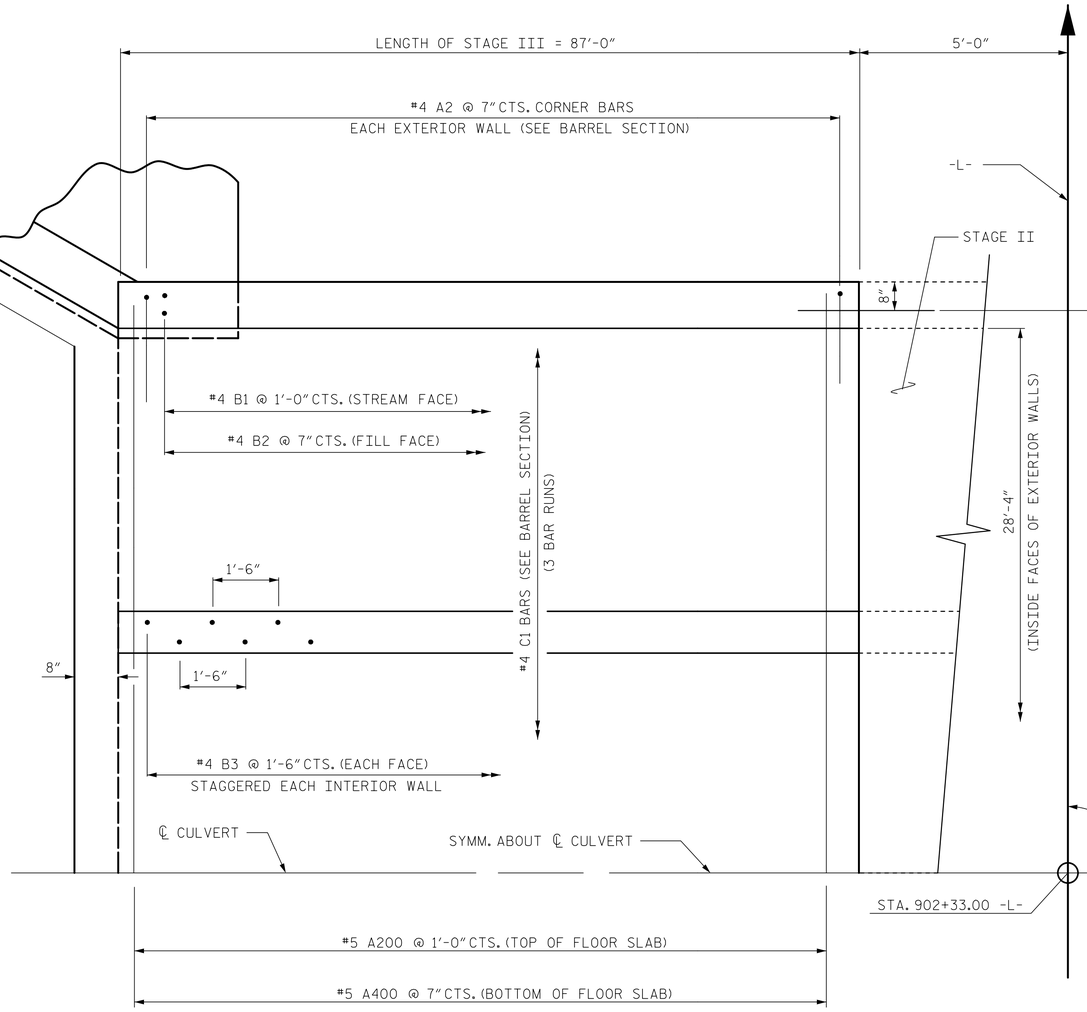
TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW STAGE III

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-7
1			3			TOTAL SHEETS
2			4			9

