

CULVERT INDEX

INDEX NO.	STR. NO.	STATION	DESCRIPTION	PHASE CONST. NO.	SHEET NO.
(C1)	--	478+64.40 -L- OFFSET 106.48' LT.	SINGLE 8' X 7' RCBC	C1-P1A, C1-P1B	C-1 THRU C-6
(C2)	--	1+26.46 -SPBY8-	SINGLE 10' X 7' RCBC	C2-P1, C2-P2, C1&2-P2	C-7 THRU C-12
(C2&3)	1223	9+04.29 -RPAY8-	DOUBLE 10' X 7' RCBC COMBINATION OF CULVERTS #2 & #3	C2&3-P1A, RW18-P1, C2&3-P1B C2&3Y-P1 & RW18-P4	C-13 THRU C-22
(C3)	--	2+22.93 -SPCY8-	SINGLE 10' X 7' RCBC	C3-P1, C3-P2, C3-P3	C-23 THRU C-27
(C4)	--	505+19.00 -L-	SINGLE 7' X 8' RCBC	PHASES I & II	C-28 THRU C-34

SUMMARY OF PHASE CONSTRUCTION

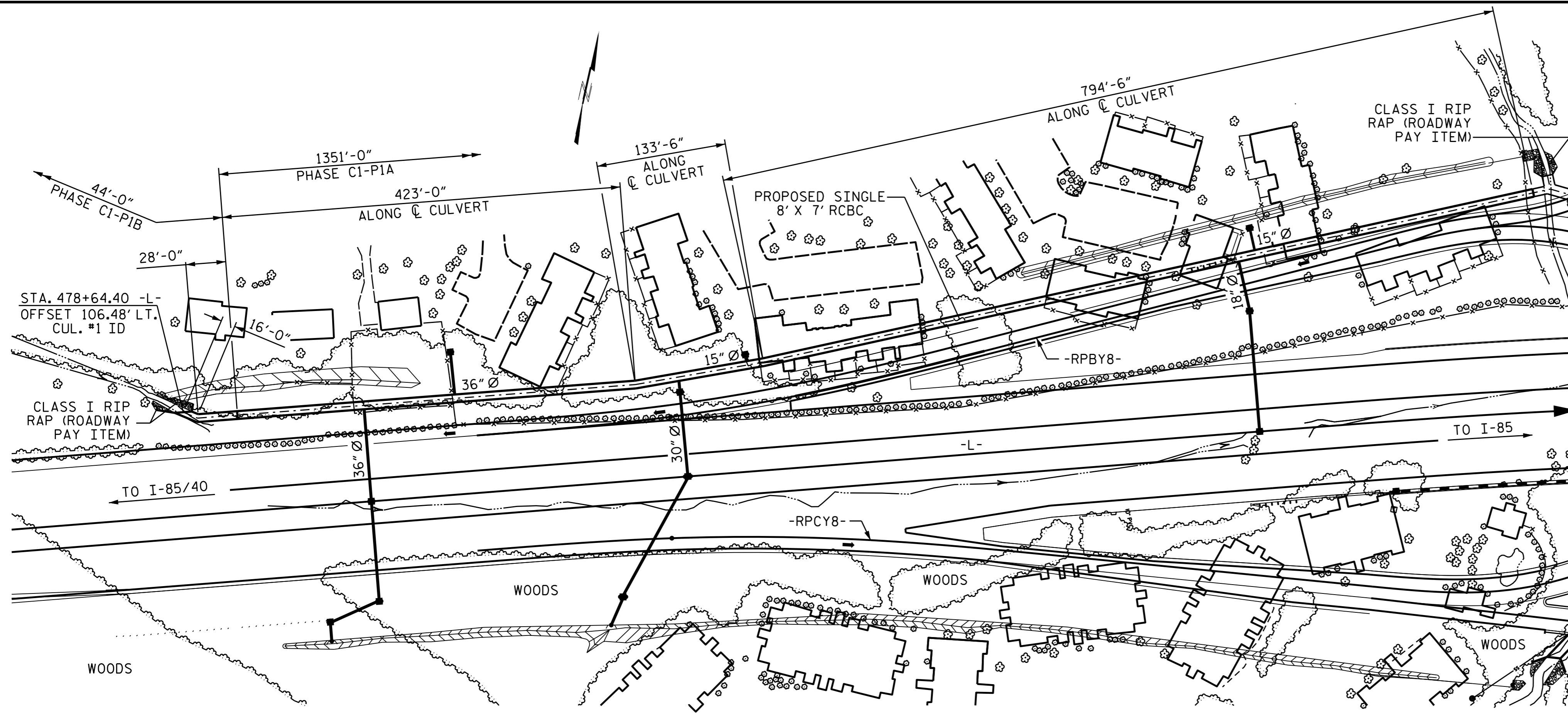
PHASE	NO.	DESCRIPTION	SIZE	LENGTH	BARREL SECTION	SHEET No.
PHASE I	C1-P1A	CUL #1, PHASE IA	1-8'x7'	1351'	D-D	C-1 TO C-4
	C1-P1B	CUL #1, PHASE IB	1-8'x7'	44'	D-D	C-1 TO C-5
	C2-P1	CUL #2, PHASE I	1-10'x7'	161'	C-C	C-7 TO C-9
	C2&3-P1A	CUL #2 & #3, PHASE IA	2-10'x7'	500'	A-A	C-15 & C-16
	RW18-P1	SSP RET WALL, PHASE I	PZ27	8'	--	C-15 & C-17
	C2&3-P1B	CUL #2 & #3, PHASE IB	2-10'x7'	208.8'	B-B	C-15 & C-16
PHASE II	C2&3Y-P1	CUL #2 & #3, PHASE I	2-10'x7'	80.7'	B-B, C-C & E-E	C-18 & C-19
	C3-P1	CUL #3, PHASE I	1-10'x7'	283.5'	E-E	C-23 TO C-26
	C2-P2	CUL #2, PHASE II	1-10'x7'	140.5'	C-C	C-7 TO C-9
	C3-P2	CUL #3, PHASE II	1-10'x7'	149.5'	E-E	C-23 TO C-25
	C1&2-P2	CUL #1 & #2, PHASE II	1-10'x7'	52.7'	C-C & D-D	C-10 TO C-12
PHASE III	C3-P3	CUL #3, PHASE III	1-10'x7'	42.5'	E-E	C-23 TO C-25
PHASE IV	RW18-P4	SSP RET WALL, PHASE IV	PZ27	54.6'	--	C-17, W-21, W-22
--	C-4	CUL #4, PHASES I & II	1-8'x7'	315'	--	C-28 TO C-34

PROJECT NO. U-2524D
GUILFORD COUNTY

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUMMARY OF
CULVERT
CONSTRUCTION
SEQUENCE

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



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

NOTES:

- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- DESIGN FILL ----- 13.33'
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- 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.
- 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.
- AT THE CONTRACTORS 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.
- 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.
- THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE BARS FROM WHICH THE SAMPLES ARE TAKEN MUST THEN BE SPLICED WITH REPLACEMENT BARS OF THE SIZE AND LENGTH OF THE SAMPLE, PLUS A MINIMUM LAP SPLICE OF THIRTY BAR DIAMETERS. PAYMENT FOR THE SAMPLES OF REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.
- ALL PIPES THROUGH THE SIDEWALL OF THE CULVERT SHALL BE LOCATED BY THE ENGINEER. THE REINFORCING STEEL SHALL BE FIELD BENT AS NECESSARY TO CLEAR PIPE.
- FOR CULVERT DIVERSION DETAILS & PAY ITEM, SEE EROSION CONTROL PLANS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.

HYDRAULIC DATA

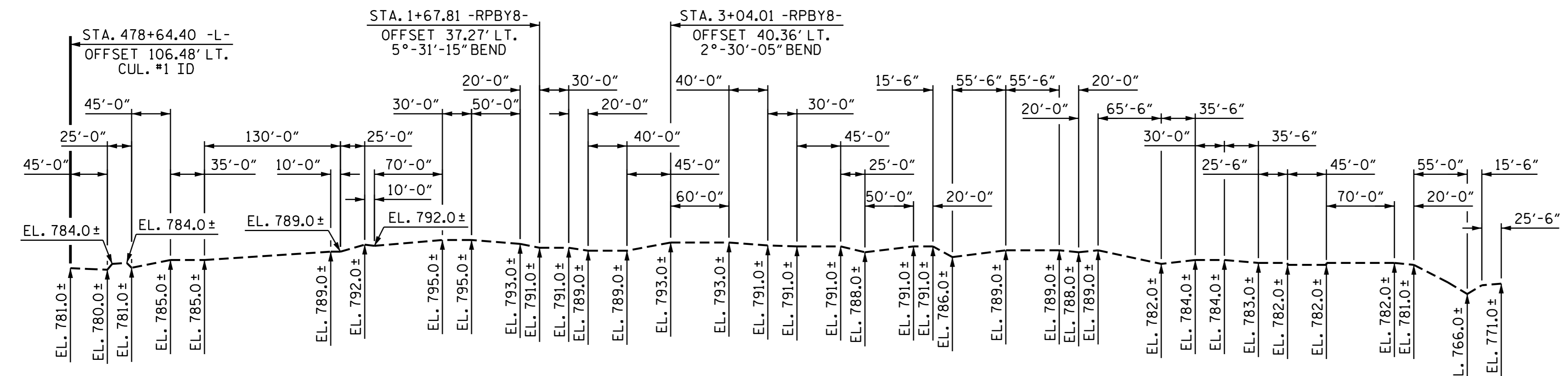
DESIGN DISCHARGE	= 180 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 784.60
DRAINAGE AREA	= 0.15 SQ. MI.
BASE DISCHARGE (Q100)	= 200 CFS
BASE HIGH WATER ELEVATION	= 784.86

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 490 CFS
FREQUENCY OF OVERTOPPING FLOOD	= >500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 790.08

GRADE DATA

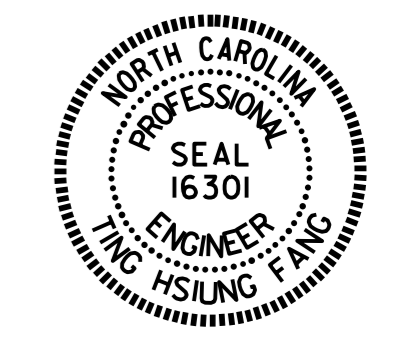
GRADE POINT ELEVATION @	STA. 478+64.55 -L- 106.40' LT.	= 798.99'
BED ELEVATION @	STA. 478+64.55 -L- 106.40' LT.	= 780.70'
ROADWAY FILL SLOPES	= 2:1	



PROFILE ALONG CULVERT

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE	
PHASE C1-P1A	1134.8 C.Y.
PHASE C1-P1B	50.0 C.Y.
TOTAL	1184.8 C.Y.
REINFORCING STEEL	
PHASE C1-P1A	172,429 LBS.
PHASE C1-P1B	6,727 LBS.
TOTAL	179,156 LBS.
FOUNDATION COND. MATERIAL	
PHASE C1-P1A	1270 TONS
PHASE C1-P1B	41 TONS
TOTAL	1311 TONS
CULVERT EXCAVATION (TOTAL)	LUMP SUM



Designed by: Ting Fang 8/16/2016
E720840097435

PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 478+64.40 -L-

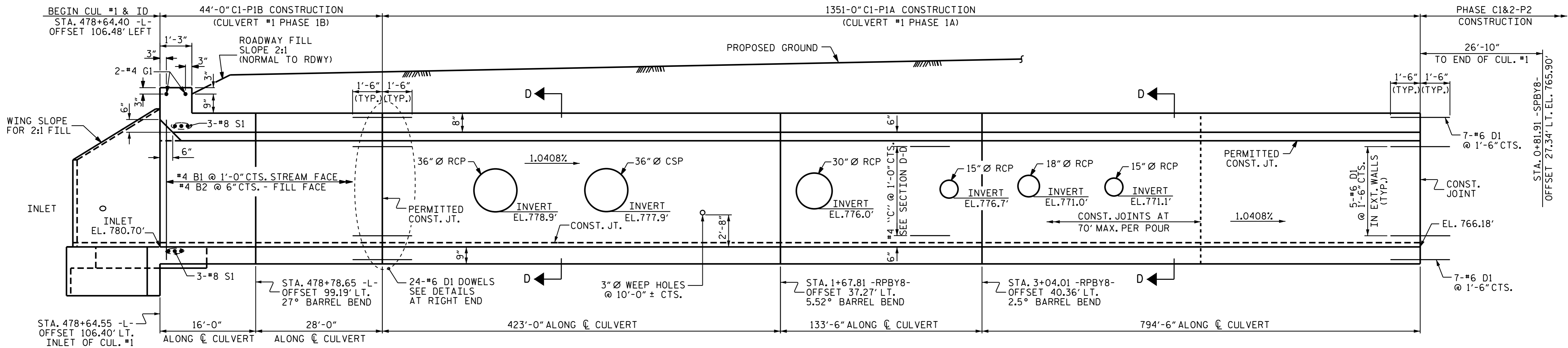
SHEET 1 OF 6

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
CULVERT #1
SINGLE 8' X 7' RCBC
C1-P1A & C1-P1B
OFFSET 106.48' LEFT

DRAWN BY: A. SORSENGINH DATE: 1/2016
CHECKED BY: T. H. FANG DATE: 5/15/16
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

REVISIONS						SHEET NO. C-1
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

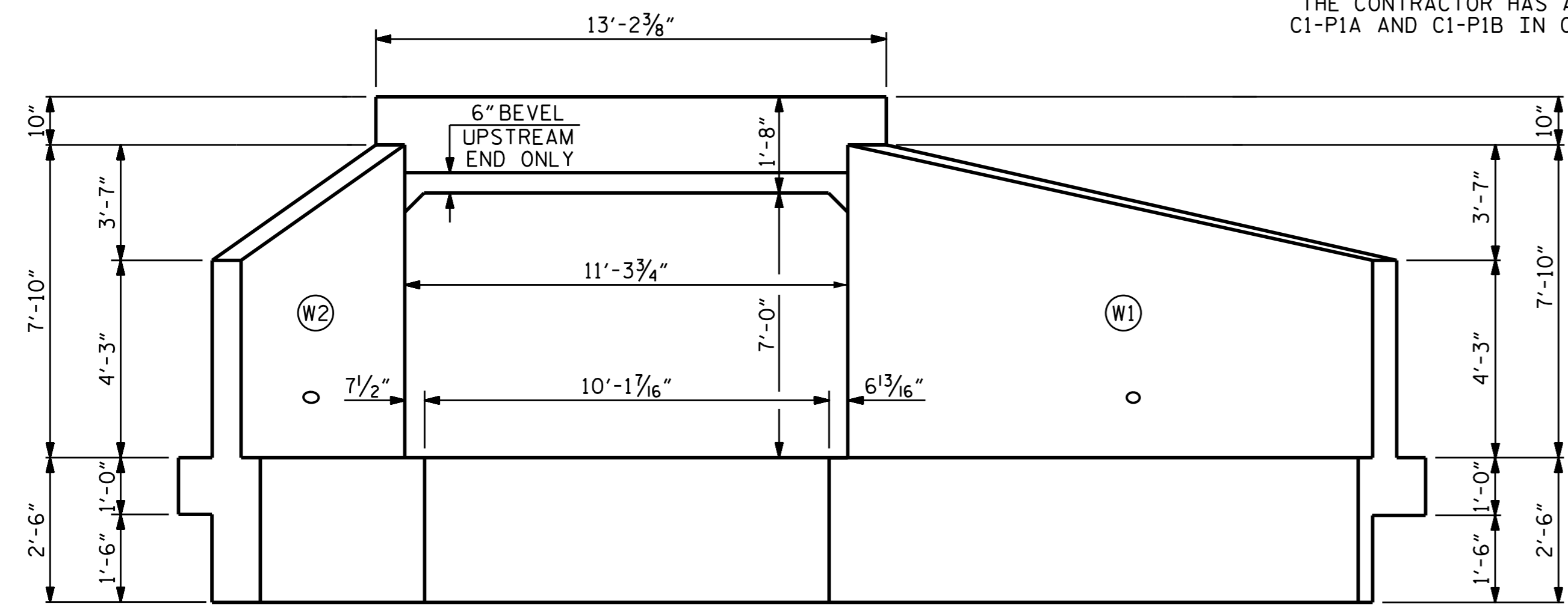


C1-P1B

C1-P1A

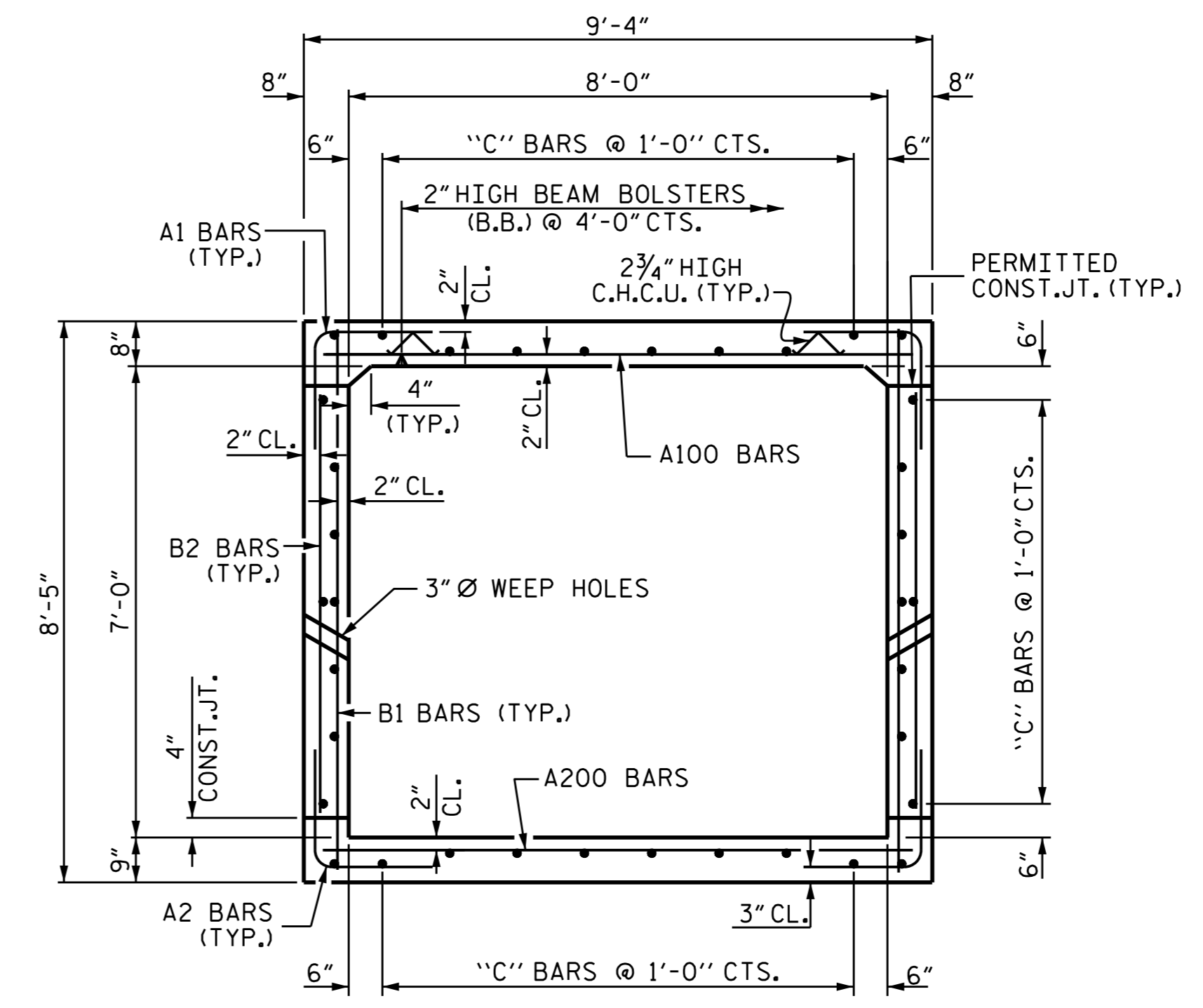
CULVERT SECTION ALONG C CULVERT

FOR PIPES THRU EXTERIOR WALL, SEE WALL OPENING DETAILS.
THE CONTRACTOR HAS AN OPTION TO CONSTRUCT
C1-P1A AND C1-P1B IN ONE PHASE OR SEPARATELY.



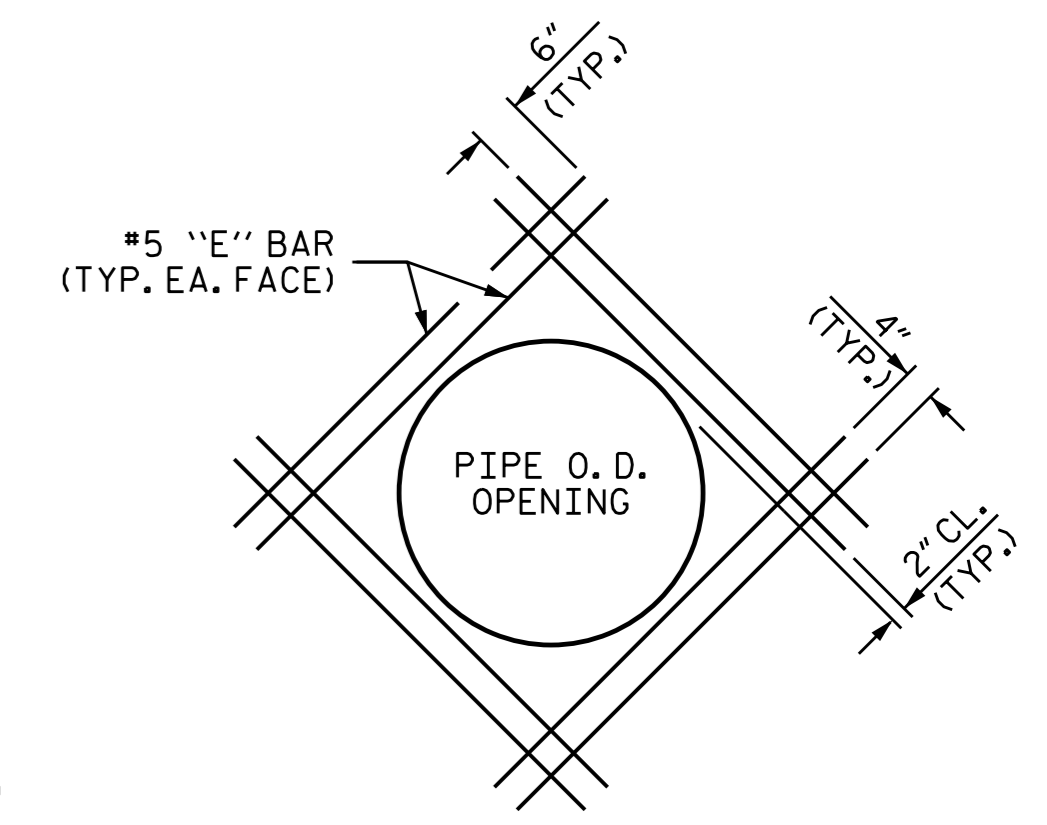
INLET END ELEVATION NORMAL TO SKEW

45° STD. WING AT INLET END



SECTION D-D

RIGHT ANGLE SECTION OF BARREL
THERE ARE 36 "C" BARS IN SECTION OF BARREL



WALL OPENING DETAILS

FOR PIPE THRU EXTERIOR WALL.
FIELD CUT & BEND "B" & "C" BARS AS NEEDED
TO CLEAR PIPE

PIPE SIZE	O. D.	BAR	LENGTH
15" Ø	19.5"	E1	3'-8"
18" Ø	23.0"	E2	4'-0"
30" Ø	37.0"	E3	5'-2"
36" Ø	44.0"	E4	5'-9"

TOTAL CULVERT #1 QUANTITIES			
PAY ITEM	PHASE 1A C1-P1A	PHASE 1B C1-P1B	TOTAL
CLASS A CONCRETE			
BARREL @ 0.840 CY/FT	1134.8 C.Y.	37.0 C.Y.	1171.8 C.Y.
WINGS ETC.		13.0 C.Y.	13.0 C.Y.
SUBTOTAL	1134.8 C.Y.	50.0 C.Y.	1184.8 C.Y.
REINFORCING STEEL			
BARREL	172,429 LBS.	5,978 LBS.	178,407 LBS.
WINGS ETC.		749 LBS.	749 LBS.
SUBTOTAL	172,429 LBS.	6,727 LBS.	179,156 LBS.
CULVERT EXCAVATION	LUMP SUM	LUMP SUM	LUMP SUM
FOUNDATION COND. MAT'L	1270 TONS	41 TONS	1311 TONS

PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 478+64.40 -L-

SHEET 2 OF 6

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
BARREL STANDARD
CULVERT #1
SINGLE 8' X 7' RCBC
C1-P1A & C1-P1B
OFFSET 106.48' LEFT

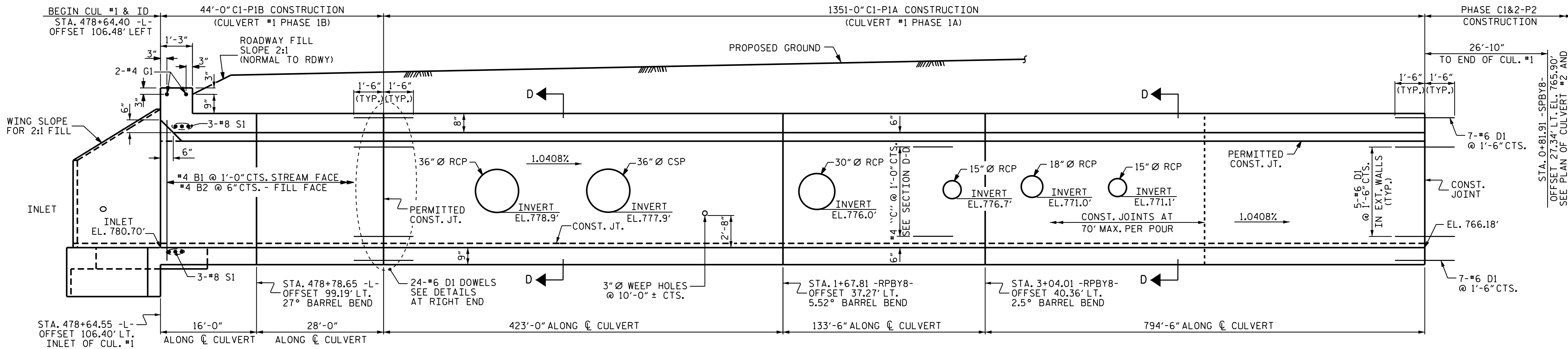


DocuSign by
Ting Fang
E72088400977435... 7/15/2016

REVISIONS						SHEET NO. C-2
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

DRAWN BY: A. SORSENGINH DATE: 1/2016
CHECKED BY: T. H. FANG DATE: 5/15/16
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

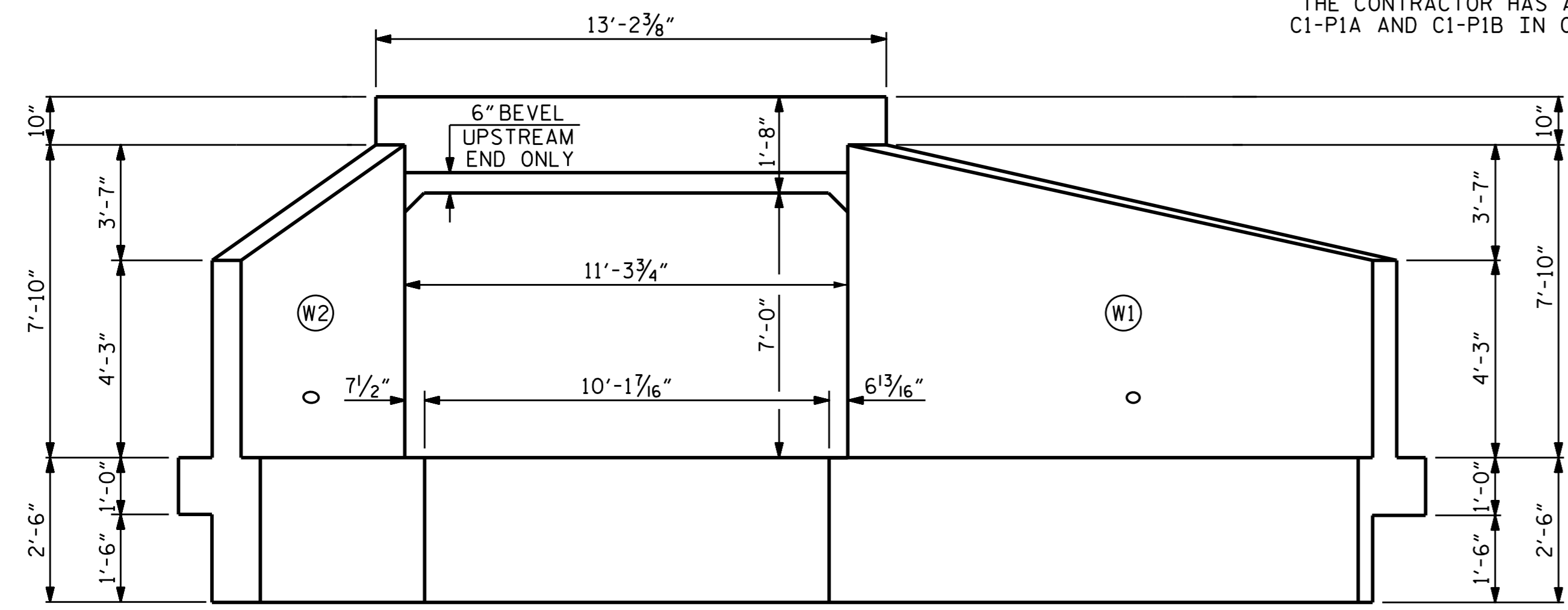


C1-P1B

C1-P1A

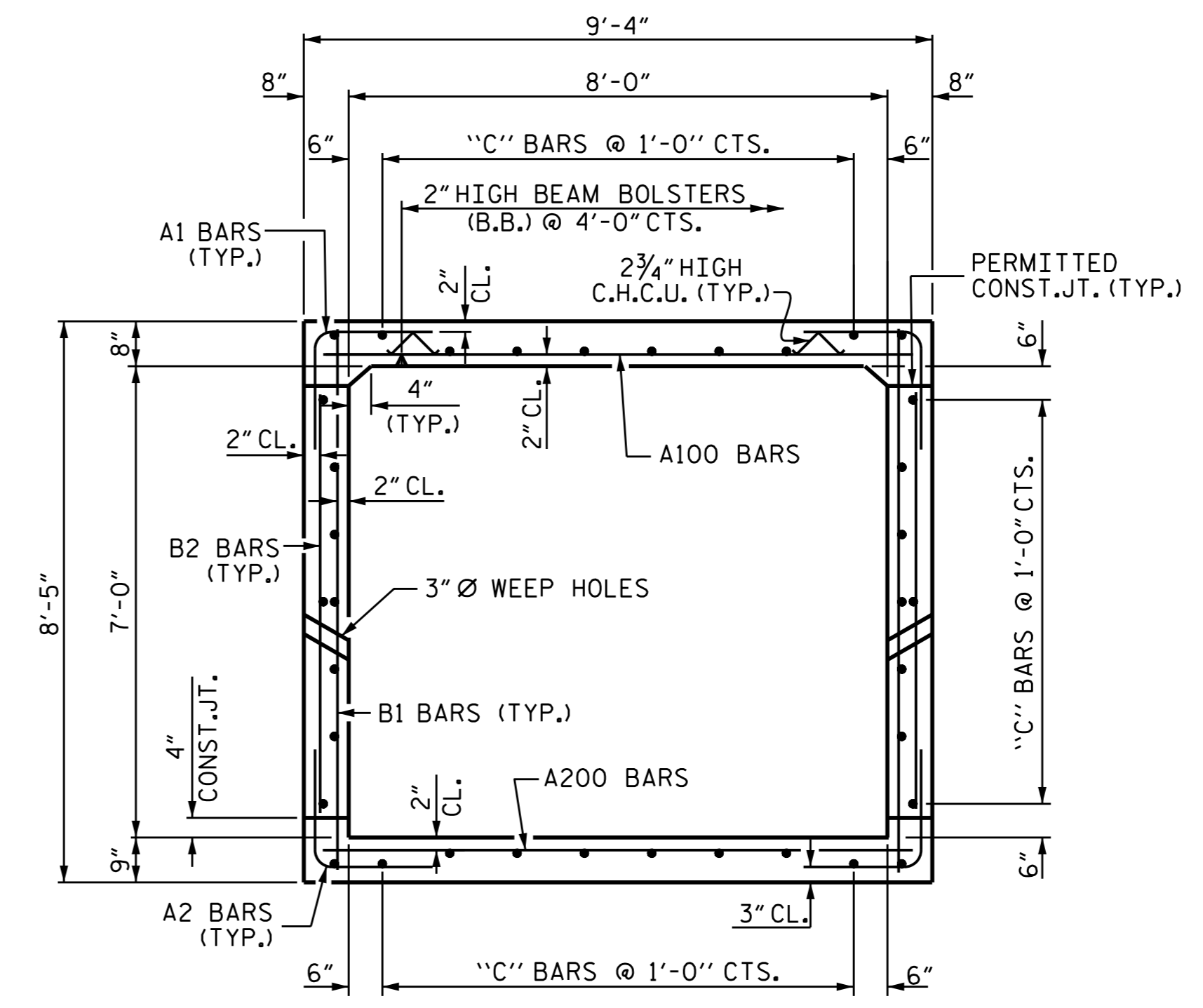
CULVERT SECTION ALONG C CULVERT

FOR PIPES THRU EXTERIOR WALL, SEE WALL OPENING DETAILS.
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C1-P1A AND C1-P1B IN ONE PHASE OR SEPARATELY.



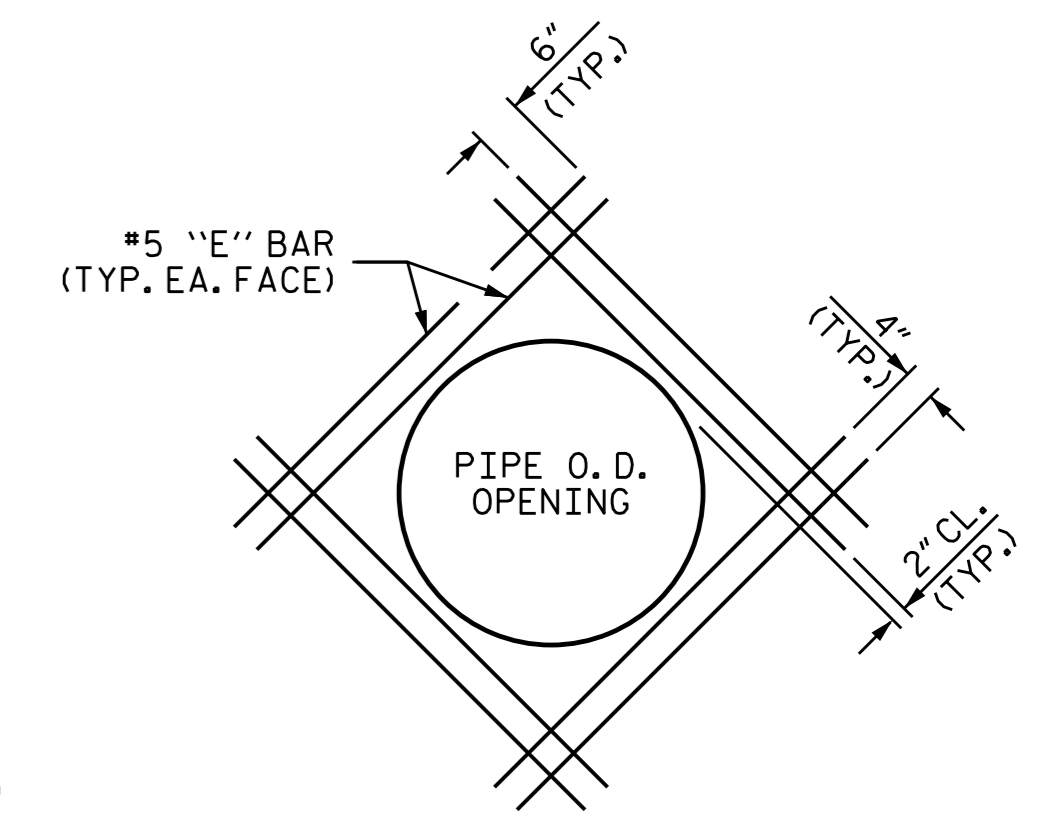
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TOTAL CULVERT #1 QUANTITIES			
PAY ITEM	PHASE 1A C1-P1A	PHASE 1B C1-P1B	TOTAL
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CULVERT EXCAVATION	LUMP SUM	LUMP SUM	LUMP SUM
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PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 478+64.40 -L-

SHEET 2 OF 6

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
BARREL STANDARD
CULVERT #1
SINGLE 8' X 7' RCBC
C1-P1A & C1-P1B
OFFSET 106.48' LEFT



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Ting Fang 8/16/2016
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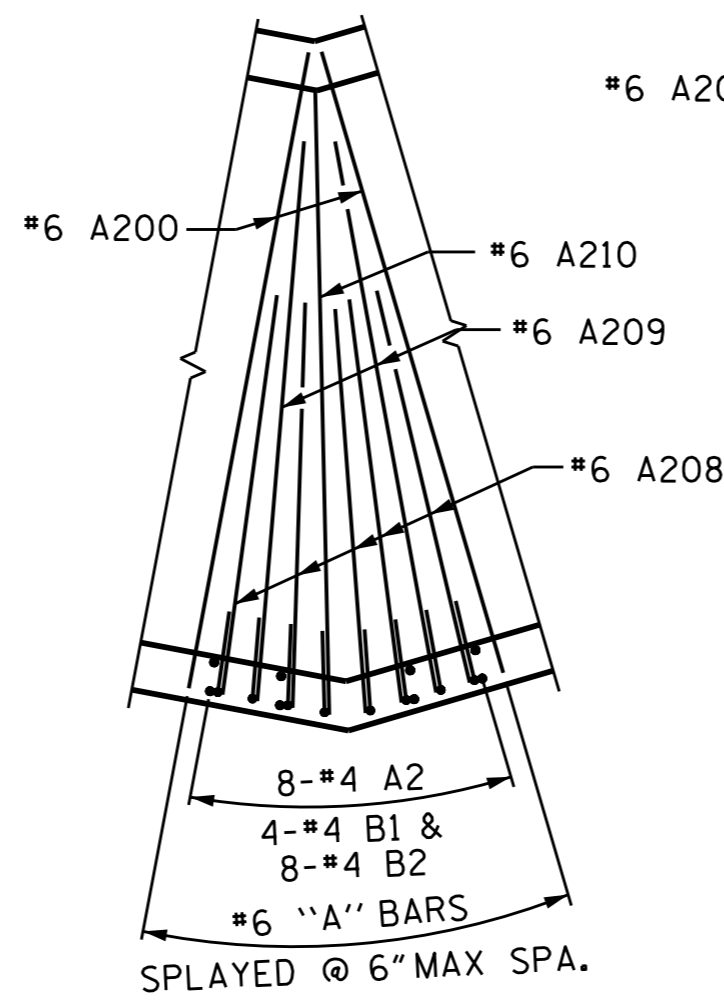
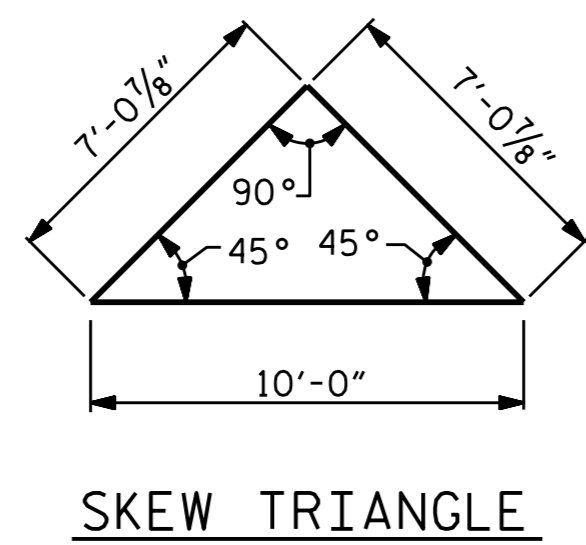
REVISIONS						SHEET NO. C-2
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

DRAWN BY: A. SORSENGINH DATE: 1/2016
CHECKED BY: T. H. FANG DATE: 5/15/16
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

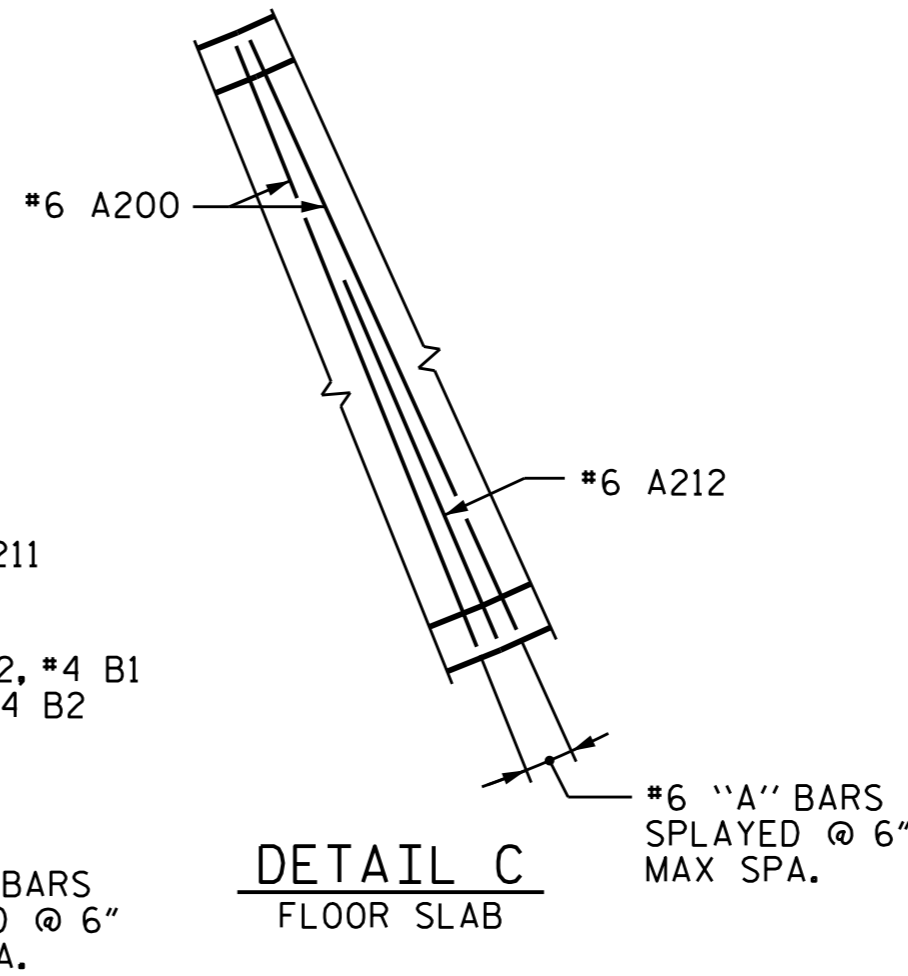
BILL OF MATERIAL

PHASE 1B C1-P1B

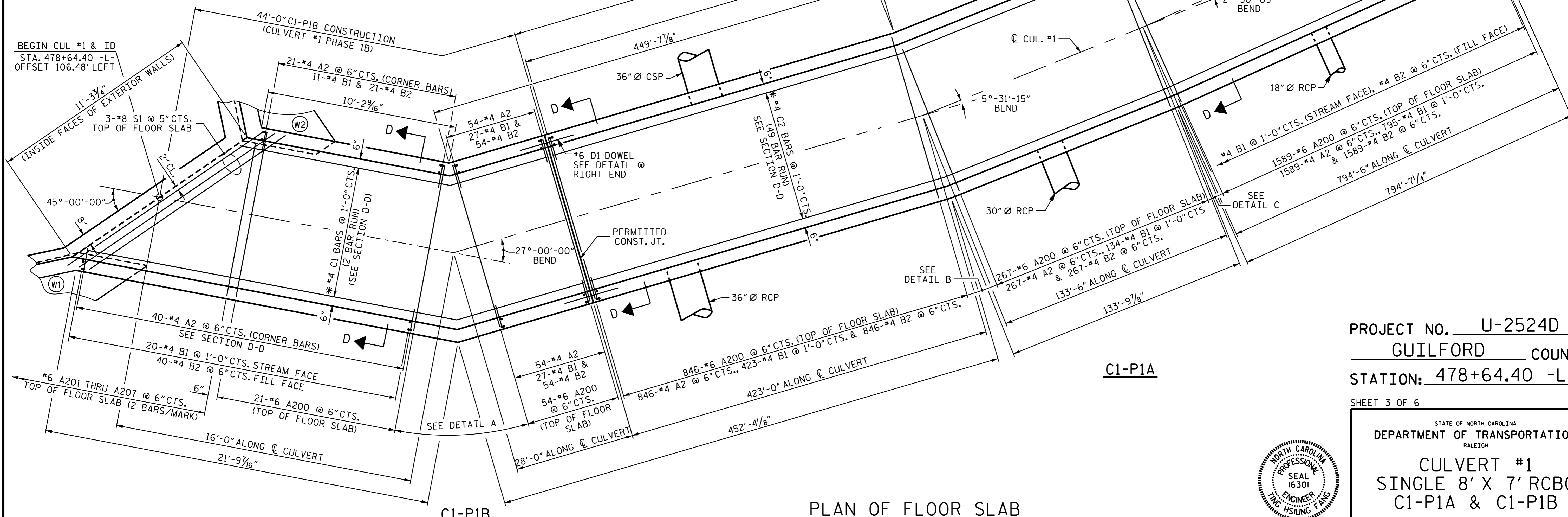
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	177	#4	1	5'-8"	670	C1	72	#4	STR	26'-4"	1267
A2	177	#4	1	5'-4"	631						
A100	69	#5	STR	9'-0"	648	G1	2	#4	STR	12'-8"	17
A101	2	#5	STR	8'-1"	17	S1	6	#8	STR	12'-8"	203
A102	2	#5	STR	7'-0"	15	REINFORCING STEEL = 5,978 LBS.					
A103	2	#5	STR	5'-11"	12	FOR BAR TYPE DETAILS AND SPLICE LENGTH CHART, SEE SHEET 4 OF 6.					
A104	2	#5	STR	4'-10"	10						
A105	2	#5	STR	3'-9"	8						
A106	2	#5	STR	2'-8"	6						
A107	5	#5	STR	6'-1"	32						
A108	2	#5	STR	7'-9"	16						
A109	1	#5	STR	8'-9"	9						
A200	75	#6	STR	9'-0"	1014						
A201	2	#6	STR	8'-1"	24						
A202	2	#6	STR	7'-1"	21						
A203	2	#6	STR	6'-1"	18						
A204	2	#6	STR	5'-1"	15						
A205	2	#6	STR	4'-1"	12						
A206	2	#6	STR	3'-1"	9						
A207	2	#6	STR	2'-1"	6						
A208	5	#6	STR	5'-7"	42						
A209	2	#6	STR	7'-9"	23						
A210	1	#6	STR	8'-8"	13						
B1	89	#4	STR	7'-11"	471						
B2	177	#4	STR	6'-4"	749						



DETAIL B FLOOR SLAB



DETAIL C FLOOR SLAB



PLAN OF FLOOR SLAB

* FIELD BEND "C" BARS AS NECESSARY. CONTRACTOR HAS AN OPTION TO CONSTRUCT C1-P1A AND C1-P1B IN ONE PHASE OR SEPARATELY.

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 478+64.40 -L-

SHEET 3 OF 6



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #1
SINGLE 8' X 7' RCBC
C1-P1A & C1-P1B
 FLOOR SLAB DETAILS

DRAWN BY: A. SORSENGINH DATE: 1/2016
 CHECKED BY: T. H. FANG DATE: 5/15/16
 DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

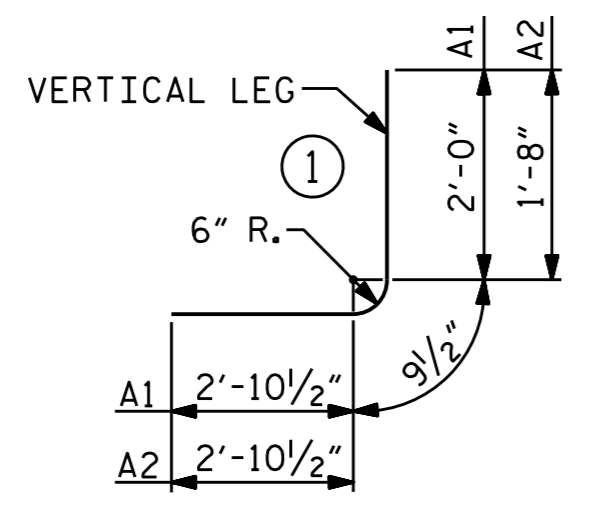
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 Ting Fang
 E72088400977435
 7/15/2016

REVISIONS						SHEET NO. C-3
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

BILL OF MATERIAL

BAR TYPE

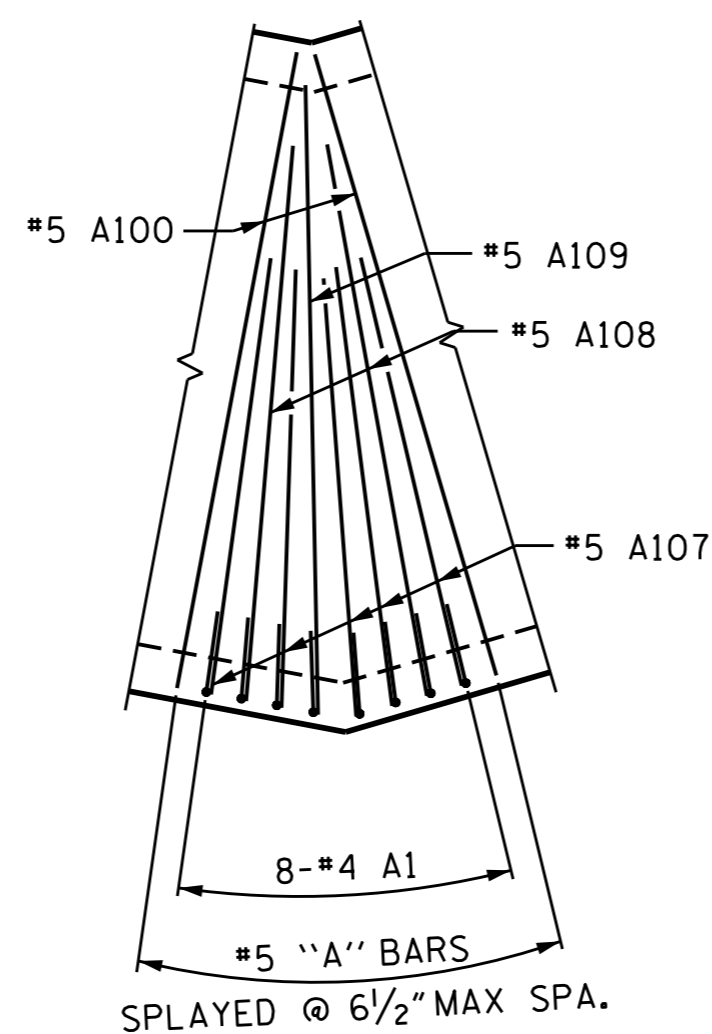
PHASE 1A C1-P1A					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	5413	#4	1	5'-8"	20490
A2	5413	#4	1	5'-4"	19285
A100	2494	#5	STR	9'-0"	23411
A110	2	#5	STR	6'-3"	13
A111	1	#5	STR	8'-3"	9
A200	2702	#6	STR	9'-0"	36526
A211	2	#6	STR	5'-4"	16
A212	1	#6	STR	5'-5"	8
B1	2709	#4	STR	7'-11"	14326
B2	5413	#4	STR	6'-4"	22901
C2	1764	#4	STR	29'-6"	34761
D1	48	#6	STR	3'-0"	216
E1	32	#5	STR	3'-8"	122
E2	16	#5	STR	4'-0"	67
E3	16	#5	STR	5'-2"	86
E4	32	#5	STR	5'-9"	192
REINFORCING STEEL				=	172,429 LBS.



