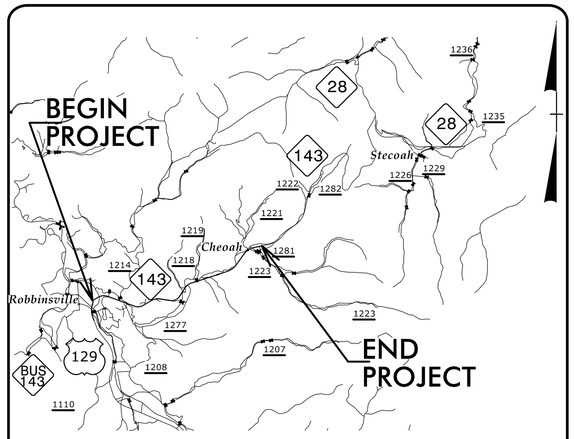
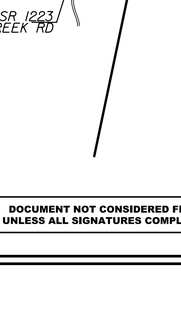
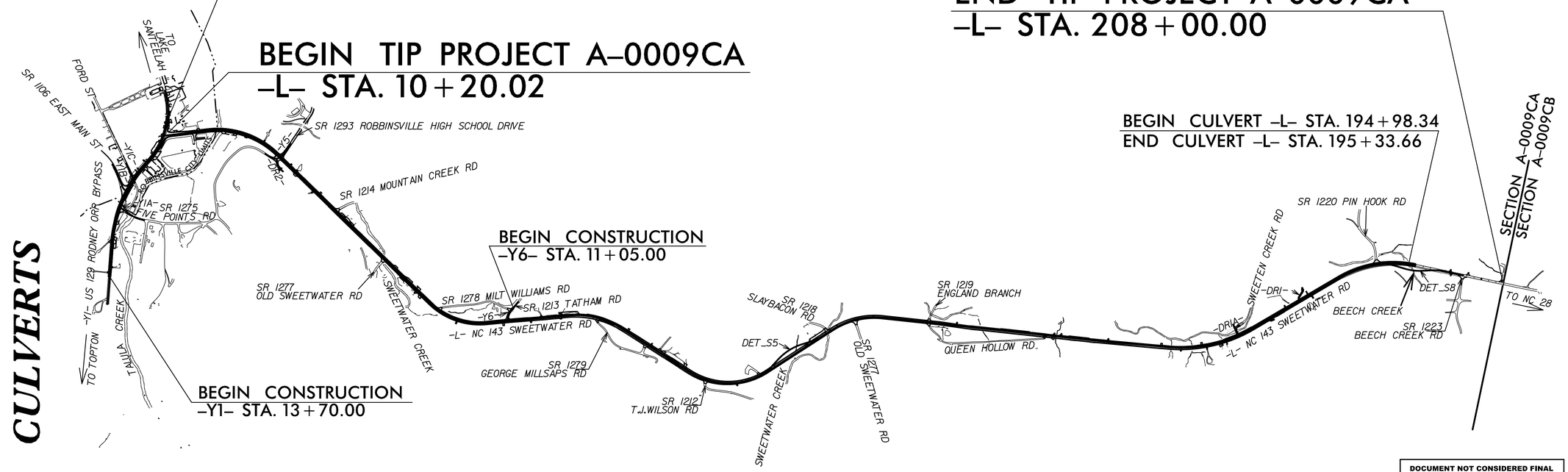






TIP PROJECT: A-0009CA

CONTRACT: C204731

CULVERTS

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

GRAHAM COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	A-0009CA		

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
32572.1.FS10	APD-0074(178)	PE
32572.2.13	0143012	ROW
32572.2.16	UNASSIGNED	UTIL.
32572.3.13	0129007	CONST.

LOCATION: UPGRADE US 129 FROM SOUTH OF SR 1275 (FIVE POINTS ROAD) TO NC 143 AND UPGRADE NC 143 FROM US 129 TO SR 1223 (BEECH CREEK ROAD)

TYPE OF WORK: GRADING, PAVING, DRAINAGE, CULVERTS, RETAINING WALLS, AND SIGNALS

VICINITY MAP

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

DESIGN DATA

ADT 2019 = 6300
ADT 2045 = 8800
K = 11 %
D = 57.5 %
T = 7 % *
V = 50MPH - BEGIN PROJECT TO FIVE POINTS RD
60MPH - FIVE POINTS RD TO END OF PROJECT
* TTST = 2% DUAL = 5%
FUNC CLASS = RURAL ARTERIAL REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT A-0009CA	=	3.720 MILES
LENGTH STRUCTURE TIP PROJECT A-0009CA	=	0.007 MILES
TOTAL LENGTH TIP PROJECT A-0009CA	=	3.727 MILES

NCDOT CONTACT: WANDA H. AUSTIN, PE

PLANS PREPARED BY:

TGS ENGINEERS
201 W. MARION ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

PLANS PREPARED FOR:

NORTH CAROLINA DEPARTMENT OF TRANSPORATION
DIVISION 14
252 Webster Rd
Sylva, NC 28779

LETTING DATE:
AUGUST 16, 2022

MARC CHEEK, PE
STRUCTURES DESIGN ENGINEER

2018 STANDARD SPECIFICATIONS

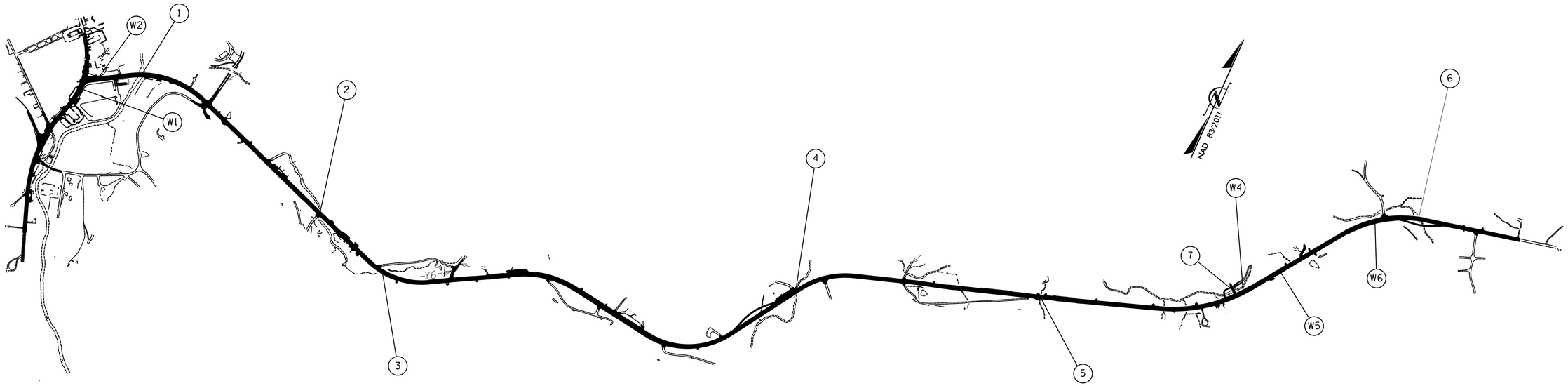
STRUCTURES DESIGN ENGINEER

SEAL 20125
MARSHALL G. CHEEK, JR.

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

7/14/2022 | 10:58 AM EDT

7/14/2022
$$$$$$$$$$$$DGN$$$$$$$$$$$$$$$$$$$$$
User:ZSmith



INDEX

STR	STATION	DESCRIPTION	SHEET NUMBERS
1	17+34.70 -L-	QUADRUPLE 12 FT.X 12 FT. REINFORCED CONCRETE BOX CULVERT, LEFT & RIGHT HEADWALL/ WING EXTENSIONS	C1-1 THRU C1-5
2	46+41.00 -L-	TRIPLE 12 FT. X 9 FT. REINFORCED CONCRETE BOX CULVERT, LEFT & RIGHT EXTENSIONS	C2-1 THRU C2-14
3	108+27.00 -L-	SINGLE 7 FT. X 8 FT. REINFORCED CONCRETE BOX CULVERT	C3-1 THRU C3-6
4	113+69.00 -L-	TRIPLE 11 FT. X 9.2 FT. REINFORCED CONCRETE BOX CULVERT LEFT EXTENSION	C4-1 THRU C4-8
5	144+74.50 -L-	DOUBLE 66"Ø ALUMINUM PIPE WITH CONCRETE HEADWALLS	C5-1 THRU C5-4
6	195+16.00 -L-	DOUBLE 12 FT. X 8 FT. REINFORCED CONCRETE BOX CULVERT	C6-1 THRU C6-7
7	10+59.00 -DR1A-	SINGLE 16 FT. X 9 FT. REINFORCED CONCRETE BOX CULVERT	C7-1 THRU C7-8
W1,W2	32+55.00 -Y1- TO 34+15.00 -Y1- 11+79.00 -L- TO 12+50.00 -L-	CAST-IN-PLACE GRAVITY RETAINING WALL	W1/W2-1-THRU W1/W2-2
W4	167+75.00 -L- TO 171+75.00 -L-	SHORED MSE RETAINING WALL	W4-1 THRU W4-5
W5	175+35.00 -L- TO 176+65.00 -L-	CAST-IN-PLACE GRAVITY RETAINING WALL	W5-1 THRU W5-2
W6	186+75.00 -L- TO 192+05.00 -L-	SOIL NAIL RETAINING WALL	W6-1 THRU W6-2

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
DocuSigned by: 6/1/2022

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. A-0009CA

GRAHAM COUNTY

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

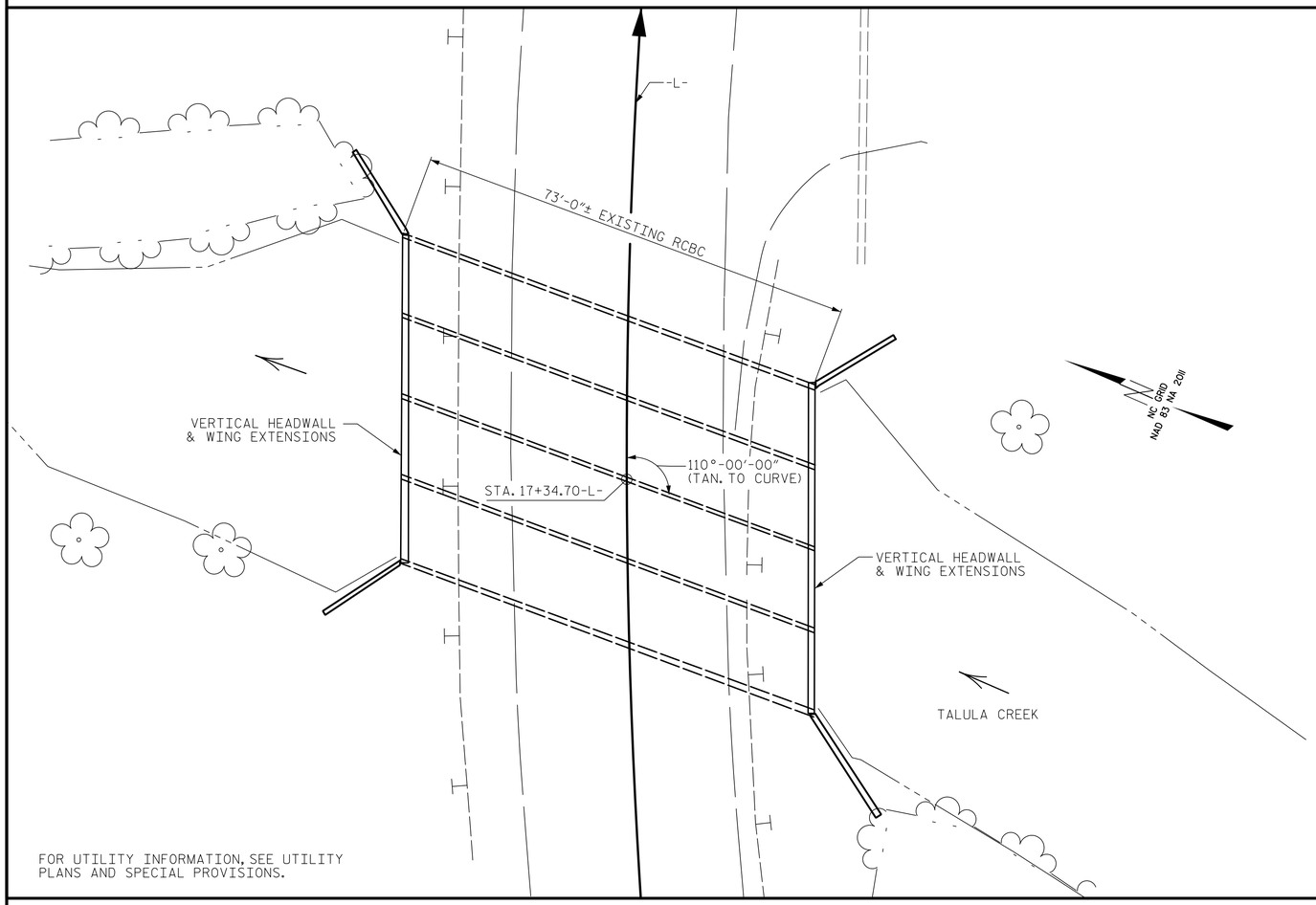
INDEX OF SHEETS

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

DRAWN BY : S.B. WILLIAMS DATE : 2-22
CHECKED BY : MGC DATE : 4-22

5/23/2022
X:\NCDOT\A-0009\Structures\A-0009CA\A-009_SMU_ IS_370000.dgn
User:smassinople

BENCH MARK #1: SPIKE NAIL SET IN BASE OF 18" MAPLE; 30 LT. OF STA. 14+27.88 -L-; ELEV. 1993.80



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

NOTES:

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

THE RESIDENT ENGINEER SHALL CHECK THE HEIGHT OF THE HEADWALL AND WING EXTENSIONS BEFORE CONSTRUCTION TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.

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

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

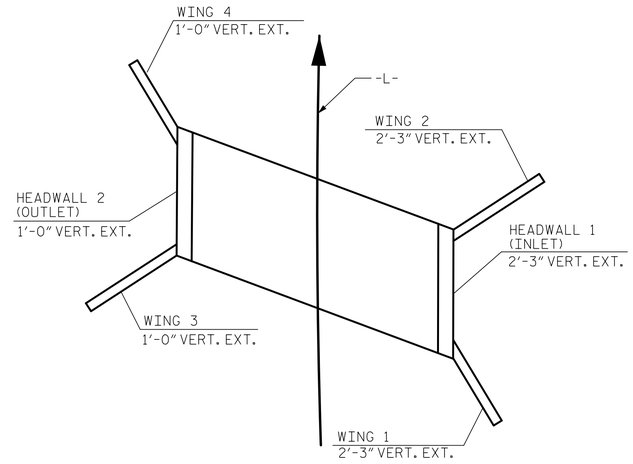
FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

F.A. PROJECT NO.: APD-0074(178)

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
INLET HEADWALL & WING EXTENSIONS	8.8	C.Y.
OUTLET HEADWALL & WING EXTENSIONS	4.0	C.Y.
TOTAL	12.8	C.Y.
REINFORCING STEEL		
INLET HEADWALL & WING EXTENSIONS	737	LBS.
OUTLET HEADWALL & WING EXTENSIONS	456	LBS.
TOTAL	1,193	LBS.



CULVERT LAYOUT

HYDRAULIC DATA

DESIGN DISCHARGE	= 5,080 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS
DESIGN HIGH WATER ELEVATION	= 1988.0'
BASE DISCHARGE (Q100)	= 6080 CFS
BASE HIGH WATER ELEVATION	= 1989.4'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 8850+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS
OVERTOPPING FLOOD ELEVATION	= 1994.0'

SAMPLE BAR REPLACEMENT

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

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

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 17+34.70 -L-

SHEET 1 OF 5 STRUCTURE NO. 370134

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

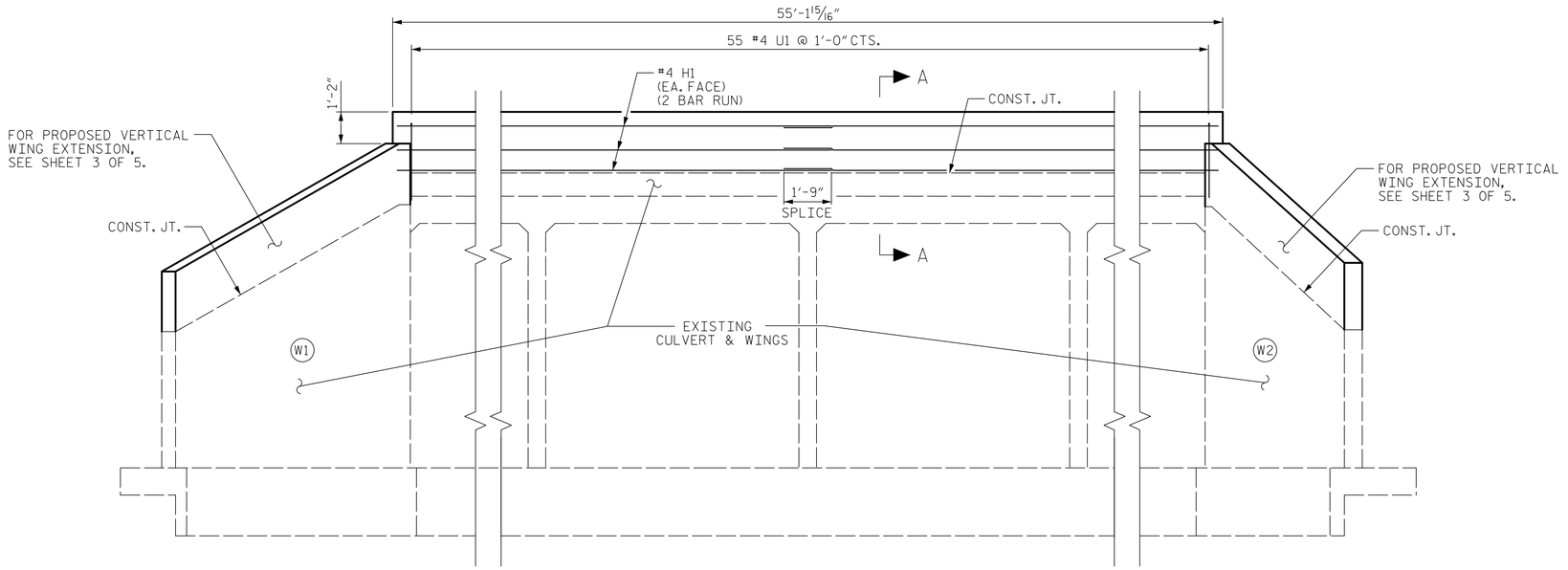
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

QUADRUPLE 12FT. x 12FT. CONCRETE BOX CULVERT
110° SKEW

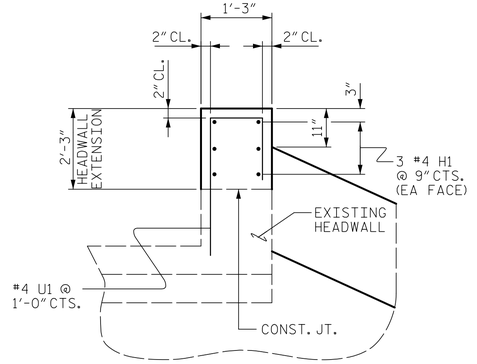
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-1
1			3			TOTAL SHEETS
2			4			5

STR. #1

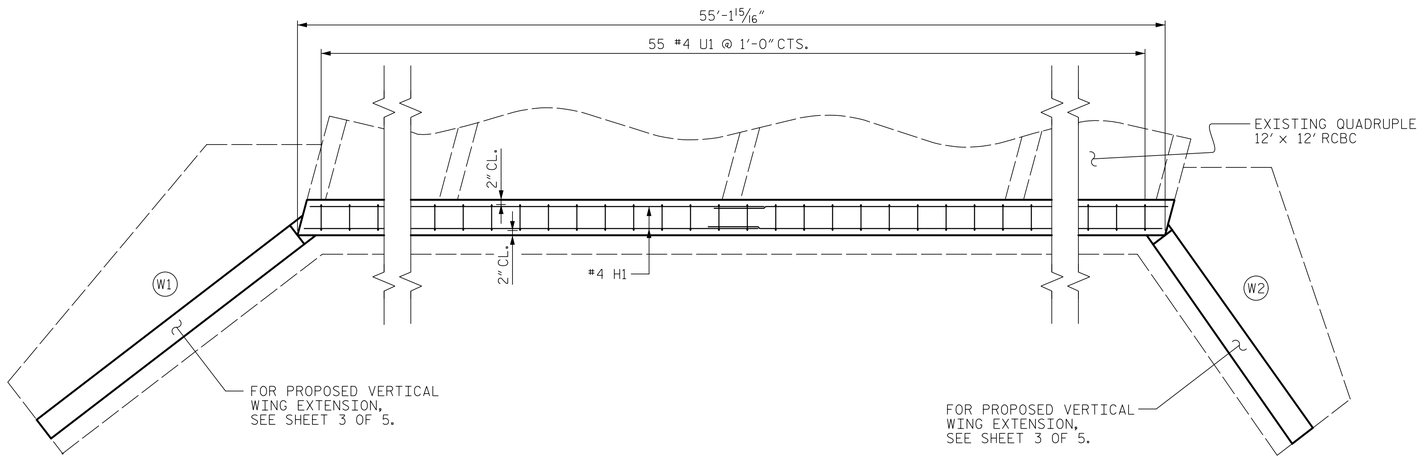
DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	4/22
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	4/22



ELEVATION OF HEADWALL & WING EXTENSIONS - INLET END



SECTION A-A



PLAN OF HEADWALL & WING EXTENSIONS - INLET END

DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	4/22
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	4/22

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 17+34.70 -L-

SHEET 2 OF 5

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

Marshall G. Cheek, Jr.

6/1/2022

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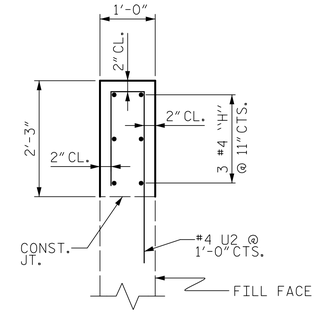
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

VERTICAL EXTENSION OF EXISTING INLET HEADWALL

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

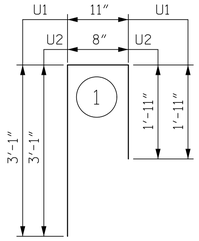
STR. #1



SECTION B-B

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL FOR EXISTING INLET HEADWALL EXTENSION

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	28'-4"	227
U1	55	#4	1	5'-11"	217

REINFORCING STEEL 444 LBS

CLASS A CONCRETE
HEADWALL EXTENSION 5.7 CY
TOTAL 5.7 CY

BILL OF MATERIAL FOR EXISTING WING W1 EXTENSION

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H2	6	#4	STR	21'-5"	86
U2	21	#4	1	5'-8"	79

REINFORCING STEEL 165 LBS

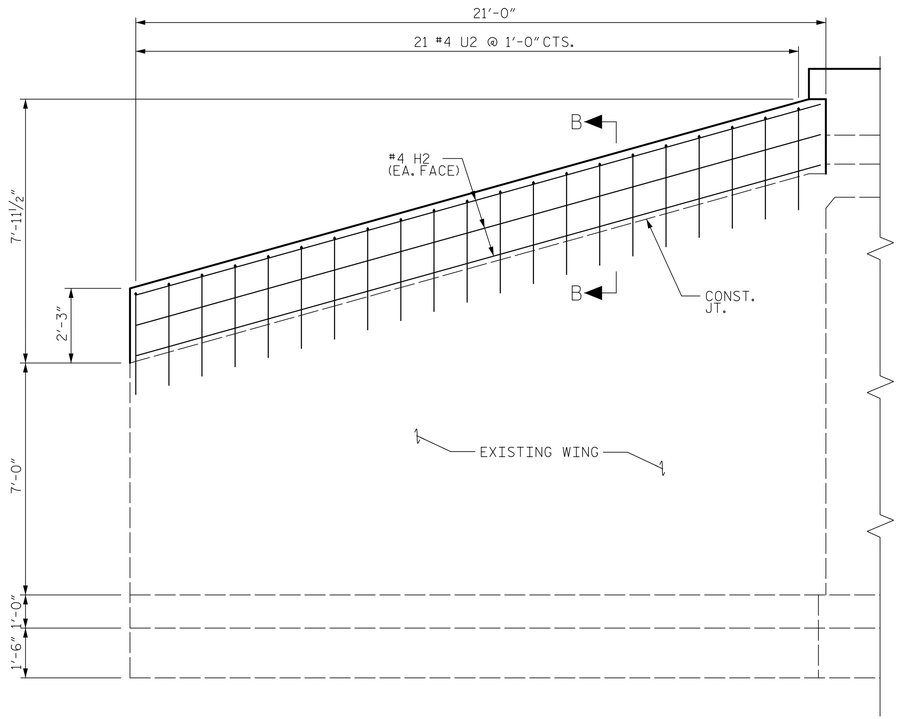
CLASS A CONCRETE
WING EXTENSION 1.8 CY
TOTAL 1.8 CY

BILL OF MATERIAL FOR EXISTING WING W2 EXTENSION

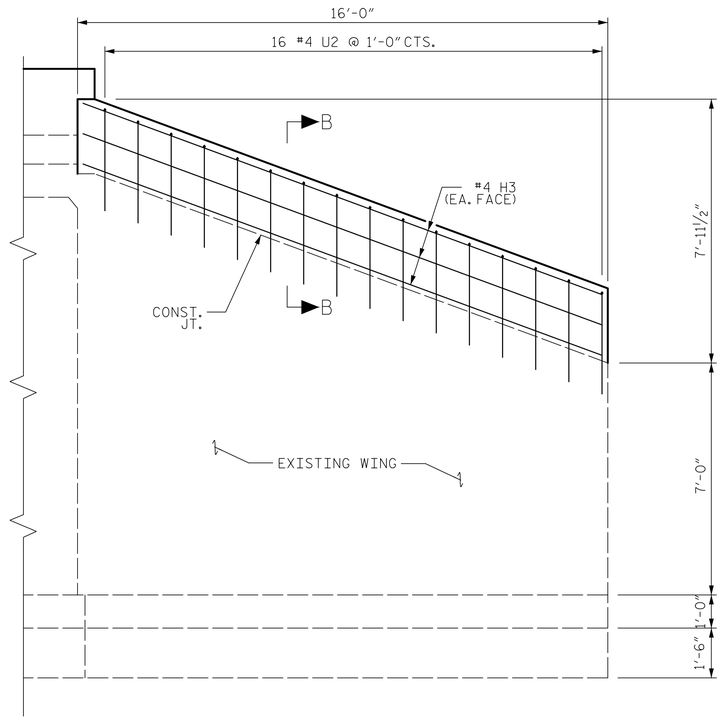
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H3	6	#4	STR	16'-8"	67
U2	16	#4	1	5'-8"	61

REINFORCING STEEL 128 LBS

CLASS A CONCRETE
WING EXTENSION 1.3 CY
TOTAL 1.3 CY



ELEVATION W1



ELEVATION W2

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 17+34.70 -L-

SHEET 3 OF 5

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

Marshall G. Cheek, Jr.

6/1/2022

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TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

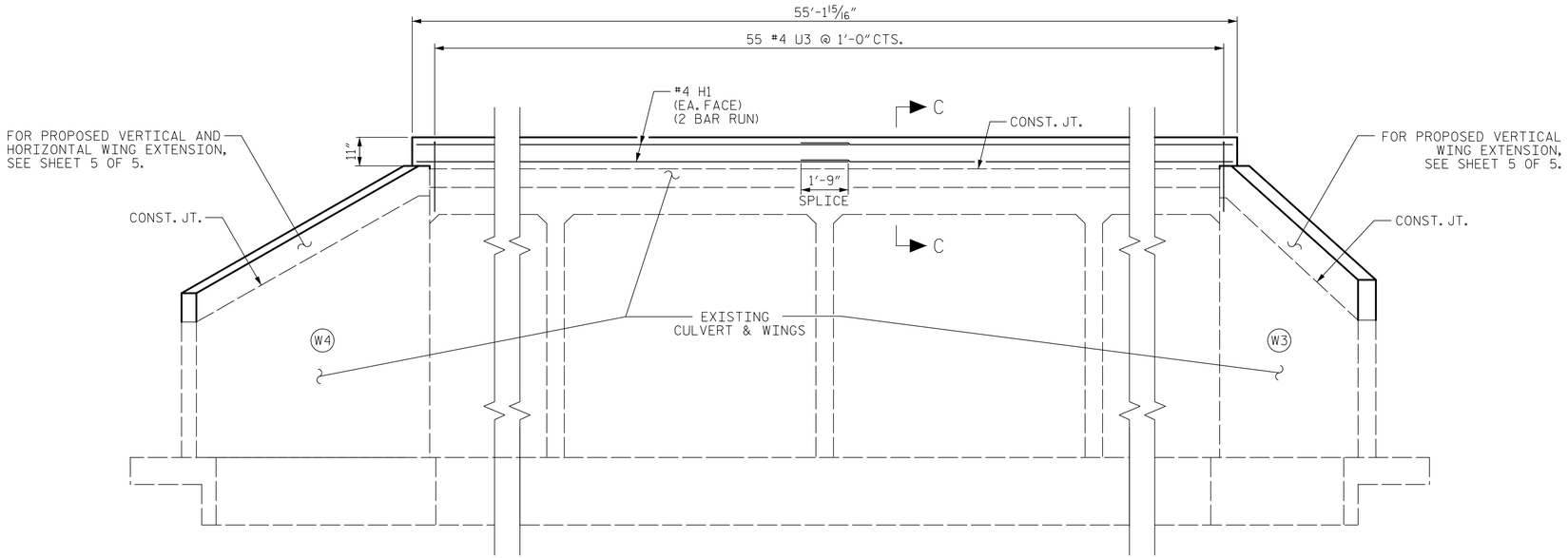
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

INLET END WING EXTENSIONS WINGS 1 & 2

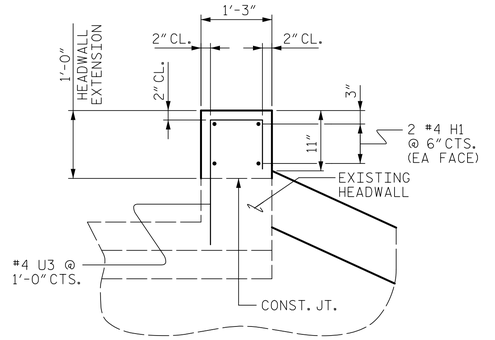
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-3
1			3			TOTAL SHEETS
2			4			5

DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	4/22
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	4/22

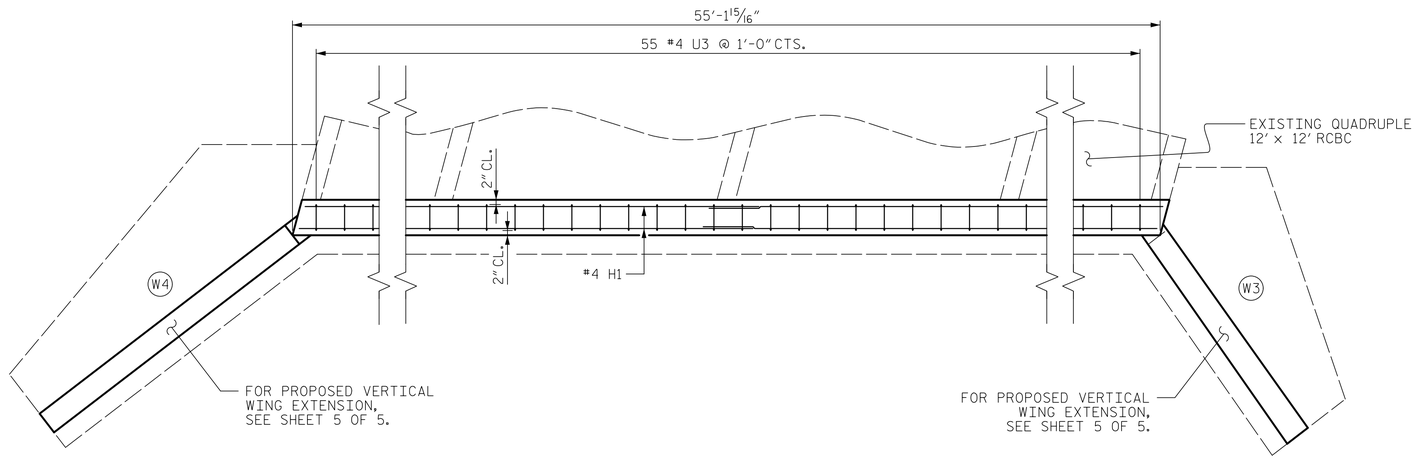
STR. #1



ELEVATION OF HEADWALL & WING EXTENSIONS - OUTLET END



SECTION C-C



PLAN OF HEADWALL & WING EXTENSIONS - OUTLET END

DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	4/22
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	4/22

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 17+34.70 -L-

SHEET 4 OF 5

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

Marshall G. Cheek, Jr.

6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

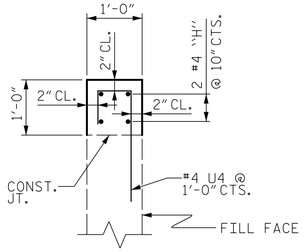
TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

VERTICAL EXTENSION OF EXISTING OUTLET HEADWALL

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

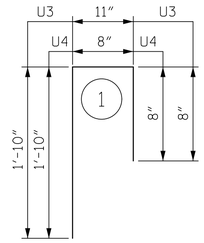
STR. #1



SECTION D-D

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL FOR EXISTING OUTLET HEADWALL EXTENSION

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	8	#4	STR	28'-4"	151
U3	55	#4	1	3'-5"	126

REINFORCING STEEL 277 LBS

CLASS A CONCRETE
HEADWALL EXTENSION 2.6 CY
TOTAL 2.6 CY

BILL OF MATERIAL FOR EXISTING WING W3 EXTENSION

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H4	4	#4	STR	16'-8"	45
U4	16	#4	1	3'-2"	34

REINFORCING STEEL 79 LBS

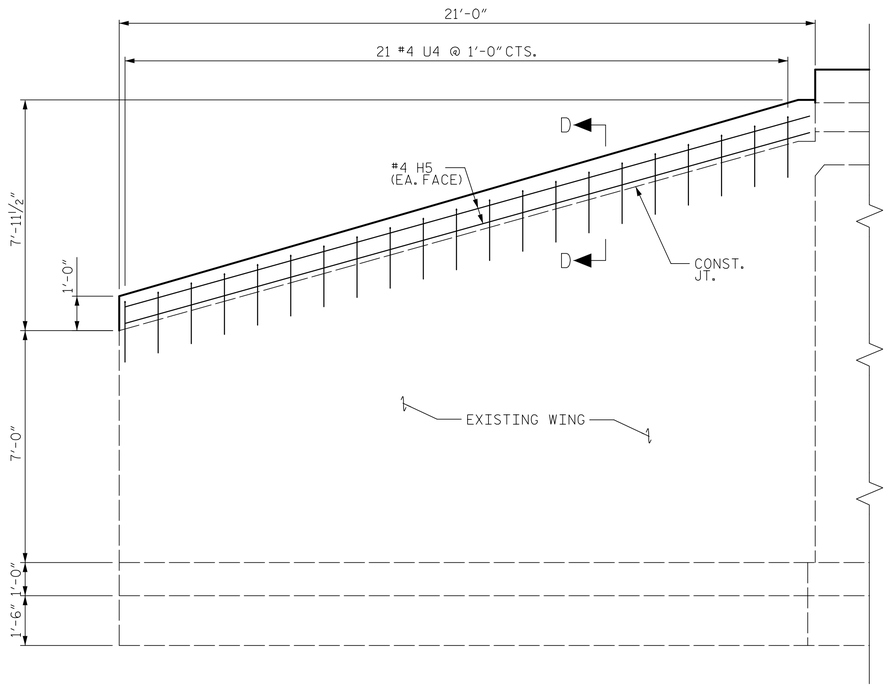
CLASS A CONCRETE
WING EXTENSION 0.6 CY
TOTAL 0.6 CY

BILL OF MATERIAL FOR EXISTING WING W4 EXTENSION

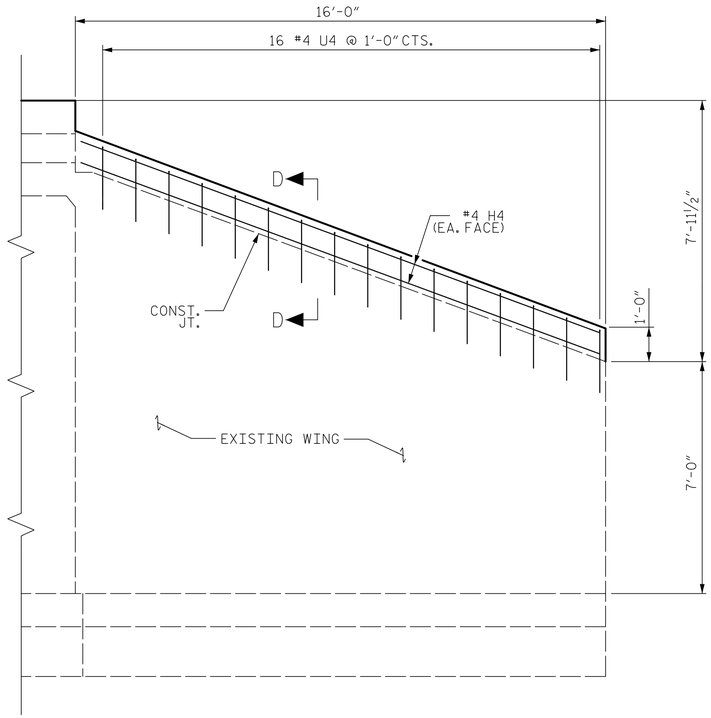
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H5	4	#4	STR	21'-1"	56
U4	21	#4	1	3'-2"	44

REINFORCING STEEL 100 LBS

CLASS A CONCRETE
WING EXTENSION 0.8 CY
TOTAL 0.8 CY



ELEVATION W4



ELEVATION W3

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 17+34.70 -L-

SHEET 5 OF 5

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 Marshall G. Creech, Jr. 6/1/2022 MARSHALL G. CREECH, JR. ENGINEER

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

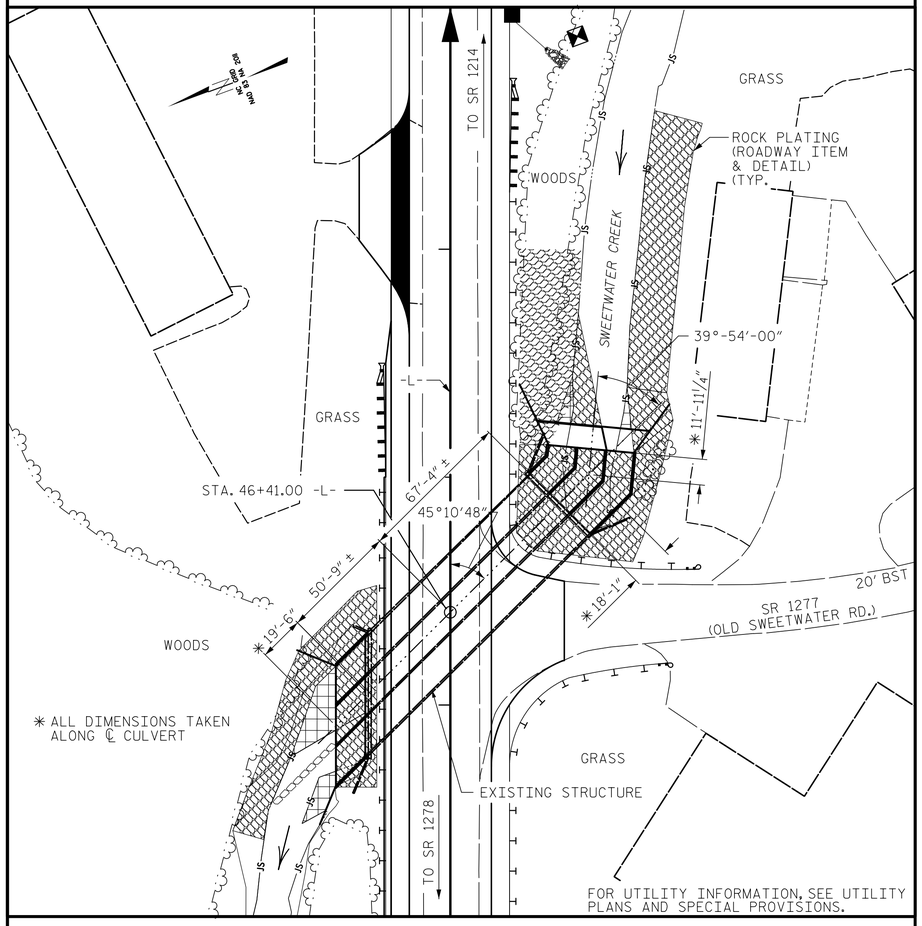
OUTLET END WING EXTENSIONS WINGS 3 & 4

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

DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	4/22
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	4/22

STR. #1

BENCH MARK #3: STA. 48+93.40 -L- 56' RT. ELEV. 2016.23'
SPIKE NAIL IN BASE OF 10" POPLAR



LOCATION SKETCH

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
LEFT EXTENSION	118.3	C.Y.
RIGHT EXTENSION	202.4	C.Y.
TOTAL	320.7	C.Y.
REINFORCING STEEL		
LEFT EXTENSION	15,495	LBS
RIGHT EXTENSION	27,074	LBS
TOTAL	42,569	LBS
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.		
LEFT EXTENSION	59	TONS
RIGHT EXTENSION	130	TONS
TOTAL	189	TONS

SAMPLE BAR REPLACEMENT

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

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

ROADWAY DATA

GRADE POINT ELEV. @ STA. 46+41.00 -L- = 2017.48'
BED ELEV. @ STA. 46+41.00 -L- = 1997.17' ±
ROADWAY SLOPES = 1.5 : 1

HYDROGRAPHIC DATA

DESIGN DISCHARGE = 3210 CFS
FREQUENCY OF DESIGN FLOOD = 50 YRS
DESIGN HIGH WATER ELEVATION = 2009.5'
DRAINAGE AREA = 13.7 SQ. MI.
BASE DISCHARGE (Q100) = 3870 CFS
BASE HIGH WATER ELEVATION = 2011.2'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 5720 CFS
FREQUENCY OF OVERTOPPING FLOOD = 500 YRS
OVERTOPPING FLOOD ELEVATION = 2017.44'

NOTES:

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

DESIGN FILL---------- 10.05' MAX.

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. 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.

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.

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

AT THE CONTRACTOR'S OPTION HE MAY SUBMIT, TO THE ENGINEER FOR APPROVAL, DESIGN AND DETAIL DRAWINGS FOR A PRECAST REINFORCED CONCRETE BOX CULVERT IN LIEU OF THE CAST-IN-PLACE CULVERT SHOWN ON THE PLANS. THE DESIGN SHALL PROVIDE THE SAME SIZE AND NUMBER OF BARRELS AS USED ON THE CAST-IN-PLACE DESIGN. FOR OPTIONAL PRECAST REINFORCED CONCRETE BOX CULVERT, SEE SPECIAL PROVISIONS.

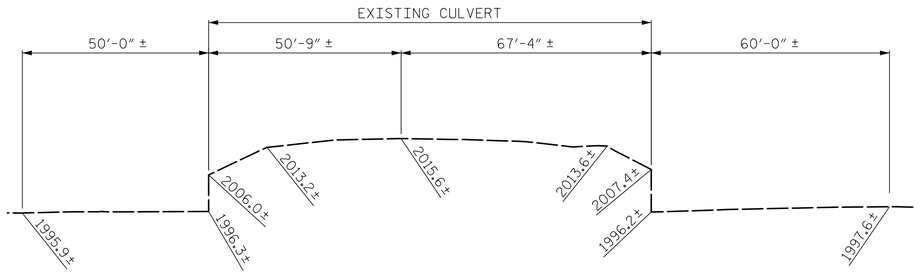
THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

EXCAVATE 1 FOOT BELOW CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS. FOUNDATION CONDITIONING MATERIAL SHOULD CONSIST OF SELECT MATERIAL CLASS V OR VI FOR RCBC.

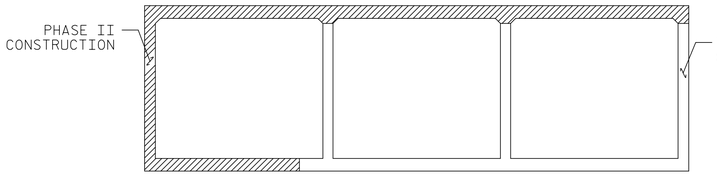
IF REQUIRED, UNDERCUT LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.

DOWELS SHALL BE USED TO CONNECT THE PROPOSED EXTENSIONS TO THE EXISTING CULVERT. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.