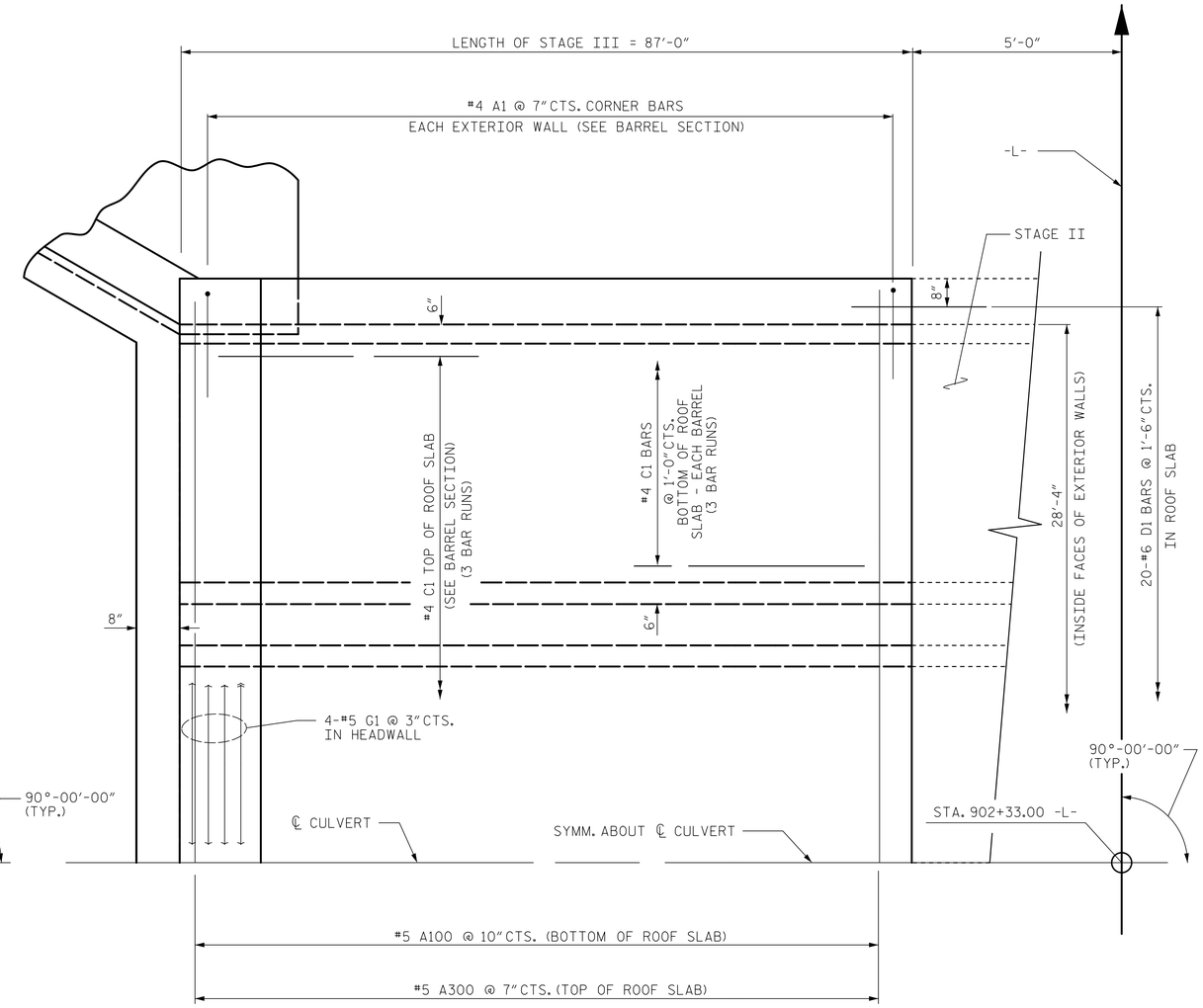
ASSEMBLED BY :	ZCS	DATE :	9/21
CHECKED BY :	MGC	DATE :	10/21
DRAWN BY : JEM	8/89	REV. 6/19	MAA/THC
CHECKED BY : ARB	8/89		

FILE NAME: 414_013_I-5987B_Site_18_SMU_CU_007.dgn

SITE 18



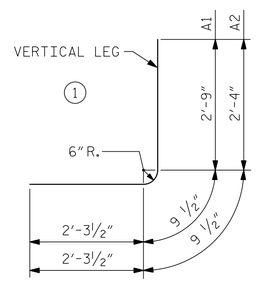
PART PLAN - FLOOR SLAB



PART PLAN - ROOF SLAB

NOTE: FOR S1 BARS IN FLOOR SLAB & FOOTING, SEE WING SHEET.