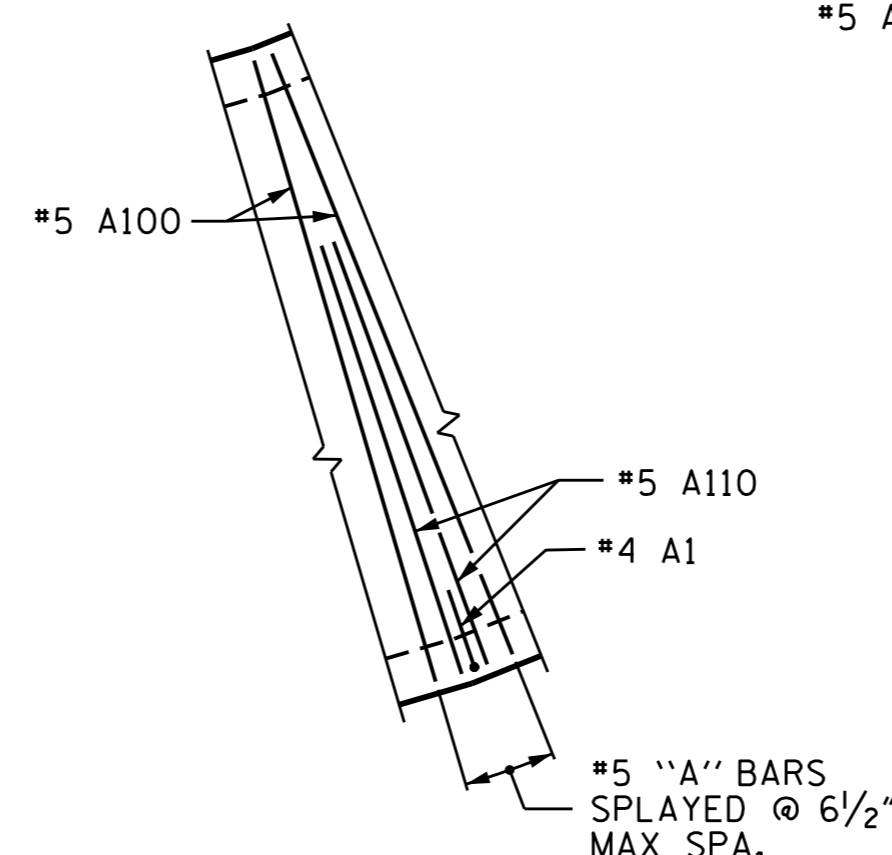
BAR DIMENSIONS ARE OUT TO OUT

SPLICE LENGTH CHART

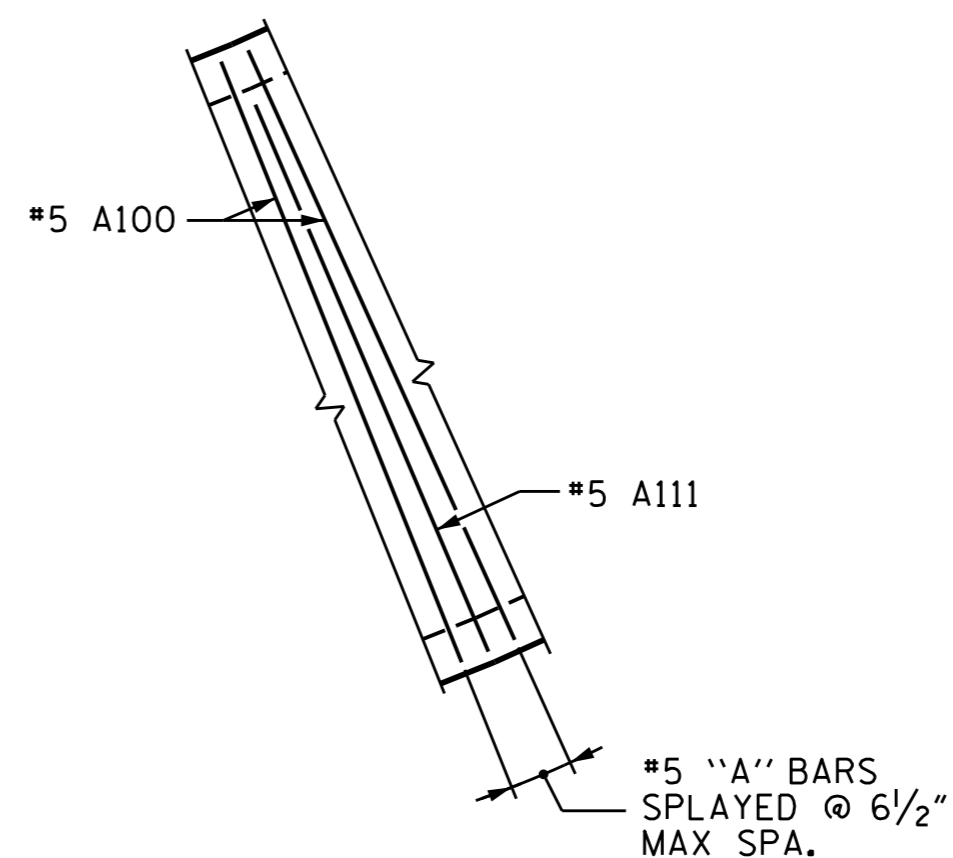
BAR	SIZE	SPLICE LENGTH
"C"	#4	1'-11"



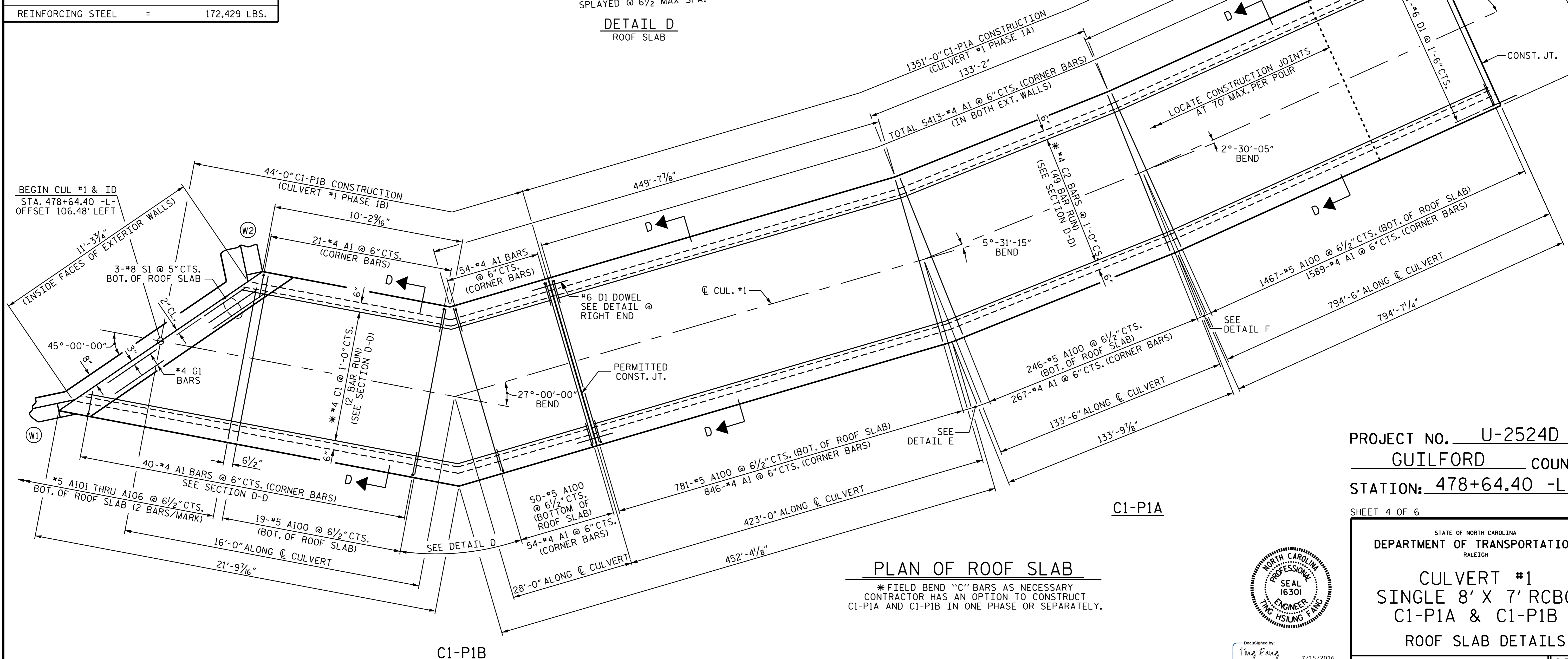
DETAIL D
ROOF SLAB



DETAIL E
ROOF SLAB



DETAIL F
ROOF SLAB



PLAN OF ROOF SLAB
* FIELD BEND "C" BARS AS NECESSARY
CONTRACTOR HAS AN OPTION TO CONSTRUCT
C1-P1A AND C1-P1B IN ONE PHASE OR SEPARATELY.

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 478+64.40 -L-
 SHEET 4 OF 6



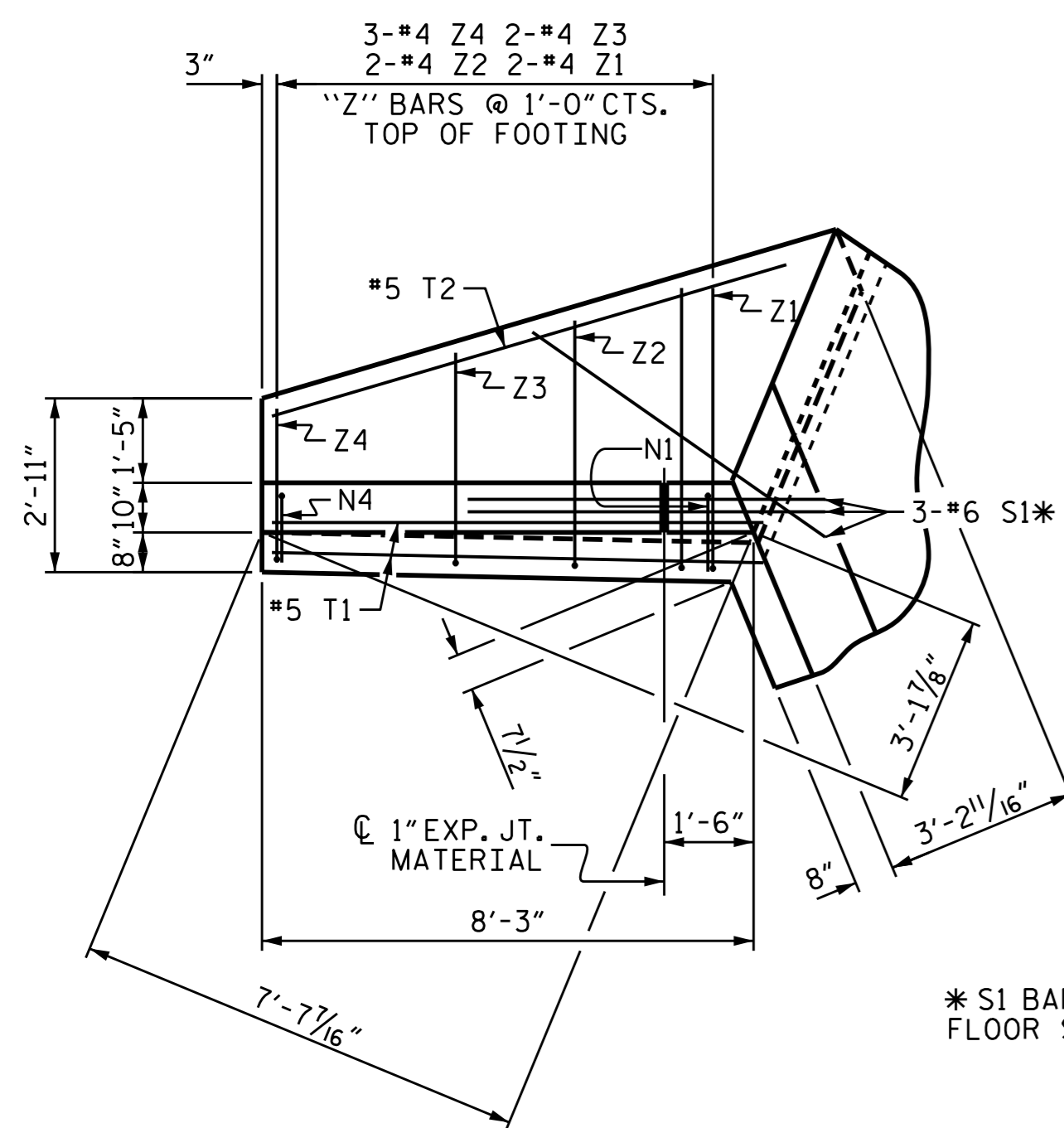
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STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #1
SINGLE 8' X 7' RCBC
C1-P1A & C1-P1B
ROOF SLAB DETAILS

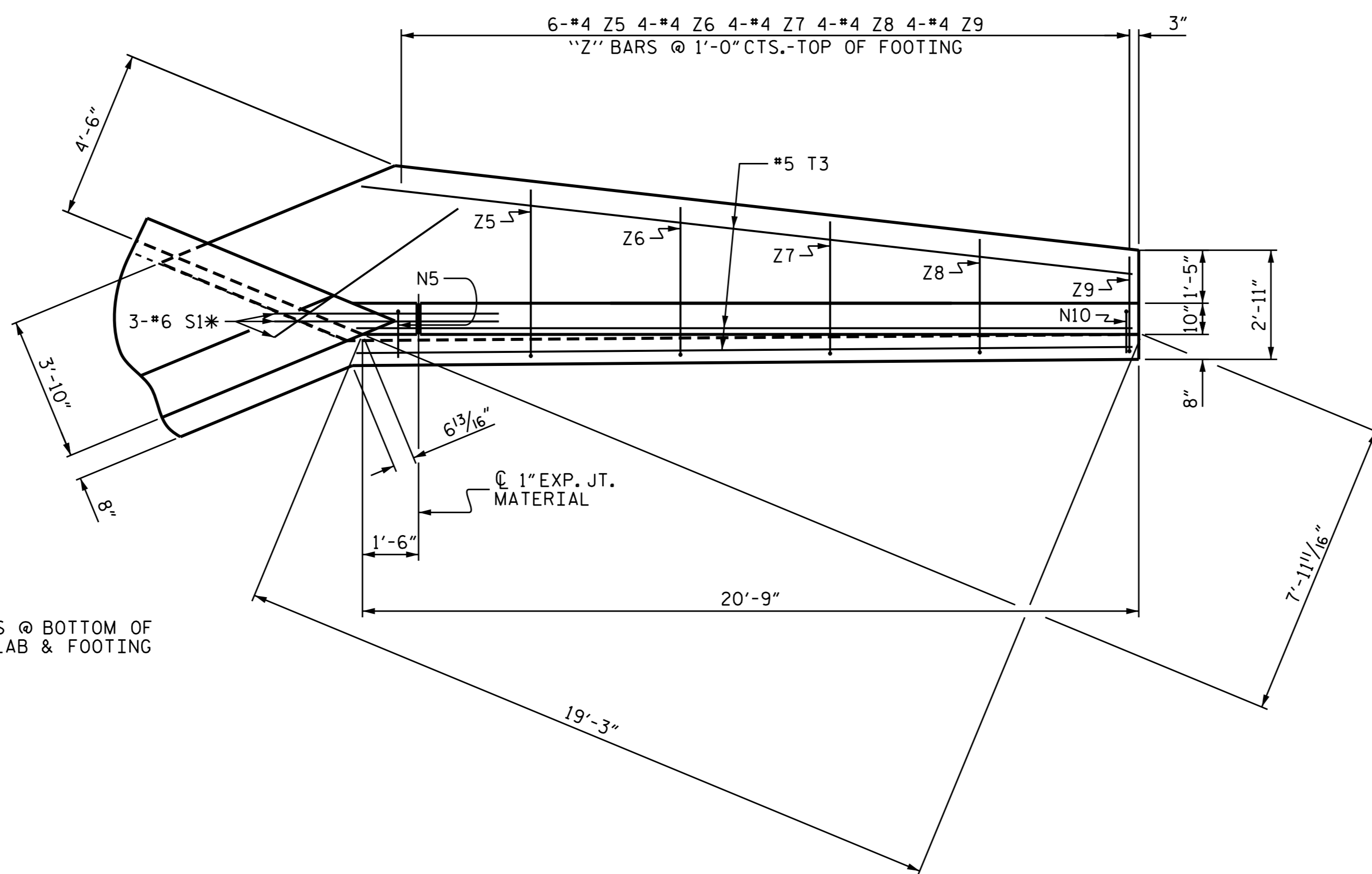
DRAWN BY: A. SORSENGINH DATE: 1/2016
 CHECKED BY: T. H. FANG DATE: 5/15/16
 DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

DOCUMENT NOT CONSIDERED
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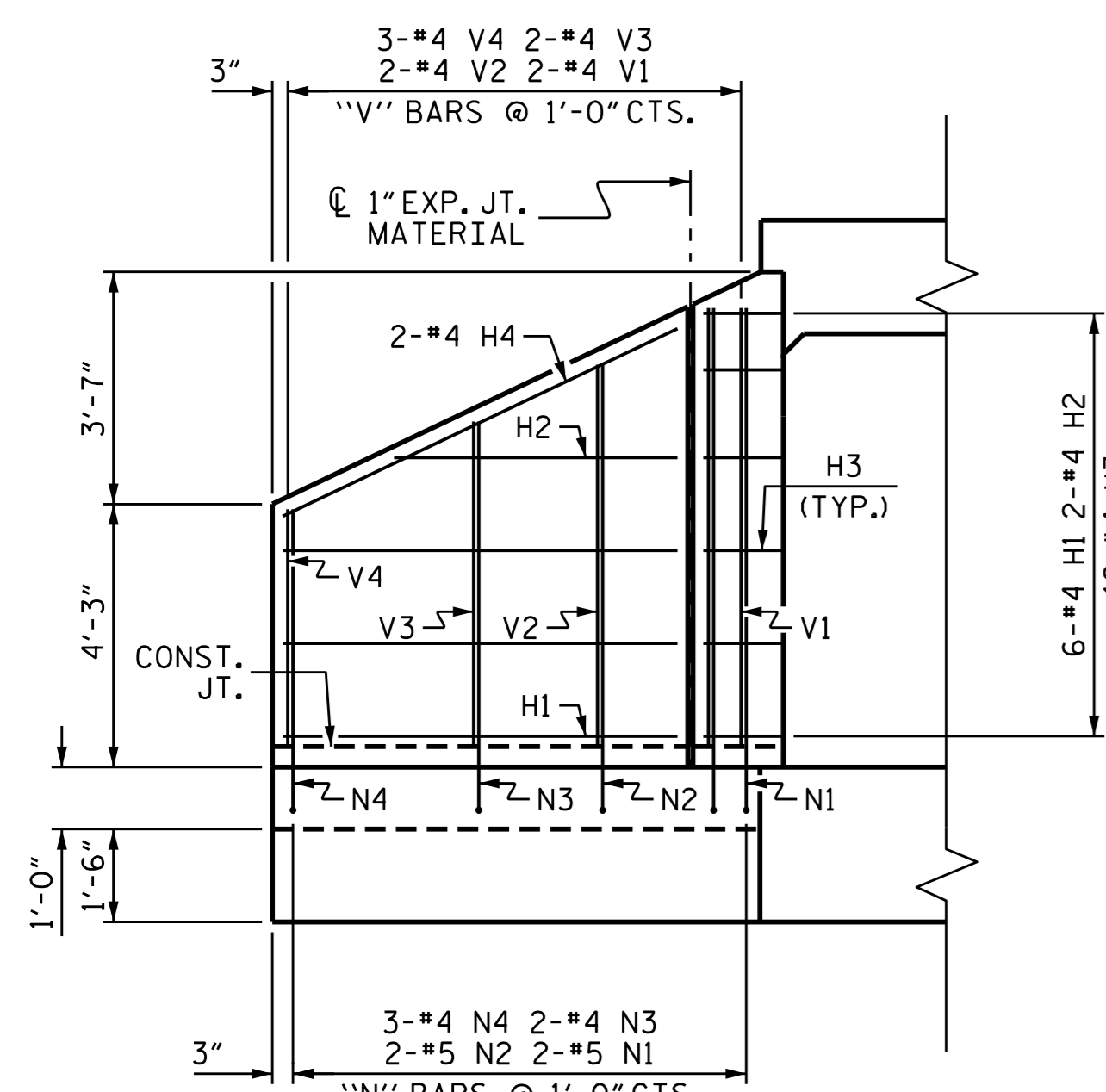
REVISIONS						SHEET NO. C-4
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			



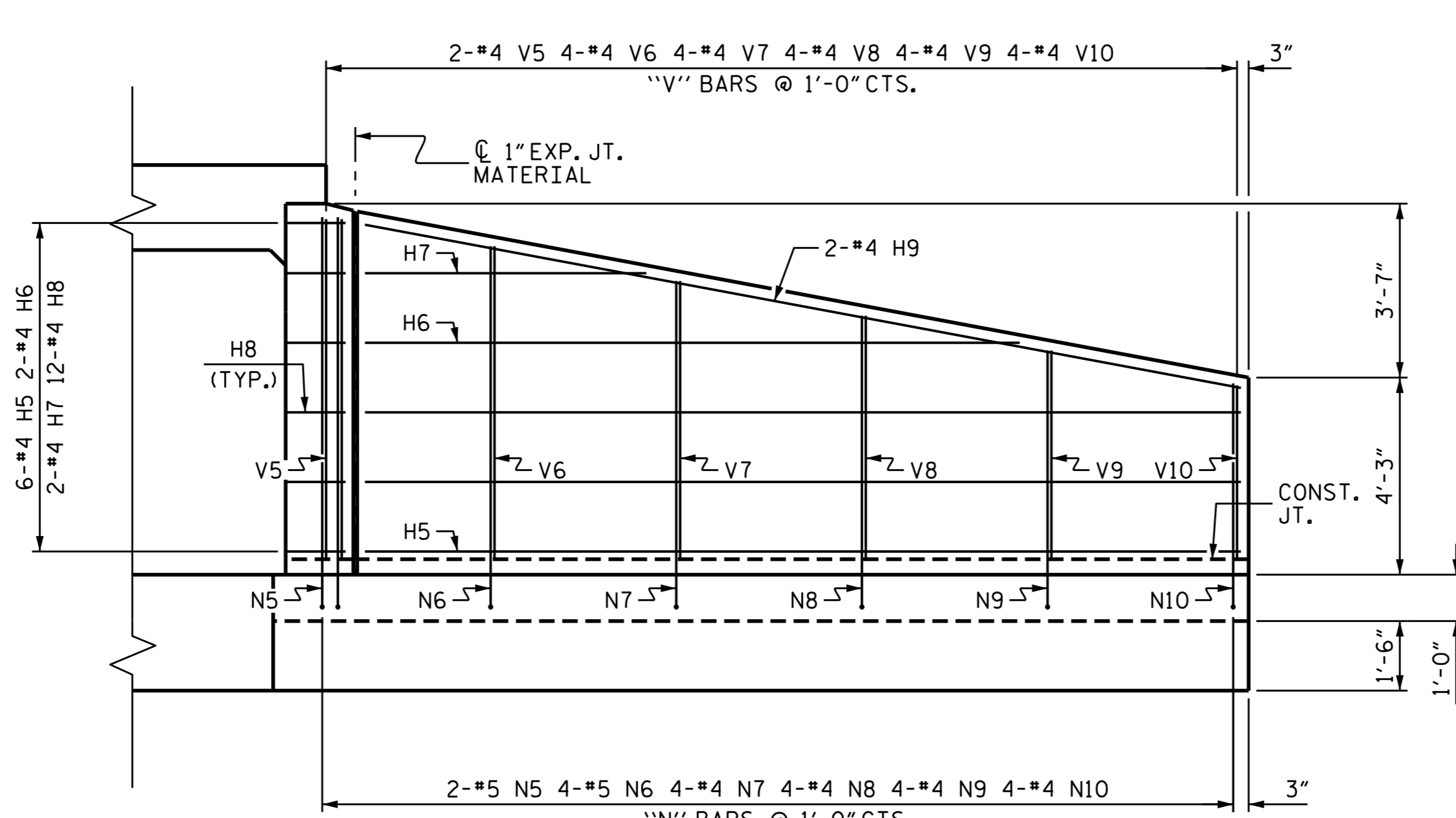
PLAN W2



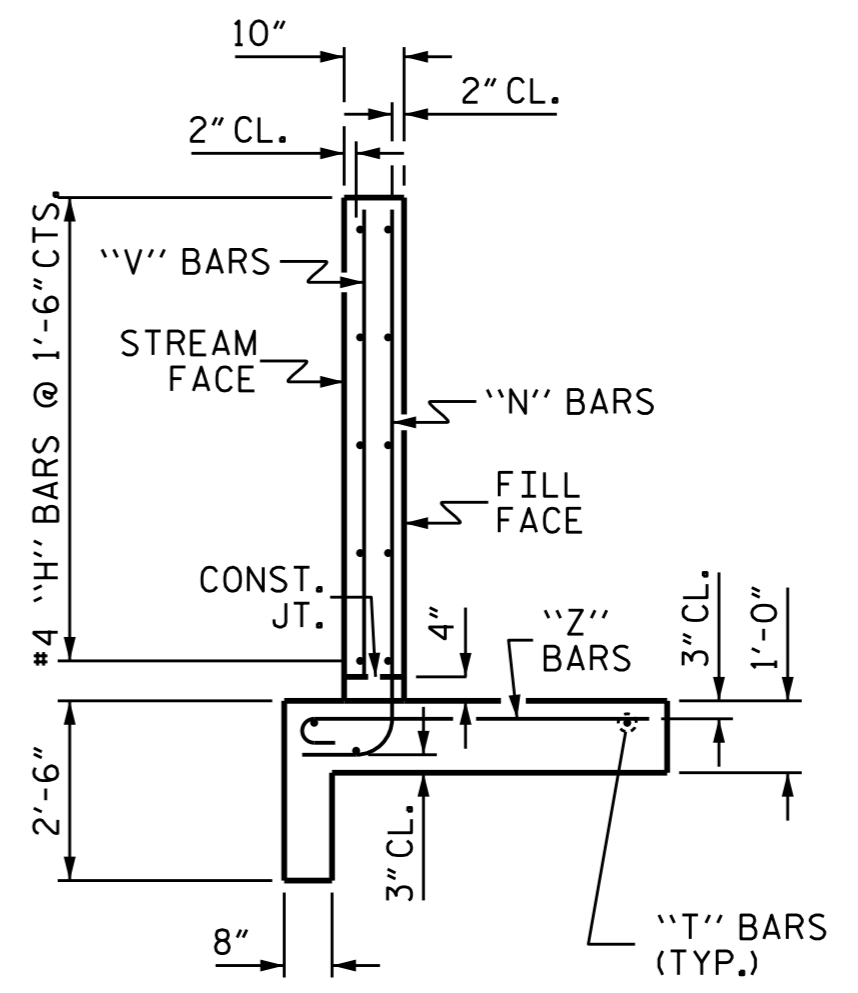
PLAN W1



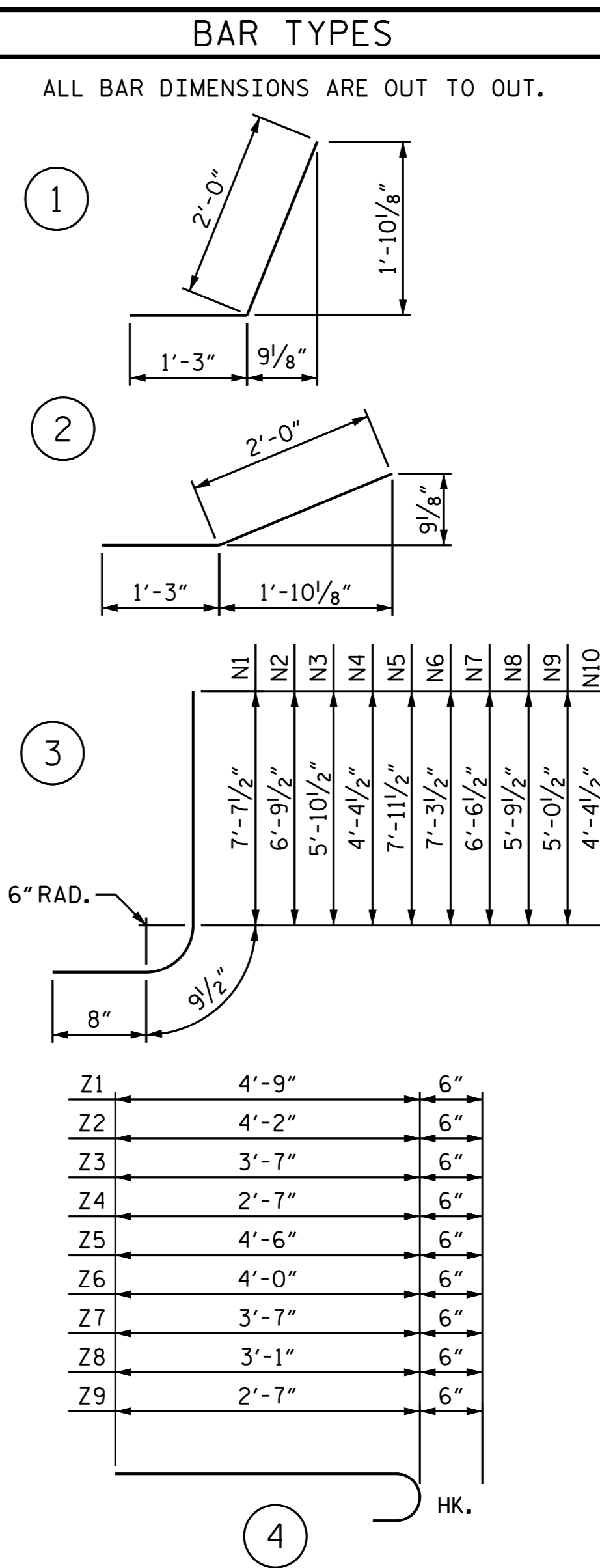
ELEVATION W2



ELEVATION W1



SECTION



BILL OF MATERIAL					
BAR NO.	SIZE	TYPE	LENGTH	WEIGHT	
H1	#4	STR	6'-4"	25	
H2	#4	STR	4'-6"	6	
H3	#4	1	3'-3"	26	
H4	#4	STR	7'-0"	9	
H5	#4	STR	18'-10"	75	
H6	#4	STR	14'-1"	19	
H7	#4	STR	6'-0"	8	
H8	#4	2	3'-3"	26	
H9	#4	STR	19'-2"	26	
N1	#5	3	9'-1"	19	
N2	#5	3	8'-3"	17	
N3	#4	3	7'-4"	10	
N4	#4	3	5'-7"	11	
N5	#5	3	9'-5"	20	
N6	#5	3	8'-9"	37	
N7	#4	3	8'-0"	21	
N8	#4	3	7'-3"	19	
N9	#4	3	6'-6"	17	
N10	#4	3	5'-10"	16	
S1	#6	STR	6'-0"	54	
T1	#5	STR	8'-3"	17	
T2	#5	STR	9'-0"	9	
T3	#5	STR	20'-9"	65	
V1	#4	STR	7'-1"	9	
V2	#4	STR	6'-2"	8	
V3	#4	STR	5'-3"	7	
V4	#4	STR	3'-9"	8	
V5	#4	STR	7'-4"	10	
V6	#4	STR	6'-9"	18	
V7	#4	STR	6'-0"	16	
V8	#4	STR	5'-3"	14	
V9	#4	STR	4'-6"	12	
V10	#4	STR	3'-9"	10	
Z1	#4	4	5'-3"	7	
Z2	#4	4	4'-8"	6	
Z3	#4	4	4'-1"	5	
Z4	#4	4	3'-1"	6	
Z5	#4	4	5'-0"	20	
Z6	#4	4	4'-6"	12	
Z7	#4	4	4'-1"	11	
Z8	#4	4	3'-7"	10	
Z9	#4	4	3'-1"	8	
REINFORCING STEEL FOR 2 WINGS				749	LBS
CLASS A CONCRETE					
2 WINGS				11.8	CY
1 HEADWALL				0.6	CY
1 END CURTAIN WALL				0.6	CY
TOTAL				13.0	CY

ASSEMBLED BY : A. SORSENGINH DATE : 1/2016
 CHECKED BY : T. H. FANG DATE : 5/15/16
 DRAWN BY : CCJ 01/00
 CHECKED BY : RWW 03/00



DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 478+64.40 -L-
 SHEET 5 OF 6
 DEPARTMENT OF TRANSPORTATION
 STANDARD WINGS
 FOR CULVERT #1
 SINGLE 8' X 7' RCBC
 H = 7'-0" SLOPE = 2:1
 45° SKEW AT INLET END

REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			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		
						MOMENT				SHEAR						
						LIVE-LOAD FACTORS (LL)	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	1.05	--	1.75	1.05	1	TOP SLAB	4.33	1.17	1	TOP SLAB	0.81		
	HL-93 (OPERATING)	N/A		1.36	--	1.35	1.36	1	TOP SLAB	4.33	1.51	1	TOP SLAB	0.81		
	HS-20 (INVENTORY)	36.000	②	1.07	38.43	1.75	1.07	1	TOP SLAB	4.33	1.22	1	TOP SLAB	0.81		
	HS-20 (OPERATING)	36.000		1.38	49.82	1.35	1.38	1	TOP SLAB	4.33	1.58	1	TOP SLAB	0.81		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		1.94	26.14	1.40	1.94	1	TOP SLAB	4.33	2.22	1	TOP SLAB	0.81		
		SNGARBS2	20.000		1.81	36.23	1.40	1.81	1	TOP SLAB	4.33	2.07	1	TOP SLAB	0.81	
		SNAGRIS2	22.000		1.94	42.60	1.40	1.94	1	TOP SLAB	4.33	2.22	1	TOP SLAB	0.81	
		SNCOTTS3	27.250	③	1.31	35.65	1.40	1.31	1	TOP SLAB	4.33	1.46	1	TOP SLAB	7.85	
		SNAGGRS4	34.925		1.70	59.30	1.40	1.70	1	TOP SLAB	4.33	1.90	1	BOTTOM SLAB	0.87	
		SNS5A	35.550		1.56	55.37	1.40	1.56	1	TOP SLAB	4.33	1.74	1	TOP SLAB	7.85	
		SNS6A	39.950		1.56	62.22	1.40	1.56	1	TOP SLAB	4.33	1.74	1	TOP SLAB	7.85	
		SNS7B	42.000		1.56	65.41	1.40	1.56	1	TOP SLAB	4.33	1.74	1	TOP SLAB	7.85	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.94	63.91	1.40	1.94	1	TOP SLAB	4.33	2.22	1	TOP SLAB	0.81	
		TNT4A	33.075		1.56	51.51	1.40	1.56	1	TOP SLAB	4.33	1.73	1	TOP SLAB	7.85	
		TNT6A	41.600		1.56	64.79	1.40	1.56	1	TOP SLAB	4.33	1.74	1	TOP SLAB	0.81	
		TNT7A	42.000		1.56	65.42	1.40	1.56	1	TOP SLAB	4.33	1.74	1	TOP SLAB	0.81	
		TNT7B	42.000		1.56	65.41	1.40	1.56	1	TOP SLAB	4.33	1.73	1	TOP SLAB	7.85	
		TNAGRIT4	43.000		1.49	63.92	1.40	1.49	1	TOP SLAB	4.33	1.65	1	TOP SLAB	7.85	
		TNAGT5A	45.000		1.52	68.19	1.40	1.52	1	TOP SLAB	4.33	1.67	1	TOP SLAB	7.85	
		TNAGT5B	45.000		1.56	70.09	1.40	1.56	1	TOP SLAB	4.33	1.73	1	TOP SLAB	7.85	

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	--

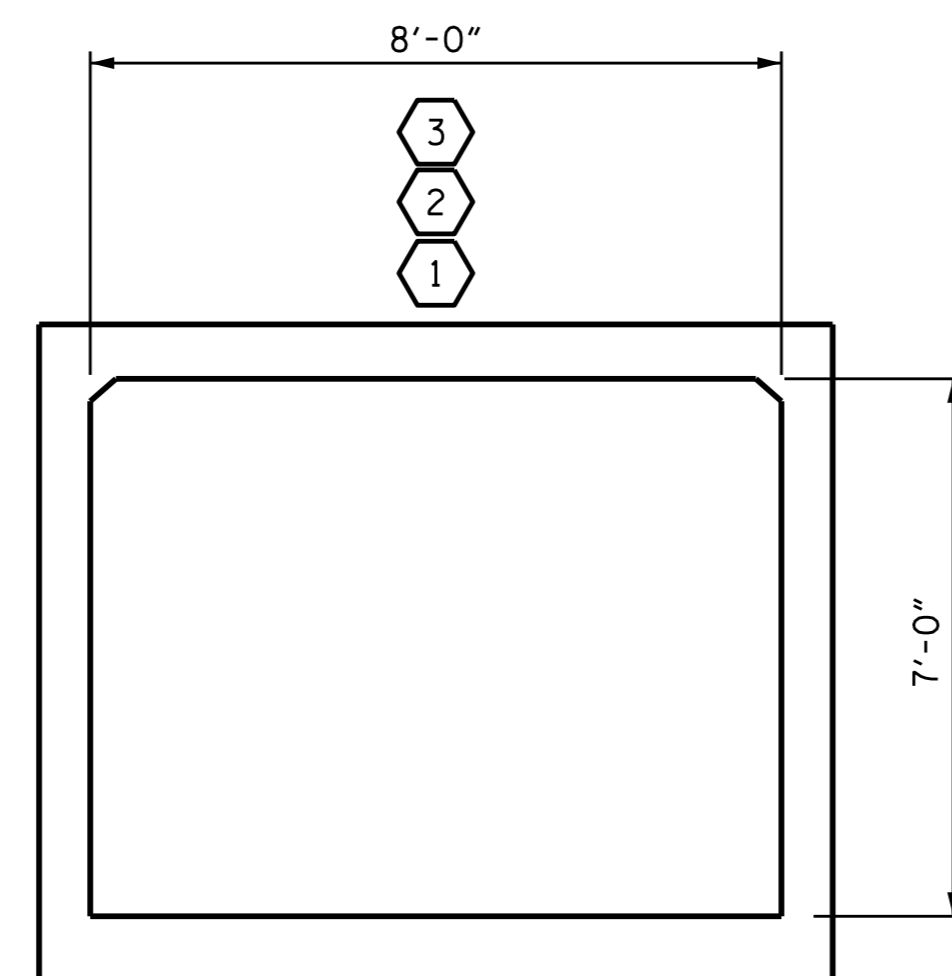
NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

-
-
-
-

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



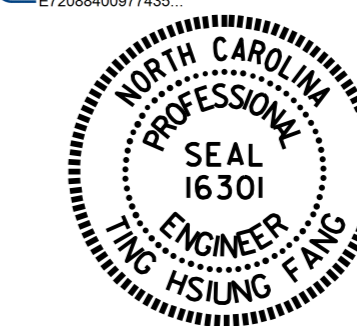
LRFR SUMMARY

(LOOKING DOWNSTREAM)

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 478+64.40 -L-

SHEET 6 OF 6

DocuSigned by:
 Ting Fang
 672088400977436 7/14/2016



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

REVISIONS						SHEET NO. C-6
NO.	BY:	DATE:	NO.	BY:	DATE:	
①			③			TOTAL SHEETS 34
②			④			

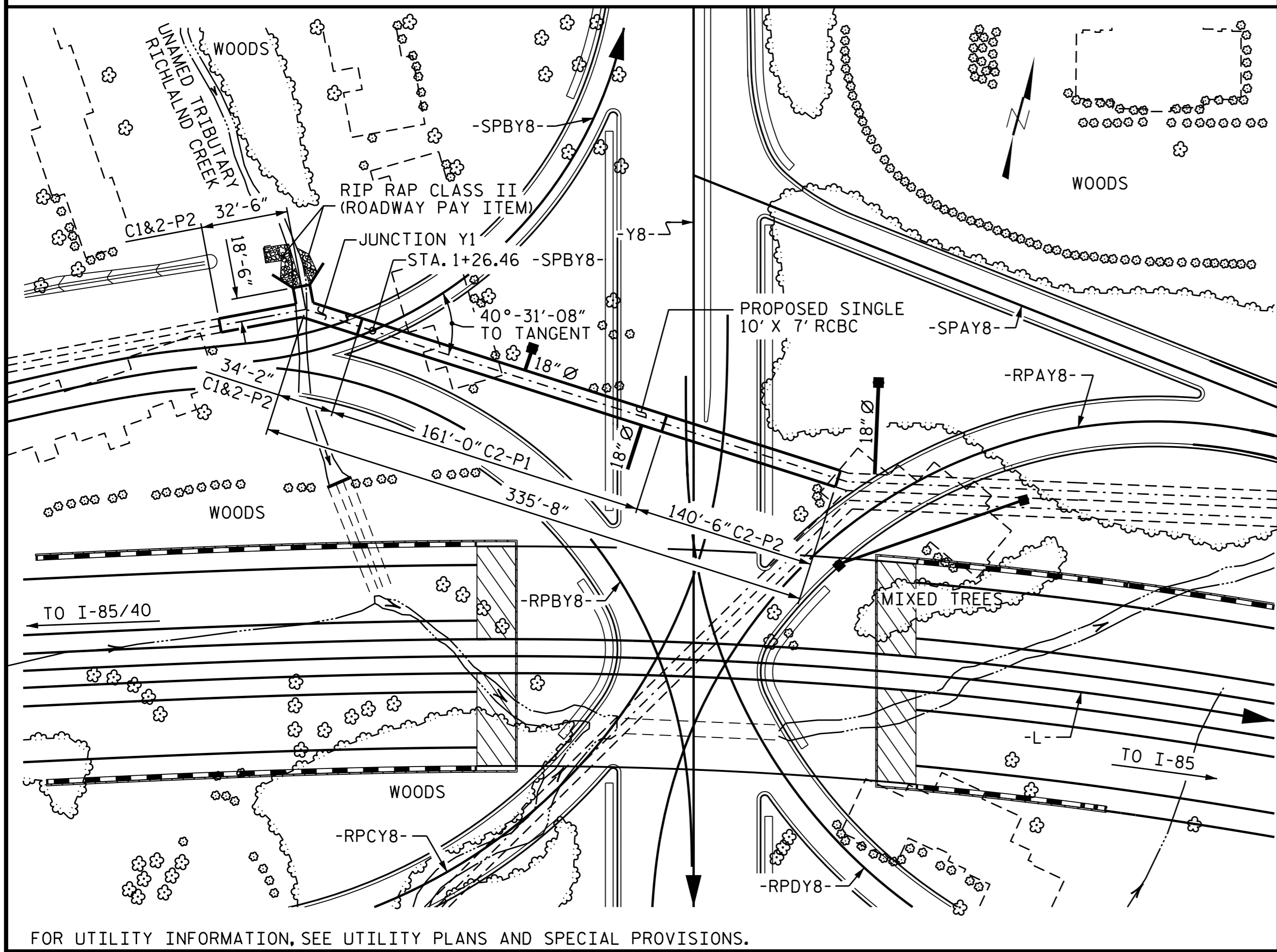
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 FINAL UNLESS ALL
 SIGNATURES COMPLETED

CUL #1

STD. NO. LRFR5

ASSEMBLED BY : CHECKED BY :	A. SORSENGINH T. H. FANG	DATE : DATE :	1/2016 5/15/16
DRAWN BY : CHECKED BY :	WMC GM	REV. 10/1/11	MAA/GM

BM #18: RR SPIKE IN 22" OAK, STA. 10+00.00 -Y8-, N 18° 44' 24.6" W, DIST. 575.94', EL. 808.40'



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	= 390 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 771.70
DRAINAGE AREA	= 0.38 SQ. MI.
BASE DISCHARGE (Q100)	= 410 CFS
BASE HIGH WATER ELEVATION	= 771.88

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= >470+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= >500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 777.83

GRADE DATA

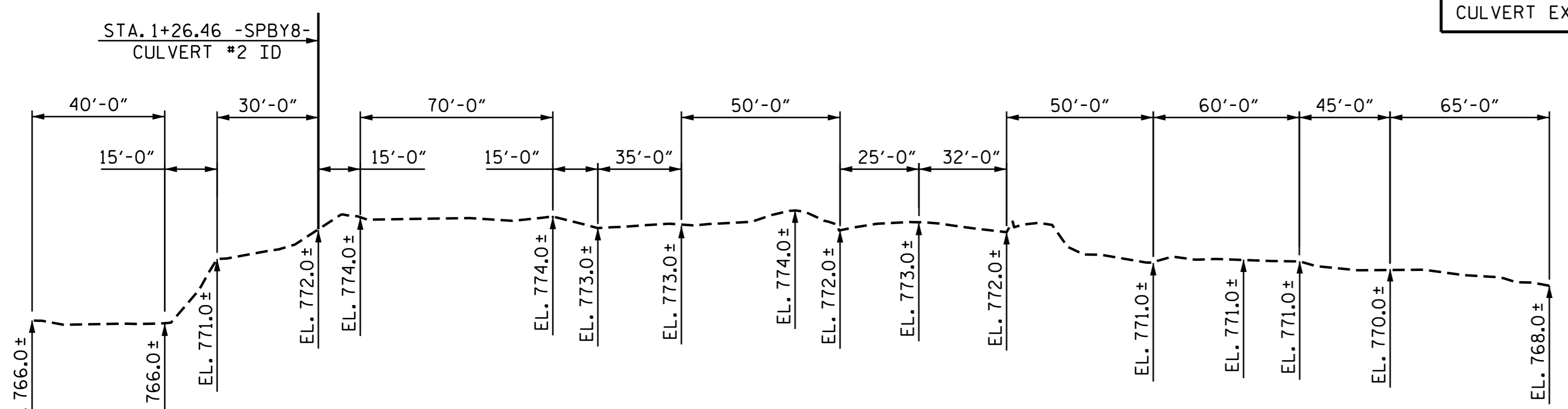
GRADE POINT ELEVATION @ STA. 1+26.46 -SPBY8-	= 778.54'
BED ELEVATION @ STA. 1+26.46 -SPBY8-	= 765.14'
ROADWAY FILL SLOPES	= 4:1

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
PHASE C2-P1	152.0	C.Y.
PHASE C2-P2	132.6	C.Y.
PHASE C1&2-P2	82.2	C.Y.
TOTAL	366.8	C.Y.
REINFORCING STEEL		
PHASE C2-P1	23,748	LBS.
PHASE C2-P2	20,521	LBS.
PHASE C1&2-P2	12,283	LBS.
TOTAL	56,552	LBS.
FOUNDATION COND. MATERIAL		
PHASE C2-P1	174	TONS
PHASE C2-P2	152	TONS
PHASE C1&2-P2	82	TONS
TOTAL	408	TONS
CULVERT EXCAVATION (TOTAL)	LUMP SUM	

NOTES:

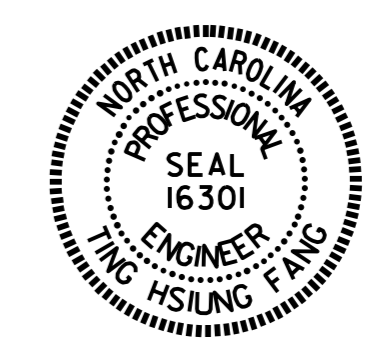
- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- DESIGN FILL MAXIMUM ----- 6.99 FT.
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
- 3" Ø WEEP HOLES INDICATED 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.
- AT THE CONTRACTORS 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.
- 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.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE BARS FROM WHICH THE SAMPLES ARE TAKEN MUST THEN BE SPLICED WITH REPLACEMENT BARS OF THE SIZE AND LENGTH OF THE SAMPLE, PLUS A MINIMUM LAP SPLICE OF THIRTY BAR DIAMETERS. PAYMENT FOR THE SAMPLES OF REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.
- ALL PIPES THROUGH THE SIDEWALL OF THE CULVERT SHALL BE LOCATED BY THE ENGINEER. THE REINFORCING STEEL SHALL BE FIELD BENT AS NECESSARY TO CLEAR PIPE.
- FOR CULVERT DIVERSION DETAILS & PAY ITEM, SEE EROSION CONTROL PLANS.
- FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.



PROFILE ALONG CULVERT #2

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 1+26.46 -SPBY8-

SHEET 1 OF 7



Designed by: Ting Fang 8/16/2016

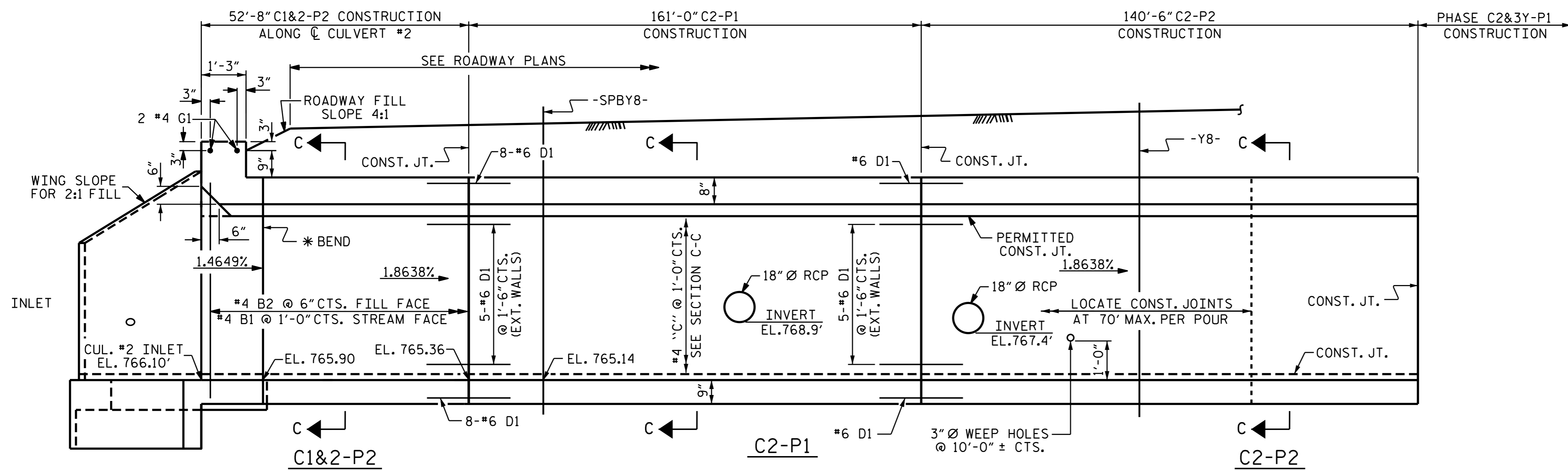
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

CULVERT #2
 SINGLE 10' X 7' RCBC
 C2-P1, C2-P2 & C1&2-P2
 40°-31'-08" SKEW

DRAWN BY :	A. SORSENGINH	DATE :	1/2016
CHECKED BY :	T. H. FANG	DATE :	5/15/16
DESIGN ENGINEER OF RECORD :	A. SORSENGINH	DATE :	5/26/16

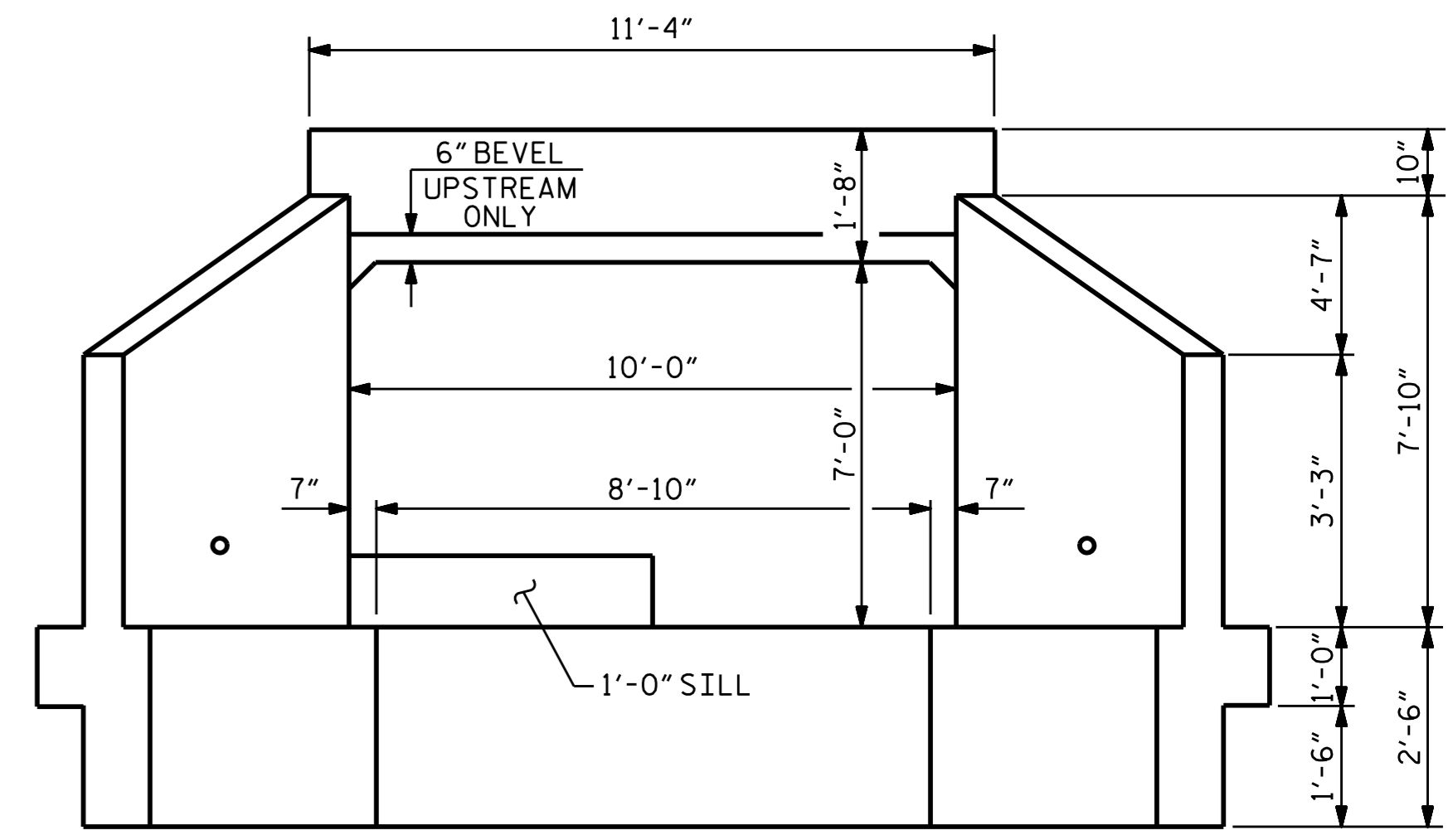
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

REVISIONS						SHEET NO. C-7
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			



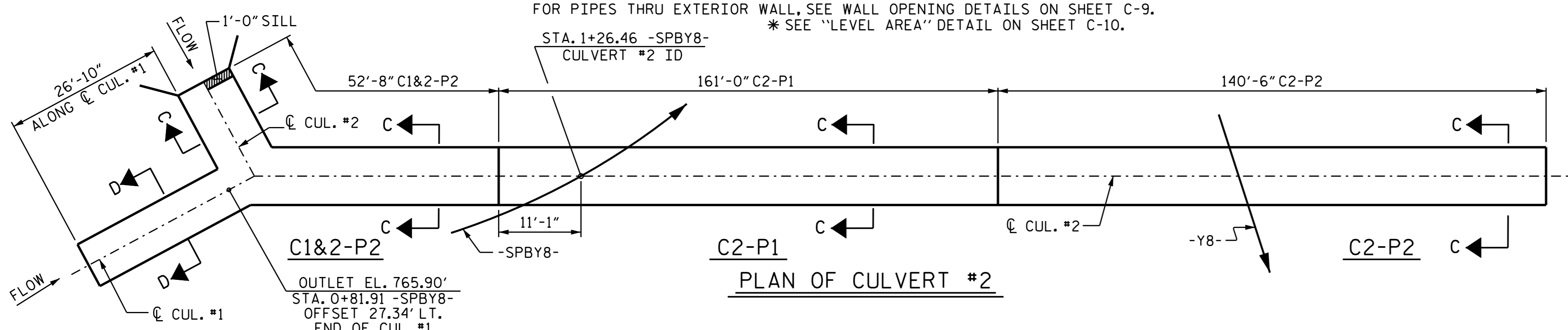
CULVERT SECTION ALONG CULVERT

PORTION OF CUL #1 ON PHASE C1&2-P2 NOT SHOWN FOR CLARITY. FOR PIPES THRU EXTERIOR WALL, SEE WALL OPENING DETAILS ON SHEET C-9. * SEE "LEVEL AREA" DETAIL ON SHEET C-10.