F.A. PROJECT NO.: APD-0074(178)



PROFILE ALONG ℄ CULVERT



CONSTRUCTION PHASING

(LOOKING DOWNSTREAM)

PHASE I CONSTRUCTION

PHASE II CONSTRUCTION

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 46+41.00 -L-

SHEET 1 OF 14

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
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SUITE 209
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT LT & RT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-1
1			3			TOTAL SHEETS
2			4			14

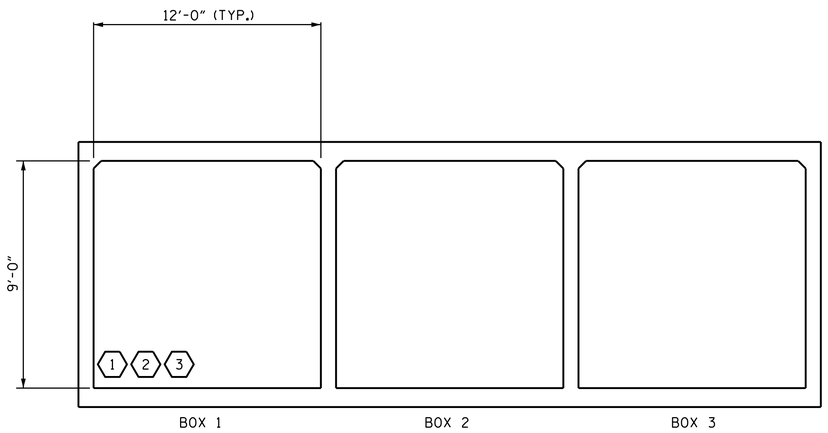
STR #2

DRAWN BY : STM DATE : 04/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 04/21

3/23/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #2 46+41.00 -L-\Final Plans\DGNs\412_001_A-0009CA_SMU_CU01_370132.dgn
User:ZSmith

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)	1.15	--	1.75	1.15	1	EXTERIOR WALL	0.75	2.20	1	EXTERIOR WALL	0.75	
		HL-93 (OPERATING)	N/A		1.48	--	1.35	1.48	1	EXTERIOR WALL	0.75	2.86	1	EXTERIOR WALL	0.75	
		HS-20 (INVENTORY)	36.000	(2)	1.16	41.76	1.75	1.16	1	EXTERIOR WALL	0.75	2.21	1	EXTERIOR WALL	0.75	
		HS-20 (OPERATING)	36.000		1.51	54.36	1.35	1.51	1	EXTERIOR WALL	0.75	2.87	1	EXTERIOR WALL	0.75	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		1.53	20.66	1.40	1.53	1	EXTERIOR WALL	0.75	2.89	1	EXTERIOR WALL	0.75	
		SNGARBS2	20.000		1.45	29.00	1.40	1.45	1	EXTERIOR WALL	0.75	2.86	1	EXTERIOR WALL	0.75	
		SNAGRIS2	22.000		1.42	31.24	1.40	1.42	1	EXTERIOR WALL	0.75	2.87	1	EXTERIOR WALL	0.75	
		SNCOTTS3	27.250		1.43	38.97	1.40	1.43	1	EXTERIOR WALL	0.75	2.75	1	EXTERIOR WALL	0.75	
		SNAGGRS4	34.925		1.44	50.29	1.40	1.44	1	EXTERIOR WALL	0.75	2.27	1	TOP SLAB	11.67	
		SNS5A	35.550		1.45	51.55	1.40	1.45	1	EXTERIOR WALL	0.75	2.38	1	TOP SLAB	11.67	
		SNS6A	39.950		1.43	57.13	1.40	1.43	1	EXTERIOR WALL	0.75	2.33	1	TOP SLAB	11.67	
		SNS7B	42.000		1.39	58.38	1.40	1.39	1	EXTERIOR WALL	0.75	2.26	1	TOP SLAB	11.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.43	47.19	1.40	1.43	1	EXTERIOR WALL	0.75	2.82	1	EXTERIOR WALL	0.75	
		TNT4A	33.075		1.44	47.63	1.40	1.44	1	EXTERIOR WALL	0.75	2.70	1	TOP SLAB	11.67	
		TNT6A	41.600		1.43	59.49	1.40	1.43	1	EXTERIOR WALL	0.75	2.46	1	TOP SLAB	11.67	
		TNT7A	42.000		1.41	59.22	1.40	1.41	1	EXTERIOR WALL	0.75	2.66	1	TOP SLAB	11.67	
		TNT7B	42.000		1.44	60.48	1.40	1.44	1	EXTERIOR WALL	0.75	2.38	1	TOP SLAB	11.67	
		TNAGRIT4	43.000		1.43	61.49	1.40	1.43	1	EXTERIOR WALL	0.75	2.31	1	TOP SLAB	11.67	
		TNAGT5A	45.000	(3)	1.38	62.10	1.40	1.38	1	EXTERIOR WALL	0.75	2.43	1	TOP SLAB	11.67	
		TNAGT5B	45.000		1.42	63.90	1.40	1.42	1	EXTERIOR WALL	0.75	2.14	1	TOP SLAB	11.67	



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. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 2 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR. Marshall G. Cheek, Jr. 6/1/2022

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CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-2
1			3			TOTAL SHEETS
2			4			14

ASSEMBLED BY :	STM	DATE :	12/21
CHECKED BY :	MGC	DATE :	02/22
DRAWN BY : WMC	7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM	7/11	REV. 12/17	MAA/THC

3/15/2022
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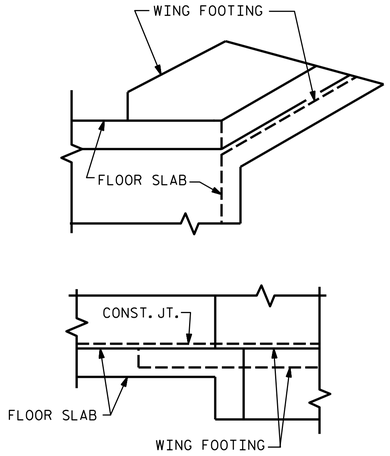
User:smassinople

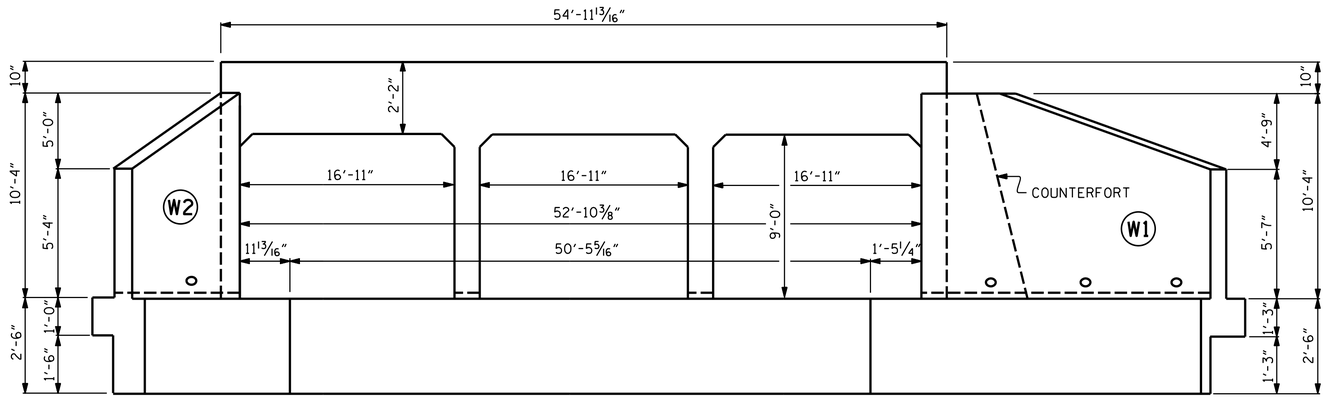
STR #2

STD. NO. LRFR5

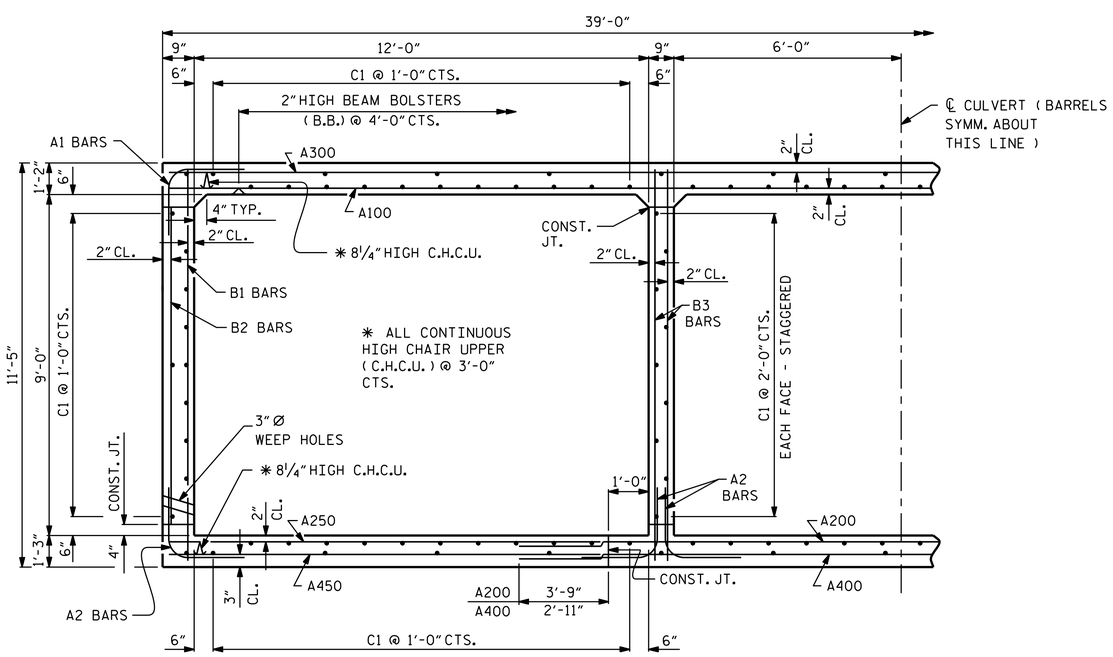


DETAIL

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

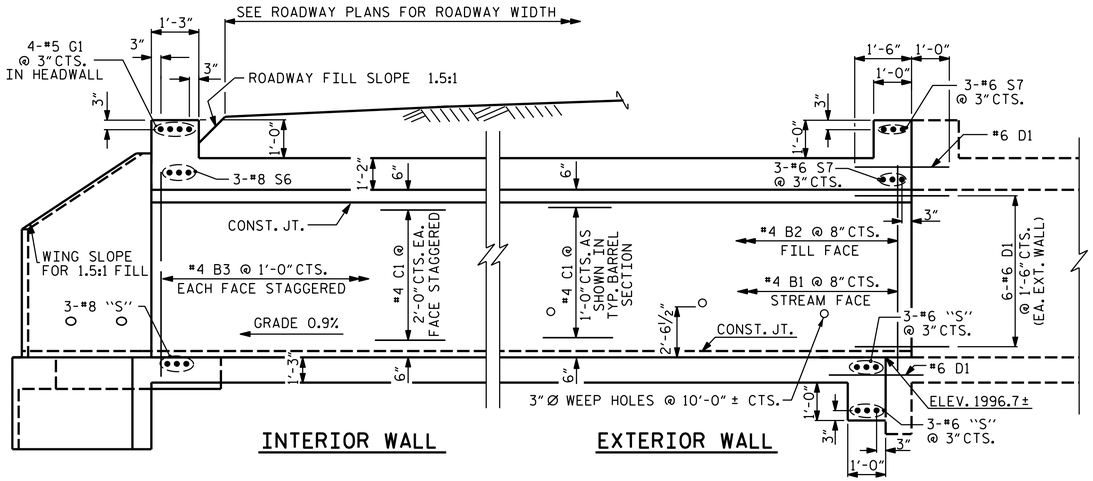


OUTLET END ELEVATION NORMAL TO SKEW



RIGHT ANGLE SECTION OF BARREL

THERE ARE 138 "C" BARS IN SECTION OF BARREL.
(LOOKING DOWNSTREAM)



CULVERT EXTENSION SECTION NORMAL TO ROADWAY

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 46+41.00 -L-

SHEET 3 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
SEAL E3A4DC41...
6/1/2022

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CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT LEFT EXTENSION 45°-10′-48″ SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-3
1			3			TOTAL SHEETS
2			4			14

STR #2

DRAWN BY : STM DATE : 04/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 04/21

3/15/2022
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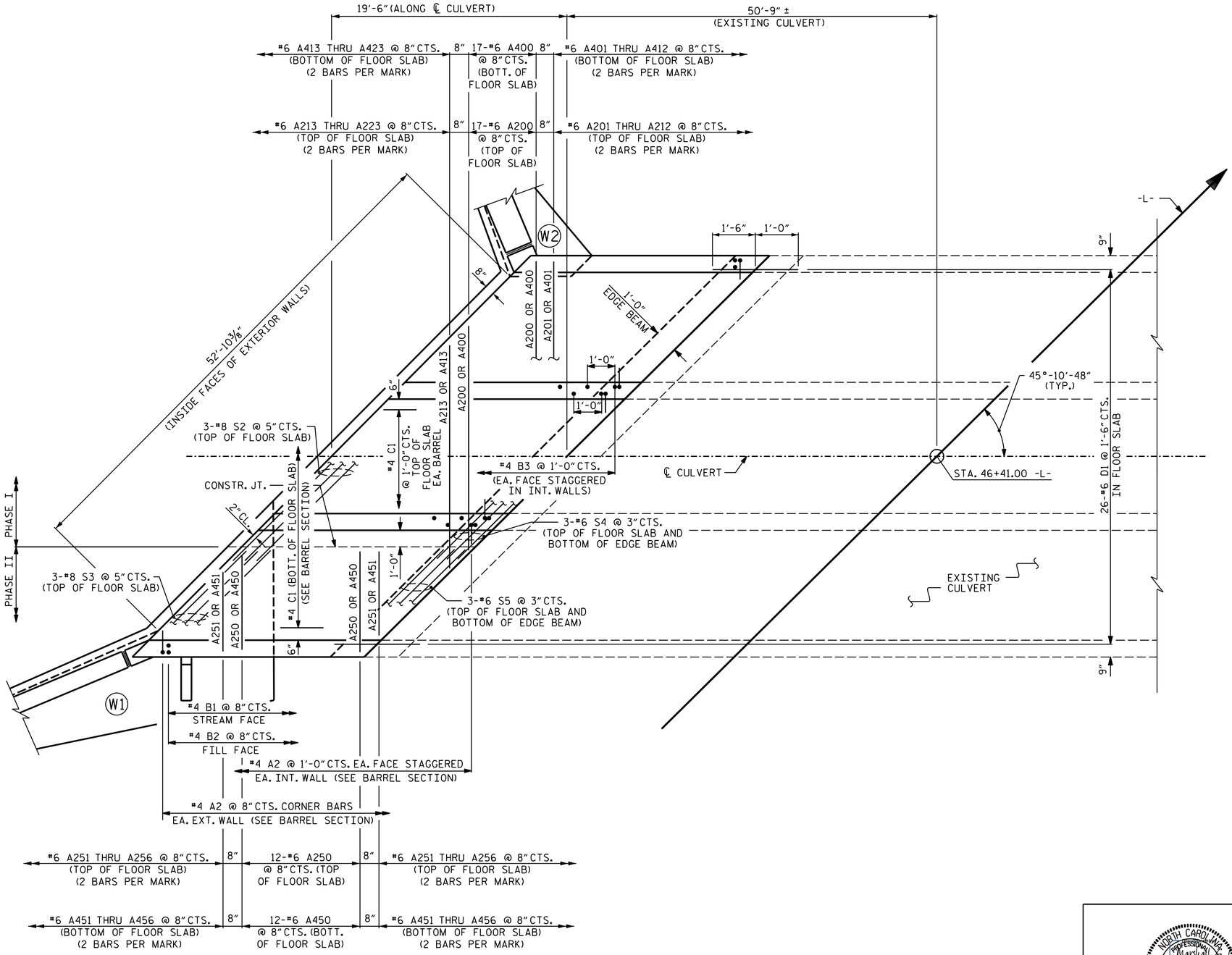

PLAN OF FLOOR SLAB

NOTE: FOR S1 IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.
FOR DOWELS IN EXTERIOR WALLS, SEE SHEET 3 OF 14.

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 4 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT LEFT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-4
1			3			TOTAL SHEETS
2			4			14

DRAWN BY : STM DATE : 11/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 04/21

3/15/2022
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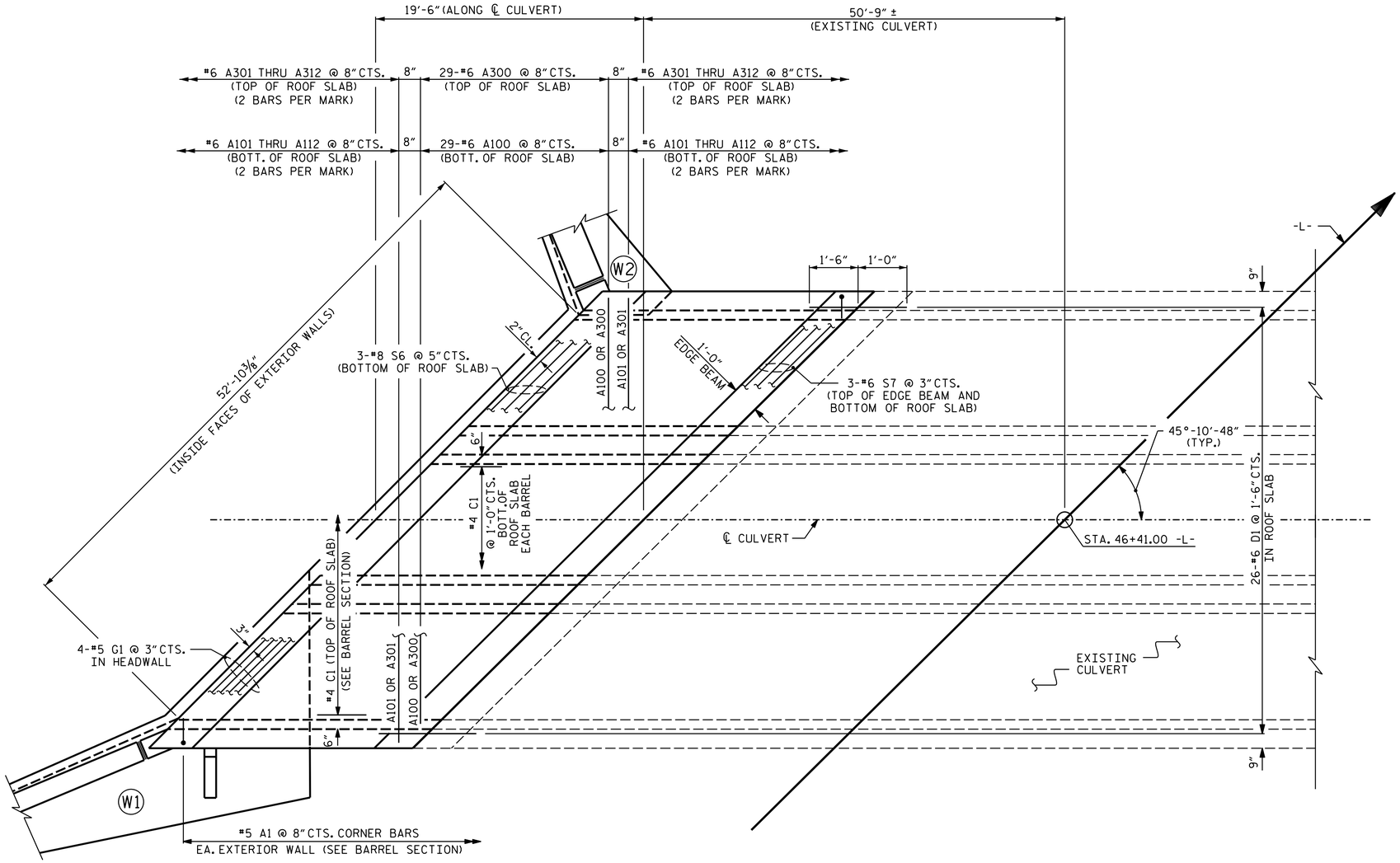
User:smassinople

STR #2



PLAN OF ROOF SLAB

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 5 OF 14

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT LEFT EXTENSION 45°-10'-48" SKEW

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
SEAL F3A0DC41...
6/1/2022

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REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-5
1			3			TOTAL SHEETS
2			4			14

STR #2

DRAWN BY :	STM	DATE :	11/21
CHECKED BY :	MGC	DATE :	02/22
DESIGN ENGINEER OF RECORD:	STM	DATE :	04/21

3/15/2022
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User:smassinople

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	58	#5	5	7'-1"	428
A2	136	#4	5	6'-9"	613
A100	29	#6	STR	19'-0"	828
A101	4	#6	STR	17'-11"	108
A102	4	#6	STR	16'-6"	99
A103	4	#6	STR	15'-2"	91
A104	4	#6	STR	13'-10"	83
A105	4	#6	STR	12'-6"	75
A106	4	#6	STR	11'-2"	67
A107	4	#6	STR	9'-10"	59
A108	4	#6	STR	8'-6"	51
A109	4	#6	STR	7'-2"	43
A110	4	#6	STR	5'-10"	35
A111	4	#6	STR	4'-6"	27
A112	4	#6	STR	3'-2"	19

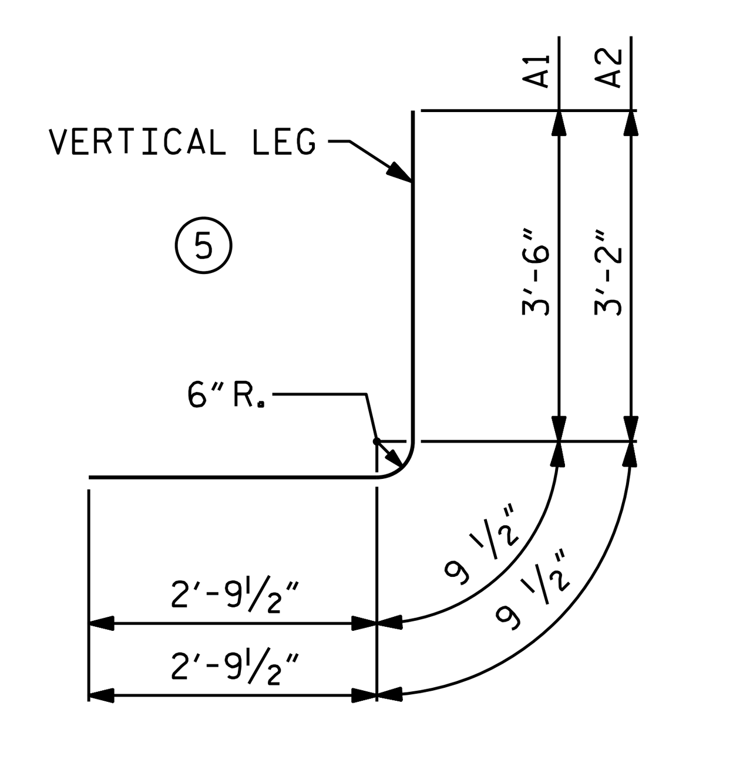
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A200	17	#6	STR	19'-0"	485
A201	2	#6	STR	17'-11"	54
A202	2	#6	STR	16'-6"	50
A203	2	#6	STR	15'-2"	46
A204	2	#6	STR	13'-10"	42
A205	2	#6	STR	12'-6"	38
A206	2	#6	STR	11'-2"	34
A207	2	#6	STR	9'-10"	30
A208	2	#6	STR	8'-6"	26
A209	2	#6	STR	7'-2"	22
A210	2	#6	STR	5'-10"	18
A211	2	#6	STR	4'-6"	14
A212	2	#6	STR	3'-2"	10
A213	2	#6	STR	17'-8"	53
A214	2	#6	STR	16'-4"	49
A215	2	#6	STR	15'-0"	45
A216	2	#6	STR	13'-8"	41
A217	2	#6	STR	12'-4"	37
A218	2	#6	STR	11'-0"	33
A219	2	#6	STR	9'-7"	29
A220	2	#6	STR	8'-3"	25
A221	2	#6	STR	6'-11"	21
A222	2	#6	STR	5'-7"	17
A223	2	#6	STR	4'-3"	13
A250	12	#6	STR	11'-5"	206
A251	4	#6	STR	10'-1"	61
A252	4	#6	STR	8'-9"	53
A253	4	#6	STR	7'-5"	45
A254	4	#6	STR	6'-1"	37
A255	4	#6	STR	4'-9"	29
A256	4	#6	STR	3'-5"	21

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A300	29	#6	STR	19'-0"	828
A301	4	#6	STR	17'-11"	108
A302	4	#6	STR	16'-6"	99
A303	4	#6	STR	15'-2"	91
A304	4	#6	STR	13'-10"	83
A305	4	#6	STR	12'-6"	75
A306	4	#6	STR	11'-2"	67
A307	4	#6	STR	9'-10"	59
A308	4	#6	STR	8'-6"	51
A309	4	#6	STR	7'-2"	43
A310	4	#6	STR	5'-10"	35
A311	4	#6	STR	4'-6"	27
A312	4	#6	STR	3'-2"	19

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A400	17	#6	STR	19'-0"	485
A401	2	#6	STR	17'-11"	54
A402	2	#6	STR	16'-6"	50
A403	2	#6	STR	15'-2"	46
A404	2	#6	STR	13'-10"	42
A405	2	#6	STR	12'-6"	38
A406	2	#6	STR	11'-2"	34
A407	2	#6	STR	9'-10"	30
A408	2	#6	STR	8'-6"	26
A409	2	#6	STR	7'-2"	22
A410	2	#6	STR	5'-10"	18
A411	2	#6	STR	4'-6"	14
A412	2	#6	STR	3'-2"	10
A413	2	#6	STR	17'-8"	53
A414	2	#6	STR	16'-4"	49
A415	2	#6	STR	15'-0"	45
A416	2	#6	STR	13'-8"	41
A417	2	#6	STR	12'-4"	37
A418	2	#6	STR	11'-0"	33
A419	2	#6	STR	9'-7"	29
A420	2	#6	STR	8'-3"	25
A421	2	#6	STR	6'-11"	21
A422	2	#6	STR	5'-7"	17
A423	2	#6	STR	4'-3"	13
A450	12	#6	STR	11'-5"	206
A451	4	#6	STR	10'-1"	61
A452	4	#6	STR	8'-9"	53
A453	4	#6	STR	7'-5"	45
A454	4	#6	STR	6'-1"	37
A455	4	#6	STR	4'-9"	29
A456	4	#6	STR	3'-5"	21

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	58	#4	STR	11'-0"	426
B2	58	#4	STR	8'-4"	323
B3	78	#4	STR	11'-0"	573
C1	138	#4	STR	19'-2"	1767
D1	64	#6	STR	2'-6"	240
G1	4	#5	STR	54'-6"	227
S2	3	#8	STR	42'-3"	338
S3	3	#8	STR	16'-0"	128
S4	6	#6	STR	42'-5"	382
S5	6	#6	STR	16'-0"	144
S6	3	#8	STR	54'-6"	437
S7	6	#6	STR	54'-6"	491
REINFORCING STEEL					13,055 LBS

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTH CHART

BAR	SIZE	SPLICE LENGTH
A200	#6	2'-9"
A400	#6	3'-7"
"B"	#4	1'-10"
C1	#4	1'-10"
"S"	#6	3'-8"
"S"	#8	3'-8"

LEFT EXTENSION QUANTITIES

CLASS A CONCRETE		
BARREL @ 4.50 CY/FT	87.8	C.Y.
WINGS, ETC.	26.4	C.Y.
EDGE BEAMS	4.1	C.Y.
TOTAL	118.3	C.Y.
REINFORCING STEEL		
BARREL	13,055	LBS.
WINGS, ETC.	2,440	LBS.
TOTAL	15,495	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	59 TONS	

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 6 OF 14

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

Marshall G. Cheek, Jr.

6/1/2022

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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 12 FT. X 9 FT. CONCRETE BOX CULVERT LEFT EXTENSION 45°-10'-48" SKEW

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

SHEET NO. C2-6

TOTAL SHEETS 14

DRAWN BY : STM DATE : 04/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 04/21

STR #2

3/15/2022
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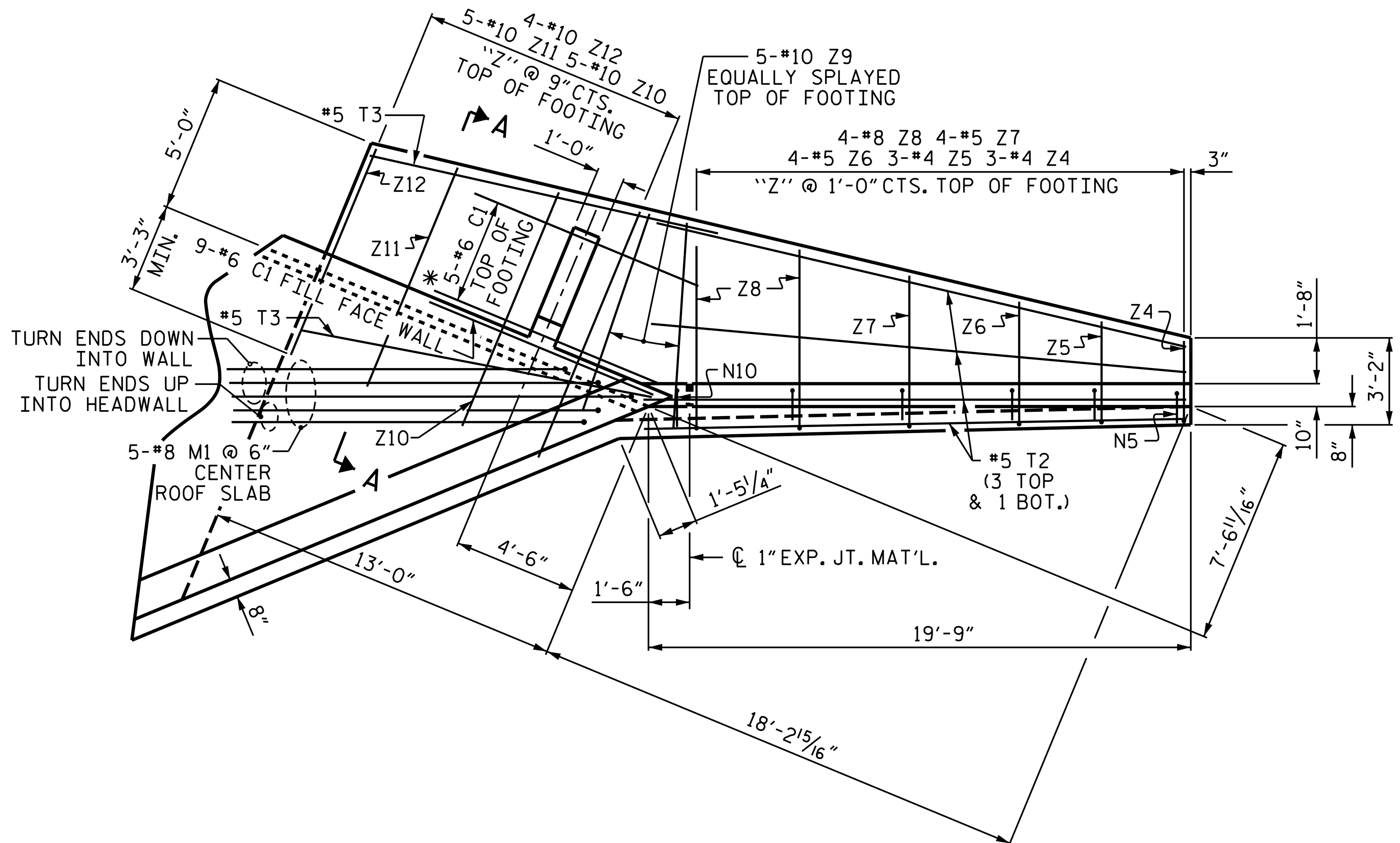
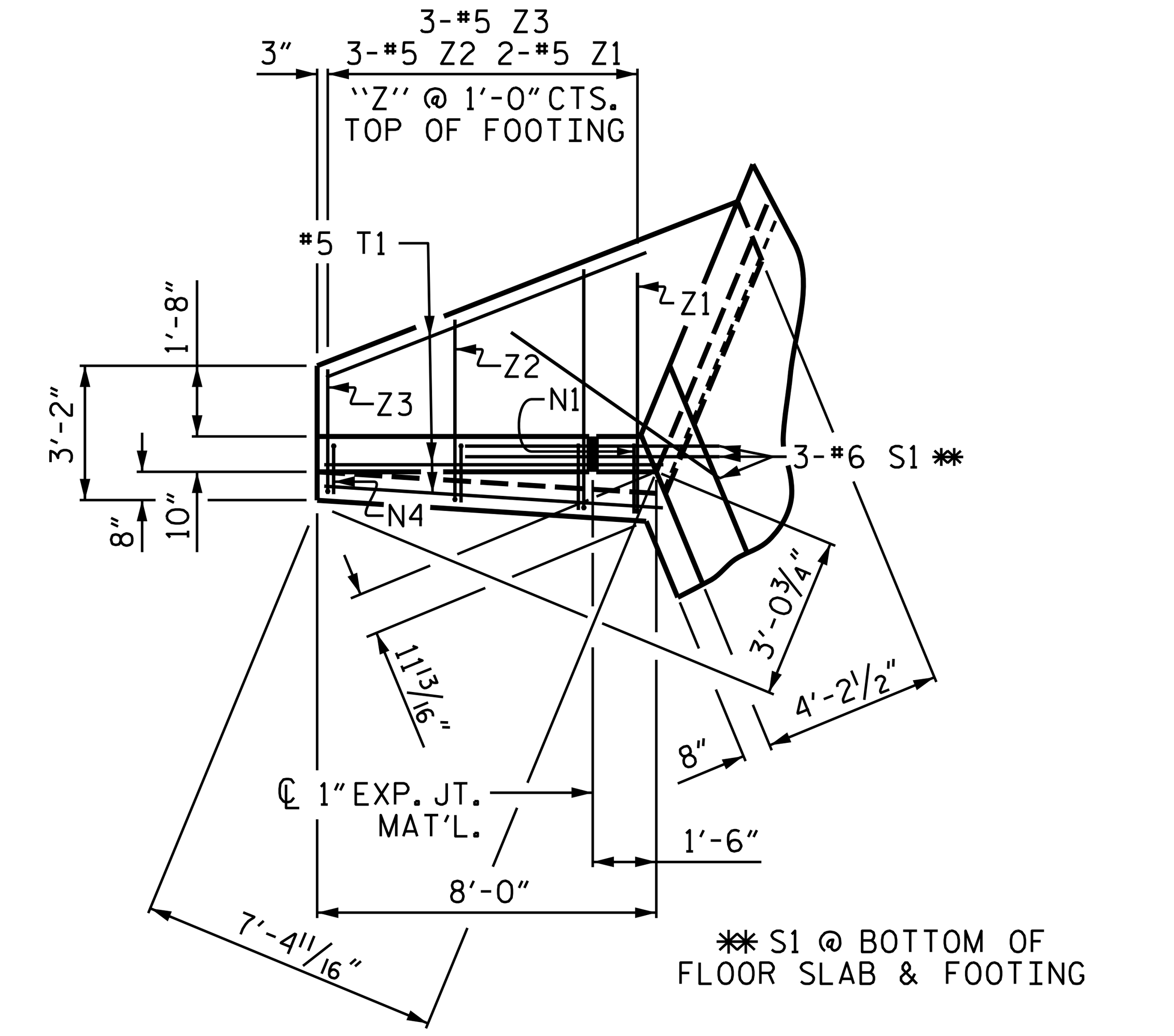
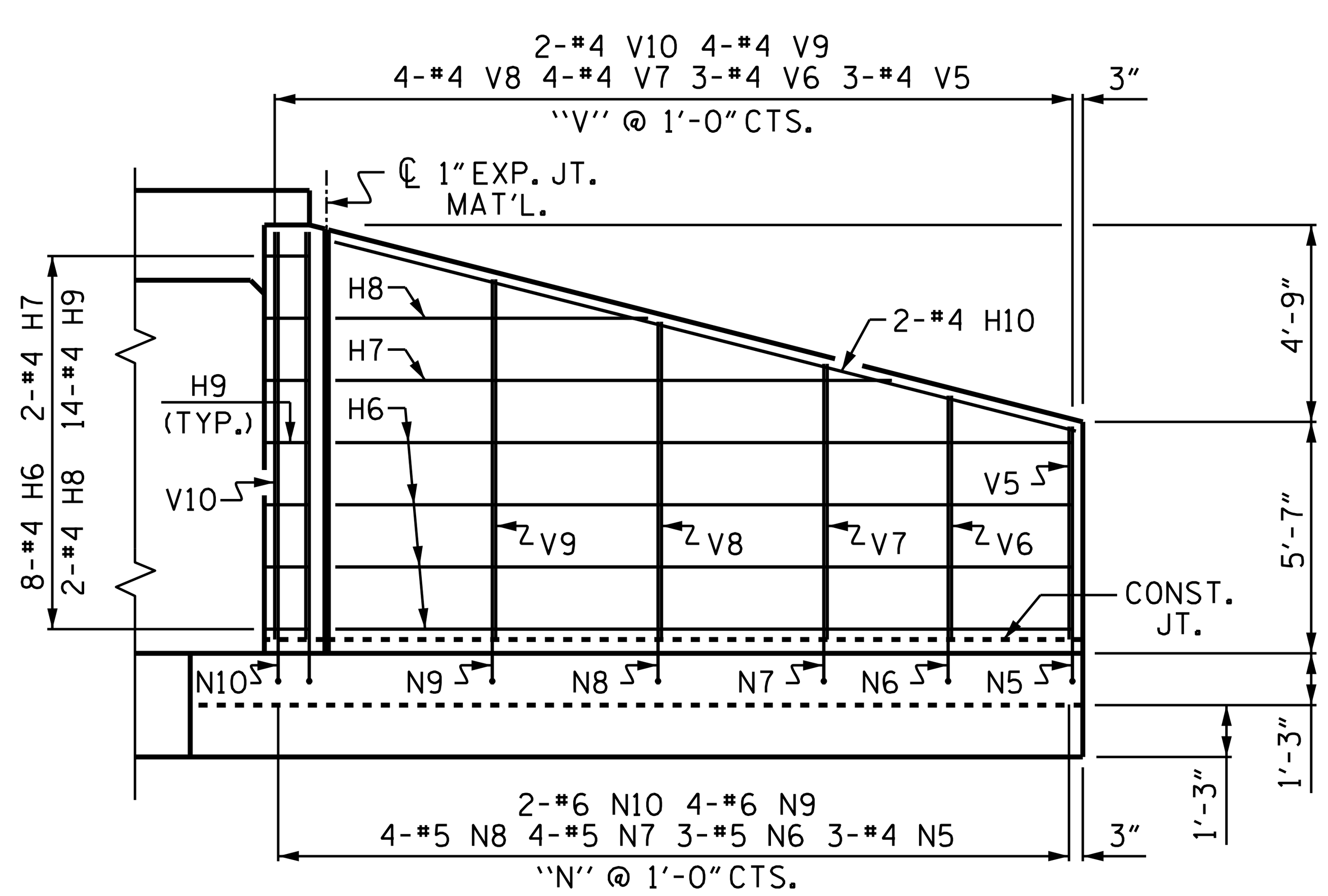


PLAN W1

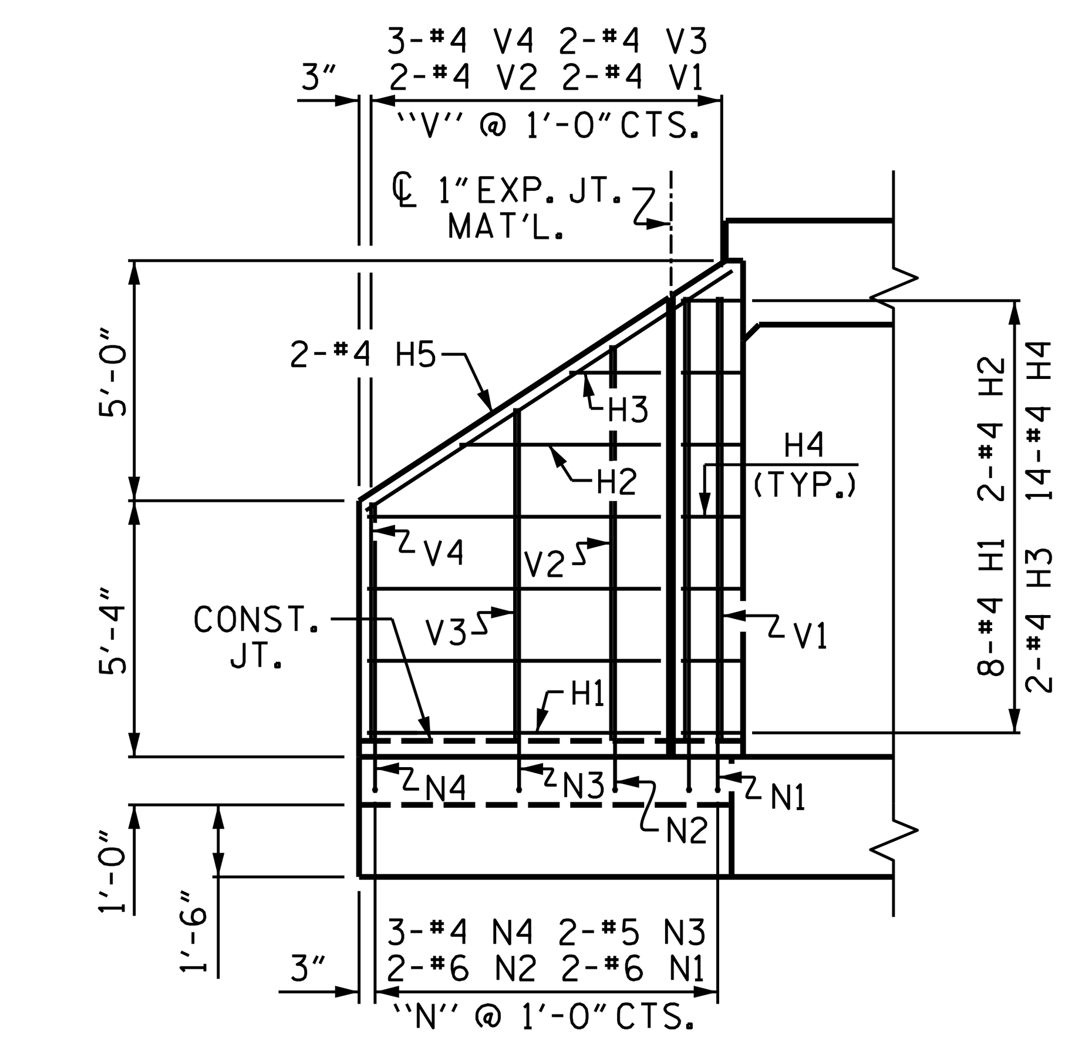
* CENTER ALL #6 C1 ON ℄ COUNTERFORT



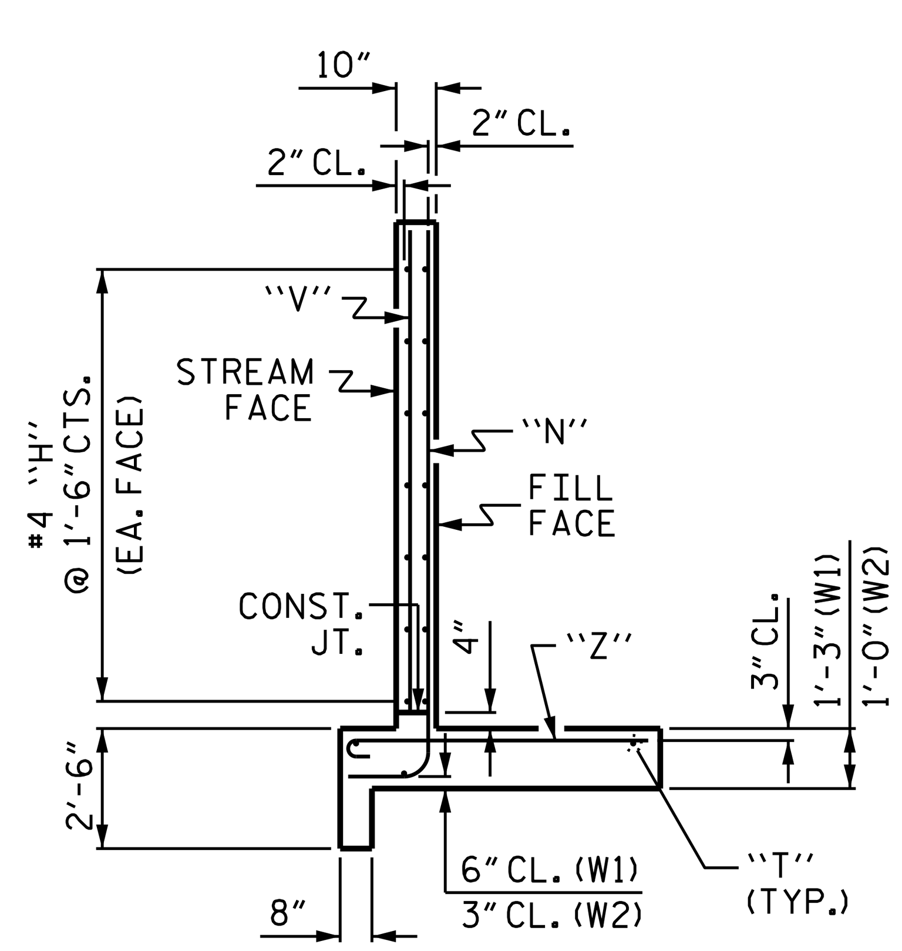
PLAN W2



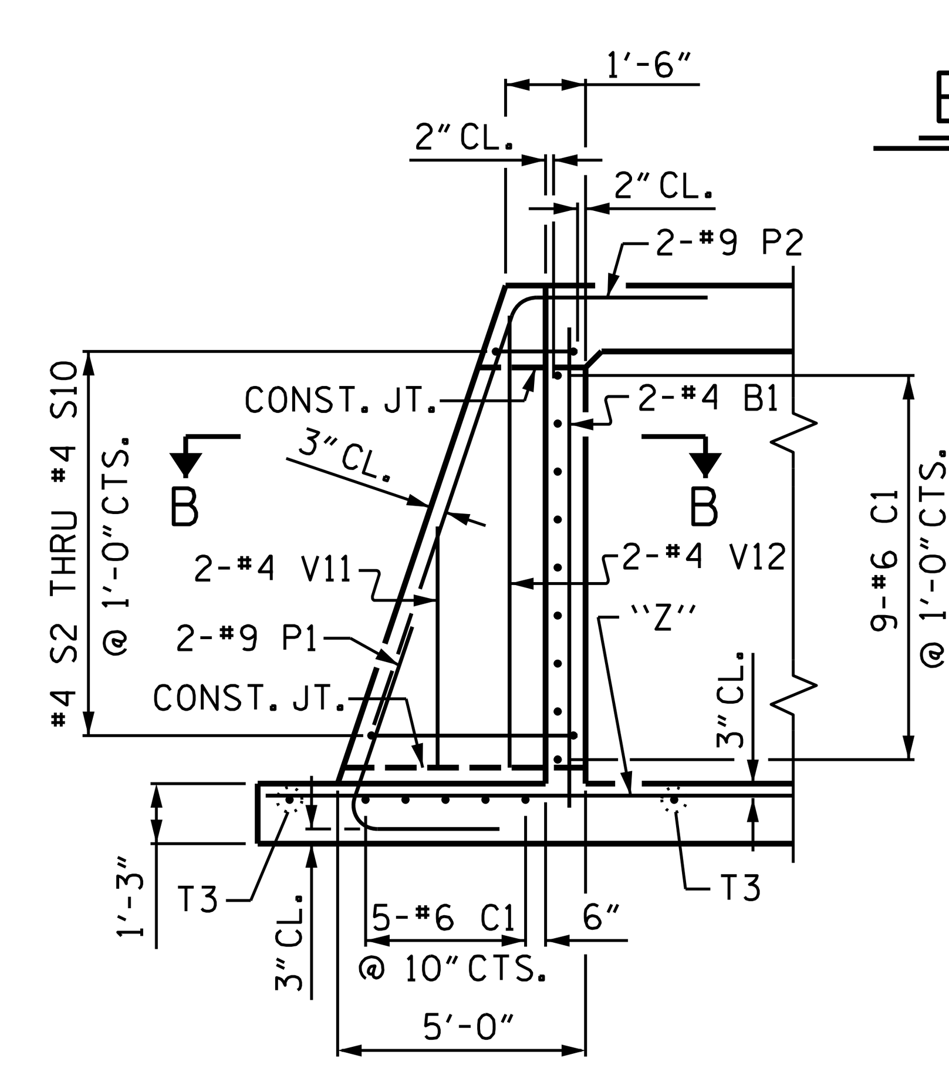
ELEVATION W1



ELEVATION W2

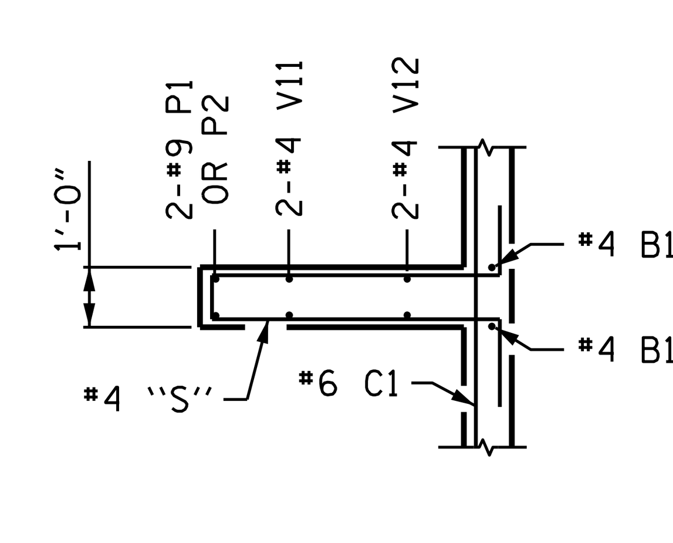


WING SECTION



SECTION A-A

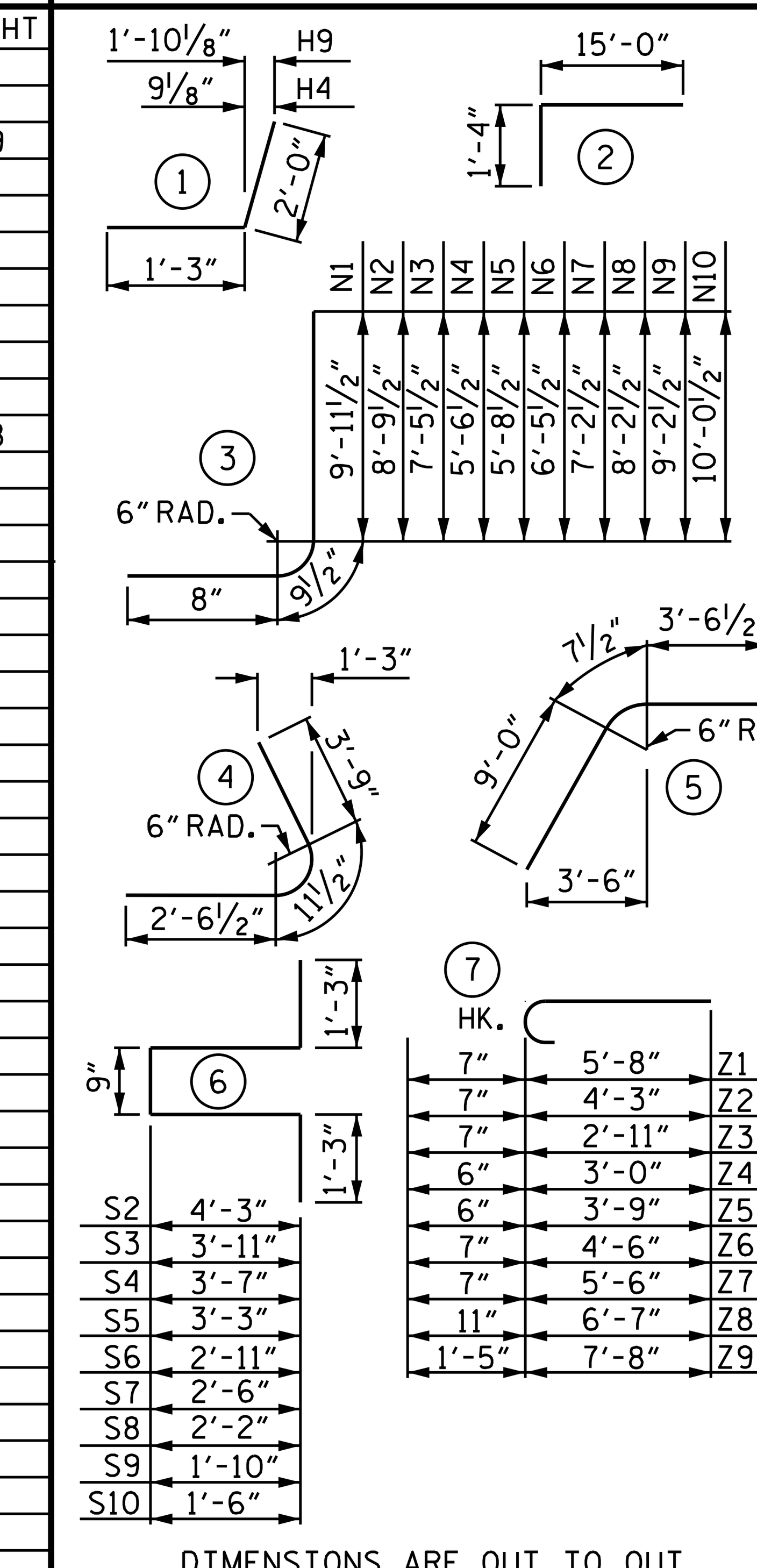
STANDARD REINFORCING STEEL IN BARREL NOT SHOWN



SECTION B-B

	BILL OF MATERIAL					
	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
LONG WING W1	B1	2	#4	STR	10'-0"	13
	C1	14	#6	STR	9'-0"	189
	H6	8	#4	STR	17'-10"	95
	H7	2	#4	STR	13'-5"	18
	H8	2	#4	STR	7'-6"	10
	H9	14	#4	1	3'-3"	30
	H10	2	#4	STR	18'-5"	25
	M1	5	#8	2	16'-4"	218
	N5	3	#4	3	7'-2"	14
	N6	3	#5	3	7'-11"	25
	N7	4	#5	3	8'-8"	36
	N8	4	#5	3	9'-8"	40
	N9	4	#6	3	10'-8"	64
	N10	2	#6	3	11'-6"	35
	P1	2	#9	4	7'-3"	49
	P2	2	#9	5	13'-2"	90
	S2	1	#4	6	11'-9"	8
	S3	1	#4	6	11'-1"	7
	S4	1	#4	6	10'-5"	7
	S5	1	#4	6	9'-9"	7
	S6	1	#4	6	9'-1"	6
	S7	1	#4	6	8'-3"	6
	S8	1	#4	6	7'-7"	5
	S9	1	#4	6	6'-11"	5
	S10	1	#4	6	6'-3"	4
	T2	4	#5	STR	19'-8"	82
	T3	2	#5	STR	13'-0"	27
	V5	3	#4	STR	5'-1"	10
	V6	3	#4	STR	5'-9"	12
	V7	4	#4	STR	6'-6"	17
	V8	4	#4	STR	7'-5"	20
	V9	4	#4	STR	8'-5"	22
	V10	2	#4	STR	9'-4"	12
	V11	2	#4	STR	3'-0"	4
	V12	2	#4	STR	7'-3"	10
	Z4	3	#4	7	3'-6"	7
	Z5	3	#4	7	4'-3"	9
	Z6	4	#5	7	5'-1"	21
	Z7	4	#5	7	6'-1"	25
	Z8	4	#8	7	7'-6"	80
	Z9	5	#10	7	9'-1"	195
	Z10	5	#10	STR	10'-1"	217
	Z11	5	#10	STR	9'-4"	201
	Z12	4	#10	STR	8'-7"	148
	REINFORCING STEEL FOR 1 W1 WING					2,125 LBS.