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
A200	#5	2'-4"
A400	#5	2'-4"
"B"	#4	1'-11"
"C"	#4	1'-11"

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	298	#4	1	5'-10"	1161
A2	298	#4	1	5'-5"	1078
A100	105	#5	STR	29'-6"	3231
A200	87	#5	STR	29'-6"	2677
A300	149	#5	STR	29'-6"	4585
A400	149	#5	STR	29'-6"	4585
B1	174	#4	STR	9'-2"	1065
B2	298	#4	STR	7'-4"	1460
B3	230	#4	STR	9'-2"	1408
C1	324	#4	STR	30'-2"	6529
G1	4	#5	STR	29'-6"	123
D1	54	#6	STR	2'-6"	203
REINFORCING STEEL					28,105 LBS

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 902+33.00 -L-

SHEET 8 OF 9

ASSEMBLED BY :	ZCS	DATE :	10/21
CHECKED BY :	MGC	DATE :	10/21
DRAWN BY : TSS	11/90	REV. 6/19	MAA/THC
CHECKED BY : ARB	11/90		

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER
Docusigned by: Marshall A. Cheek, Jr.
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4/12/2022 | 10:50 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

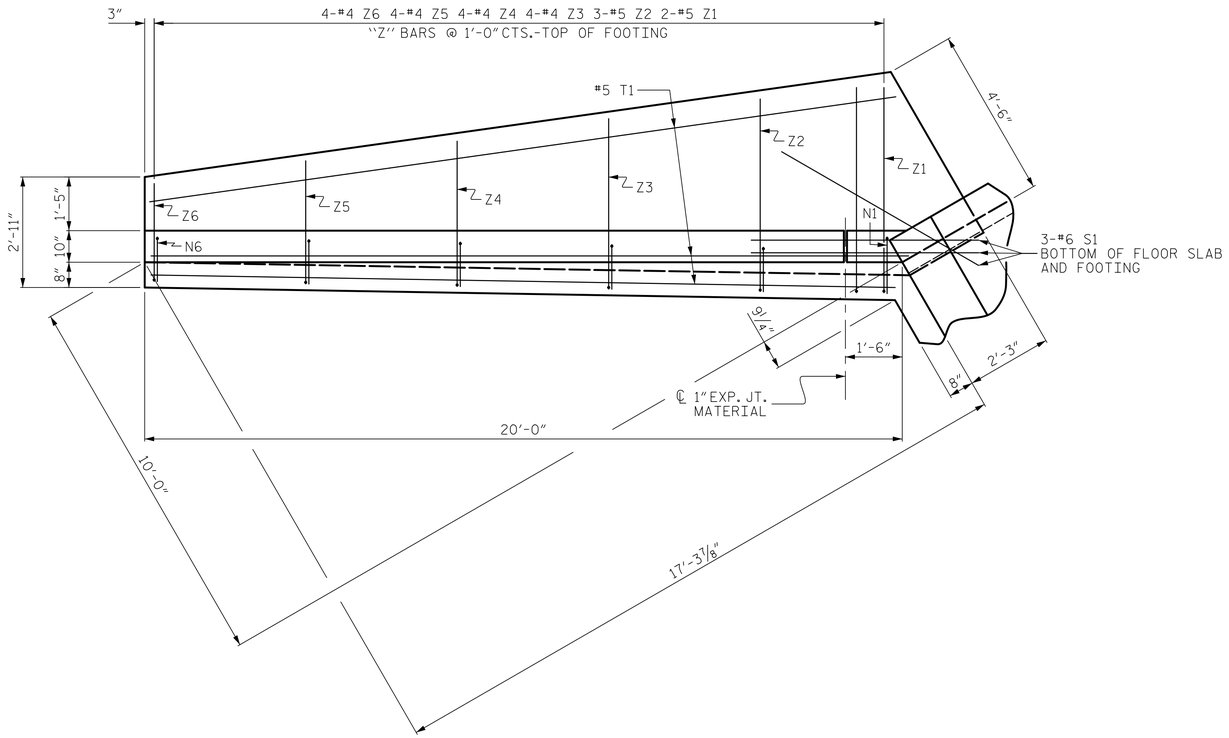
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 9 FT. X 8 FT. CONCRETE BOX CULVERT STAGE III