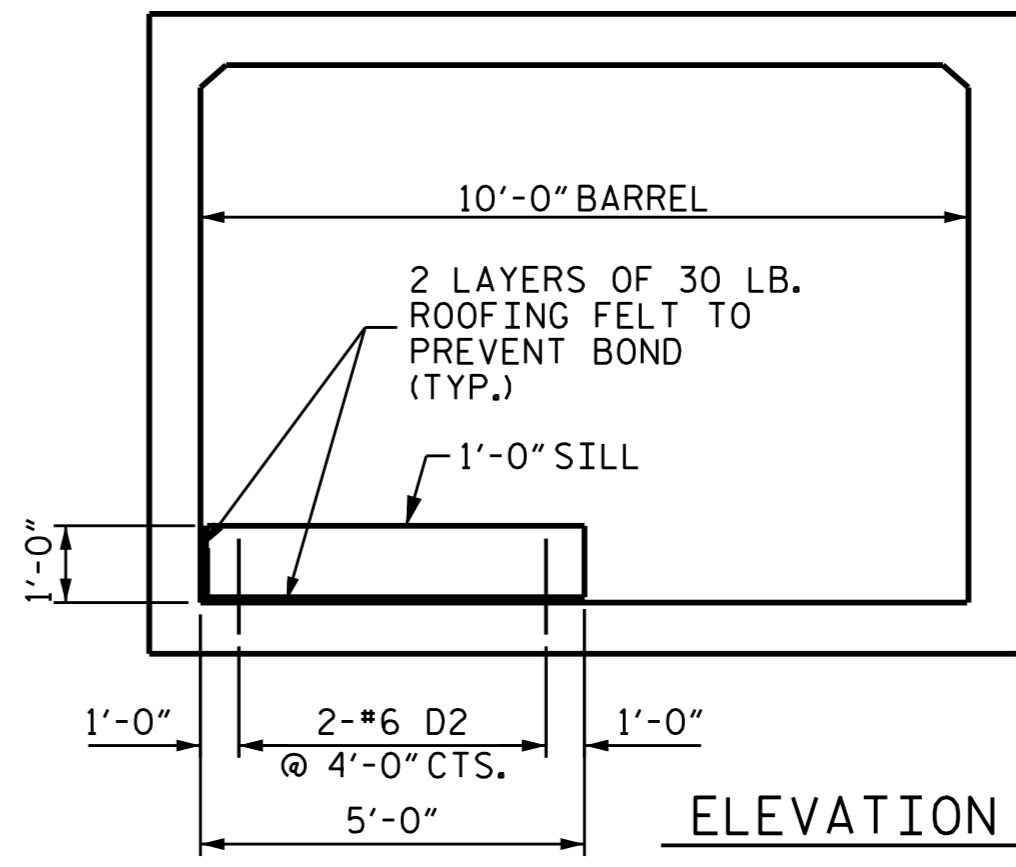


INLET END ELEVATION

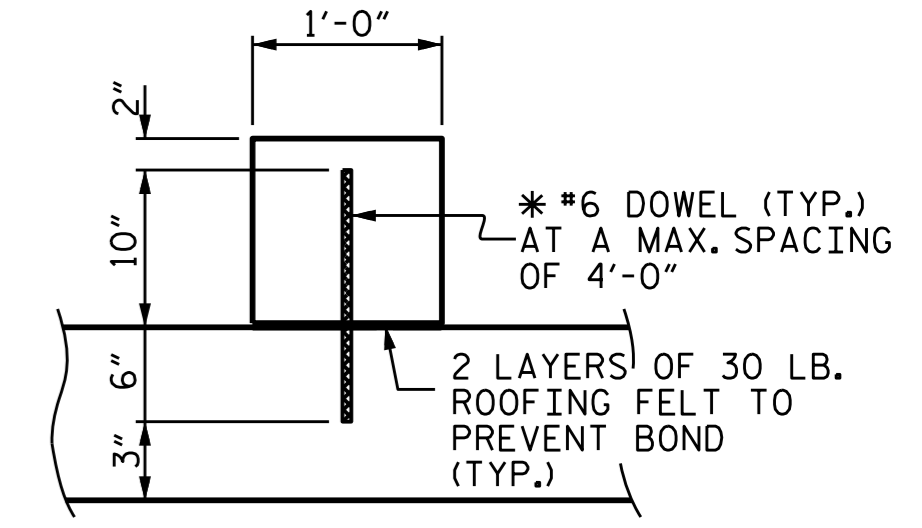
LOOKING DOWN STREAM



PLAN OF CULVERT #2

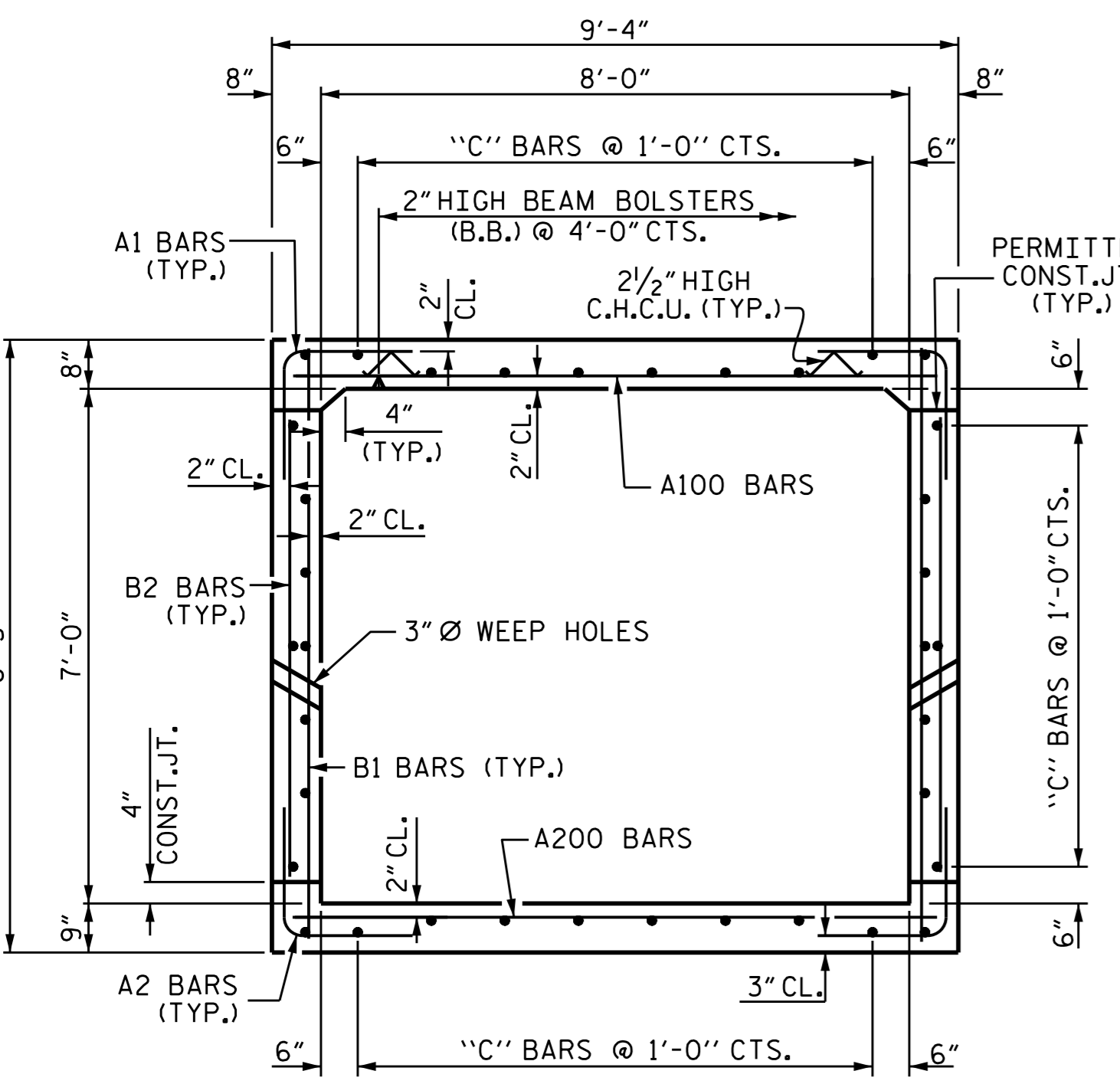


ELEVATION



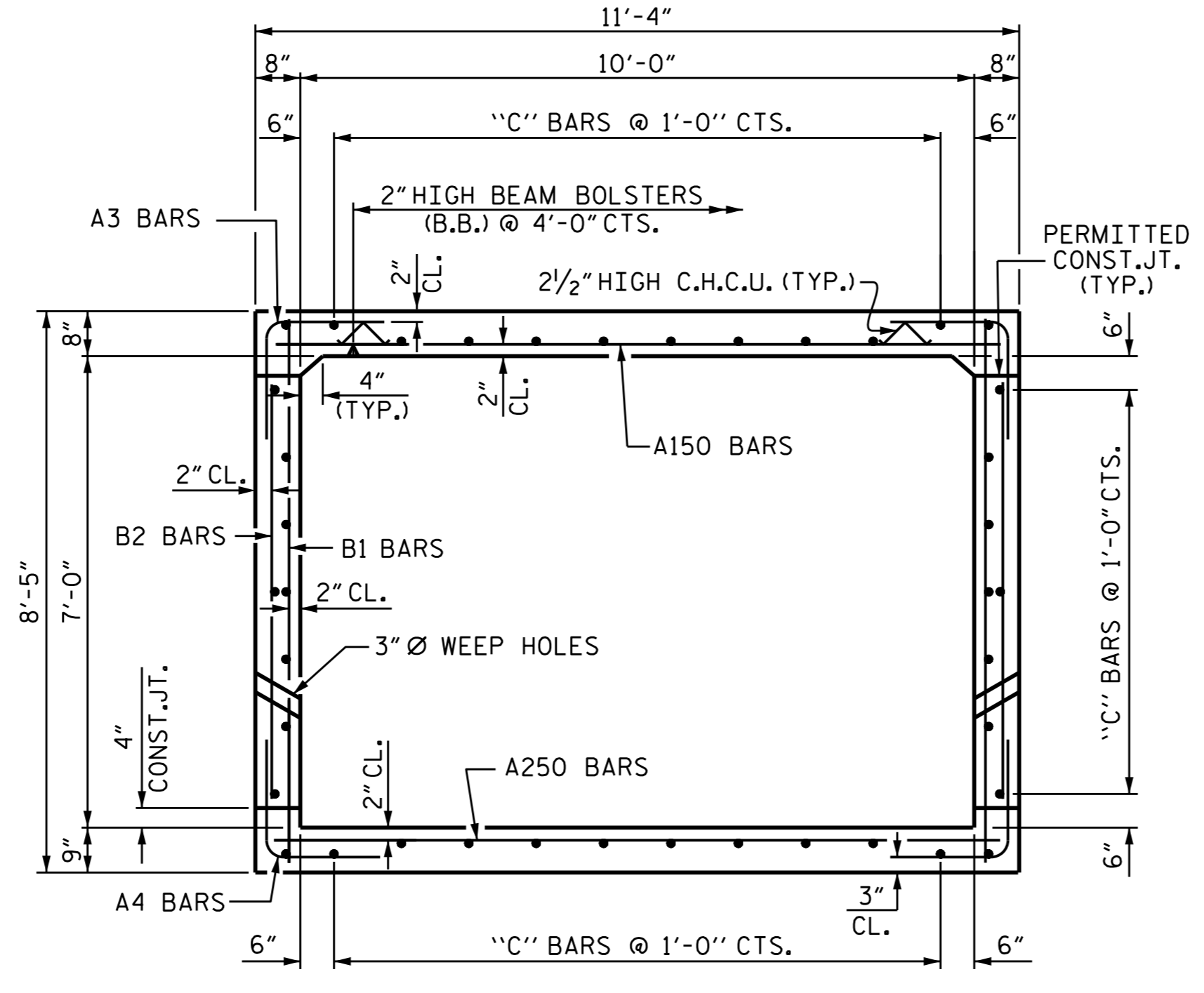
SECTION THROUGH SILL

CULVERT SILL DETAILS



SECTION D-D

THERE ARE 36 "C" BARS IN BARREL SECTION FOR CULVERT #1



SECTION C-C

THERE ARE 40 "C" BARS IN BARREL SECTION FOR CULVERT #2

TOTAL CULVERT #2 QUANTITIES				
PAY ITEM	PHASE I C2-P1	PHASE II C2-P2	PHASE II C1&2-P2	TOTAL
CLASS A CONCRETE				
BARREL @ 0.944 CY/FT	152.0 C.Y.	132.6 C.Y.	72.6 C.Y.	357.2 C.Y.
WINGS ETC.			9.6 C.Y.	9.6 C.Y.
SUBTOTAL	152.0 C.Y.	132.6 C.Y.	82.2 C.Y.	366.8 C.Y.
REINFORCING STEEL				
BARREL	23,748 LBS.	20,521 LBS.	11,707 LBS.	55,976 LBS.
WINGS ETC.			576 LBS.	576 LBS.
SUBTOTAL	23,748 LBS.	20,521 LBS.	12,283 LBS.	56,552 LBS.
CULVERT EXCAVATION	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM
FOUNDATION COND. MAT'L	174 TONS	152 TONS	82 TONS	408 TONS



DocuSigned by: Ting Fang 8/16/2016

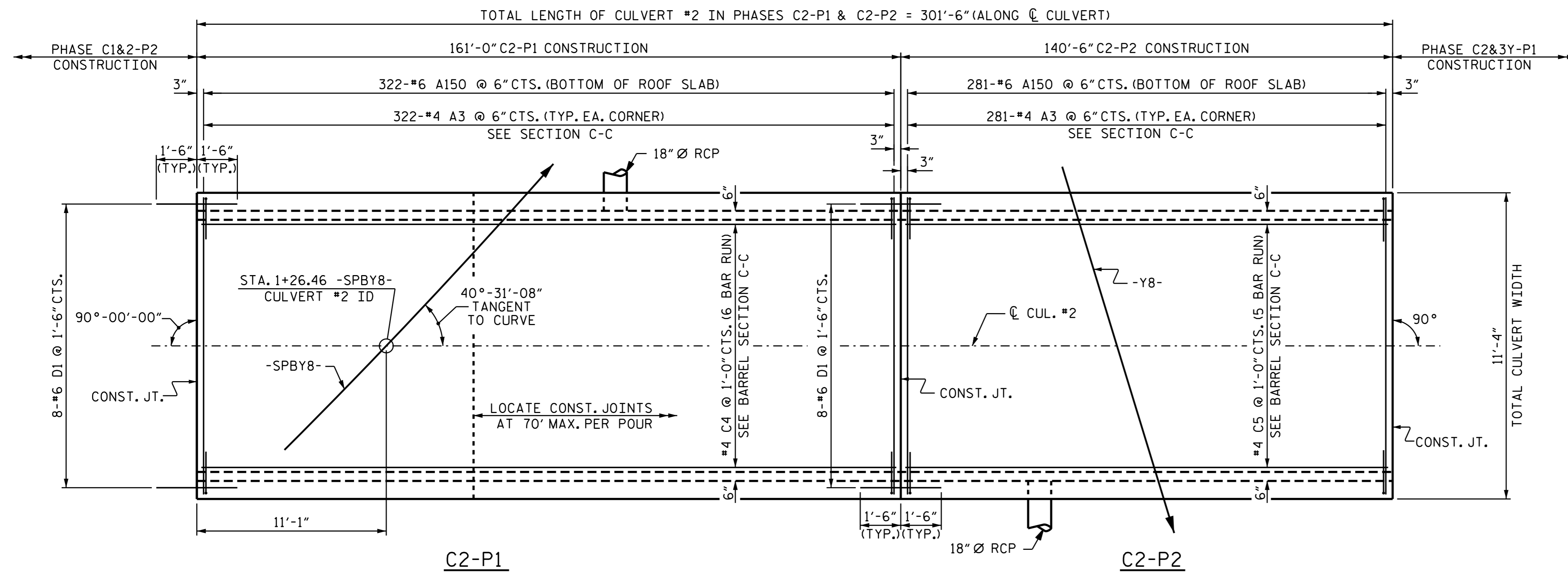
PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 1+26.46 -SPBY8-

SHEET 2 OF 7
 STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #2
SINGLE 10' X 7' RCBC
C2-P1, C2-P2 & C1&2-P2
40°-31'-08" SKEW

DRAWN BY: A. SORSENGINH DATE: 1/2016
 CHECKED BY: T. H. FANG DATE: 5/15/16
 DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

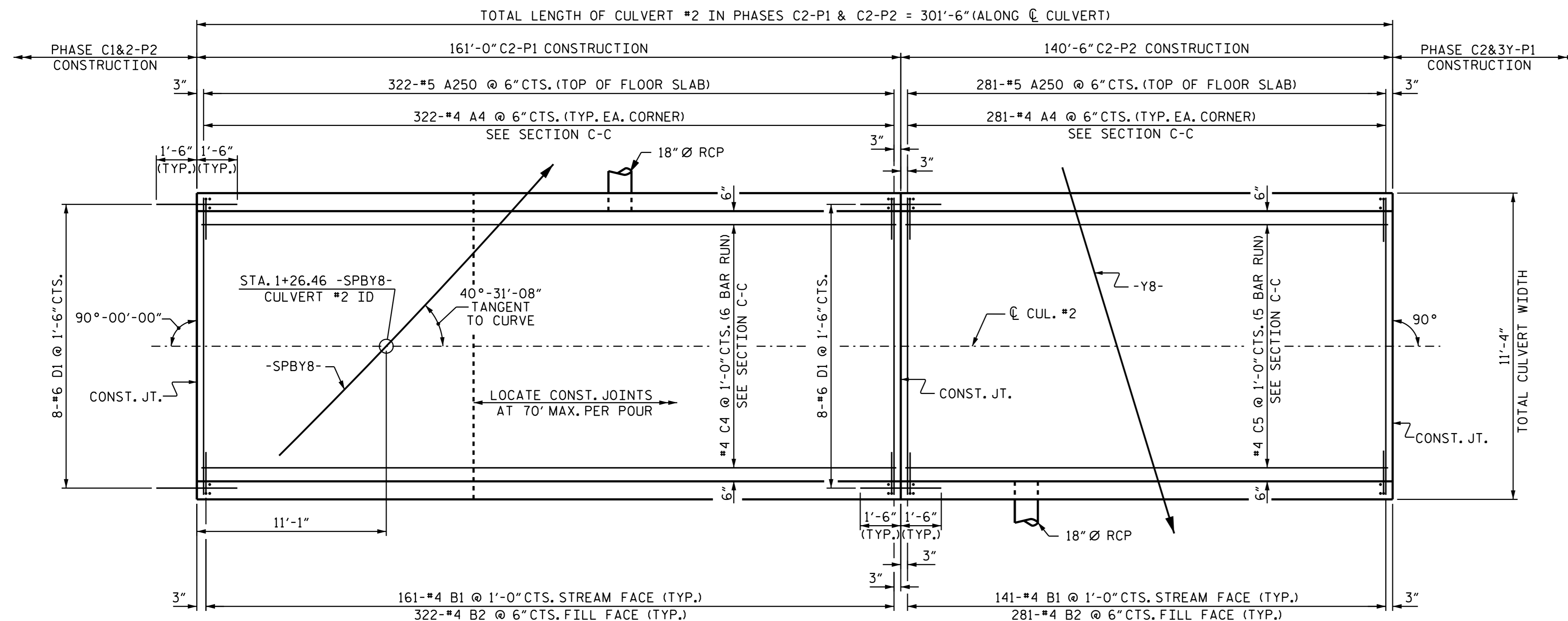
DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
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REVISIONS						SHEET NO. C-8
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			



PLAN OF ROOF SLAB

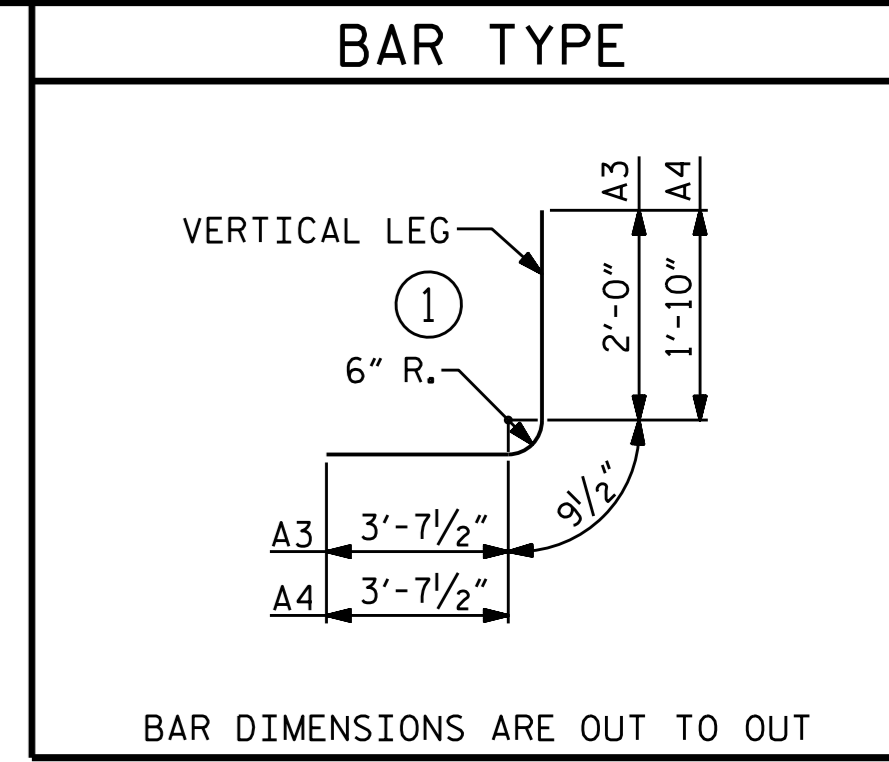
FOR BARREL SECTION DETAILS, SEE SECTION C-C ON SHEET C-8



PLAN OF FLOOR SLAB

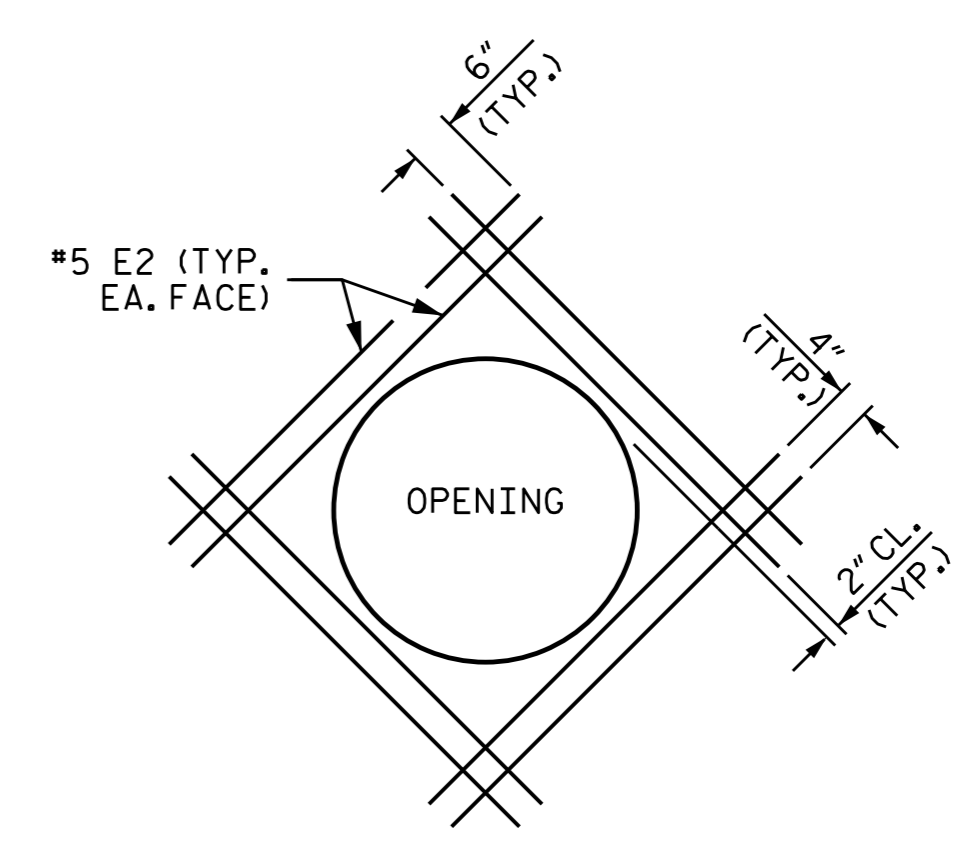
FOR BARREL SECTION DETAILS, SEE SECTION C-C ON SHEET C-8

BAR SCHEDULE											
PHASE I C2-P1 CONSTRUCTION						PHASE II C2-P2 CONSTRUCTION					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A3	644	#4	1	6'-5"	2760	A3	562	#4	1	6'-5"	2409
A4	644	#4	1	6'-3"	2689	A4	562	#4	1	6'-3"	2346
A150	322	#6	STR	11'-0"	5320	A150	281	#6	STR	11'-0"	4643
A250	322	#5	STR	11'-0"	3694	A250	281	#5	STR	11'-0"	3224
B1	322	#4	STR	7'-11"	1703	B1	282	#4	STR	7'-11"	1491
B2	644	#4	STR	6'-4"	2725	B2	562	#4	STR	6'-4"	2378
C4	240	#4	STR	28'-5"	4556	C5	200	#4	STR	29'-8"	3963
D1	52	#6	STR	3'-0"	234	E2	16	#5	STR	4'-0"	67
E2	16	#5	STR	4'-0"	67						
REINFORCING STEEL = 23,748 LBS.						REINFORCING STEEL = 20,521 LBS.					



SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
"C"	#4	1'-11"



PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 1+26.46 -SPBY8-

SHEET 3 OF 7



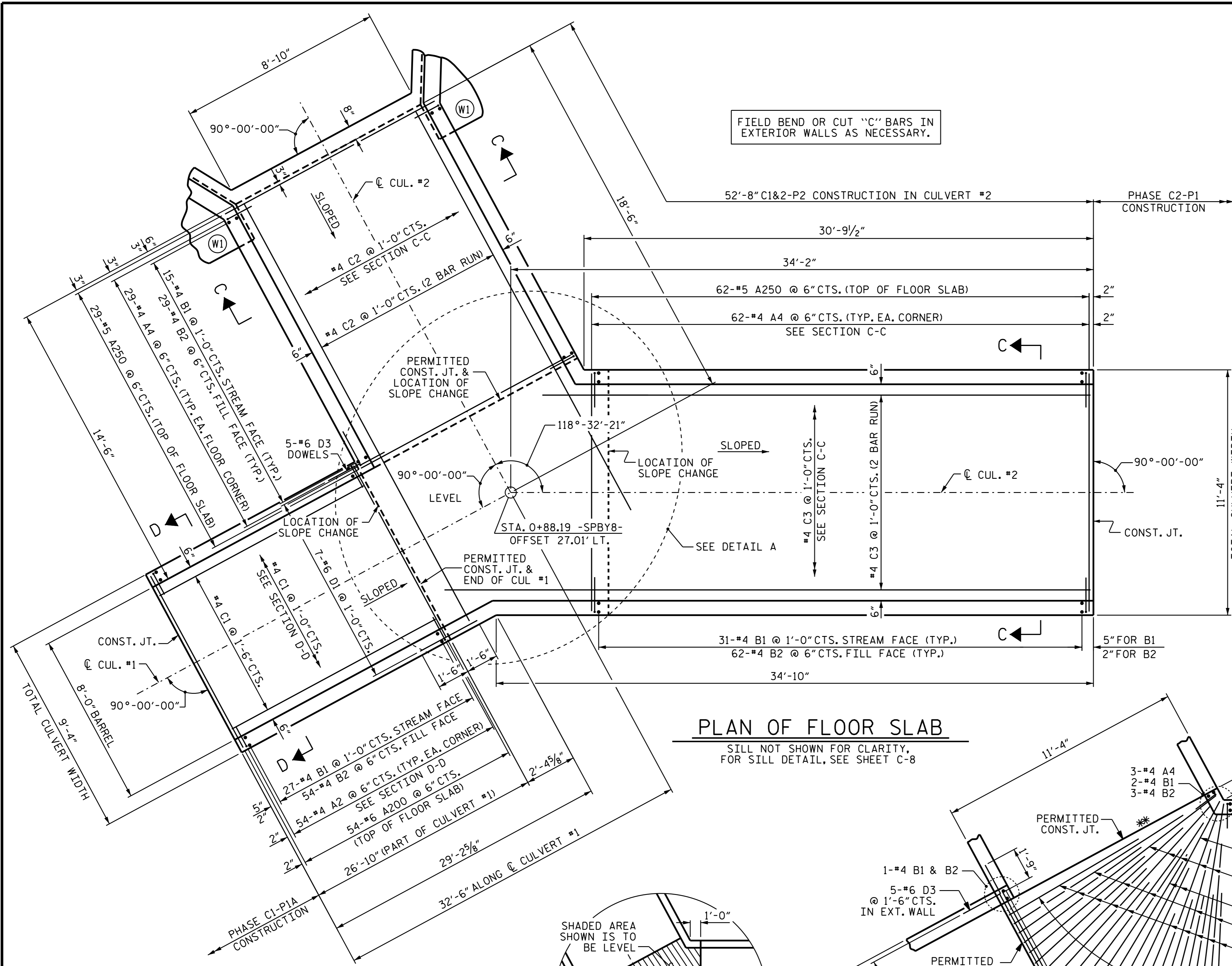
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #2
 SINGLE 10' X 7' RCBC
 PHASES C2-P1 & C2-P2
 DETAILS
 40°-31'-08" SKEW

REVISIONS

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

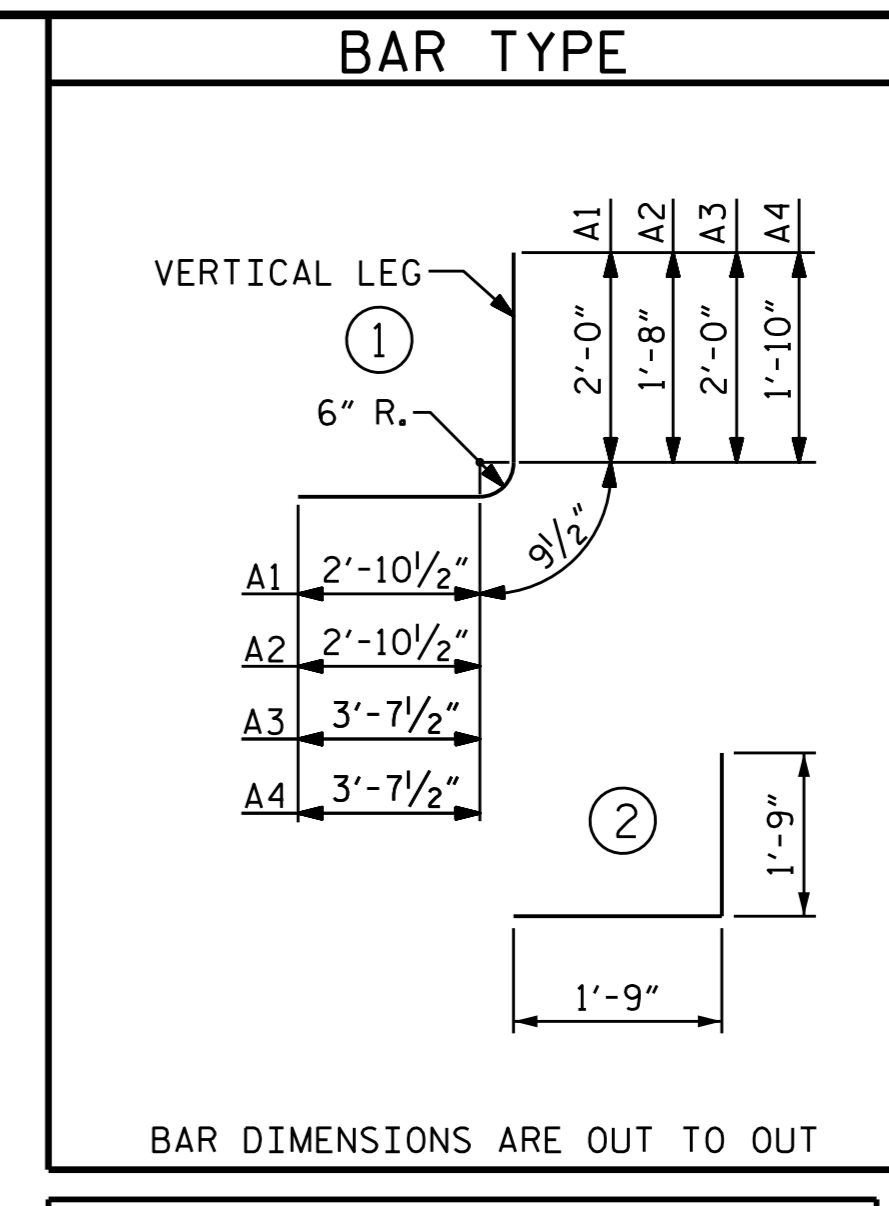
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DRAWN BY: A. SORSENGINH DATE: 1/2016
 CHECKED BY: T. H. FANG DATE: 5/15/16
 DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16



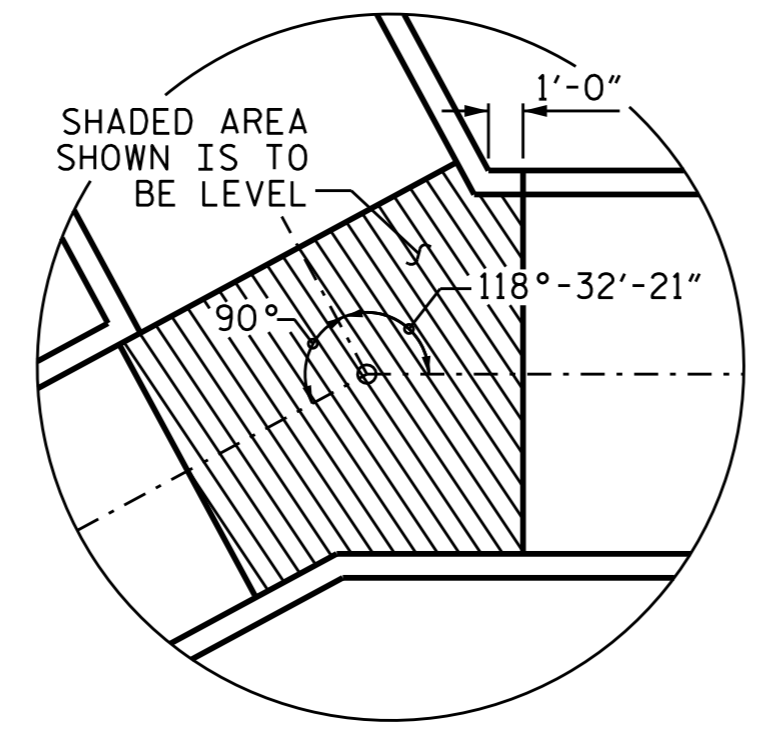
PLAN OF FLOOR SLAB

SILL NOT SHOWN FOR CLARITY, FOR SILL DETAIL, SEE SHEET C-8

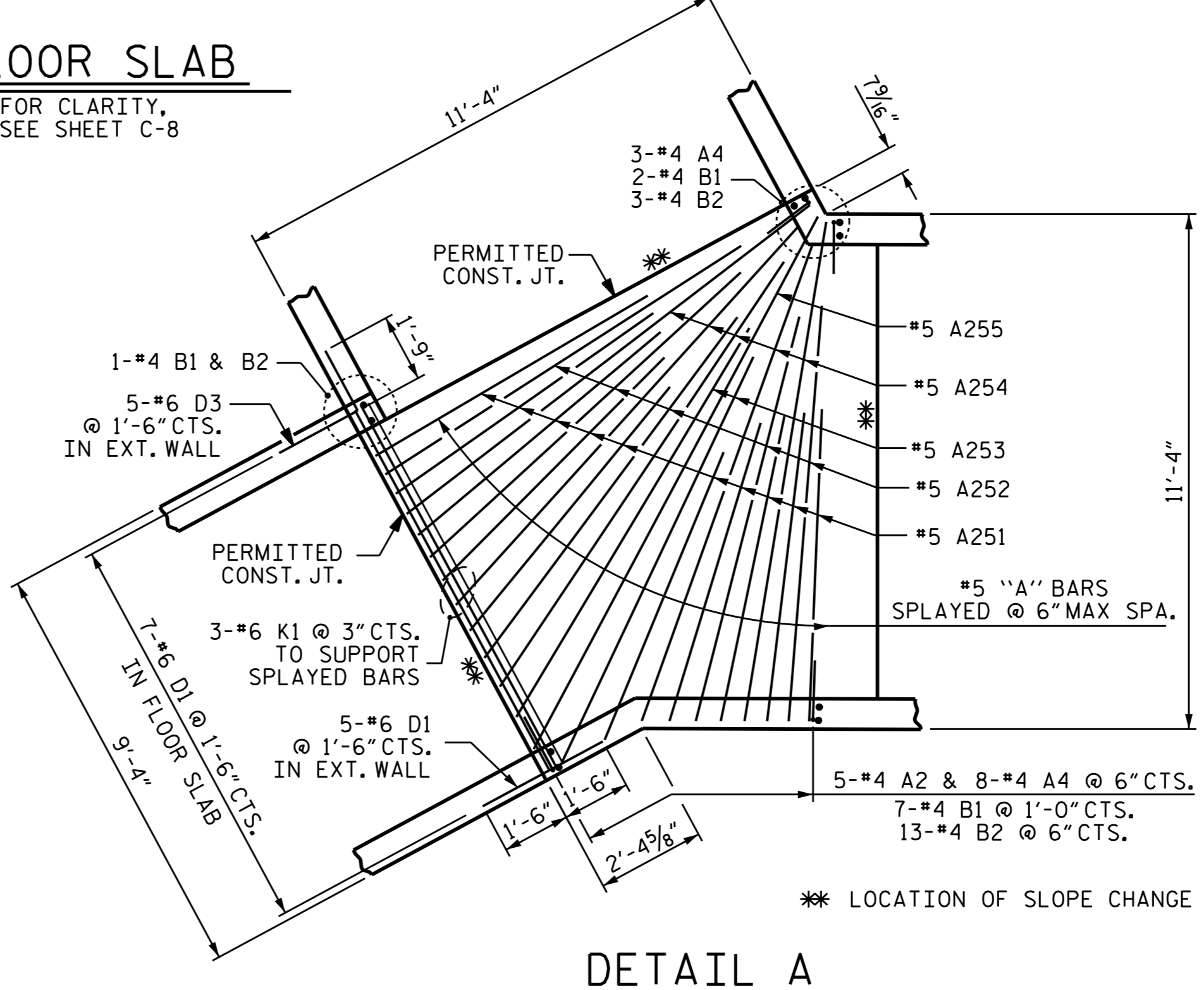


BAR SCHEDULE					
PHASE II C1&2-P2 CONSTRUCTION					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	113	#4	1	5'-8"	428
A2	113	#4	1	5'-4"	403
A3	193	#4	1	6'-5"	827
A4	193	#4	1	6'-3"	806
A100	54	#6	STR	9'-0"	730
A150	91	#6	STR	11'-0"	1504
A151	10	#6	STR	7'-1"	106
A152	5	#6	STR	9'-2"	69
A153	2	#6	STR	9'-10"	30
A154	5	#6	STR	11'-1"	83
A155	1	#6	STR	13'-2"	20
A200	54	#6	STR	9'-0"	730
A250	91	#5	STR	11'-0"	1044
A251	10	#5	STR	7'-1"	74
A252	5	#5	STR	9'-2"	48
A253	2	#5	STR	9'-10"	21
A254	5	#5	STR	11'-1"	58
A255	1	#5	STR	13'-2"	14
B1	156	#4	STR	7'-11"	825
B2	307	#4	STR	6'-4"	1299
C1	36	#4	STR	26'-8"	641
C2	80	#4	STR	12'-6"	668
C3	80	#4	STR	20'-0"	1069
D1	19	#6	STR	3'-0"	86
D2	2	#6	STR	1'-4"	4
D3	5	#6	2	3'-6"	26
G1	2	#4	STR	11'-0"	15
K1	6	#6	STR	9'-0"	81
REINFORCING STEEL =					11,707 LBS.

SPLICE LENGTHS CHART		
BAR	SIZE	SPLICE LENGTH
"C"	#4	1'-11"



LEVEL AREA FOR BOTH FLOOR & ROOF SLABS.



DETAIL A
#4 "C" BARS NOT SHOWN FOR CLARITY
BED SLOPE IS 0.00% IN THIS DOG-LEG SECTION.

PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 1+26.46 -SPBY8-
SHEET 4 OF 7



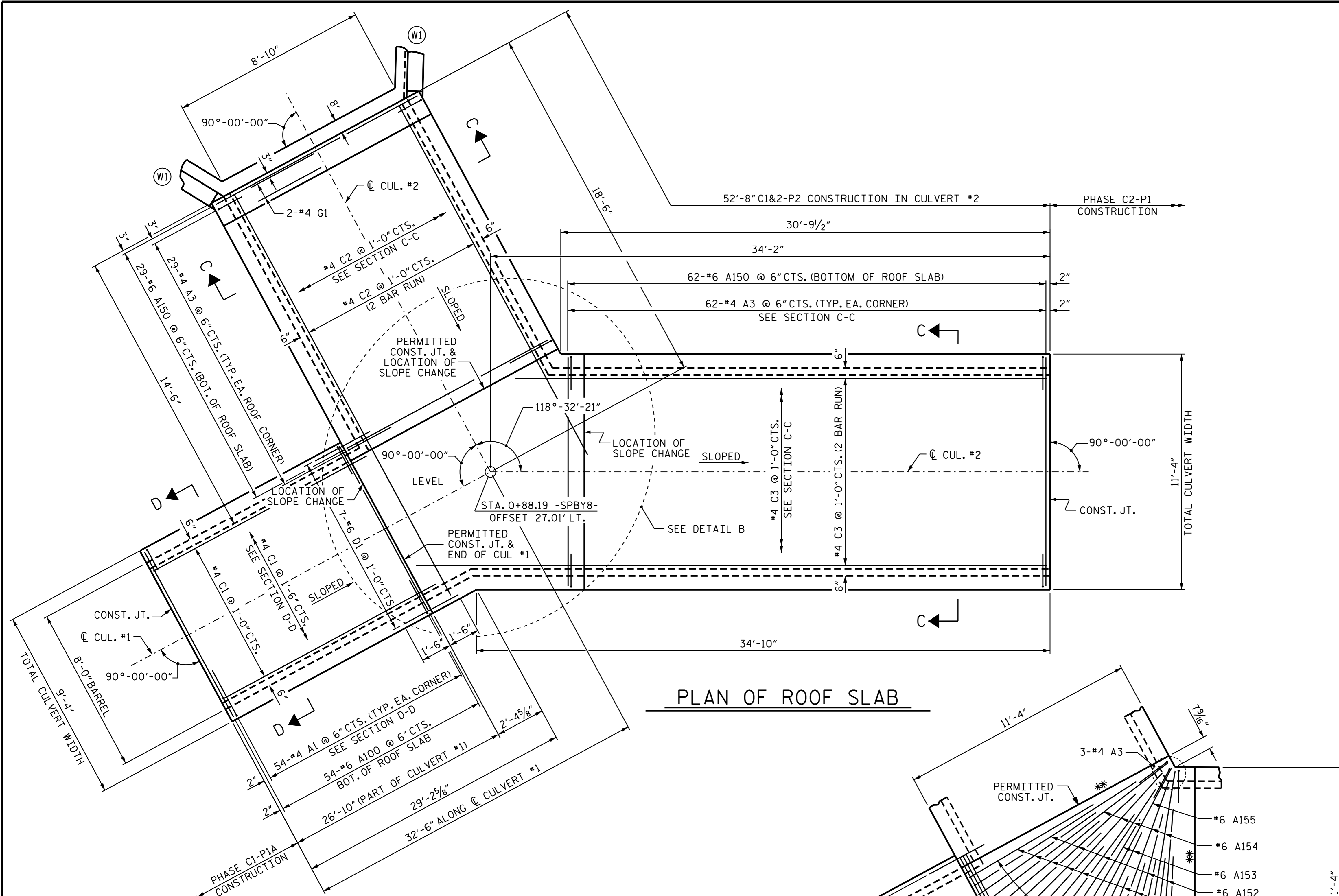
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
CULVERTS #1 & #2 PHASE C1&2-P2 FLOOR SLAB DETAILS					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

DRAWN BY: A. SORSENGINH DATE: 1/2016
CHECKED BY: T. H. FANG DATE: 5/15/16
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 5/26/16

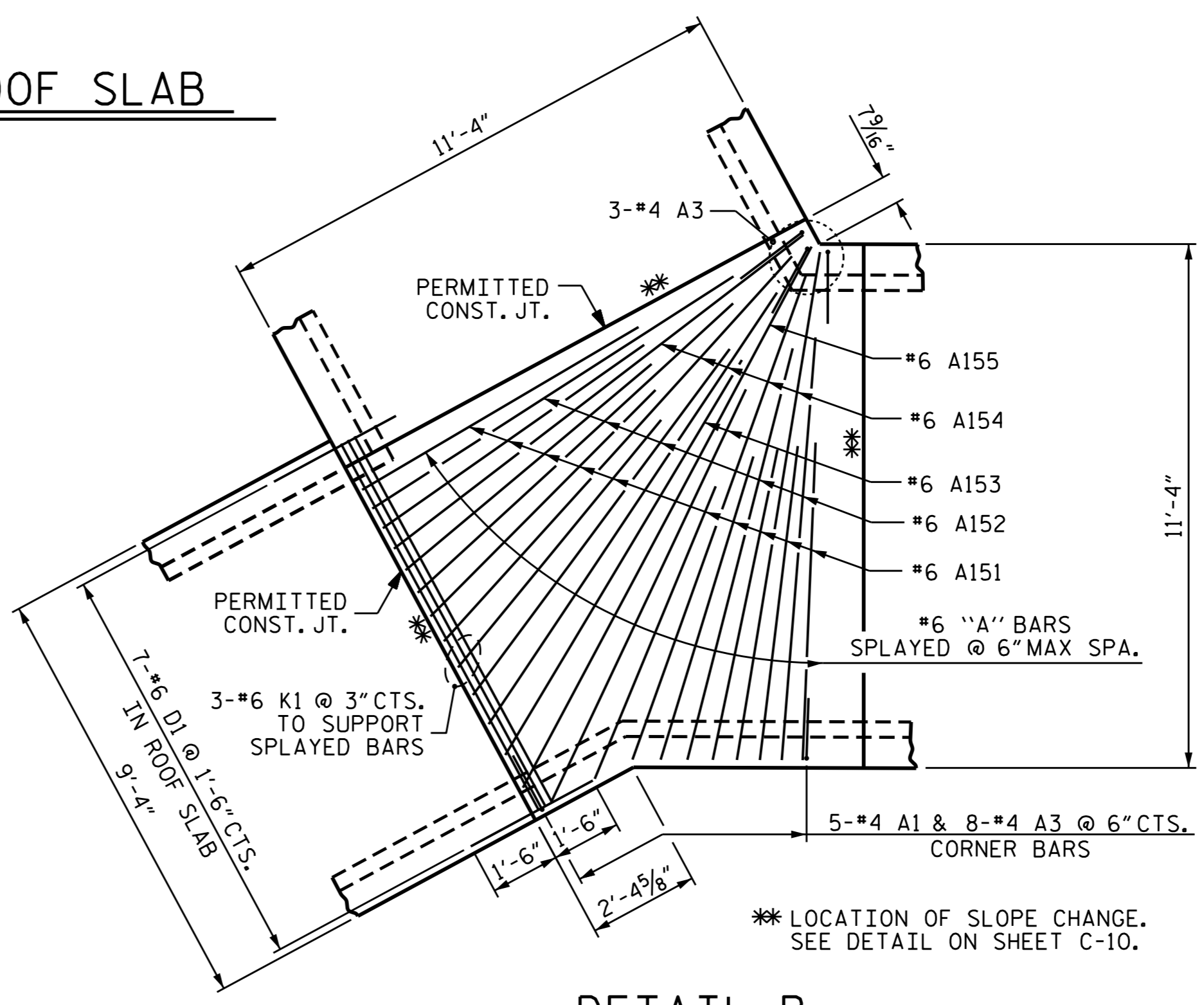
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

SHEET NO. C-10
TOTAL SHEETS 34

CUL #2

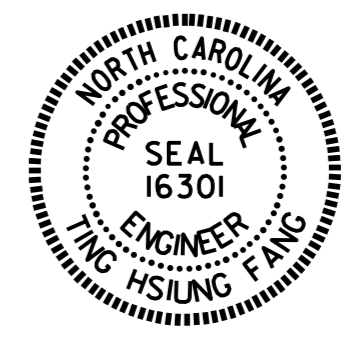


PLAN OF ROOF SLAB



DETAIL B

*4 "C" BARS NOT SHOWN FOR CLARITY.