BAR TYPES



	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
SHORT WING W2	H1	8	#4	STR	6'-1"	33
	H2	2	#4	STR	4'-2"	6
	H3	2	#4	STR	1'-11"	3
	H4	14	#4	1	3'-3"	30
	H5	2	#4	STR	9'-1"	12
	N1	2	#6	3	11'-5"	34
	N2	2	#6	3	10'-3"	31
	N3	2	#5	3	8'-11"	19
	N4	3	#4	3	7'-0"	14
	S1	3	#6	STR	6'-0"	27
	T1	3	#5	STR	8'-0"	25
	V1	2	#4	STR	9'-2"	12
	V2	2	#4	STR	7'-11"	11
	V3	2	#4	STR	6'-8"	9
	V4	3	#4	STR	4'-10"	10
	Z1	2	#5	7	6'-3"	13
	Z2	3	#5	7	4'-10"	15
	Z3	3	#5	7	3'-6"	11
	REINFORCING STEEL FOR 1 W2 WING					315 LBS.

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.

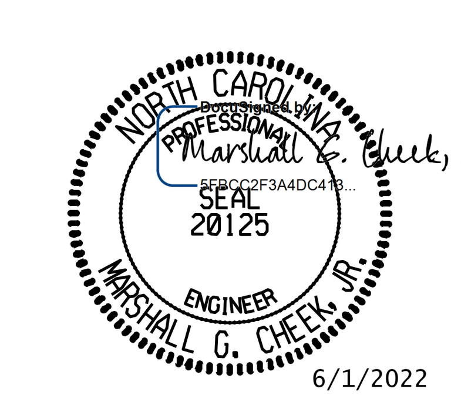
G1 BARS IN HEADWALL ARE INCLUDED WITH THE BARREL REINFORCING STEEL.

WING QUANTITES	
REINFORCING STEEL FOR 2 WINGS	2,440 LBS.
CLASS A CONCRETE	
2 WINGS	20.8 C.Y.
1 END CURTAIN WALL	3.1 C.Y.
1 HEADWALL	2.5 C.Y.
TOTAL	26.4 C.Y.

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-



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STATE OF NORTH CAROLINA
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RALEIGH

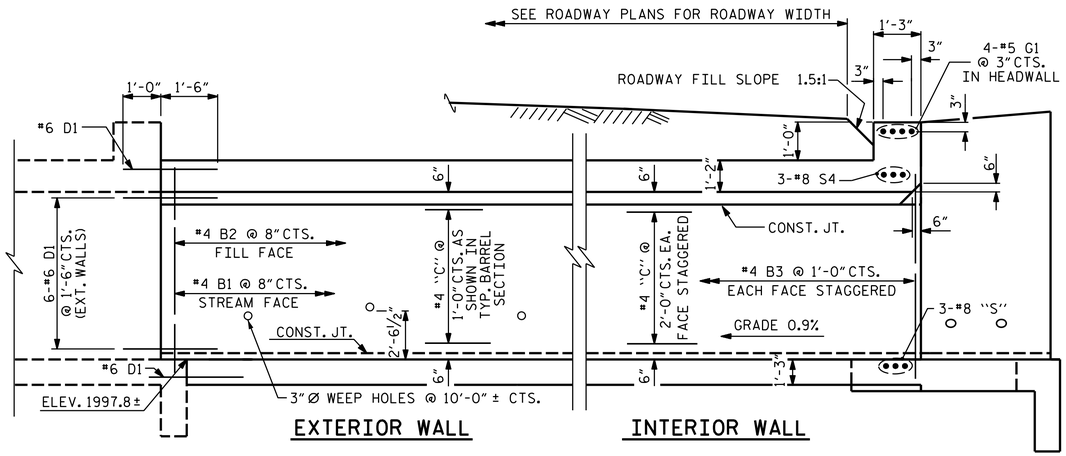
WINGS FOR LEFT EXTENSION

H = 9'-0" SLOPE = 1.5:1

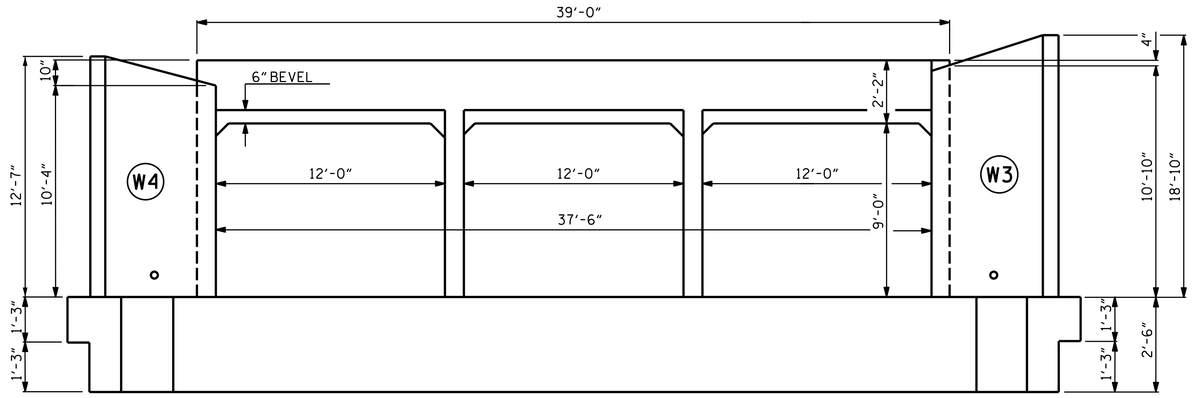
45° SKEW

REVISIONS								SHEET NO.
NO.	BY:	DATE:		NO.	BY:	DATE:		C2-7
1				3				TOTAL SHEETS
2				4				14

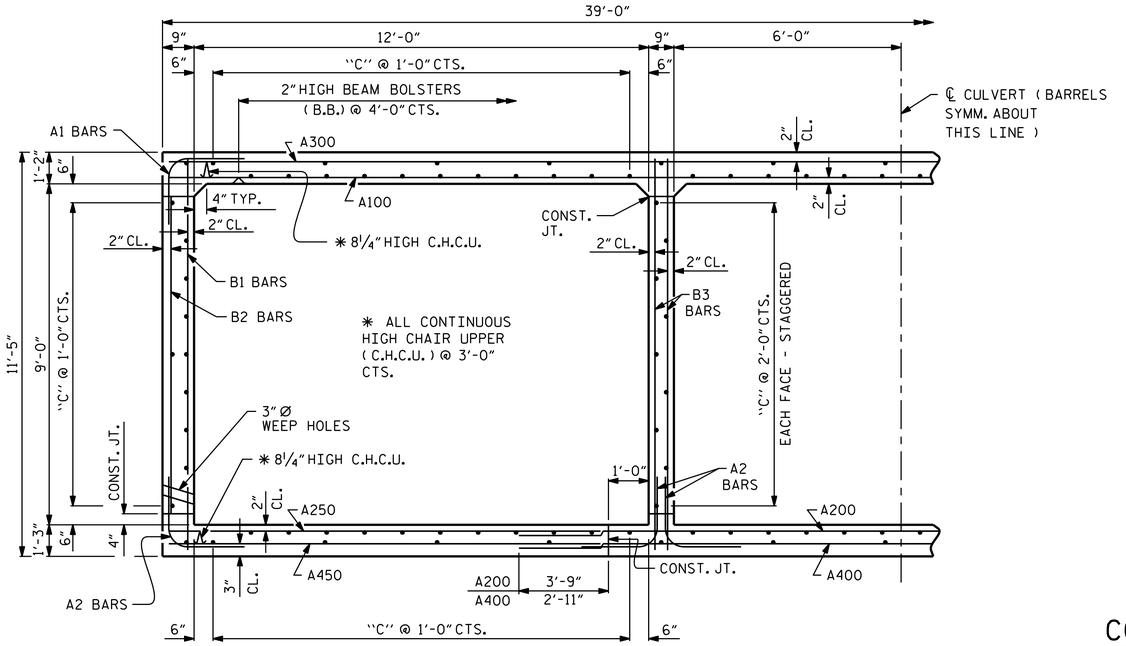
ASSEMBLED BY :	STM	DATE :	09/21
CHECKED BY :	MGC	DATE :	02/22



CULVERT EXTENSION SECTION NORMAL TO ROADWAY

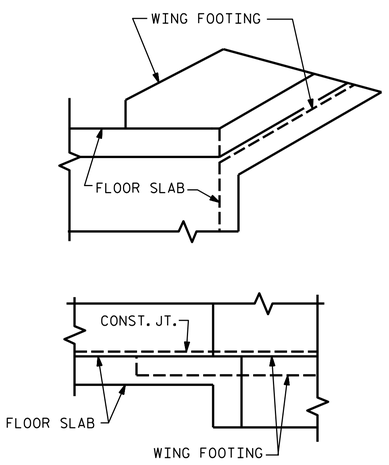


INLET END ELEVATION



RIGHT ANGLE SECTION OF BARREL

THERE ARE 138 "C" IN SECTION OF BARREL.
(LOOKING DOWNSTREAM)



DETAIL

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

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 46+41.00 -L-

SHEET 8 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-8
1			3			TOTAL SHEETS
2			4			14

DRAWN BY : STM DATE : 04/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 04/21

3/15/2022
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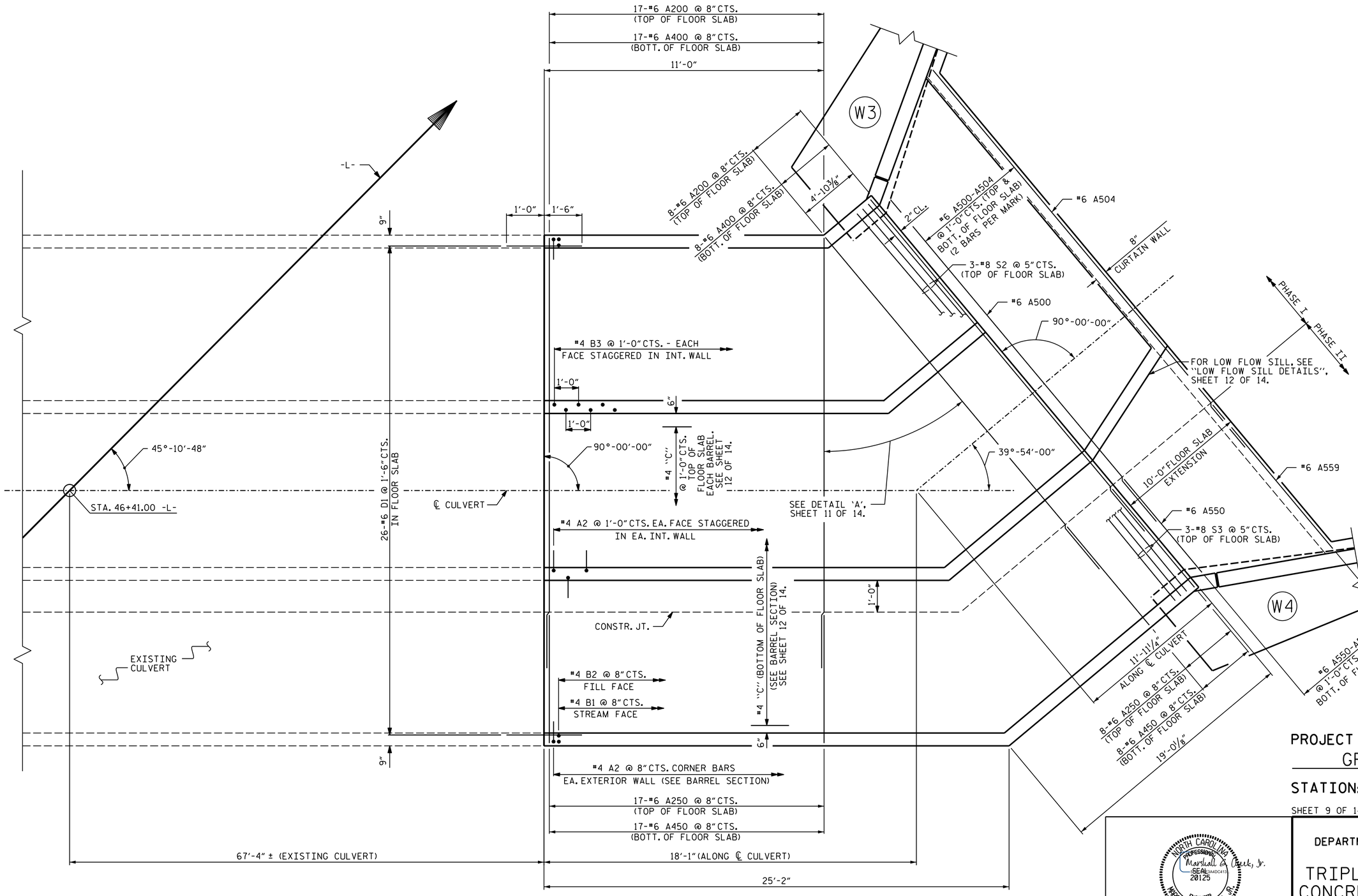
Users\mossinople

STR #2



PLAN OF FLOOR SLAB

NOTES: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.
FOR D1 DOWELS IN WALLS, SEE SHEET 8 OF 14.

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 9 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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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

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-9
1			3			TOTAL SHEETS
2			4			14

STR #2

DRAWN BY : STM DATE : 04/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 04/21

3/15/2022
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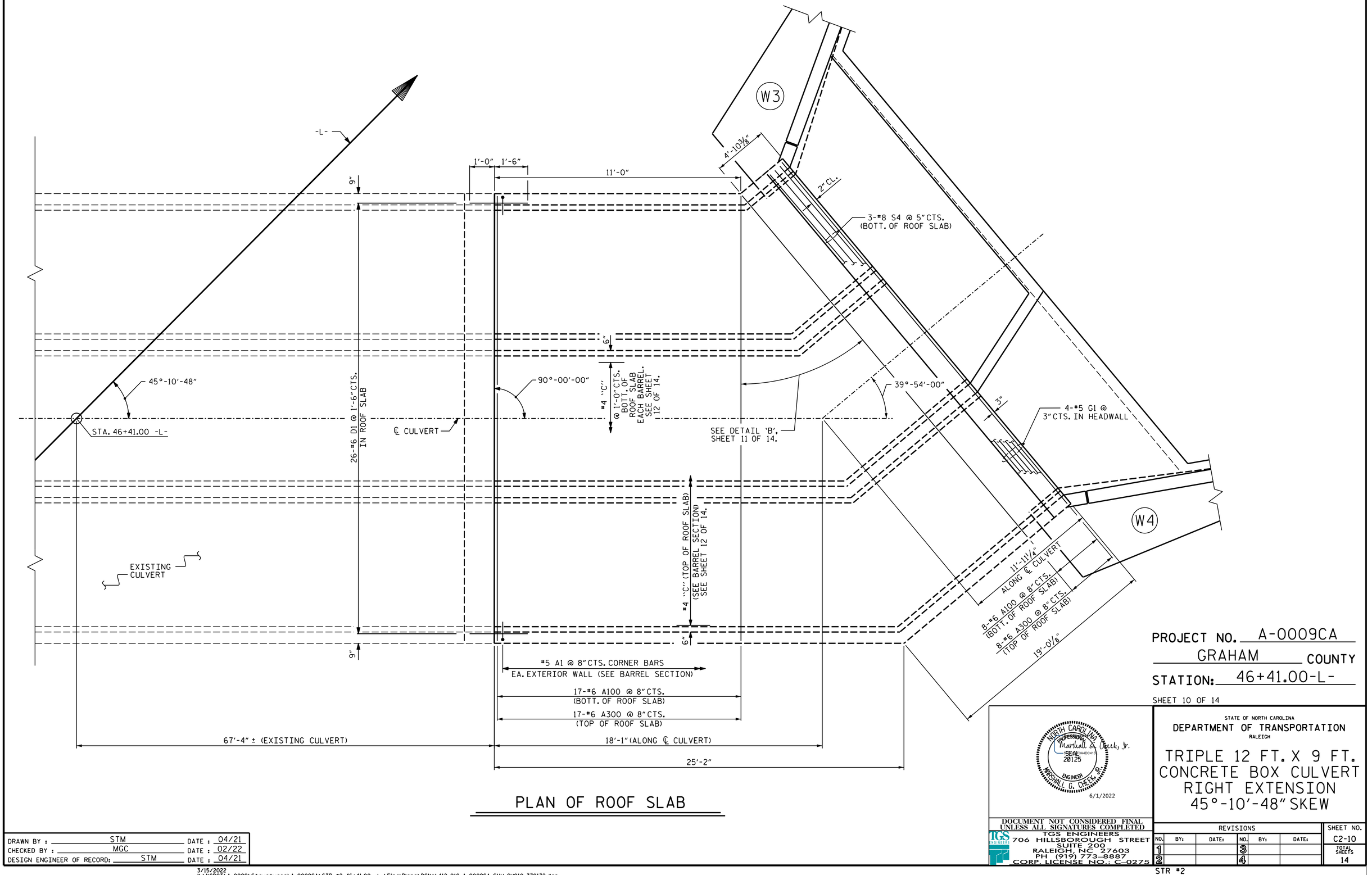

PLAN OF ROOF SLAB

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00-L-

SHEET 10 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR. — Marshall G. Cheek, Jr. SEAL 34ADC413

6/1/2022

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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 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-10
1			3			TOTAL SHEETS
2			4			14

STR #2

DRAWN BY :	STM	DATE :	04/21
CHECKED BY :	MGC	DATE :	02/22
DESIGN ENGINEER OF RECORD:	STM	DATE :	04/21

3/15/2022
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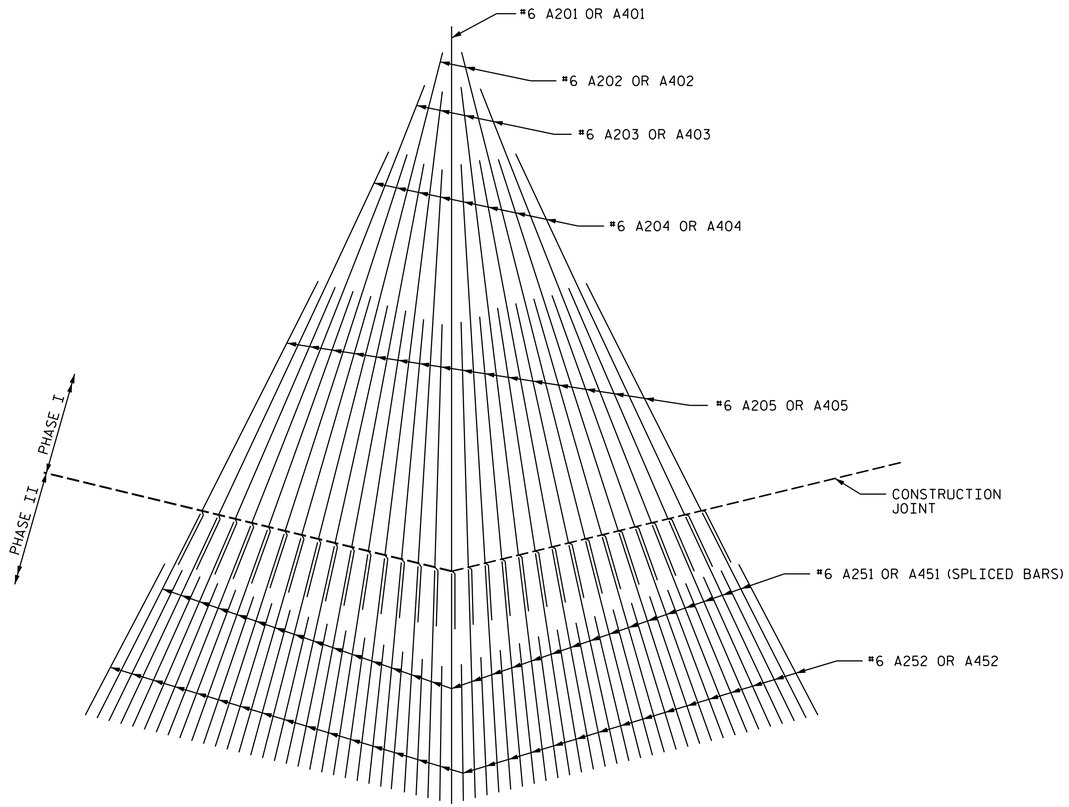
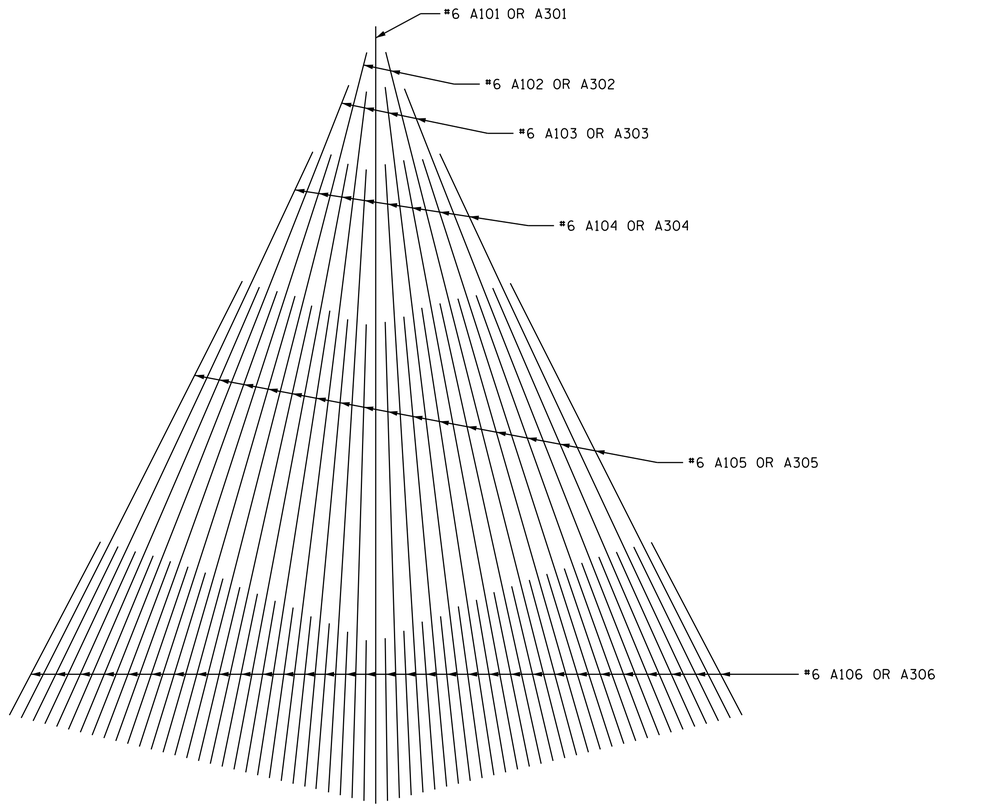


DETAIL A

FLOOR SLAB



DETAIL B

ROOF SLAB

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 11 OF 14

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

Marshall G. Cheek, Jr.

6/1/2022

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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

RALEIGH

TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-11
1			3			TOTAL SHEETS
2			4			14

STR #2

DRAWN BY : STM DATE : 04/21

CHECKED BY : MGC DATE : 02/22

3/15/2022
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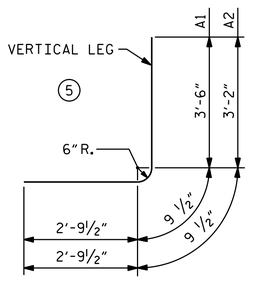
User:smassinople

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
A200	#6	3'-7"
A400	#6	2'-9"
A500	#6	2'-9"
"B"	#4	1'-11"
"C"	#4	1'-10"
"S"	#8	3'-8"

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	92	#5	5	7'-1"	680
A2	216	#4	5	6'-9"	974
A100	25	#6	STR	38'-7"	1449
A101	1	#6	STR	41'-0"	62
A102	2	#6	STR	37'-10"	114
A103	4	#6	STR	36'-9"	221
A104	8	#6	STR	32'-5"	390
A105	16	#6	STR	25'-2"	605
A106	32	#6	STR	9'-9"	469

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A200	25	#6	STR	30'-10"	1158
A201	1	#6	STR	31'-11"	48
A202	2	#6	STR	29'-2"	88
A203	4	#6	STR	27'-11"	168
A204	8	#6	STR	24'-3"	291
A205	16	#6	STR	16'-2"	389
A250	25	#6	STR	11'-4"	426
A251	31	#6	STR	12'-1"	563
A252	32	#6	STR	8'-7"	413

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A300	25	#6	STR	38'-7"	1449
A301	1	#6	STR	41'-0"	62
A302	2	#6	STR	37'-10"	114
A303	4	#6	STR	36'-9"	221
A304	8	#6	STR	32'-5"	390
A305	16	#6	STR	25'-2"	605
A306	32	#6	STR	9'-9"	469

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A400	25	#6	STR	30'-0"	1127
A401	1	#6	STR	31'-11"	48
A402	2	#6	STR	29'-2"	88
A403	4	#6	STR	27'-11"	168
A404	8	#6	STR	24'-3"	291
A405	16	#6	STR	16'-2"	389
A450	25	#6	STR	11'-4"	426
A451	31	#6	STR	12'-1"	563
A452	32	#6	STR	8'-7"	413
A500	4	#6	STR	30'-2"	181
A501	4	#6	STR	31'-4"	188
A502	4	#6	STR	32'-6"	195
A503	4	#6	STR	33'-8"	202
A504	4	#6	STR	34'-10"	209
A550	2	#6	STR	11'-1"	33
A551	2	#6	STR	11'-8"	35
A552	2	#6	STR	12'-3"	37
A553	2	#6	STR	12'-10"	39
A554	2	#6	STR	13'-5"	40
A555	2	#6	STR	14'-0"	42
A556	2	#6	STR	14'-7"	44
A557	2	#6	STR	15'-2"	46
A558	2	#6	STR	15'-9"	47
A559	2	#6	STR	16'-4"	49

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	92	#4	STR	11'-0"	676
B2	92	#4	STR	8'-4"	512
B3	124	#4	STR	11'-0"	911
C1	32	#4	STR	18'-5"	394
C2	34	#4	STR	23'-0"	522
C3	30	#4	STR	27'-3"	546
C4	24	#4	STR	8'-10"	142
C5	50	#4	STR	13'-7"	454
C6	52	#4	STR	18'-3"	634
C7	54	#4	STR	22'-10"	824
D1	64	#6	STR	2'-6"	240
D2	26	#6	STR	2'-4"	91
G1	4	#5	STR	38'-8"	161
S2	3	#8	STR	30'-11"	248
S3	3	#8	STR	11'-4"	91
S4	3	#8	STR	38'-8"	310

REINFORCING STEEL 23,474 LBS

RIGHT EXTENSION QUANTITIES

CLASS A CONCRETE

BARREL @ 4.50 CY/FT 135.1 C.Y.

BOTTOM SLAB EXTENSION 20.1 C.Y.

LOW FLOW SILL 1.6 C.Y.

WINGS, ETC. 45.6 C.Y.

TOTAL 202.4 C.Y.

REINFORCING STEEL

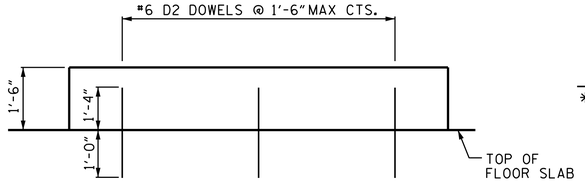
BARREL, BOTTOM SLAB EXTENSION & LOW FLOW SILL 23,474 LBS.

WINGS, ETC. 3600 LBS.

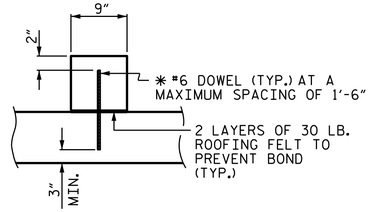
TOTAL 27,074 LBS.

CULVERT EXCAVATION LUMP SUM

FOUNDATION COND. MAT'L. 130 TONS



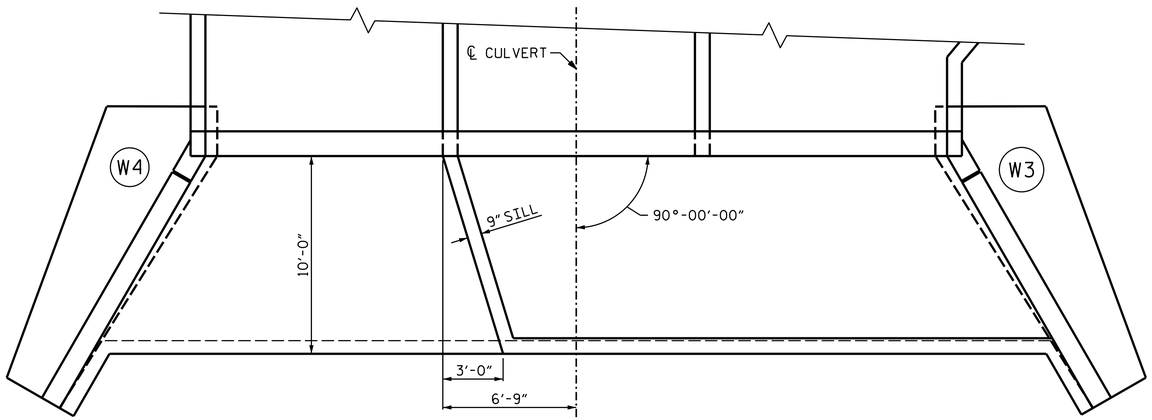
ELEVATION



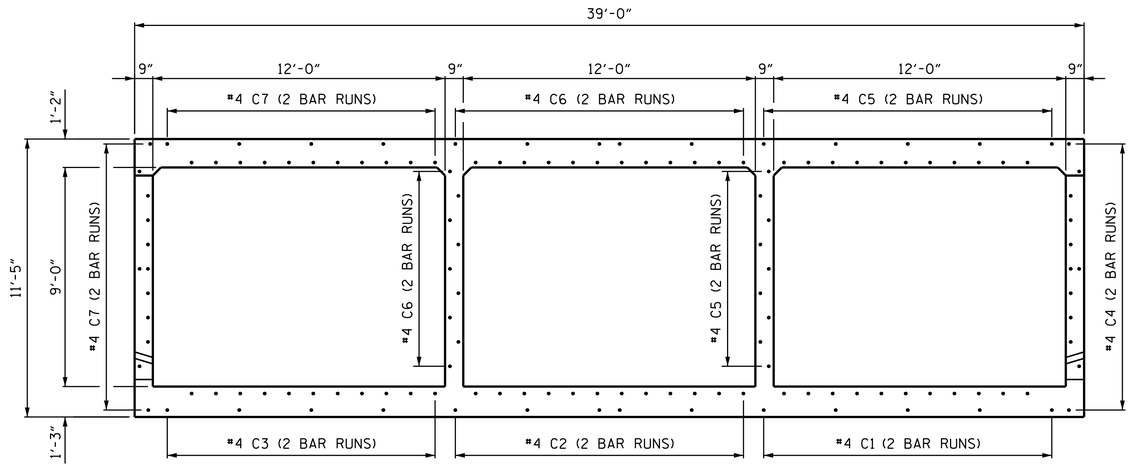
SECTION THROUGH SILL

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

LOW FLOW SILL DETAILS



PLAN OF LOW FLOW SILL LAYOUT



"C" BAR LAYOUT - RIGHT EXTENSION

FIELD BEND "C" AS NECESSARY

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 46+41.00 -L-

SHEET 12 OF 14

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

Marshall G. Cheek, Jr. 3A4DC41...

6/1/2022

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 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION 45°-10'-48" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-12
1			3			TOTAL SHEETS
2			4			14

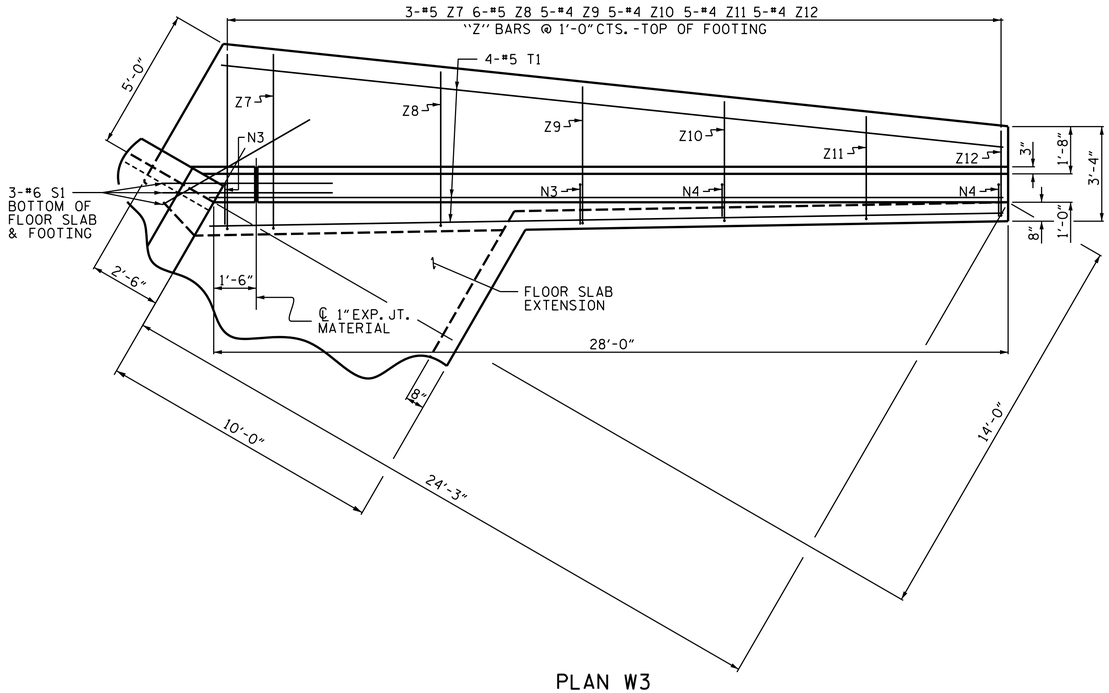
STR #2

DRAWN BY : STM DATE : 04/21

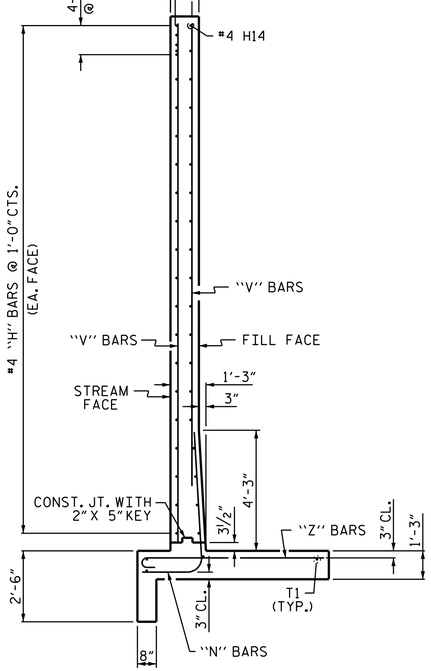
CHECKED BY : MGC DATE : 02/22

DESIGN ENGINEER OF RECORD: STM DATE : 04/21

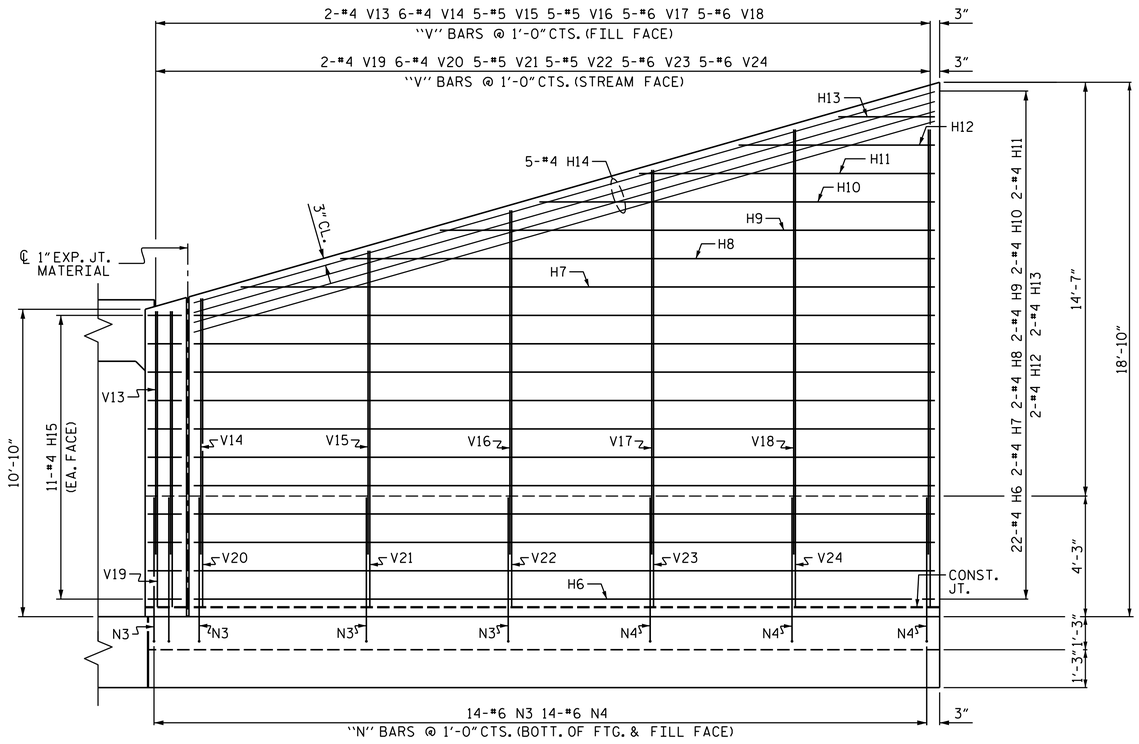
3/15/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #2 46+41.00 -L-\Final Plans\DGNs\412_023_A-0009CA_SMU_CU012_370132.dgn
User:smassinople



PLAN W3

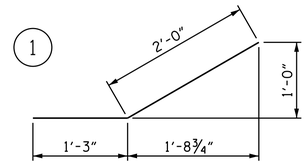


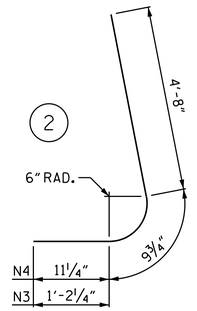
TYPICAL WING SECTION

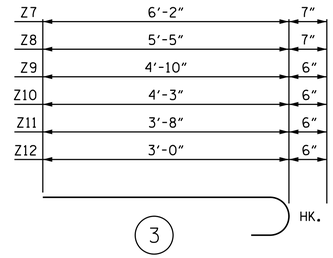


ELEVATION W3

BAR TYPES







ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H6	22	#4	STR	26'-1"	383
H7	2	#4	STR	24'-5"	33
H8	2	#4	STR	20'-11"	28
H9	2	#4	STR	17'-5"	23
H10	2	#4	STR	13'-11"	19
H11	2	#4	STR	10'-5"	14
H12	2	#4	STR	6'-11"	9
H13	2	#4	STR	3'-5"	5
H14	5	#4	STR	27'-2"	91
H15	22	#4	1	3'-3"	48
N3	14	#6	2	6'-8"	140
N4	14	#6	2	6'-5"	135
S1	3	#6	STR	6'-0"	27
T1	4	#5	STR	27'-11"	116
V13	2	#4	STR	8'-6"	11
V14	6	#4	STR	9'-0"	36
V15	5	#5	STR	10'-8"	56
V16	5	#5	STR	12'-1"	63
V17	5	#6	STR	13'-6"	101
V18	5	#6	STR	14'-11"	112
V19	2	#4	STR	10'-5"	14
V20	6	#4	STR	10'-10"	43
V21	5	#5	STR	12'-6"	65
V22	5	#5	STR	14'-0"	73
V23	5	#6	STR	15'-5"	116
V24	5	#6	STR	16'-10"	126
Z7	3	#5	3	6'-9"	21
Z8	6	#5	3	6'-0"	38
Z9	5	#4	3	5'-4"	18
Z10	5	#4	3	4'-9"	16
Z11	5	#4	3	4'-2"	14
Z12	5	#4	3	3'-6"	12

REINFORCING STEEL
FOR 1 WING 2006 LBS

CLASS A CONCRETE
1 WING 22.7 CY
1 HEADWALL 1.8 CY
1 END CURTAIN WALL 3.0 CY
TOTAL 27.5 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.