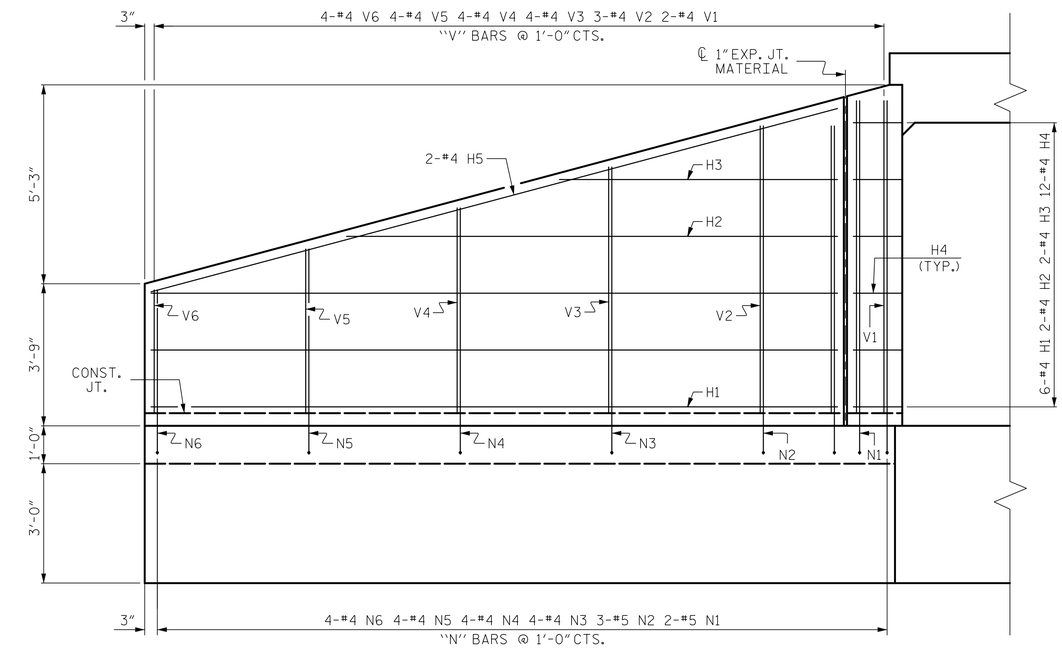
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-8
1			3			TOTAL SHEETS
2			4			9