Designed by: *Ting Fang*
E7208840097435 7/15/2016

PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 1+26.46 -SPBY8-

SHEET 5 OF 7

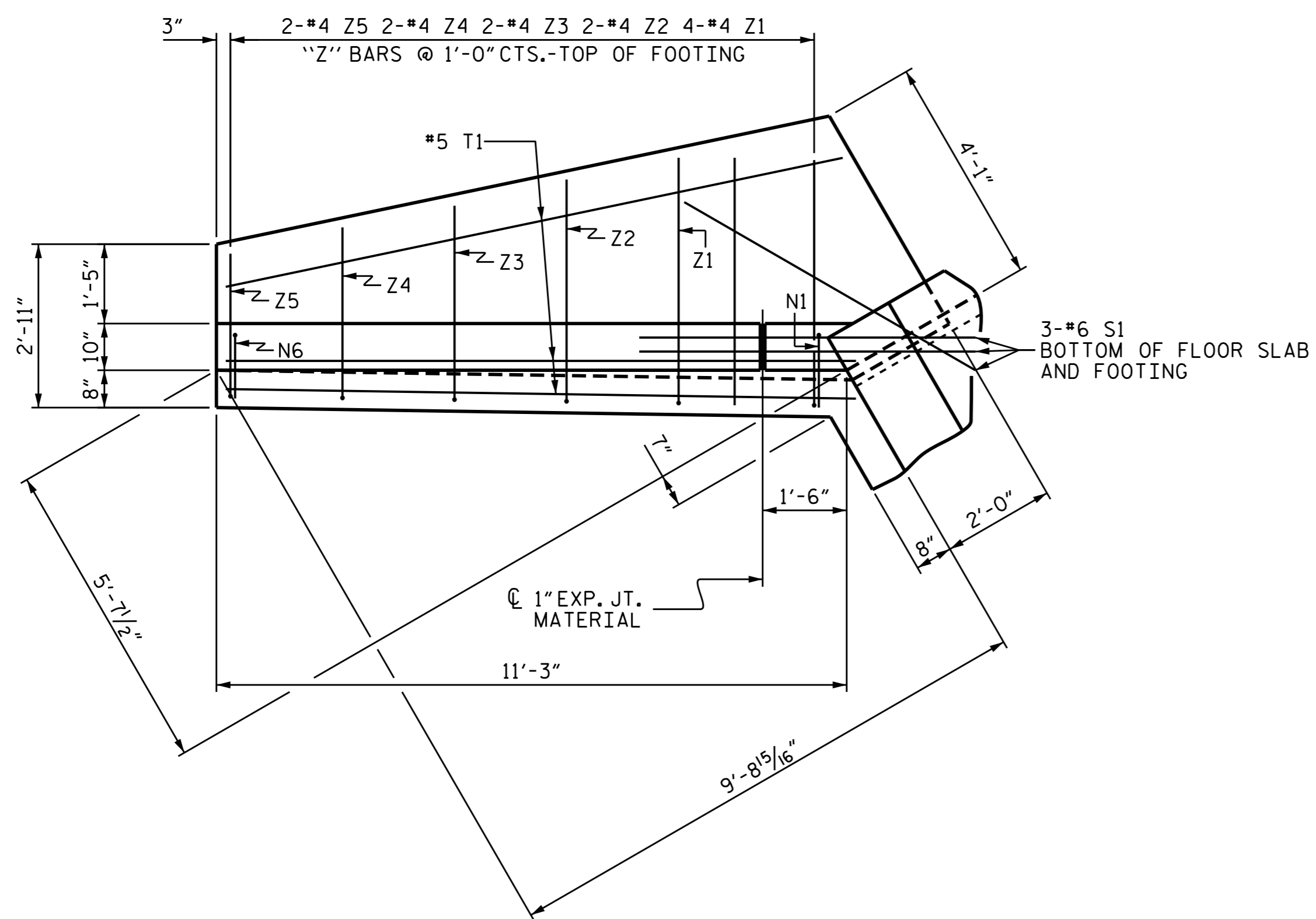
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
CULVERTS #1 & #2
PHASE C1&2-P2
ROOF SLAB DETAILS

DRAWN BY : A. SORSENGINH DATE : 1/2016
CHECKED BY : T. H. FANG DATE : 5/15/16
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE : 5/26/16

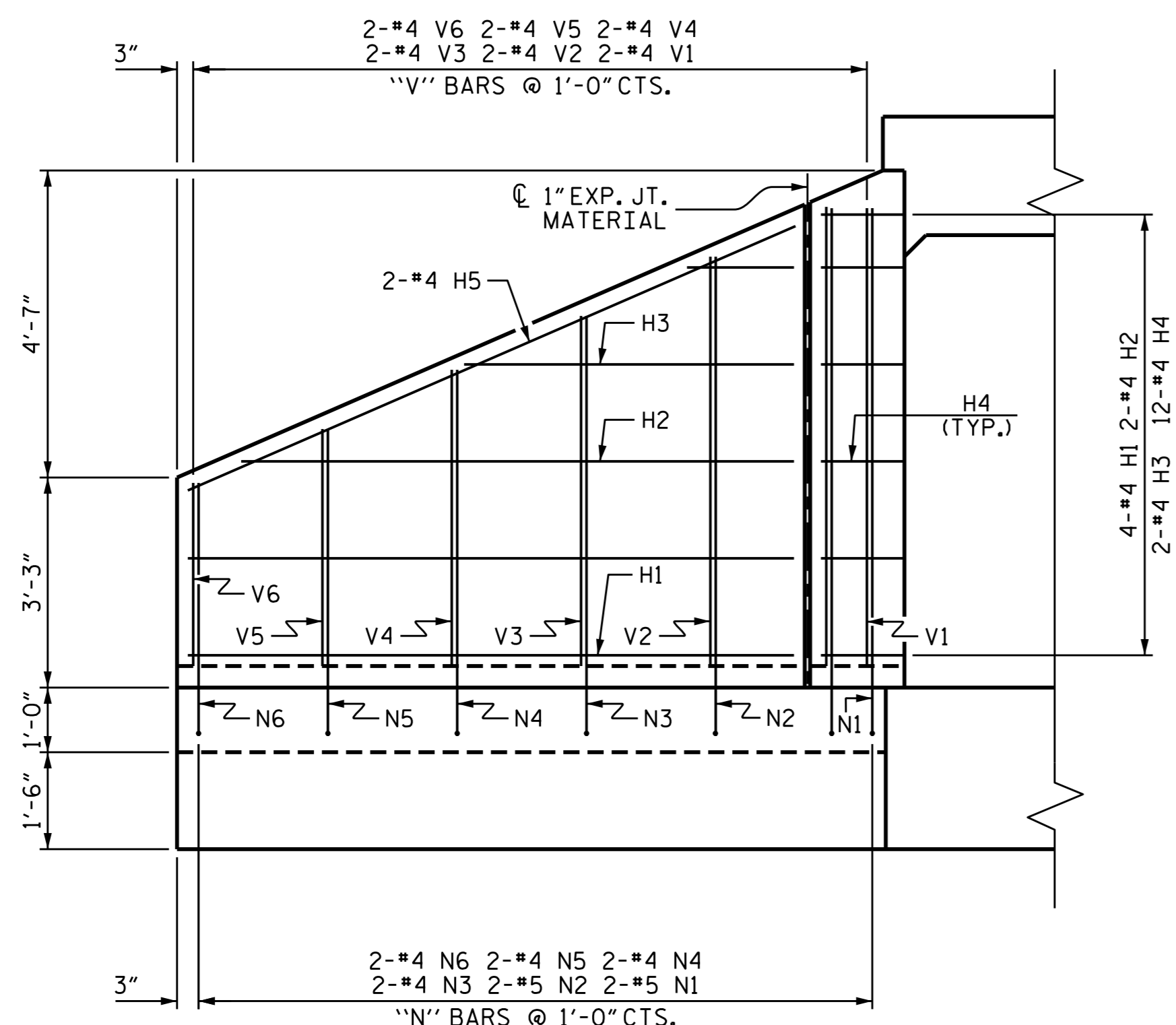
DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

REVISIONS						SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:	C-11	
1			3			TOTAL	34
2			4			SHEETS	

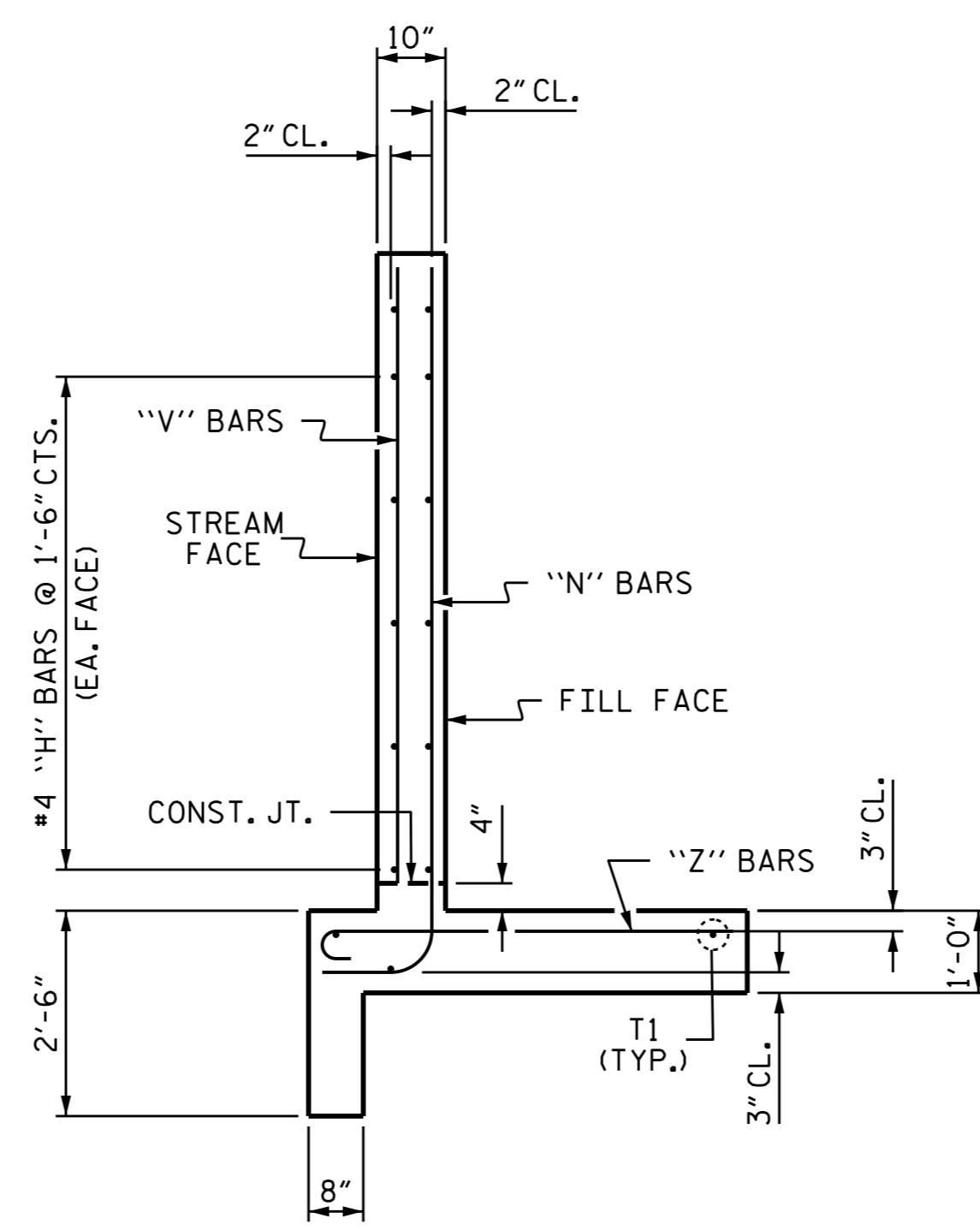
CUL #2



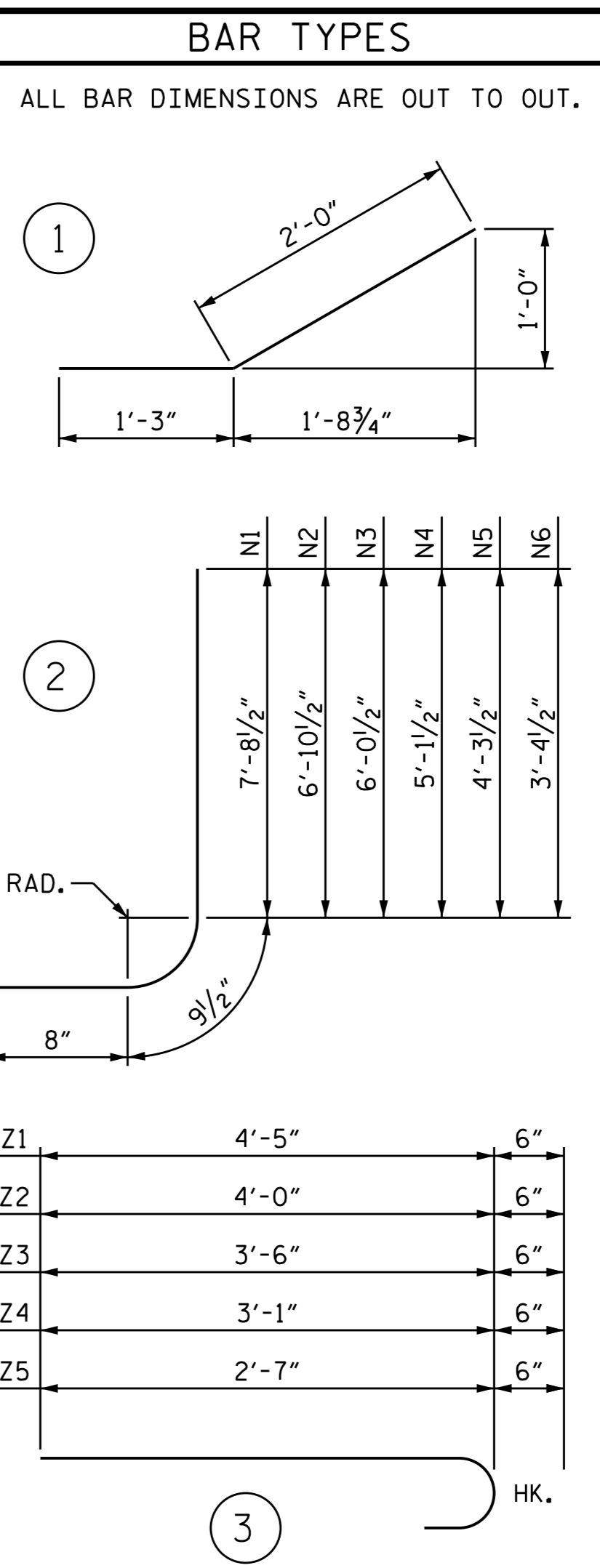
PLAN



ELEVATION



TYPICAL WING SECTION



BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	8	#4	STR	9'-4"	50
H2	4	#4	STR	8'-6"	23
H3	4	#4	STR	5'-1"	14
H4	24	#4	1	3'-3"	52
H5	4	#4	STR	10'-3"	27
N1	4	#5	2	9'-2"	38
N2	4	#5	2	8'-4"	35
N3	4	#4	2	7'-6"	20
N4	4	#4	2	6'-7"	18
N5	4	#4	2	5'-9"	15
N6	4	#4	2	4'-10"	13
S1	6	#6	STR	6'-0"	54
T1	6	#5	STR	11'-3"	70
V1	4	#4	STR	7'-1"	19
V2	4	#4	STR	6'-4"	17
V3	4	#4	STR	5'-5"	14
V4	4	#4	STR	4'-7"	12
V5	4	#4	STR	3'-8"	10
V6	4	#4	STR	2'-10"	8
Z1	8	#4	3	4'-11"	26
Z2	4	#4	3	4'-6"	12
Z3	4	#4	3	4'-0"	11
Z4	4	#4	3	3'-7"	10
Z5	4	#4	3	3'-1"	8

TOTAL REINFORCING STEEL FOR 2 WINGS 576 LBS

CLASS A CONCRETE
 2 WINGS 8.6 CY
 1 HEADWALL 0.5 CY
 1 END CURTAIN WALL 0.5 CY
 TOTAL 9.6 CY

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 1+26.46 -SPBY8-

SHEET 6 OF 7

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD WINGS
 FOR C1&2-P2
 SINGLE 10' X 7' RCBC
 H = 7'-0" SLOPE = 2:1
 90° SKEW INLET WING



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

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ASSEMBLED BY : A. SORSENGNH DATE : 1/2016
 CHECKED BY : T. H. FANG DATE : 5/15/16
 DRAWN BY : CCJ 10/99
 CHECKED BY : RWW 03/00

**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		
						MOMENT				SHEAR						
						LIVE-LOAD FACTORS (LL)	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	1.08	--	1.75	1.08	1	BOTTOM SLAB	5.33	1.19	1	TOP SLAB	0.81		
	HL-93 (OPERATING)	N/A		1.40	--	1.35	1.40	1	BOTTOM SLAB	5.33	1.54	1	TOP SLAB	0.81		
	HS-20 (INVENTORY)	36.000	②	1.52	54.85	1.75	1.52	1	BOTTOM SLAB	5.33	1.56	1	TOP SLAB	0.81		
	HS-20 (OPERATING)	36.000		1.98	71.10	1.35	1.98	1	BOTTOM SLAB	5.33	2.02	1	TOP SLAB	0.81		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		2.78	37.48	1.40	2.78	1	BOTTOM SLAB	5.33	2.82	1	TOP SLAB	0.81		
		SNGARBS2	20.000		2.60	52.01	1.40	2.60	1	BOTTOM SLAB	5.33	2.64	1	TOP SLAB	0.81	
		SNAGRIS2	22.000		2.78	61.08	1.40	2.78	1	BOTTOM SLAB	5.33	2.82	1	TOP SLAB	0.81	
		SNCOTTS3	27.250	③	1.36	36.95	1.40	1.36	1	BOTTOM SLAB	5.33	1.48	1	TOP SLAB	0.81	
		SNAGGRS4	34.925		1.46	51.04	1.40	1.46	1	BOTTOM SLAB	5.33	1.59	1	BOTTOM SLAB	0.87	
		SNS5A	35.550		1.46	51.94	1.40	1.46	1	BOTTOM SLAB	5.33	1.59	1	BOTTOM SLAB	0.87	
		SNS6A	39.950		1.46	58.37	1.40	1.46	1	BOTTOM SLAB	5.33	1.59	1	BOTTOM SLAB	0.87	
		SNS7B	42.000		1.46	61.37	1.40	1.46	1	BOTTOM SLAB	5.33	1.59	1	BOTTOM SLAB	0.87	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.39	78.89	1.40	2.39	1	BOTTOM SLAB	5.33	2.56	1	BOTTOM SLAB	0.87	
		TNT4A	33.075		1.62	53.55	1.40	1.62	1	BOTTOM SLAB	5.33	1.76	1	TOP SLAB	0.81	
		TNT6A	41.600		1.43	59.55	1.40	1.43	1	BOTTOM SLAB	5.33	1.56	1	BOTTOM SLAB	0.87	
		TNT7A	42.000		1.55	65.02	1.40	1.55	1	BOTTOM SLAB	5.33	1.69	1	BOTTOM SLAB	0.87	
		TNT7B	42.000		1.47	61.55	1.40	1.47	1	BOTTOM SLAB	5.33	1.59	1	BOTTOM SLAB	0.87	
		TNAGRIT4	43.000		1.54	66.35	1.40	1.54	1	BOTTOM SLAB	5.33	1.68	1	TOP SLAB	0.81	
		TNAGT5A	45.000		1.58	71.00	1.40	1.58	1	BOTTOM SLAB	5.33	1.72	1	TOP SLAB	0.81	
		TNAGT5B	45.000		1.62	72.86	1.40	1.62	1	BOTTOM SLAB	5.33	1.76	1	TOP SLAB	0.81	

LOAD FACTORS:

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

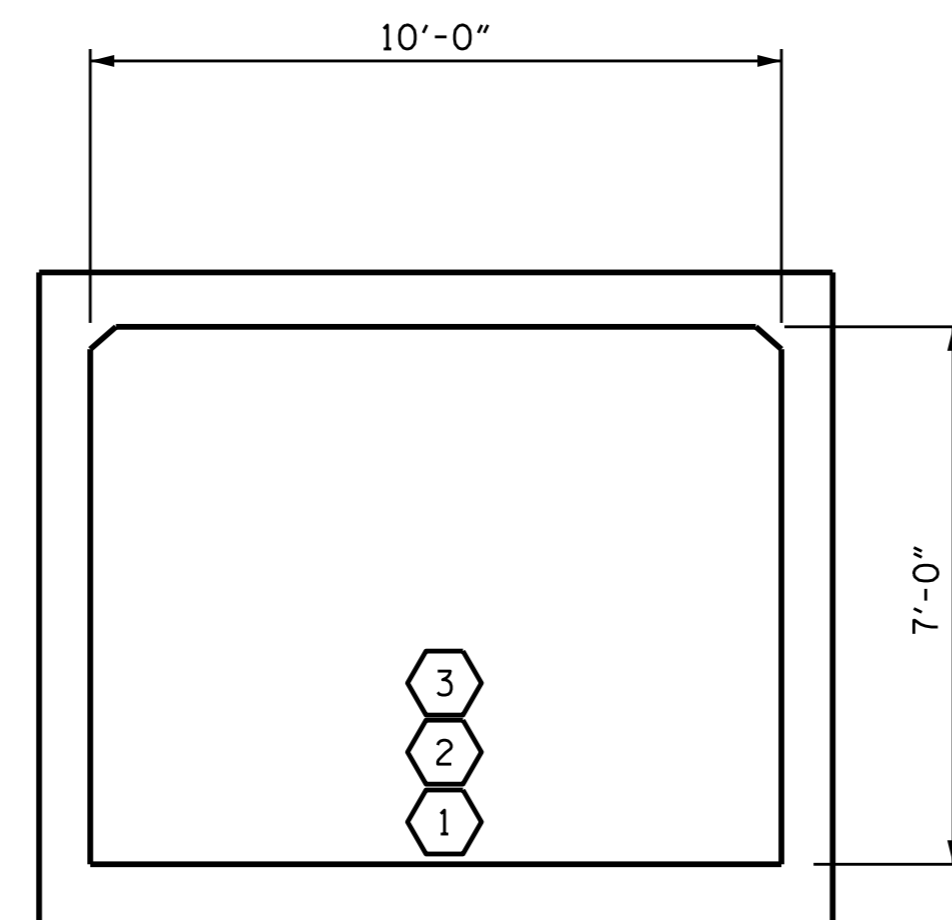
NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

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

③	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. U-2524D
GUILFORD COUNTY
 STATION: 1+26.46 -SPBY8-

SHEET 7 OF 7



DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
 SIGNATURES COMPLETED

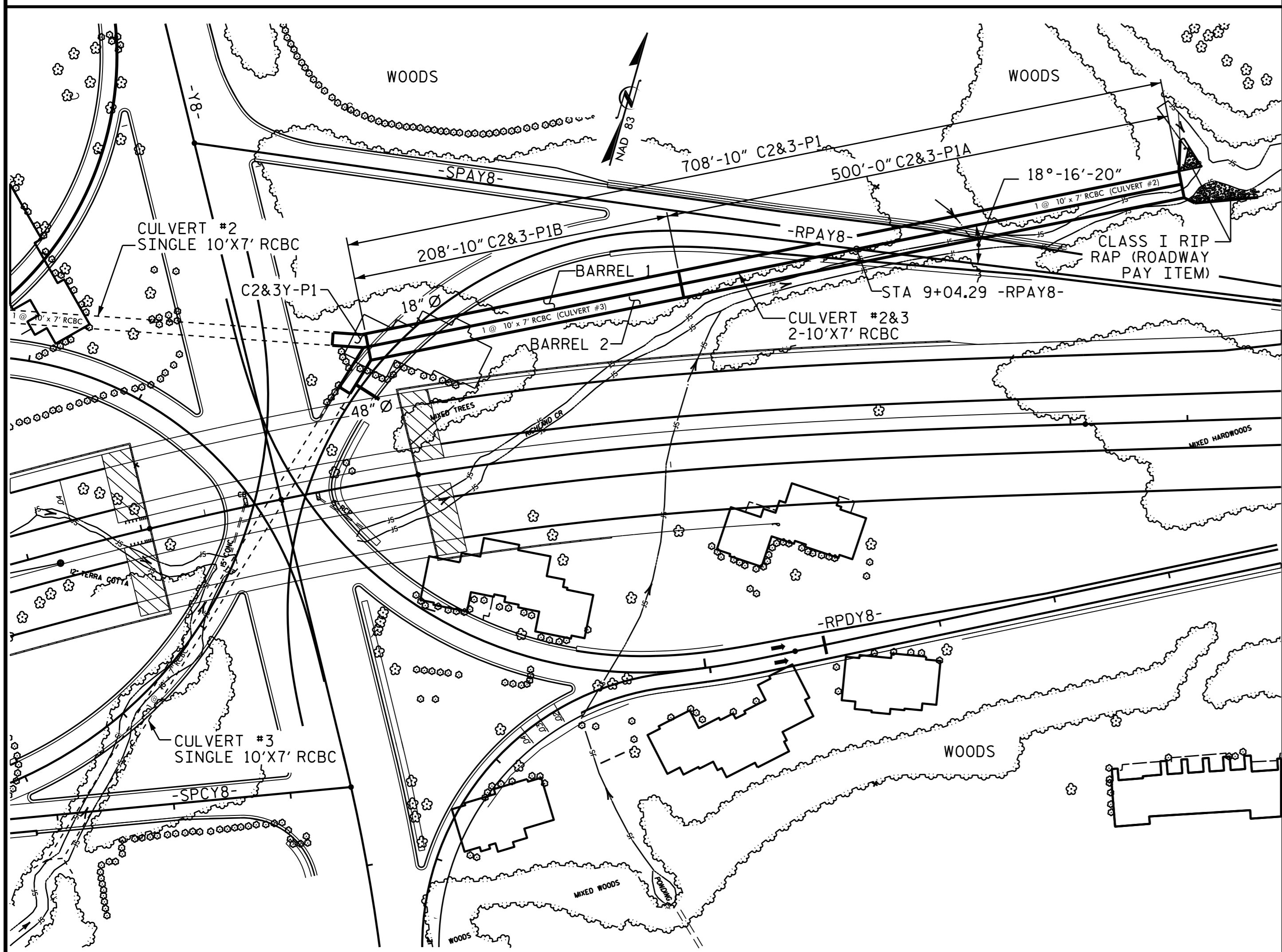
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD
 LRFR SUMMARY FOR
 REINFORCED CONCRETE
 BOX CULVERTS
 (NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO. C-13
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

ASSEMBLED BY : P. K. NEWTON DATE : 7/8/16
 CHECKED BY : T. H. FANG DATE : 7/11/16
 DRAWN BY : WMC 7/11 REV. 10/1/11 MAA/GM
 CHECKED BY : CM 7/11

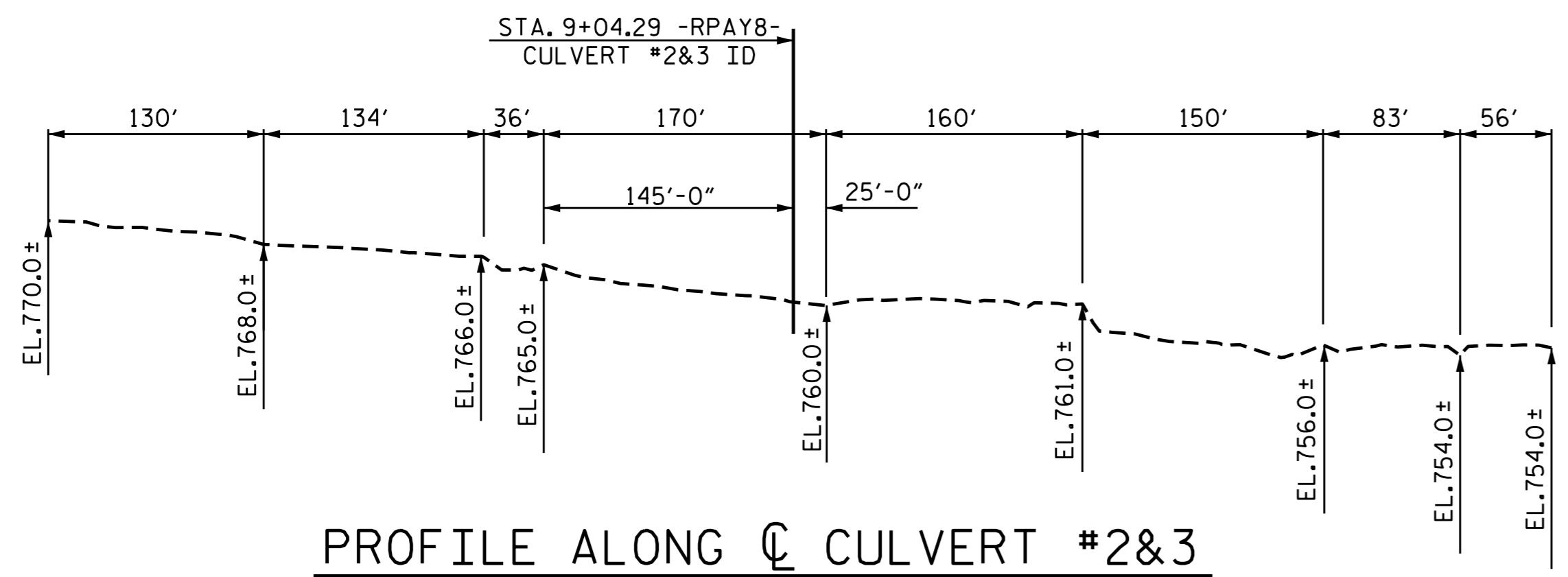
BM #18: RR SPIKE SET IN 22" OAK, STA. 10+00 -Y8-, N 18° 44' 24.6" W 575.94', EL. 808.40'

F.A. PROJECT NO. NHF-0708(53)



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH



PROFILE ALONG CULVERT #2&3

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

CULVERT #2&3	
GRADE DATA	
GRADE POINT ELEVATION @ STA. 9+04.29 -RPAY8-	= 786.82'
BED ELEVATION @ STA. 9+04.29 -RPAY8-	= 757.0'
ROADWAY FILL SLOPES	= 2:1

BARREL 1 - CULVERT #2

HYDRAULIC DATA	
DESIGN DISCHARGE	= 390 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 771.70
DRAINAGE AREA	= 0.38 SQ. MI.
BASE DISCHARGE (Q100)	= 410 CFS
BASE HIGH WATER ELEVATION	= 771.88

OVERTOPPING FLOOD DATA	
OVERTOPPING DISCHARGE	= >470+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= >500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 777.83

GRADE DATA	
GRADE POINT ELEVATION @ STA. 1+26.46 -SPBY8-	= 778.54'
BED ELEVATION @ STA. 1+26.46 -SPBY8-	= 765.14'
ROADWAY FILL SLOPES	= 4:1

BARREL 2 - CULVERT #3

HYDRAULIC DATA	
DESIGN DISCHARGE	= 712 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 772.00
DRAINAGE AREA	= 1.12 SQ. MI.
BASE DISCHARGE (Q100)	= 902 CFS
BASE HIGH WATER ELEVATION	= 773.64

OVERTOPPING FLOOD DATA	
OVERTOPPING DISCHARGE	= 1100 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 100+ YRS.
OVERTOPPING FLOOD ELEVATION	= 777.39

GRADE DATA	
GRADE POINT ELEVATION @ STA. 2+22.93 -SPCY8-	= 777.95'
BED ELEVATION @ STA. 2+22.93 -SPCY8-	= 762.42'
ROADWAY FILL SLOPES	= 2:1

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE	
PHASE C2&3-P1	2,014.1 C.Y.
PHASE C2&3Y-P1	81.1 C.Y.
TOTAL	2,095.2 C.Y.
REINFORCING STEEL	
PHASE C2&3-P1	203,135 LBS.
PHASE C2&3Y-P1	13,025 LBS.
TOTAL	216,160 LBS.
FOUNDATION COND. MATERIAL	
PHASE C2&3-P1	1,300 TONS
PHASE C2&3Y-P1	87 TONS
TOTAL	1,387 TONS
CULVERT EXCAVATION (TOTAL)	LUMP SUM

NOTES

- ASSUMED LIVE LOAD -----HL-93 OR ALTERNATE LOADING.
- DESIGN FILL MAX./MIN. ----- 25'/8'
- FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTE SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTING AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS, AND WING FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALL.
- 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 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- STEEL IN THE BOTTOM SLAB MAY BE SPliced AT THE PERMITTED CONSTRUCTION JOINT AT THE CONTRACTOR'S OPTION. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL AND BOTH FACES OF INTERIOR WALLS ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE BARS FROM WHICH THE SAMPLES ARE TAKEN MUST THEN BE SPliced WITH REPLACEMENT BARS OF THE SIZE AND LENGTH OF THE SAMPLE, PLUS A MINIMUM LAP SPLICE OF THIRTY BAR DIAMETERS. PAYMENT FOR THE SAMPLES OF REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.
- ALL PIPES THROUGH THE SIDEWALL OF THE CULVERT SHALL BE LOCATED BY THE ENGINEER. THE REINFORCING STEEL SHALL BE FIELD BENT AS NECESSARY TO CLEAR PIPE.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROLS PLANS.
- A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT AT WING 2 AND AT THE JOINT BETWEEN WING 1 AND RETAINING WALL #18.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.
- DETAILED DRAWINGS FOR FALSEWORK AND FORMS FOR CONSTRUCTION OF C2&3-P1A SHALL BE SUBMITTED. SEE SHEET SN.

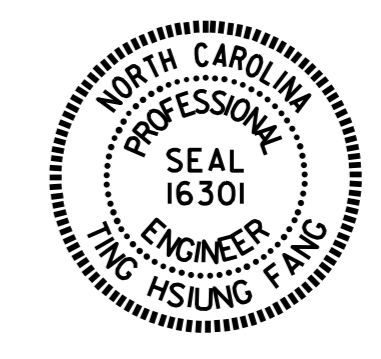
RETAINING WALL #18 CONSTRUCTION SEQUENCE

- STEP 1: RETAINING WALL #18 FROM STA. 6+35.81 -RPAY8- (OFFSET 77.76' RT.) TO STA. 6+26.35 -RPAY8- (OFFSET 73.0' RT.) SHALL BE CONSTRUCTED DURING PHASE I.
- STEP 2: RETAINING WALL #18 FROM STA. 6+26.35 -RPAY8- (OFFSET 73.0' RT.) TO STA. 5+73.18 -RPAY8- (OFFSET 86.09' RT.) SHALL BE CONSTRUCTED DURING PHASE IV AT A TIME WHEN TEMPORARY CHANNEL #1 IS NO LONGER NEEDED AND HAS BEEN REMOVED.

CULVERT #2&3 IS A COMBINATION OF CULVERTS #2 & #3 FROM TWO SINGLE BARRELS TO ONE DOUBLE BARREL

PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 9+04.29 -RPAY8-

SHEET 1 OF 9 STR. #1223



DocuSigned by: Ting Fang 8/16/2016

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

CULVERT #2&3
DOUBLE 10' X 7' RCBC
C2&3-P1 & C2&3Y-P1
18°-16'-20" SKEW

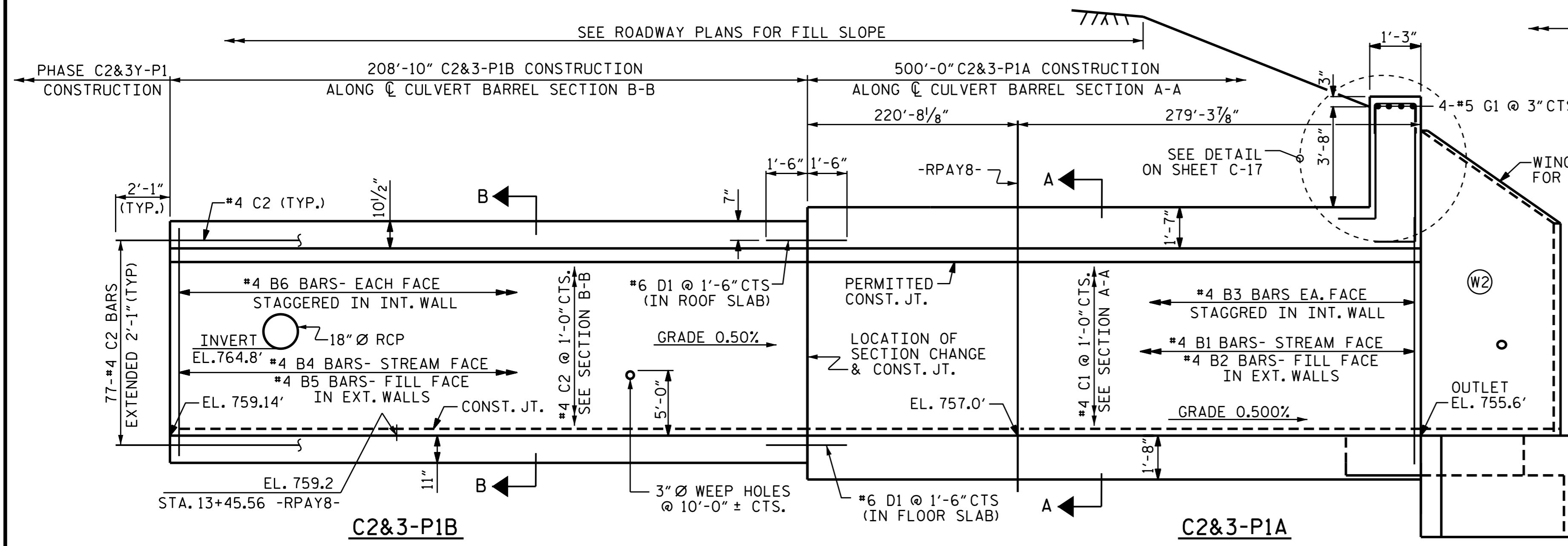
REVISIONS				SHEET NO.
NO.	BY:	DATE:	BY:	DATE:
1			3	
2			4	

TOTAL SHEETS 34

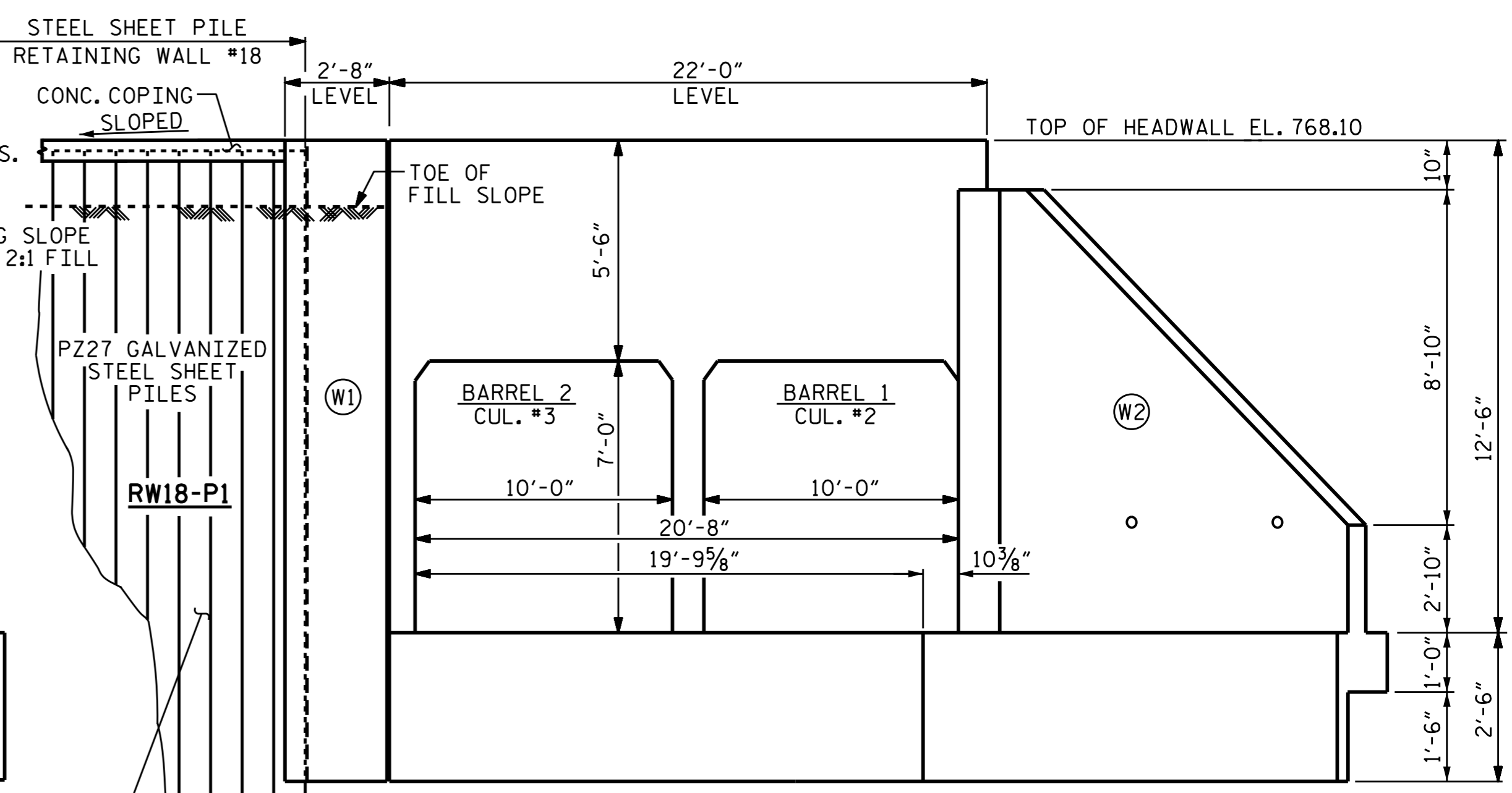
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ADDED NOV. 1, 1990

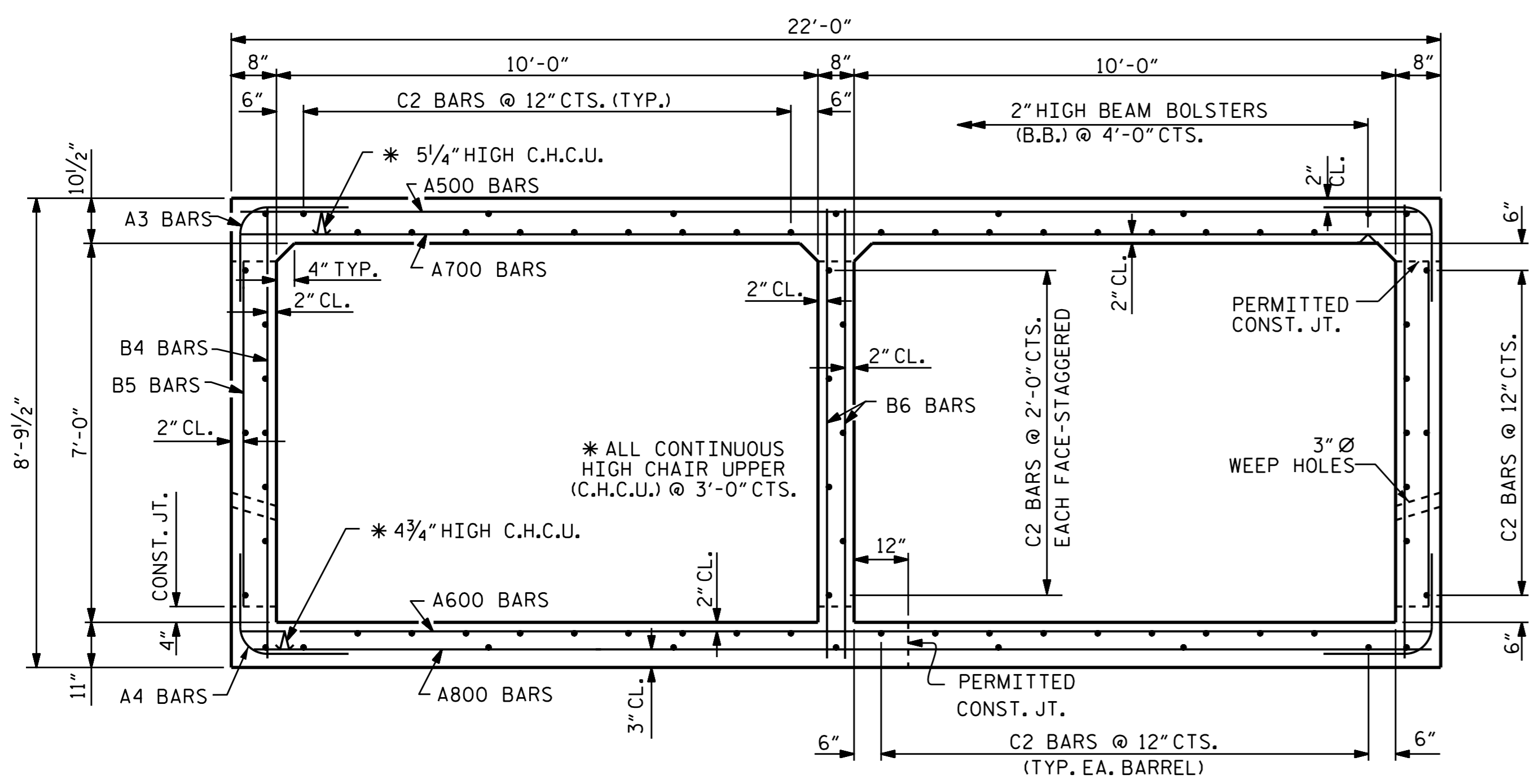
ASSEMBLED BY: E.I. OMILE	DATE: 4/14	SPECIAL
CHECKED BY: T. H. FANG	DATE: 6/6/16	
DRAWN BY: R.W. WRIGHT	DATE: JULY, 1990	STANDARD
CHECKED BY: D.A. GLADDEN	DATE: JULY, 1990	



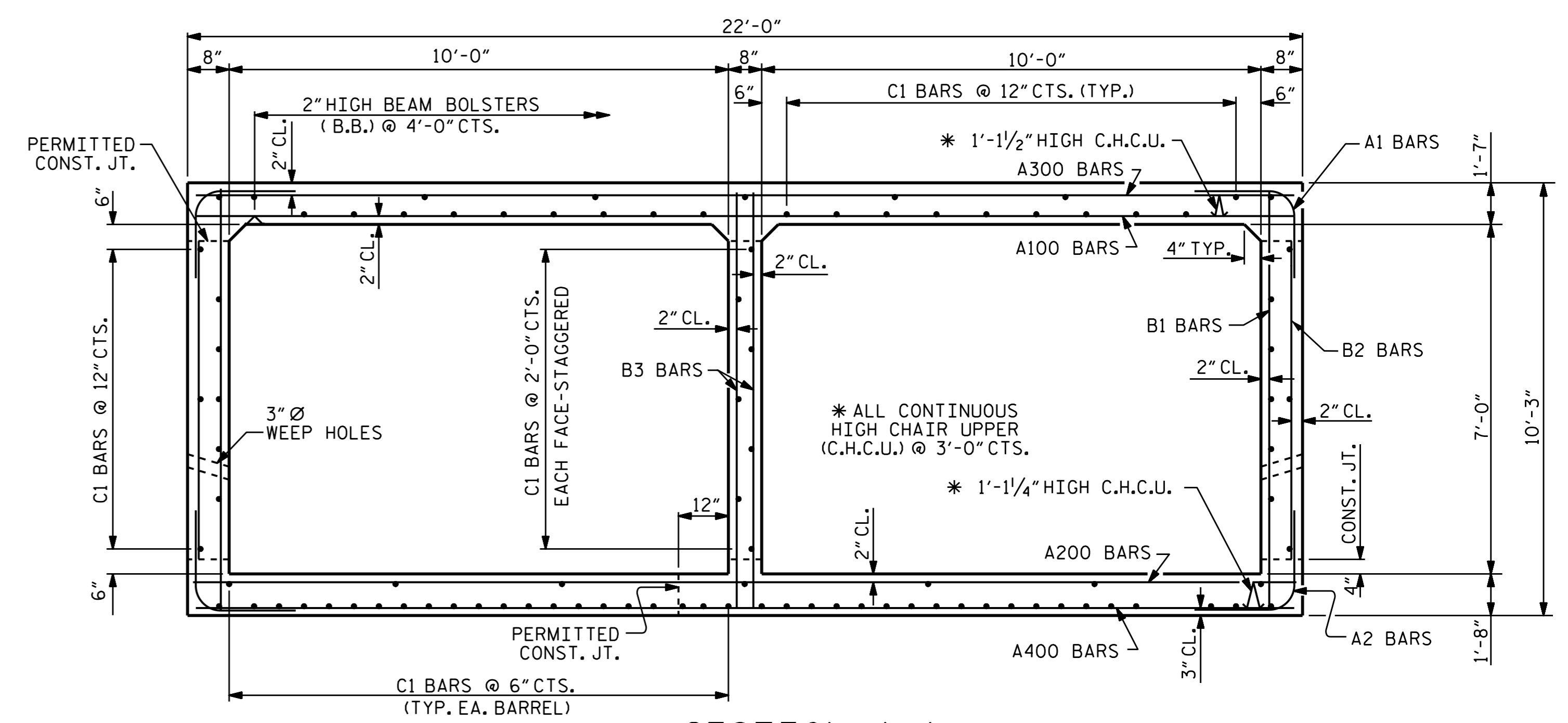
CULVERT SECTION ALONG Q CULVERT



OUTLET END ELEVATION
 LOOKING UPSTREAM

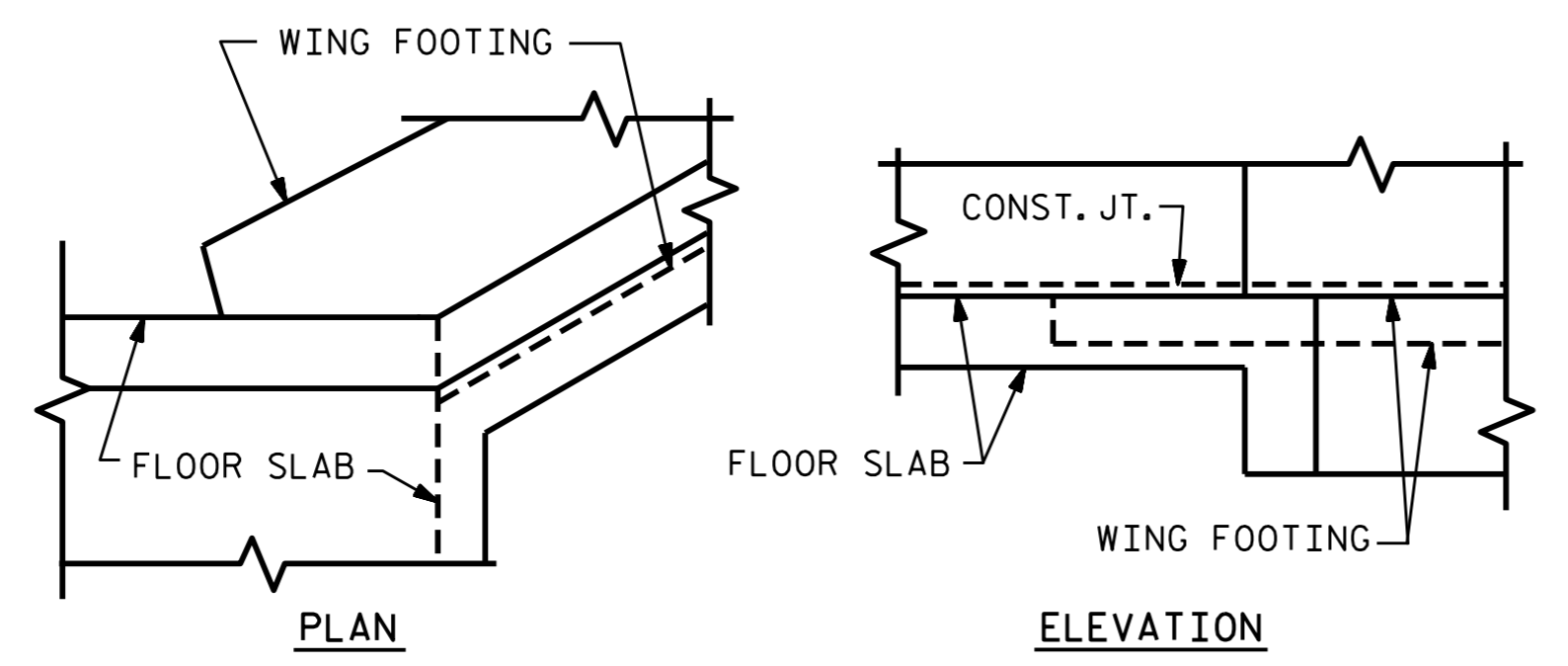


SECTION B-B
 THERE ARE 77 C2 BARS IN SECTION OF BARREL.



SECTION A-A
 THERE ARE 99 C1 BARS IN SECTION OF BARREL.

I HEREBY CERTIFY THESE PLANS
 ARE THE AS-BUILT PLANS



CONNECTION OF WING FOOTING & FLOOR SLAB
 FOR SECTION A-A, THE FLOOR SLAB IS THICKER THAN FOOTING

TOTAL CULVERT C2&3-P1 QUANTITIES			
ITEM	C2&3-P1A	C2&3-P1B	TOTAL C2&3-P1
CLASS A CONCRETE			
BARREL & MISC ITEMS *	1,599.2 C.Y.	414.9 C.Y.	2,014.1 C.Y.
WING (W2)	8.0 C.Y.	--	8.0 C.Y.
SUBTOTAL	1,607.2 C.Y.	414.9 C.Y.	2,022.1 C.Y.
REINFORCING STEEL			
BARREL & MISC. ITEM *	151,350 LBS.	51,260 LBS.	202,610 LBS.
WING (W2)	525 LBS.	--	525 LBS.
SUBTOTAL	151,875 LBS.	51,260 LBS.	203,135 LBS.
CULVERT EXCAVATION	LUMP SUM	LUMP SUM	LUMP SUM
FOUNDATION COND. MAT'L	917 TONS	383 TONS	1,300 TONS

* MISC. ITEMS' QUANTITY INCLUDE HEADWALL, CURTAIN WALL, WING W1, AND COPING.

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-
 SHEET 2 OF 9



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 BARREL STANDARD
 CULVERT #2&3
 DOUBLE 10' X 7' RCBC
 C2&3-P1A & C2&3-P1B
 18°-16'-20" SKEW

REVISIONS
 NO. BY: DATE: NO. BY: DATE:
 1 I.T.F. 7/6/16
 2 J.A.J. 7/16/16

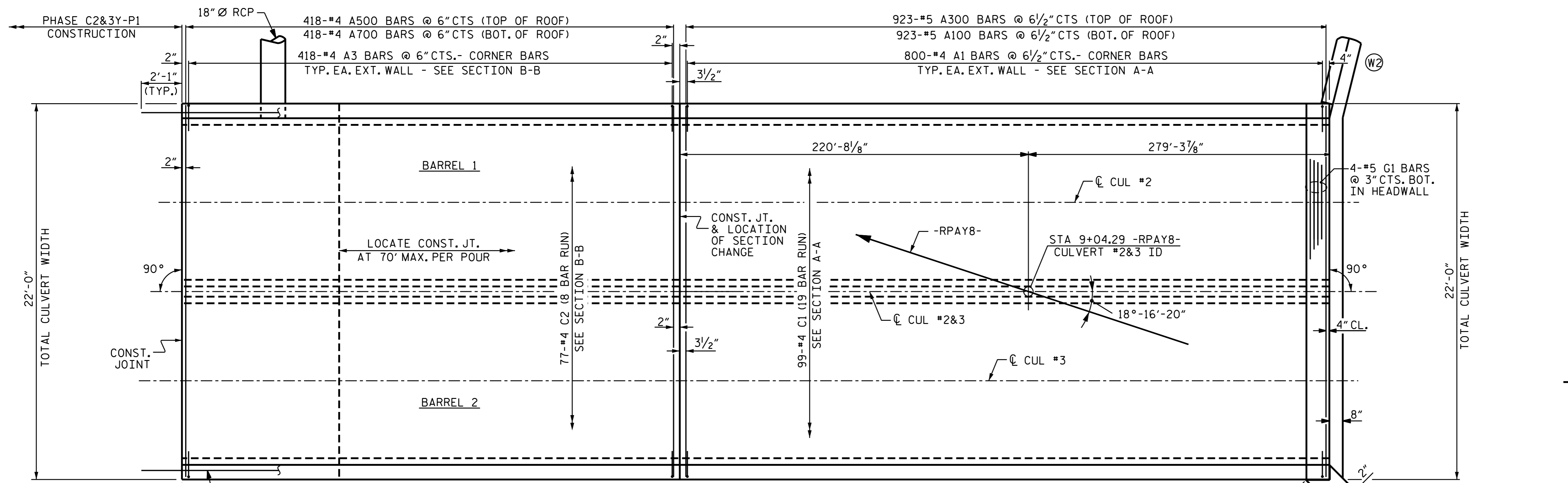
SHEET NO. C-15
 TOTAL SHEETS 34
 CUL #2&3

REVISED 11-9-99 BY M.M. CHECKED BY R.W.M.
 REDRAWN NOV. 1990 BY TSS CHECKED BY ARB

ASSEMBLED BY: M. SHAHIDI DATE: 6/8/16
 CHECKED BY: I. H. FANG DATE: 7/6/16
 DRAWN BY: RALPH D. UNDERWOOD DATE: MAY 1971
 CHECKED BY: JOEL A. JOHNSON DATE: JULY 1971

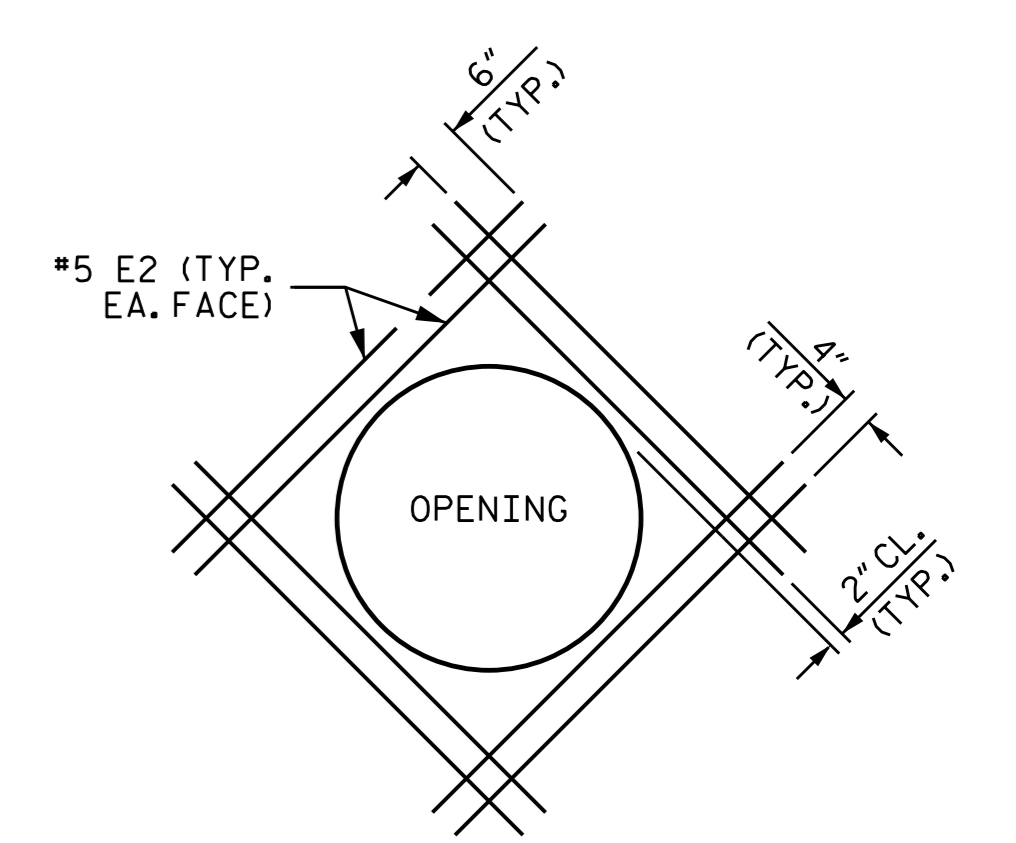
SPECIAL
 STANDARD

DOCUMENT NOT CONSIDERED
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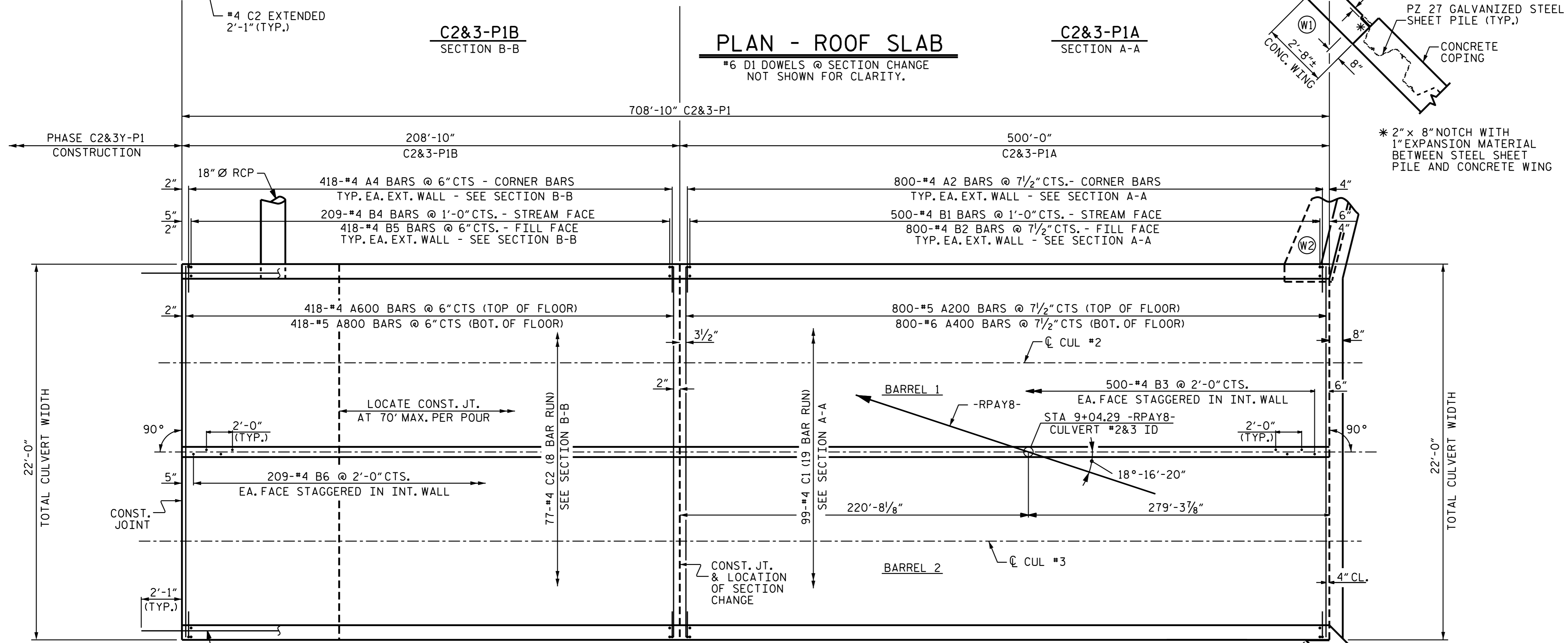
PLAN - ROOF SLAB

*6 D1 DOWELS @ SECTION CHANGE NOT SHOWN FOR CLARITY.