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

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 46+41.00 -L-

SHEET 13 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

WING W3 FOR TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION

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

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-13
1			3			TOTAL SHEETS
2			4			14

STR #2

DRAWN BY : STM DATE : 12/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 12/21

3/15/2022
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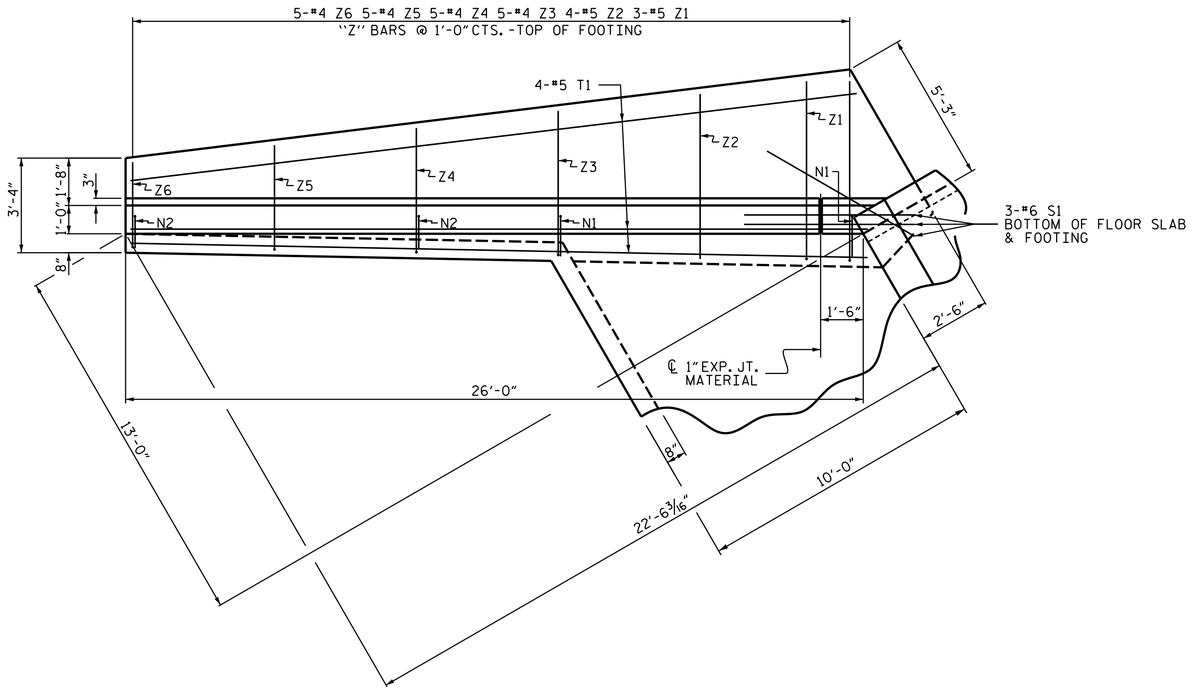
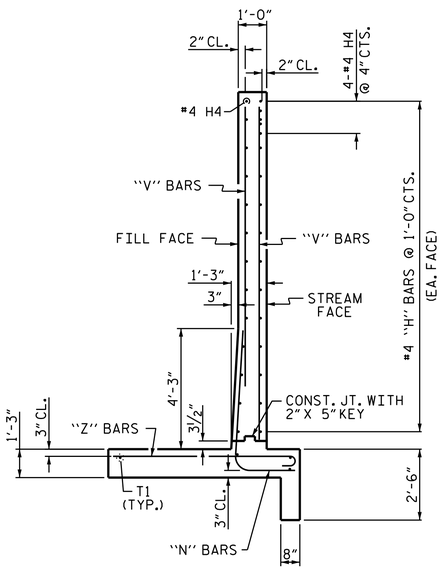
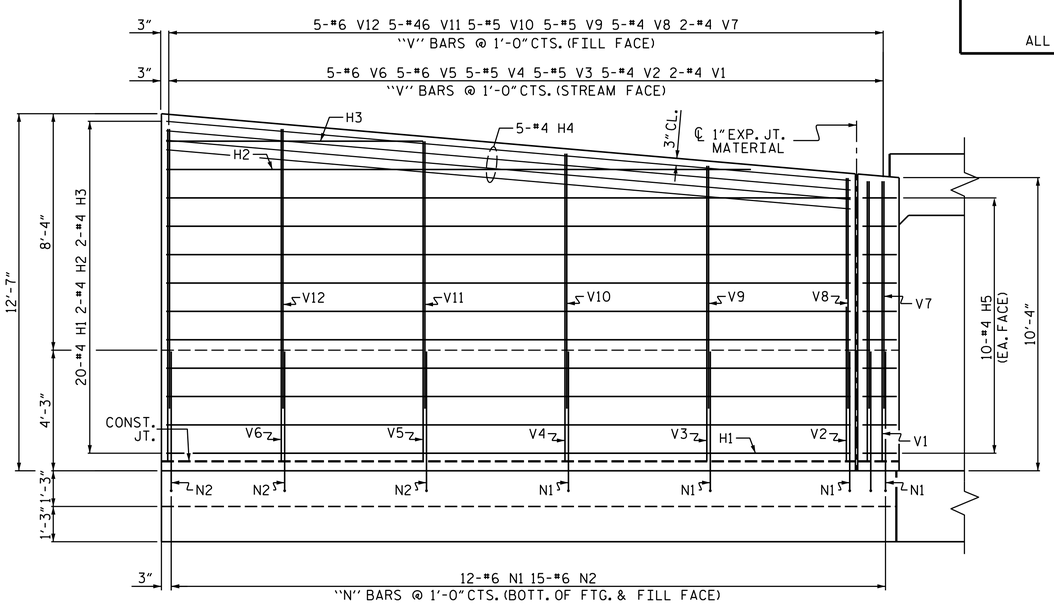
User:smassinople



PLAN W4

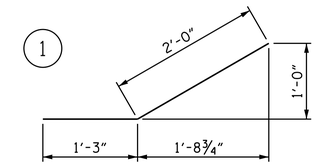


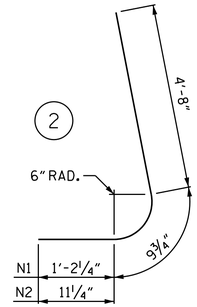
TYPICAL WING SECTION

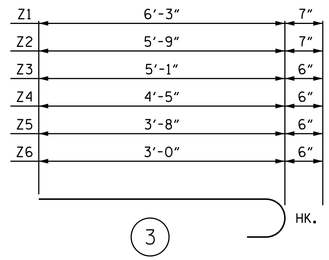


ELEVATION W4

BAR TYPES







ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	20	#4	STR	24'-1"	322
H2	2	#4	STR	20'-7"	27
H3	2	#4	STR	9'-0"	12
H4	5	#4	STR	24'-3"	81
H5	20	#4	1	3'-3"	43
N1	12	#6	2	6'-8"	120
N2	15	#6	2	6'-5"	145
S1	3	#6	STR	6'-0"	27
T1	4	#5	STR	25'-10"	108
V1	2	#4	STR	9'-6"	13
V2	5	#4	STR	9'-10"	33
V3	5	#5	STR	10'-3"	53
V4	5	#5	STR	10'-9"	56
V5	5	#6	STR	11'-3"	84
V6	5	#6	STR	11'-8"	88
V7	2	#4	STR	8'-0"	11
V8	5	#4	STR	8'-1"	27
V9	5	#5	STR	8'-6"	44
V10	5	#5	STR	9'-0"	47
V11	5	#6	STR	9'-5"	71
V12	5	#6	STR	9'-10"	74
Z1	3	#5	3	6'-10"	21
Z2	4	#5	3	6'-4"	26
Z3	5	#4	3	5'-7"	19
Z4	5	#4	3	4'-11"	16
Z5	5	#4	3	4'-2"	14
Z6	5	#4	3	3'-6"	12

REINFORCING STEEL
FOR 1 WING 1594 LBS

CLASS A CONCRETE
1 WING 18.1 CY
TOTAL 18.1 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. A-0009CA
GRAHAM COUNTY
STATION: 46+41.00 -L-

SHEET 14 OF 14

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

WING W4 FOR TRIPLE 12 FT. X 9 FT. CONCRETE BOX CULVERT RIGHT EXTENSION

DRAWN BY : STM DATE : 12/21
CHECKED BY : MGC DATE : 02/22
DESIGN ENGINEER OF RECORD: STM DATE : 12/21

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 209
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

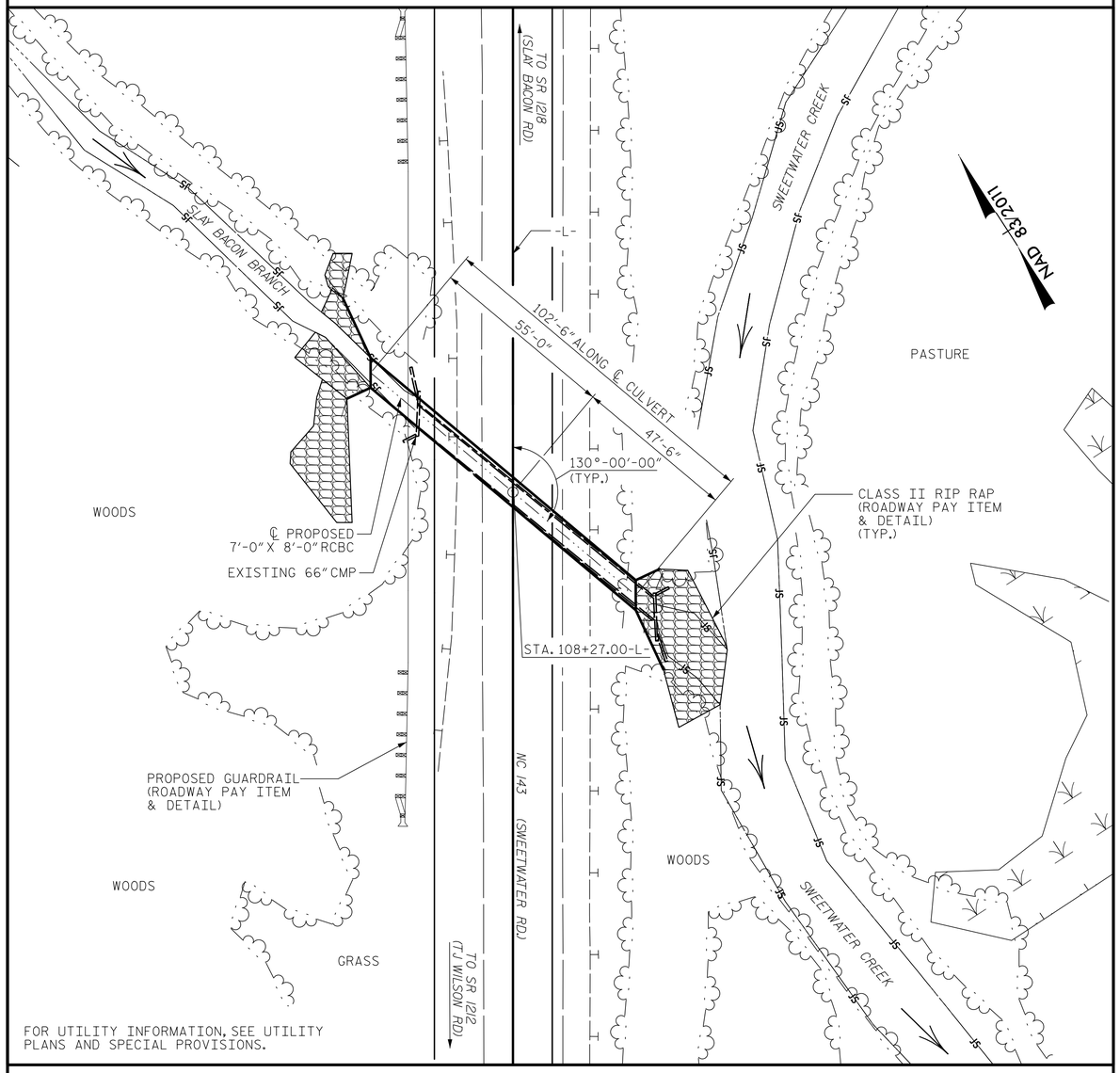
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-14
1			3			TOTAL SHEETS
2			4			14

STR #2

3/15/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #2 46+41.00 -L-\Final Plans\DGNs\412_027_A-0009CA_SMU_CU014_370132.dgn
User:smassinople

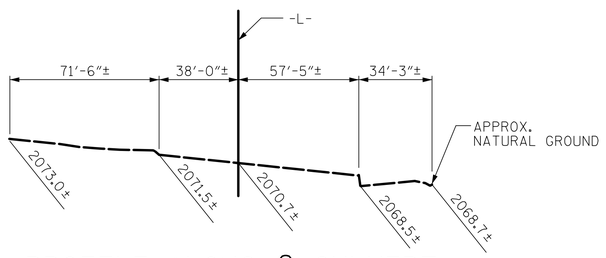
F.A. PROJECT NO.: APD-0074(178)

BENCH MARK #6: SPIKE NAIL IN BASE OF 24" WHITE OAK; 56' RT OF STA. 118+67 -L-; ELEV. = 2100.03



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH



PROFILE ALONG ℄ CULVERT

DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	4/21
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	4/21

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 0.92 CY/FT	94.3	C.Y.
WINGS, ETC.	31.0	C.Y.
SILLS	1.3	C.Y.
TOTAL	126.6	C.Y.
REINFORCING STEEL		
BARREL & SILLS	9,442	LBS.
WINGS, ETC.	1,858	LBS.
TOTAL	11,300	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	90 TONS	

ROADWAY DATA

GRADE POINT ELEV. @ STA. 108+27.00-L- = 2084.41
BED ELEV. @ STA. 108+27.00-L- = 2069.8
ROADWAY SLOPES = 2:1

HYDROGRAPHIC DATA

DESIGN DISCHARGE = 430 CFS
FREQUENCY OF DESIGN FLOOD = 50 YRS
DESIGN HIGH WATER ELEVATION = 2079.8
DRAINAGE AREA = 0.58 SQ. MI.
BASE DISCHARGE (Q100) = 530 CFS
BASE HIGH WATER ELEVATION = 2081.3

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 700 CFS
FREQUENCY OF OVERTOPPING FLOOD = >100 YRS
OVERTOPPING FLOOD ELEVATION = 2084.2

SAMPLE BAR REPLACEMENT

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

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

NOTES:

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

DESIGN FILL---------- 6.0' MAX.

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

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

CONCRETE IN CULVERT TO BE POURED IN THE FOLLOWING ORDER:

1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.

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

DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.

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.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

EXCAVATE 1 FOOT BELOW CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS. FOUNDATION CONDITIONING MATERIAL SHOULD CONSIST OF SELECT MATERIAL CLASS V OR VI FOR RCBC.

IF REQUIRED, UNDERCUT LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.

FOR TRAFFIC PHASING, SEE TRAFFIC CONTROL PLANS.

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 108+27.00 -L-

SHEET 1 OF 6

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

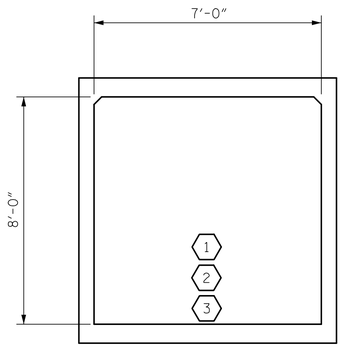
SINGLE 7 FT. x 8 FT. CONCRETE BOX CULVERT 130° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-1
1			3			TOTAL SHEETS
2			4			6

STR. #3

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 (γLL)	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)	1.11	--	1.75	1.11	1	BOTTOM SLAB	4.25	1.75	1	BOTTOM SLAB	0.75	
		HL-93 (OPERATING)	N/A		1.43	--	1.35	1.43	1	BOTTOM SLAB	4.25	2.27	1	BOTTOM SLAB	0.75	
		HS-20 (INVENTORY)	36.000	(2)	1.15	47.52	1.75	1.15	1	BOTTOM SLAB	4.25	1.83	1	BOTTOM SLAB	0.75	
		HS-20 (OPERATING)	36.000		1.50	61.56	1.35	1.50	1	BOTTOM SLAB	4.25	2.37	1	BOTTOM SLAB	0.75	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.06	23.22	1.40	2.06	1	TOP SLAB	4.25	4.01	1	TOP SLAB	0.75	
		SNGARBS2	20.000		1.92	33.40	1.40	1.92	1	TOP SLAB	4.25	3.75	1	TOP SLAB	0.75	
		SNAGRIS2	22.000		2.06	37.84	1.40	2.06	1	TOP SLAB	4.25	4.01	1	TOP SLAB	0.75	
		SNCOTTS3	27.250	(3)	1.39	44.15	1.40	1.39	1	BOTTOM SLAB	4.25	2.19	1	BOTTOM SLAB	0.75	
		SNAGGRS4	34.925		1.78	62.26	1.40	1.78	1	BOTTOM SLAB	4.25	2.82	1	BOTTOM SLAB	0.75	
		SNS5A	35.550		2.01	62.57	1.40	2.01	1	TOP SLAB	4.25	3.61	1	BOTTOM SLAB	0.75	
		SNS6A	39.950		1.63	70.31	1.40	1.63	1	BOTTOM SLAB	4.25	2.58	1	BOTTOM SLAB	0.75	
		SNS7B	42.000		1.63	73.92	1.40	1.63	1	BOTTOM SLAB	4.25	2.58	1	BOTTOM SLAB	0.75	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.05	56.76	1.40	2.05	1	TOP SLAB	4.25	4.01	1	TOP SLAB	0.75	
		TNT4A	33.075		1.65	58.21	1.40	1.65	1	BOTTOM SLAB	4.25	2.61	1	BOTTOM SLAB	0.75	
		TNT6A	41.600		1.63	73.22	1.40	1.63	1	BOTTOM SLAB	4.25	2.58	1	BOTTOM SLAB	0.75	
		TNT7A	42.000		1.64	73.92	1.40	1.64	1	BOTTOM SLAB	4.25	2.60	1	BOTTOM SLAB	0.75	
		TNT7B	42.000		1.63	73.92	1.40	1.63	1	BOTTOM SLAB	4.25	2.58	1	BOTTOM SLAB	0.75	
		TNAGRIT4	43.000		1.65	73.96	1.40	1.65	1	BOTTOM SLAB	4.25	2.61	1	BOTTOM SLAB	0.75	
		TNAGT5A	45.000		1.65	74.40	1.40	1.65	1	BOTTOM SLAB	4.25	2.61	1	BOTTOM SLAB	0.75	
		TNAGT5B	45.000		1.65	79.20	1.40	1.65	1	BOTTOM SLAB	4.25	2.61	1	BOTTOM SLAB	0.75	



LRFR SUMMARY

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. A-0009CA

GRAHAM COUNTY

STATION: 108+27.00 -L-

SHEET 2 OF 6

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
SEAL F3A4DC41...
6/1/2022

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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

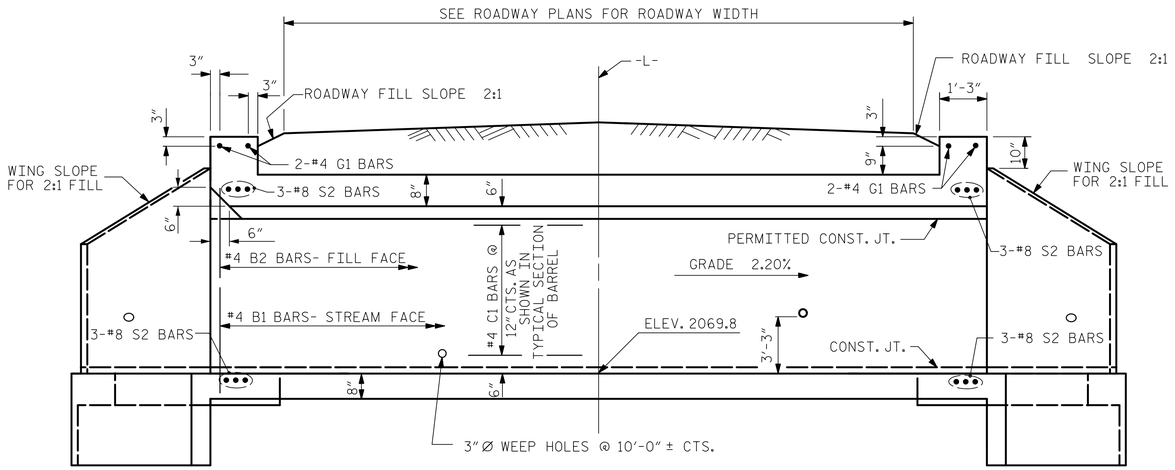
LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-2
1			3			TOTAL SHEETS
2			4			6

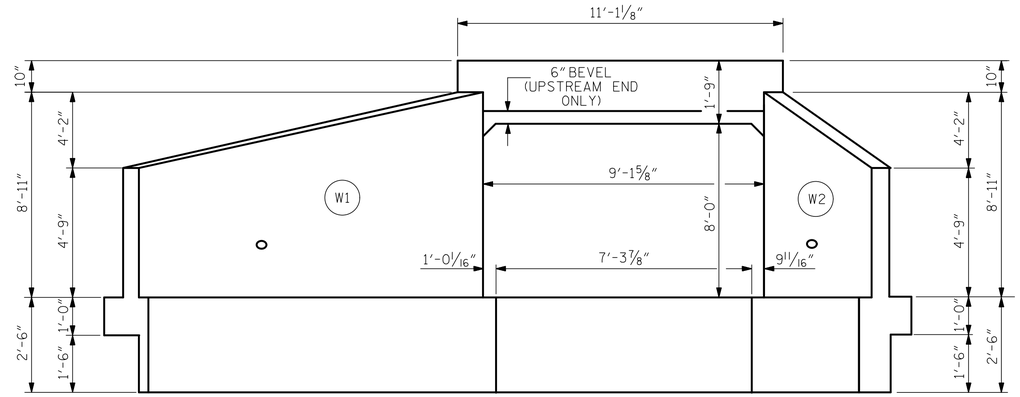
STR. #3 STD. NO. LRFR5

ASSEMBLED BY :	ZCS	DATE :	2/21
CHECKED BY :	MGC	DATE :	4/21
DRAWN BY : WMC	7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM	7/11	REV. 12/17	MAA/THC

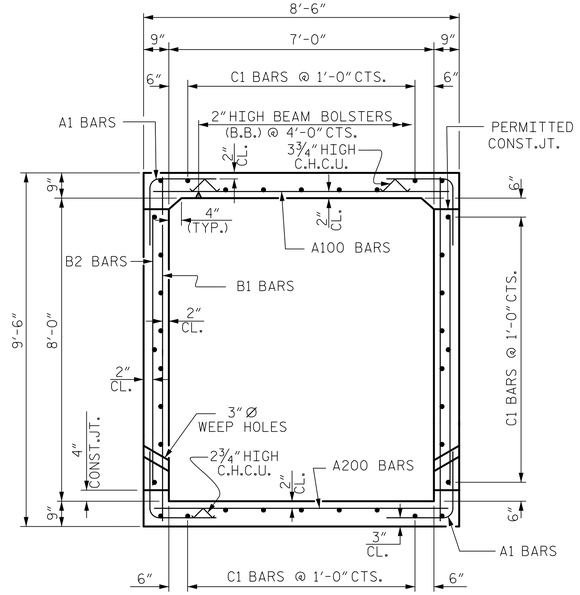
2/21/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #3 108+27.00 -L-\Final Plans\DGNs\413_003_A-0009CA_SMU_CU02.dgn
User:ZSmith



CULVERT SECTION NORMAL TO ROADWAY



END ELEVATION NORMAL TO SKEW



RIGHT ANGLE SECTION OF BARREL

THERE ARE 36 "C" BARS IN SECTION OF BARREL

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 108+27.00 -L-

SHEET 3 OF 6

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

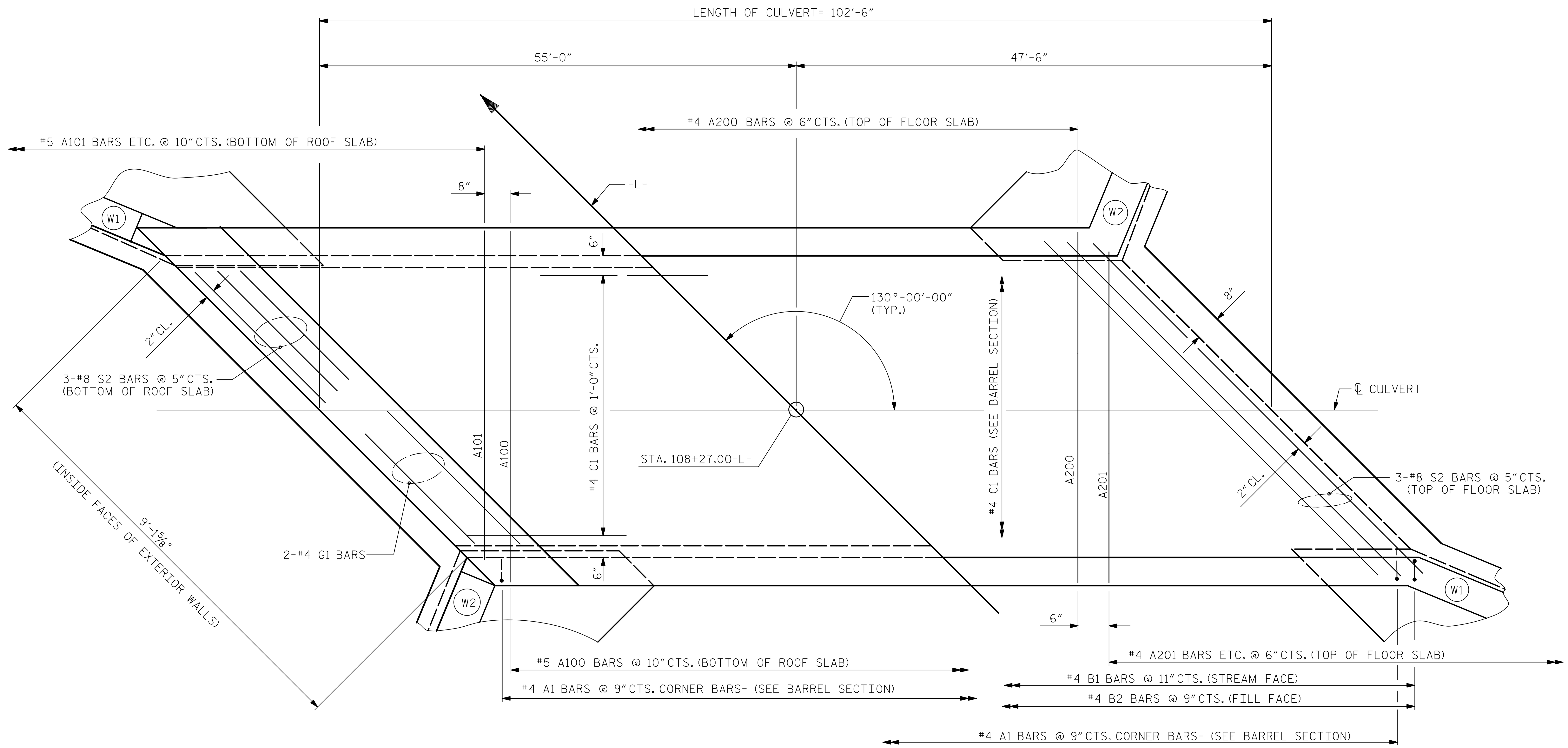
SINGLE 7 FT. X 8 FT. CONCRETE BOX CULVERT 130° SKEW

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

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-3
1			3			TOTAL SHEETS
2			4			6

DRAWN BY :	ZCS	DATE : 2/21
CHECKED BY :	MGC	DATE : 4/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE : 4/21



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB

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

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 108+27.00 -L-

SHEET 4 OF 6

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 7 FT. X 8 FT. CONCRETE BOX CULVERT 130° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-4
1			3			TOTAL SHEETS
2			4			6

STR. #3

DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 4/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 4/21

2/21/2022
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User:ZSmith

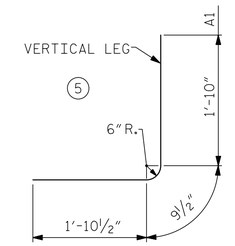
NOTES

NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED OR FLOODPLAIN AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. RIP-RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL IN THE CULVERT BARREL. IF RIP-RAP IS USED TO LINE THE BARREL, NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

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.

BAR TYPE



DIMENSIONS ARE OUT TO OUT

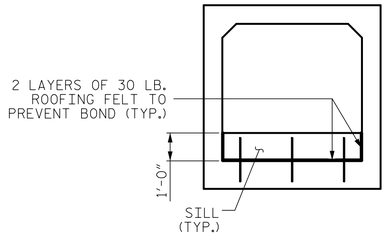
SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
``B''	#4	1'-10"
C1	#4	1'-11"

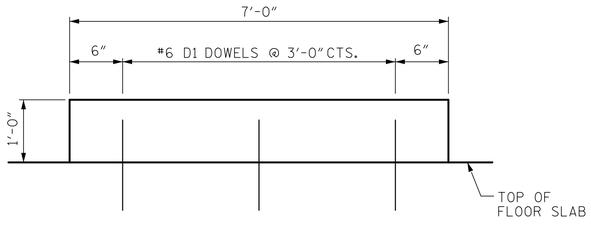
BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	544	#4	5	4'-6"	1635
A100	115	#5	STR	8'-1"	970
A101	2	#5	STR	7'-2"	15
A102	2	#5	STR	6'-2"	13
A103	2	#5	STR	5'-2"	11
A104	2	#5	STR	4'-2"	9
A105	2	#5	STR	3'-2"	7
A200	191	#4	STR	8'-1"	1031
A201	2	#4	STR	7'-7"	10
A202	2	#4	STR	7'-0"	9
A203	2	#4	STR	6'-4"	8
A204	2	#4	STR	5'-9"	8
A205	2	#4	STR	5'-2"	7
A206	2	#4	STR	4'-7"	6
A207	2	#4	STR	4'-0"	5
A208	2	#4	STR	3'-5"	5
A209	2	#4	STR	2'-9"	4
B1	224	#4	STR	8'-6"	1272
B2	272	#4	STR	8'-0"	1454
C1	108	#4	STR	35'-8"	2573
D1	15	#6	STR	1'-3"	28
G1	4	#4	STR	10'-5"	28
S2	12	#8	STR	10'-5"	334

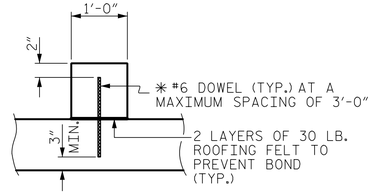
REINFORCING STEEL 9,442 LBS



INLET ELEVATION



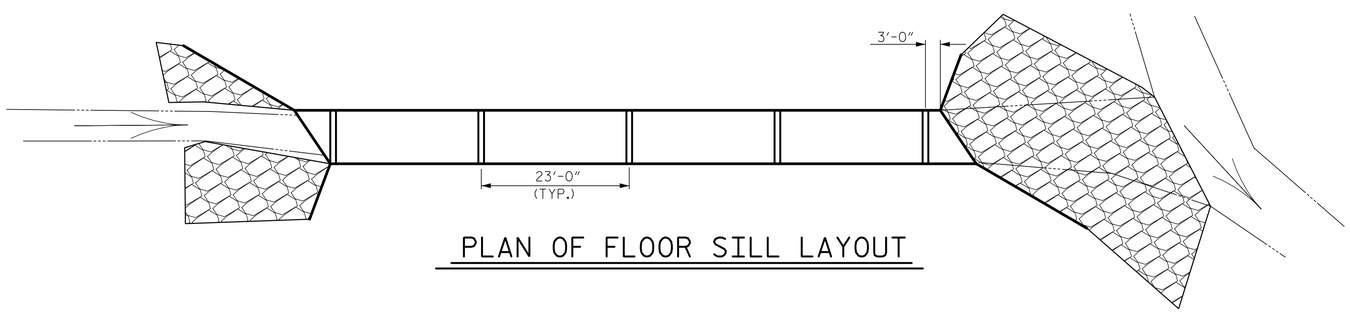
ELEVATION



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. A-0009CA

GRAHAM COUNTY

STATION: 108+27.00 -L-

SHEET 5 OF 6

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
SIGNATURE 34ADC413...
6/1/2022

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

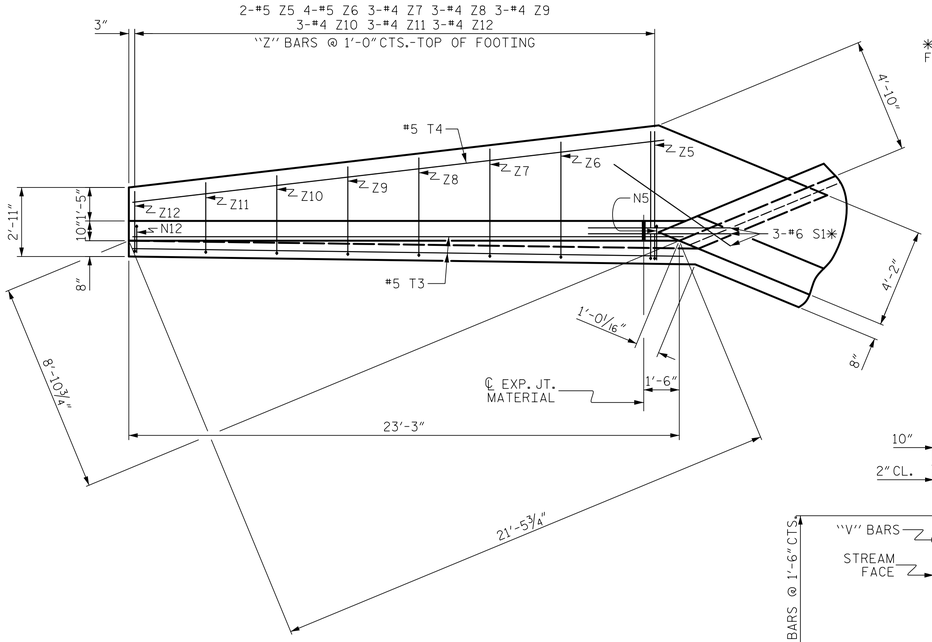
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 7 FT. X 8 FT. CONCRETE BOX CULVERT 130° SKEW

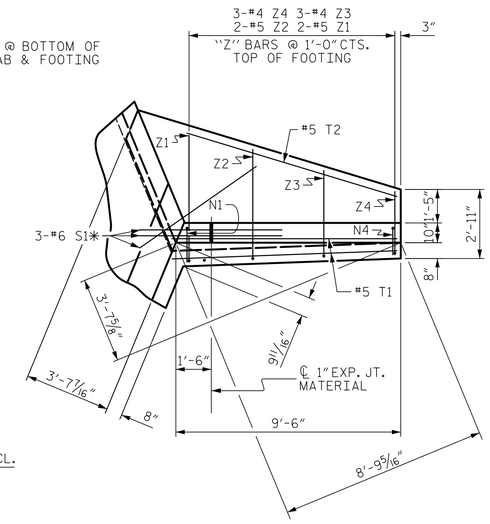
REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-5
1			3			TOTAL SHEETS
2			4			6

DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 4/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 4/21

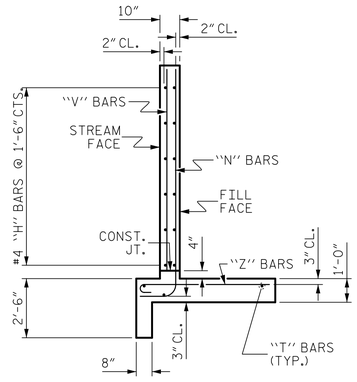
2/21/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #3 108+27.00 -L-\Final Plans\DGNs\413_009_A-0009CA_SMU_CU05.dgn
User:ZSmith



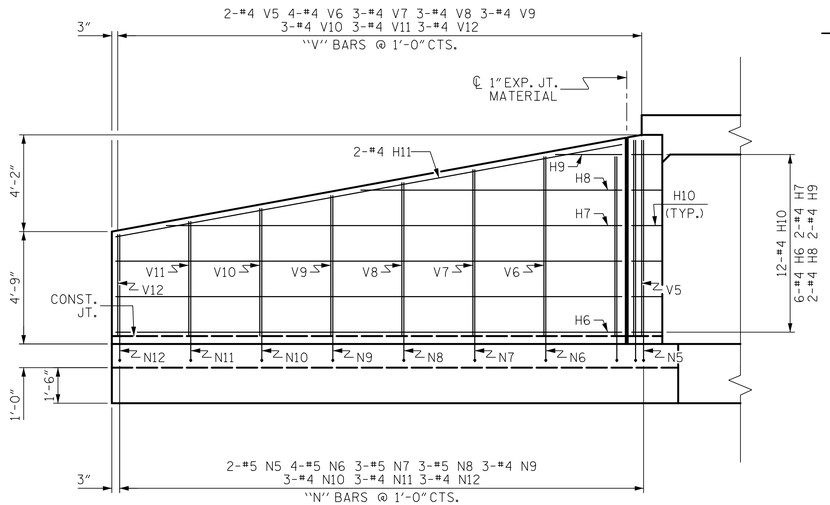
PLAN W1



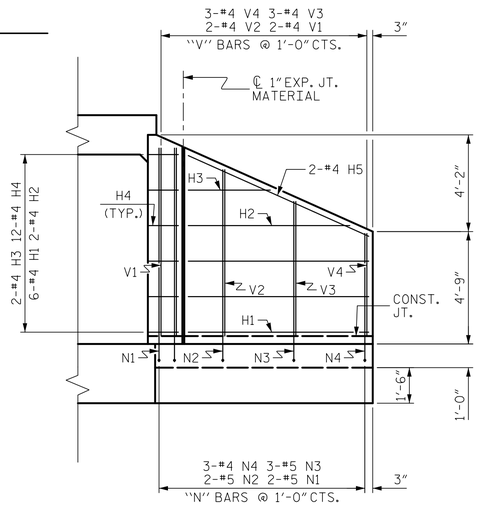
PLAN W2



TYPICAL WING SECTION

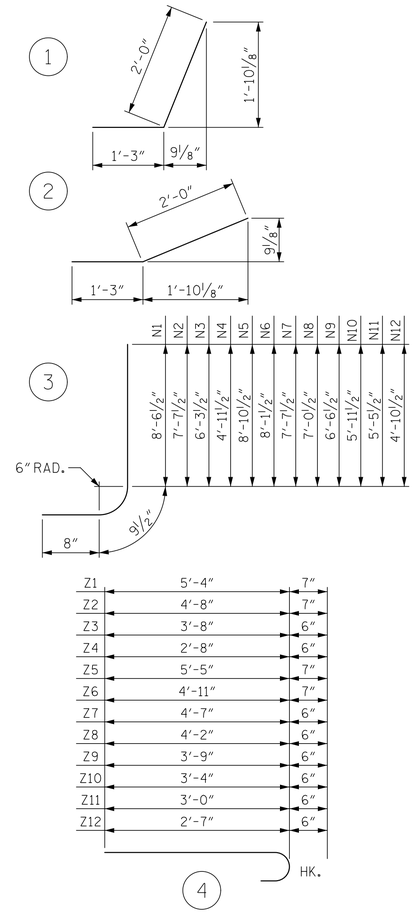


ELEVATION W1



ELEVATION W2

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	7'-7"	61
H2	4	#4	STR	6'-9"	18
H3	4	#4	STR	3'-5"	9
H4	24	#4	1	3'-3"	52
H5	4	#4	STR	8'-4"	22
H6	12	#4	STR	21'-4"	171
H7	4	#4	STR	19'-3"	51
H8	4	#4	STR	11'-0"	29
H9	4	#4	STR	2'-9"	7
H10	24	#4	2	3'-3"	52
H11	4	#4	STR	21'-8"	58
N1	4	#5	3	10'-0"	42
N2	4	#5	3	9'-1"	38
N3	6	#5	3	7'-9"	48
N4	6	#4	3	6'-5"	26
N5	4	#5	3	10'-4"	43
N6	8	#5	3	9'-7"	80
N7	6	#5	3	9'-1"	57
N8	6	#5	3	8'-6"	53
N9	6	#4	3	8'-0"	32
N10	6	#4	3	7'-5"	30
N11	6	#4	3	6'-11"	28
N12	6	#4	3	6'-4"	25
S1	12	#6	STR	6'-0"	108
T1	4	#5	STR	9'-6"	40
T2	2	#5	STR	9'-3"	19
T3	4	#5	STR	23'-3"	97
T4	2	#5	STR	22'-7"	47
V1	4	#4	STR	7'-8"	20
V2	4	#4	STR	6'-10"	18
V3	6	#4	STR	5'-7"	22
V4	6	#4	STR	4'-4"	17
V5	4	#4	STR	8'-1"	22
V6	8	#4	STR	7'-4"	39
V7	6	#4	STR	6'-10"	27
V8	6	#4	STR	6'-3"	25
V9	6	#4	STR	5'-9"	23
V10	6	#4	STR	5'-3"	21
V11	6	#4	STR	4'-9"	19
V12	6	#4	STR	4'-3"	17
Z1	4	#5	4	5'-11"	25
Z2	4	#5	4	5'-3"	22
Z3	6	#4	4	4'-2"	17
Z4	6	#4	4	3'-2"	13
Z5	4	#5	4	6'-0"	25
Z6	8	#5	4	5'-6"	46
Z7	6	#4	4	5'-1"	20
Z8	6	#4	4	4'-8"	19
Z9	6	#4	4	4'-3"	17
Z10	6	#4	4	3'-10"	15
Z11	6	#4	4	3'-6"	14
Z12	6	#4	4	3'-1"	12
REINFORCING STEEL FOR 4 WINGS					1858 LBS
CLASS A CONCRETE					
4 WINGS					29.1 CY
2 HEADWALLS					1.0 CY
2 END CURTAIN WALLS					0.9 CY
TOTAL					31.0 CY

NOTES:

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

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.

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 108+27.00 -L-

SHEET 6 OF 6

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR. — Marshall G. Cheek, Jr. — 6/1/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD WINGS FOR SINGLE BARREL CONCRETE BOX CULVERT

H = 8'-0" SLOPE = 2:1

ASSEMBLED BY :	ZCS
CHECKED BY :	MGC
DATE :	4/21
DATE :	4/21
DRAWN BY : CCJ	01/00
CHECKED BY : RWW	03/00
REV. 6/19	MAA/THC

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TGS ENGINEERS
706 HILLSBOROUGH STREET
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. C3-6

TOTAL SHEETS 6

STR. #3

STD. NO. CW13508-SB

2/21/2022
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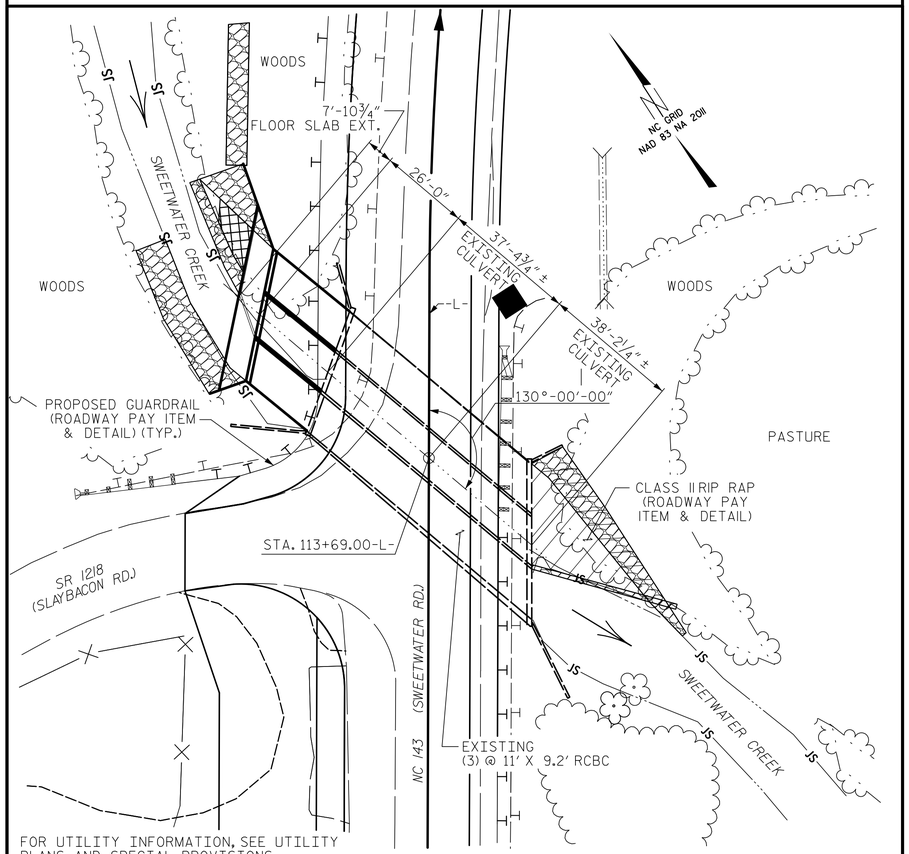
User:ZSmith

F.A. PROJECT NO.: APD-0074(178)

BENCH MARK #6:
SPIKE NAIL IN BASE OF 24" WHITE OAK; 56' RIGHT OF STA. 118+67-L-; ELEV=2100.03



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 3.27 CY/FT	85.0	C.Y.
WINGS, ETC.	22.4	C.Y.
BOTTOM SLAB EXT.	11.1	C.Y.
LOW FLOW SILL	1.4	C.Y.
TOTAL	119.9	C.Y.
REINFORCING STEEL		
BARREL & SILL	16,136	LBS.
WINGS, ETC.	1,074	LBS.
TOTAL	17,210	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	96 TONS	

SAMPLE BAR REPLACEMENT

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

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

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

SEAL

ROADWAY DATA

GRADE POINT ELEV. @ STA. 113+69.00-L- = 2089.01'
BED ELEV. @ STA. 113+69.00-L- = 2075.0'±
ROADWAY SLOPES = 2 : 1

HYDROGRAPHIC DATA

DESIGN DISCHARGE = 2960 CFS
FREQUENCY OF DESIGN FLOOD = 50 YRS
DESIGN HIGH WATER ELEVATION = 2085.1'
DRAINAGE AREA = 10.7 SQ. MI.
BASE DISCHARGE (Q100) = 3570 CFS
BASE HIGH WATER ELEVATION = 2086.5'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 4300 CFS
FREQUENCY OF OVERTOPPING FLOOD = >200 YRS
OVERTOPPING FLOOD ELEVATION = 2087.7'

NOTES:

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

DESIGN FILL---------- 5.4'

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

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

CONCRETE IN CULVERT TO BE POURED IN THE FOLLOWING ORDER:

1. PHASE I WING FOOTINGS AND FLOOR SLAB INCLUDING 4" 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.

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.

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

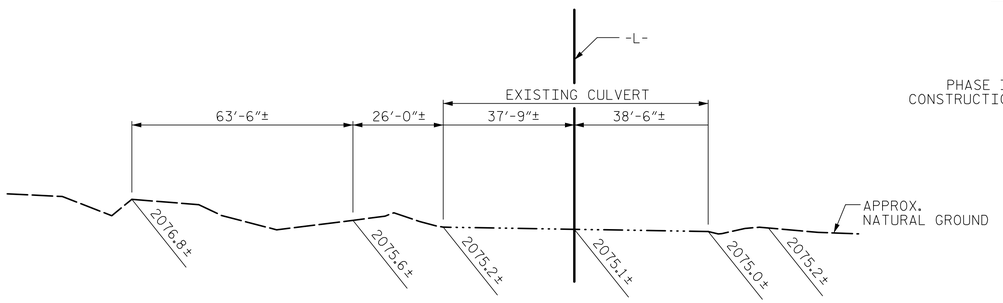
AT THE CONTRACTOR'S OPTION HE MAY SUBMIT, TO THE ENGINEER FOR APPROVAL, DESIGN AND DETAIL DRAWINGS FOR A PRECAST REINFORCED CONCRETE BOX CULVERT IN LIEU OF THE CAST-IN-PLACE CULVERT SHOWN ON THE PLANS. THE DESIGN SHALL PROVIDE THE SAME SIZE AND NUMBER OF BARRELS AS USED ON THE CAST-IN-PLACE DESIGN. FOR OPTIONAL PRECAST REINFORCED CONCRETE BOX CULVERT, SEE SPECIAL PROVISIONS.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

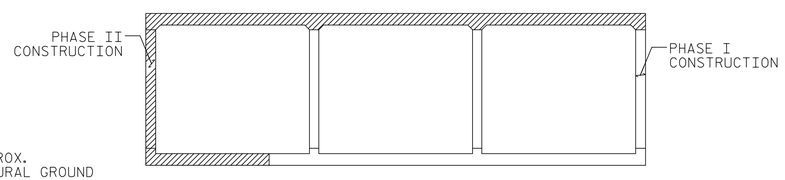
EXCAVATE 1 FOOT BELOW CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS. FOUNDATION CONDITIONING MATERIAL SHOULD CONSIST OF SELECT MATERIAL CLASS V OR VI FOR RCBC.

IF REQUIRED, UNDERCUT LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.