FILE NAME: 414_015_I-5987B_Site_18_SMU_CU_008.dgn

SITE 18

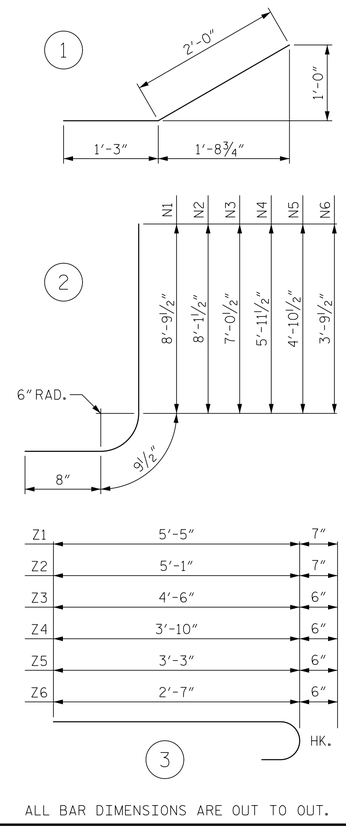


PLAN



ELEVATION

BAR TYPES



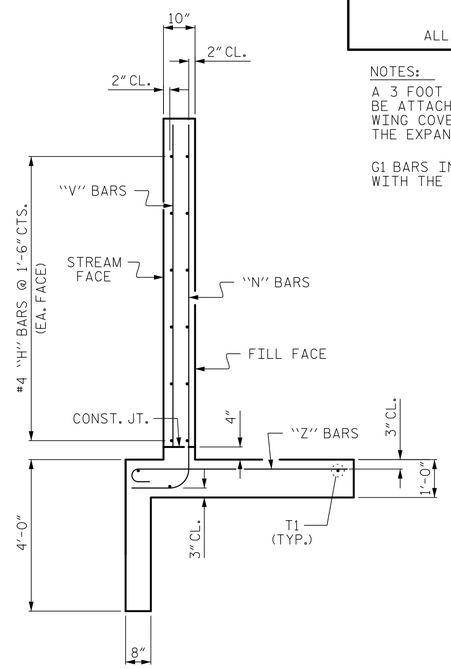
ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	24	#4	STR	18'-1"	290
H2	8	#4	STR	12'-11"	69
H3	8	#4	STR	7'-4"	39
H4	48	#4	1	3'-3"	104
H5	8	#4	STR	18'-9"	100
N1	8	#5	2	10'-3"	86
N2	12	#5	2	9'-7"	120
N3	16	#4	2	8'-6"	91
N4	16	#4	2	7'-5"	79
N5	16	#4	2	6'-4"	68
N6	16	#4	2	5'-3"	56
S1	12	#6	STR	6'-0"	108
T1	12	#5	STR	19'-8"	246
V1	8	#4	STR	8'-2"	44
V2	12	#4	STR	7'-5"	59
V3	16	#4	STR	6'-4"	68
V4	16	#4	STR	5'-4"	57
V5	16	#4	STR	4'-3"	45
V6	16	#4	STR	3'-3"	35
Z1	8	#5	3	6'-0"	50
Z2	12	#5	3	5'-8"	71
Z3	16	#4	3	5'-0"	53
Z4	16	#4	3	4'-2"	45
Z5	16	#4	3	3'-9"	40
Z6	16	#4	3	3'-1"	33

REINFORCING STEEL
FOR 4 WINGS 2056 LBS

CLASS A CONCRETE
4 WINGS 35.9 CY
2 HEADWALLS 2.8 CY
2 END CURTAIN WALLS 5.3 CY
TOTAL 44.0 CY



TYPICAL WING SECTION

NOTES:

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.

G1 BARS IN HEADWALL ARE INCLUDED WITH THE BARREL REINFORCING STEEL.

PROJECT NO. I-5987B

ROBESON COUNTY

STATION: 902+33.00 -L-

SHEET 9 OF 9

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER
DOCUSIGNED BY & CHECKED BY
4/12/2022 | 10:50 AM EDT

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TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

WINGS FOR CONCRETE BOX CULVERT

H = 8'-0" SLOPE = 3:1
90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C18-9
1			3			TOTAL SHEETS
2			4			9

ASSEMBLED BY :	STM	DATE :	5/21
CHECKED BY :	ZCS	DATE :	10/21
DRAWN BY : CCJ	10/99	REV. 6/19	MAA/THC
CHECKED BY : RWW	03/00		

FILE NAME: 414_017_I-5987B_Site_18_SMU_CU_009.dgn

SITE 18

STANDARD NOTES

DESIGN DATA:

SPECIFICATIONS - - - - - - - - - - - - - - - - -	A.A.S.H.T.O. (CURRENT)
LIVE LOAD -	SEE PLANS
IMPACT ALLOWANCE - - - - - - - - - - - - - - - -	SEE A.A.S.H.T.O.
STRESS IN EXTREME FIBER OF STRUCTURAL STEEL - AASHTO M270 GRADE 36 - -	20,000 LBS. PER SQ. IN.
- AASHTO M270 GRADE 50W - -	27,000 LBS. PER SQ. IN.
- AASHTO M270 GRADE 50 - -	27,000 LBS. PER SQ. IN.
REINFORCING STEEL IN TENSION - GRADE 60 - - -	24,000 LBS. PER SQ. IN.
CONCRETE IN COMPRESSION - - - - - - - - - - - -	1,200 LBS. PER SQ. IN.
CONCRETE IN SHEAR - - - - - - - - - - - - - - -	SEE A.A.S.H.T.O.
STRUCTURAL TIMBER - TREATED OR UNTREATED EXTREME FIBER STRESS - - -	1,800 LBS. PER SQ. IN.
COMPRESSION PERPENDICULAR TO GRAIN OF TIMBER - - - - -	375 LBS. PER SQ. IN.
EQUIVALENT FLUID PRESSURE OF EARTH - - - - -	30 LBS. PER CU. FT. (MINIMUM)

MATERIAL AND WORKMANSHIP:

EXCEPT AS MAY OTHERWISE BE SPECIFIED ON PLANS OR IN THE SPECIAL PROVISIONS, ALL MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE 2018 "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 ¾" WITH THE FOLLOWING EXCEPTIONS: TOP CORNERS OF CURBS MAY BE ROUNDED TO 1½" RADIUS WHICH IS BUILT INTO CURB FORMS; CORNERS OF TRANSVERSE FLOOR EXPANSION JOINTS SHALL BE ROUNDED WITH A ¼" 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 ¼" 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 ⅞" Ø SHEAR STUDS FOR THE ¾" Ø STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 - ⅞" Ø STUDS FOR 4 - ¾" Ø STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF ⅞" Ø STUDS ALONG THE BEAM AS SHOWN FOR ¾" Ø STUDS BASED ON THE RATIO OF 3 - ⅞" Ø STUDS FOR 4 - ¾" Ø STUDS. STUDS OF THE LENGTH SPECIFIED ON THE PLANS MUST BE PROVIDED. THE MAXIMUM SPACING SHALL BE 2'-0".

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

WITH THE SOLE EXCEPTION OF EDGES AT SURFACES WHICH BEAR ON OTHER SURFACES, ALL SHARP EDGES AND ENDS OF SHAPES AND PLATES SHALL BE SLIGHTLY ROUNDED BY SUITABLE MEANS TO A RADIUS OF APPROXIMATELY 1/16 INCH OR EQUIVALENT FLAT SURFACE AT A SUITABLE ANGLE PRIOR TO PAINTING, GALVANIZING, OR METALLIZING.

HANDRAILS AND POSTS:

METAL STANDARDS AND FACES OF THE CONCRETE END POSTS FOR THE METAL RAIL SHALL BE SET NORMAL TO THE GRADE OF THE CURB, UNLESS OTHERWISE SHOWN ON PLANS. THE METAL RAIL AND TOPS OF CONCRETE POSTS USED WITH THE ALUMINUM RAIL SHALL BE BUILT PARALLEL TO THE GRADE OF THE CURB.

METAL HANDRAILS SHALL BE IN ACCORDANCE WITH THE PLANS. RAILS SHALL BE AS MANUFACTURED FOR BRIDGE RAILING. CASTINGS SHALL BE OF A UNIFORM APPEARANCE. FINS 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.

ENGLISH

JANUARY, 1990

REV. 6-16-95 EEM (c) RGW REV. 5-7-03 RWW (c) JTE REV. 10-1-11 MAA (c) GM
REV. 8-16-99 RWW (c) LES REV. 5-1-06 TLA (c) GM REV. 12-17 MAA (c) THC
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