WALL OPENING DETAILS

FOR 18" Ø PIPE THRU EXTERIOR WALL
 FIELD CUT & BEND "B" & "C" BARS AS NEEDED
 TO CLEAR PIPE



PLAN - FLOOR SLAB

*6 D1 DOWELS @ SECTION CHANGE NOT SHOWN FOR CLARITY.



DocuSign by:
 Ting Fang
 8/16/2016

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-

SHEET 3 OF 9

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

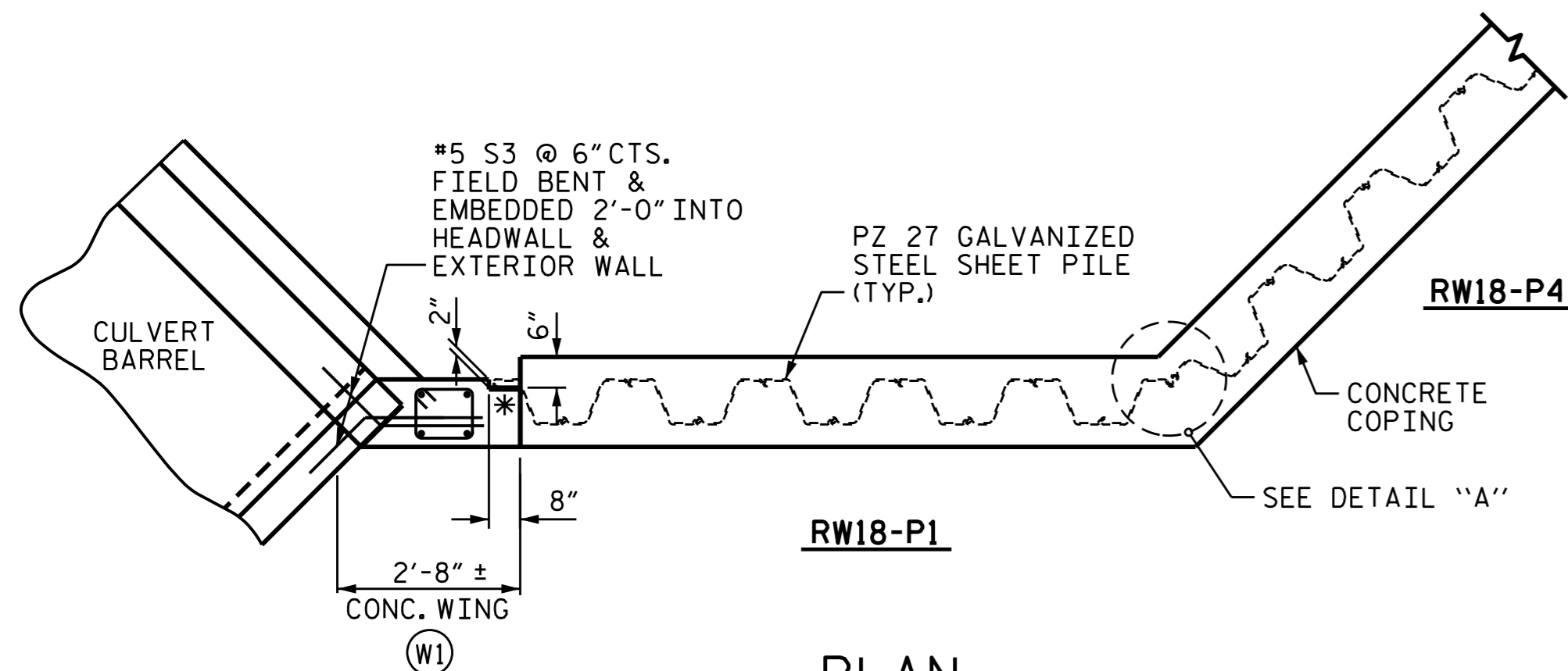
CULVERT #2&3
DOUBLE 10' X 7' RCBC
C2&3-P1A & C2&3-P1B
18°-16'-20" SKEW

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

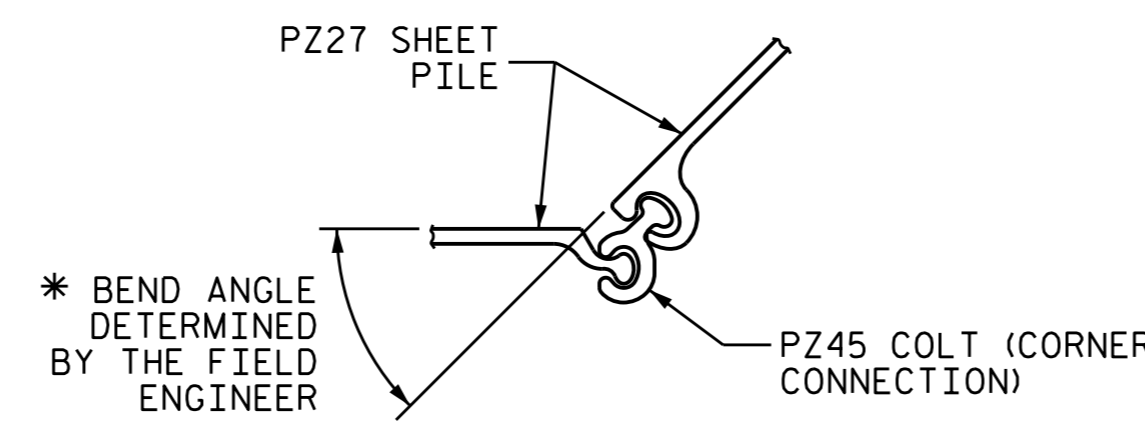
TOTAL SHEETS: 34

DRAWN BY: E. I. OMILE DATE: 3/25/14
 CHECKED BY: T. H. FANG DATE: 6/21/16
 DESIGN ENGINEER OF RECORD: P. K. NEWTON DATE: 7/13/16

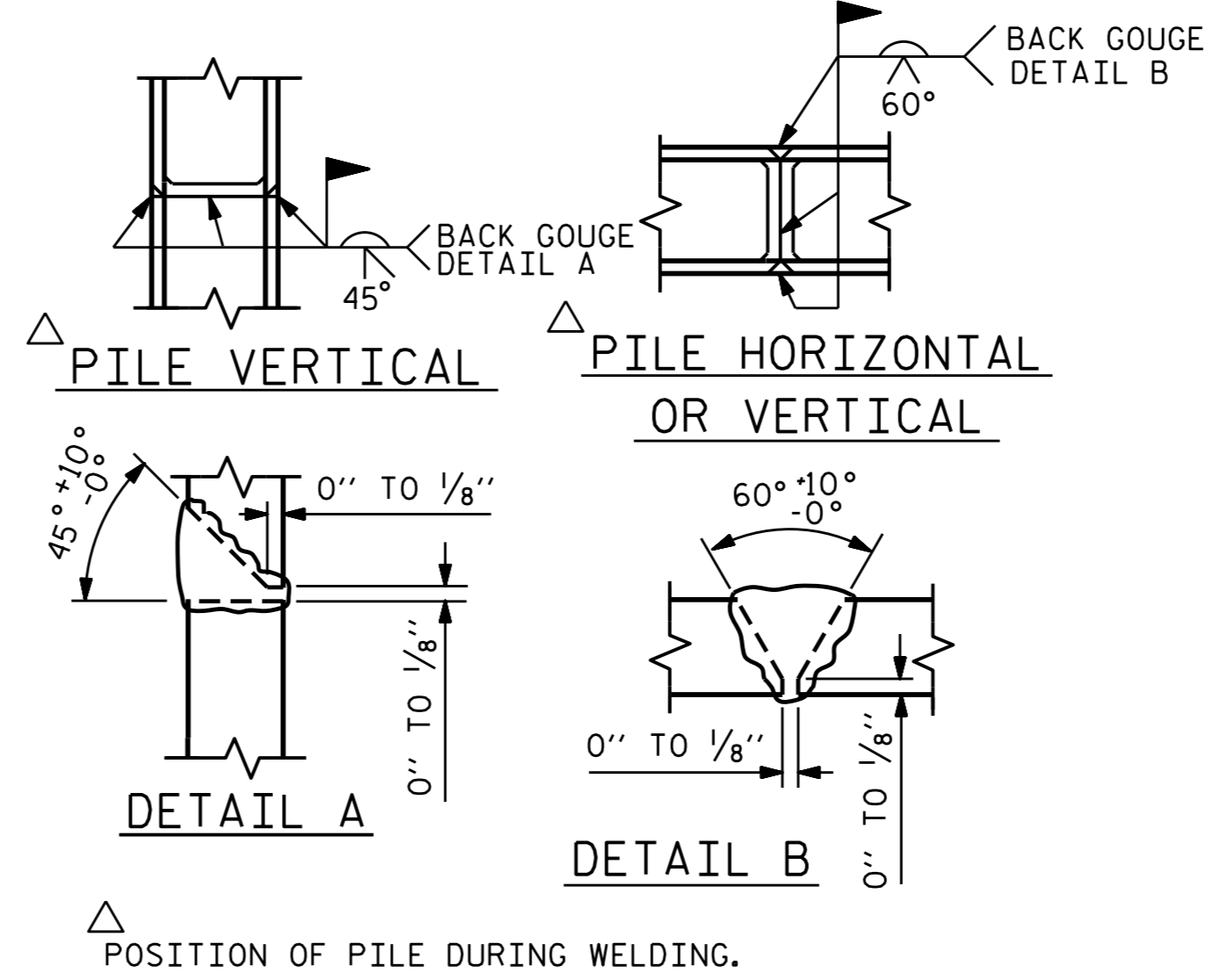
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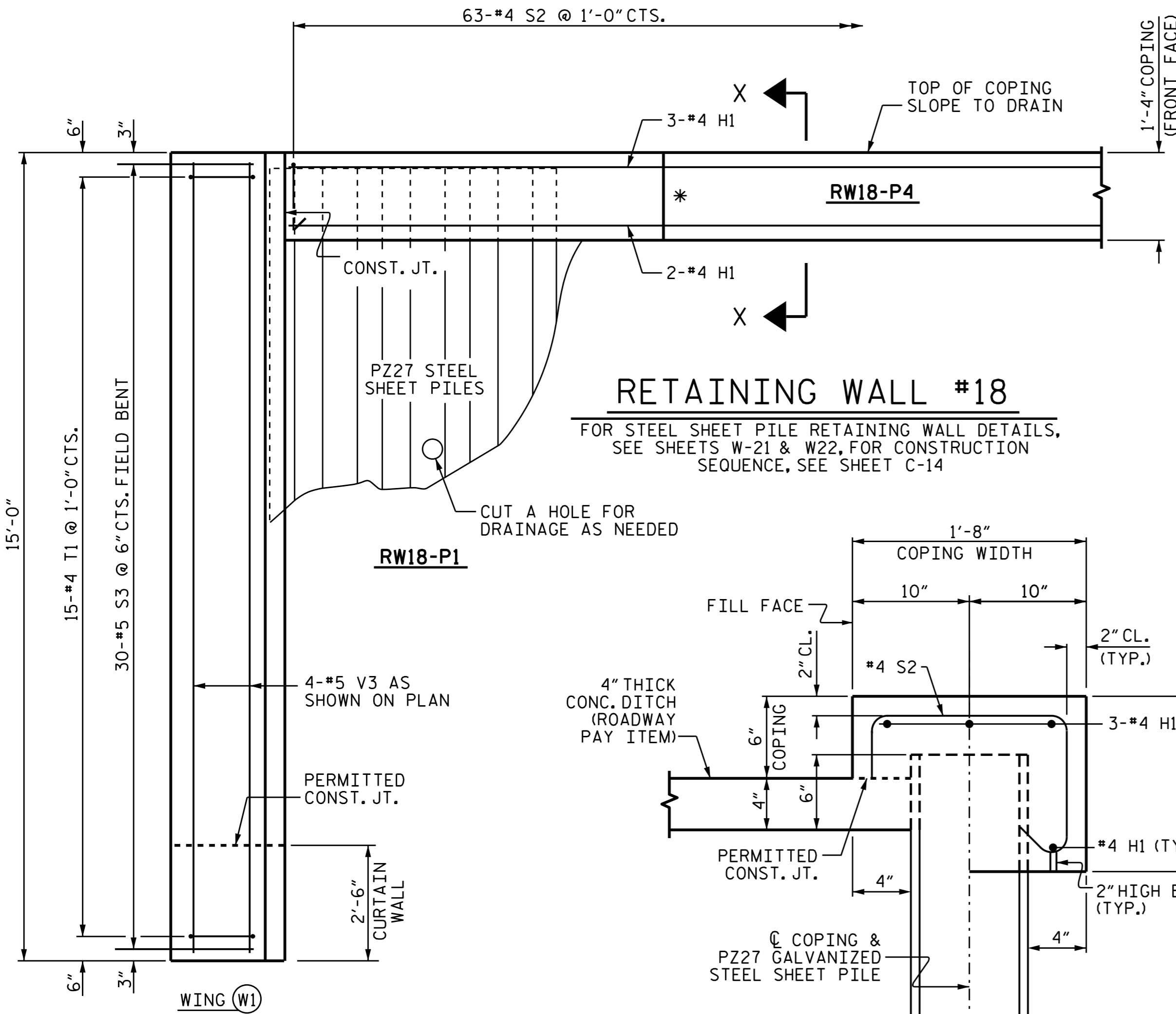
PLAN
 * 2" x 8" NOTCH WITH 1" EXPANSION MATERIAL BETWEEN STEEL SHEET PILE AND CONCRETE WING



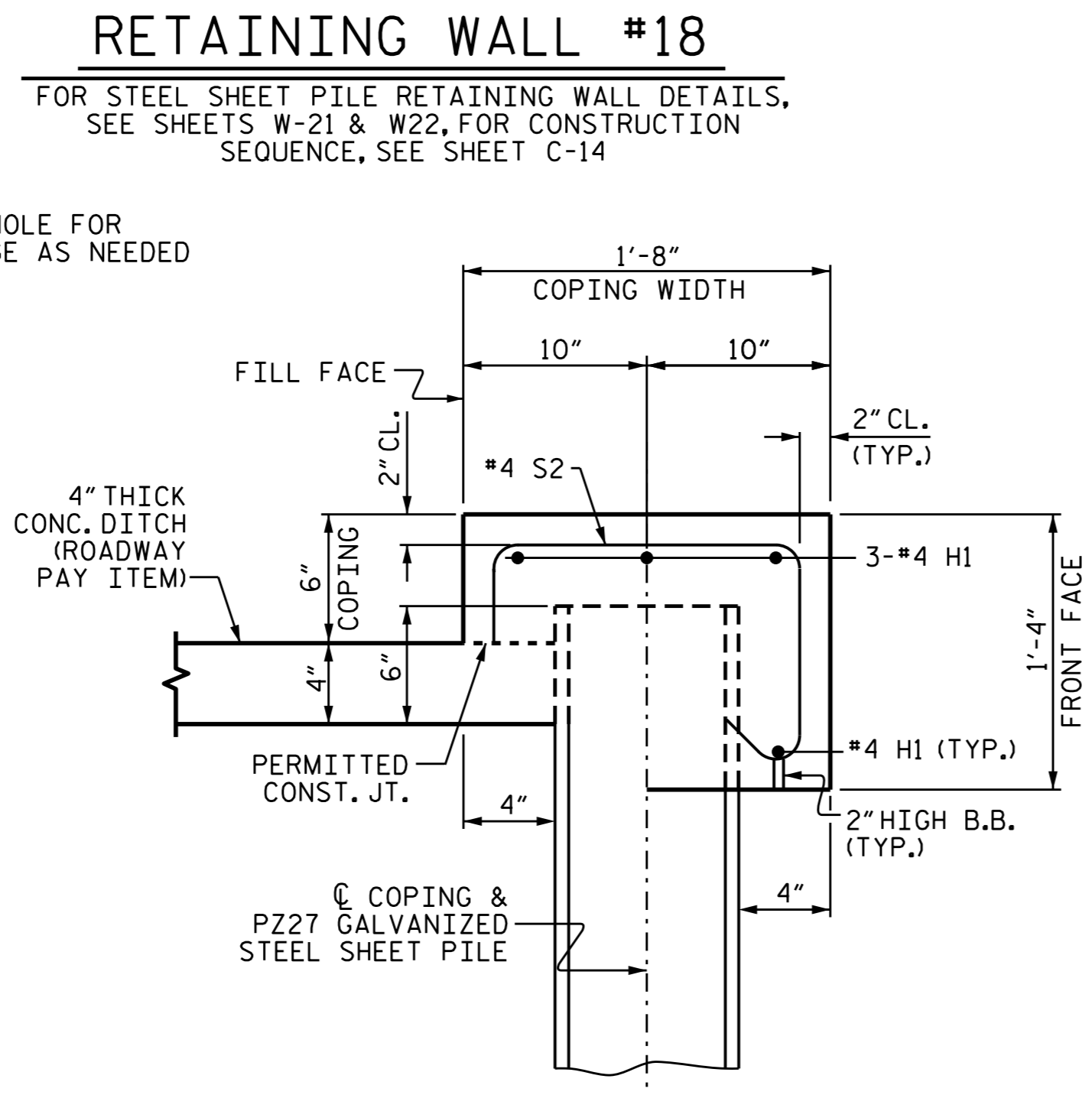
DETAIL "A"



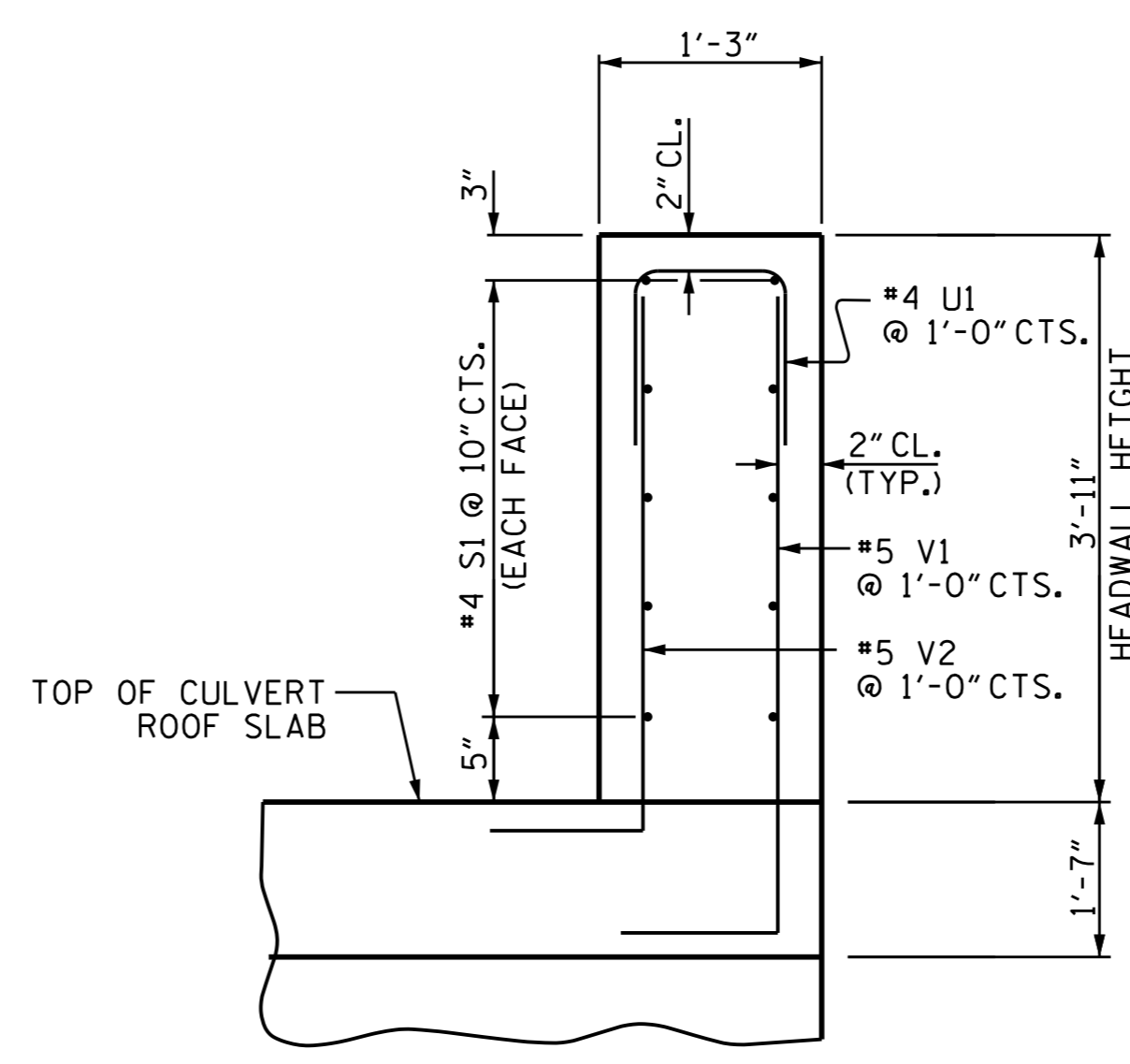
PILE SPLICE DETAILS



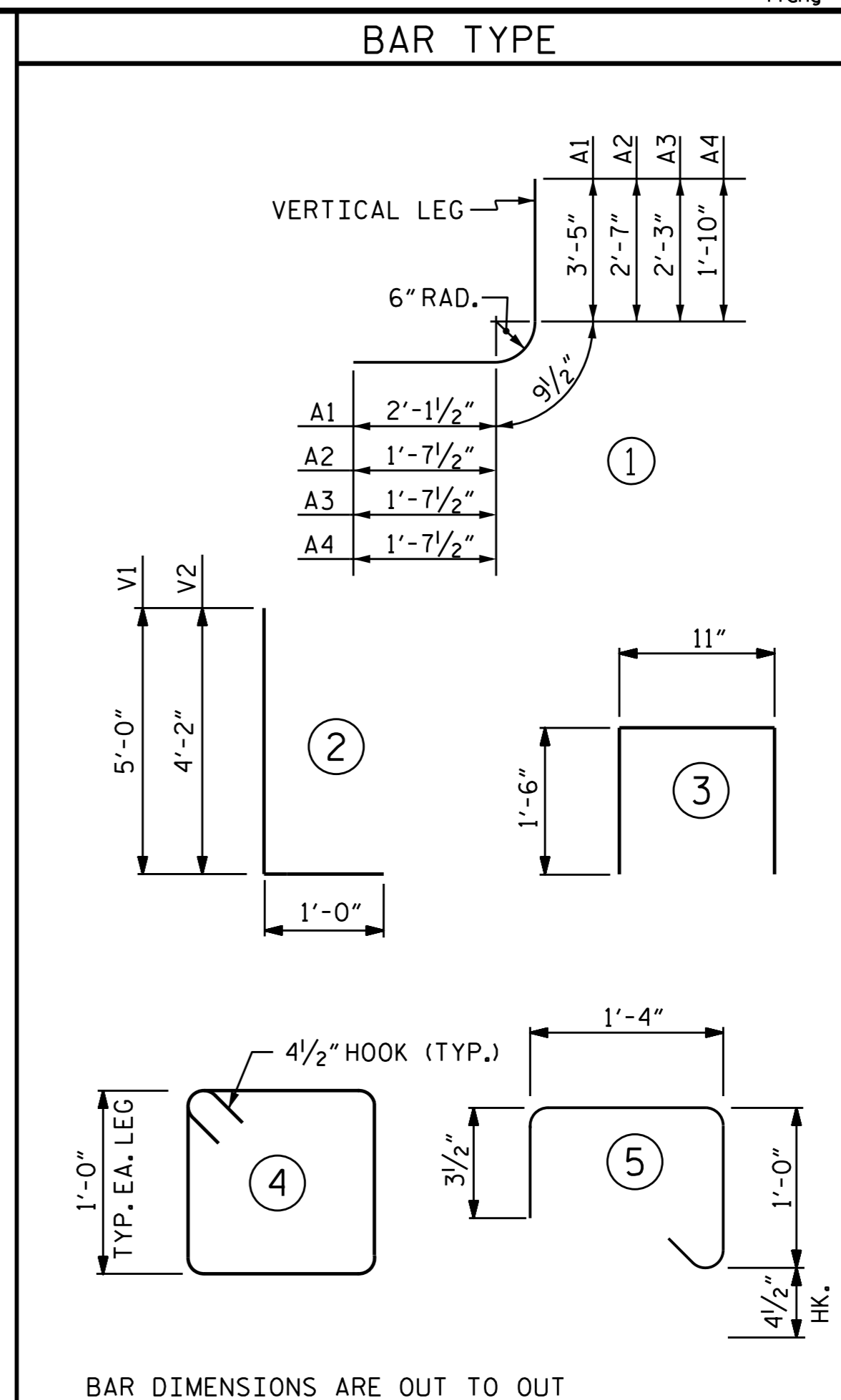
ELEVATION



SECTION X-X
 CONCRETE COPING DETAILS



SECTION THRU HEADWALL



BAR DIMENSIONS ARE OUT TO OUT

BAR SCHEDULE					
PHASE C2&3-P1A CONSTRUCTION					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	1600	#4	1	6'-4"	6,769
A2	1600	#4	1	5'-0"	5,344
A100	923	#5	STR	21'-8"	20,858
A200	800	#5	STR	21'-8"	18,079
A300	923	#5	STR	21'-8"	20,858
A400	800	#6	STR	21'-8"	26,035
B1	1000	#4	STR	9'-11"	6,625
B2	1600	#4	STR	6'-4"	6,769
B3	500	#4	STR	9'-11"	3,312
C1	1881	#4	STR	28'-2"	35,392
D1	48	#6	STR	3'-0"	216
G1	4	#5	STR	21'-8"	90
H1	12	#4	STR	22'-2"	178
S1	10	#4	STR	21'-8"	145
S2	63	#4	5	3'-0"	126
S3	30	#5	STR	4'-6"	141
T1	15	#4	4	4'-9"	38
U1	22	#4	3	3'-11"	58
V1	22	#5	2	6'-0"	138
V2	22	#5	2	5'-2"	119
V3	4	#5	STR	14'-8"	61
REINFORCING STEEL				LBS	**151,350

PHASE C2&3-P1B CONSTRUCTION					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A3	836	#4	1	4'-8"	2,606
A4	836	#4	1	4'-3"	2,373
A500	418	#4	STR	21'-8"	6,050
A600	418	#4	STR	21'-8"	6,050
A700	418	#4	STR	21'-8"	6,050
A800	418	#5	STR	21'-8"	9,446
B4	418	#4	STR	8'-5"	2,350
B5	836	#4	STR	6'-4"	3,537
B6	209	#4	STR	8'-5"	1,175
C2	616	#4	STR	28'-1"	11,556
E2	16	#4	STR	4'-0"	67
REINFORCING STEEL				LBS	51,260

* QUANTITY INCLUDES HEADWALL, CURTAIN WALL, WING W1 AND COPING.

BAR	SIZE	SPLICE LENGTH
"C"	#4	1'-11"

CLASS AA CONCRETE		
3'-11" HEADWALL	4.0	C.Y.
CURTAIN WALL	1.3	C.Y.
WING (W1)	2.3	C.Y.
COPING	4.2	C.Y.
TOTAL	11.8	C.Y.

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-
 SHEET 4 OF 9



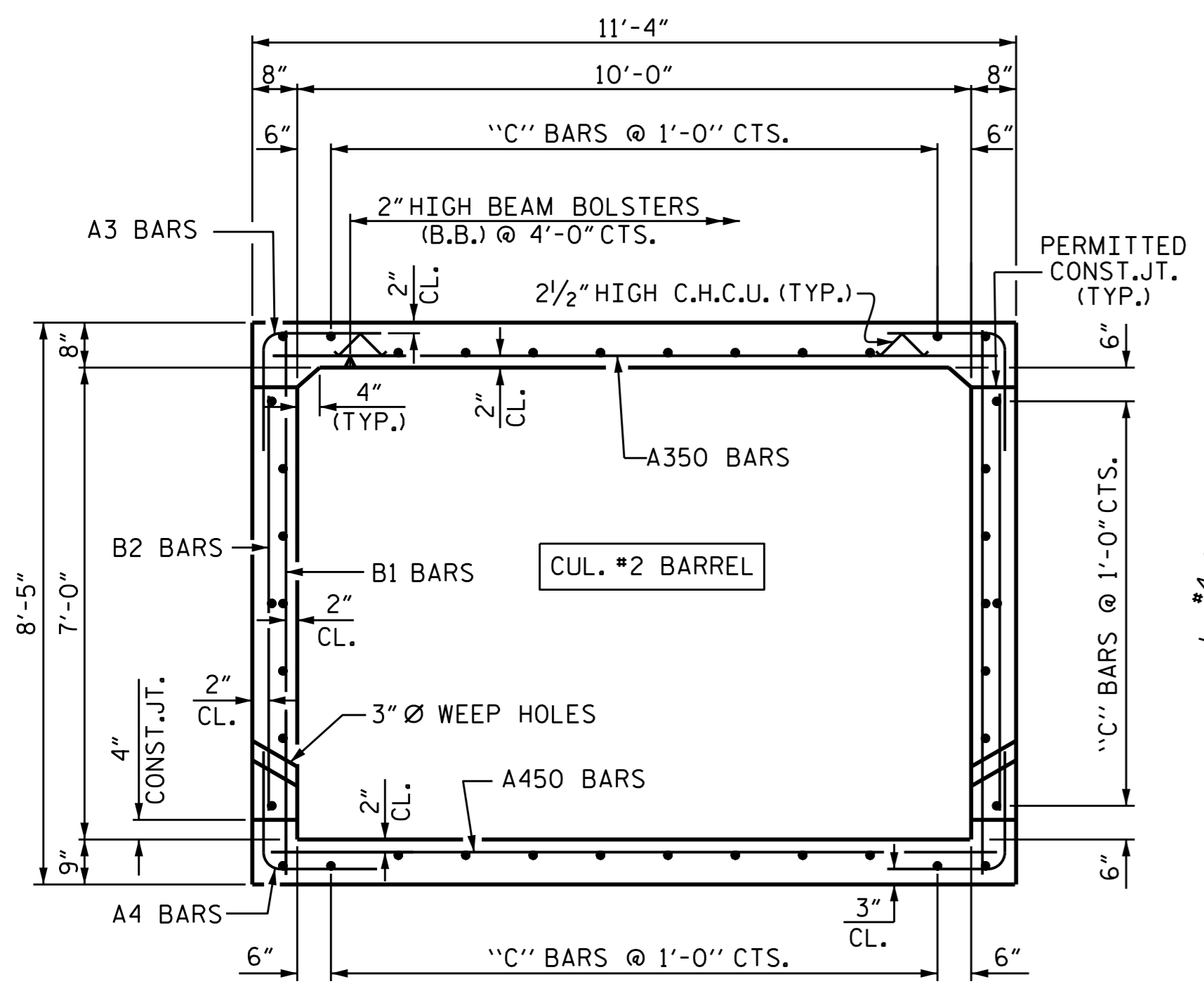
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #2&3
DOUBLE 10' X 7' RCBC
C2&3-P1 DETAILS
 18°-16'-20" SKEW

DRAWN BY : M. SHAHIDI DATE : 7/5/16
 CHECKED BY : T. H. FANG DATE : 7/6/16
 DESIGN ENGINEER OF RECORD : P. K. NEWTON DATE : 7/13/16

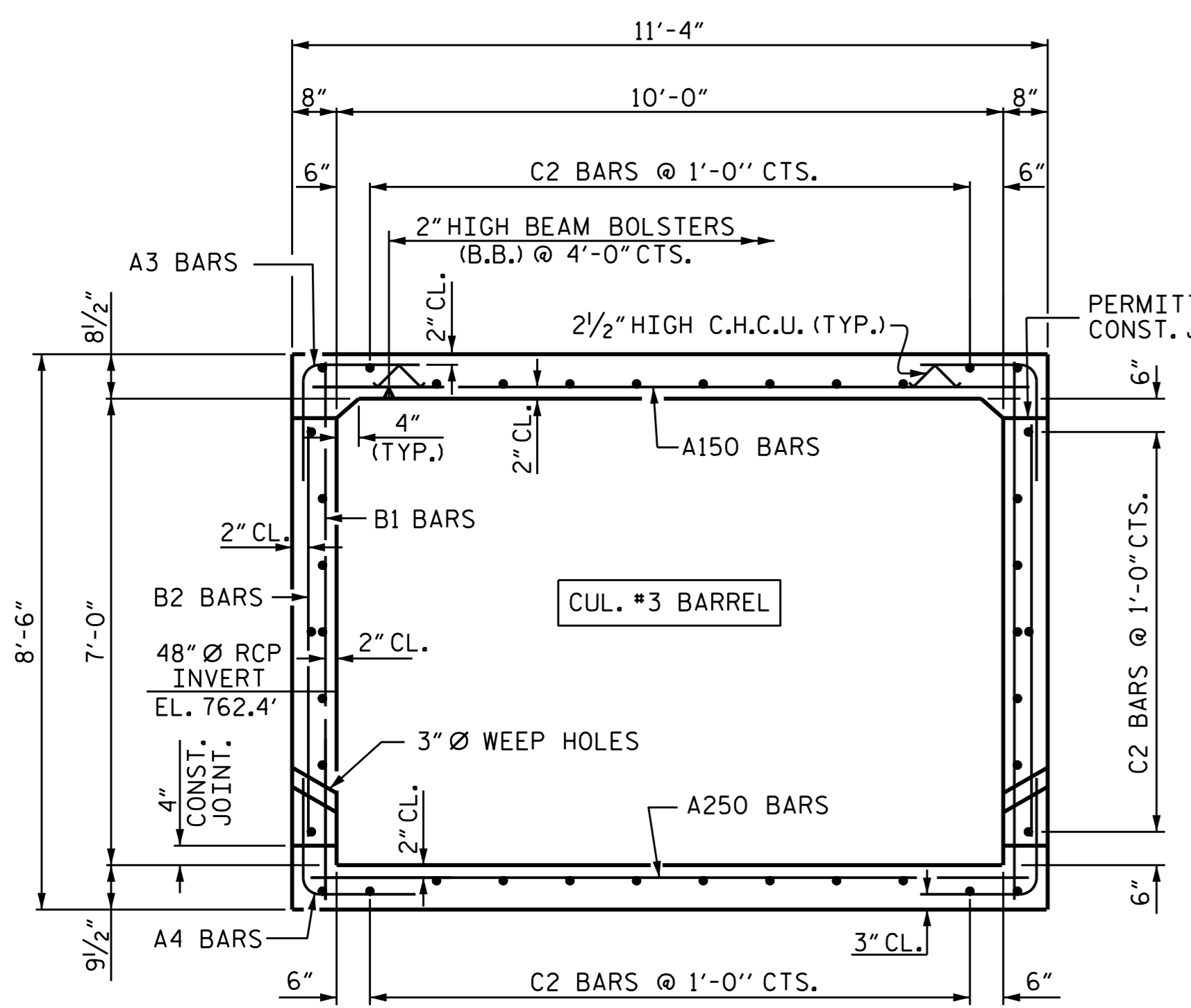
DocuSigned by: *Ting Fang* 8/16/2016
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REVISIONS					SHEET NO.
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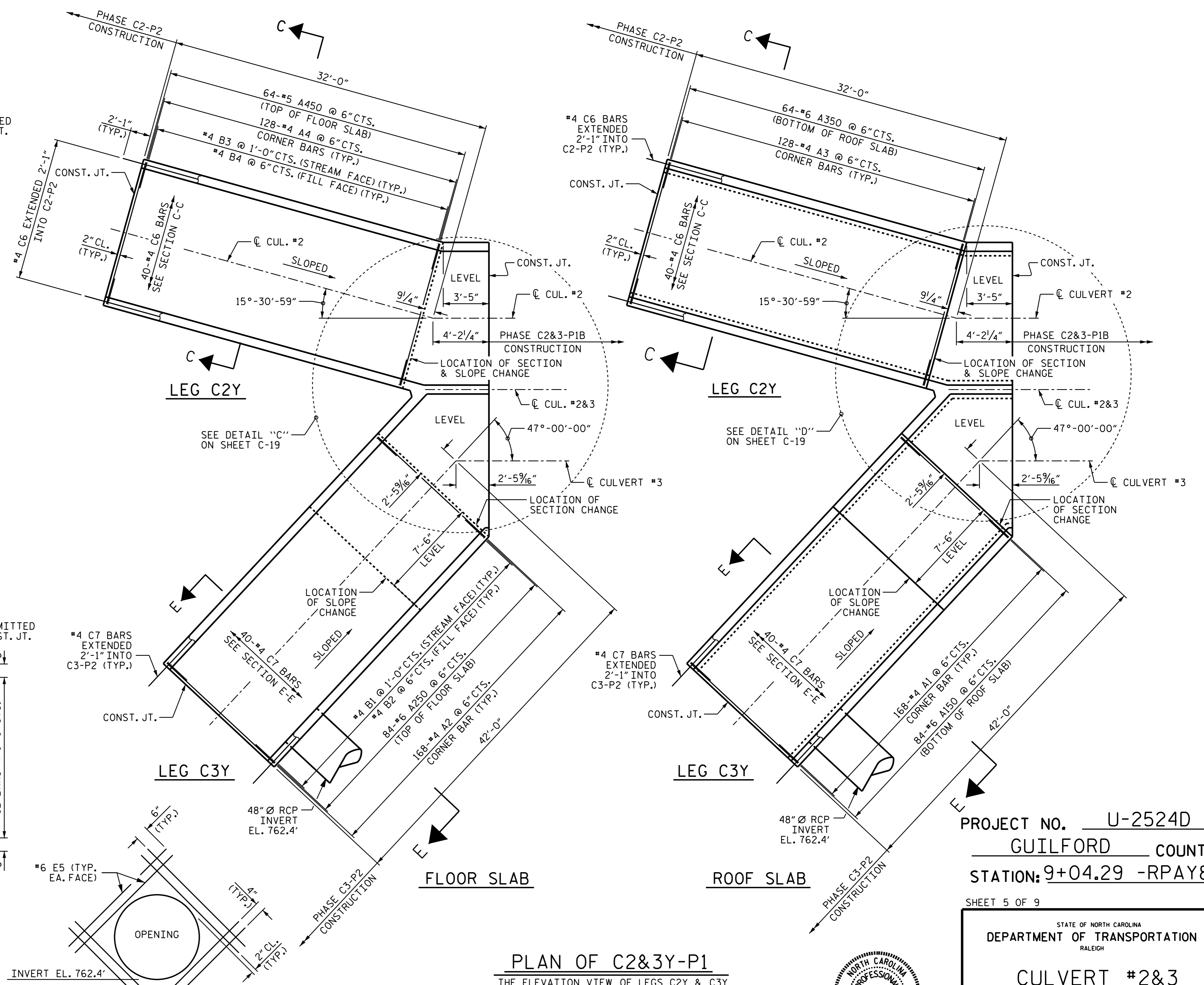
TOTAL SHEETS: 34



SECTION C-C
 THERE ARE 40 'C' BARS IN BARREL SECTION FOR LEG C2Y

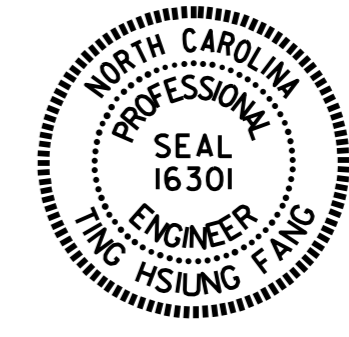


SECTION E-E
 THERE ARE 40 C2 BARS IN SECTION OF BARREL SECTION FOR LEG C3Y



PLAN OF C2&3Y-P1
 THE ELEVATION VIEW OF LEGS C2Y & C3Y NOT SHOWN FOR CLARITY.

WALL OPENING DETAILS
 FOR 48" Ø PIPE THRU EXTERIOR WALL
 FIELD CUT & BEND 'B' & 'C' BARS AS NEEDED TO CLEAR PIPE



PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-
 SHEET 5 OF 9

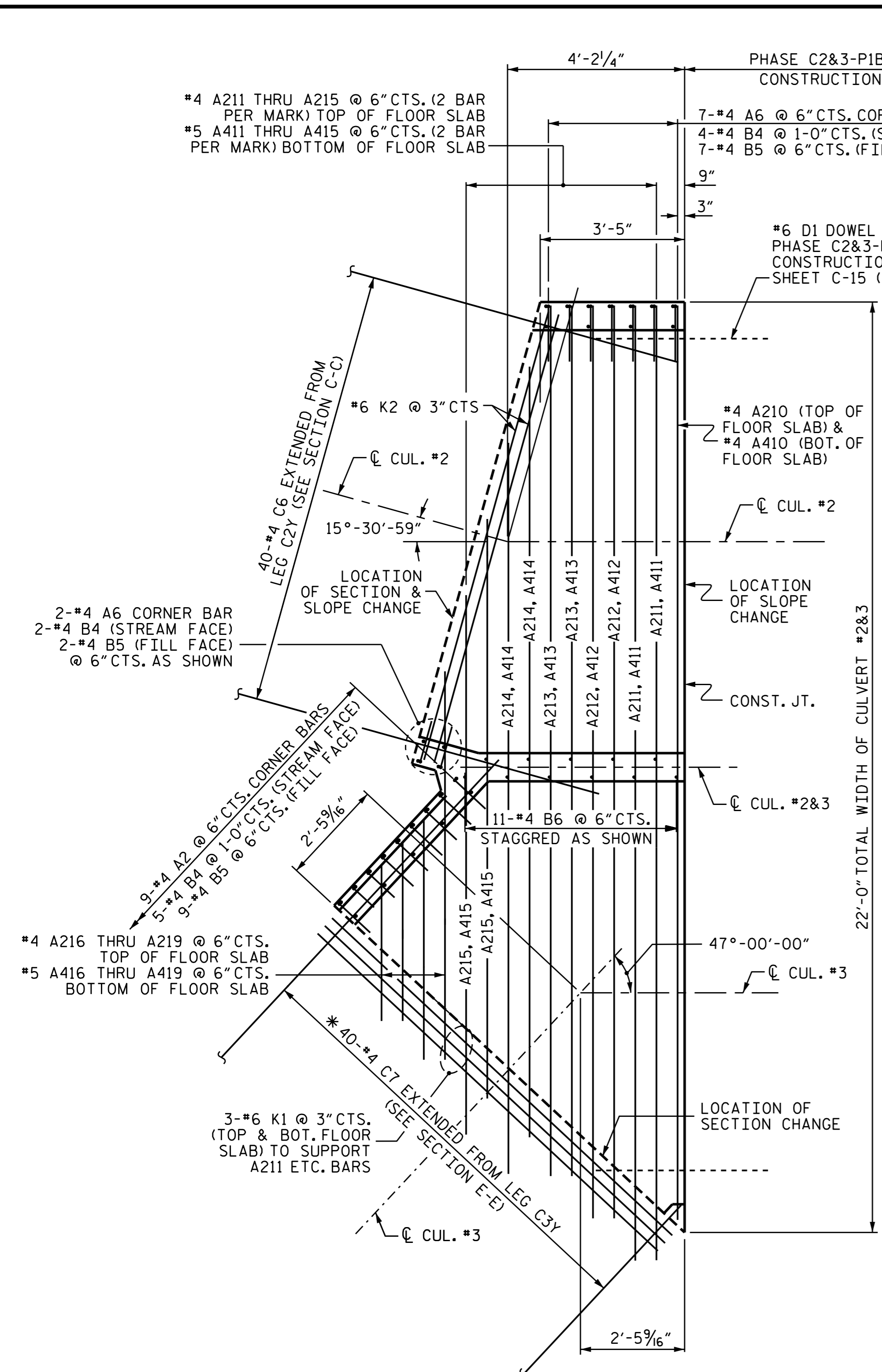
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #2&3
DOUBLE 10' X 7' RCBC
C2&3Y-P1 DETAILS

DRAWN BY: P. K. NEWTON DATE: 6/21/16
 CHECKED BY: T. H. FANG DATE: 6/21/16
 DESIGN ENGINEER OF RECORD: P. K. NEWTON DATE: 7/13/16

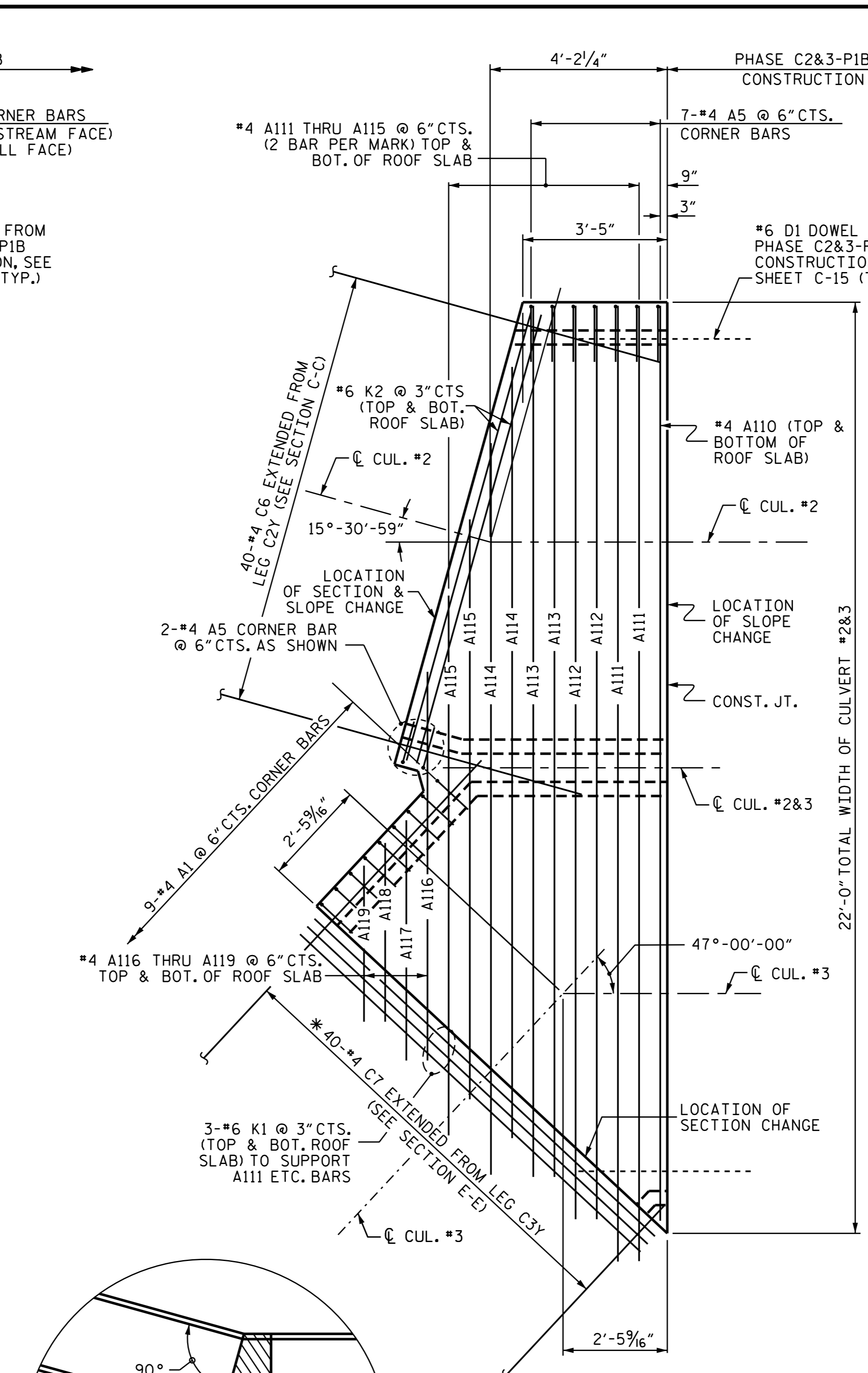
Documented by: Ting Fang 7/15/2016
 E7208490977435
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REVISIONS		SHEET NO.	
NO.	DATE	NO.	DATE
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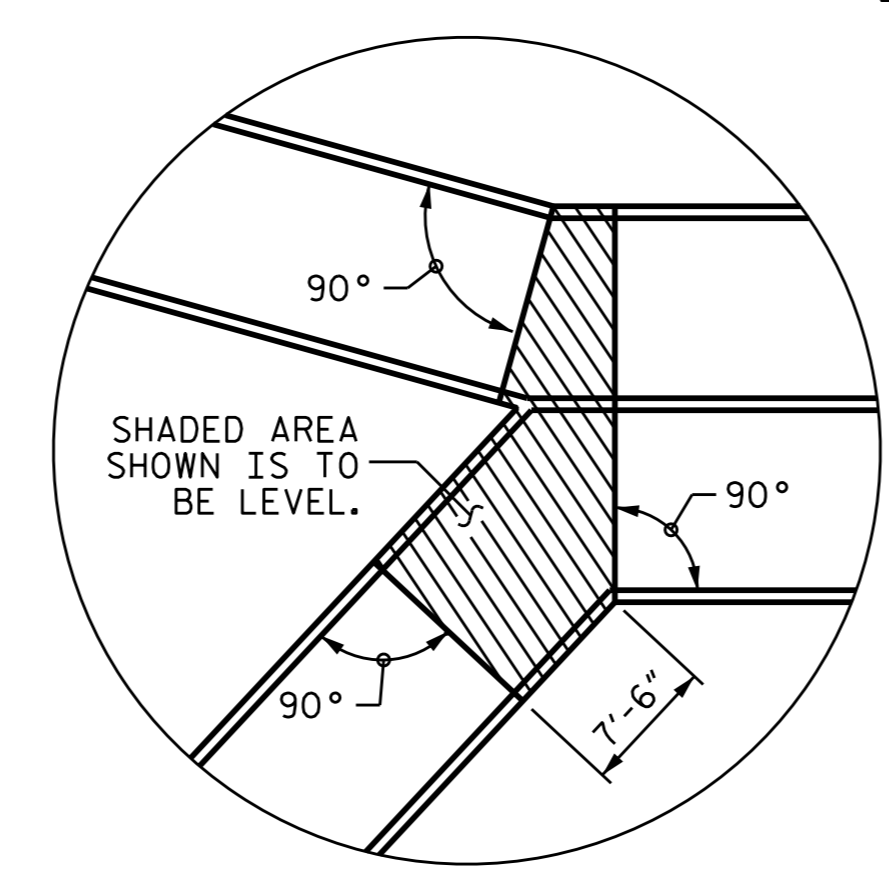
CUL #2&3



**DETAIL "C"
 FLOOR SLAB DETAILS**
 *FIELD BEND OR CUT "C" BARS AS NECESSARY.



**DETAIL "D"
 ROOF SLAB DETAILS**
 *FIELD BEND OR CUT "C" BARS AS NECESSARY.

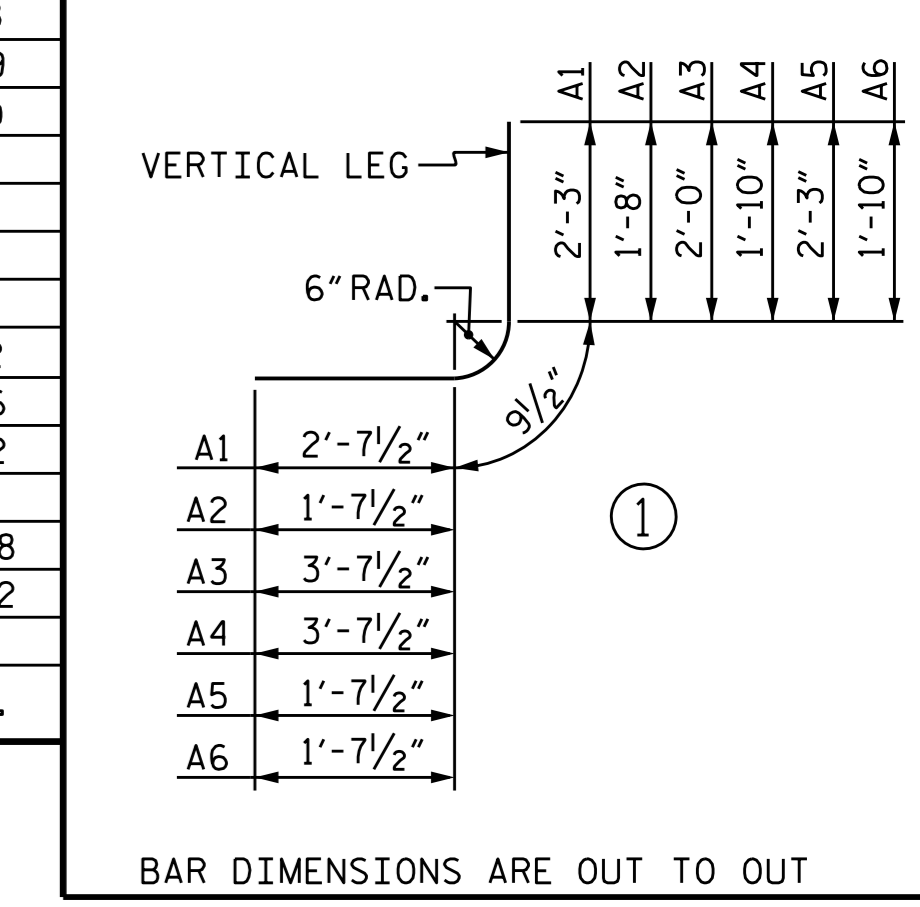


LEVEL AREA
 FOR BOTH FLOOR & ROOF SLABS.