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



PROFILE ALONG ℄ CULVERT



CONSTRUCTION PHASING

(LOOKING UPSTREAM)

PHASE I CONSTRUCTION
PHASE II CONSTRUCTION

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 113+69.00 -L-

SHEET 1 OF 8 STRUCTURE No. 370133

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER Marshall G. Chick, Jr. 6/1/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. x 9.2 FT. CONCRETE BOX CULVERT LEFT EXTENSION 130° SKEW

DRAWN BY : ZCS DATE : 3/21
CHECKED BY : MGC DATE : 8/21
DESIGN ENGINEER OF RECORD : ZCS DATE : 4/22

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

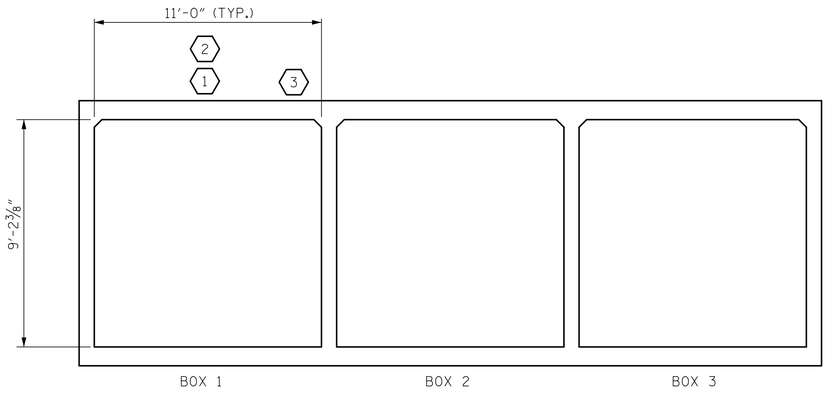
TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-1
1			3			TOTAL SHEETS
2			4			8

STR. #4

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 (γLL)	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	1.12	--	1.75	1.12	1	TOP SLAB	6.21	1.27	1	BOTTOM SLAB	11.71	
		HL-93 (OPERATING)	N/A		1.45	--	1.35	1.45	1	TOP SLAB	6.21	1.64	1	TOP SLAB	11.71	
		HS-20 (INVENTORY)	36.000	2	1.16	41.76	1.75	1.16	1	TOP SLAB	6.21	1.52	1	TOP SLAB	11.71	
		HS-20 (OPERATING)	36.000		1.51	54.36	1.35	1.51	1	TOP SLAB	6.21	1.98	1	TOP SLAB	11.71	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.34	31.59	1.40	2.34	1	TOP SLAB	6.21	3.01	1	BOTTOM SLAB	11.71	
		SNGARBS2	20.000		2.19	43.80	1.40	2.19	1	TOP SLAB	6.21	2.75	1	TOP SLAB	11.71	
		SNAGRIS2	22.000		2.18	47.96	1.40	2.18	1	TOP SLAB	11.71	2.58	1	BOTTOM SLAB	11.71	
		SNCOTTS3	27.250		1.40	38.15	1.40	1.40	1	TOP SLAB	6.21	1.81	1	BOTTOM SLAB	11.71	
		SNAGGRS4	34.925		1.48	51.69	1.40	1.48	1	TOP SLAB	6.21	1.64	1	BOTTOM SLAB	11.71	
		SNS5A	35.550		1.62	57.59	1.40	1.67	1	TOP SLAB	6.21	1.62	1	BOTTOM SLAB	11.71	
		SNS6A	39.950		1.44	57.53	1.40	1.55	1	TOP SLAB	6.21	1.44	1	BOTTOM SLAB	11.71	
		SNS7B	42.000		1.40	58.80	1.40	1.48	1	TOP SLAB	11.71	1.40	1	BOTTOM SLAB	11.71	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.75	57.75	1.40	1.93	1	TOP SLAB	11.71	1.75	1	BOTTOM SLAB	11.71	
		TNT4A	33.075		1.66	54.90	1.40	1.66	1	TOP SLAB	6.21	1.74	1	BOTTOM SLAB	11.71	
		TNT6A	41.600		1.45	60.32	1.40	1.62	1	TOP SLAB	11.71	1.45	1	BOTTOM SLAB	11.71	
		TNT7A	42.000		1.44	60.48	1.40	1.63	1	TOP SLAB	11.71	1.44	1	BOTTOM SLAB	11.71	
		TNT7B	42.000		1.44	60.48	1.40	1.54	1	TOP SLAB	6.21	1.44	1	BOTTOM SLAB	11.71	
		TNAGRIT4	43.000		1.34	57.62	1.40	1.54	1	TOP SLAB	11.71	1.34	1	BOTTOM SLAB	11.71	
		TNAGT5A	45.000		1.28	57.60	1.40	1.52	1	TOP SLAB	11.71	1.28	1	BOTTOM SLAB	11.71	
		TNAGT5B	45.000	3	1.28	57.60	1.40	1.34	1	TOP SLAB	11.71	1.28	1	BOTTOM SLAB	11.71	



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. A-0009CA

GRAHAM COUNTY

STATION: 113+69.00 -L-

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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 (NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-2
1			3			TOTAL SHEETS
2			4			8

STR. #4 STD. NO. LRFR5

ASSEMBLED BY :	ZCS	DATE :	6/21
CHECKED BY :	MGC	DATE :	9/21
DRAWN BY : WMC	7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM	7/11	REV. 12/17	MAA/THC

5/23/2022
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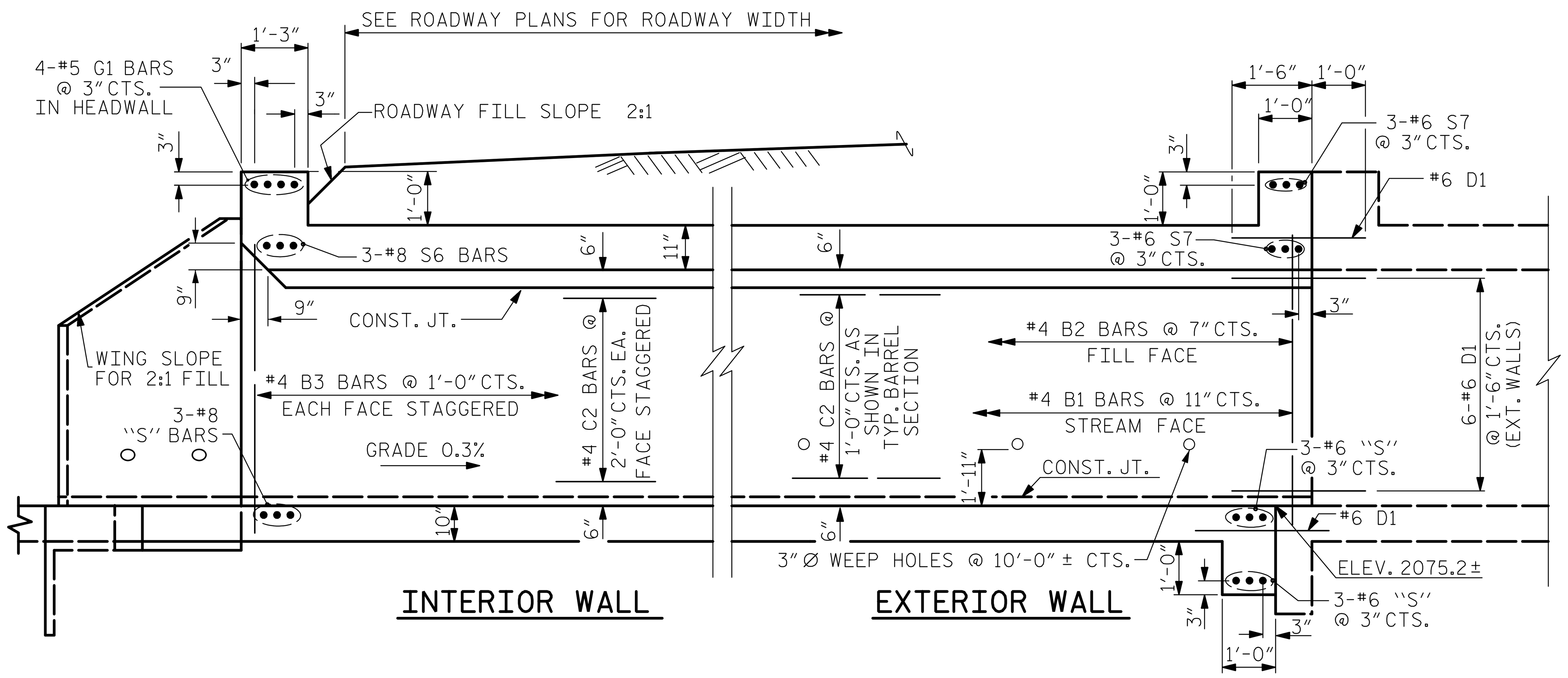
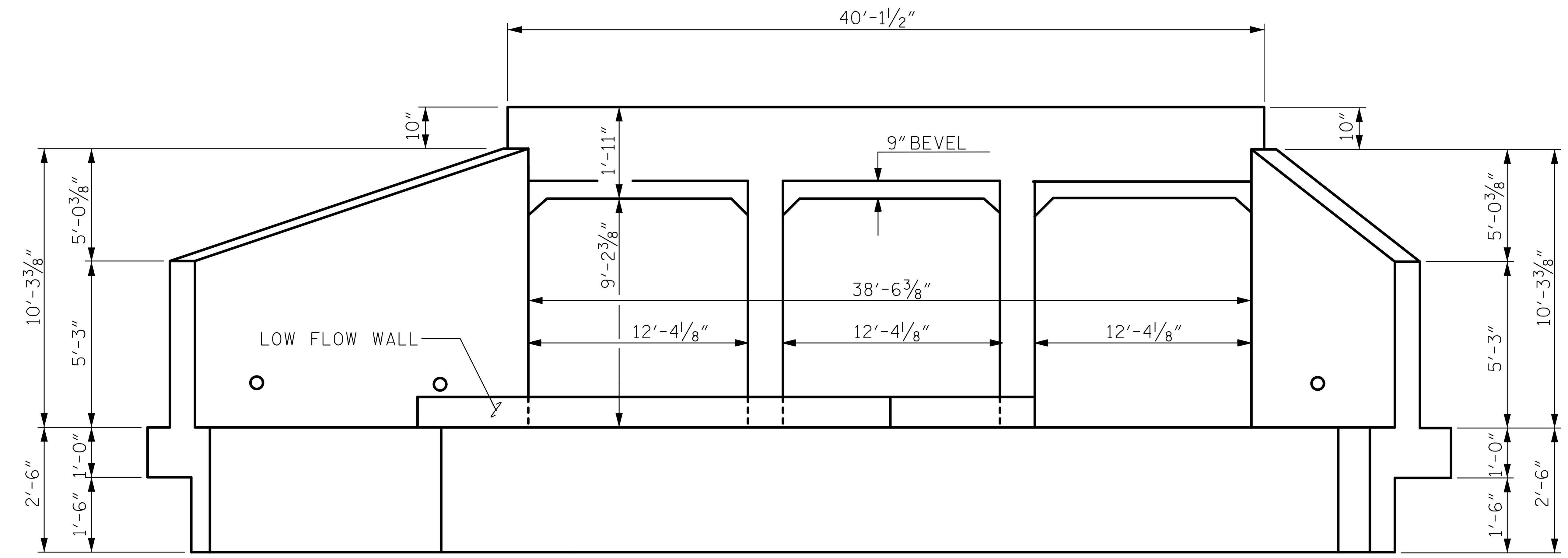
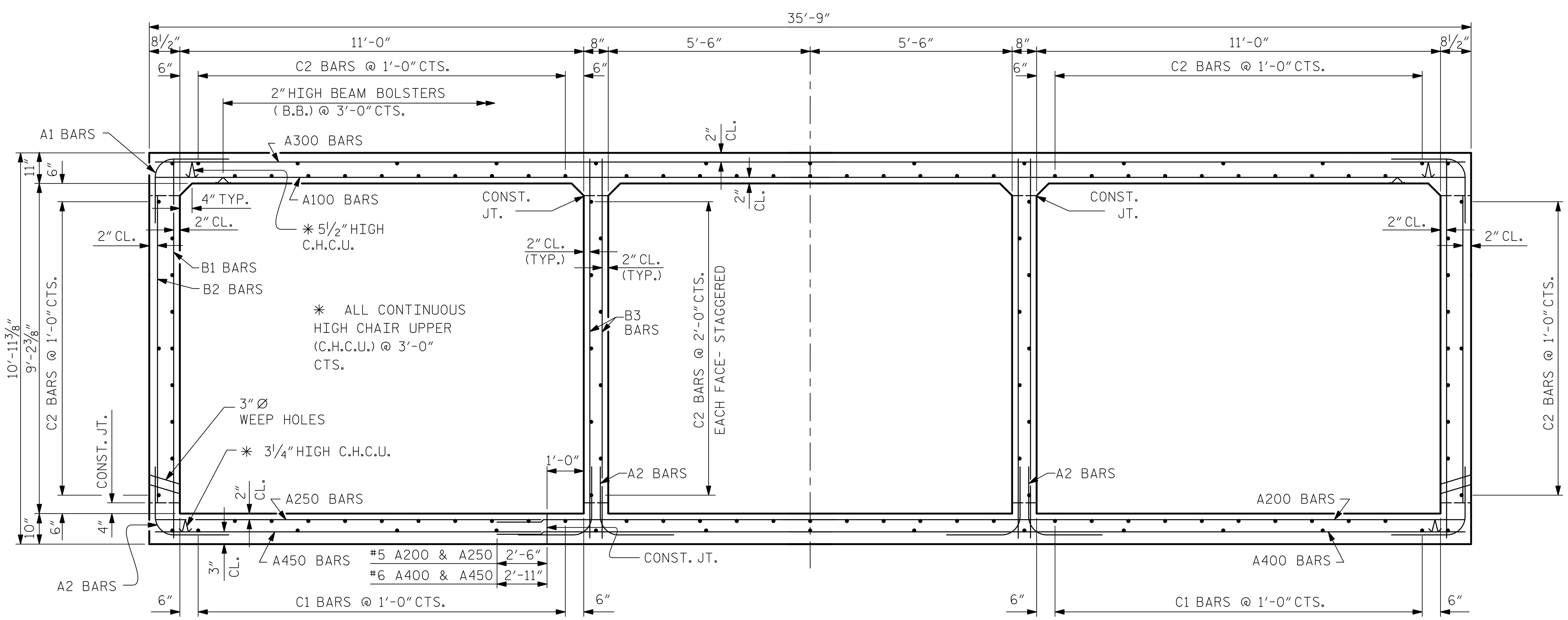
User:ZSmith



CULVERT EXTENSION SECTION NORMAL TO ROADWAY



INLET END ELEVATION NORMAL TO SKEW



RIGHT ANGLE SECTION OF BARREL EXTENSION

THERE ARE 130 ''C'' BARS IN SECTION OF BARREL.
LOOKING UPSTEAM

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 113+69.00 -L-

SHEET 3 OF 8

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. X 9.2 FT. CONCRETE BOX CULVERT LEFT EXTENSION 130° SKEW

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR.
6/1/2022

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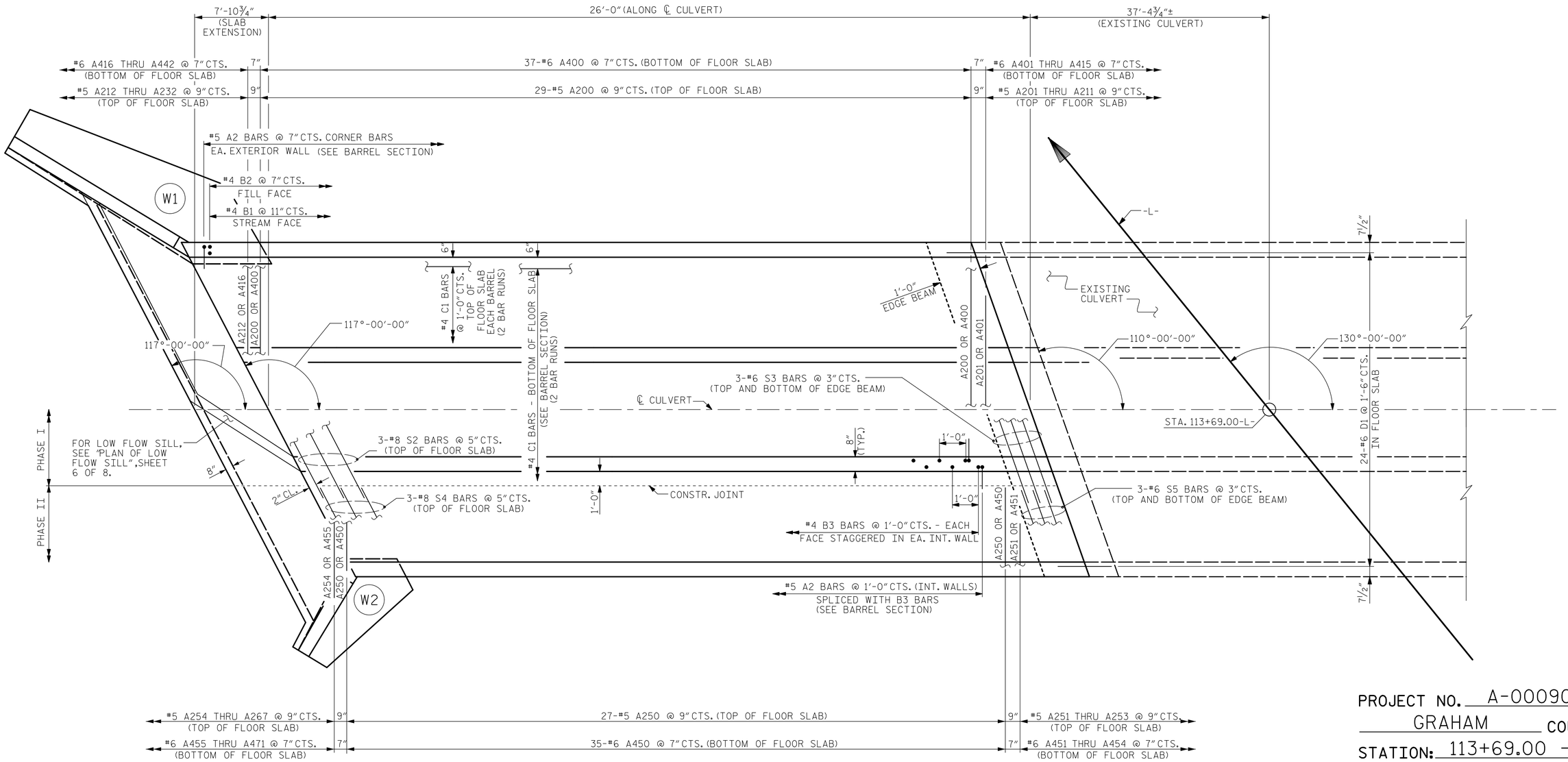
TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-3
1			3			TOTAL SHEETS
2			4			8

DRAWN BY : ZCS DATE : 3/21
CHECKED BY : MGC DATE : 8/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 11/21

STR. #4



PLAN OF FLOOR SLAB

NOTES: FOR S1 BARS IN FLOOR SLAB & WING FOOTINGS, SEE WING SHEET.
FOR D1 DOWELS IN EXTERIOR WALLS, SEE SHEET 3 OF 8.

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 113+69.00 -L-
SHEET 4 OF 8

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. X 9.2 FT. CONCRETE BOX CULVERT LEFT EXTENSION

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-4
1			3			TOTAL SHEETS
2			4			8

DRAWN BY :	ZCS	DATE :	3/21
CHECKED BY :	MGC	DATE :	9/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE :	4/22

6/1/2022
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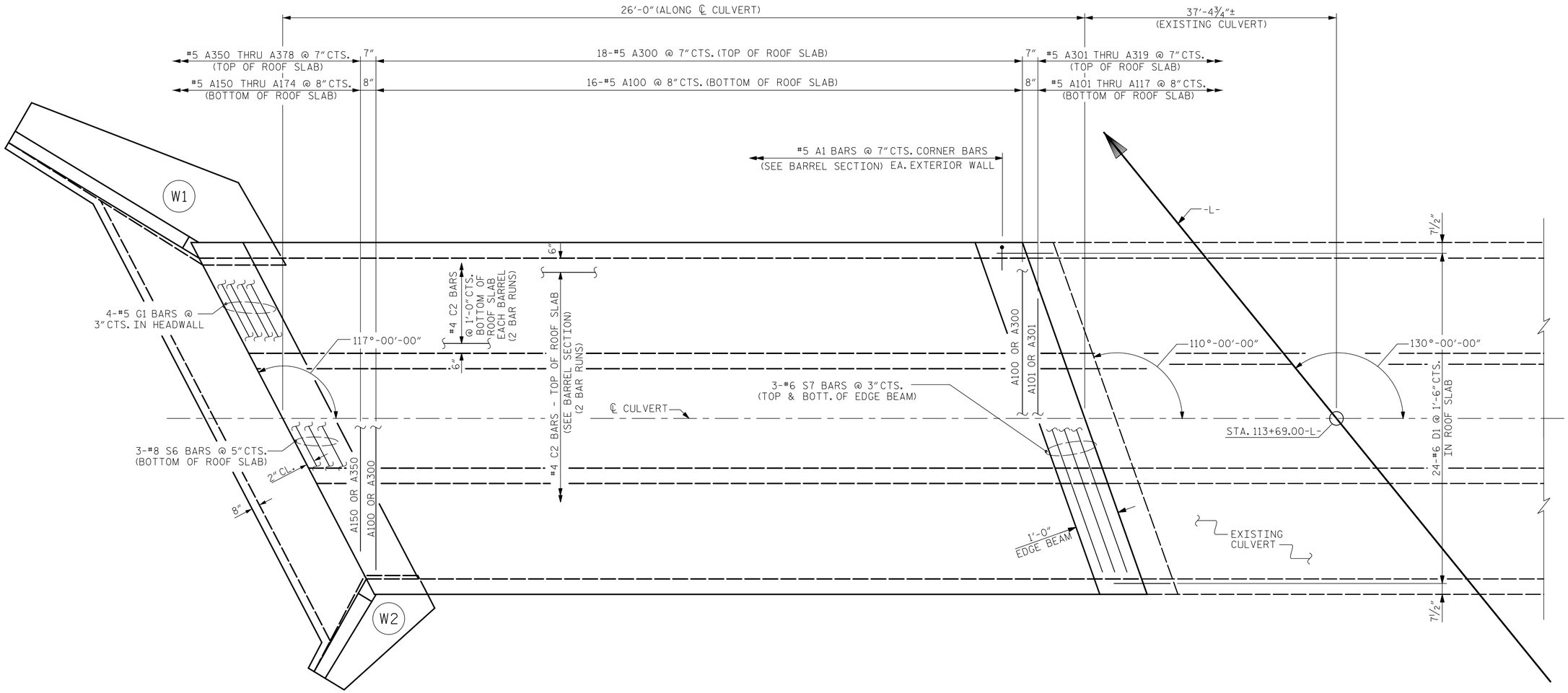
User:zsmith

STR. #4



PLAN OF ROOF SLAB

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 113+69.00 -L-

SHEET 5 OF 8

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
6/1/2022

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

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. X 9.2 FT. CONCRETE BOX CULVERT LEFT EXTENSION

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-5
1			3			TOTAL SHEETS
2			4			8

DRAWN BY : ZCS DATE : 3/21
CHECKED BY : MGC DATE : 9/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 4/22

6/1/2022
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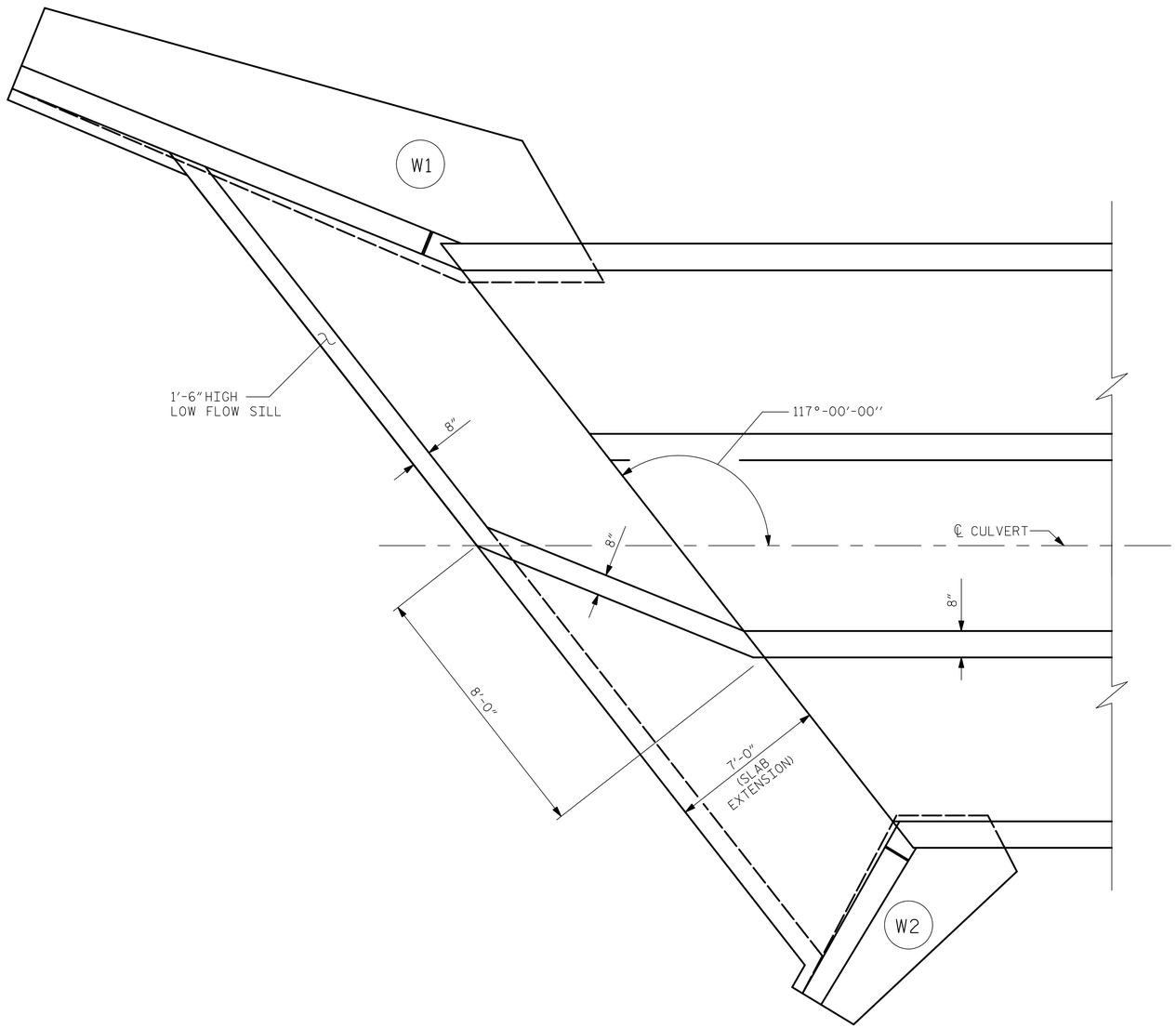
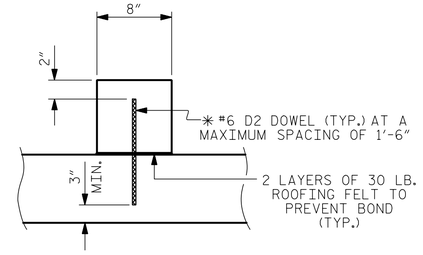
User:ZSmith



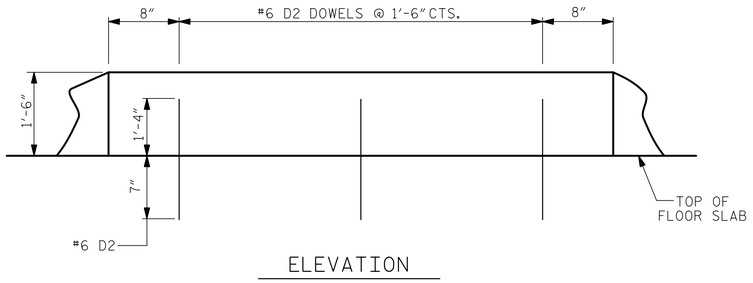
PLAN OF LOW FLOW SILL

NOTE: FOR SLAB EXTENSION REINFORCEMENT, SEE PLAN OF FLOOR SLAB, SHEET 4 OF 8.



SECTION THROUGH WALL

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



ELEVATION

WALL DETAILS

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 113+69.00 -L-

SHEET 6 OF 8

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
SEBCC2F3A40C43...
6/1/2022

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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 11 FT. X 9.2 FT. CONCRETE BOX CULVERT LEFT EXTENSION

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-6
1			3			TOTAL SHEETS
2			4			8

DRAWN BY :	ZCS	DATE :	6/21
CHECKED BY :	MGC	DATE :	9/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE :	4/22

6/1/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #4 113+69.00 -L-\Final Plans\DGNs\414_011_A-0009CA_SMU_CU06_370133.dgn
User:ZSmith

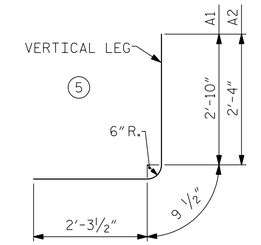
STR. #4

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	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	87	#5	5	5′-11″	537	A200	29	#5	STR	27′-5″	829	A300	18	#5	STR	35′-4″	663	A400	37	#6	STR	27′-9″	1542	A450	35	#6	STR	10′-4″	543
A2	191	#5	5	5′-5″	1079	A201	1	#5	STR	25′-9″	27	A301	1	#5	STR	33′-10″	35	A401	1	#6	STR	27′-6″	41	A451	1	#6	STR	8′-9″	13
						A202	1	#5	STR	23′-8″	25	A302	1	#5	STR	32′-3″	34	A402	1	#6	STR	25′-10″	39	A452	1	#6	STR	7′-1″	11
A100	16	#5	STR	35′-4″	590	A203	1	#5	STR	21′-6″	22	A303	1	#5	STR	30′-7″	32	A403	1	#6	STR	24′-3″	36	A453	1	#6	STR	5′-5″	8
A101	1	#5	STR	33′-8″	35	A204	1	#5	STR	19′-5″	20	A304	1	#5	STR	28′-11″	30	A404	1	#6	STR	22′-7″	34	A454	1	#6	STR	3′-10″	6
A102	1	#5	STR	31′-9″	33	A205	1	#5	STR	17′-3″	18	A305	1	#5	STR	27′-3″	28	A405	1	#6	STR	20′-11″	31	A455	1	#6	STR	11′-1″	17
A103	1	#5	STR	29′-10″	31	A206	1	#5	STR	15′-2″	16	A306	1	#5	STR	25′-8″	27	A406	1	#6	STR	19′-3″	29	A456	1	#6	STR	12′-0″	18
A104	1	#5	STR	28′-0″	29	A207	1	#5	STR	13′-1″	14	A307	1	#5	STR	24′-0″	25	A407	1	#6	STR	17′-8″	27	A457	1	#6	STR	13′-0″	20
A105	1	#5	STR	26′-1″	27	A208	1	#5	STR	10′-11″	11	A308	1	#5	STR	22′-4″	23	A408	1	#6	STR	16′-0″	24	A458	1	#6	STR	14′-0″	21
A106	1	#5	STR	24′-3″	25	A209	1	#5	STR	8′-10″	9	A309	1	#5	STR	20′-8″	22	A409	1	#6	STR	14′-4″	22	A459	1	#6	STR	14′-11″	22
A107	1	#5	STR	22′-4″	23	A210	1	#5	STR	6′-8″	7	A310	1	#5	STR	19′-1″	20	A410	1	#6	STR	12′-8″	19	A460	1	#6	STR	15′-11″	24
A108	1	#5	STR	20′-5″	21	A211	1	#5	STR	4′-7″	5	A311	1	#5	STR	17′-5″	18	A411	1	#6	STR	11′-0″	17	A461	1	#6	STR	15′-11″	24
A109	1	#5	STR	18′-7″	19	A212	1	#5	STR	27′-9″	29	A312	1	#5	STR	15′-9″	16	A412	1	#6	STR	9′-5″	14	A462	1	#6	STR	14′-9″	22
A110	1	#5	STR	16′-8″	17	A213	1	#5	STR	26′-4″	27	A313	1	#5	STR	14′-1″	15	A413	1	#6	STR	7′-9″	12	A463	1	#6	STR	13′-8″	21
A111	1	#5	STR	14′-10″	15	A214	1	#5	STR	24′-11″	26	A314	1	#5	STR	12′-6″	13	A414	1	#6	STR	6′-1″	9	A464	1	#6	STR	12′-7″	19
A112	1	#5	STR	12′-11″	13	A215	1	#5	STR	23′-5″	24	A315	1	#5	STR	10′-10″	11	A415	1	#6	STR	4′-5″	7	A465	1	#6	STR	11′-5″	17
A113	1	#5	STR	11′-1″	12	A216	1	#5	STR	22′-0″	23	A316	1	#5	STR	9′-2″	10	A416	1	#6	STR	27′-6″	41	A466	1	#6	STR	10′-4″	16
A114	1	#5	STR	9′-2″	10	A217	1	#5	STR	20′-7″	21	A317	1	#5	STR	7′-6″	8	A417	1	#6	STR	26′-4″	40	A467	1	#6	STR	9′-2″	14
A115	1	#5	STR	7′-3″	8	A218	1	#5	STR	19′-2″	20	A318	1	#5	STR	5′-10″	6	A418	1	#6	STR	25′-3″	38	A468	1	#6	STR	8′-1″	12
A116	1	#5	STR	5′-5″	6	A219	1	#5	STR	17′-8″	18	A319	1	#5	STR	4′-3″	4	A419	1	#6	STR	24′-1″	36	A469	1	#6	STR	6′-11″	10
A117	1	#5	STR	3′-6″	4	A220	1	#5	STR	16′-3″	17							A420	1	#6	STR	23′-0″	35	A470	1	#6	STR	5′-10″	9
						A221	1	#5	STR	14′-10″	15	A350	1	#5	STR	34′-4″	36	A421	1	#6	STR	21′-11″	33	A471	1	#6	STR	4′-9″	7
A150	1	#5	STR	34′-0″	35	A222	1	#5	STR	13′-4″	14	A351	1	#5	STR	33′-3″	35	A422	1	#6	STR	20′-9″	31						
A151	1	#5	STR	32′-9″	34	A223	1	#5	STR	12′-2″	13	A352	1	#5	STR	32′-1″	33	A423	1	#6	STR	19′-8″	30	B1	57	#4	STR	10′-7″	403
A152	1	#5	STR	31′-5″	33	A224	1	#5	STR	11′-3″	12	A353	1	#5	STR	31′-0″	32	A424	1	#6	STR	18′-6″	28	B2	87	#4	STR	8′-11″	518
A153	1	#5	STR	30′-2″	31	A225	1	#5	STR	10′-3″	11	A354	1	#5	STR	29′-10″	31	A425	1	#6	STR	17′-5″	26	B3	104	#4	STR	10′-7″	735
A154	1	#5	STR	28′-11″	30	A226	1	#5	STR	9′-3″	10	A355	1	#5	STR	28′-9″	30	A426	1	#6	STR	16′-3″	24						
A155	1	#5	STR	27′-8″	29	A227	1	#5	STR	8′-3″	9	A356	1	#5	STR	27′-7″	29	A427	1	#6	STR	15′-2″	23	C1	92	#4	STR	19′-1″	1173
A156	1	#5	STR	26′-4″	27	A228	1	#5	STR	7′-3″	8	A357	1	#5	STR	26′-6″	28	A428	1	#6	STR	14′-1″	21	C2	168	#4	STR	15′-3″	1711
A157	1	#5	STR	25′-1″	26	A229	1	#5	STR	6′-4″	7	A358	1	#5	STR	25′-5″	27	A429	1	#6	STR	12′-11″	19						
A158	1	#5	STR	23′-9″	25	A230	1	#5	STR	5′-4″	6	A359	1	#5	STR	24′-3″	25	A430	1	#6	STR	12′-2″	18	D1	60	#6	STR	2′-6″	225
A159	1	#5	STR	22′-6″	23	A231	1	#5	STR	4′-4″	5	A360	1	#5	STR	23′-2″	24	A431	1	#6	STR	11′-5″	17	D2	26	#6	STR	1′-11″	75
A160	1	#5	STR	21′-3″	22	A232	1	#5	STR	3′-4″	3	A361	1	#5	STR	22′-0″	23	A432	1	#6	STR	10′-8″	16						
A161	1	#5	STR	19′-11″	21							A362	1	#5	STR	20′-11″	22	A433	1	#6	STR	9′-11″	15	G1	4	#5	STR	39′-8″	165
A162	1	#5	STR	18′-8″	19	A250	27	#5	STR	10′-4″	291	A363	1	#5	STR	19′-9″	21	A434	1	#6	STR	9′-2″	14						
A163	1	#5	STR	17′-5″	18	A251	1	#5	STR	8′-2″	9	A364	1	#5	STR	18′-8″	19	A435	1	#6	STR	8′-4″	13	S2	3	#8	STR	31′-11″	256
A164	1	#5	STR	16′-1″	17	A252	1	#5	STR	6′-1″	6	A365	1	#5	STR	17′-6″	18	A436	1	#6	STR	7′-7″	11	S3	6	#6	STR	29′-4″	264
A165	1	#5	STR	14′-9″	15	A253	1	#5	STR	3′-11″	4	A366	1	#5	STR	16′-5″	17	A437	1	#6	STR	6′-10″	10	S4	3	#8	STR	11′-8″	93
A166	1	#5	STR	13′-6″	14	A254	1	#5	STR	10′-9″	11	A367	1	#5	STR	15′-4″	16	A438	1	#6	STR	6′-1″	9	S5	6	#6	STR	10′-11″	98
A167	1	#5	STR	12′-3″	13	A255	1	#5	STR	12′-0″	13	A368	1	#5	STR	14′-2″	15	A439	1	#6	STR	5′-4″	8	S6	3	#8	STR	39′-8″	318
A168	1	#5	STR	11′-0″	11	A256	1	#5	STR	13′-3″	14	A369	1	#5	STR	13′-1″	14	A440	1	#6	STR	4′-7″	7	S7	6	#6	STR	37′-6″	338
A169	1	#5	STR	9′-9″	10	A257	1	#5	STR	14′-6″	15	A370	1	#5	STR	11′-11″	12	A441	1	#6	STR	3′-9″	6						
A170	1	#5	STR	8′-5″	9	A258	1	#5	STR	15′-8″	16	A371	1	#5	STR	10′-10″	11	A442	1	#6	STR	3′-0″	5						
A171	1	#5	STR	7′-2″	7	A259	1	#5	STR	15′-8″	16	A372	1	#5	STR	9′-8″	10												
A172	1	#5	STR	5′-11″	6	A260	1	#5	STR	14′-3″	15	A373	1	#5	STR	8′-7″	9												
A173	1	#5	STR	4′-7″	5	A261	1	#5	STR	12′-10″	13	A374	1	#5	STR	7′-6″	8												
A174	1	#5	STR	3′-4″	3	A262	1	#5	STR	11′-5″	12	A375	1	#5	STR	6′-4″	7												
						A263	1	#5	STR	9′-11″	10	A376	1	#5	STR	5′-3″	5												
						A264	1	#5	STR	8′-6″	9	A377	1	#5	STR	4′-1″	4												
						A265	1	#5	STR	7′-1″	7	A378	1	#5	STR	3′-0″	3												
						A266	1	#5	STR	5′-8″	6																		
						A267	1	#5	STR	4′-2″	4																		

REINFORCING STEEL 16,136 LBS

BAR TYPE



DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
A200	#5	2′-4″
A400	#6	2′-9″
''B''	#4	1′-10″
C1	#4	2′-5″
''S''	#6	2′-9″
''S''	#8	3′-8″

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 113+69.00 -L-

SHEET 7 OF 8

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 — Marshall G. Check, Jr. — 6/1/2022

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

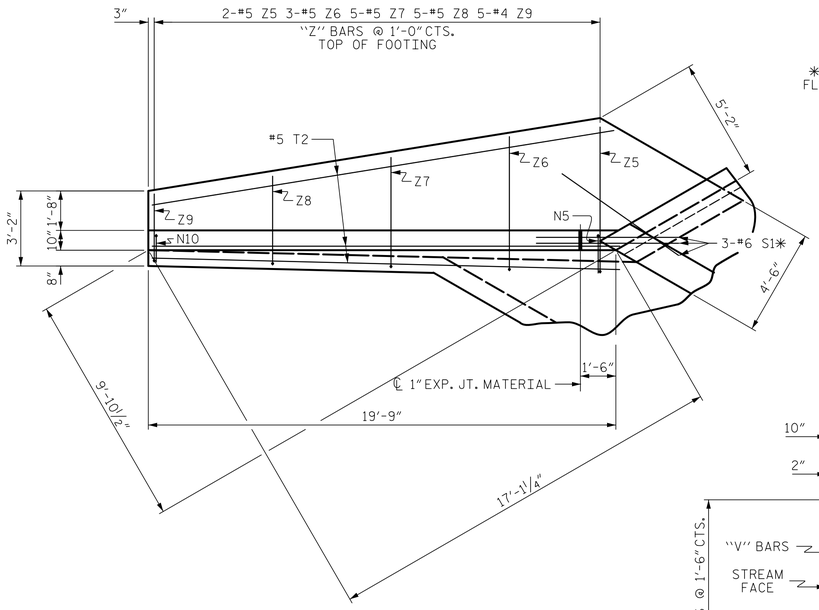
TRIPLE 11 FT. X 9.2 FT. CONCRETE BOX CULVERT LEFT EXTENSION

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-7
1			3			TOTAL SHEETS
2			4			8

DRAWN BY : ZCS DATE : 7/21
CHECKED BY : MGC DATE : 9/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 4/22

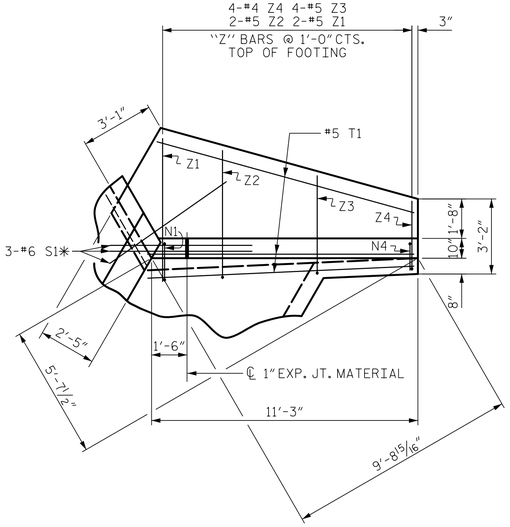
6/1/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #4 113+69.00 -L-\Final Plans\DGNs\414_013_A-0009CA_SMU_CU07_370133.dgn
User:ZSmith

STR. #4

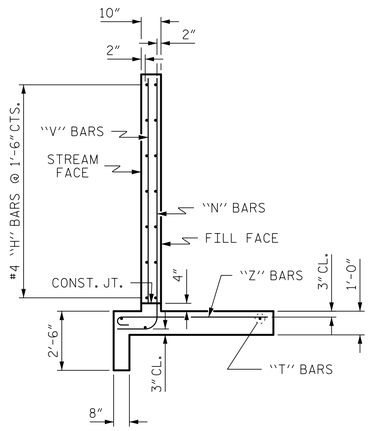


PLAN W1

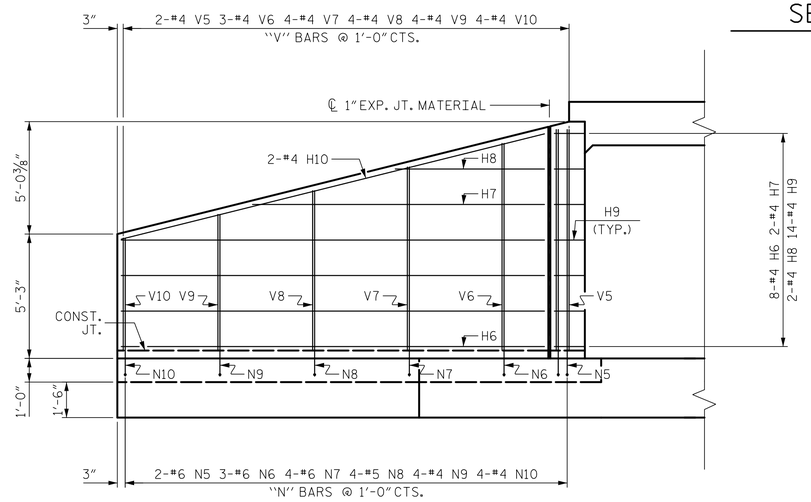
* S1 BARS @ BOTTOM OF FLOOR SLAB AND FOOTING



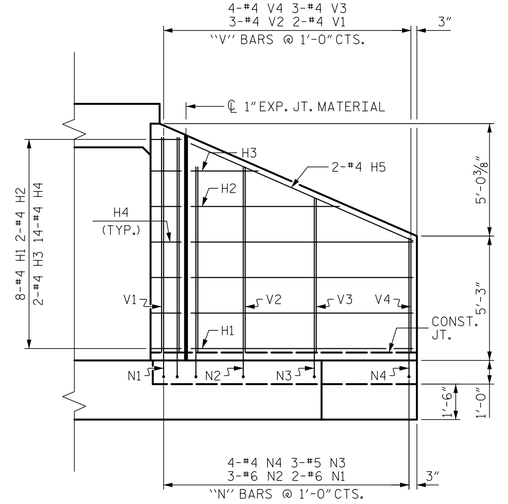
PLAN W2



TYPICAL WING SECTION

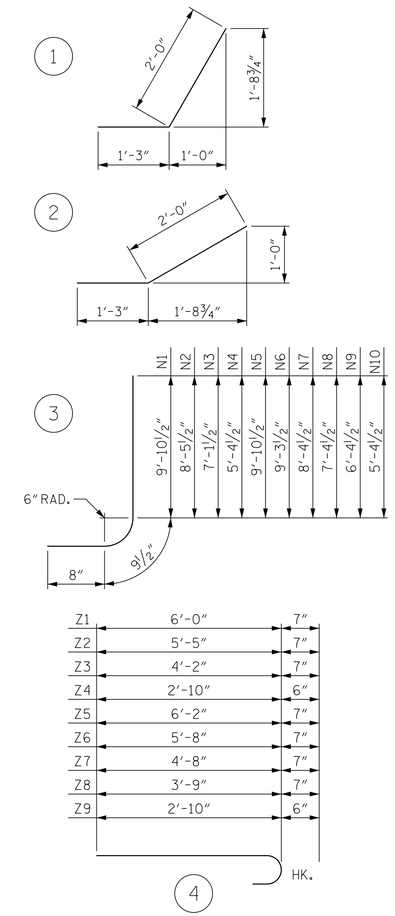


ELEVATION W1



ELEVATION W2

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	8	#4	STR	9'-4"	50
H2	2	#4	STR	6'-3"	8
H3	2	#4	STR	2'-10"	4
H4	14	#4	1	3'-3"	30
H5	2	#4	STR	10'-2"	14
H6	8	#4	STR	17'-10"	95
H7	2	#4	STR	12'-4"	16
H8	2	#4	STR	6'-3"	8
H9	14	#4	2	3'-3"	30
H10	2	#4	STR	18'-5"	25
N1	2	#6	3	11'-4"	34
N2	3	#6	3	9'-11"	45
N3	3	#5	3	8'-7"	27
N4	4	#4	3	6'-10"	18
N5	2	#6	3	11'-4"	34
N6	3	#6	3	10'-9"	48
N7	4	#6	3	9'-10"	59
N8	4	#5	3	8'-10"	37
N9	4	#4	3	7'-10"	21
N10	4	#4	3	6'-10"	18
S1	6	#6	STR	6'-0"	54
T1	3	#5	STR	11'-3"	35
T2	3	#5	STR	19'-9"	62
V1	2	#4	STR	9'-1"	12
V2	3	#4	STR	7'-10"	16
V3	3	#4	STR	6'-6"	13
V4	4	#4	STR	4'-10"	13
V5	2	#4	STR	9'-4"	12
V6	3	#4	STR	8'-9"	18
V7	4	#4	STR	7'-9"	21
V8	4	#4	STR	6'-9"	18
V9	4	#4	STR	5'-9"	15
V10	4	#4	STR	4'-9"	13
Z1	2	#5	4	6'-7"	14
Z2	2	#5	4	6'-0"	13
Z3	4	#5	4	4'-9"	20
Z4	4	#4	4	3'-4"	9
Z5	2	#5	4	6'-9"	14
Z6	3	#5	4	6'-3"	20
Z7	5	#5	4	5'-3"	27
Z8	5	#5	4	4'-4"	23
Z9	5	#4	4	3'-4"	11

REINFORCING STEEL FOR 2 WINGS	1074 LBS
CLASS A CONCRETE	
2 WINGS	14.3 CY
1 HEADWALL	1.9 CY
1 END CURTAIN WALL	3.4 CY
2 EDGE BEAMS	2.8 CY
TOTAL	22.4 CY

NOTE:
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. A-0009CA
GRAHAM COUNTY
STATION: 113+69.00 -L-

SHEET 8 OF 8

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
SEAL F3A4DC41...
6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS 706 HILLSBOROUGH STREET SUITE 200
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

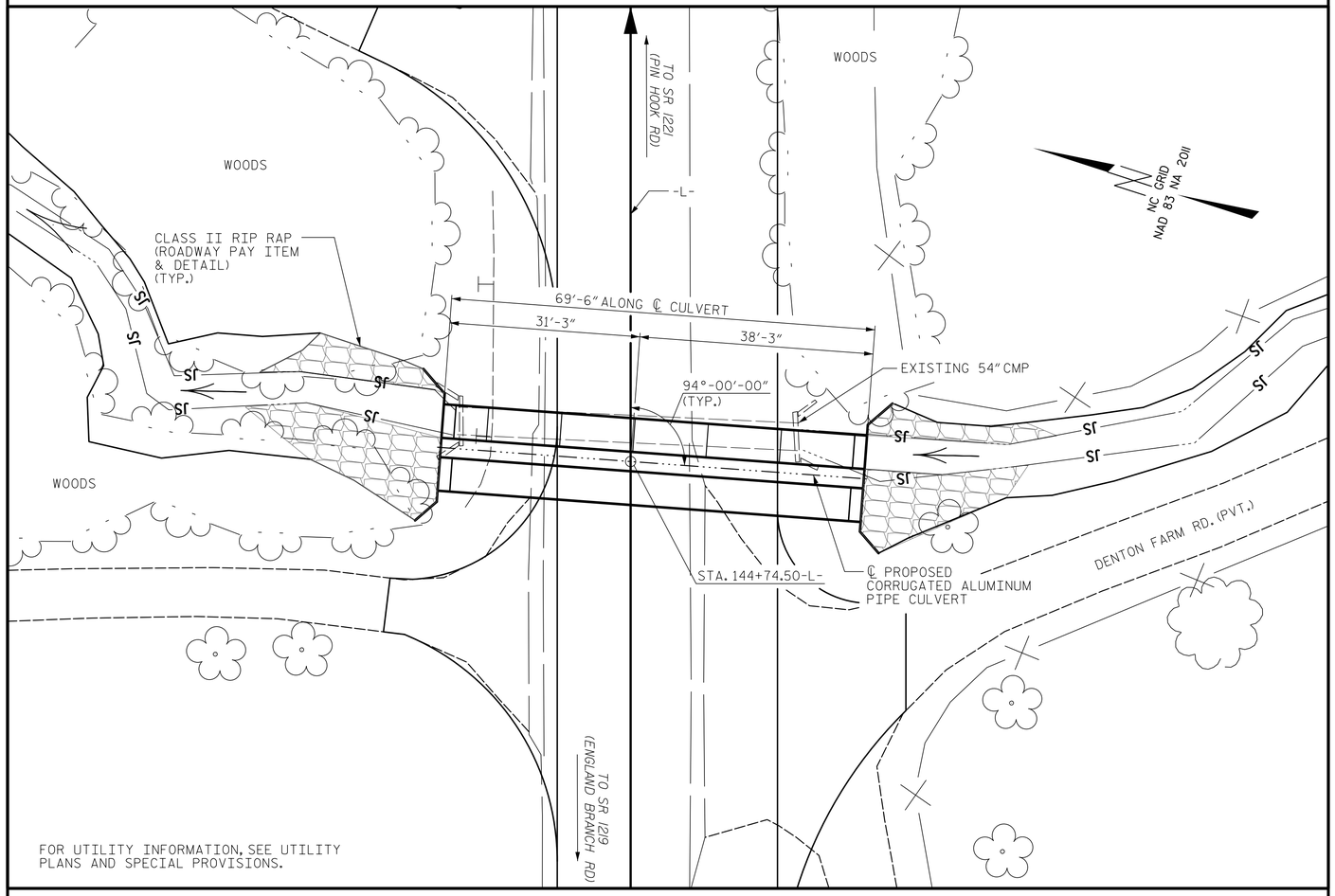
WINGS FOR CONCRETE BOX CULVERT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C4-8
1			3			TOTAL SHEETS
2			4			8

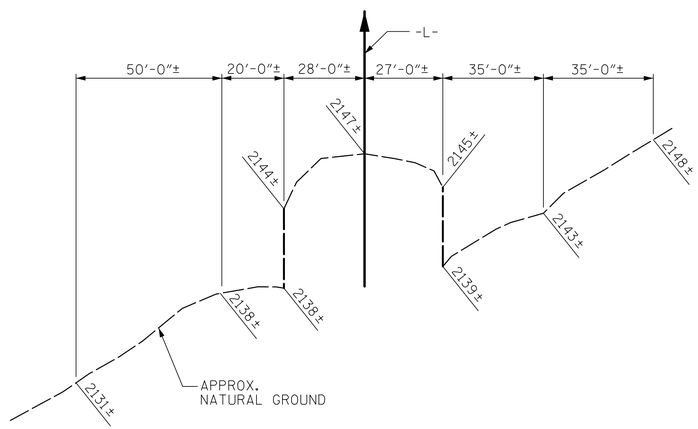
DRAWN BY :	ZCS	DATE :	3/21
CHECKED BY :	MGC	DATE :	9/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE :	4/22

5/23/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #4 113+69.00 -L-\Final Plans\DGNs\414_015_A-0009CA_SMU_CU08_370133.dgn
User:ZSmith

BENCH MARK #7: SPIKE NAIL SET IN BASE OF 20" POPLAR; 33.6' RT. OF STA. 137+92.90 -L-; ELEV. 2125.10



LOCATION SKETCH



PROFILE ALONG ℄ CULVERT

NOTES:

ASSUMED LIVE LOAD - HL-93 OR ALTERNATE.