BARREL THICKNESS DIMENSIONS					
SEGMENT	SECTION	ROOF	FLOOR	EXT. WALL	INT. WALL
LEG C2Y	C-C	8"	9"	8"	8"
LEG C3Y	E-E	8 1/2"	9 1/2"	8"	8"
DETAILS C&D	---	10 1/2"	11"	8"	8"

BAR SCHEDULE											
DETAILS C & D						LEG C2Y (1-10'X7' RCBC)					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	9	#4	1	5'-8"	34	A3	128	#4	STR	6'-5"	549
A2	9	#4	1	5'-4"	32	A4	128	#4	STR	6'-3"	534
A5	9	#4	1	4'-8"	28	A350	64	#6	STR	11'-0"	1,057
A6	9	#4	1	4'-3"	26	A450	64	#5	STR	11'-0"	734
A110	2	#4	STR	21'-6"	29						
A111	4	#4	STR	22'-6"	60	B3	64	#4	STR	7'-11"	338
A112	4	#4	STR	21'-6"	57	B4	128	#4	STR	6'-4"	542
A113	4	#4	STR	20'-6"	55						
A114	4	#4	STR	18'-3"	49	C6	80	#4	STR	21'-5"	1,145
A115	4	#4	STR	13'-9"	37						
A116	2	#4	STR	9'-3"	12	REINFORCING STEEL = 4,899 LBS.					
A117	2	#4	STR	5'-8"	8	LEG C3Y (1-10'X7' RCBC)					
A118	2	#4	STR	4'-3"	6	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A119	2	#4	STR	3'-9"	5	A1	168	#4	1	5'-8"	636
						A2	168	#4	1	5'-4"	599
A210	1	#4	STR	21'-6"	14	A210	84	#6	STR	11'-0"	1,388
A211	2	#4	STR	22'-6"	30	A211	84	#6	STR	11'-0"	1,388
A212	2	#4	STR	21'-6"	29	A150	84	#6	STR	8'-0"	449
A213	2	#4	STR	20'-6"	27	A250	84	#6	STR	6'-4"	711
A214	2	#4	STR	18'-3"	24						
A215	2	#4	STR	13'-9"	18	B1	84	#4	STR	8'-0"	449
A216	1	#4	STR	9'-3"	6	B2	168	#4	STR	6'-4"	711
A217	1	#4	STR	5'-8"	4						
A218	1	#4	STR	4'-3"	3	C7	80	#4	STR	26'-6"	1,416
A219	1	#4	STR	3'-9"	3						
						E5	16	#6	STR	6'-11"	166
A410	1	#5	STR	21'-6"	22	REINFORCING STEEL = 6,753 LBS.					
A411	2	#5	STR	22'-6"	47	BAR TYPE					
A412	2	#5	STR	21'-6"	45	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A413	2	#5	STR	20'-6"	43	A1	2	#5	STR	18'-3"	38
A414	2	#5	STR	18'-3"	38	A415	2	#5	STR	13'-9"	29
A415	2	#5	STR	13'-9"	29	A416	1	#5	STR	9'-3"	10
A416	1	#5	STR	9'-3"	10	A417	1	#5	STR	5'-8"	6
A417	1	#5	STR	5'-8"	6	A418	1	#5	STR	4'-3"	4
A418	1	#5	STR	4'-3"	4	A419	1	#5	STR	3'-9"	4
A419	1	#5	STR	3'-9"	4						
B4	11	#4	STR	8'-5"	62						
B5	18	#4	STR	6'-4"	76						
B6	11	#4	STR	8'-5"	62						
K1	12	#6	STR	11'-0"	198						
K2	8	#6	STR	11'-0"	132						
REINFORCING STEEL = 1,373 LBS.											

TOTAL C2&3Y-P1 QUANTITIES	
CLASS A CONCRETE	
LEG C2Y SEC. C-C @ 0.944 CY/FT	30.2 C.Y.
LEG C3Y SEC. E-E @ 0.979 CY/FT	41.1 C.Y.
DETAILS C & D	9.8 C.Y.
TOTAL	81.1 C.Y.
REINFORCING STEEL	
LEG C2Y SEC. C-C @ 4,899 LBS.	
LEG C3Y SEC. E-E @ 6,753 LBS.	
DETAILS C & D 1,373 LBS.	
TOTAL	13,025 LBS.
FOUNDATION COND. MATERIAL	87 TONS
CULVERT EXCAVATION	LUMP SUM



PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-
 SHEET 6 OF 9

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
**CULVERT #2&3
 DOUBLE 10' X 7' RCBC
 C2&3Y-P1 DETAILS**

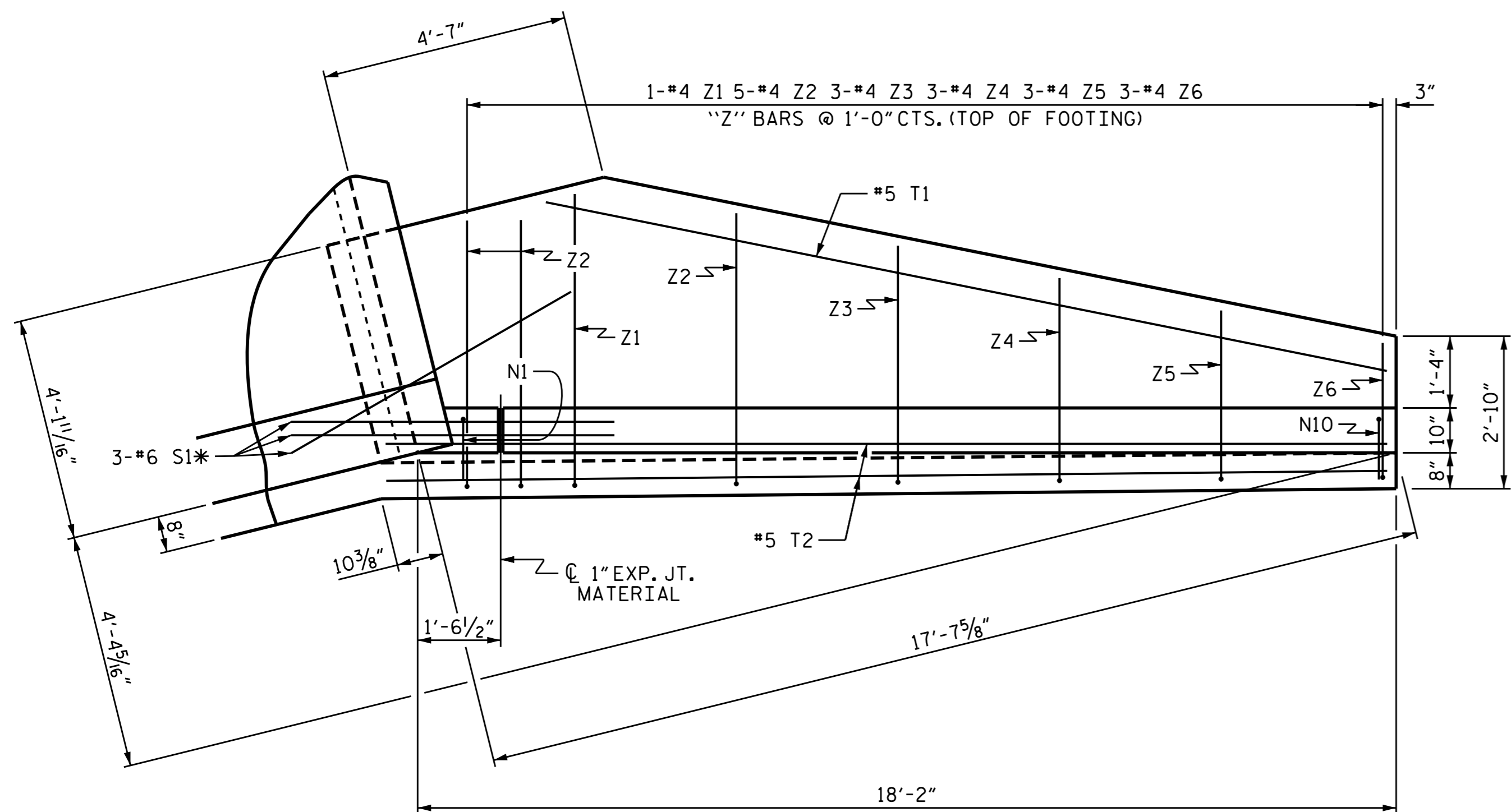


DocuSigned by:
 Ting Fang
 E7208A00977435
 7/15/2016
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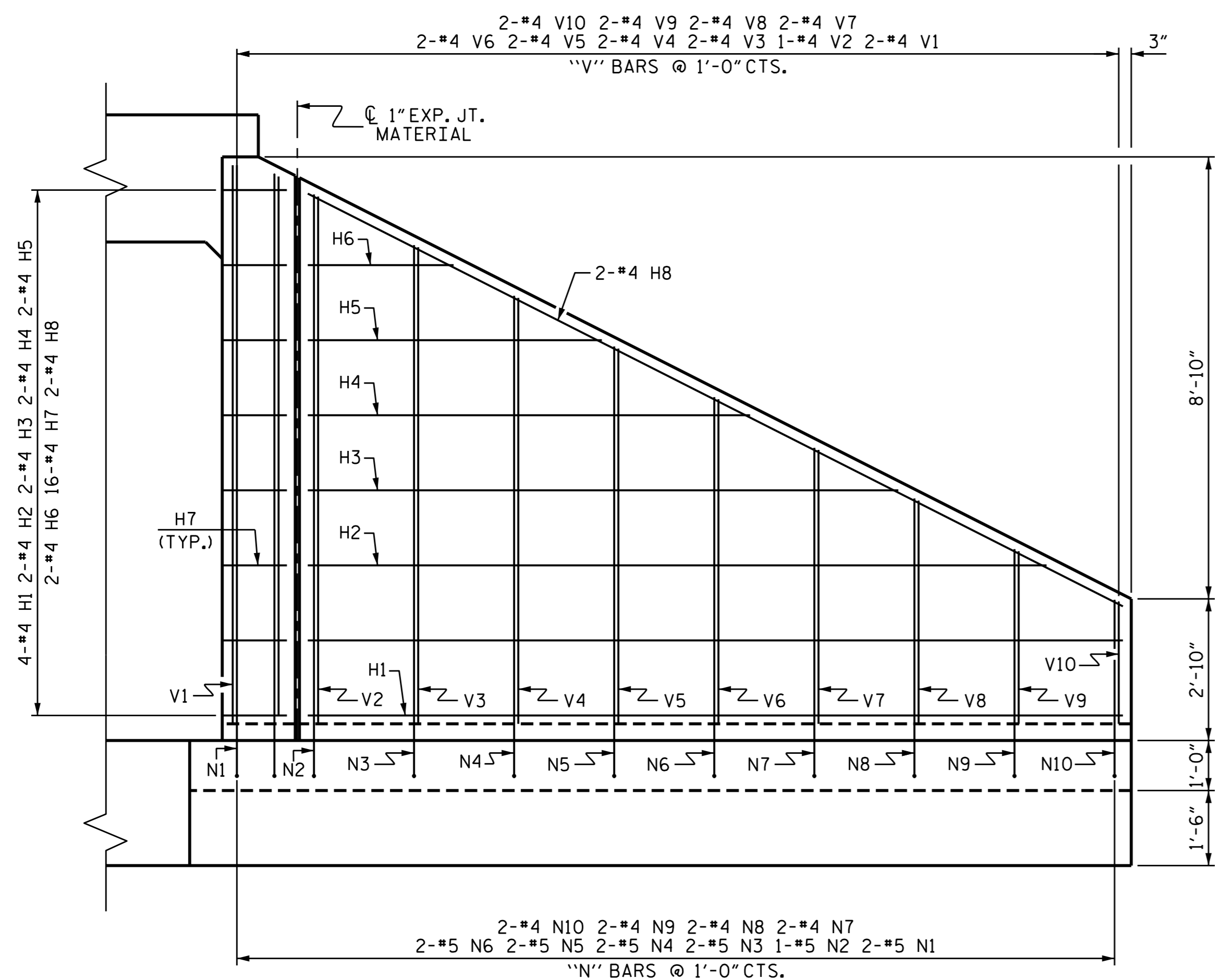
REVISIONS					SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:
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TOTAL SHEETS 34

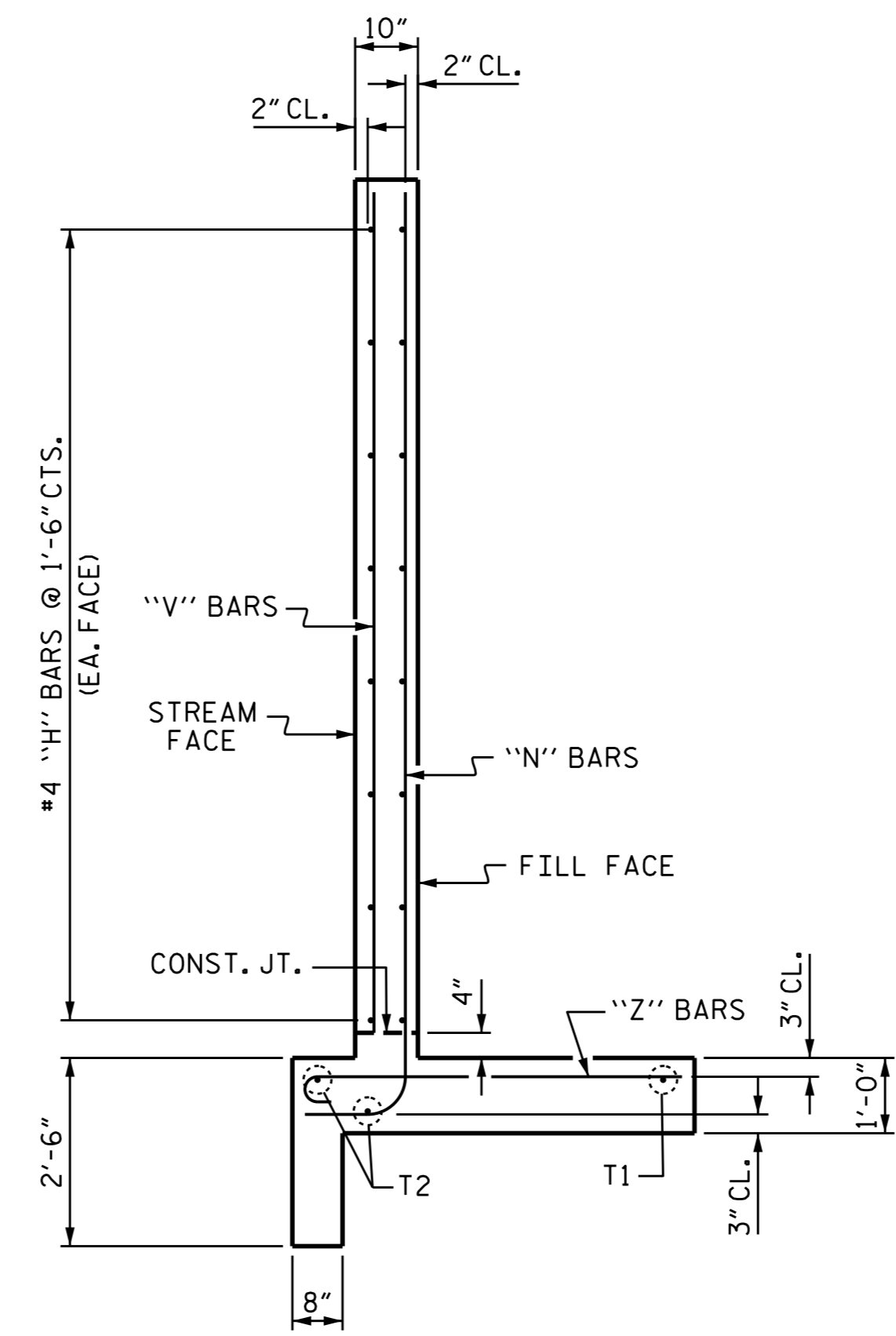
DRAWN BY: P. K. NEWTON DATE: 6/21/16
 CHECKED BY: T. H. FANG DATE: 6/21/16
 DESIGN ENGINEER OF RECORD: P. K. NEWTON DATE: 7/13/16



PLAN
S1 @ BOTTOM OF FLOOR
SLAB & FOOTING



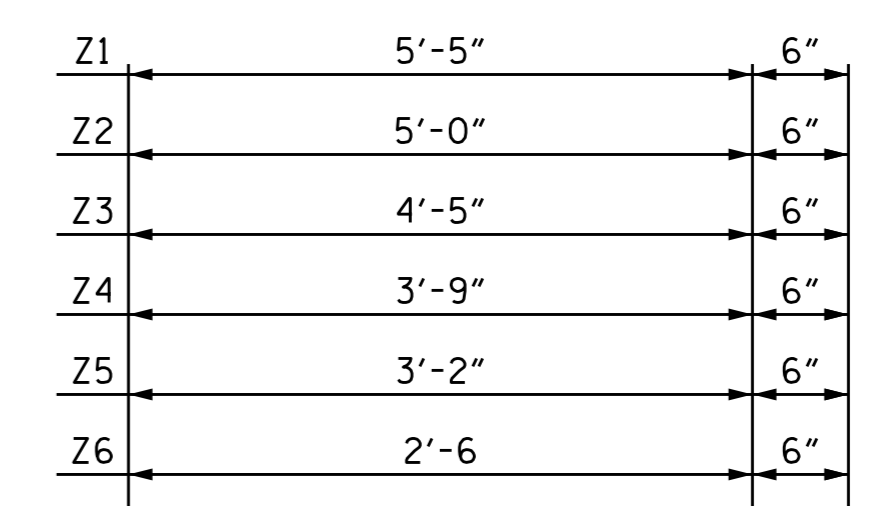
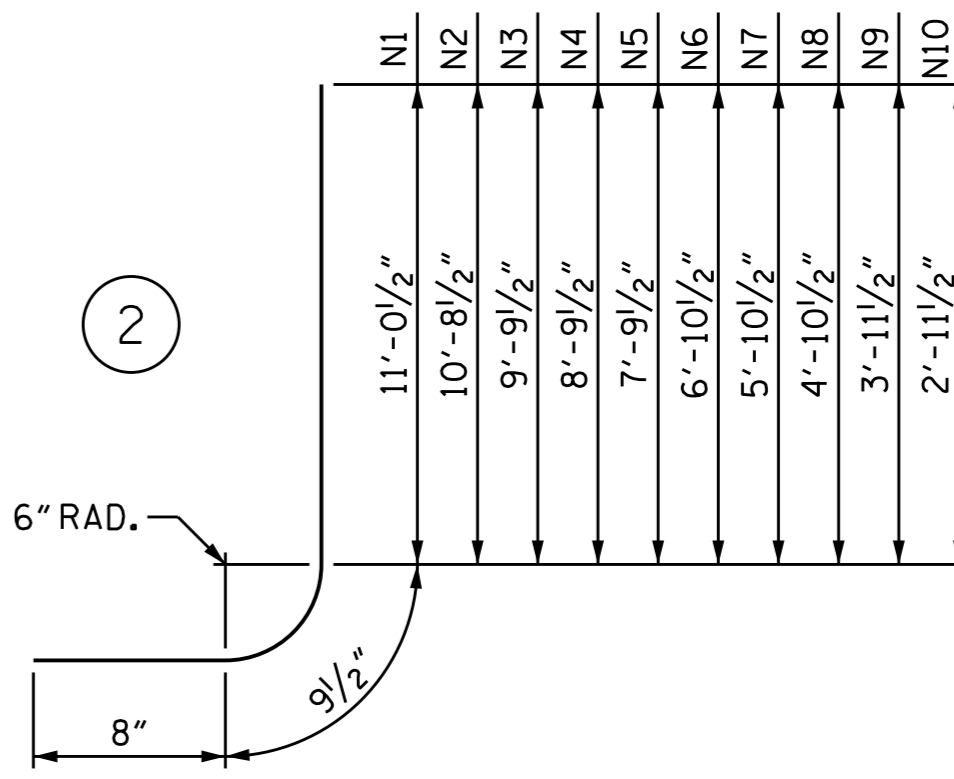
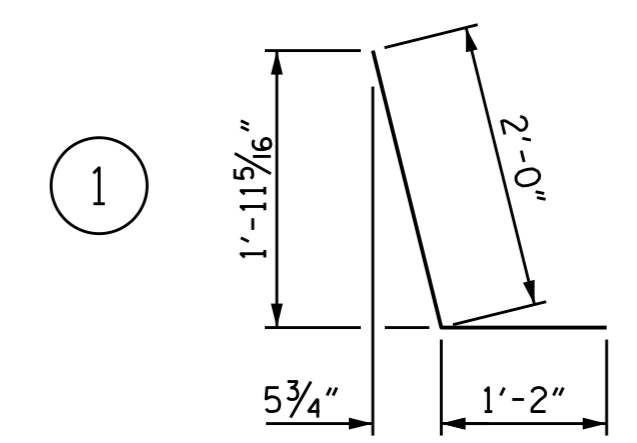
ELEVATION



TYPICAL WING SECTION

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL

BAR NO.	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	4	#4	STR	16'-3"	43
H2	2	#4	STR	14'-7"	19
H3	2	#4	STR	11'-6"	15
H4	2	#4	STR	8'-5"	11
H5	2	#4	STR	5'-4"	7
H6	2	#4	STR	2'-3"	3
H7	16	#4	1	3'-2"	34
H8	2	#4	STR	18'-0"	24
N1	2	#5	2	12'-6"	26
N2	1	#5	2	12'-2"	13
N3	2	#5	2	11'-3"	23
N4	2	#5	2	10'-3"	21
N5	2	#5	2	9'-3"	19
N6	2	#5	2	8'-4"	17
N7	2	#4	2	7'-4"	10
N8	2	#4	2	6'-4"	8
N9	2	#4	2	5'-5"	7
N10	2	#4	2	4'-5"	6
S1	3	#6	STR	6'-0"	27
T1	1	#5	STR	15'-11"	17
T2	2	#5	STR	18'-7"	39
V1	2	#4	STR	10'-6"	14
V2	1	#4	STR	10'-2"	7
V3	2	#4	STR	9'-2"	12
V4	2	#4	STR	8'-3"	11
V5	2	#4	STR	7'-3"	10
V6	2	#4	STR	6'-3"	8
V7	2	#4	STR	5'-4"	7
V8	2	#4	STR	4'-4"	6
V9	2	#4	STR	3'-4"	4
V10	2	#4	STR	2'-5"	3
Z1	1	#4	3	5'-11"	4
Z2	5	#4	3	5'-6"	18
Z3	3	#4	3	4'-11"	10
Z4	3	#4	3	4'-3"	9
Z5	3	#4	3	3'-8"	7
Z6	3	#4	3	3'-0"	6

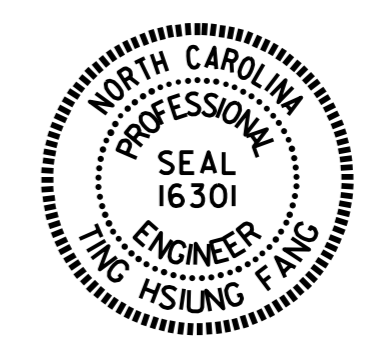
TOTAL REINFORCING STEEL FOR 1 WING 525 LBS

CLASS A CONCRETE FOR 1 WING 8.0 CY
TOTAL 8.0 CY

FOR HEAD WALL & CURTAIN WALL QUANTITIES, SEE SHEET C-17

PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 9+04.29 -RPAY8-

SHEET 7 OF 9



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
CULVERT #2&3
DOUBLE 10' X 7' RCBC
OUTLET END WING (W2)

H = 7'-0" SLOPE = 2:1

Designed by: Ting Fang 7/15/2016

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

DRAWN BY: A. SORSENGINH DATE: 7/2016
CHECKED BY: T. H. FANG DATE: 7/2016
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE: 7/2016

**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		
						MOMENT				SHEAR						
						LIVE-LOAD FACTORS (LL)	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	1.41	--	1.75	5.70	1	EXTERIOR WALL	4.31	1.41	1	EXTERIOR WALL	1.27		
	HL-93 (OPERATING)	N/A		1.82	--	1.35	7.38	1	EXTERIOR WALL	4.31	1.82	1	EXTERIOR WALL	1.27		
	HS-20 (INVENTORY)	36.000	②	1.41	50.60	1.75	5.70	1	EXTERIOR WALL	4.31	1.41	1	EXTERIOR WALL	1.27		
	HS-20 (OPERATING)	36.000		1.82	65.59	1.35	7.38	1	EXTERIOR WALL	4.31	1.82	1	EXTERIOR WALL	1.27		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500	③	1.74	23.54	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNGARBS2	20.000		1.74	34.88	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNAGRIS2	22.000		1.74	38.37	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNCOTTS3	27.250		1.74	47.52	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNAGGRS4	34.925		1.74	60.91	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNS5A	35.550		1.74	62.00	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNS6A	39.950		1.74	69.67	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		SNS7B	42.000		1.74	73.25	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.74	57.55	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNT4A	33.075		1.74	57.68	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNT6A	41.600		1.74	72.55	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNT7A	42.000		1.74	73.25	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNT7B	42.000		1.74	73.25	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNAGRIT4	43.000		1.74	74.99	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNAGT5A	45.000		1.74	78.48	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	
		TNAGT5B	45.000		1.74	78.48	1.40	7.11	1	EXTERIOR WALL	4.31	1.74	1	EXTERIOR WALL	1.27	

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	--

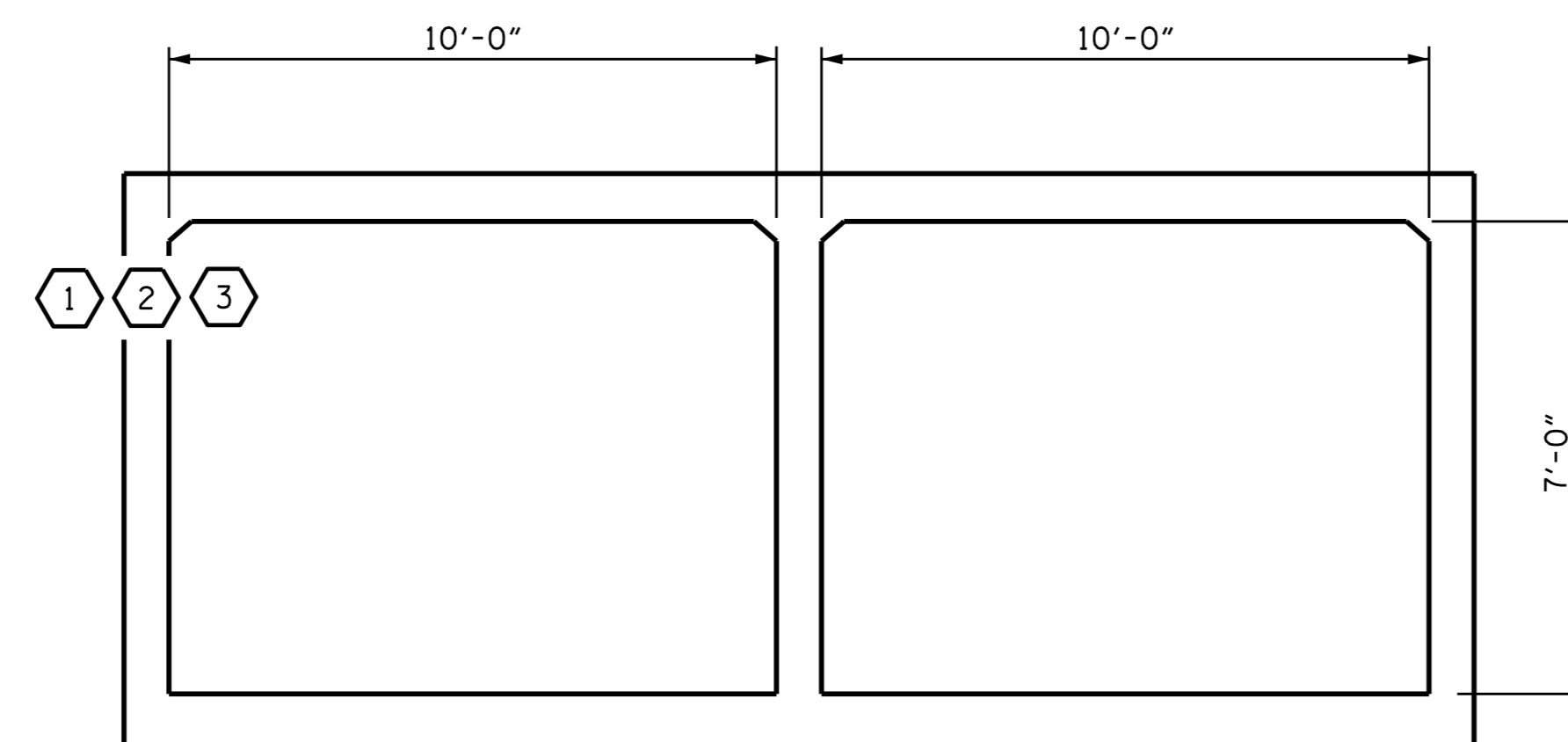
NOTE:

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. U-2524D
GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-

SHEET 8 OF 9



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

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

REVISIONS						SHEET NO. C-21
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
 SIGNATURES COMPLETED

ASSEMBLED BY : P. K. NEWTON DATE : 7/8/16
 CHECKED BY : T. H. FANG DATE : 7/11/16
 DRAWN BY : WMC 7/11 REV. 10/1/11 MAA/GM
 CHECKED BY : GM 7/11

**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		
						MOMENT				SHEAR						
						LIVE-LOAD FACTORS (LL)	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	1.23	1	TOP SLAB	4.53	1.14	1	TOP SLAB	9.70		
	HL-93 (OPERATING)	N/A		1.48	--	1.35	1.60	1	TOP SLAB	4.53	1.48	1	TOP SLAB	9.70		
	HS-20 (INVENTORY)	36.000	②	1.26	45.29	1.75	1.73	1	TOP SLAB	4.53	1.26	1	BOTTOM SLAB	9.67		
	HS-20 (OPERATING)	36.000		1.63	58.71	1.35	2.24	1	TOP SLAB	4.53	1.63	1	BOTTOM SLAB	9.67		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.79	37.69	1.40	3.14	1	TOP SLAB	4.53	2.79	1	TOP SLAB	9.70	
		SNGARBS2	20.000		2.46	49.30	1.40	2.93	1	TOP SLAB	4.53	2.46	1	BOTTOM SLAB	9.67	
		SNAGRIS2	22.000		2.28	50.25	1.40	3.14	1	TOP SLAB	4.53	2.28	1	BOTTOM SLAB	9.67	
		SNCOTTS3	27.250		1.41	38.36	1.40	1.54	1	TOP SLAB	4.53	1.41	1	TOP SLAB	9.70	
		SNAGGRS4	34.925		1.48	51.65	1.40	1.73	1	TOP SLAB	4.53	1.48	1	BOTTOM SLAB	9.67	
		SNS5A	35.550		1.46	51.82	1.40	1.73	1	TOP SLAB	4.53	1.46	1	TOP SLAB	9.70	
		SNS6A	39.950		1.39	55.54	1.40	1.73	1	TOP SLAB	4.53	1.39	1	BOTTOM SLAB	9.67	
		SNS7B	42.000		1.33	56.04	1.40	1.77	1	TOP SLAB	4.53	1.33	1	BOTTOM SLAB	9.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.76	58.02	1.40	3.14	1	TOP SLAB	4.53	1.76	1	BOTTOM SLAB	9.67	
		TNT4A	33.075		1.68	55.48	1.40	1.83	1	TOP SLAB	4.53	1.68	1	TOP SLAB	9.70	
		TNT6A	41.600		1.49	61.85	1.40	1.77	1	TOP SLAB	4.53	1.49	1	TOP SLAB	9.70	
		TNT7A	42.000		1.53	64.12	1.40	1.96	1	TOP SLAB	4.53	1.53	1	BOTTOM SLAB	9.67	
		TNT7B	42.000		1.54	64.72	1.40	1.74	1	TOP SLAB	4.53	1.54	1	BOTTOM SLAB	9.67	
		TNAGRIT4	43.000		1.43	61.62	1.40	1.75	1	TOP SLAB	4.53	1.43	1	BOTTOM SLAB	9.67	
		TNAGT5A	45.000		1.31	59.02	1.40	1.79	1	TOP SLAB	4.53	1.31	1	BOTTOM SLAB	9.67	
		TNAGT5B	45.000		③	1.25	56.31	1.40	1.83	1	TOP SLAB	4.53	1.25	1	BOTTOM SLAB	9.67

LOAD FACTORS:

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

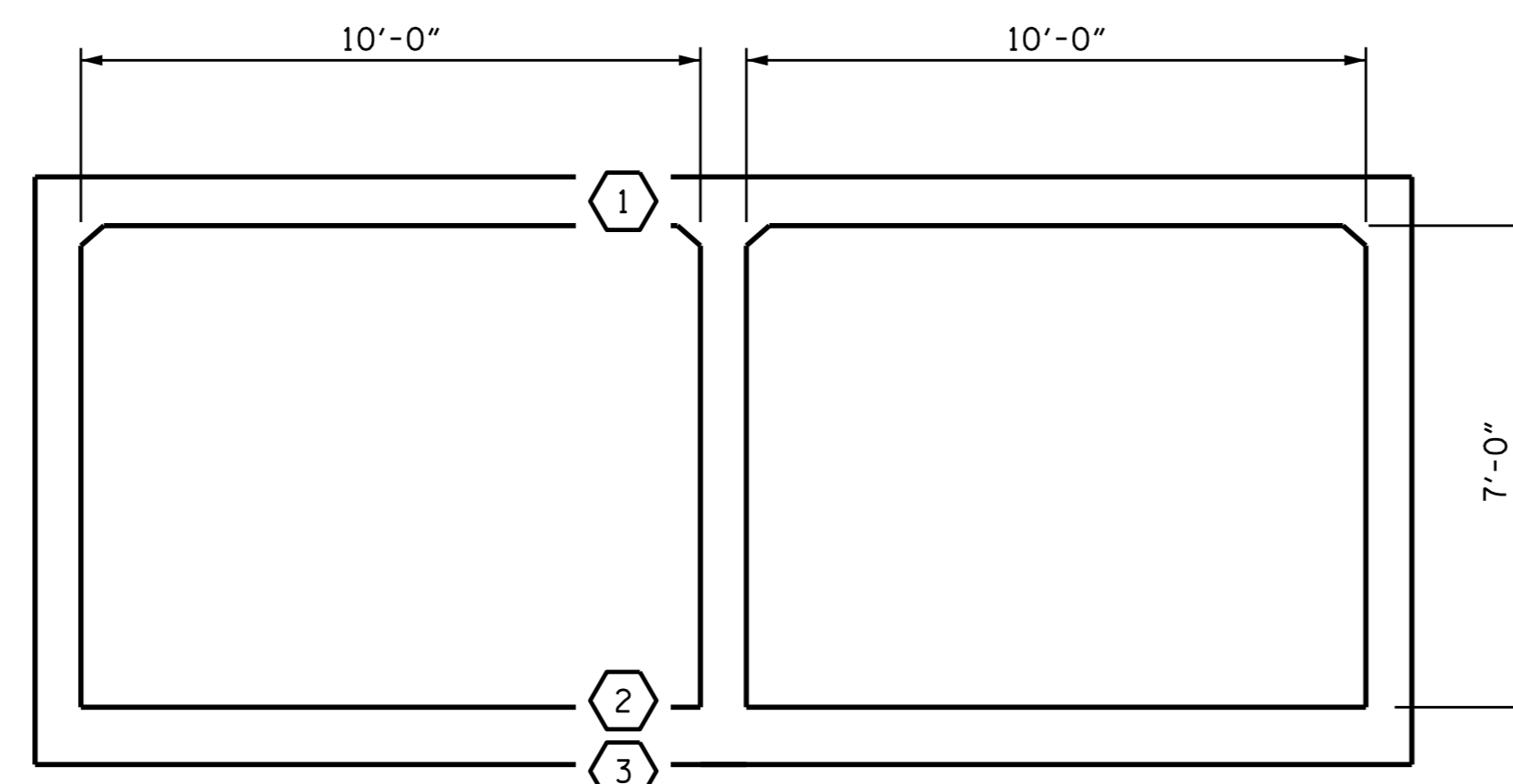
NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

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

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



LRFR SUMMARY
(LOOKING DOWNSTREAM)

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 9+04.29 -RPAY8-

SHEET 9 OF 9



DocuSigned by:
 Ting Fang
 7/14/2016
 E72088400977435

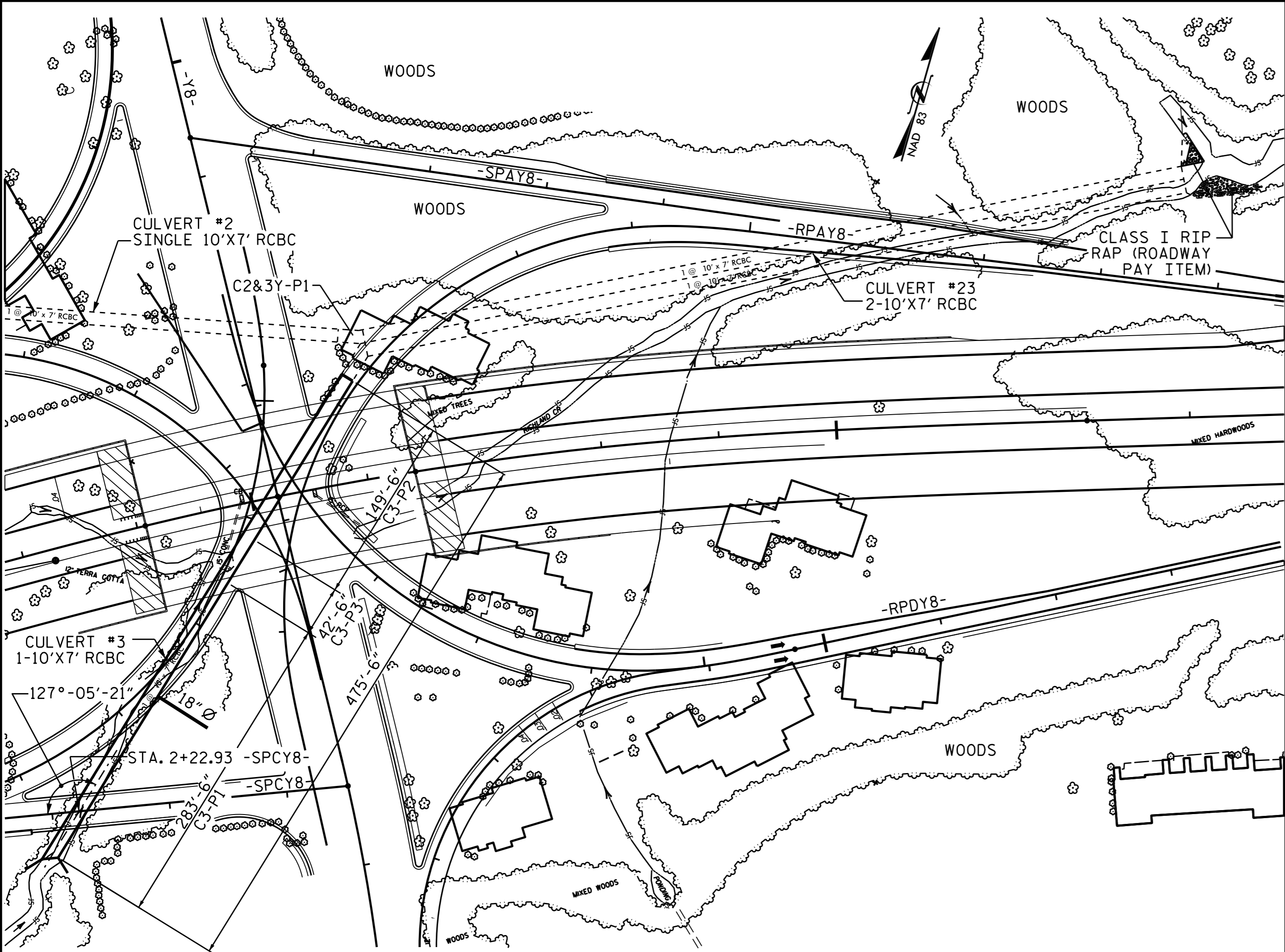
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
**STANDARD
 LRFR SUMMARY FOR
 REINFORCED CONCRETE
 BOX CULVERTS**
 (NON-INTERSTATE TRAFFIC)
 SECTION B-B

REVISIONS						SHEET NO. C-22
NO.	BY:	DATE:	NO.	BY:	DATE:	
①			③			TOTAL SHEETS 34
②			④			

ASSEMBLED BY : P. K. NEWTON DATE : 7/8/16
 CHECKED BY : T. H. FANG DATE : 7/11/16
 DRAWN BY : WMC 7/11 REV. 10/1/11 MAA/GM
 CHECKED BY : GM 7/11

BM #19: RR SPIKE SET IN 18" OAK, STA. 31+26 -Y8-, S 22° 19' 57.9" E DIST. 312.72', EL. 841.27'

F.A. PROJECT NO. NHF-0708(53)



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	=	712 CFS
FREQUENCY OF DESIGN FLOOD	=	50 YRS.
DESIGN HIGH WATER ELEVATION	=	772.00
DRAINAGE AREA	=	1.12 SQ. MI.
BASE DISCHARGE (Q100)	=	902 CFS
BASE HIGH WATER ELEVATION	=	773.64

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	=	1100 CFS
FREQUENCY OF OVERTOPPING FLOOD	=	100+ YRS.
OVERTOPPING FLOOD ELEVATION	=	777.39

GRADE DATA

GRADE POINT ELEVATION @		
STA. 2+22.93 -SPCY8-	=	777.95'
BED ELEVATION @		
STA. 2+22.93 -SPCY8-	=	762.42'
ROADWAY FILL SLOPES	=	2:1

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
PHASE C3-P1	288.7	C.Y.
PHASE C3-P2	146.4	C.Y.
PHASE C3-P3	41.6	C.Y.
TOTAL	476.7	C.Y.
REINFORCING STEEL		
PHASE C3-P1	44,082	LBS.
PHASE C3-P2	22,723	LBS.
PHASE C3-P3	6,426	LBS.
TOTAL	73,231	LBS.
FOUNDATION COND. MATERIAL		
PHASE C3-P1	307	TONS
PHASE C3-P2	162	TONS
PHASE C3-P3	46	TONS
TOTAL	514	TONS
CULVERT EXCAVATION (TOTAL)	LUMP SUM	

NOTES

- ASSUMED LIVE LOAD -----HL-93 OR ALTERNATE LOADING.
- DESIGN FILL ----- 8.80'
- FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTE SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTING AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS, AND WING FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALL.
- 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 FEET. 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 AND BOTH FACES OF INTERIOR WALLS ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.

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

ALL PIPES THROUGH THE SIDEWALL OF THE CULVERT SHALL BE LOCATED BY THE ENGINEER. THE REINFORCING STEEL SHALL BE FIELD BENT AS NECESSARY TO CLEAR PIPE.

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

A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

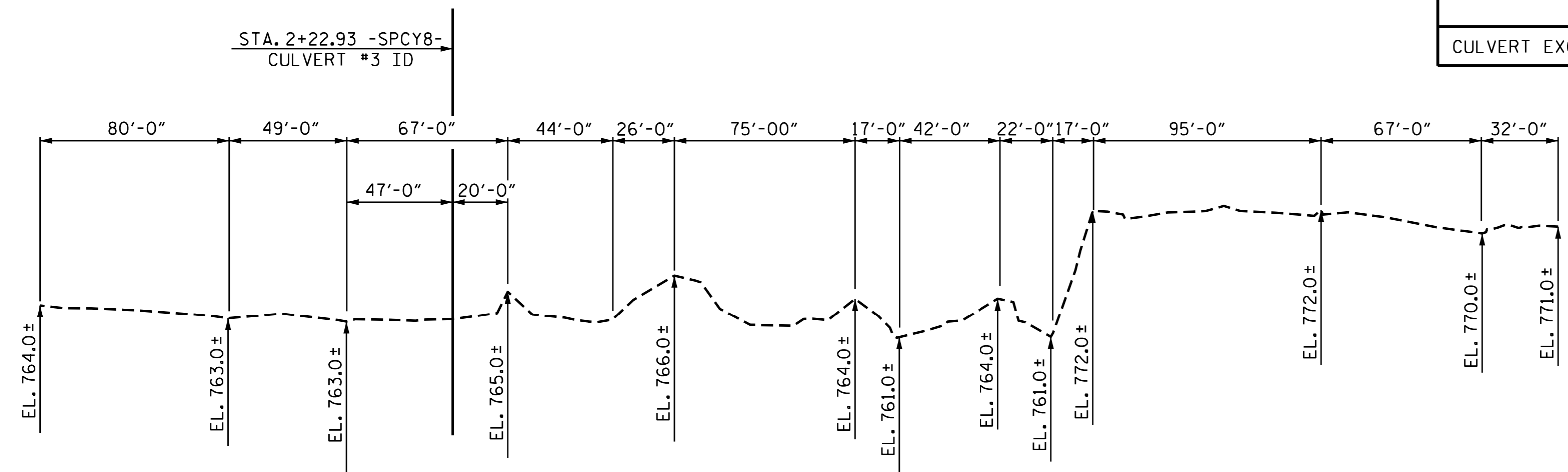
FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

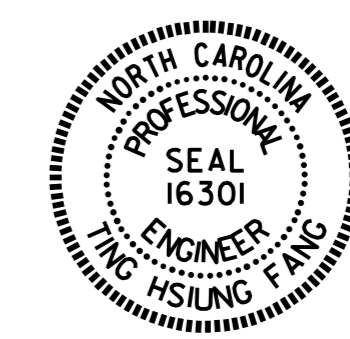
I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS



PROFILE ALONG CULVERT #3

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 2+22.93 -SPCY8-

SHEET 1 OF 5



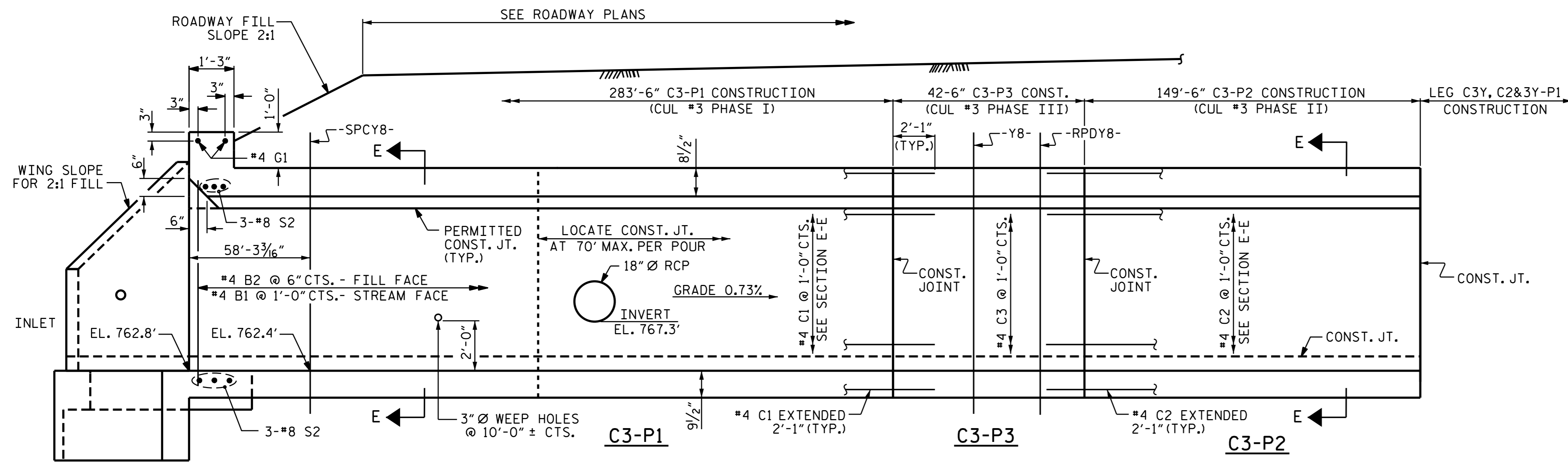
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #3
 SINGLE 10' X 7' RCBC
 C3-P1, C3-P2 & C3-P3
 127° -05'-21" SKEW

REVISIONS				SHEET NO.
NO.	BY:	DATE:	NO.	C-23
1			3	
2			4	
TOTAL SHEETS				34

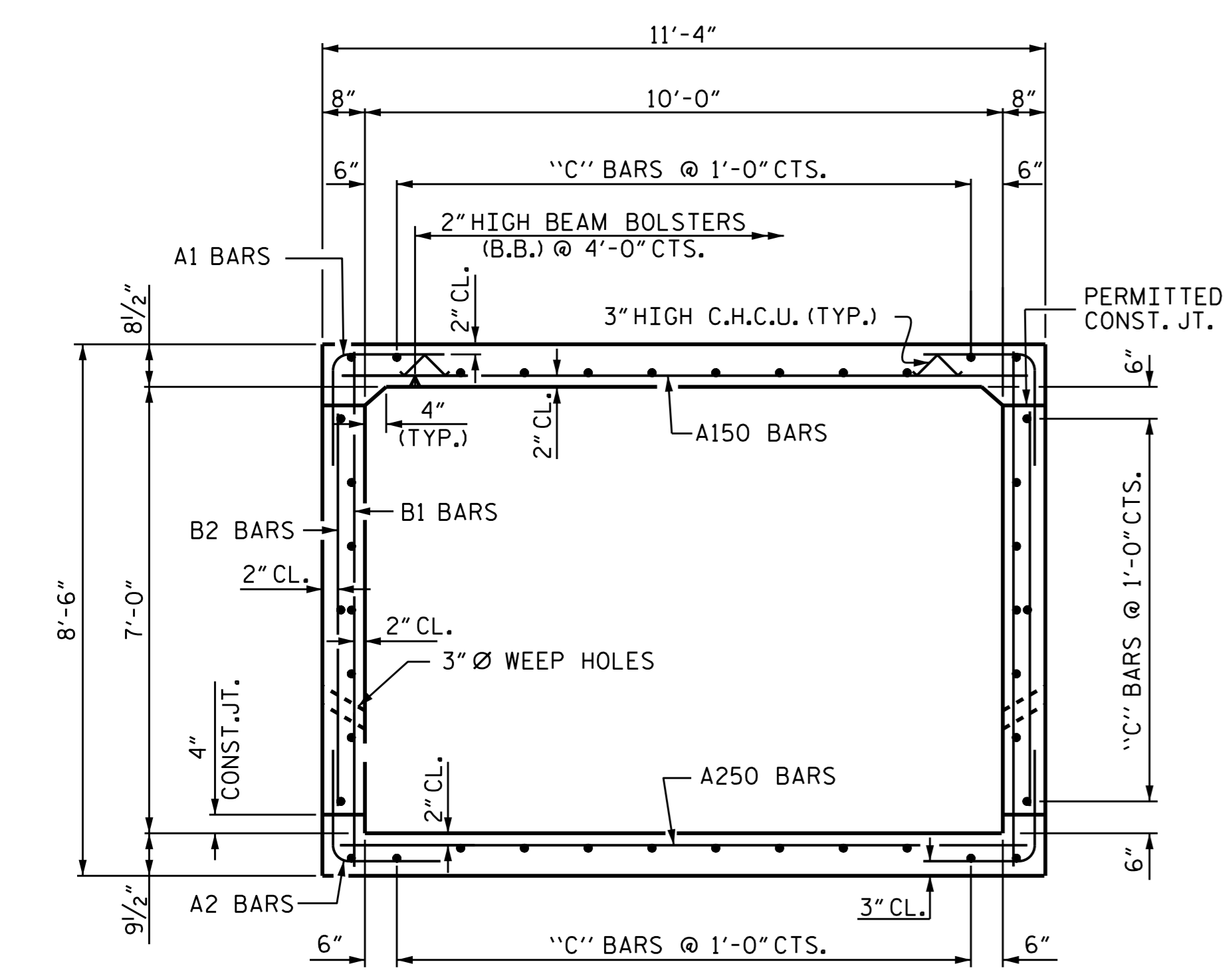
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

ASSEMBLED BY: E.I. OMILE	DATE: 4/14	SPECIAL
CHECKED BY: I.H. FANG	DATE: 6/6/16	
DRAWN BY: R.W. WRIGHT	DATE: JULY, 1990	STANDARD
CHECKED BY: D.A. GLADDEN	DATE: JULY, 1990	

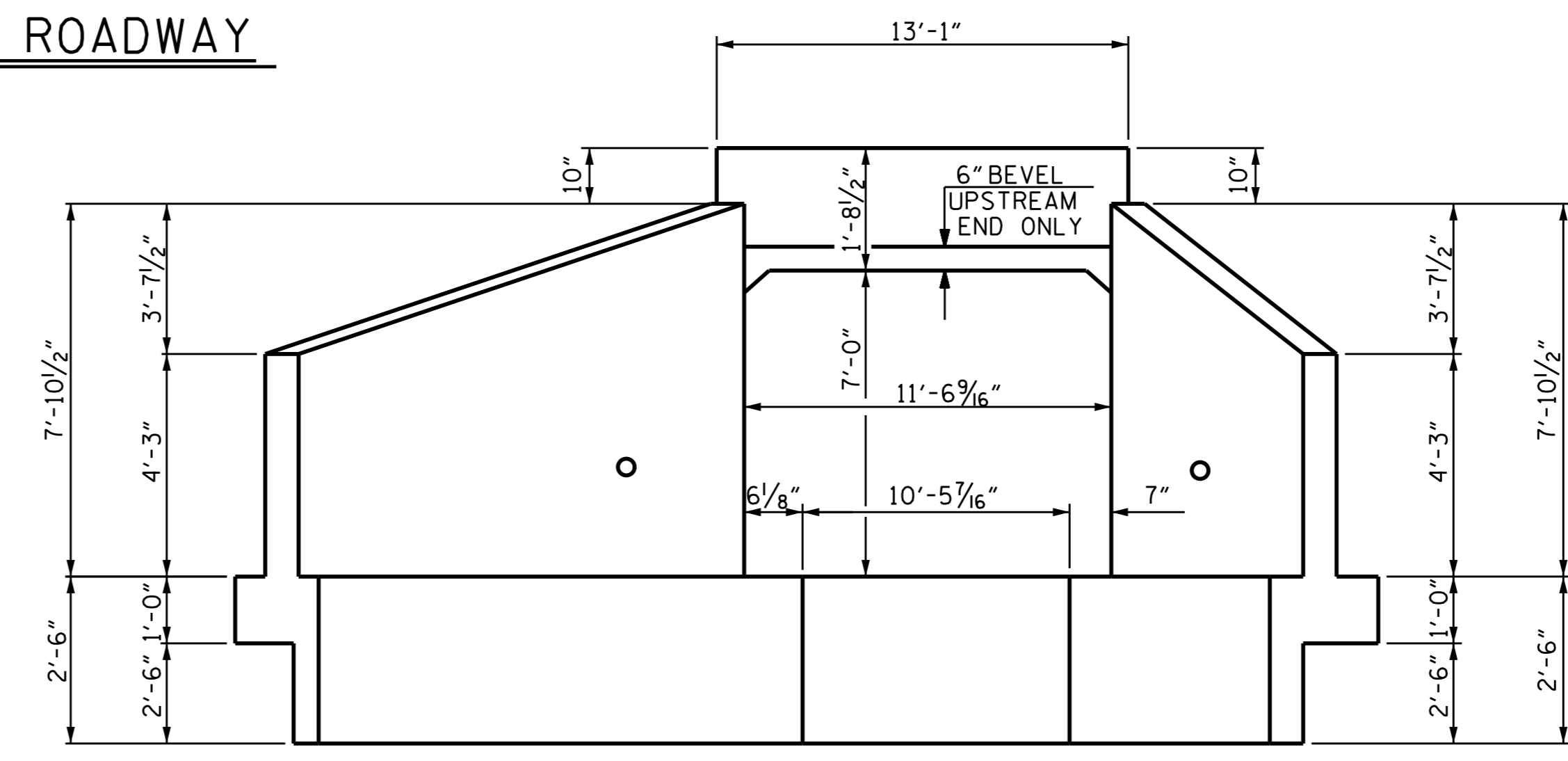
ADDED NOV. 1, 1990



CULVERT SECTION NORMAL TO ROADWAY



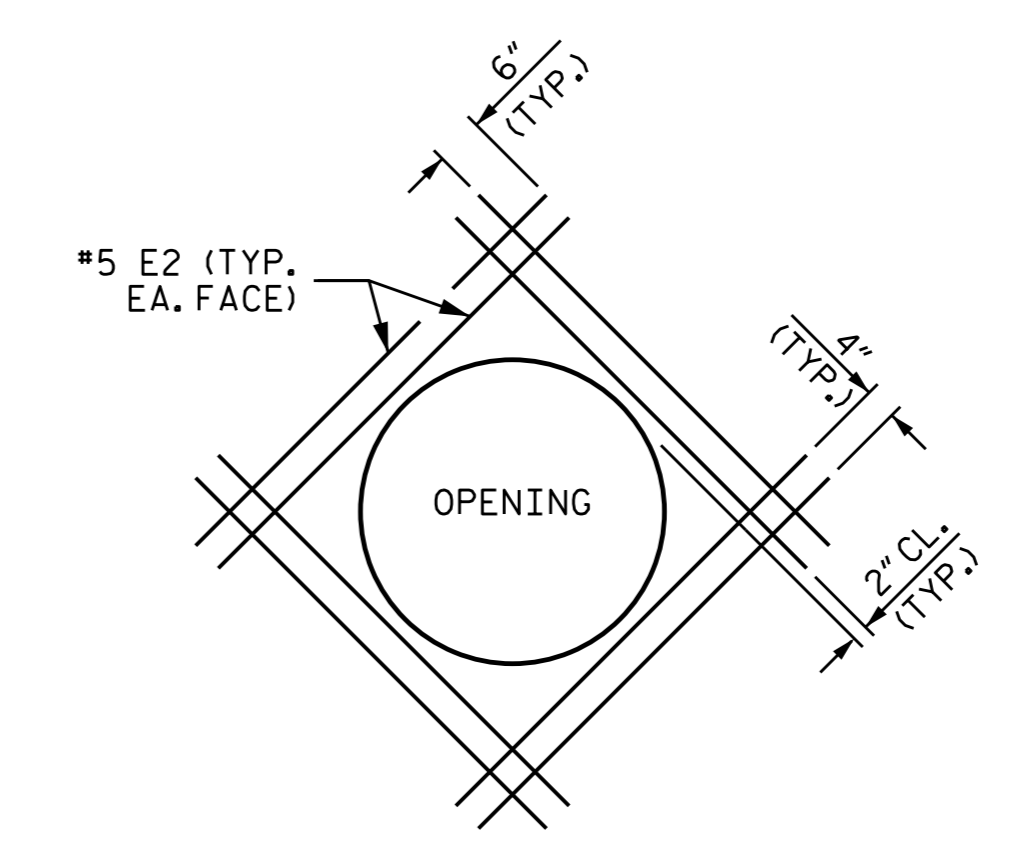
SECTION E-E
THERE ARE 40 "C" BARS IN SECTION OF BARREL



INLET END ELEVATION NORMAL TO SKEW

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

TOTAL CULVERT #3 QUANTITIES					
ITEM	C3-P1 PHASE I	C3-P2 PHASE II	C3-P3 PHASE III	TOTAL	
CLASS A CONCRETE					
BARREL @ 0.979 CY/FT	277.6 C.Y.	146.4 C.Y.	41.6 C.Y.	465.6	C.Y.
WINGS ETC.	11.1 C.Y.	--	--	11.1	C.Y.
SUBTOTAL	288.7 C.Y.	146.4 C.Y.	41.6 C.Y.	476.7	C.Y.
REINFORCING STEEL					
BARREL & SILLS	43,422 LBS.	22,723 LBS.	6,426 LBS.	72,571	LBS.
WINGS ETC.	660 LBS.	--	--	660	LBS.
SUBTOTAL	44,082 LBS.	22,723 LBS.	6,426 LBS.	73,231	LBS.
CULVERT EXCAVATION	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	
FOUNDATION COND. MAT'L	307 TONS	162 TONS	46 TONS	514	TONS



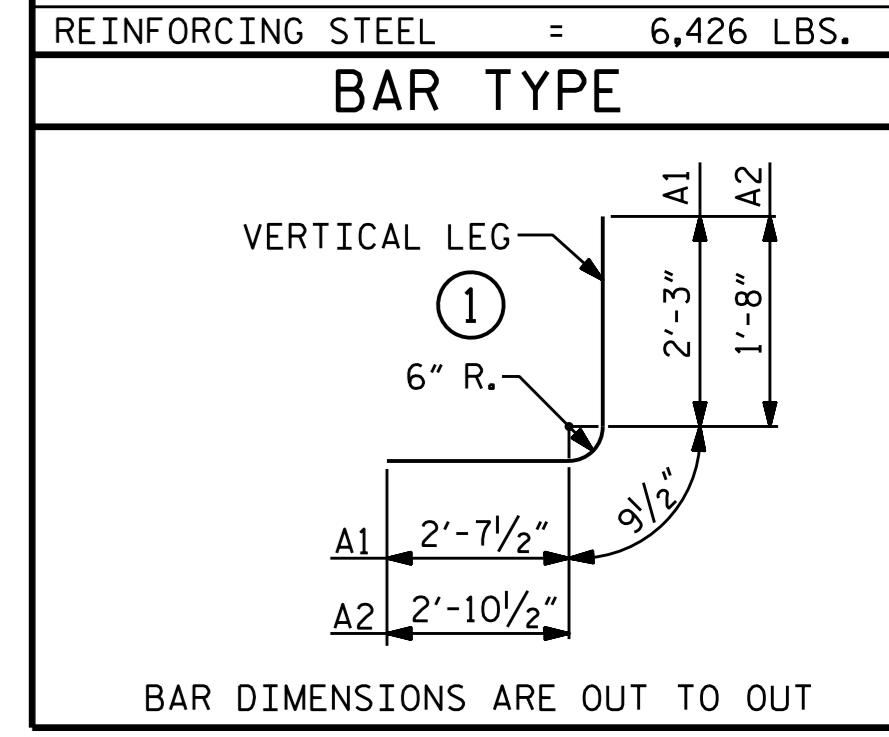
WALL OPENING DETAILS
FOR 18" Ø PIPE THRU EXTERIOR WALL
FIELD CUT & BEND "B" & "C" BARS AS NEEDED TO CLEAR PIPE

BAR SCHEDULE											
PHASE C3-P2 CONSTRUCTION						PHASE C3-P1 CONSTRUCTION					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	598	#4	1	5'-8"	2264	A1	1131	#4	1	5'-8"	4281
A2	598	#4	1	5'-4"	2131	A2	1131	#4	1	5'-4"	4029
A150	299	#6	STR	11'-0"	4940	A150	561	#6	STR	11'-0"	9269
A250	299	#6	STR	11'-0"	4940	A151	2	#6	STR	9'-0"	27
B1	300	#4	STR	8'-0"	1603	A152	2	#6	STR	7'-4"	22
B2	598	#4	STR	6'-4"	2530	A153	2	#6	STR	5'-7"	17
C2	240	#4	STR	26'-11"	4315	A154	2	#6	STR	3'-10"	12
REINFORCING STEEL = 22,723 LBS.						REINFORCING STEEL = 43,441 LBS.					

SPlice LENGTHS CHART		
BAR	SIZE	SPlice LENGTH
"C"	#4	1'-11"

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	575	#4	STR	8'-0"	3073
B2	1146	#4	STR	6'-4"	4848
C1	440	#4	STR	28'-0"	8230
E2	16	#5	STR	4'-0"	67
G1	2	#4	STR	12'-7"	17
S2	6	#8	STR	12'-7"	202

PHASE C3-P3 CONSTRUCTION					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	170	#4	1	5'-8"	644
A2	170	#4	1	5'-4"	606
A150	85	#6	STR	11'-0"	1404
A250	85	#6	STR	11'-0"	1404
B1	86	#4	STR	8'-0"	460
B2	170	#4	STR	6'-4"	719
C3	80	#4	STR	22'-3"	1189



PROJECT NO. U-2524D
GUILFORD COUNTY
STATION: 2+22.93 -SPCY8-

SHEET 2 OF 5
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
BARREL STANDARD
CULVERT #3
SINGLE 10' X 7' RCBC
C3-P1, C3-P2 & C3-P3
127°-05'-21" SKEW

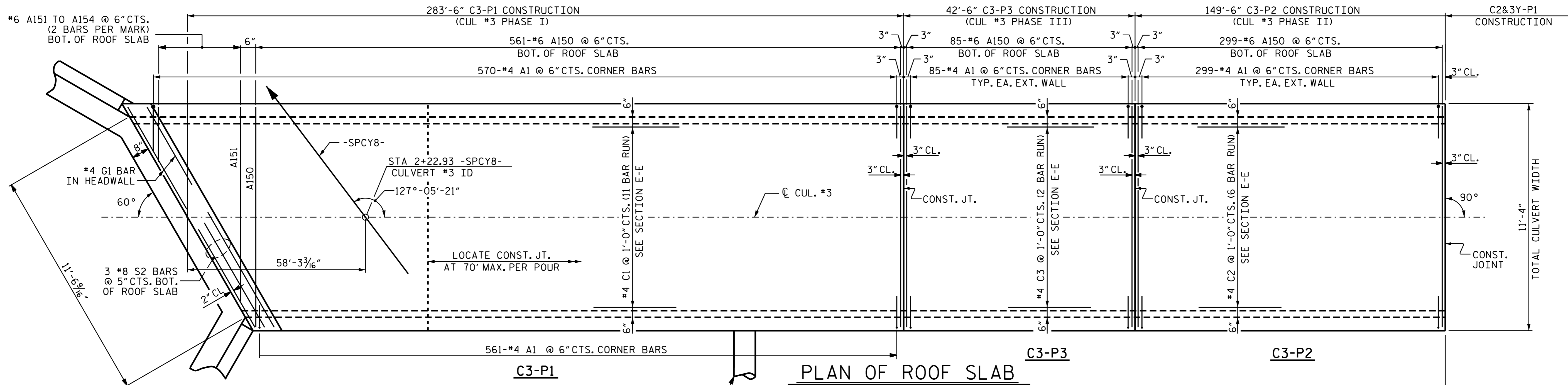


DESIGNED BY: Ting Fang
8/16/2016
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

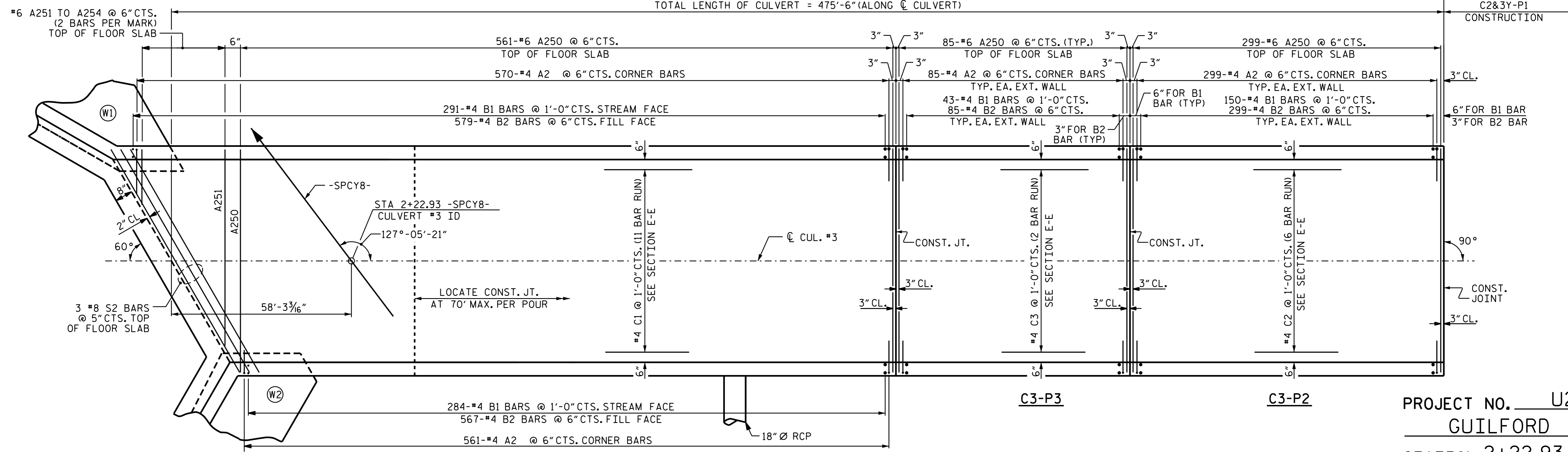
REVISIONS				SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		

REVISED 11-19-99 BY M.M. CHECKED BY R.M.W.
REDRAWN NOV. 1990 BY TSS. CHECKED BY ARB

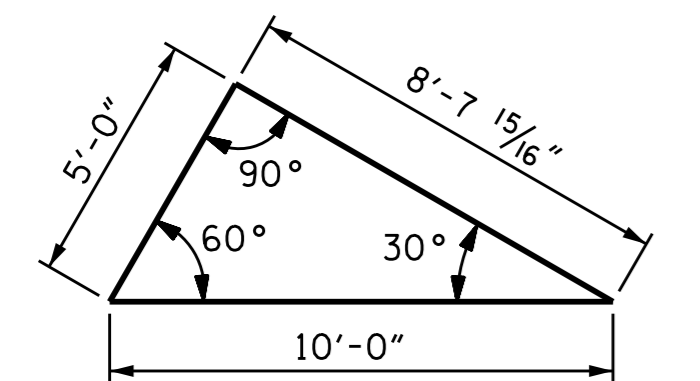
ASSEMBLED BY: M. SHAHIDI	DATE: 6/2/16	SPECIAL
CHECKED BY: T. H. FANG	DATE: 7/6/16	
DRAWN BY: RALPH D. UNDERWOOD	DATE: MAY 1971	STANDARD
CHECKED BY: JOEL A. JOHNSON	DATE: JULY 1971	



PLAN OF ROOF SLAB
 "C" BAR EXTENSION AT CONSTRUCTION JOINT NOT SHOWN FOR CLARITY.



PLAN OF FLOOR SLAB
 "C" BAR EXTENSION AT CONSTRUCTION JOINT NOT SHOWN FOR CLARITY.



SKEW TRIANGLE

PROJECT NO. U2524D
 GUILFORD COUNTY
 STATION: 2+22.93 -SPCY8-

SHEET 3 OF 5



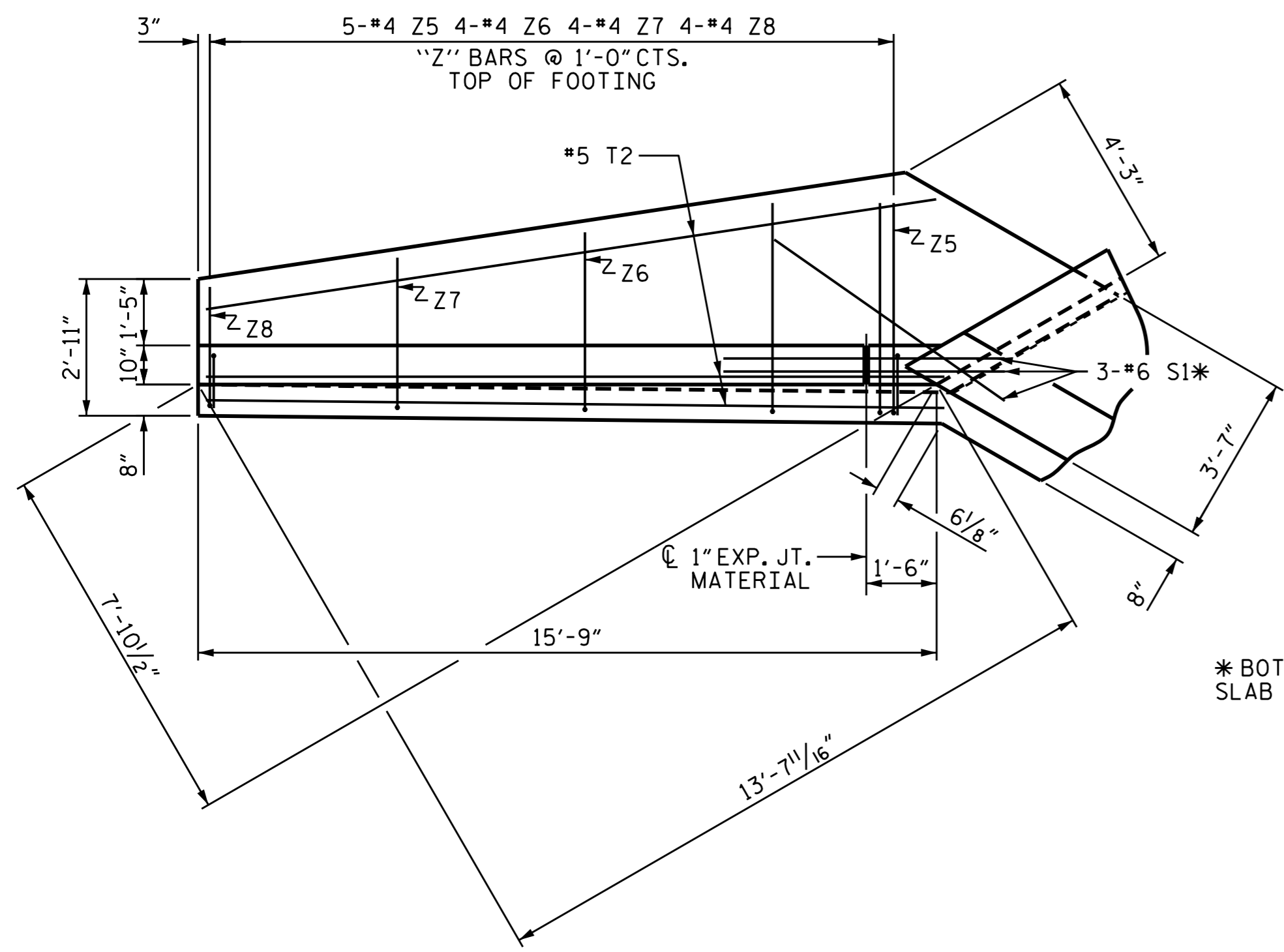
DocuSigned by:
 Ting Fang
 E7208840077435 8/16/2016

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 BARREL STANDARD
 CULVERT #3
 SINGLE 10' X 7' RCBC
 C3-P1, C3-P2 & C3-P3
 127°-05'-21" SKEW

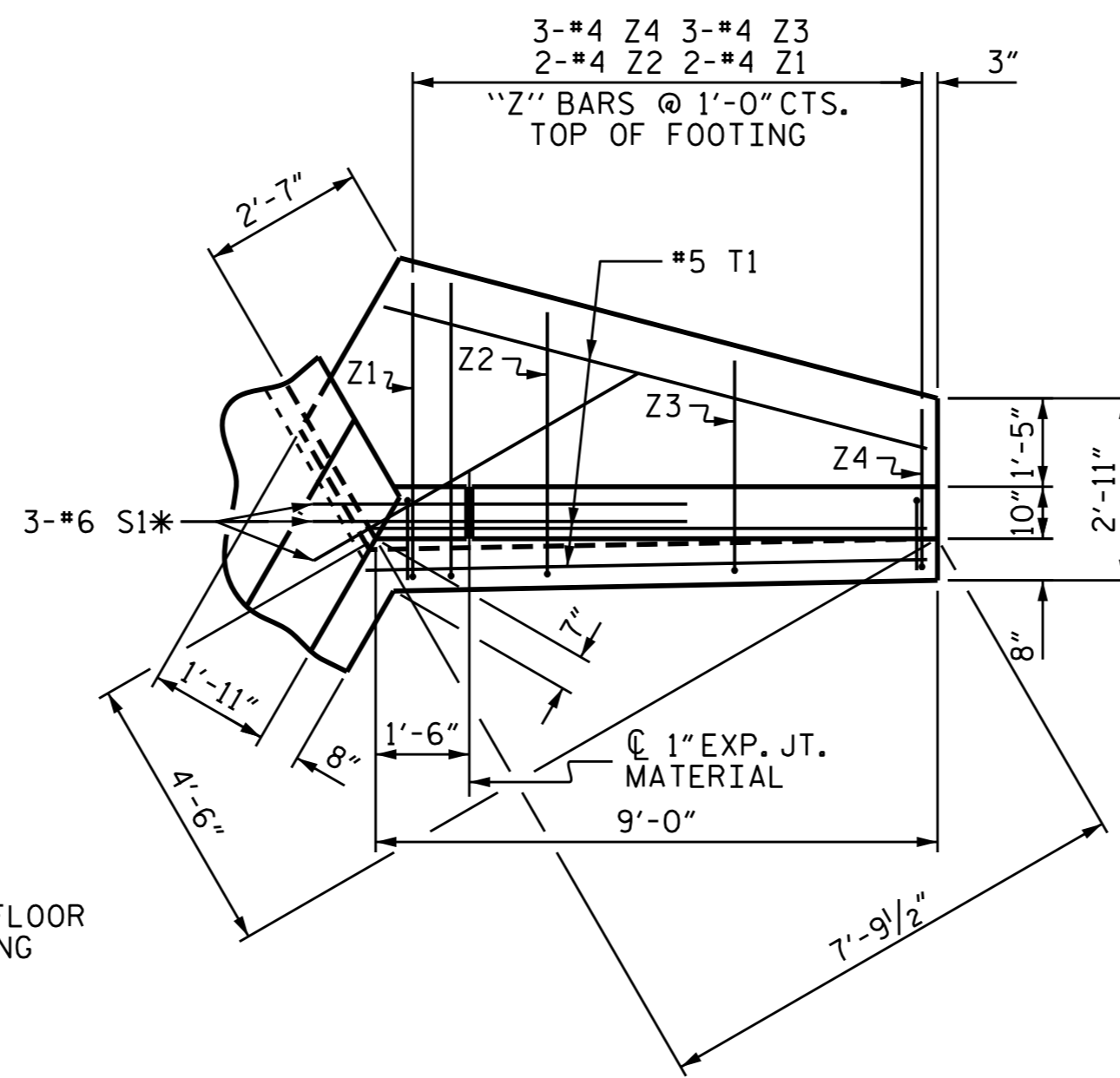
DRAWN BY : A. SORSENGINH DATE : 1/2016
 CHECKED BY : T. H. FANG DATE : 5/15/16
 DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE : 5/26/16

DOCUMENT NOT CONSIDERED
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 SIGNATURES COMPLETED

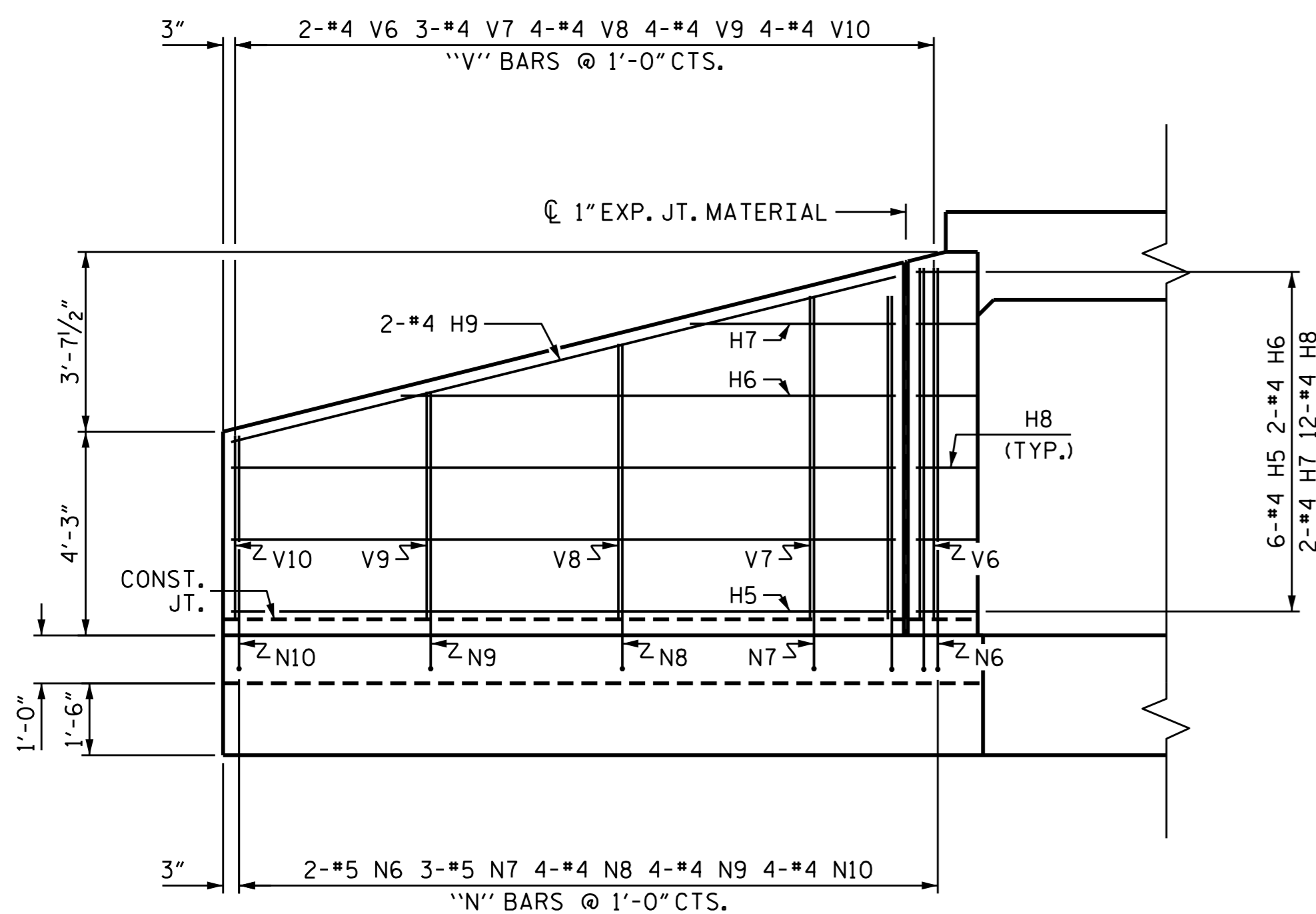
REVISIONS						SHEET NO. C-25
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			



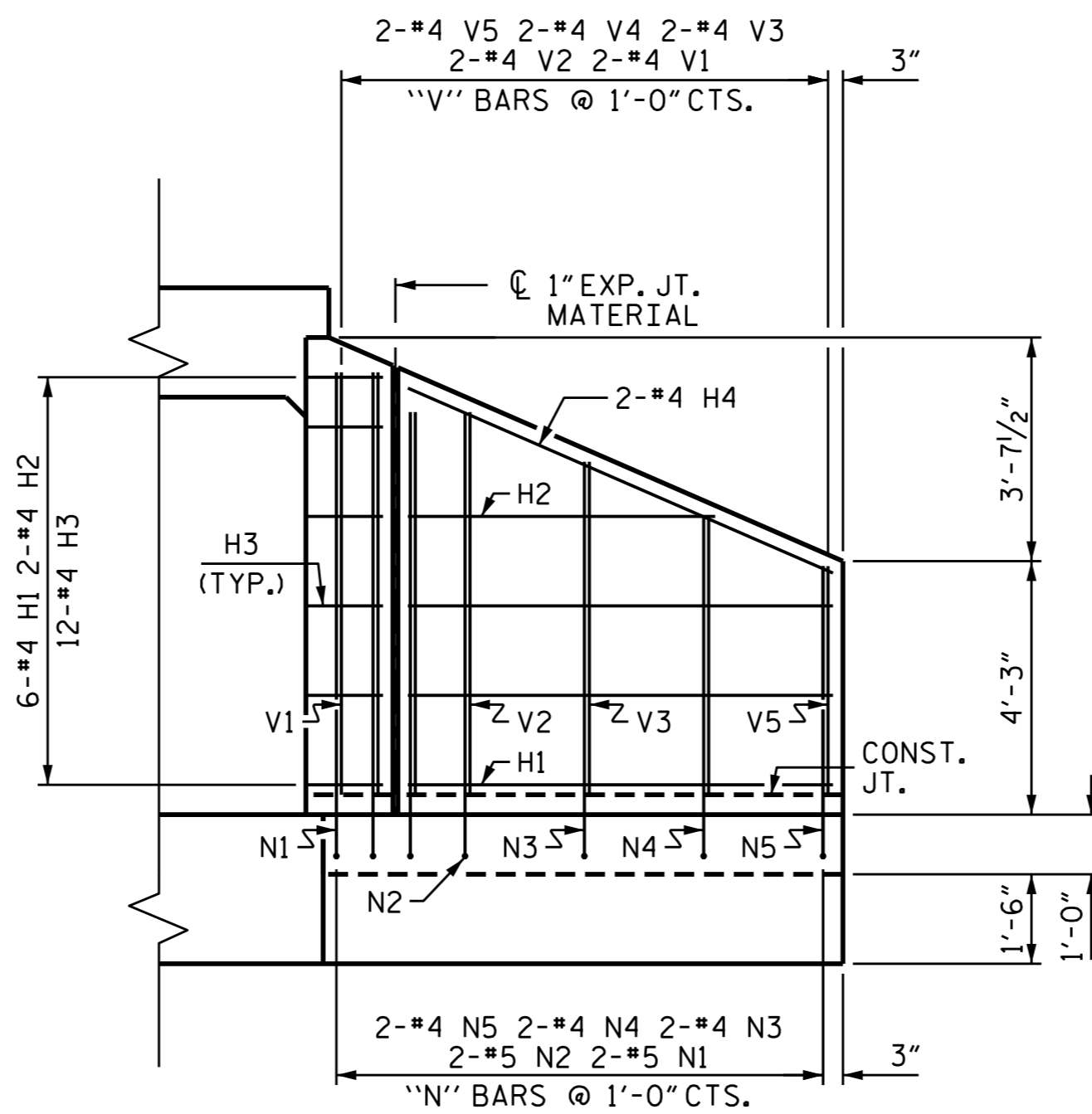
PLAN W1



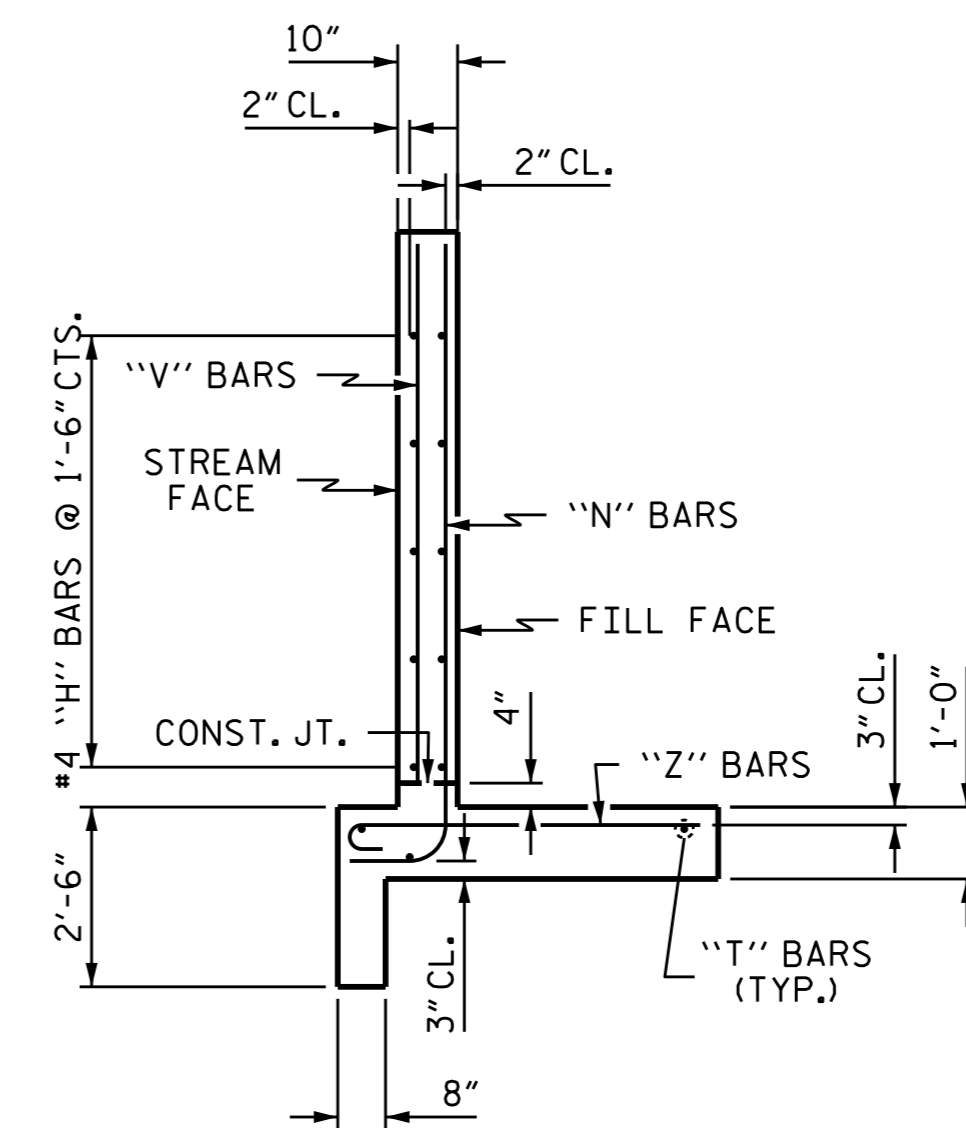
PLAN W2



ELEVATION W1



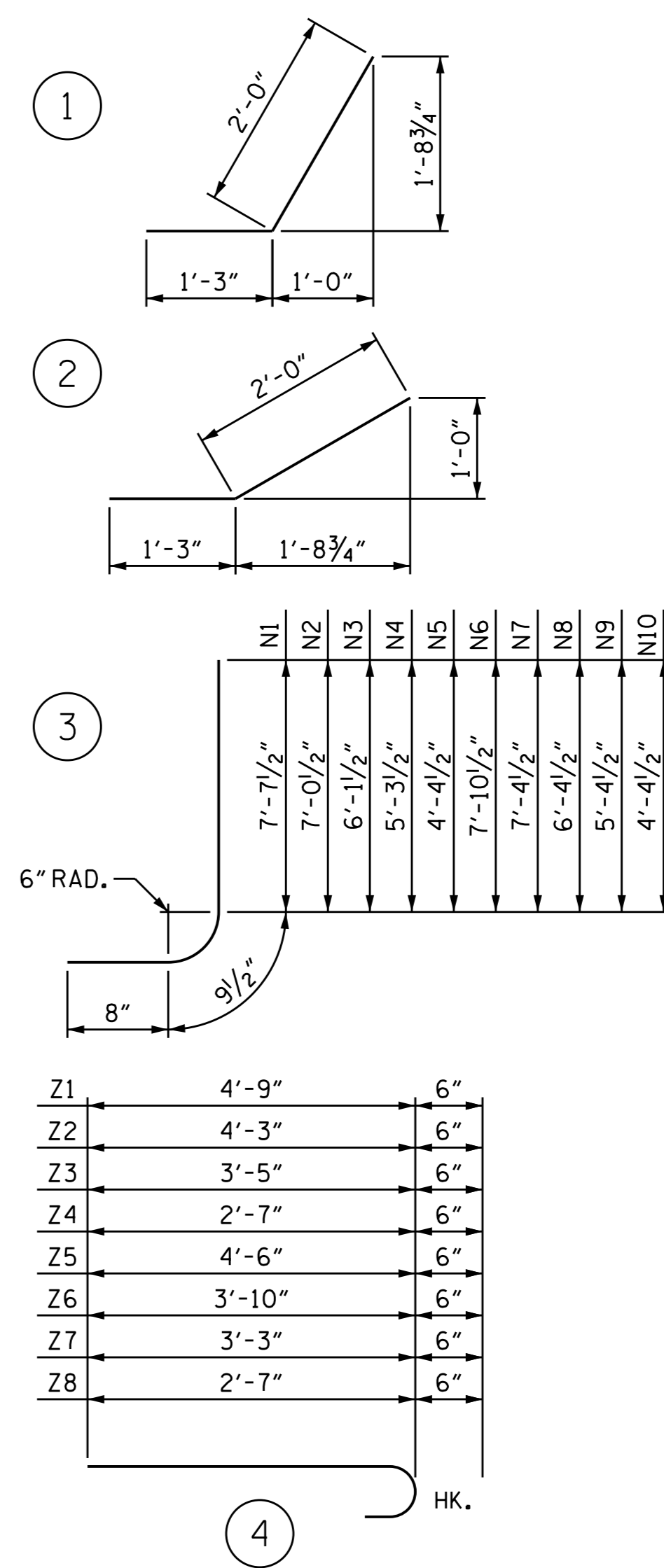
ELEVATION W2



TYPICAL WING SECTION

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL

BAR NO.	SIZE	TYPE	LENGTH	WEIGHT	
H1	#6	#4	STR	7'-1"	28
H2	2	#4	STR	5'-2"	7
H3	12	#4	1	3'-3"	26
H4	2	#4	STR	7'-9"	10
H5	6	#4	STR	13'-10"	55
H6	2	#4	STR	10'-4"	14
H7	2	#4	STR	4'-3"	5
H8	12	#4	2	3'-3"	26
H9	2	#4	STR	14'-3"	19
N1	2	#5	3	9'-1"	19
N2	2	#5	3	8'-6"	18
N3	2	#4	3	7'-7"	10
N4	2	#4	3	6'-9"	9
N5	2	#4	3	5'-10"	8
N6	2	#5	3	9'-4"	19
N7	3	#5	3	8'-10"	28
N8	4	#4	3	7'-10"	21
N9	4	#4	3	6'-10"	18
N10	4	#4	3	5'-10"	16
S1	6	#6	STR	6'-0"	54
T1	3	#5	STR	9'-0"	28
T2	3	#5	STR	15'-9"	49
V1	2	#4	STR	7'-1"	9
V2	2	#4	STR	6'-5"	9
V3	2	#4	STR	5'-7"	7
V4	2	#4	STR	4'-8"	6
V5	2	#4	STR	3'-10"	5
V6	2	#4	STR	7'-4"	10
V7	3	#4	STR	6'-9"	14
V8	4	#4	STR	5'-9"	15
V9	4	#4	STR	4'-9"	13
V10	4	#4	STR	3'-10"	10
Z1	2	#4	4	5'-3"	7
Z2	2	#4	4	4'-9"	6
Z3	3	#4	4	3'-11"	8
Z4	3	#4	4	3'-1"	6
Z5	5	#4	4	5'-0"	17
Z6	4	#4	4	4'-4"	12
Z7	4	#4	4	3'-9"	10
Z8	4	#4	4	3'-1"	8
REINFORCING STEEL FOR 2 WINGS				660 LBS	
CLASS A CONCRETE					
2 WINGS				9.9 CY	
1 HEADWALL				0.6 CY	
1 END CURTAIN WALLS				0.6 CY	
TOTAL				11.1 CY	

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 2+22.93 -SPCY8-

SHEET 4 OF 5

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION

CULVERT #3
 SINGLE 10'X7' RCBC
 INLET END WINGS

H = 7'-0" SLOPE = 2:1
 120° SKEW



DocuSigned by:
 Ting Fang 8/16/2016

DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
 SIGNATURES COMPLETED

REVISIONS				SHEET NO.		
NO.	BY:	DATE:	NO.	BY:	DATE:	TOTAL SHEETS
1			3			34
2			4			

ASSEMBLED BY: A. SORSENGINH DATE: 6/7/16
 CHECKED BY: T. H. FANG DATE: 6/15/16
 DRAWN BY: CCJ 11/99
 CHECKED BY: RWW 03/00

**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		
						MOMENT				SHEAR						
						LIVE-LOAD FACTORS (LL)	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	1.27	--	1.75	1.55	1	TOP SLAB	5.33	1.27	1	BOTTOM SLAB	0.90		
	HL-93 (OPERATING)	N/A		1.64	--	1.35	2.01	1	TOP SLAB	5.33	1.64	1	BOTTOM SLAB	0.90		
	HS-20 (INVENTORY)	36.000	②	1.65	59.29	1.75	2.12	1	TOP CORNER WALL	0.58	1.65	1	BOTTOM SLAB	0.90		
	HS-20 (OPERATING)	36.000		2.13	76.86	1.35	2.75	1	TOP CORNER WALL	0.58	2.13	1	BOTTOM SLAB	0.90		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		2.98	40.19	1.40	3.66	1	BOT CORNER WALL	7.36	2.98	1	BOTTOM SLAB	0.90		
		SNGARBS2	20.000		2.80	56.09	1.40	3.44	1	TOP CORNER WALL	0.58	2.80	1	BOTTOM SLAB	0.90	
		SNAGRIS2	22.000		2.98	65.50	1.40	3.66	1	BOT CORNER WALL	7.36	2.98	1	BOTTOM SLAB	0.90	
		SNCOTTS3	27.250	③	1.59	43.22	1.40	1.91	1	TOP CORNER WALL	0.58	1.59	1	BOTTOM SLAB	0.90	
		SNAGGRS4	34.925		1.60	55.85	1.40	2.05	1	TOP CORNER WALL	0.58	1.60	1	BOTTOM SLAB	9.76	
		SNS5A	35.550		1.65	58.80	1.40	2.06	1	TOP CORNER WALL	0.58	1.65	1	BOTTOM SLAB	0.90	
		SNS6A	39.950		1.64	65.51	1.40	2.06	1	TOP CORNER WALL	0.58	1.64	1	BOTTOM SLAB	0.90	
		SNS7B	42.000		1.64	68.88	1.40	2.06	1	TOP CORNER WALL	0.58	1.64	1	BOTTOM SLAB	0.90	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.58	85.14	1.40	3.20	1	TOP CORNER WALL	0.58	2.58	1	BOTTOM SLAB	0.90	
		TNT4A	33.075		1.88	62.14	1.40	2.23	1	TOP CORNER WALL	0.58	1.88	1	BOTTOM SLAB	0.90	
		TNT6A	41.600		1.60	66.53	1.40	2.02	1	TOP CORNER WALL	0.58	1.60	1	BOTTOM SLAB	9.76	
		TNT7A	42.000		1.76	73.89	1.40	2.17	1	TOP CORNER WALL	0.58	1.76	1	BOTTOM SLAB	9.76	
		TNT7B	42.000		1.65	69.47	1.40	2.07	1	TOP CORNER WALL	0.58	1.65	1	BOTTOM SLAB	0.90	
		TNAGRIT4	43.000		1.79	77.05	1.40	2.14	1	TOP CORNER WALL	0.58	1.79	1	BOTTOM SLAB	0.90	
		TNAGT5A	45.000		1.83	82.15	1.40	2.18	1	TOP CORNER WALL	0.58	1.83	1	BOTTOM SLAB	0.90	
		TNAGT5B	45.000		1.88	84.54	1.40	2.23	1	TOP CORNER WALL	0.58	1.88	1	BOTTOM SLAB	0.90	

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	--

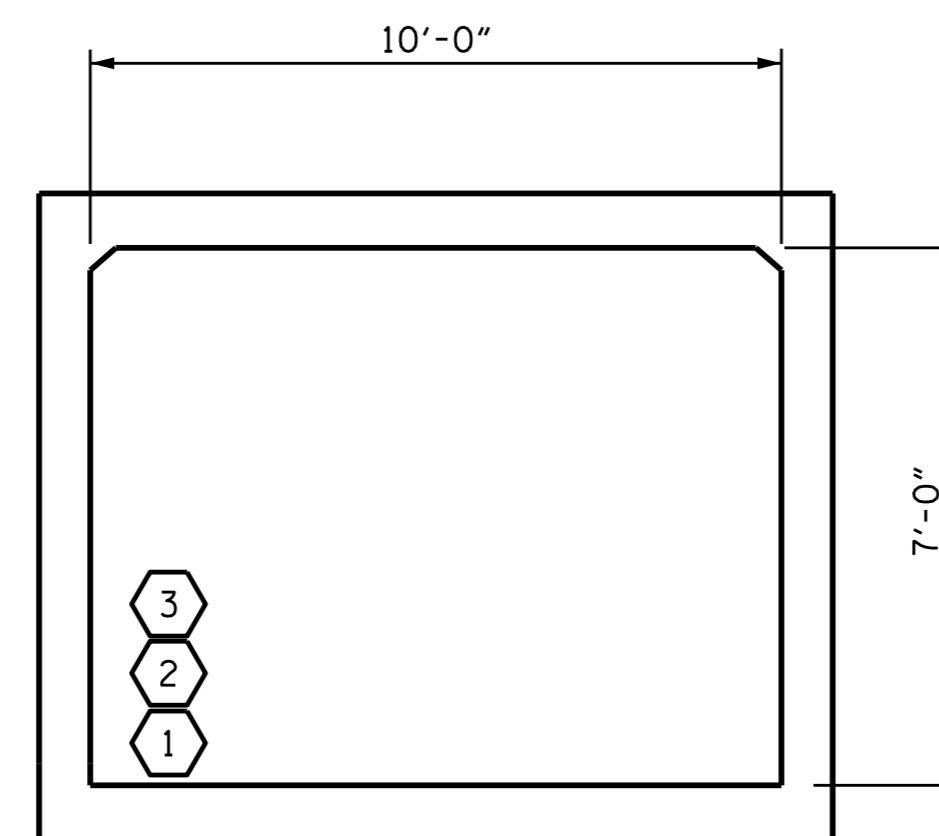
NOTE:

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. U-2524D
GUILFORD COUNTY
 STATION: 2+22.93 -SPCY8-

SHEET 5 OF 5



DocuSigned by:
Ting Fang 7/14/2016

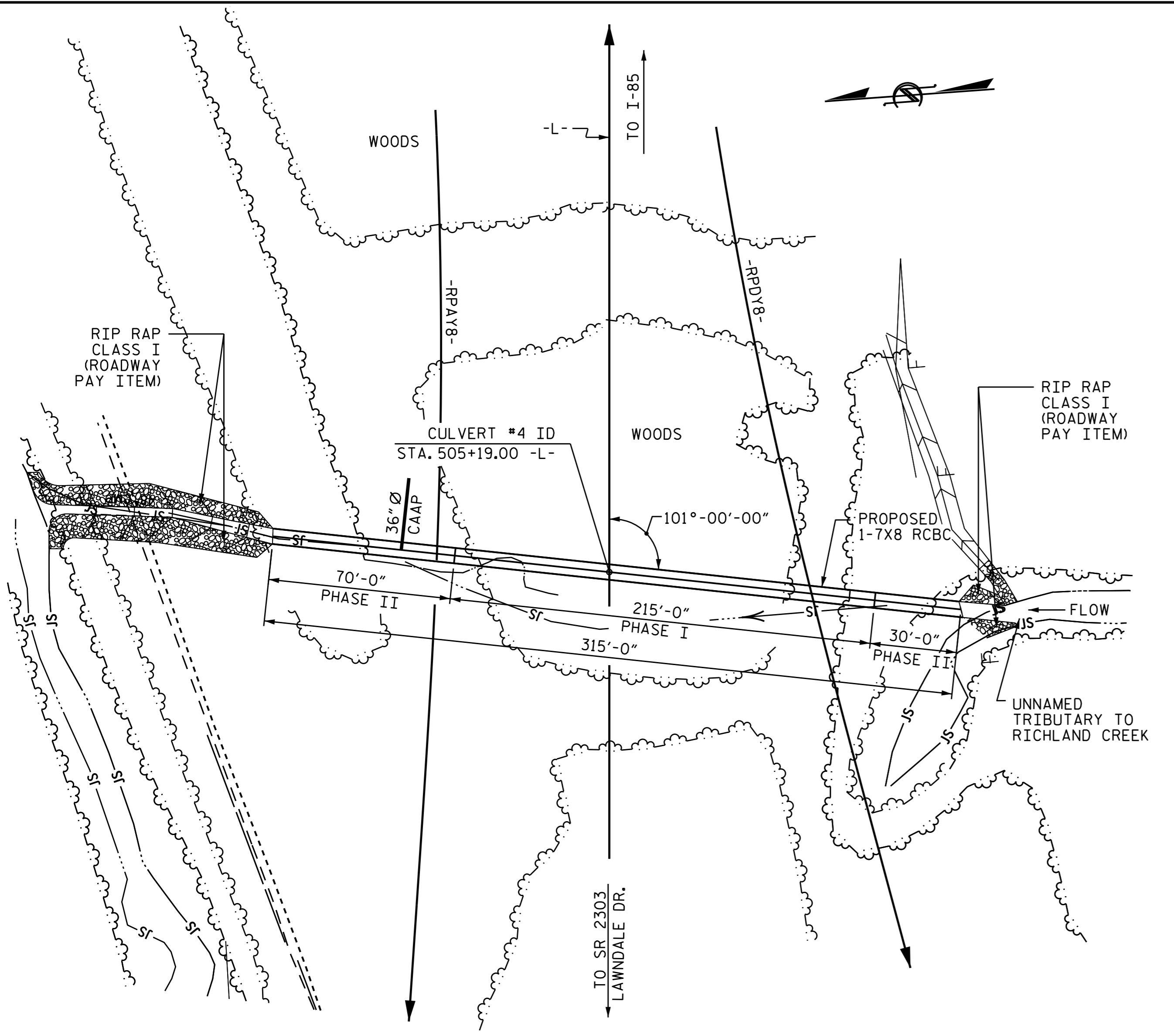
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD
 LRFR SUMMARY FOR
 REINFORCED CONCRETE
 BOX CULVERTS
 (NON-INTERSTATE TRAFFIC)
 SINGLE BARREL

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-27
①			③			TOTAL SHEETS
②			④			34

ASSEMBLED BY : P. K. NEWTON	DATE : 7/8/16
CHECKED BY : T. H. FANG	DATE : 7/11/16
DRAWN BY : WMC 7/11	REV. 10/1/11 MAA/GM
CHECKED BY : GM 7/11	

T10-585, NAIL SET 146.93' LT OF -L- STA.503+26.50 EL.761.20

F.A. PROJECT NO. NHF-0708(53)



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

HYDRAULIC DATA

DESIGN DISCHARGE	= 240 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 767.7
DRAINAGE AREA	= 0.22 SQ. MI.
BASE DISCHARGE (Q100)	= 260 CFS
BASE HIGH WATER ELEVATION	= 768.02