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

THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF THE CULVERT BEFORE CONSTRUCTION TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.

FILL DEPTH 3'-0".

EXCAVATE AT LEAST 1 FOOT BELOW THE CULVERT AND REPLACE EXCAVATED MATERIAL WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS. FOUNDATION CONDITIONING MATERIAL SHOULD CONSIST OF SELECT MATERIAL CLASS V OR VI FOR RCBC.

IF REQUIRED, UNDERCUT LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

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

THE ENTIRE AREA OF THE ALUMINUM PIPES IN CONTACT WITH THE CONCRETE HEADWALL SHALL BE THOROUGHLY COATED WITH NEOPRENE SEALANT FOR CORROSION PROTECTION AT THE DIRECTION OF THE ENGINEER.

FOR CORRUGATED ALUMINUM PIPE CULVERT, SEE SPECIAL PROVISIONS.

F.A. PROJECT NO.: APD-0074(178)

TOTAL STRUCTURE QUANTITIES	
CORRUGATED ALUMINUM PIPE CULVERT	LUMP SUM
CULVERT EXCAVATION	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	89 TONS

SAMPLE BAR REPLACEMENT

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

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

ROADWAY DATA

GRADE POINT ELEV. @ STA. 144+74.50-L- = 2147.65'
BED ELEV. @ STA. 144+74.50-L- = 2138.3'
ROADWAY SLOPES = VARIES

HYDRAULIC DATA

DESIGN DISCHARGE = 330 CFS
FREQUENCY OF DESIGN FLOOD = 50 YRS
DESIGN HIGH WATER ELEVATION = 2146.5'
DRAINAGE AREA = 0.39 SQ. MI.
BASE DISCHARGE (Q100) = 410 CFS
BASE HIGH WATER ELEVATION = 2146.8'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 410 CFS
FREQUENCY OF OVERTOPPING FLOOD = 100 YRS
OVERTOPPING FLOOD ELEVATION = 2146.8'

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 144+74.50 -L-

SHEET 1 OF 4

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
5F6C3F3A4DC41...
6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

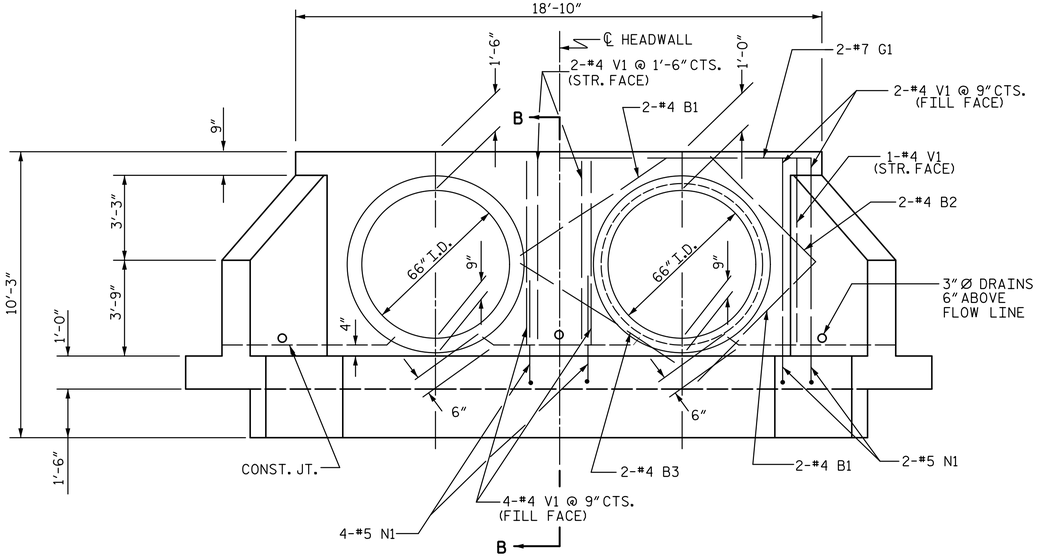
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

CORRUGATED ALUMINUM PIPE CULVERT 94° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C5-1
1			3			TOTAL SHEETS
2			4			4

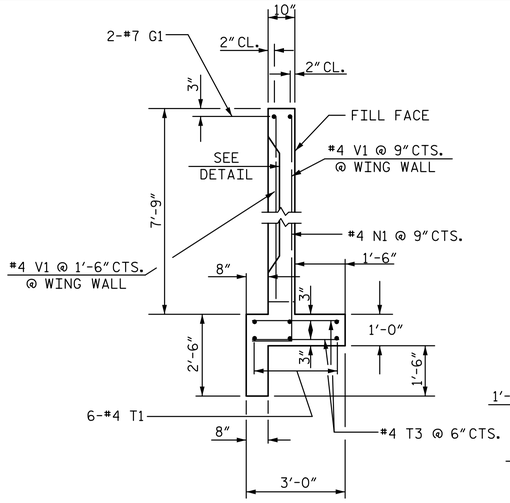
STR. #5

DRAWN BY :	ZCS	DATE :	12/21
CHECKED BY :	MGC	DATE :	1/22



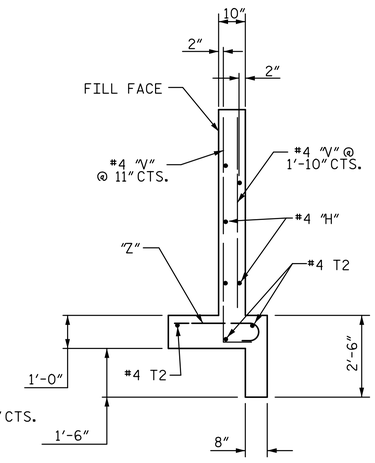
INLET ELEVATION

DIMENSIONS AND REINFORCING STEEL SYMMETRICAL ABOUT ℄ HEADWALL.



SECTION B-B

PIPES NOT SHOWN FOR CLARITY



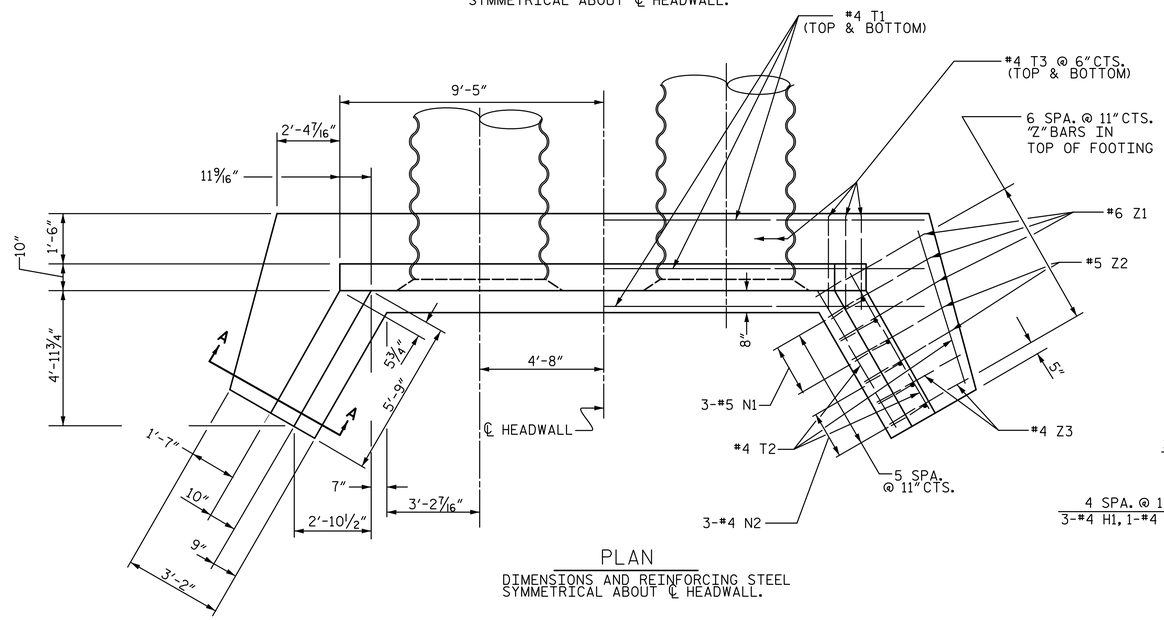
SECTION A-A

BILL OF MATERIAL FOR INLET HEADWALL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	8	#4	STR	6′-1″	33
B2	4	#4	STR	5′-1″	14
B3	4	#4	STR	7′-0″	19
G1	2	#7	STR	18′-6″	76
H1	10	#4	1	6′-4″	42
H2	2	#4	1	4′-9″	6
H3	4	#4	1	2′-11″	8
N1	14	#5	2	4′-5″	64
N2	6	#4	2	3′-11″	16
T1	6	#4	STR	23′-0″	92
T2	6	#4	STR	6′-0″	24
T3	76	#4	STR	2′-6″	127
V1	12	#4	STR	7′-3″	58
V2	6	#4	STR	5′-8″	23
V3	6	#4	STR	4′-7″	18
V4	6	#4	STR	3′-4″	13
Z1	6	#6	3	4′-6″	41
Z2	4	#5	3	3′-11″	16
Z3	4	#4	3	3′-3″	9

REINFORCING STEEL 699 LBS

CLASS A CONCRETE
TOTAL 9.5 CY



PLAN

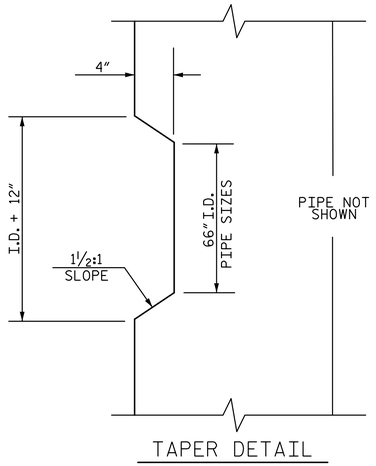
DIMENSIONS AND REINFORCING STEEL SYMMETRICAL ABOUT ℄ HEADWALL.

NOTES

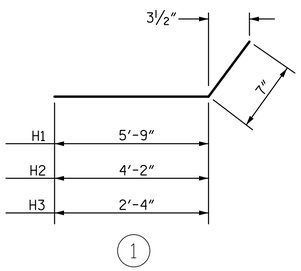
NO SEPARATE PAYMENT WILL BE MADE FOR REINFORCING STEEL OR CLASS A CONCRETE. THE ENTIRE COST OF THESE ITEMS SHALL BE PAID FOR UNDER THE LUMP SUM PRICE BID FOR CORRUGATED ALUMINUM PIPE CULVERT.

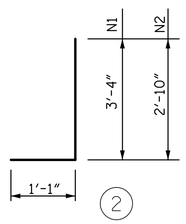
CHAMFER ALL EXPOSED CORNERS 1″.

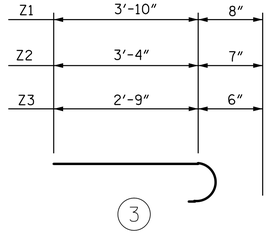
PLACE A STONE DRAIN CONSISTING OF ONE (1) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A POROUS FABRIC AT EACH WEEP HOLE. PLACE SUBDRAIN FINE AGGREGATE BENEATH, AROUND AND OVER THE STONE DRAIN SO THE STONE DRAIN IS COMPLETELY COVERED BY A LAYER OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT THICK. WHERE THERE IS MORE THAN ONE WEEP HOLE IN A WING WALL, PLACE A HORIZONTAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION TO CONNECT ALL STONE DRAINS. PLACE A VERTICAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION AT EACH WEEP HOLE TO AN ELEVATION OF TWO (2) FEET BELOW THE SURFACE OF THE EMBANKMENT.



TAPER DETAIL

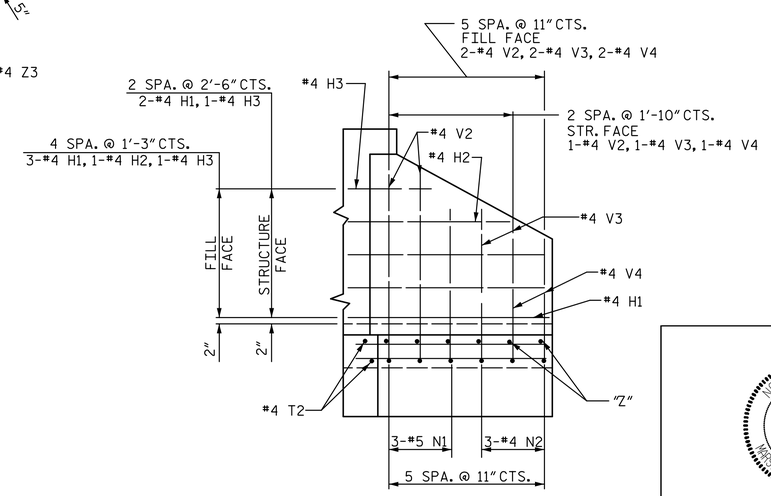






BAR TYPES

ALL DIMENSIONS ARE SHOWN OUT TO OUT



WING ELEVATION

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 144+74.50 -L-

SHEET 2 OF 4

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

Marshall G. Cheek, Jr.

6/1/2022

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TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

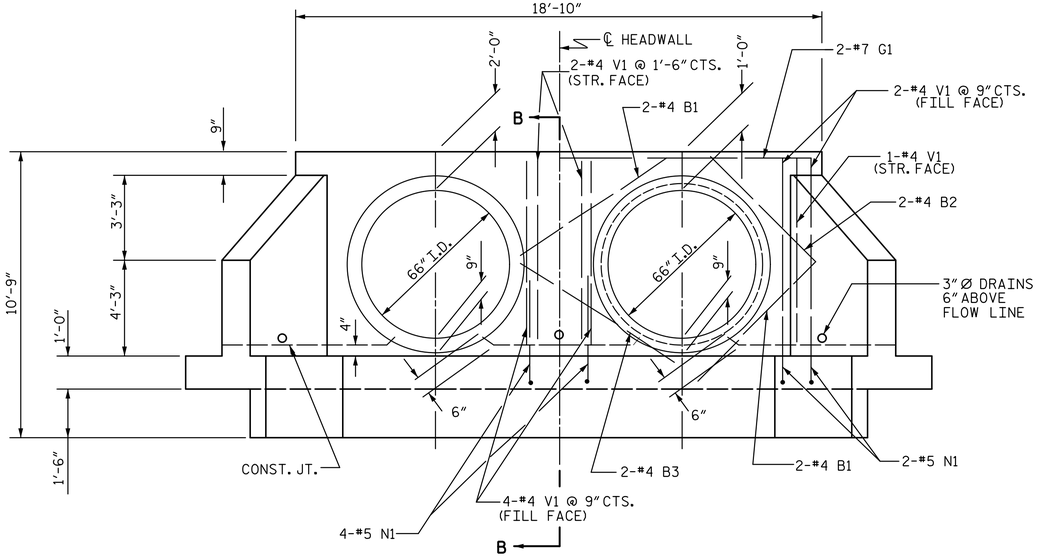
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

CORRUGATED ALUMINUM PIPE CULVERT 94° SKEW INLET HEADWALL

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C5-2
1			3			TOTAL SHEETS
2			4			4

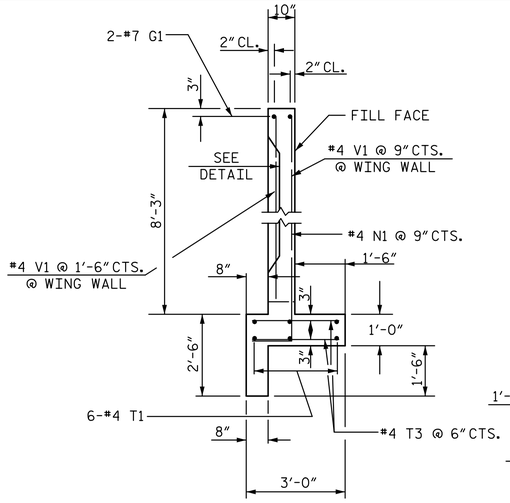
DRAWN BY : ZCS DATE : 12/21
CHECKED BY : MGC DATE : 1/22

STR. #5



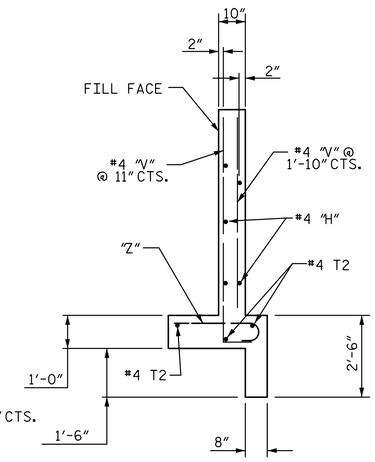
OUTLET ELEVATION

DIMENSIONS AND REINFORCING STEEL SYMMETRICAL ABOUT ℄ HEADWALL.



SECTION B-B

PIPES NOT SHOWN FOR CLARITY



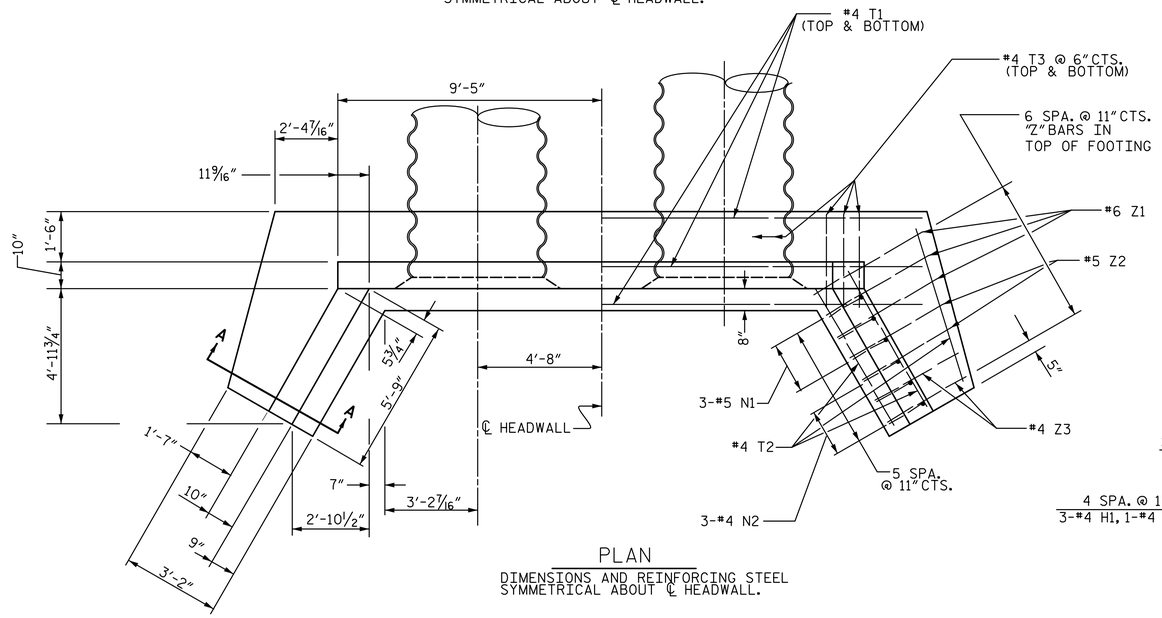
SECTION A-A

BILL OF MATERIAL FOR OUTLET HEADWALL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	8	#4	STR	7'-0"	37
B2	4	#4	STR	5'-10"	16
B3	4	#4	STR	7'-0"	19
G1	2	#7	STR	18'-6"	76
H1	10	#4	1	6'-4"	42
H2	2	#4	1	4'-10"	6
H3	4	#4	1	3'-3"	9
N1	14	#5	2	4'-11"	72
N2	6	#4	2	4'-5"	18
T1	6	#4	STR	23'-0"	92
T2	6	#4	STR	6'-0"	24
T3	76	#4	STR	2'-6"	127
V1	12	#4	STR	7'-9"	62
V2	6	#4	STR	6'-2"	25
V3	6	#4	STR	5'-1"	20
V4	6	#4	STR	3'-11"	16
Z1	6	#6	3	4'-6"	41
Z2	4	#5	3	3'-11"	16
Z3	4	#4	3	3'-3"	9

REINFORCING STEEL 727 LBS

CLASS A CONCRETE TOTAL 9.7 CY



PLAN

DIMENSIONS AND REINFORCING STEEL SYMMETRICAL ABOUT ℄ HEADWALL.

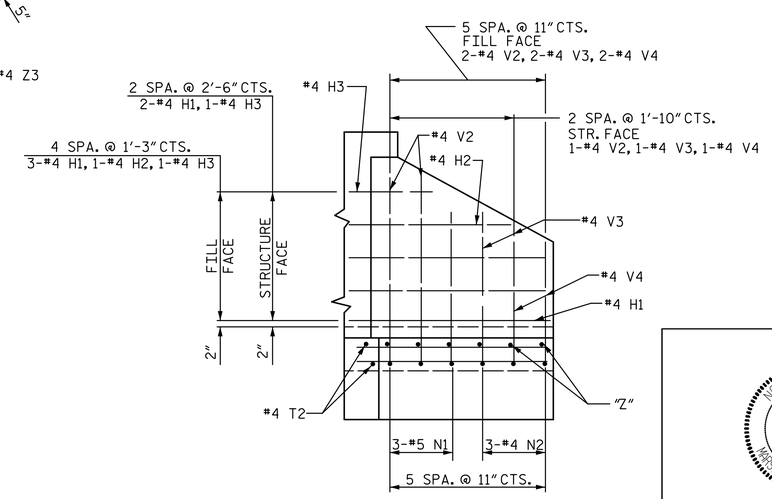
NOTES

NO SEPARATE PAYMENT WILL BE MADE FOR REINFORCING STEEL OR CLASS A CONCRETE. THE ENTIRE COST OF THESE ITEMS SHALL BE PAID FOR UNDER THE LUMP SUM PRICE BID FOR CORRUGATED ALUMINUM PIPE CULVERT.

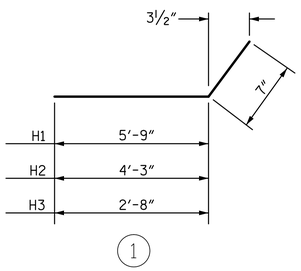
CHAMFER ALL EXPOSED CORNERS 1".

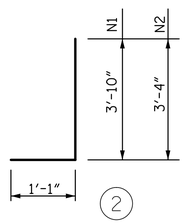
PLACE A STONE DRAIN CONSISTING OF ONE (1) CUBIC FOOT OF NUMBER 78M STONE CONTAINED IN A POROUS FABRIC AT EACH WEEP HOLE. PLACE SUBDRAIN FINE AGGREGATE BENEATH, AROUND AND OVER THE STONE DRAIN SO THE STONE DRAIN IS COMPLETELY COVERED BY A LAYER OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT THICK. WHERE THERE IS MORE THAN ONE WEEP HOLE IN A WING WALL, PLACE A HORIZONTAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION TO CONNECT ALL STONE DRAINS. PLACE A VERTICAL DRAIN OF SUBDRAIN FINE AGGREGATE AT LEAST ONE (1) FOOT SQUARE IN CROSS SECTION AT EACH WEEP HOLE TO AN ELEVATION OF TWO (2) FEET BELOW THE SURFACE OF THE EMBANKMENT.

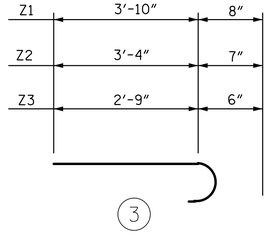
TAPER DETAIL



WING ELEVATION







BAR TYPES

ALL DIMENSIONS ARE SHOWN OUT TO OUT

DRAWN BY : ZCS DATE : 12/21
CHECKED BY : MGC DATE : 1/22

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 144+74.50 -L-

SHEET 3 OF 4

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

CORRUGATED ALUMINUM PIPE CULVERT 94° SKEW OUTLET HEADWALL

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
804-C N. LAFAYETTE ST
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PH (704) 476-0003
CORP. LICENSE NO.: C-0275

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C5-3
1			3			TOTAL SHEETS
2			4			4

STR. #5

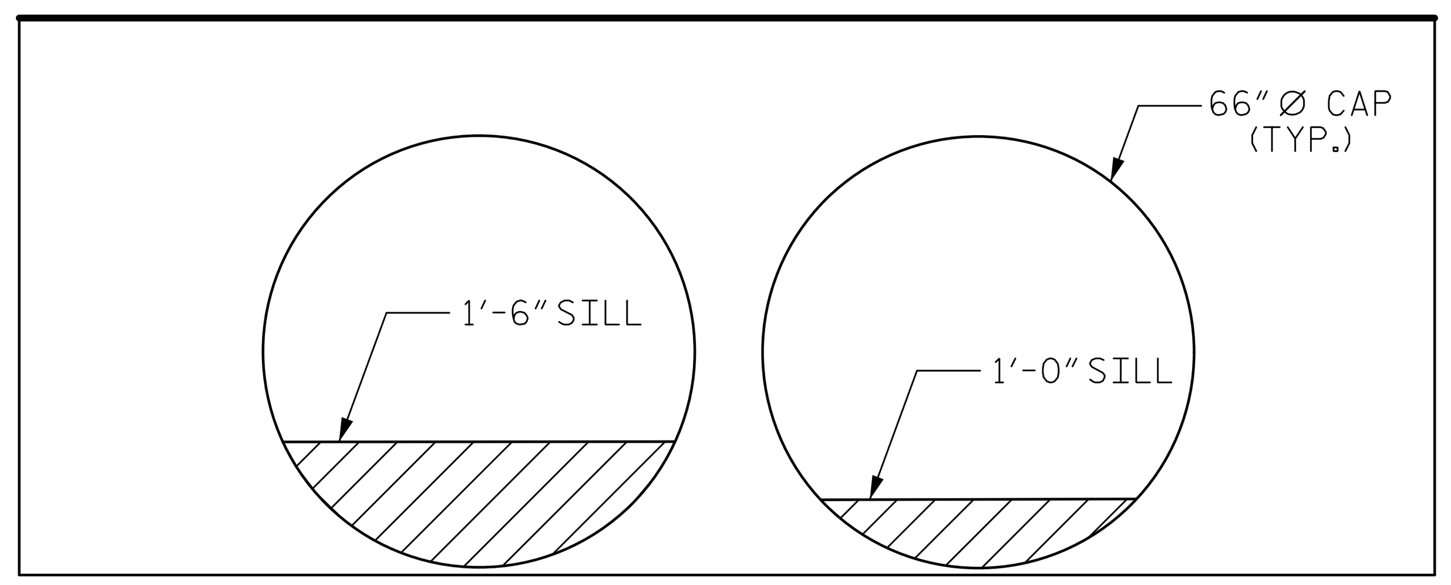
NOTES:

PLACE A 3"Ø WEEP HOLE IN THE HIGH FLOW SILL AT THE OUTLET END.

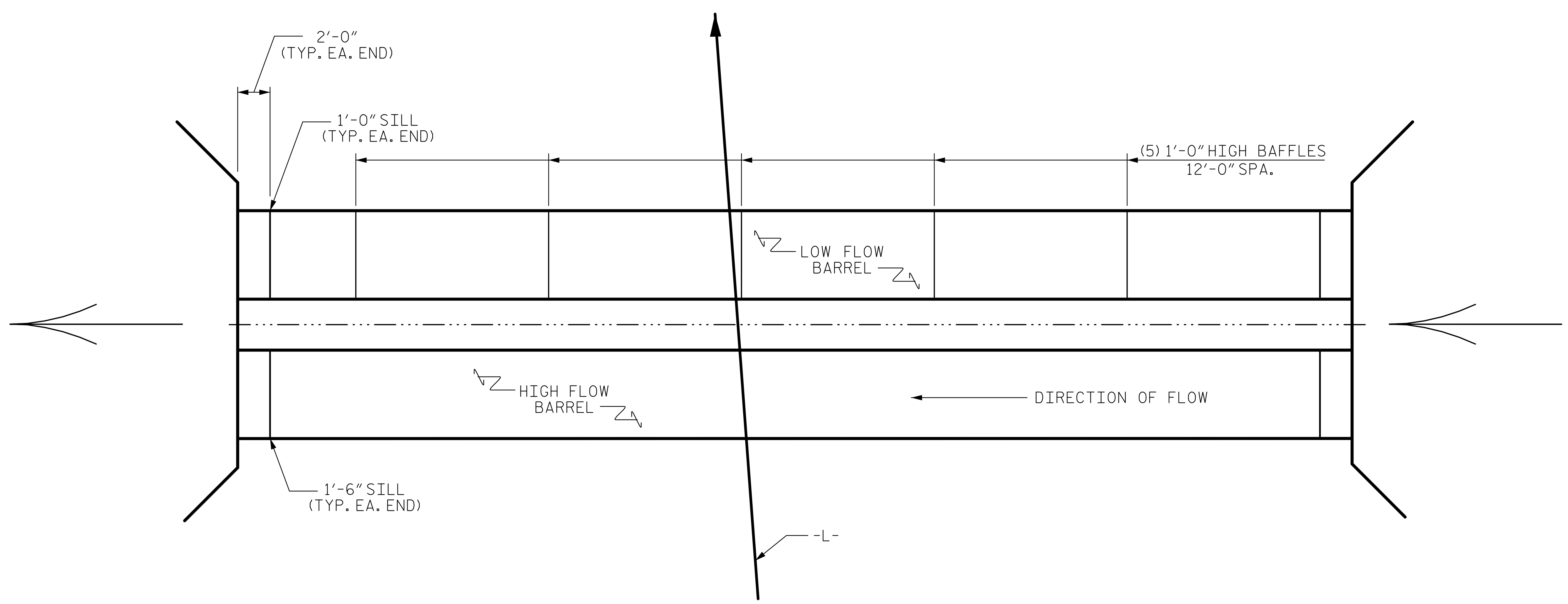
NATIVE MATERIAL EXCAVATED FROM THE EXISTING STREAM BED OR FLOOD PLAIN SHALL BE STOCKPILED AND LATER PLACED IN THE PROPOSED CULVERT BETWEEN SILLS TO PROVIDE A CONTINUOUS FLOW CHANNEL. RIP RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL. IF RIP RAP IS USED, NATIVE MATERIAL SHALL BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A LEVEL SURFACE FOR ANIMAL PASSAGE. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

THE ENTIRE COST OF WORK REQUIRED TO PLACE THE EXCAVATED MATERIAL SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE BID FOR CULVERT EXCAVATION.

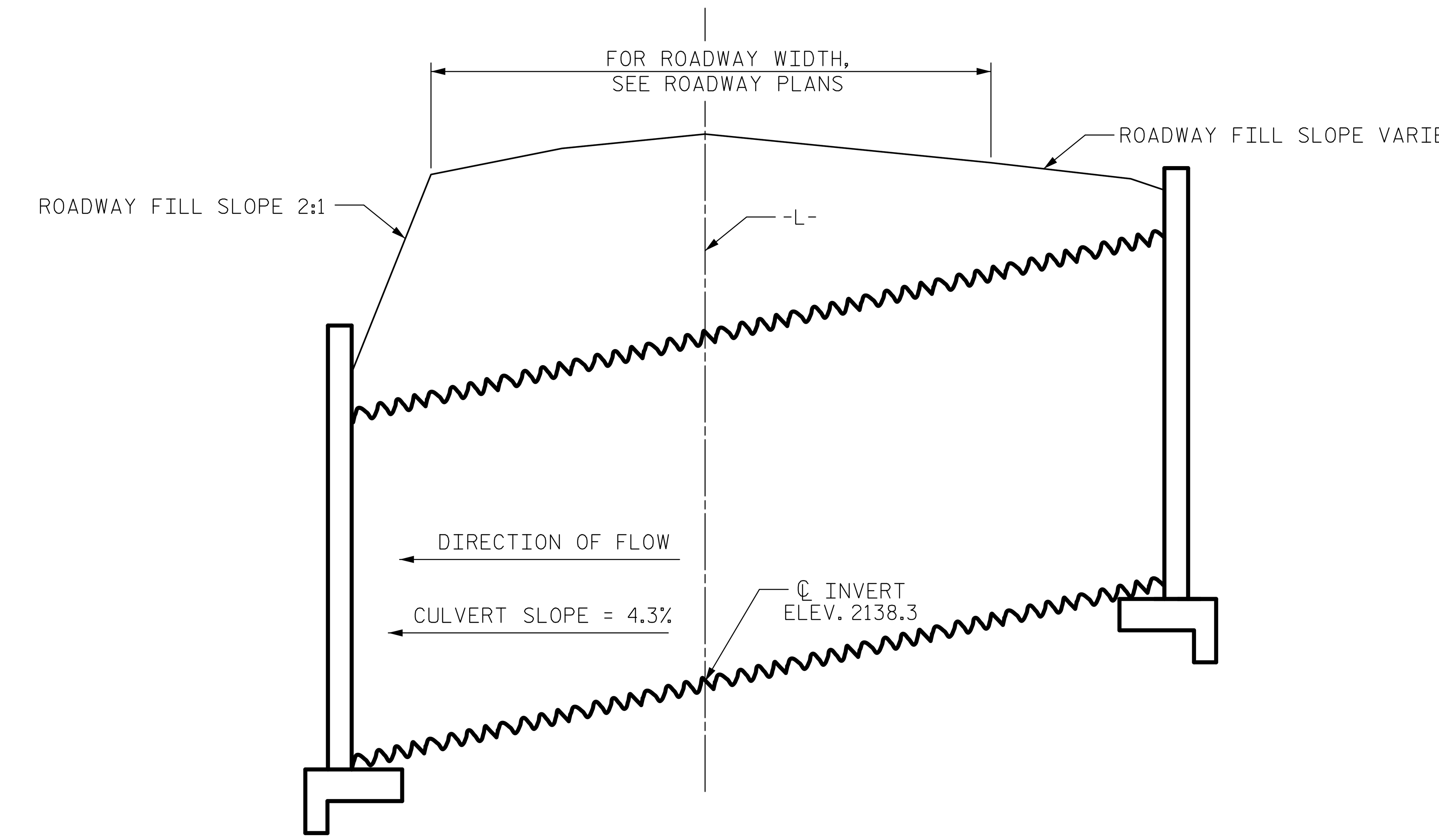
THE ENTIRE COST OF THE SILLS SHALL BE INCLUDED IN THE LUMP SUM PRICE BID FOR CORRUGATED ALUMINUM PIPE CULVERT.



ELEVATION
(LOOKING DOWNSTREAM)



FLOOR SILL LAYOUT



CULVERT SECTION NORMAL TO ROADWAY

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 144+74.50 -L-

SHEET 4 OF 4

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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

CORRUGATED ALUMINUM PIPE CULVERT
94° SKEW

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

SHEET NO. C5-4
TOTAL SHEETS 4

STR #5

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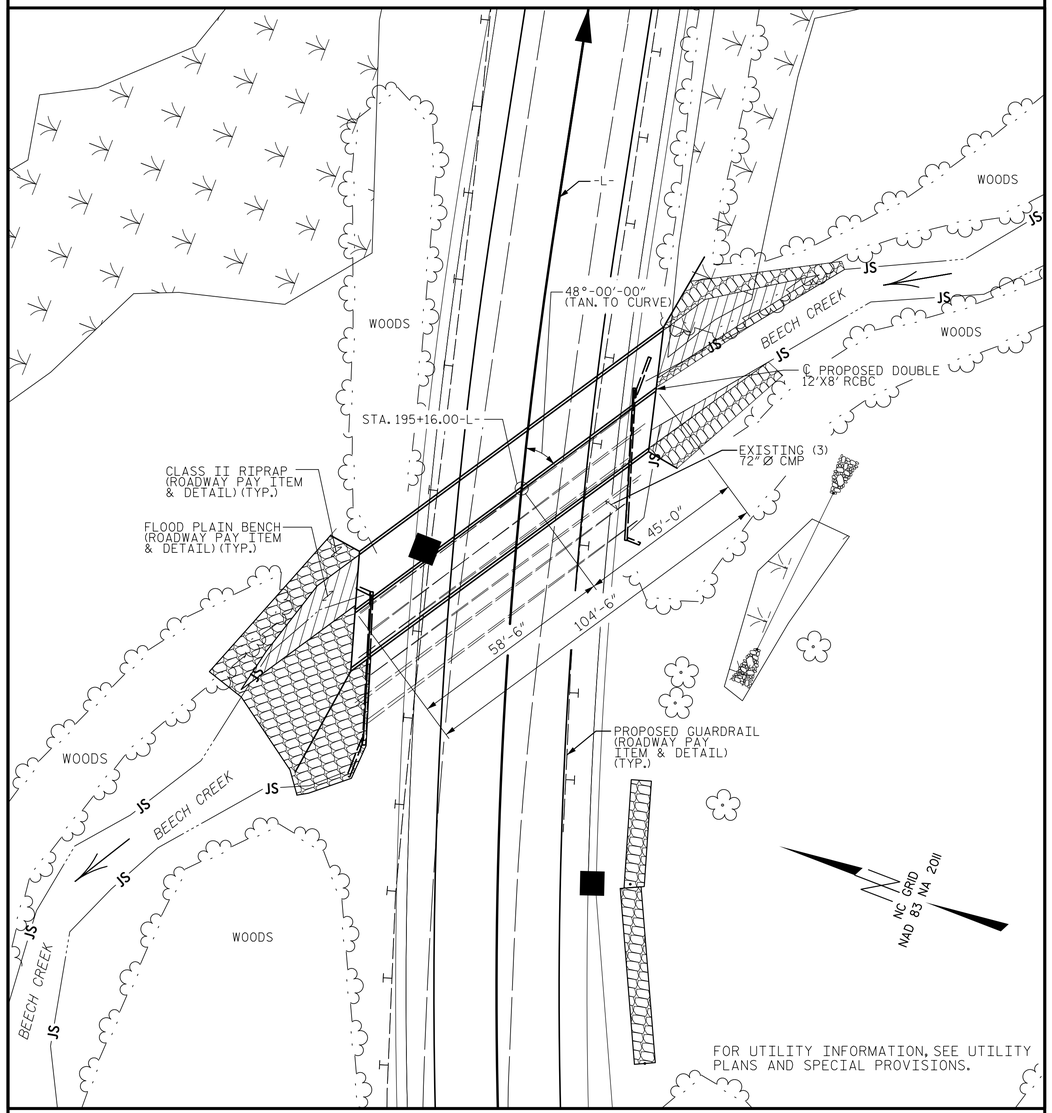
CHECKED BY :	MGC	DATE :	1/22

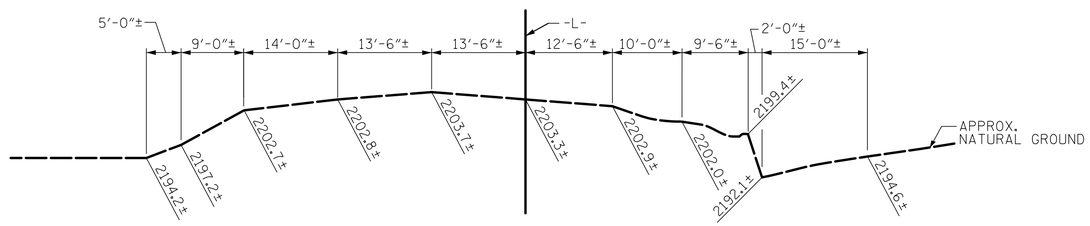
5/23/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #5 144+75.00 -L-\FinalPlans\DGNs\415_007_A-0009CA_SMU_CU04.dgn
User:ZSmith

F.A. PROJECT NO.: APD-0074(178)

BENCH MARK #10: SPIKE NAIL IN BASE OF 14" DBL POPLAR; 40' RT OF STA. 197+38 -L-; ELEV. = 2200.60



LOCATION SKETCH



PROFILE ALONG ℄ CULVERT

DRAWN BY :	ZCS	DATE :	1/21
CHECKED BY :	MGC	DATE :	6/21
DESIGN ENGINEER OF RECORD :	ZCS	DATE :	11/21

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 3.02 CY/FT	315.6	C.Y.
WINGS, ETC.	45.5	C.Y.
SILLS	8.0	C.Y.
TOTAL	369.1	C.Y.
REINFORCING STEEL		
BARREL & SILLS	39,286	LBS.
WINGS, ETC.	4,751	LBS.
TOTAL	44,037	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	223 TONS	

ROADWAY DATA

GRADE POINT ELEV. @ STA. 195+16.00-L- = 2203.83'
BED ELEV. @ STA. 195+16.00-L- _____ = 2190.0'
ROADWAY SLOPES _____ = 2:1

HYDROGRAPHIC DATA

DESIGN DISCHARGE _____ = 1400 CFS
FREQUENCY OF DESIGN FLOOD _____ = 50 YRS
DESIGN HIGH WATER ELEVATION _____ = 2200.3'
DRAINAGE AREA _____ = 4.39 SQ. MI.
BASE DISCHARGE (Q100) _____ = 1700 CFS
BASE HIGH WATER ELEVATION _____ = 2201.4'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE _____ = 1600 CFS
FREQUENCY OF OVERTOPPING FLOOD _ = >50 YRS
OVERTOPPING FLOOD ELEVATION _____ = 2201.0'

SAMPLE BAR REPLACEMENT

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

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

NOTES:

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

DESIGN FILL---------- 7.4' MAX.; 1.0' MIN.

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

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

CONCRETE IN CULVERT TO BE POURED IN THE FOLLOWING ORDER:

1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.

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

DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.

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.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

EXCAVATE 1 FOOT BELOW CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS. FOUNDATION CONDITIONING MATERIAL SHOULD CONSIST OF SELECT MATERIAL CLASS V OR VI FOR RCBC.

IF REQUIRED, UNDERCUT LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 195+16.00 -L-

SHEET 1 OF 7

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 — Marshall G. Cheek, Jr. — ENGINEER — MARSHALL G. CHEEK, JR.
6/1/2022

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TGS ENGINEERS
804-C N. LAFAYETTE ST
SHELBY, NC 28150
PH (704) 476-0003
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

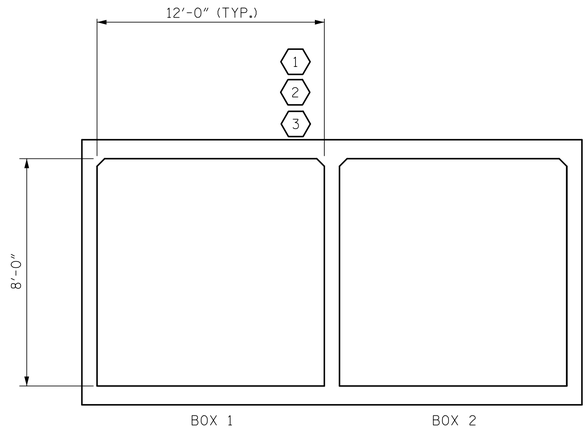
DOUBLE 12 FT. x 8 FT. CONCRETE BOX CULVERT 48° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-1
1			3			TOTAL SHEETS
2			4			7

STR #6

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 (γLL)	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	1.09	--	1.75	1.11	1	TOP SLAB	6.75	1.09	1	TOP SLAB	12.75	
		HL-93 (OPERATING)	N/A		1.41	--	1.35	1.43	1	TOP SLAB	6.75	1.41	1	TOP SLAB	12.75	
		HS-20 (INVENTORY)	36.000	2	1.14	41.04	1.75	1.15	1	TOP SLAB	6.75	1.14	1	TOP SLAB	12.75	
		HS-20 (OPERATING)	36.000		1.47	52.92	1.35	1.49	1	TOP SLAB	6.75	1.47	1	TOP SLAB	12.75	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.30	31.05	1.40	2.30	1	TOP SLAB	6.75	2.88	1	TOP SLAB	12.75	
		SNGARBS2	20.000		2.15	43.00	1.40	2.15	1	TOP SLAB	6.75	2.49	1	TOP SLAB	12.75	
		SNAGRIS2	22.000		2.30	50.60	1.40	2.30	1	TOP SLAB	6.75	2.61	1	TOP SLAB	12.75	
		SNCOTTS3	27.250	3	1.35	36.79	1.40	1.38	1	TOP SLAB	6.75	1.35	1	TOP SLAB	12.75	
		SNAGGRS4	34.925		1.59	55.53	1.40	1.66	1	TOP SLAB	6.75	1.59	1	TOP SLAB	12.75	
		SNS5A	35.550		1.49	52.97	1.40	1.58	1	TOP SLAB	6.75	1.49	1	TOP SLAB	12.75	
		SNS6A	39.950		1.48	59.13	1.40	1.57	1	TOP SLAB	6.75	1.48	1	TOP SLAB	12.75	
		SNS7B	42.000		1.48	62.16	1.40	1.63	1	TOP SLAB	6.75	1.48	1	TOP SLAB	12.75	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.98	65.34	1.40	2.22	1	BOTTOM SLAB	6.75	1.98	1	BOTTOM SLAB	12.75	
		TNT4A	33.075		1.57	51.93	1.40	1.65	1	TOP SLAB	6.75	1.57	1	TOP SLAB	12.75	
		TNT6A	41.600		1.48	61.57	1.40	1.69	1	TOP SLAB	6.75	1.48	1	TOP SLAB	12.75	
		TNT7A	42.000		1.51	63.42	1.40	1.66	1	TOP SLAB	6.75	1.51	1	TOP SLAB	12.75	
		TNT7B	42.000		1.55	65.10	1.40	1.60	1	TOP SLAB	6.75	1.55	1	TOP SLAB	12.75	
		TNAGRIT4	43.000		1.52	65.36	1.40	1.65	1	TOP SLAB	6.75	1.52	1	BOTTOM SLAB	12.75	
		TNAGT5A	45.000		1.53	68.85	1.40	1.85	1	TOP SLAB	6.75	1.53	1	TOP SLAB	12.75	
		TNAGT5B	45.000		1.49	67.05	1.40	1.65	1	TOP SLAB	6.75	1.49	1	TOP SLAB	12.75	



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. A-0009CA

GRAHAM COUNTY

STATION: 195+16.00 -L-

SHEET 2 OF 7

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 MARSHALL G. CHEEK, JR. ENGINEER
Marshall G. Cheek, Jr.
6/1/2022

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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 (NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-2
1			3			TOTAL SHEETS
2			4			7

STR #6 STD. NO. LRFR5

ASSEMBLED BY :	ZCS	DATE :	2/21
CHECKED BY :	MGC	DATE :	6/21
DRAWN BY : WMC	7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM	7/11	REV. 12/17	MAA/THC

3/22/2022
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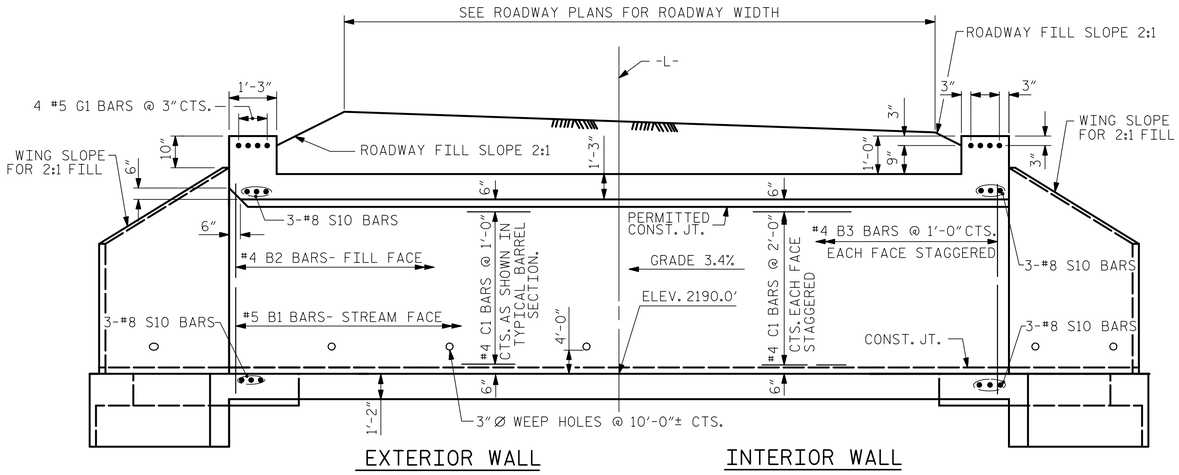
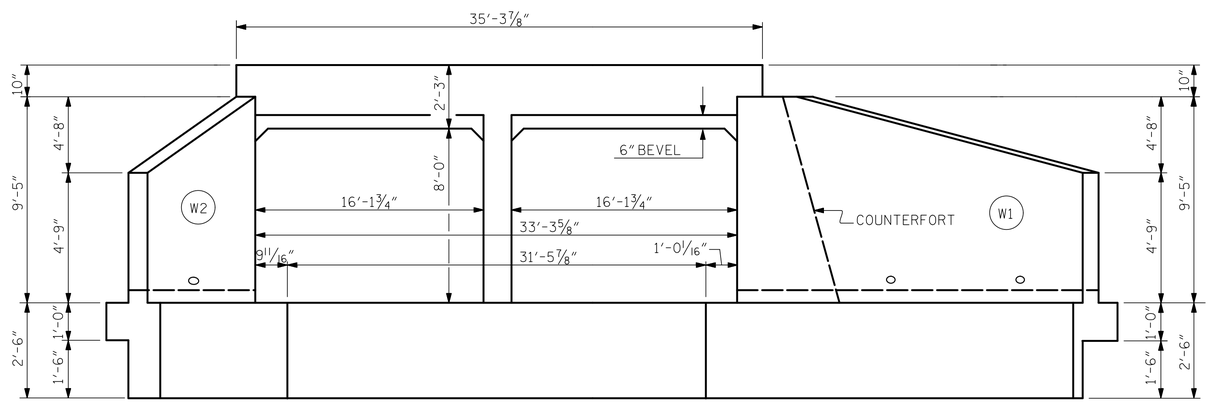
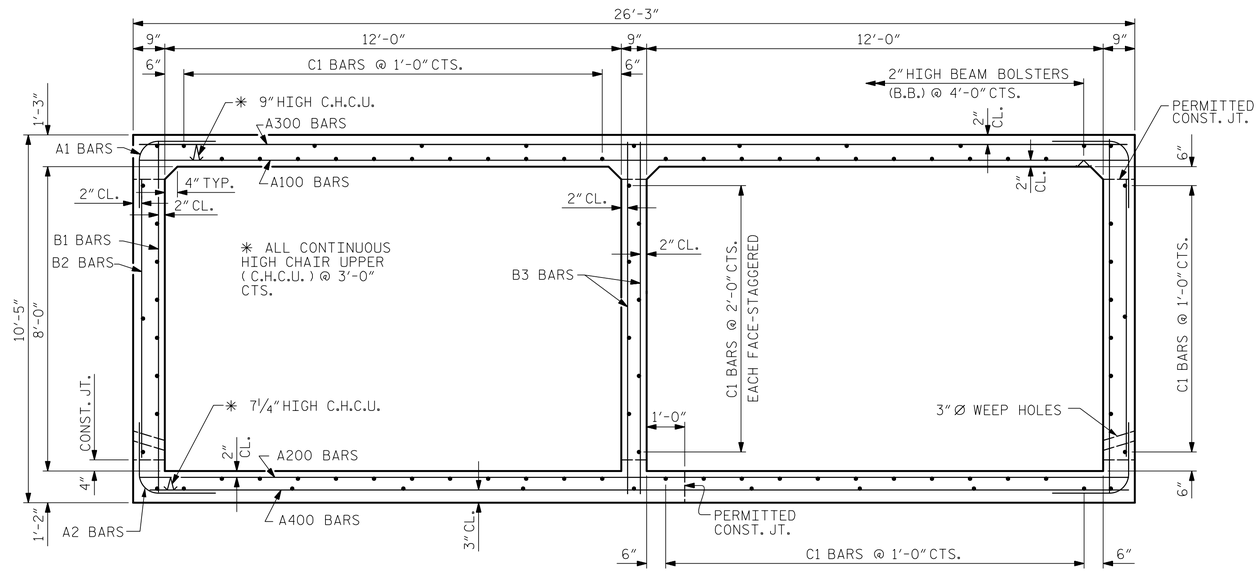
User:ZSmith



CULVERT SECTION NORMAL TO ROADWAY

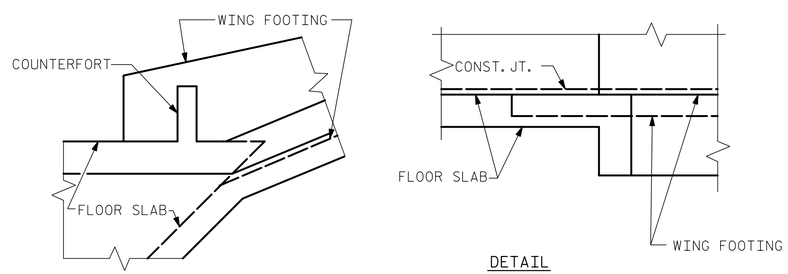


INLET END ELEVATION NORMAL TO SKEW



RIGHT ANGLE SECTION OF BARREL

THERE ARE 92 "C" BARS IN SECTION OF BARREL.



DETAIL

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

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 195+16.00 -L-

SHEET 3 OF 7

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

6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

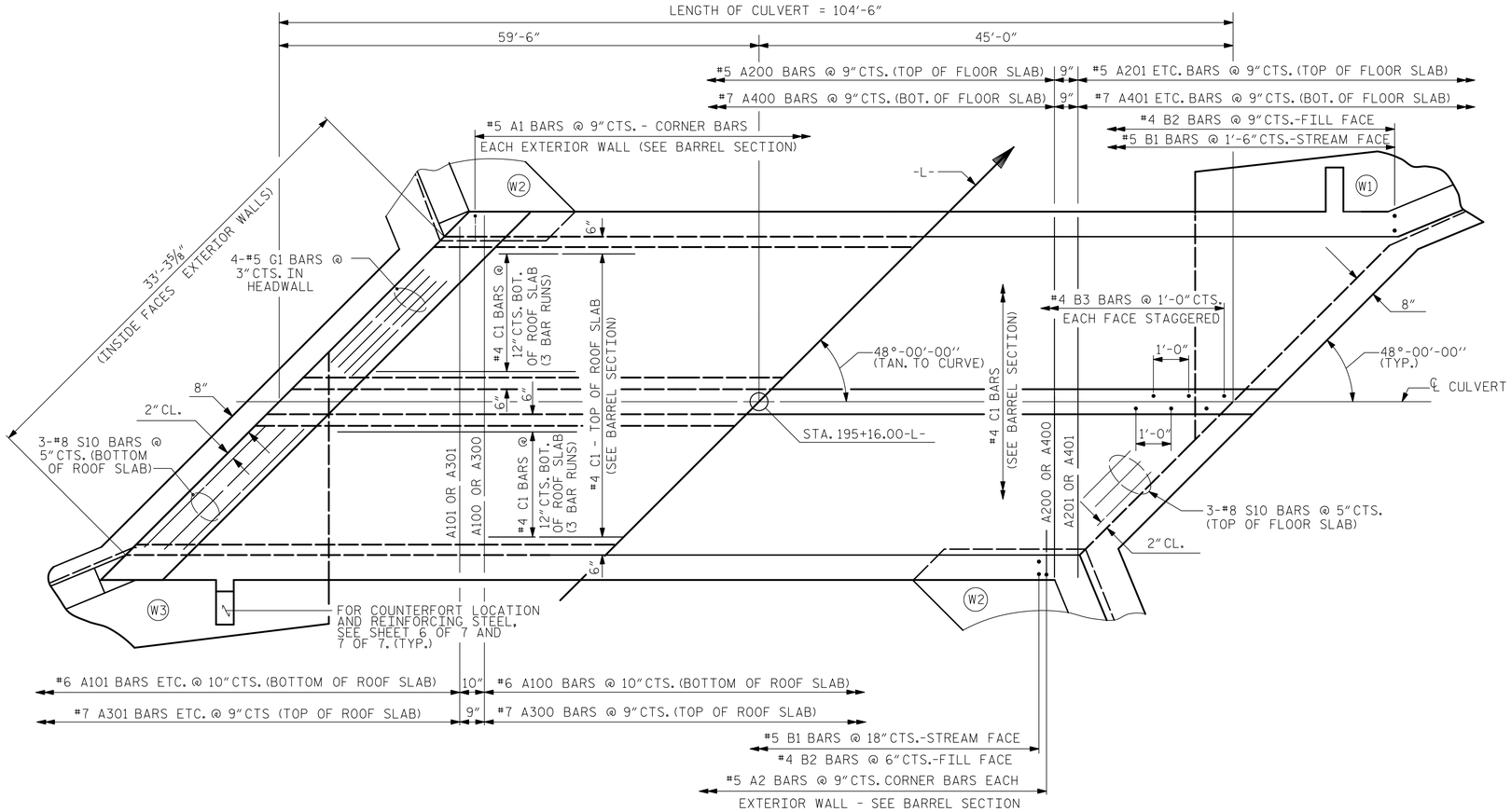
TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 200
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 12 FT. x 8 FT. CONCRETE BOX CULVERT 48° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-3
1			3			TOTAL SHEETS
2			4			7

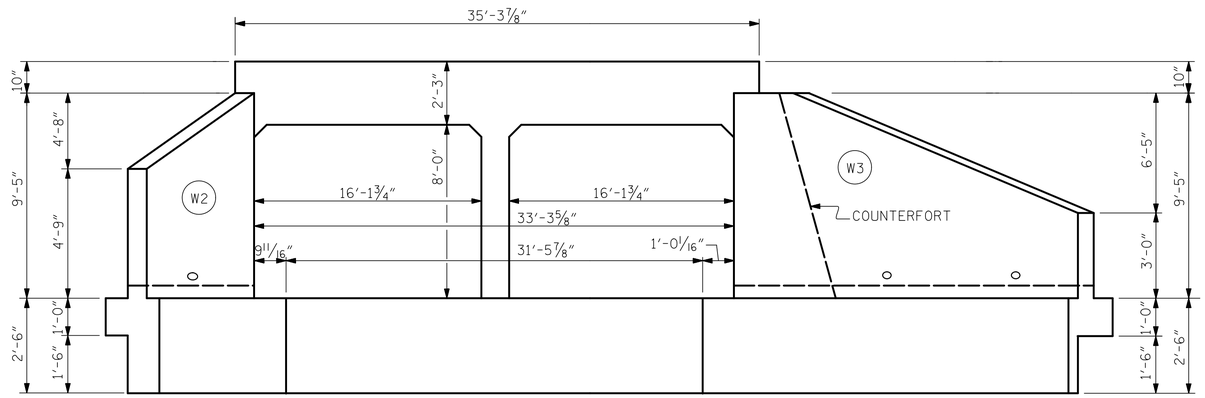
DRAWN BY :	ZCS	DATE :	2/21
CHECKED BY :	MGC	DATE :	6/21
DESIGN ENGINEER OF RECORD:	ZCS	DATE :	11/21



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB

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



OUTLET END ELEVATION NORMAL TO SKEW

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 195+16.00 -L-

SHEET 4 OF 7

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

6/1/2022

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

DOUBLE 12 FT. x 8 FT.
CONCRETE BOX CULVERT
48° SKEW

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
706 HILLSBOROUGH STREET
SUITE 209
RALEIGH, NC 27603
PH (919) 773-8887
CORP. LICENSE NO.: C-0275

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-4
1			3			TOTAL SHEETS
2			4			7

DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 6/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 11/21

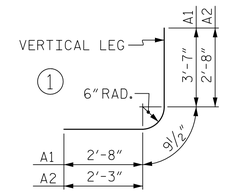
BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	270	#5	1	7'-1"	1995	A200	108	#5	STR	25'-11"	2919	A300	108	#7	STR	25'-11"	5721	A400	108	#7	STR	25'-11"	5721
A2	270	#5	1	5'-9"	1619	A201	2	#5	STR	25'-4"	53	A301	2	#7	STR	25'-4"	104	A401	2	#7	STR	25'-4"	104
						A202	2	#5	STR	24'-6"	51	A302	2	#7	STR	24'-6"	100	A402	2	#7	STR	24'-6"	100
A100	97	#6	STR	25'-11"	3776	A203	2	#5	STR	23'-8"	49	A303	2	#7	STR	23'-8"	97	A403	2	#7	STR	23'-8"	97
A101	2	#6	STR	25'-4"	76	A204	2	#5	STR	22'-10"	48	A304	2	#7	STR	22'-10"	93	A404	2	#7	STR	22'-10"	93
A102	2	#6	STR	24'-5"	73	A205	2	#5	STR	22'-0"	46	A305	2	#7	STR	22'-0"	90	A405	2	#7	STR	22'-0"	90
A103	2	#6	STR	23'-6"	71	A206	2	#5	STR	21'-2"	44	A306	2	#7	STR	21'-2"	87	A406	2	#7	STR	21'-2"	87
A104	2	#6	STR	22'-7"	68	A207	2	#5	STR	20'-4"	42	A307	2	#7	STR	20'-4"	83	A407	2	#7	STR	20'-4"	83
A105	2	#6	STR	21'-8"	65	A208	2	#5	STR	19'-6"	41	A308	2	#7	STR	19'-6"	80	A408	2	#7	STR	19'-6"	80
A106	2	#6	STR	20'-9"	62	A209	2	#5	STR	18'-8"	39	A309	2	#7	STR	18'-8"	76	A409	2	#7	STR	18'-8"	76
A107	2	#6	STR	19'-10"	60	A210	2	#5	STR	17'-10"	37	A310	2	#7	STR	17'-10"	73	A410	2	#7	STR	17'-10"	73
A108	2	#6	STR	18'-10"	57	A211	2	#5	STR	17'-0"	35	A311	2	#7	STR	17'-0"	69	A411	2	#7	STR	17'-0"	69
A109	2	#6	STR	17'-11"	54	A212	2	#5	STR	16'-2"	34	A312	2	#7	STR	16'-2"	66	A412	2	#7	STR	16'-2"	66
A110	2	#6	STR	17'-0"	51	A213	2	#5	STR	15'-4"	32	A313	2	#7	STR	15'-4"	63	A413	2	#7	STR	15'-4"	63
A111	2	#6	STR	16'-1"	48	A214	2	#5	STR	14'-6"	30	A314	2	#7	STR	14'-6"	59	A414	2	#7	STR	14'-6"	59
A112	2	#6	STR	15'-2"	46	A215	2	#5	STR	13'-8"	29	A315	2	#7	STR	13'-8"	56	A415	2	#7	STR	13'-8"	56
A113	2	#6	STR	14'-3"	43	A216	2	#5	STR	12'-10"	27	A316	2	#7	STR	12'-10"	52	A416	2	#7	STR	12'-10"	52
A114	2	#6	STR	13'-4"	40	A217	2	#5	STR	12'-0"	25	A317	2	#7	STR	12'-0"	49	A417	2	#7	STR	12'-0"	49
A115	2	#6	STR	12'-5"	37	A218	2	#5	STR	11'-2"	23	A318	2	#7	STR	11'-2"	46	A418	2	#7	STR	11'-2"	46
A116	2	#6	STR	11'-6"	35	A219	2	#5	STR	10'-4"	22	A319	2	#7	STR	10'-4"	42	A419	2	#7	STR	10'-4"	42
A117	2	#6	STR	10'-7"	32	A220	2	#5	STR	9'-6"	20	A320	2	#7	STR	9'-6"	39	A420	2	#7	STR	9'-6"	39
A118	2	#6	STR	9'-7"	29	A221	2	#5	STR	8'-8"	18	A321	2	#7	STR	8'-8"	35	A421	2	#7	STR	8'-8"	35
A119	2	#6	STR	8'-8"	26	A222	2	#5	STR	7'-10"	16	A322	2	#7	STR	7'-10"	32	A422	2	#7	STR	7'-10"	32
A120	2	#6	STR	7'-9"	23	A223	2	#5	STR	7'-0"	15	A323	2	#7	STR	7'-0"	29	A423	2	#7	STR	7'-0"	29
A121	2	#6	STR	6'-10"	21	A224	2	#5	STR	6'-2"	13	A324	2	#7	STR	6'-2"	25	A424	2	#7	STR	6'-2"	25
A122	2	#6	STR	5'-11"	18	A225	2	#5	STR	5'-4"	11	A325	2	#7	STR	5'-4"	22	A425	2	#7	STR	5'-4"	22
A123	2	#6	STR	5'-0"	15	A226	2	#5	STR	4'-6"	9	A326	2	#7	STR	4'-6"	18	A426	2	#7	STR	4'-6"	18
A124	2	#6	STR	4'-1"	12	A227	2	#5	STR	3'-8"	8	A327	2	#7	STR	3'-8"	15	A427	2	#7	STR	3'-8"	15

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	140	#5	STR	9'-11"	1448
B2	278	#4	STR	7'-4"	1362
B3	208	#4	STR	9'-11"	1378
C1	276	#4	STR	36'-4"	6699
D1	24	#6	STR	2'-9"	99
D2	24	#6	STR	1'-9"	63
G1	8	#5	STR	34'-10"	291
S10	12	#8	STR	34'-10"	1116

REINFORCING STEEL LBS. 39,286

BAR TYPE



BAR DIMENSIONS ARE OUT TO OUT

SPLICE LENGTHS CHART

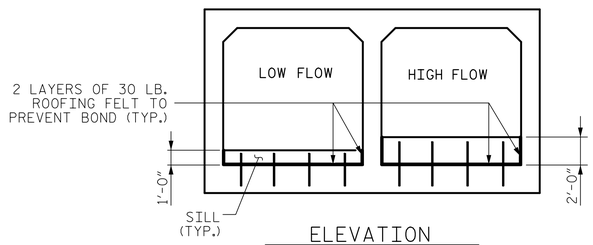
BAR	SIZE	SPLICE LENGTH
"B"	#4	1'-10"
C1	#4	1'-11"
"S"	#6	2'-9"
"S"	#8	3'-8"

NOTES

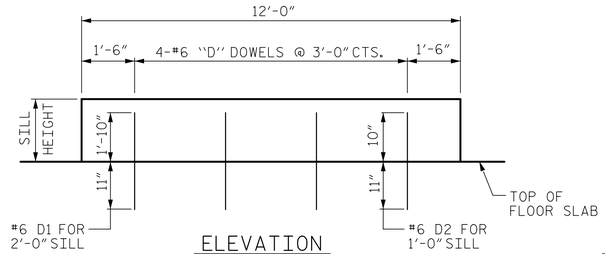
NATIVE MATERIAL BETWEEN SILLS IN THE CULVERT SHALL PROVIDE A CONTINUOUS FLOW CHANNEL. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED AT THE PROJECT SITE DURING CONSTRUCTION. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

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.

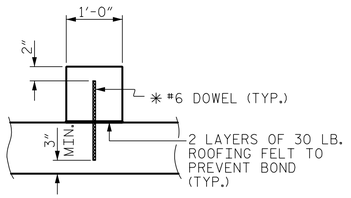
THE ENTIRE COST OF WORK REQUIRED TO CONSTRUCT THE SILLS SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS.



ELEVATION
(LOOKING DOWNSTREAM)



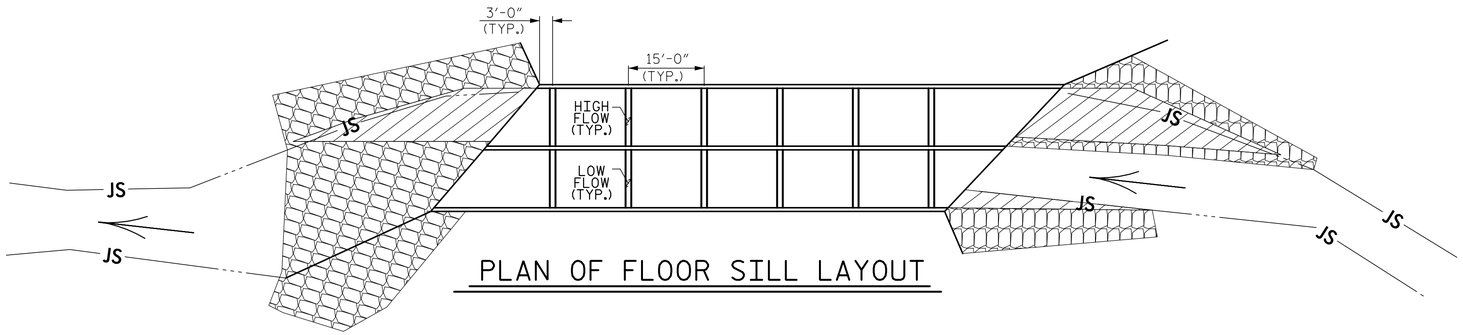
ELEVATION



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. A-0009CA

GRAHAM COUNTY

STATION: 195+16.00 -L-

SHEET 5 OF 7

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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

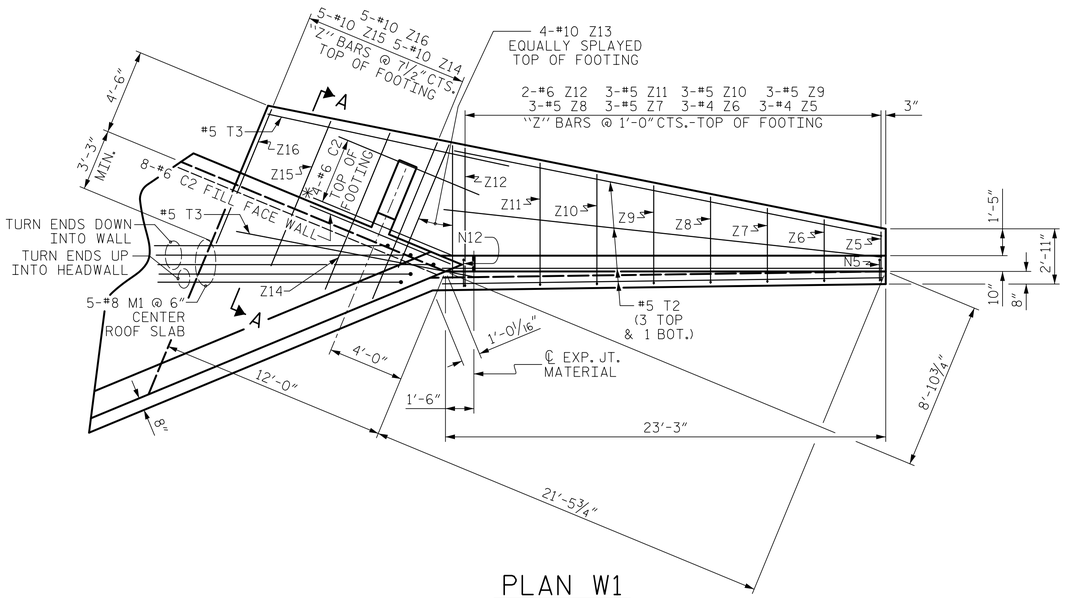
DOUBLE 12 FT. X 8 FT. CONCRETE BOX CULVERT 48° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-5
1			3			TOTAL SHEETS
2			4			7

DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 6/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 11/21

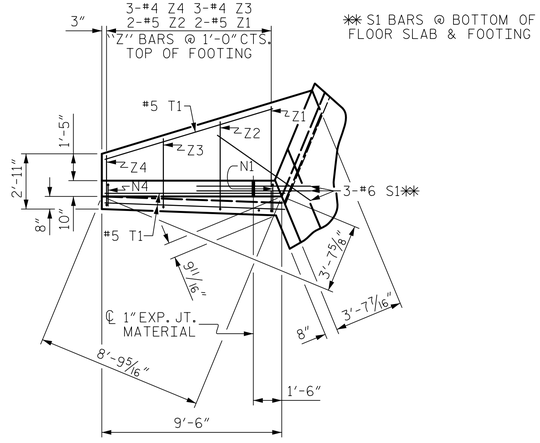
3/22/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #6 195+16.00 -L-\Final Plans\DGNs\416_009_A-0009CA_SMU_CU05.dgn
User:ZSmith

STR #6



PLAN W1

✳ CENTER ALL #6 C2 BARS ON ℄ COUNTERFORT

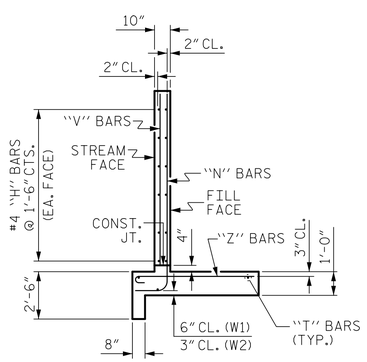


✳✳ S1 BARS @ BOTTOM OF FLOOR SLAB & FOOTING

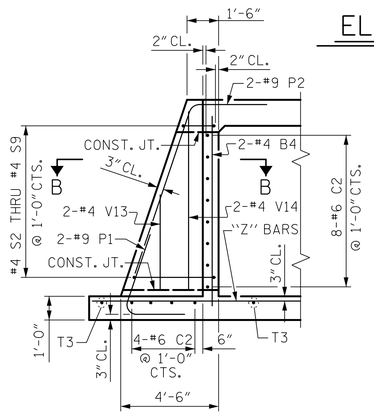
PLAN W2

ELEVATION W1

ELEVATION W2

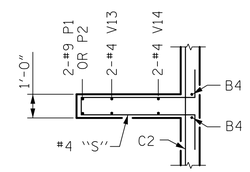


WING SECTION



SECTION A-A

STANDARD REINFORCING STEEL IN BARREL NOT SHOWN



SECTION B-B

NOTE:
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.

BILL OF MATERIAL

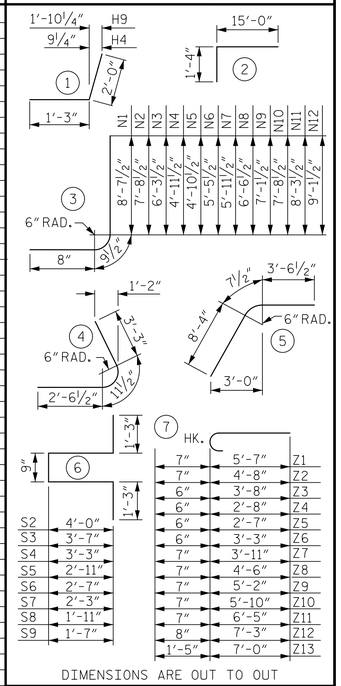
LONG WING W1

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B4	2	#4	STR	9'-0"	12
C2	12	#6	STR	8'-0"	144
H6	6	#4	STR	21'-4"	86
H7	2	#4	STR	19'-4"	26
H8	2	#4	STR	11'-5"	15
H9	2	#4	STR	3'-6"	5
H10	12	#4	1	3'-3"	26
H11	2	#4	STR	21'-9"	29
M1	5	#8	2	16'-4"	218
N5	3	#4	3	6'-4"	13
N6	3	#4	3	6'-11"	14
N7	3	#4	3	7'-5"	15
N8	3	#4	3	8'-0"	16
N9	3	#5	3	8'-7"	27
N10	3	#5	3	9'-2"	29
N11	4	#5	3	9'-9"	41
N12	2	#5	3	10'-7"	22
P1	2	#9	4	6'-9"	46
P2	2	#9	5	12'-6"	85
S2	1	#4	6	11'-3"	8
S3	1	#4	6	10'-5"	7
S4	1	#4	6	9'-9"	7
S5	1	#4	6	9'-1"	6
S6	1	#4	6	8'-5"	6
S7	1	#4	6	7'-9"	5
S8	1	#4	6	7'-1"	5
S9	1	#4	6	6'-5"	4
T2	4	#5	STR	23'-3"	97
T3	2	#5	STR	12'-0"	25
V5	3	#4	STR	4'-2"	8
V6	3	#4	STR	4'-10"	10
V7	3	#4	STR	5'-5"	11
V8	3	#4	STR	6'-0"	12
V9	3	#4	STR	6'-6"	13
V10	3	#4	STR	7'-2"	14
V11	4	#4	STR	7'-8"	20
V12	2	#4	STR	8'-7"	11
V13	2	#4	STR	4'-0"	5
V14	2	#4	STR	8'-0"	11
Z5	3	#4	7	3'-1"	6
Z6	3	#4	7	3'-9"	8
Z7	3	#5	7	4'-6"	14
Z8	3	#5	7	5'-1"	16
Z9	3	#5	7	5'-9"	18
Z10	3	#5	7	6'-5"	20
Z11	3	#5	7	7'-0"	22
Z12	2	#6	7	7'-11"	24
Z13	4	#10	7	8'-5"	145
Z14	5	#10	STR	8'-11"	192
Z15	5	#10	STR	8'-3"	177
Z16	5	#10	STR	7'-8"	165
REINFORCING STEEL FOR 1 W1 WING					1,961 LBS.

SHORT WING W2

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	7'-7"	30
H2	2	#4	STR	6'-10"	9
H3	2	#4	STR	3'-7"	5
H4	12	#4	1	3'-3"	26
H5	2	#4	STR	8'-5"	11
N1	2	#5	3	10'-1"	21
N2	2	#5	3	9'-2"	19
N3	3	#5	3	7'-9"	24
N4	3	#4	3	6'-5"	13
S1	3	#6	STR	6'-0"	27
T1	3	#5	STR	9'-6"	30
V1	2	#4	STR	8'-1"	11
V2	2	#4	STR	7'-1"	9
V3	3	#4	STR	5'-9"	12
V4	3	#4	STR	4'-4"	9
Z1	2	#5	7	6'-2"	13
Z2	2	#5	7	5'-3"	11
Z3	3	#4	7	4'-2"	8
Z4	3	#4	7	3'-2"	6
REINFORCING STEEL FOR 1 W2 WING					294 LBS.

BAR TYPES



DIMENSIONS ARE OUT TO OUT

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	7'-7"	30
H2	2	#4	STR	6'-10"	9
H3	2	#4	STR	3'-7"	5
H4	12	#4	1	3'-3"	26
H5	2	#4	STR	8'-5"	11
N1	2	#5	3	10'-1"	21
N2	2	#5	3	9'-2"	19
N3	3	#5	3	7'-9"	24
N4	3	#4	3	6'-5"	13
S1	3	#6	STR	6'-0"	27
T1	3	#5	STR	9'-6"	30
V1	2	#4	STR	8'-1"	11
V2	2	#4	STR	7'-1"	9
V3	3	#4	STR	5'-9"	12
V4	3	#4	STR	4'-4"	9
Z1	2	#5	7	6'-2"	13
Z2	2	#5	7	5'-3"	11
Z3	3	#4	7	4'-2"	8
Z4	3	#4	7	3'-2"	6
REINFORCING STEEL FOR 1 W2 WING					294 LBS.

TOTAL WING QUANTITIES

REINFORCING STEEL FOR 2 WINGS	2,255 LBS.
CLASS A CONCRETE	
2 WINGS	18.0 C.Y.
1 END CURTAIN WALL	1.9 C.Y.
1 HEADWALL	1.6 C.Y.
TOTAL	21.5 C.Y.

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 195+16.00 -L-

SHEET 6 OF 7

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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 WINGS FOR MULTIPLE BARREL CONCRETE BOX CULVERT

H = 8'-0" SLOPE = 2:1
45° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-6
1			3			TOTAL SHEETS
2			4			7

DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 6/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 11/21

3/22/2022
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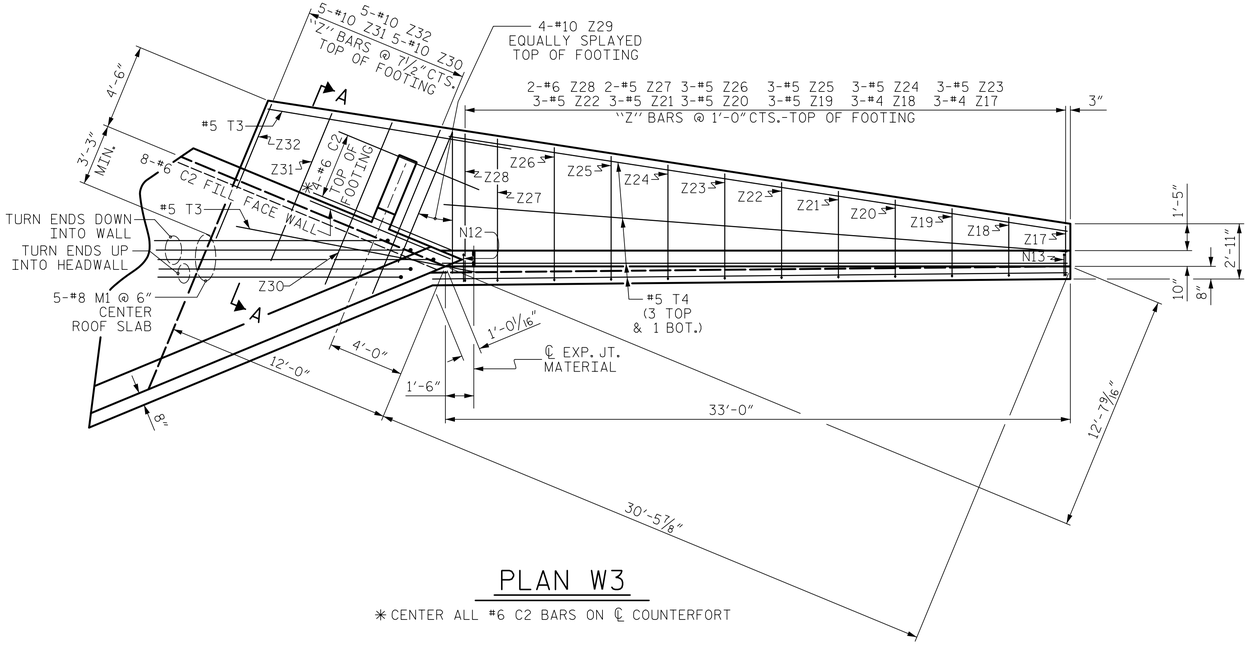
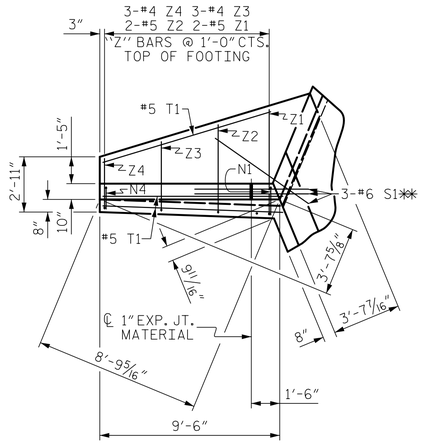
User:ZSmith

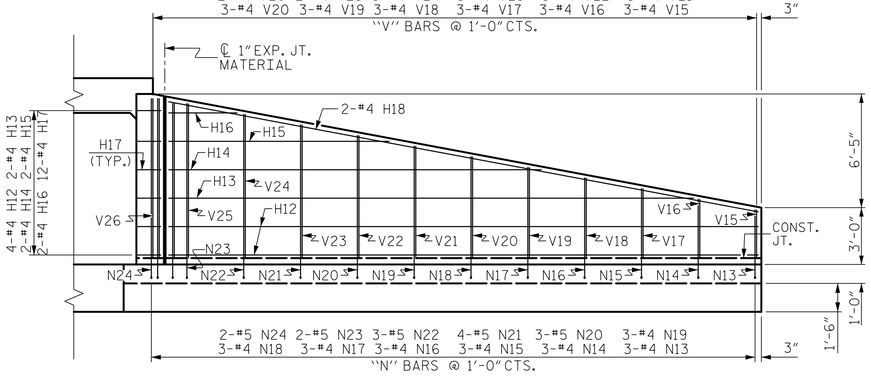


PLAN W3

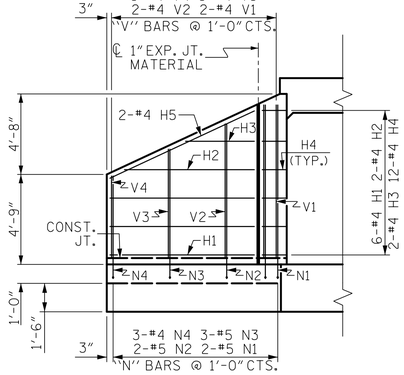
✱ CENTER ALL #6 C2 BARS ON ℄ COUNTERFORT



PLAN W2



ELEVATION W3



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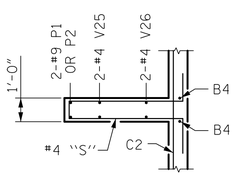
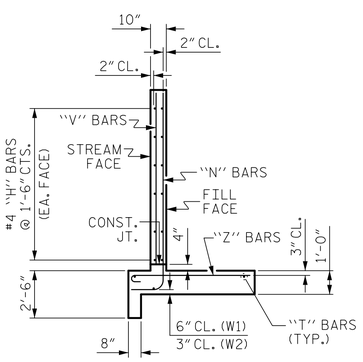
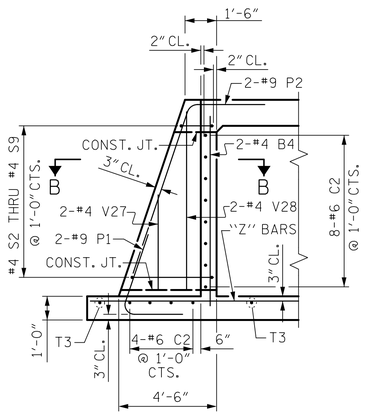


SECTION B-B



WING SECTION



SECTION A-A

STANDARD REINFORCING STEEL IN BARREL NOT SHOWN

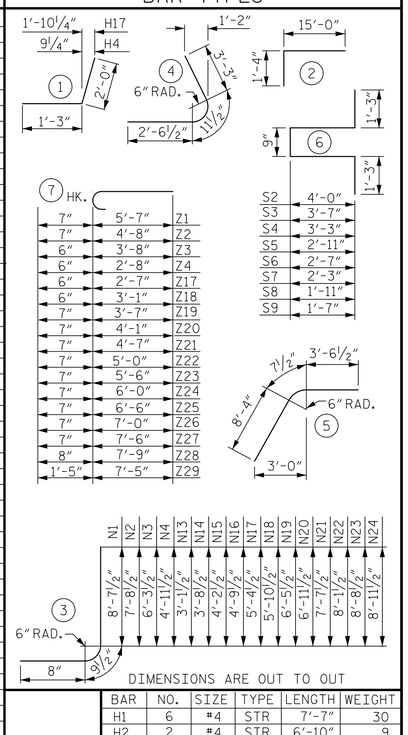
BILL OF MATERIAL

LONG WING W3

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B4	2	#4	STR	9'-0"	12
C2	12	#6	STR	8'-0"	144
H12	4	#4	STR	31'-1"	83
H13	2	#4	STR	27'-8"	37
H14	2	#4	STR	19'-7"	26
H15	2	#4	STR	11'-7"	15
H16	2	#4	STR	3'-7"	5
H17	12	#4	1	3'-6"	28
H18	2	#4	STR	31'-8"	42
M1	5	#8	2	16'-4"	218
N13	3	#4	3	4'-7"	9
N14	3	#4	3	5'-2"	10
N15	3	#4	3	5'-8"	11
N16	3	#4	3	6'-3"	13
N17	3	#4	3	6'-10"	14
N18	3	#4	3	7'-4"	15
N19	3	#4	3	7'-11"	16
N20	3	#5	3	8'-5"	26
N21	3	#5	3	9'-1"	28
N22	3	#5	3	9'-7"	30
N23	2	#5	3	10'-2"	21
N24	2	#5	3	10'-5"	22
P1	2	#9	4	6'-9"	46
P2	2	#9	5	12'-6"	85
S2	1	#4	6	11'-3"	8
S3	1	#4	6	10'-5"	7
S4	1	#4	6	9'-9"	7
S5	1	#4	6	9'-1"	6
S6	1	#4	6	8'-5"	6
S7	1	#4	6	7'-9"	5
S8	1	#4	6	7'-1"	5
S9	1	#4	6	6'-5"	4
T3	2	#5	STR	12'-0"	25
T4	4	#5	STR	33'-0"	138
V15	3	#4	STR	2'-6"	5
V16	3	#4	STR	3'-1"	6
V17	3	#4	STR	3'-7"	7
V18	3	#4	STR	4'-2"	8
V19	3	#4	STR	4'-9"	10
V20	3	#4	STR	5'-4"	11
V21	3	#4	STR	5'-10"	12
V22	3	#4	STR	6'-5"	13
V23	3	#4	STR	7'-0"	14
V24	3	#4	STR	7'-7"	15
V25	2	#4	STR	8'-2"	11
V26	2	#4	STR	8'-9"	12
V27	2	#4	STR	4'-0"	5
V28	2	#4	STR	8'-0"	11
Z17	3	#4	7	3'-1"	6
Z18	3	#4	7	3'-7"	7
Z19	3	#5	7	4'-2"	13
Z20	3	#5	7	4'-8"	15
Z21	3	#5	7	5'-2"	16
Z22	3	#5	7	5'-7"	17
Z23	3	#5	7	6'-1"	19
Z24	3	#5	7	6'-7"	21
Z25	3	#5	7	7'-1"	22
Z26	3	#5	7	7'-7"	24
Z27	2	#5	7	8'-1"	17
Z28	2	#6	7	8'-5"	25
Z29	4	#10	7	8'-10"	152
Z30	5	#10	STR	9'-2"	197
Z31	5	#10	STR	8'-4"	179
Z32	5	#10	STR	7'-8"	165

REINFORCING STEEL FOR 1 W3 WING 2,202 LBS.

BAR TYPES



DIMENSIONS ARE OUT TO OUT

SHORT WING W2

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	7'-7"	30
H2	2	#4	STR	6'-10"	9
H3	2	#4	STR	3'-7"	5
H4	12	#4	1	3'-3"	26
H5	2	#4	STR	8'-5"	11
N1	2	#5	3	10'-1"	21
N2	2	#5	3	9'-2"	19
N3	3	#5	3	7'-9"	24
N4	3	#4	3	6'-5"	13
S1	3	#6	STR	6'-0"	27
T1	3	#5	STR	9'-6"	30
V1	2	#4	STR	8'-1"	11
V2	2	#4	STR	7'-1"	9
V3	3	#4	STR	5'-9"	12
V4	3	#4	STR	4'-4"	9
Z1	2	#5	7	6'-2"	13
Z2	2	#5	7	5'-3"	11
Z3	3	#4	7	3'-8"	8
Z4	3	#4	7	2'-8"	6

REINFORCING STEEL FOR 1 W2 WING 294 LBS.

TOTAL WING QUANTITIES

REINFORCING STEEL FOR 2 WINGS	2,496 LBS.
CLASS A CONCRETE	
2 WINGS	20.5 C.Y.
1 END CURTAIN WALL	1.9 C.Y.
1 HEADWALL	1.6 C.Y.
TOTAL	24.0 C.Y.

NOTE:
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. A-0009CA
GRAHAM COUNTY
STATION: 195+16.00 -L-

SHEET 7 OF 7

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 20125 Marshall G. Cheek, Jr. 6/1/2022

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

TGS ENGINEERS
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CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

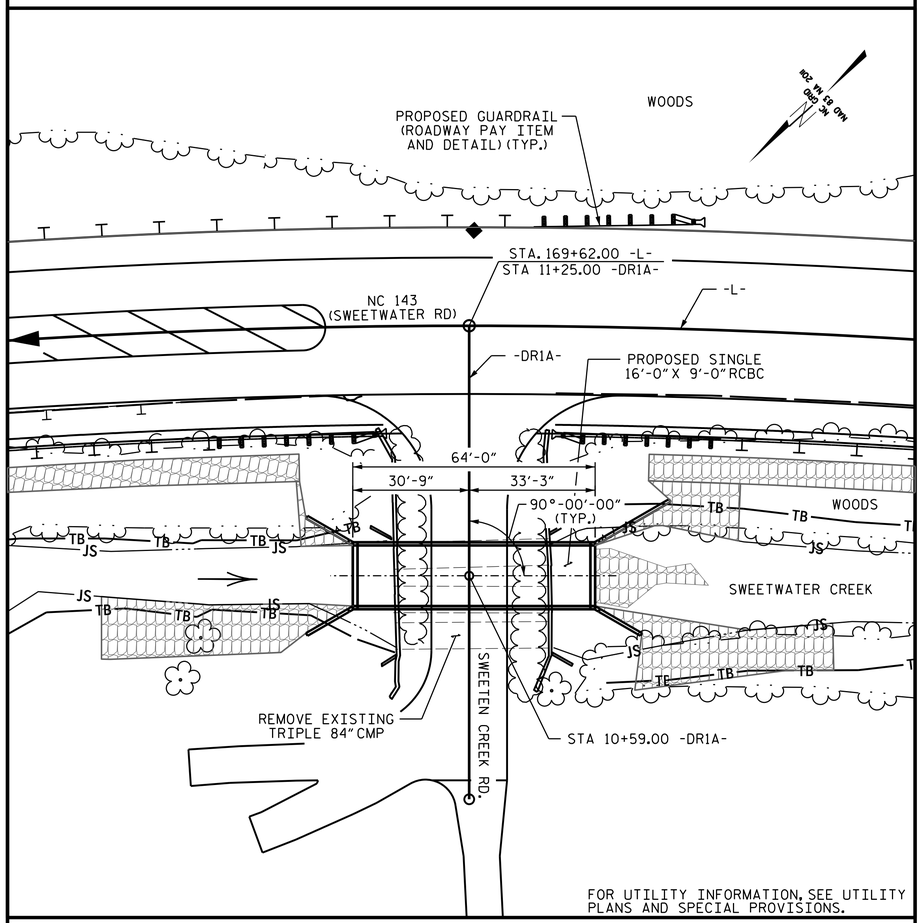
OUTLET WINGS W2 AND W3

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C6-7
1			3			TOTAL SHEETS
2			4			7

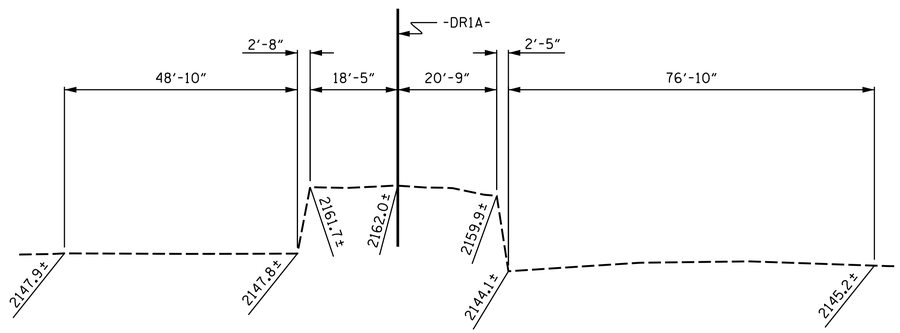
DRAWN BY : ZCS DATE : 2/21
CHECKED BY : MGC DATE : 6/21
DESIGN ENGINEER OF RECORD: ZCS DATE : 11/21

3/22/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #6 195+16.00 -L-\Final Plans\DGNs\416_013_A-0009CA_SMU_CU07.dgn
User:ZSmith

BENCH MARK #8: SPIKE NAIL SET IN BASE OF 14" POPLAR
28' LT. OF STA. 157+59 -L-; ELEV. 2148.72'



LOCATION SKETCH



PROFILE ALONG ℄ CULVERT

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 2.032 CY/FT	130.0	C.Y.
SILLS	3.0	C.Y.
WINGS, ETC.	34.4	C.Y.
TOTAL	167.4	C.Y.
REINFORCING STEEL		
BARREL	22,438	LBS.
WINGS, ETC.	2,093	LBS.
TOTAL	24,531	LBS.
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION COND. MAT'L.	98 TONS	

SAMPLE BAR REPLACEMENT

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

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

ROADWAY DATA

GRADE POINT ELEV. @ STA. 10+59.00 -DR1A-	= 2164.10'
BED ELEV. @ STA. 10+59.00 -DR1A-	= 2145.90'
ROADWAY SLOPES	= 2 :1

HYDROGRAPHIC DATA

DESIGN DISCHARGE	= 610 CFS
FREQUENCY OF DESIGN FLOOD	= 2 YRS
DESIGN HIGH WATER ELEVATION	= 2152.5'
DRAINAGE AREA	= 9.07 SQ. MI.
BASE DISCHARGE (Q100)	= 2980 CFS
BASE HIGH WATER ELEVATION	= 2154.4'

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 620 CFS
FREQUENCY OF OVERTOPPING FLOOD	= >2 YRS
OVERTOPPING FLOOD ELEVATION	= 2153.8'

F.A. PROJECT NO. : APD-0074(178)

NOTES:

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

DESIGN FILL---------- 9.15' MAX.

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 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.

AT THE CONTRACTOR'S OPTION HE MAY SUBMIT, TO THE ENGINEER FOR APPROVAL, DESIGN AND DETAIL DRAWINGS FOR A PRECAST REINFORCED CONCRETE BOX CULVERT IN LIEU OF THE CAST-IN-PLACE CULVERT SHOWN ON THE PLANS. THE DESIGN SHALL PROVIDE THE SAME SIZE AND NUMBER OF BARRELS AS USED ON THE CAST-IN-PLACE DESIGN. FOR OPTIONAL PRECAST REINFORCED CONCRETE BOX CULVERT, SEE SPECIAL PROVISIONS.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED. AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE SAMPLE BARS SHOULD COME FROM STEEL ACTUALLY USED IN THE PROJECT AND THE SAMPLE BARS SHOULD BE REPLACED BY SPICED BARS AS SPECIFIED IN THE SAMPLE BAR REPLACEMENT CHART. PAYMENT FOR THE SAMPLE BARS AND REPLACEMENT REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.

EXCAVATE 1 FOOT BELOW THE BOTTOM OF THE CULVERT AND REPLACE WITH FOUNDATION CONDITIONING MATERIAL IN ACCORDANCE WITH ARTICLE 414-4 OF THE STANDARD SPECIFICATIONS. FOUNDATION CONDITIONING MATERIAL SHOULD CONSIST OF SELECT MATERIAL CLASS V OR VI FOR RCBC.

IF REQUIRED, UNDERCUT LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.

PROJECT NO. A-0009CA
GRAHAM COUNTY
STATION: 10+59.00 -DR1A-

SHEET 1 OF 8

DRAWN BY : STM DATE : 02/22
CHECKED BY : MGC DATE : 03/22
DESIGN ENGINEER OF RECORD: STM DATE : 03/22

5/23/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #7 10+59.00 -DR1A-\Final Plans\DGNs\417_001_A-0009CA_SMU_CU01.dgn
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NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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

SINGLE 16 FT. X 9 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW

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

SHEET NO. C7-1
TOTAL SHEETS 8

STR #7

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)	1.14	--	1.75	1.14	1	EXTERIOR WALL	0.42	1.79	1	BOTTOM SLAB	0.33	
		HL-93 (OPERATING)	N/A		1.48	--	1.35	1.48	1	EXTERIOR WALL	0.42	2.32	1	BOTTOM SLAB	0.33	
		HS-20 (INVENTORY)	36.000	(2)	1.18	42.48	1.75	1.18	1	EXTERIOR WALL	0.42	1.86	1	BOTTOM SLAB	0.33	
		HS-20 (OPERATING)	36.000		1.53	55.08	1.35	1.53	1	EXTERIOR WALL	0.42	2.41	1	BOTTOM SLAB	0.33	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.63	35.51	1.40	2.63	1	EXTERIOR WALL	0.42	4.73	1	TOP SLAB	0.33	
		SNGARBS2	20.000		2.38	47.60	1.40	2.38	1	EXTERIOR WALL	0.42	4.02	1	BOTTOM SLAB	0.33	
		SNAGRIS2	22.000		2.43	53.46	1.40	2.43	1	EXTERIOR WALL	0.42	4.05	1	BOTTOM SLAB	0.33	
		SNCOTTS3	27.250		1.42	38.70	1.40	1.42	1	EXTERIOR WALL	0.42	2.20	1	BOTTOM SLAB	0.33	
		SNAGGRS4	34.925		1.42	49.59	1.40	1.42	1	EXTERIOR WALL	0.42	2.10	1	BOTTOM SLAB	15.67	
		SNS5A	35.550		1.48	52.61	1.40	1.48	1	EXTERIOR WALL	0.42	2.27	1	BOTTOM SLAB	0.33	
		SNS6A	39.950		1.30	51.94	1.40	1.30	1	EXTERIOR WALL	0.42	1.94	1	BOTTOM SLAB	0.33	
		SNS7B	42.000	(3)	1.25	52.50	1.40	1.25	1	EXTERIOR WALL	0.42	1.86	1	BOTTOM SLAB	0.33	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.74	57.42	1.40	1.74	1	EXTERIOR WALL	0.42	2.72	1	BOTTOM SLAB	15.67	
		TNT4A	33.075		1.56	51.60	1.40	1.56	1	EXTERIOR WALL	0.42	2.40	1	BOTTOM SLAB	0.33	
		TNT6A	41.600		1.38	57.41	1.40	1.38	1	EXTERIOR WALL	0.42	2.05	1	BOTTOM SLAB	15.67	
		TNT7A	42.000		1.50	63.00	1.40	1.50	1	EXTERIOR WALL	0.42	2.29	1	BOTTOM SLAB	15.67	
		TNT7B	42.000		1.40	58.80	1.40	1.40	1	EXTERIOR WALL	0.42	2.16	1	BOTTOM SLAB	0.33	
		TNAGRIT4	43.000		1.47	63.21	1.40	1.47	1	EXTERIOR WALL	0.42	2.22	1	BOTTOM SLAB	0.33	
		TNAGT5A	45.000		1.43	64.35	1.40	1.43	1	EXTERIOR WALL	0.42	2.09	1	BOTTOM SLAB	0.33	
		TNAGT5B	45.000		1.39	62.55	1.40	1.39	1	EXTERIOR WALL	0.42	2.07	1	BOTTOM SLAB	0.33	

LOAD FACTORS:

DESIGN LOAD RATING FACTORS

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

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

1.
2.
3.
4.

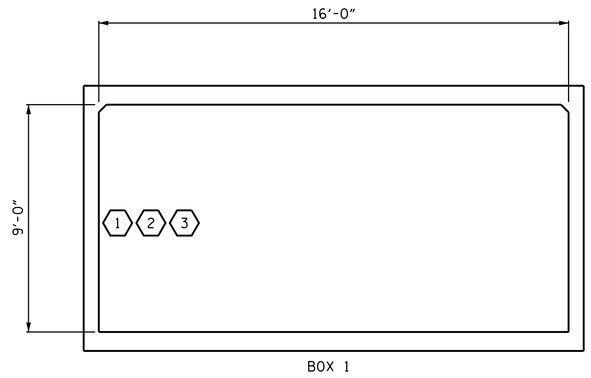
(#) CONTROLLING LOAD RATING

(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. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 2 OF 8

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

Marshall G. Cheek, Jr.

6/1/2022

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PH (919) 773-8887
CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C7-2
1			3			TOTAL SHEETS
2			4			8

ASSEMBLED BY :	STM	DATE :	02/22
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

5/23/2022
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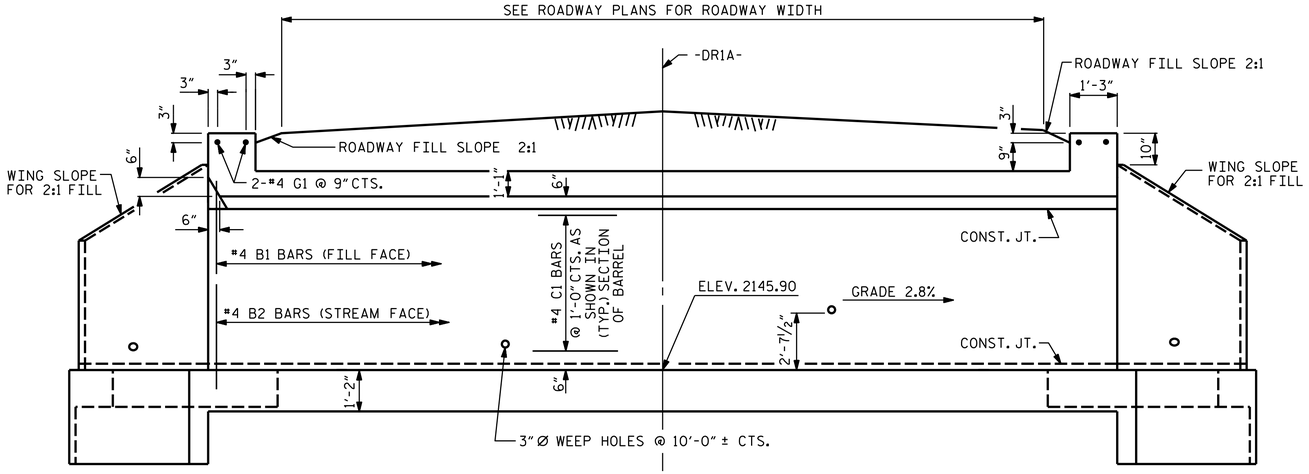
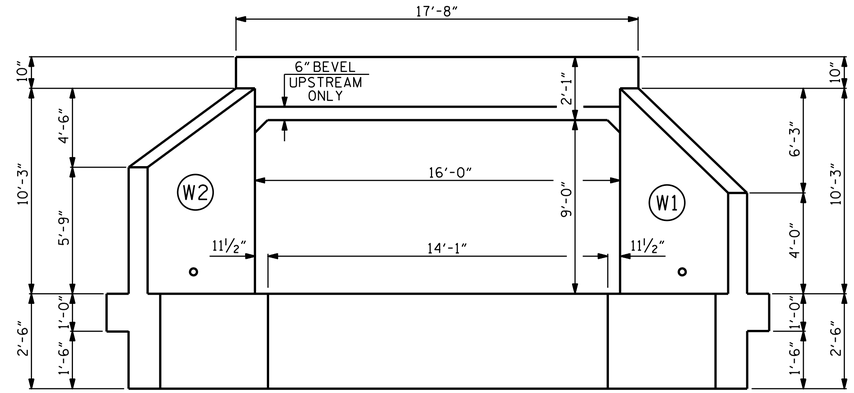
User:smassinople

STR #7

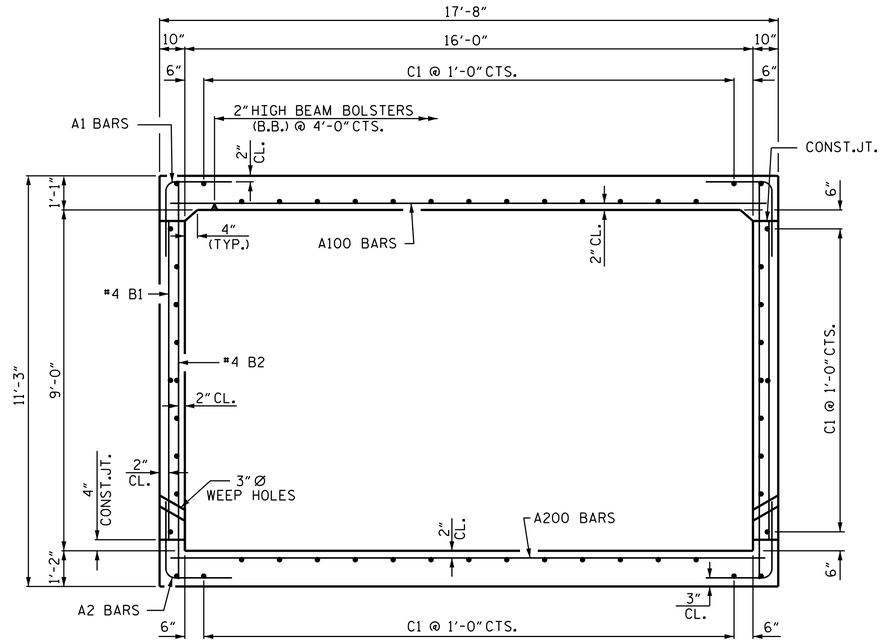
STD. NO. LRFR5



CULVERT SECTION NORMAL TO ROADWAY

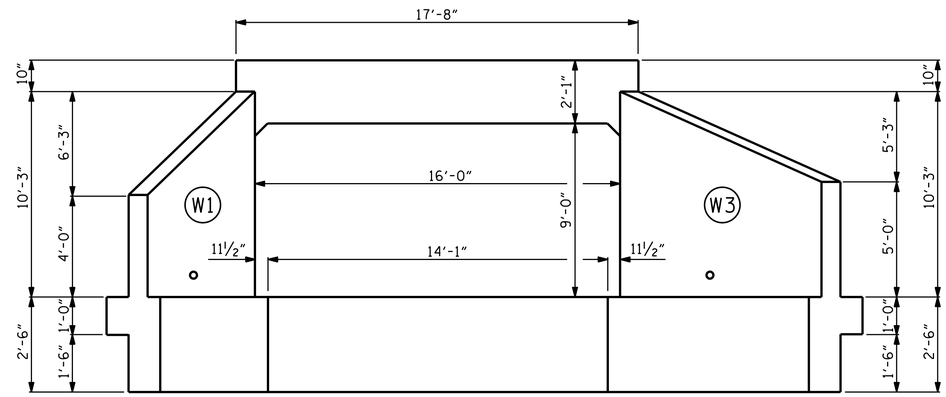


INLET END ELEVATION

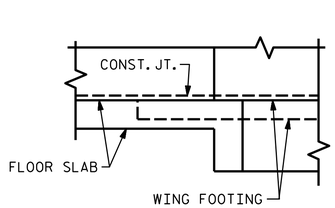


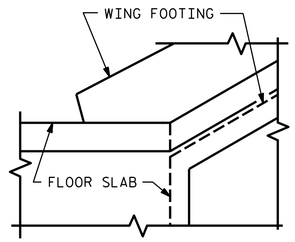
RIGHT ANGLE SECTION OF BARREL

THERE ARE 54 C1 BARS IN SECTION OF BARREL



OUTLET END ELEVATION





DETAIL

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

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 3 OF 8

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL C. CREEK, JR.
Marshall C. Creek, Jr.
6/1/2022

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

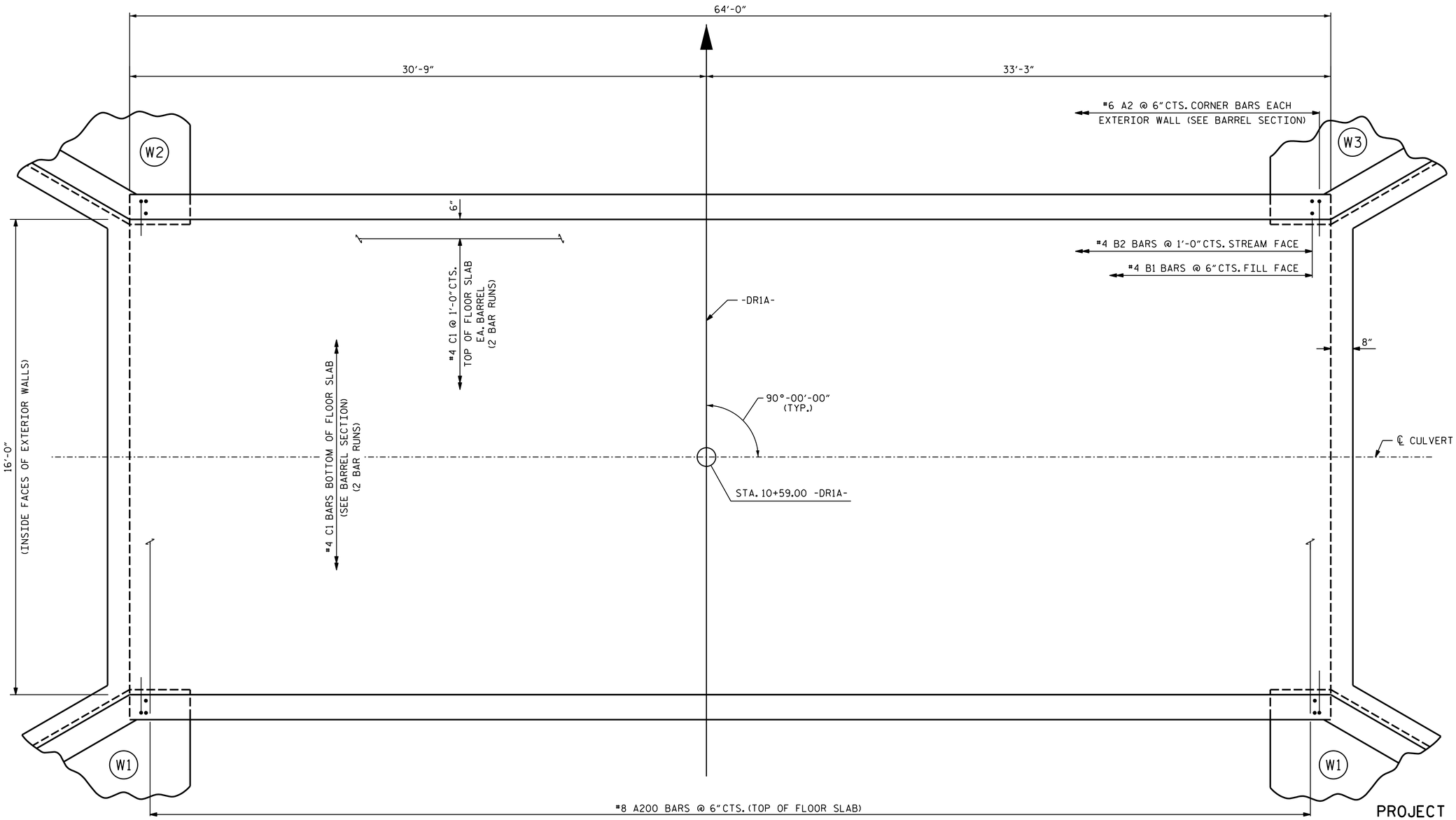
SINGLE 16 FT. X 9 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C7-3
1			3			TOTAL SHEETS
2			4			8

ASSEMBLED BY :	STM	DATE :	02/22
CHECKED BY :	MGC	DATE :	03/22

5/23/2022
X:\NCDOT\A-0009\Structures\A-0009CA\STR. #7 10+59.00 -DR1A-\Final Plans\DGNs\417_005_A-0009CA_SMU_CU03.dgn
User:smassinople

STR #7



PLAN OF FLOOR SLAB

FOR S1 BARS IN FLOOR SLAB AND WING FOOTINGS, SEE WING SHEET.

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 4 OF 8

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CHEEK, JR.
Marshall G. Cheek, Jr.
6/1/2022

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STATE OF NORTH CAROLINA
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RALEIGH

SINGLE 16 FT. X 9 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C7-4
1			3			TOTAL SHEETS
2			4			8

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

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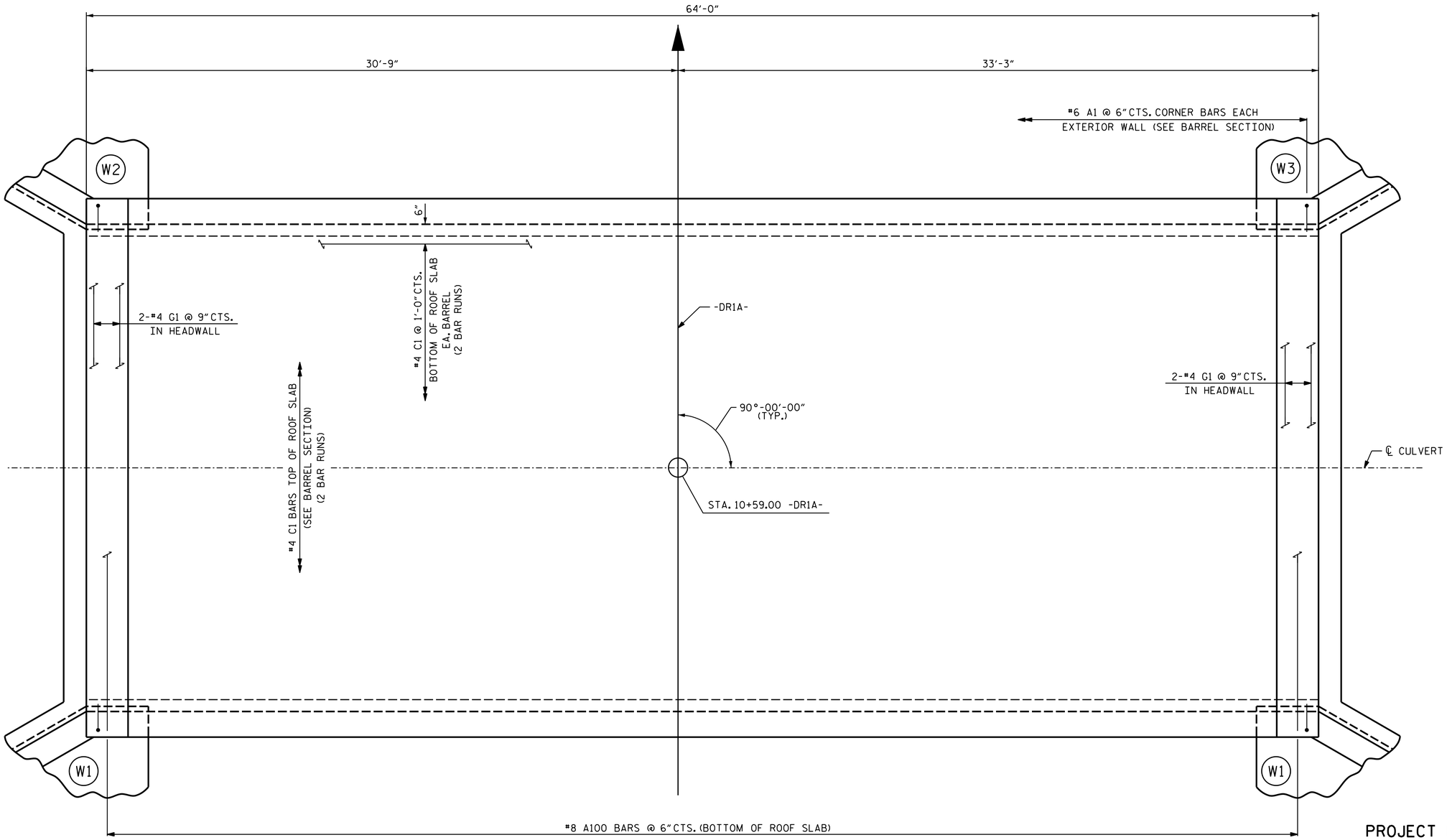

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 5 OF 8

PLAN OF ROOF SLAB

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CREEK, JR.
Marshall G. Creek, Jr.
6/1/2022

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CORP. LICENSE NO.: C-0275

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 16 FT. X 9 FT. CONCRETE BOX CULVERT 90°-00'-00" SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C7-5
1			3			TOTAL SHEETS
2			4			8

DRAWN BY : STM DATE : 02/22
CHECKED BY : MGC DATE : 03/22
DESIGN ENGINEER OF RECORD: STM DATE : 03/22

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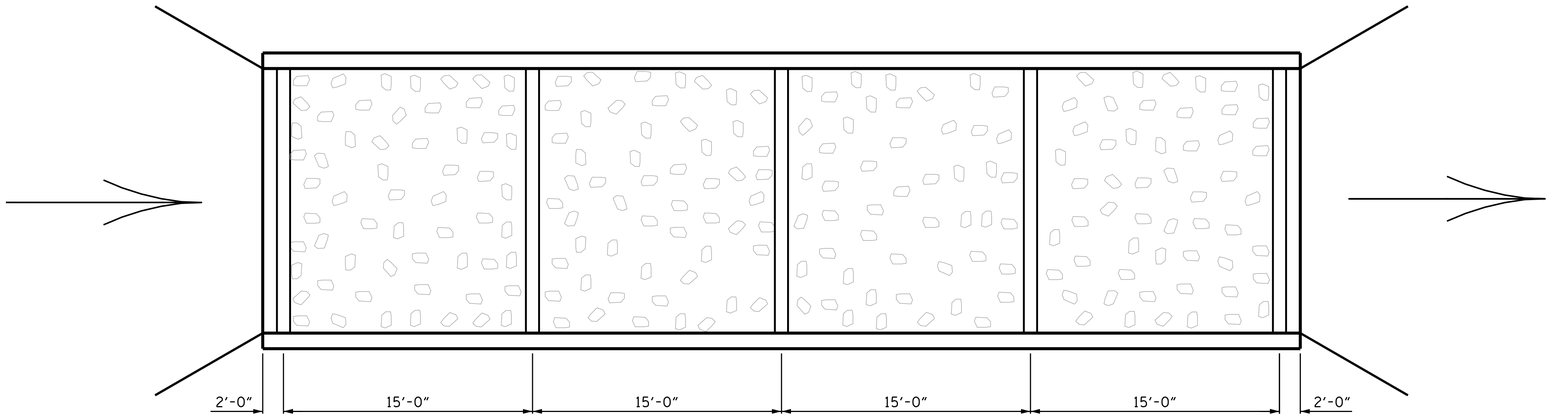
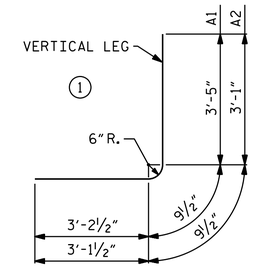
User:smassinople

STR #7



PLAN OF FLOOR SILL LAYOUT

BAR TYPE



DIMENSIONS ARE OUT TO OUT.

SPLICE LENGTHS CHART

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

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	256	#6	1	7'-5"	2852
A2	256	#6	1	7'-0"	2692
A100	128	#8	STR	17'-4"	5924
A200	128	#8	STR	17'-4"	5924
B1	256	#4	STR	10'-10"	1853
B2	128	#4	STR	8'-4"	713
C1	108	#4	STR	33'-0"	2381
D1	20	#6	STR	1'-9"	53
G1	4	#4	STR	17'-4"	46

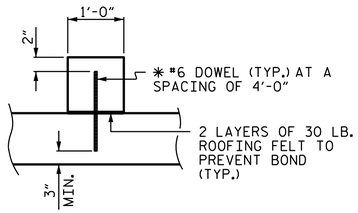
REINFORCING STEEL 22,438 LBS

NOTES

MATERIAL EXCAVATED FROM THE EXISTING BED SHALL BE STOCKPILED FOR USE IN THE PROPOSED CULVERT. BED MATERIAL MAY BE SUPPLEMENTED WITH CLASS B RIP RAP AS NECESSARY. NATIVE MATERIAL SHOULD BE PLACED ON TOP TO PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE. BED MATERIAL IS SUBJECT TO THE APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.

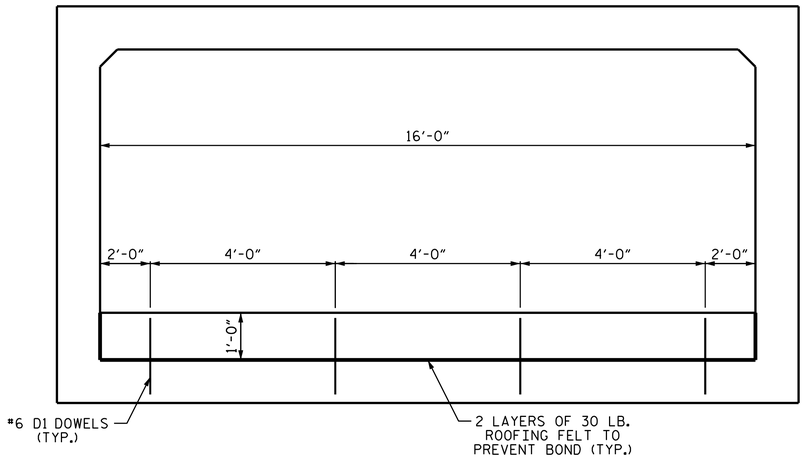
THE ENTIRE COST OF WORK REQUIRED TO PLACE EXCAVATED MATERIAL OR SUPPLEMENTAL MATERIAL AS SHOWN ON THE PLANS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE BID FOR CULVERT EXCAVATION.

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



SECTION THROUGH SILL

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



ELEVATION

SILL DETAILS

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 6 OF 8

NORTH CAROLINA PROFESSIONAL SEAL 20125 ENGINEER MARSHALL G. CREEK, JR.
Marshall G. Creek, Jr.
6/1/2022

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 16 FT. X 9 FT. CONCRETE BOX CULVERT

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C7-6
1			3			TOTAL SHEETS
2			4			8

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DESIGN ENGINEER OF RECORD: STM DATE : 03/22

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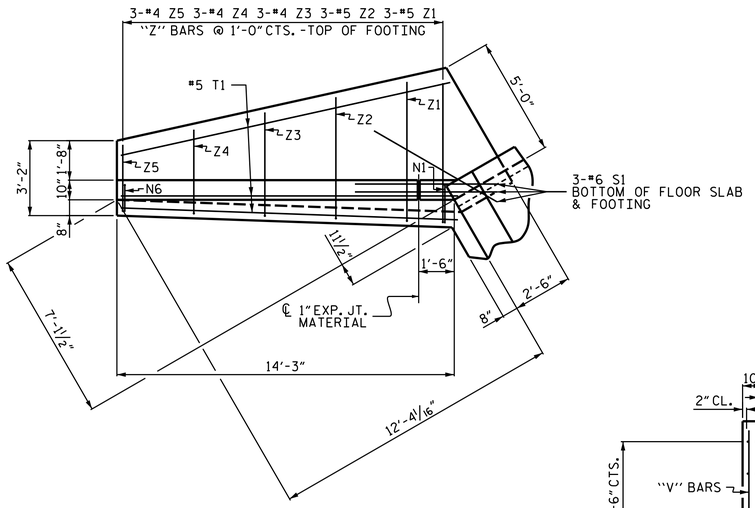
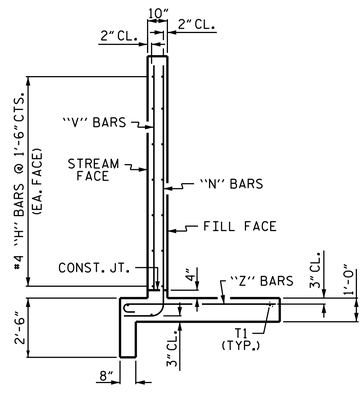
User:smassinople

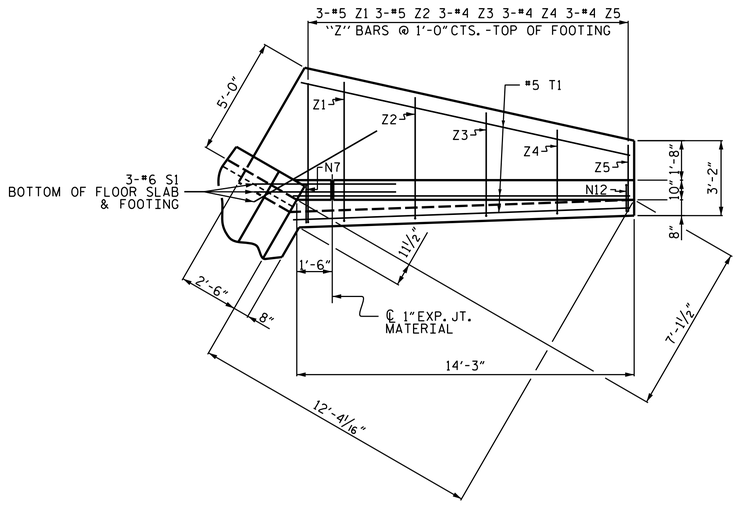
STR. #7



PLAN W2

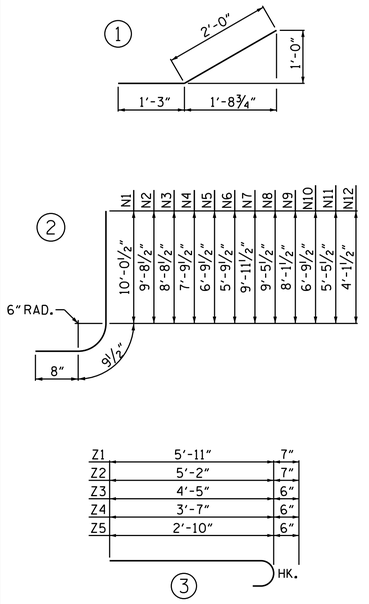


TYPICAL WING SECTION



PLAN W1

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

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.

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

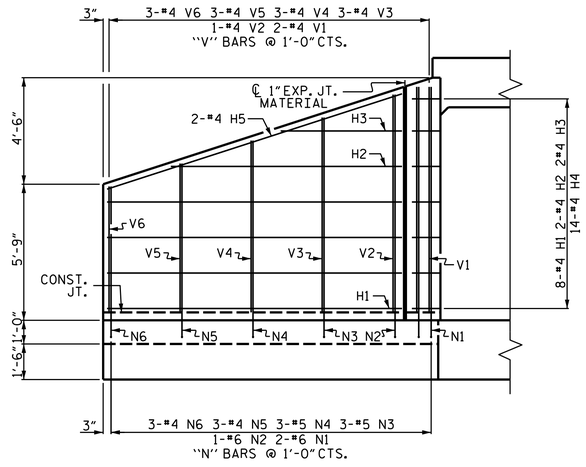
INLET WINGS BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	8	#4	STR	12'-4"	66
H2	2	#4	STR	9'-9"	13
H3	2	#4	STR	5'-1"	7
H4	14	#4	1	3'-3"	30
H5	2	#4	STR	12'-11"	17
H6	6	#4	STR	12'-4"	49
H7	2	#4	STR	9'-11"	13
H8	2	#4	STR	6'-5"	9
H9	2	#4	STR	3'-2"	4
H10	14	#4	1	3'-3"	30
H11	2	#4	STR	13'-5"	18
N1	2	#6	2	11'-6"	35
N2	1	#6	2	11'-2"	17
N3	3	#5	2	10'-2"	32
N4	3	#5	2	9'-3"	29
N5	3	#4	2	8'-3"	17
N6	3	#4	2	7'-3"	15
N7	2	#6	2	11'-5"	34
N8	1	#6	2	10'-11"	16
N9	3	#5	2	9'-7"	30
N10	3	#5	2	8'-3"	26
N11	3	#4	2	6'-11"	14
N12	3	#4	2	5'-7"	11
S1	6	#6	STR	6'-0"	54
T1	6	#5	STR	14'-3"	89
V1	2	#4	STR	9'-4"	12
V2	1	#4	STR	9'-0"	6
V3	3	#4	STR	8'-1"	16
V4	3	#4	STR	7'-2"	14
V5	3	#4	STR	6'-2"	12
V6	3	#4	STR	5'-3"	11
V7	2	#4	STR	9'-2"	12
V8	1	#4	STR	8'-9"	6
V9	3	#4	STR	7'-6"	15
V10	3	#4	STR	6'-3"	13
V11	3	#4	STR	4'-11"	10
V12	3	#4	STR	3'-7"	7
Z1	6	#5	3	6'-6"	41
Z2	6	#5	3	5'-9"	36
Z3	6	#4	3	4'-11"	20
Z4	6	#4	3	4'-1"	16
Z5	6	#4	3	3'-4"	13

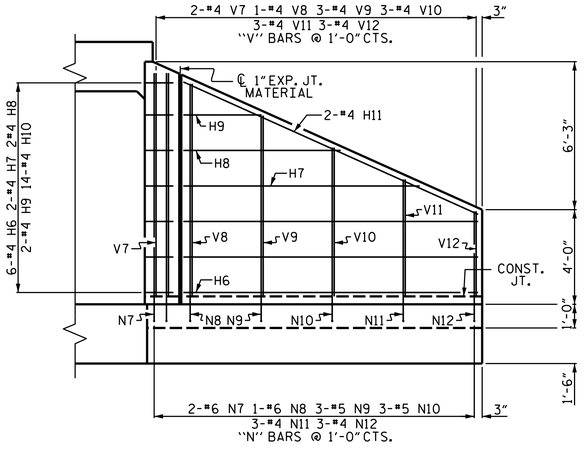
REINFORCING STEEL FOR W1 & W2 935 LBS

CLASS A CONCRETE

2 WINGS	13.6 CY
1 HEADWALL	0.8 CY
1 END CURTAIN WALL	0.9 CY
TOTAL	15.3 CY



ELEVATION W2



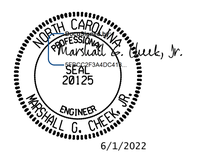
ELEVATION W1

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 7 OF 8



6/1/2022

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

INLET WINGS FOR CONCRETE BOX CULVERT

H = 9'-0" SLOPE = 2:1

90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C7-7
1			3			TOTAL SHEETS
2			4			8

STR #7

ASSEMBLED BY :	STM	DATE :	03/22
CHECKED BY :	MGC	DATE :	03/22

5/23/2022
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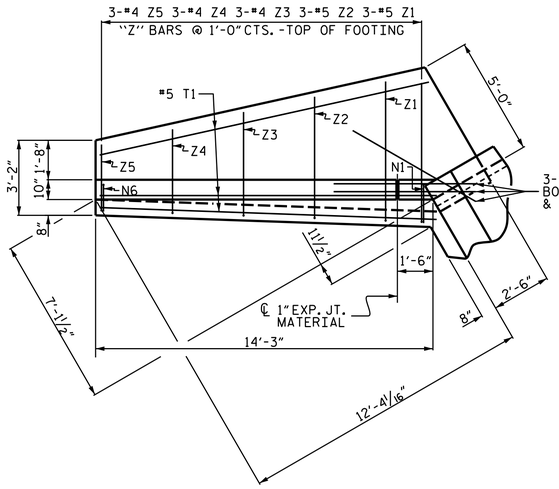
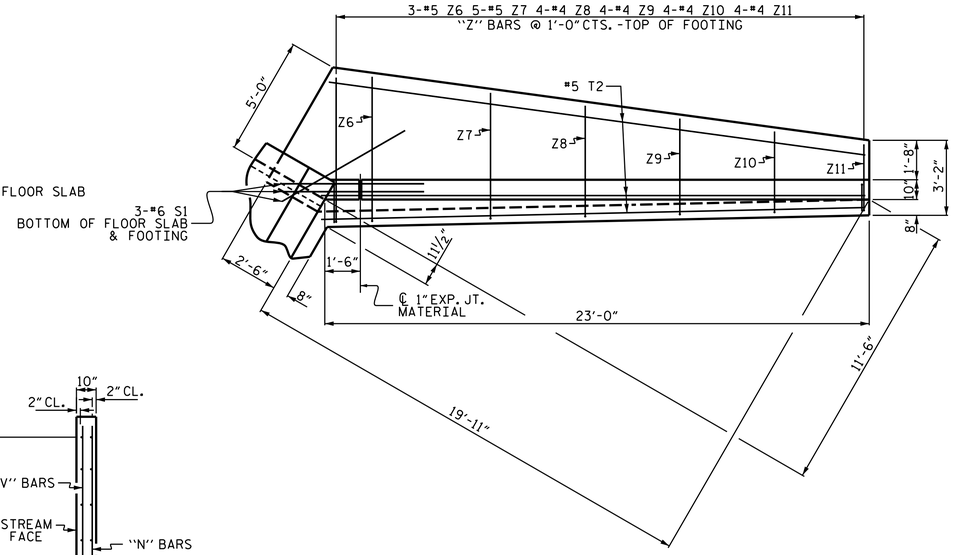
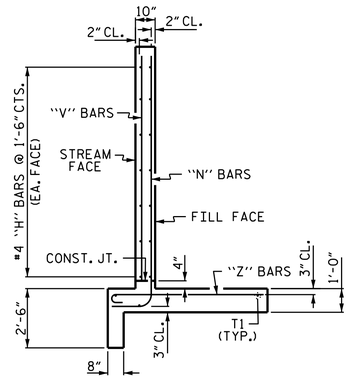


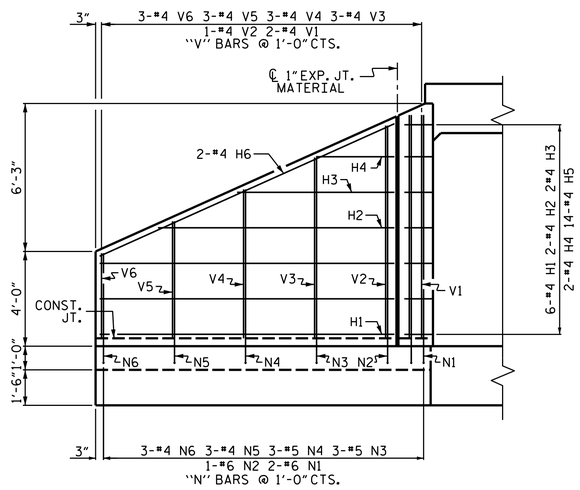
PLAN W1



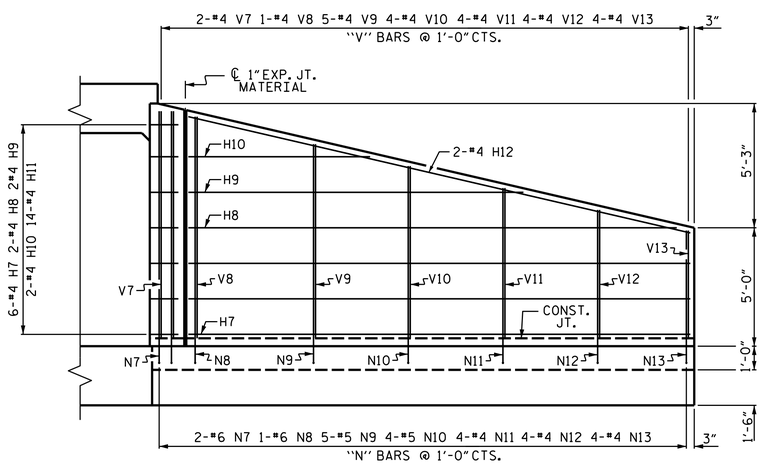
PLAN W3



TYPICAL WING SECTION

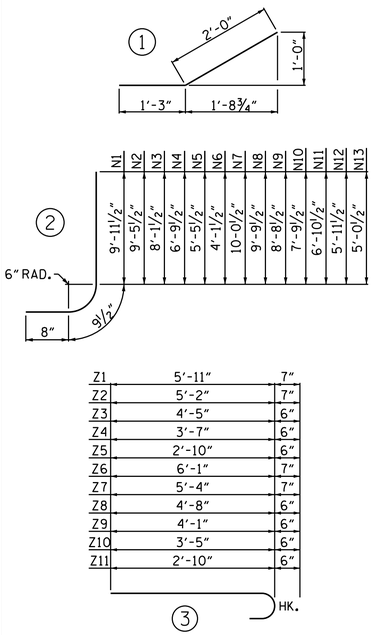


ELEVATION W1



ELEVATION W3

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT.

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.

OUTLET WINGS BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	12'-4"	49
H2	2	#4	STR	9'-10"	13
H3	2	#4	STR	6'-5"	9
H4	2	#4	STR	3'-2"	4
H5	14	#4	1	3'-3"	30
H6	2	#4	STR	13'-5"	18
H7	6	#4	STR	21'-1"	85
H8	2	#4	STR	20'-7"	27
H9	2	#4	STR	14'-2"	19
H10	2	#4	STR	7'-8"	10
H11	14	#4	1	3'-3"	30
H12	2	#4	STR	21'-7"	29
N1	2	#6	2	11'-5"	34
N2	1	#6	2	10'-11"	16
N3	3	#5	2	9'-7"	30
N4	3	#5	2	8'-3"	26
N5	3	#4	2	6'-11"	14
N6	3	#4	2	5'-7"	11
N7	2	#6	2	11'-6"	35
N8	1	#6	2	11'-3"	17
N9	5	#5	2	10'-2"	53
N10	4	#5	2	9'-3"	39
N11	4	#4	2	8'-4"	22
N12	4	#4	2	7'-5"	20
N13	4	#4	2	6'-6"	17
S1	6	#6	STR	6'-0"	54
T1	3	#5	STR	14'-3"	45
T2	3	#5	STR	23'-0"	72
V1	2	#4	STR	9'-2"	12
V2	1	#4	STR	8'-9"	6
V3	3	#4	STR	7'-6"	15
V4	3	#4	STR	6'-3"	13
V5	3	#4	STR	4'-11"	10
V6	3	#4	STR	3'-7"	7
V7	2	#4	STR	9'-3"	12
V8	1	#4	STR	9'-1"	6
V9	5	#4	STR	8'-2"	27
V10	4	#4	STR	7'-3"	19
V11	4	#4	STR	6'-4"	17
V12	4	#4	STR	5'-5"	14
V13	4	#4	STR	4'-6"	12
Z1	3	#5	3	6'-6"	20
Z2	3	#5	3	5'-9"	18
Z3	3	#4	3	4'-11"	10
Z4	3	#4	3	4'-1"	8
Z5	3	#4	3	3'-4"	7
Z6	3	#5	3	6'-8"	21
Z7	5	#5	3	5'-11"	31
Z8	4	#4	3	5'-2"	14
Z9	4	#4	3	4'-7"	12
Z10	4	#4	3	3'-11"	10
Z11	4	#4	3	3'-4"	9

REINFORCING STEEL FOR W1 & W3	1158 LBS
CLASS A CONCRETE	
2 WINGS	17.4 CY
1 HEADWALL	0.8 CY
1 END CURTAIN WALL	0.9 CY
TOTAL	19.1 CY

PROJECT NO. A-0009CA

GRAHAM COUNTY

STATION: 10+59.00 -DR1A-

SHEET 8 OF 8

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

6/1/2022

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

OUTLET WINGS FOR CONCRETE BOX CULVERT

H = 9'-0" SLOPE = 2:1

90° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C8-8
1			3			TOTAL SHEETS
2			4			8

ASSEMBLED BY :	STM	DATE :	03/22
CHECKED BY :	MGC	DATE :	03/22

5/23/2022
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User:smassinople

STR #7

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.

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ENGLISH

JANUARY, 1990

STD. NO. SN

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

6/6/2019
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User:smassinople