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 300+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= >500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 774.3

GRADE DATA

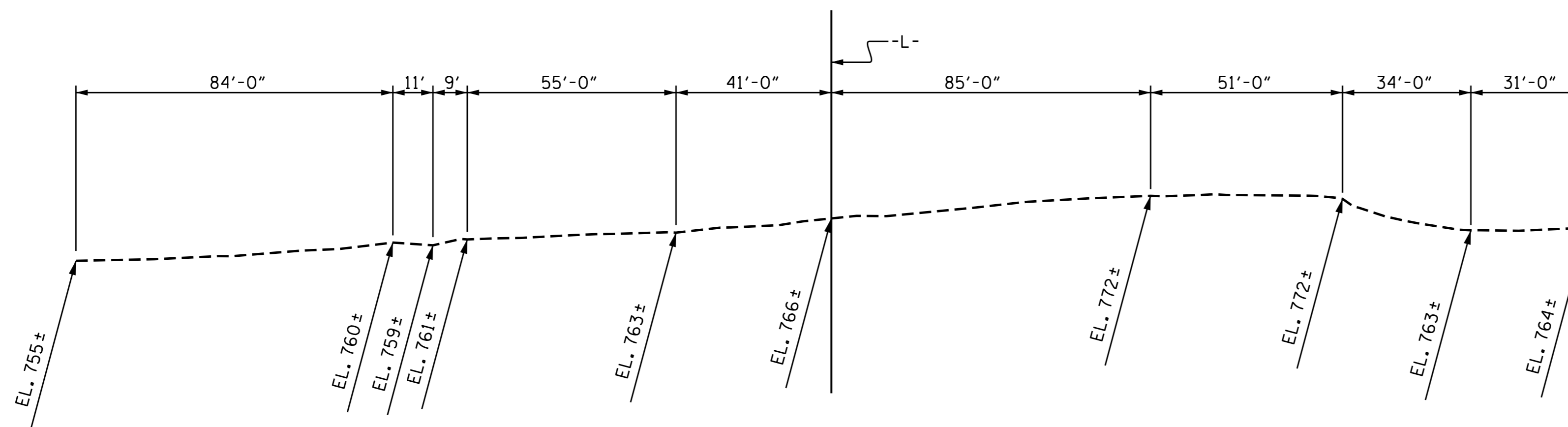
GRADE POINT ELEVATION @ STA. 505+19.00 -L-	= 790.20'
BED ELEVATION @ STA. 505+19.00 -L-	= 758.50'
ROADWAY FILL SLOPES	= 2:1

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE	
PHASE I	212.9 C.Y.
PHASE II	123.4 C.Y.
TOTAL	336.3 C.Y.
REINFORCING STEEL	
PHASE I	27,330 LBS.
PHASE II	14,452 LBS.
TOTAL	41,782 LBS.
FOUNDATION COND. MATERIAL	
PHASE I	187 TONS
PHASE II	87 TONS
TOTAL	274 TONS
CULVERT EXCAVATION (TOTAL)	LUMP SUM

NOTES:

- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- DESIGN FILL ----- 24.22'
- FOR OTHER DESIGN DATA AND NOTES SEE STANDARD NOTE SHEET.
- 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.
- 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.
- AT THE CONTRACTORS 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.
- 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.
- THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE BARS FROM WHICH THE SAMPLES ARE TAKEN MUST THEN BE SPLICED WITH REPLACEMENT BARS OF THE SIZE AND LENGTH OF THE SAMPLE, PLUS A MINIMUM LAP SPLICE OF THIRTY BAR DIAMETERS. PAYMENT FOR THE SAMPLES OF REINFORCING STEEL SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAY ITEMS.
- THE 36" Ø CAAP THROUGH THE SIDEWALL OF THE CULVERT SHALL BE LOCATED BY THE ENGINEER. THE REINFORCING STEEL SHALL BE FIELD BENT AS NECESSARY TO CLEAR PIPE.
- THE CONTRACTOR SHALL FILL THE PROPOSED CULVERT WITH NATURAL BED MATERIAL TO A DEPTH OF 1 FOOT. EXISTING BED MATERIAL SHALL BE STOCKPILED FOR USE IN THE AREA OF PROPOSED CULVERT AS DIRECTED BY THE ENGINEER. PAYMENT SHALL BE INCLUDED IN THE LUMP SUM PAY ITEM FOR CULVERT EXCAVATION
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- FOR CULVERT DIVERSION DETAILS & PAY ITEM, SEE EROSION CONTROL PLANS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR MAINTENANCE OF TRAFFIC, SEE TRAFFIC CONTROL PLANS.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

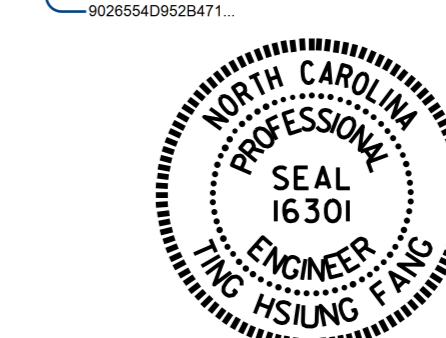


PROFILE ALONG CULVERT

DRAWN BY : REZA KOUCHEKI DATE : 1/29/16
 CHECKED BY : T. H. FANG DATE : 5/30/16
 DESIGN ENGINEER OF RECORD: REZA KOUCHEKI DATE : 4/12/16



DocuSigned by: J. M. Bailey 7/15/2016



DocuSigned by: Ting Fang 7/14/2016

PROJECT NO. U-2524D

GUILFORD COUNTY

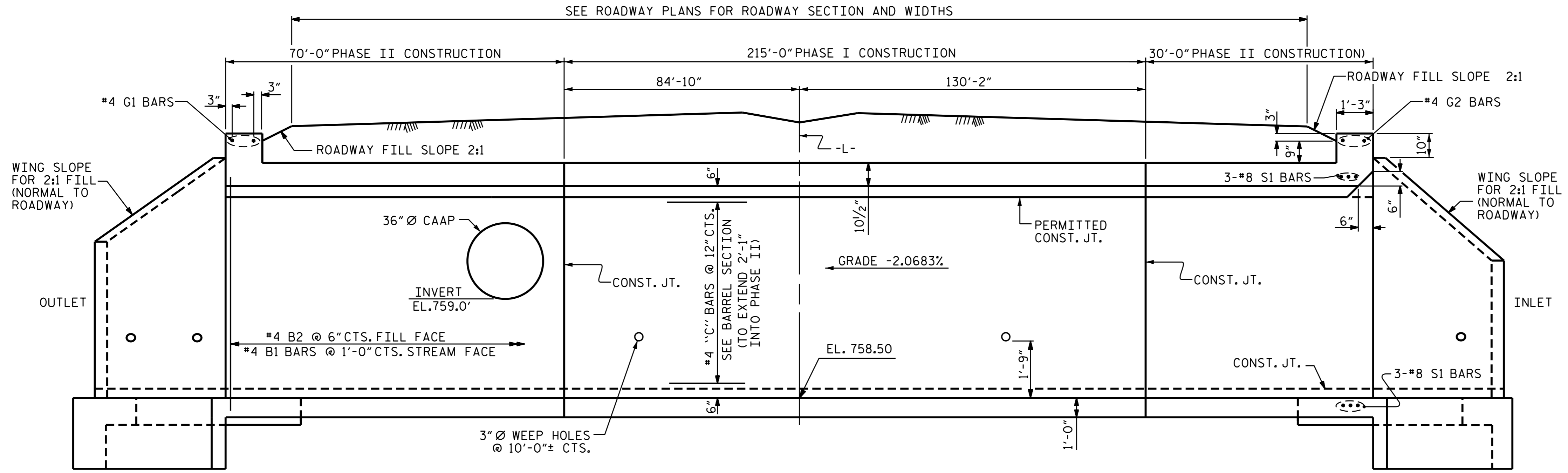
STATION: 505+19.00 -L-

SHEET 1 OF 7

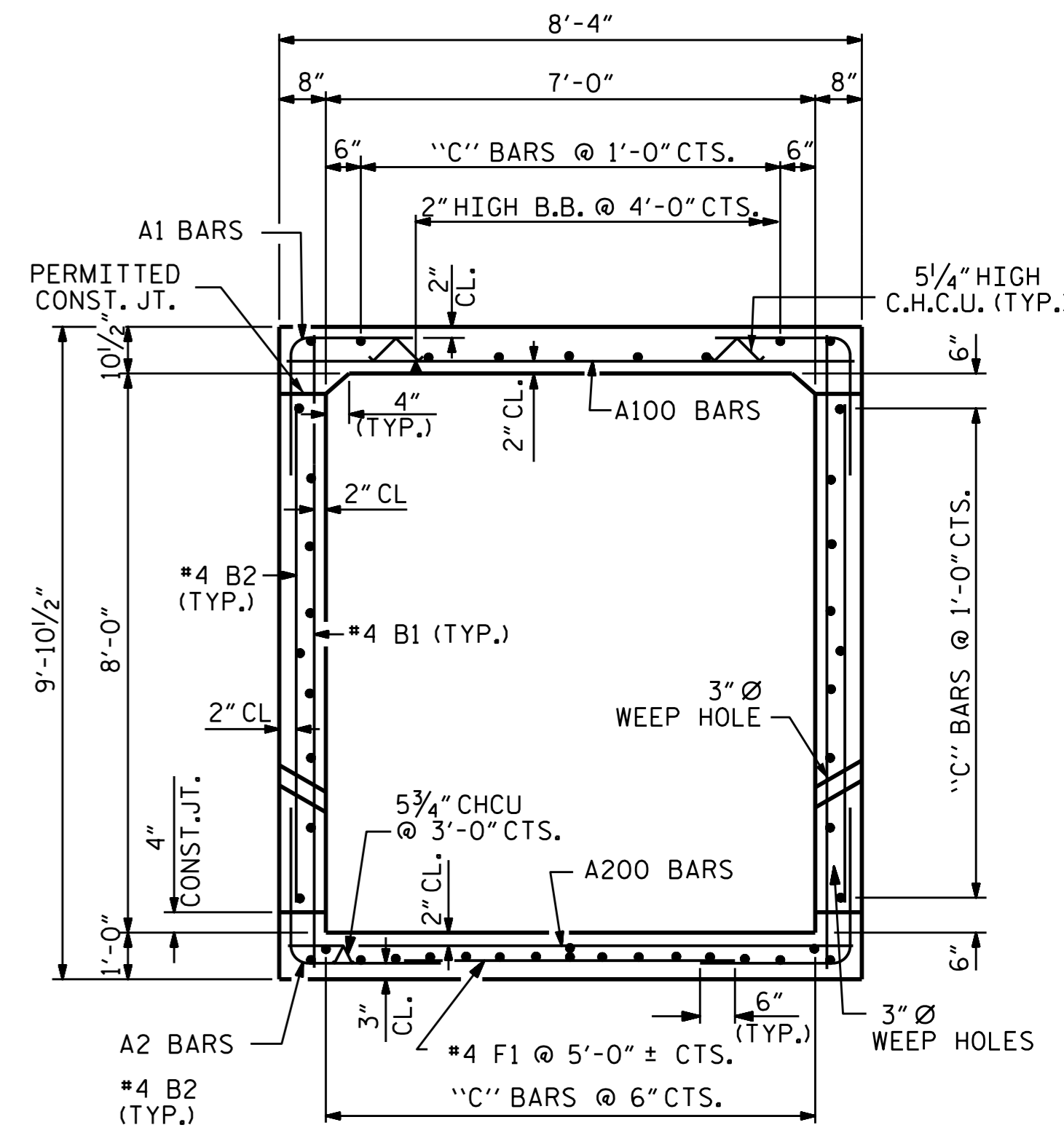
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

CULVERT #4
 SINGLE 7 FT. X 8 FT.
 CONCRETE BOX CULVERT
 101° SKEW

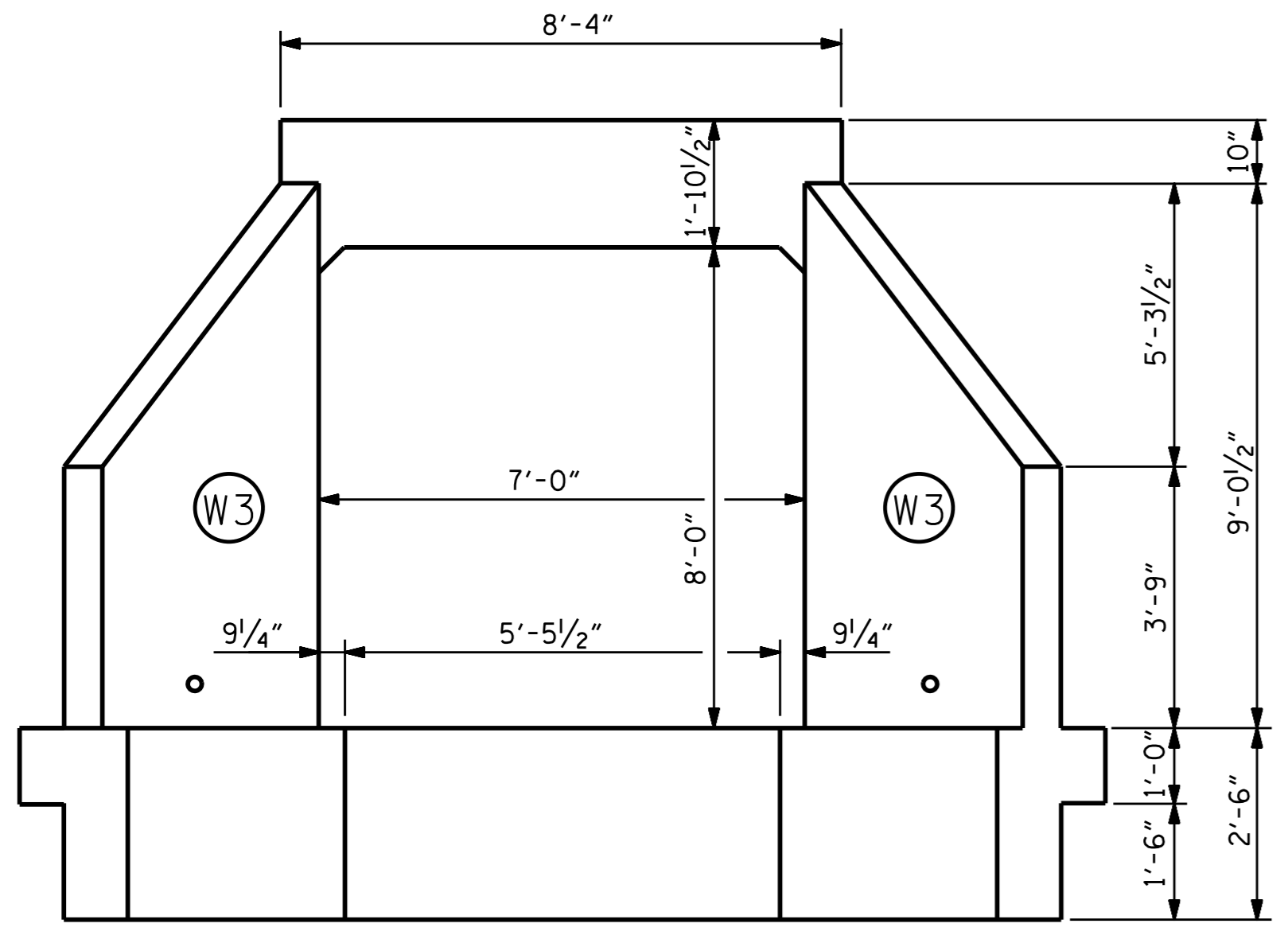
REVISIONS				SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED					TOTAL SHEETS 34



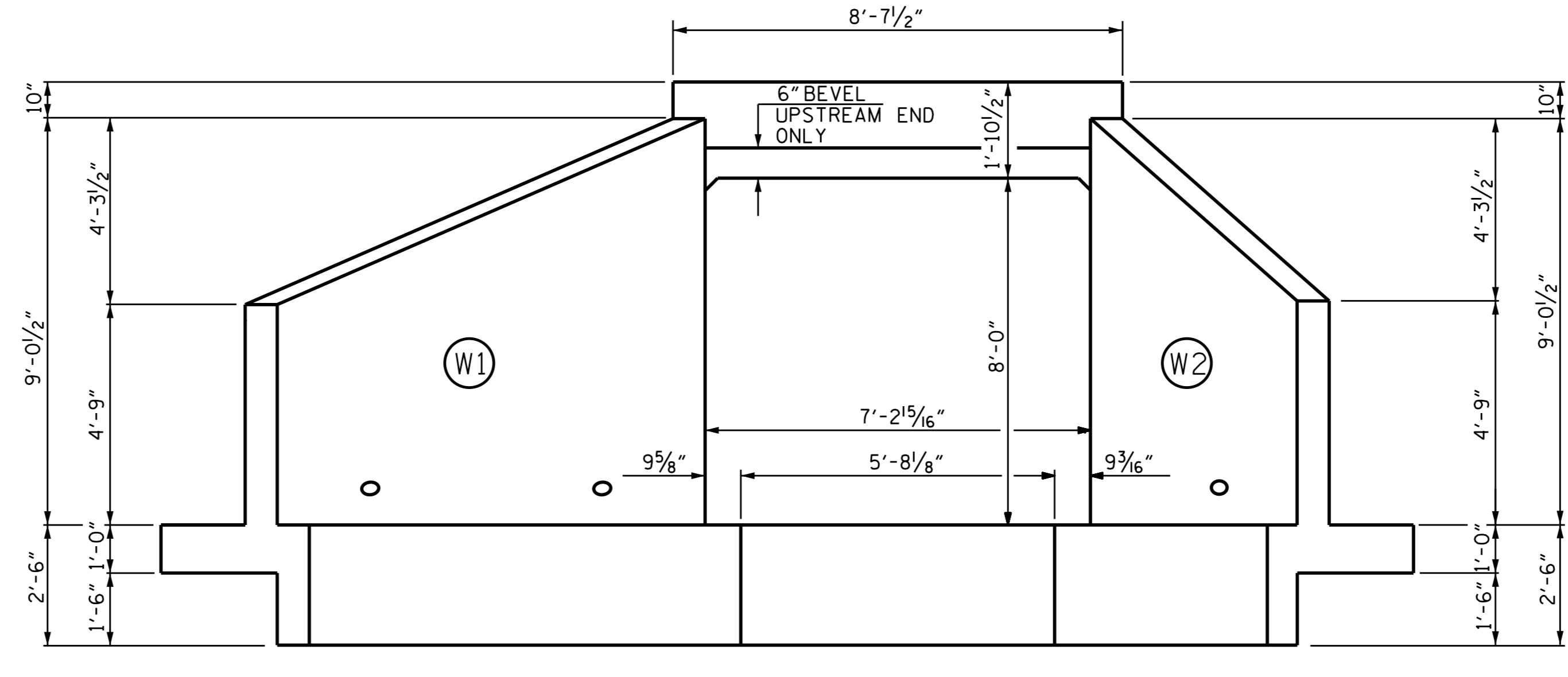
CULVERT SECTION (ALONG C CULVERT)
 FOR PIPES THRU EXTERIOR WALL, SEE WALL OPENING DETAILS.



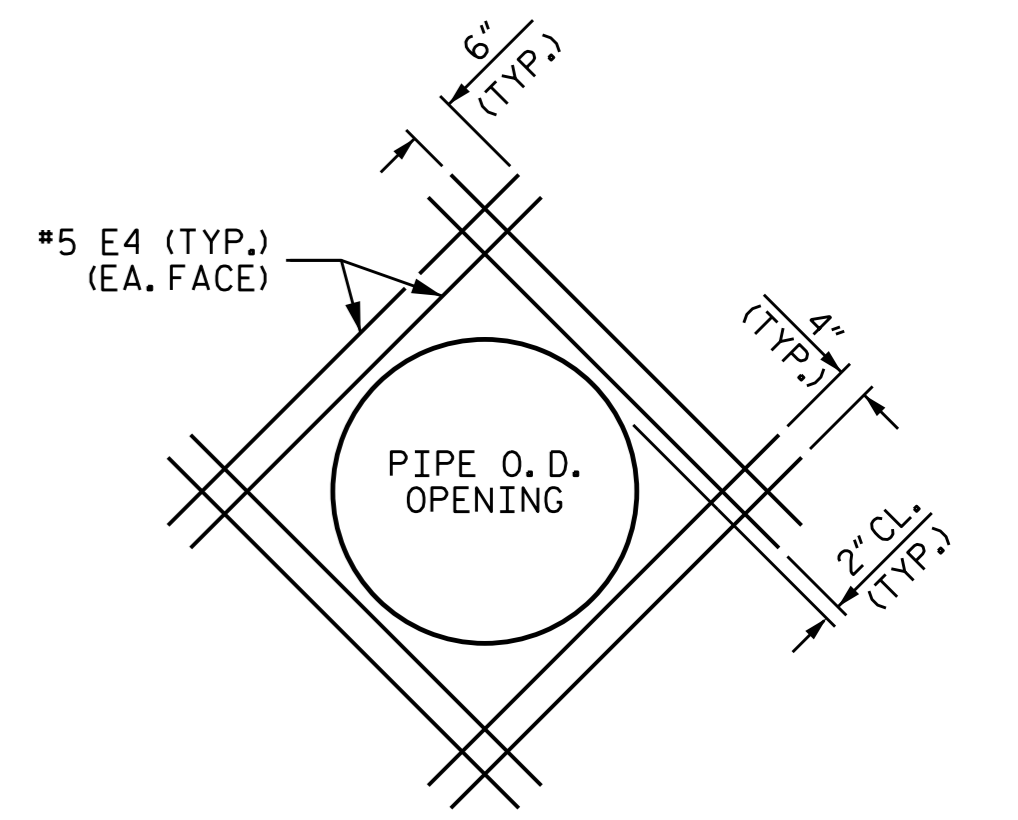
RIGHT ANGLE SECTION OF BARREL
 THERE ARE 45 "C" BARS IN SECTION OF BARREL



OUTLET END ELEVATION
 LOOKING UPSTREAM



INLET END ELEVATION NORMAL TO SKEW
 LOOKING DOWNSTREAM



WALL OPENING DETAILS
 FOR 36" Ø CAAP THRU EXTERIOR WALL.
 FIELD CUT & BEND "B" & "C" BARS AS NEEDED
 TO CLEAR PIPE

TOTAL CULVERT#4 QUANTITIES			
PHASE I		PHASE II	
CLASS A CONCRETE		CLASS A CONCRETE	
BARREL @ 0.978 CY/FT	210.3 C.Y.	BARREL @ 0.978 CY/FT	97.8 C.Y.
WING ETC.	0 C.Y.	WING ETC.	23.5 C.Y.
SILLS & BAFFLES	2.6 C.Y.	SILLS & BAFFLES	2.1 C.Y.
TOTAL	212.9 C.Y.	TOTAL	123.4 C.Y.
REINFORCING STEEL		REINFORCING STEEL	
BARREL	27,330 LBS.	BARREL	12,955 LBS.
WINGS ETC.	0 LBS.	WINGS ETC.	1,497 LBS.
TOTAL	27,330 LBS.	TOTAL	14,452 LBS.
CULVERT EXCAVATION	LUMP SUM	CULVERT EXCAVATION	LUMP SUM
FOUNDATON COND. MAT'L	187 TONS	FOUNDATON COND. MAT'L	87 TONS

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 505+19.00 -L-

SHEET 2 OF 7
 STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
CULVERT #4
SINGLE 7 FT. X 8 FT.
CONCRETE BOX CULVERT
101° SKEW



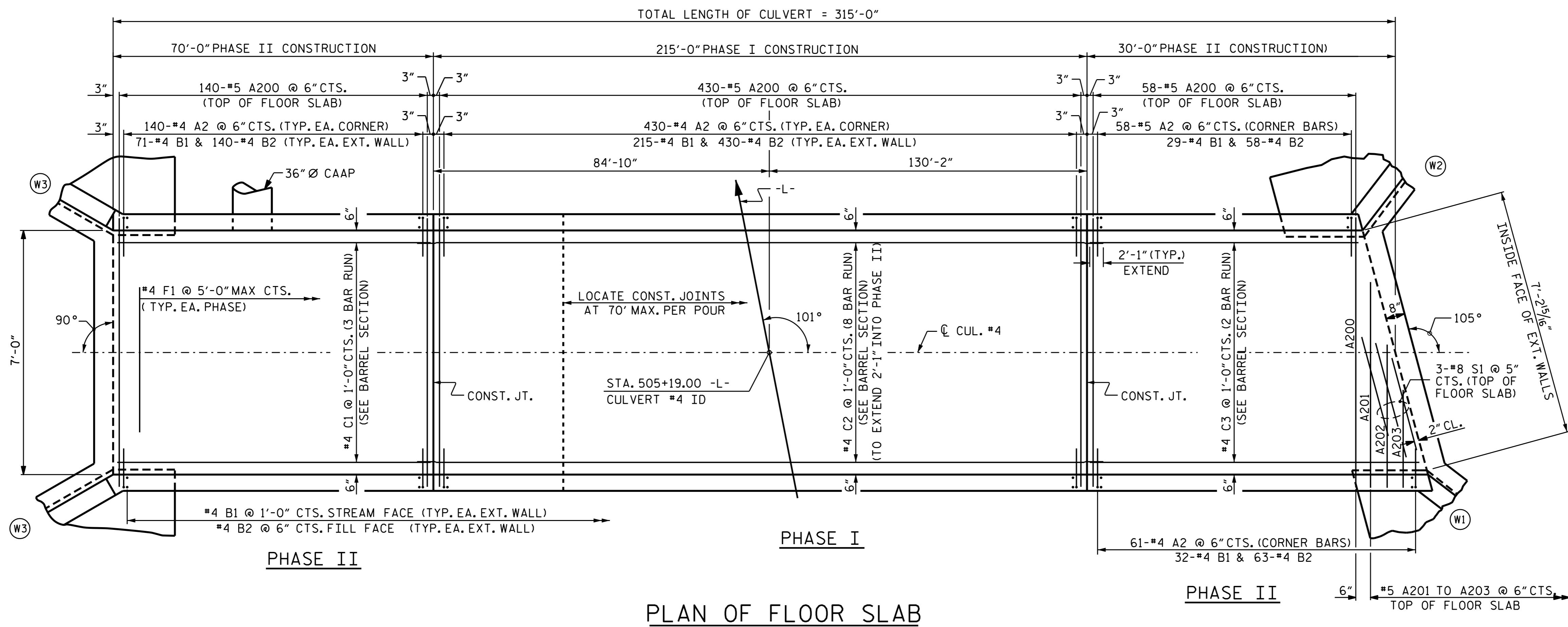
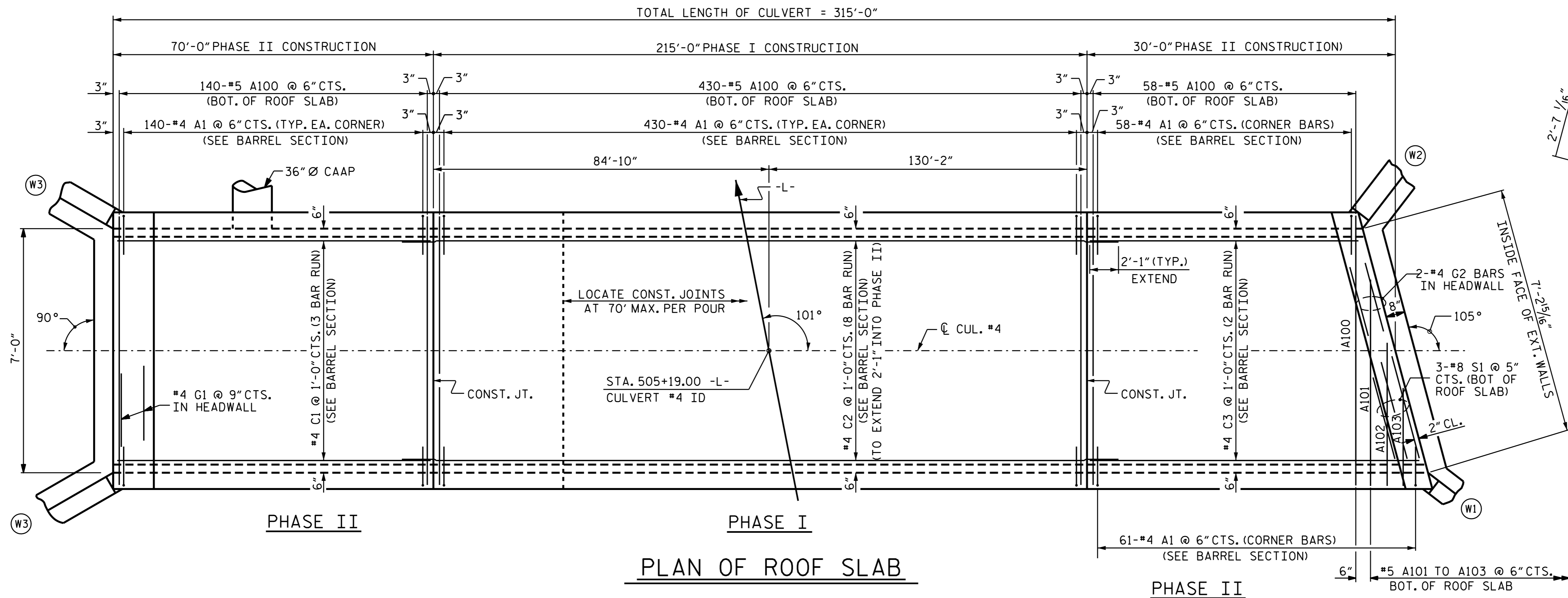
Drawn by: *Ting Fang*
 7/15/2016
 DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

TOTAL SHEETS: 34

REVISED 11-19-99 BY M.M. CHECKED BY R.W.W.

DRAWN BY: REZA KOUCHEKI DATE: 4/29/16
 CHECKED BY: T. H. FANG DATE: 5/30/16
 DESIGN ENGINEER OF RECORD: REZA KOUCHEKI DATE: 1/29/16



DocuSigned by:
Ting Fang
8/16/2016
E7208400977435

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 505+19.00 -L-

SHEET 3 OF 7

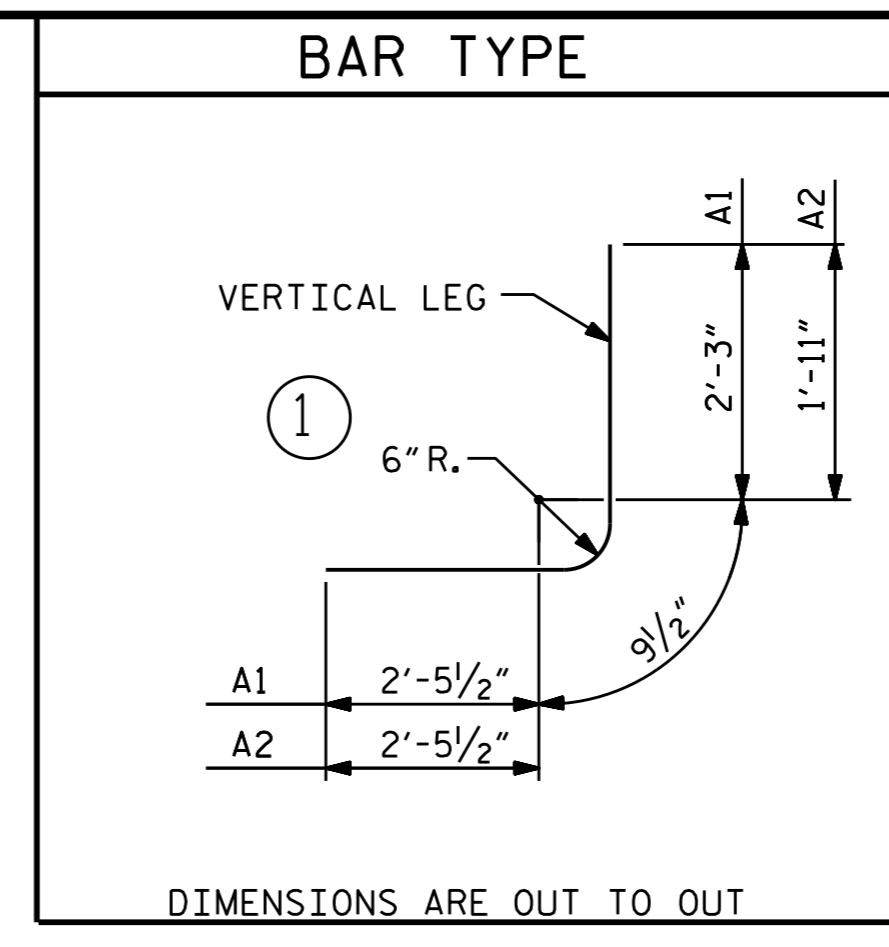
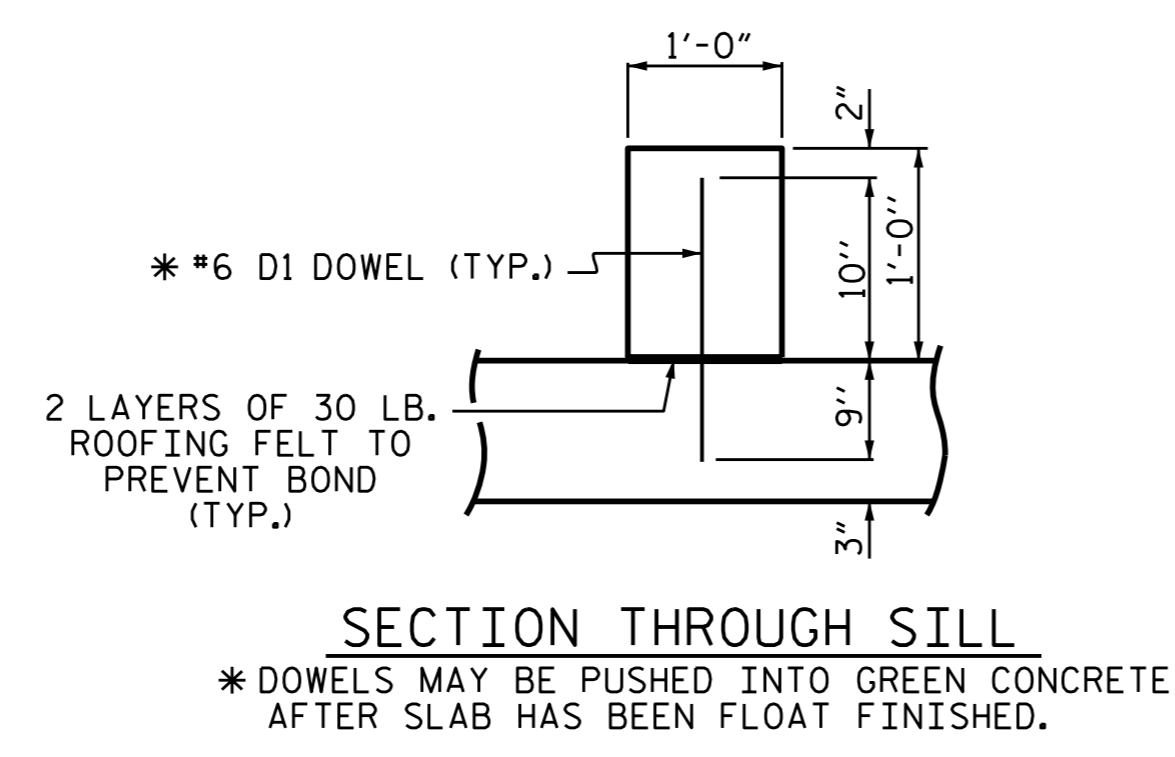
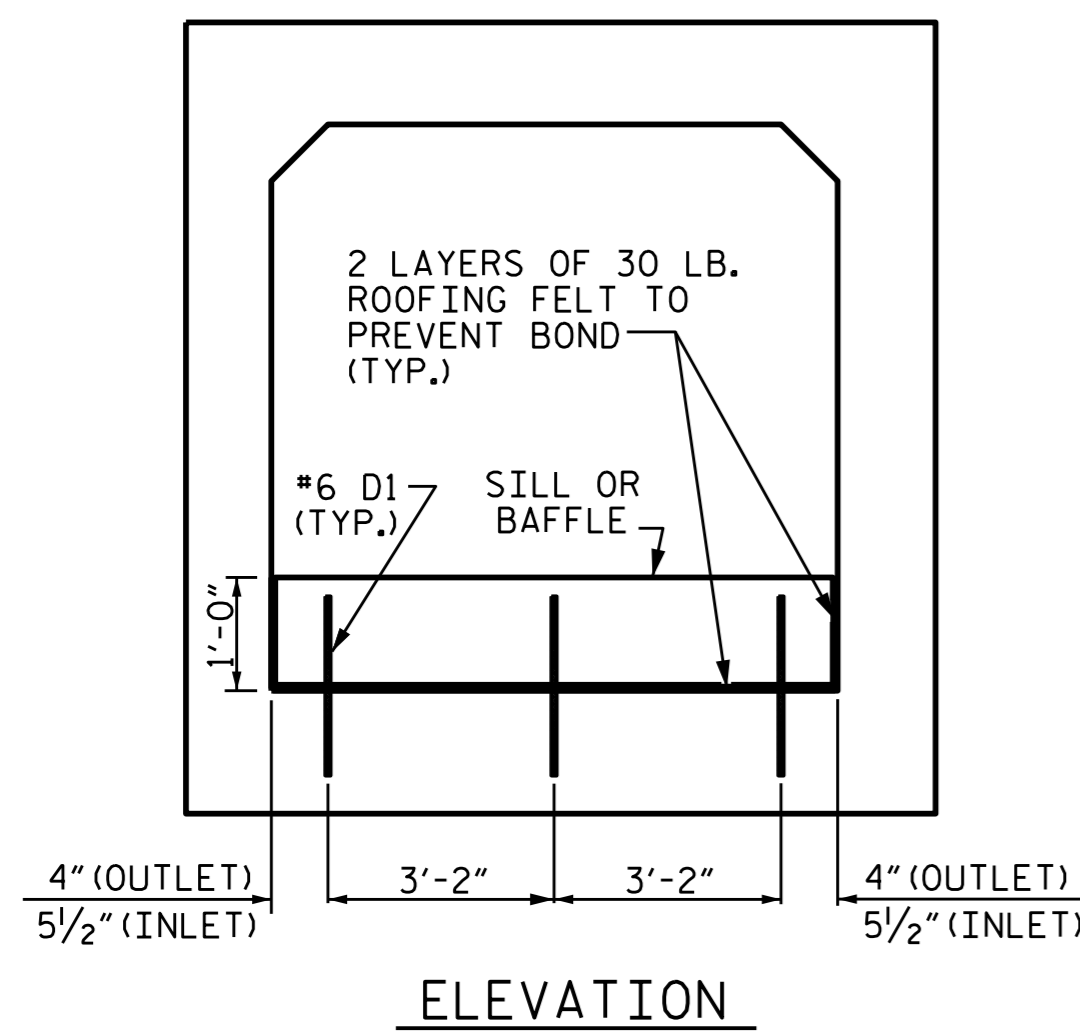
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

CULVERT #4
SINGLE 7 FT. X 8 FT.
CONCRETE BOX CULVERT
101° SKEW

DRAWN BY: REZA KOUCHEKI DATE: 4/29/16
 CHECKED BY: T. H. FANG DATE: 5/15/16
 DESIGN ENGINEER OF RECORD: REZA KOUCHEKI DATE: 1/29/16

DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
 SIGNATURES COMPLETED

REVISIONS						SHEET NO. C-30
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 34
2			4			

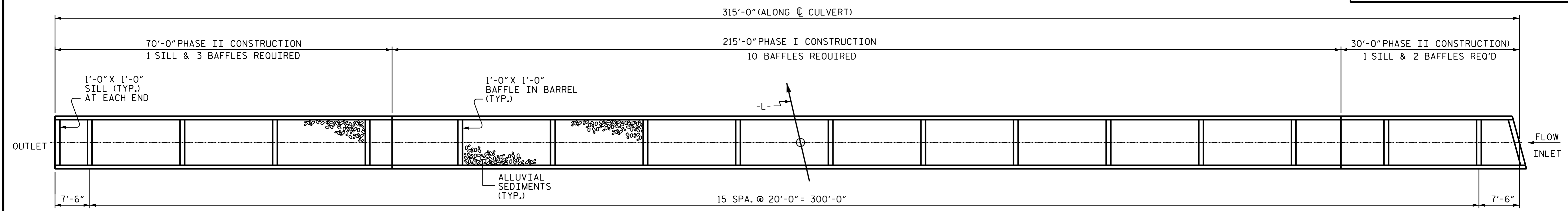


SPLICE LENGTHS CHART

BAR	SIZE	SPLICE LENGTH
"C"	#4	1'-11"

BAR SCHEDULE

PHASE I CONSTRUCTION					PHASE II CONSTRUCTION						
BAR	No.	SIZE	TYPE	LENGTH	WEIGHT	BAR	No.	SIZE	TYPE	LENGTH	WEIGHT
A1	860	4	1	5'-6"	3160	A1	399	4	1	5'-6"	1466
A2	860	4	1	5'-2"	2968	A2	399	4	1	5'-2"	1377
A100	430	5	STR	7'-11"	3551	A100	198	5	STR	7'-11"	1635
						A101	1	5	STR	6'-4"	7
A200	430	5	STR	7'-11"	3551	A102	1	5	STR	4'-5"	5
						A103	1	5	STR	2'-5"	3
B1	430	4	STR	9'-5"	2705						
B2	860	4	STR	7'-4"	4213	A200	198	5	STR	7'-11"	1635
						A201	1	5	STR	6'-4"	7
C2	360	4	STR	29'-1"	6994	A202	1	5	STR	4'-5"	5
						A203	1	5	STR	2'-5"	3
D1	30	6	STR	1'-7"	71						
						B1	203	4	STR	9'-5"	1277
F1	43	4	STR	4'-1"	117	B2	401	4	STR	7'-4"	1964
REINFORCING STEEL LBS.					27,330	REINFORCING STEEL LBS.					12,955



PLAN OF SILL & BAFFLE LOCATIONS

CULVERT FLOOR SLAB IS BURIED 1' BELOW EXISTING STREAM BED. BACKFILL BARREL WITH ALLUVIAL SEDIMENTS TO SILL HEIGHT.

THE ALLUVIAL SEDIMENTS CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. ONLY MATERIAL THAT IS EXCAVATED FROM THE STREAM BED MAY BE USED TO LINE THE CULVERT BARREL.

THE CONTRACTOR'S ATTENTION IS CALLED TO THE FACT THAT THE ALLUVIAL SEDIMENTS BACKFILL SHALL BE PLACED PRIOR TO THE CASTING OF THE ROOF SLAB.

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 505+19.00 -L-
 SHEET 4 OF 7



STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

CULVERT #4
 SINGLE 7 FT. X 8 FT.
 CONCRETE BOX CULVERT
 101° SKEW

DocuSigned by:
 Ting Fang
 E7208940097435

7/15/2016

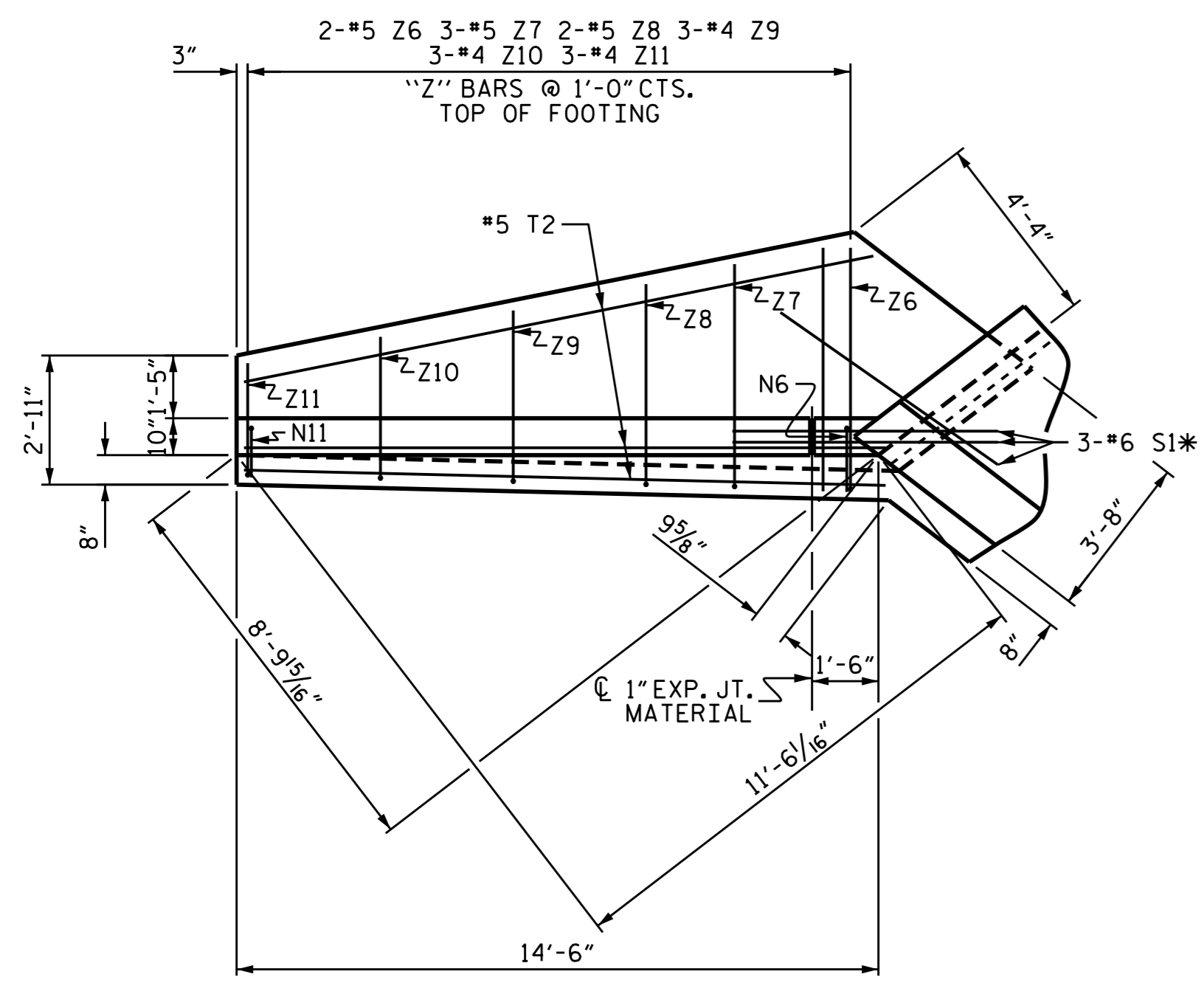
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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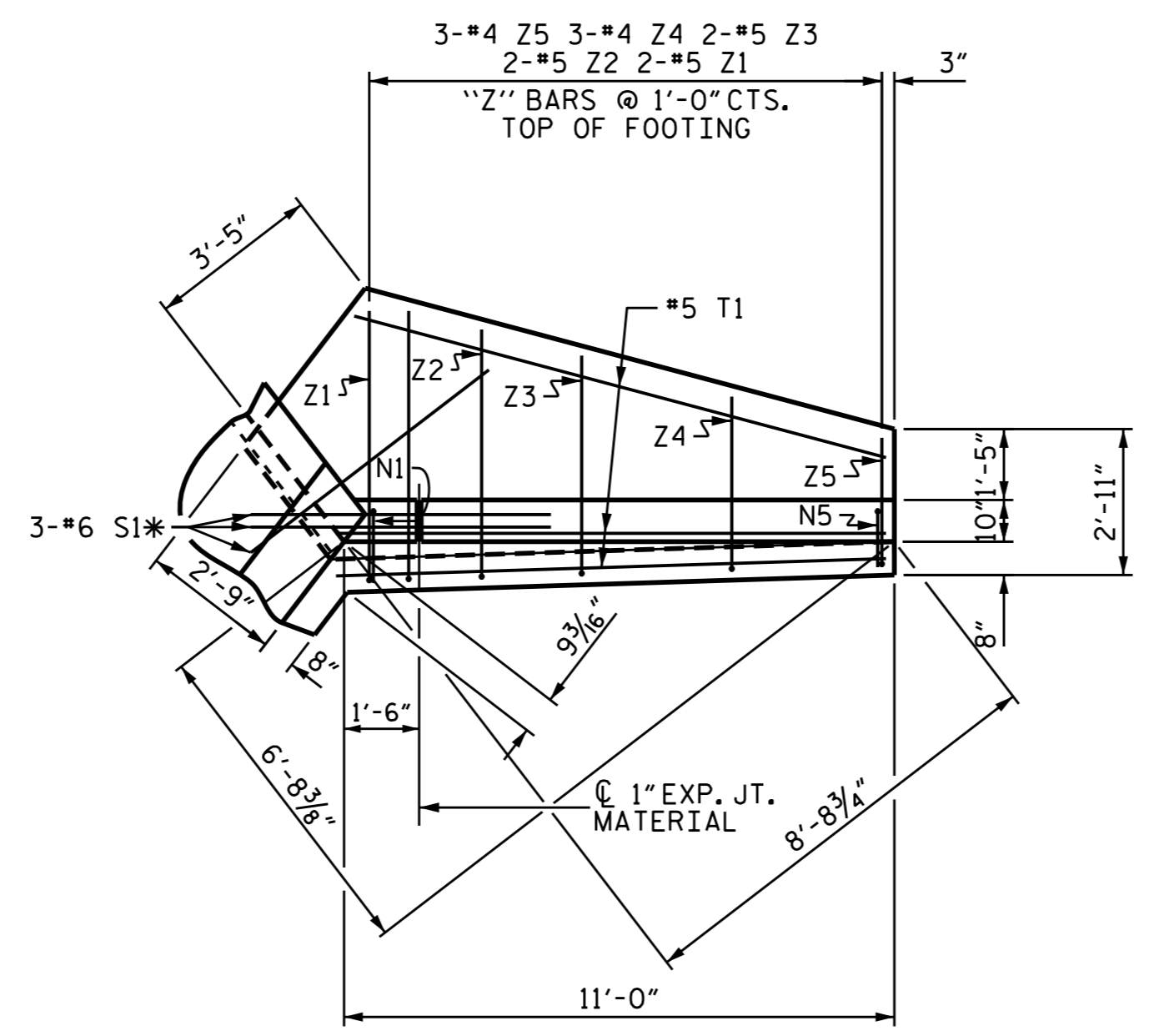
REVISOR: REZA KOUCHEKI DATE: 4/29/16
 CHECKED BY: T. H. FANG DATE: 5/15/16
 DESIGN ENGINEER OF RECORD: REZA KOUCHEKI DATE: 1/29/16

SHEET NO. C-31
 TOTAL SHEETS 34

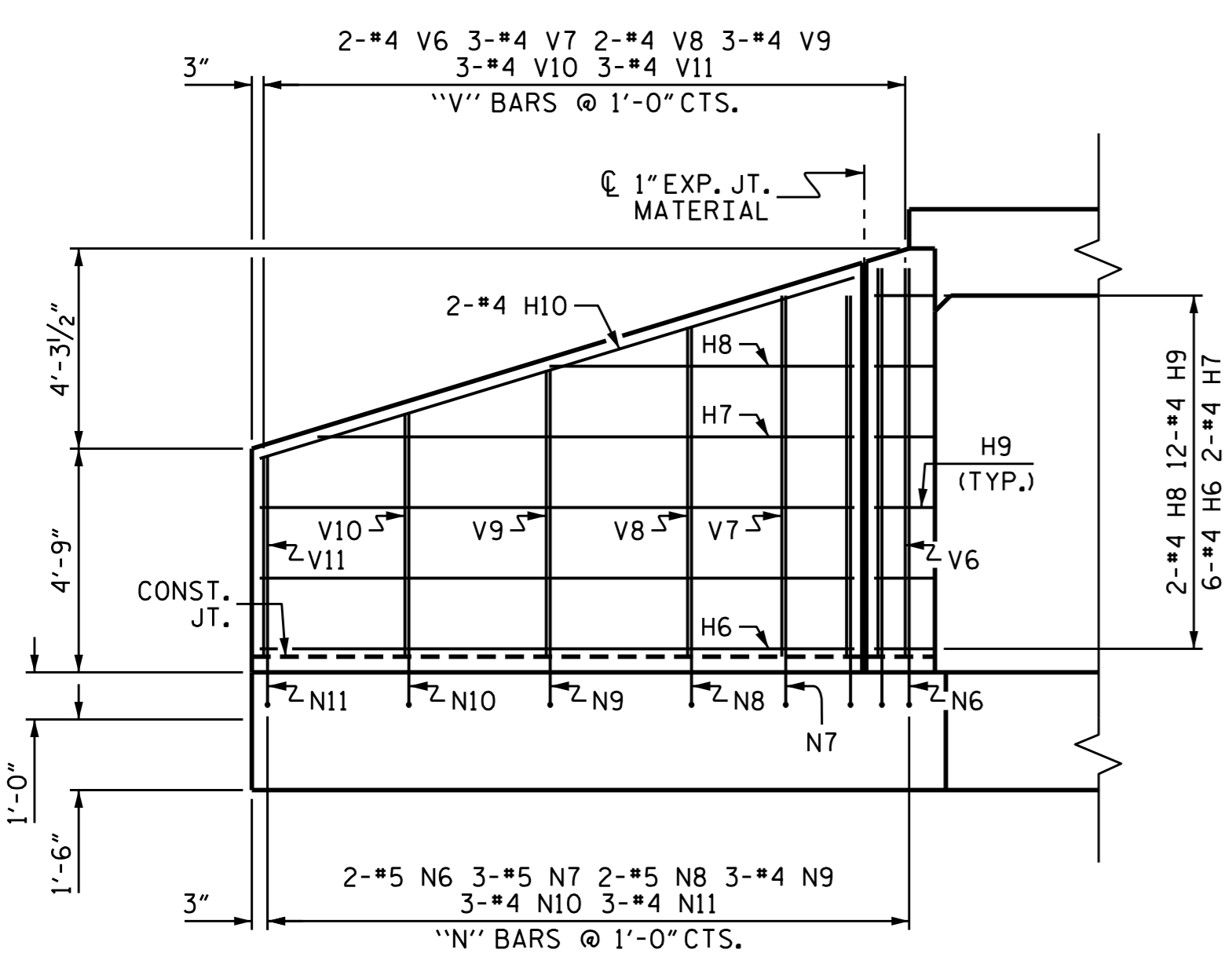
REVISED 11-19-99 BY M.M. CHECKED BY R.W.W.



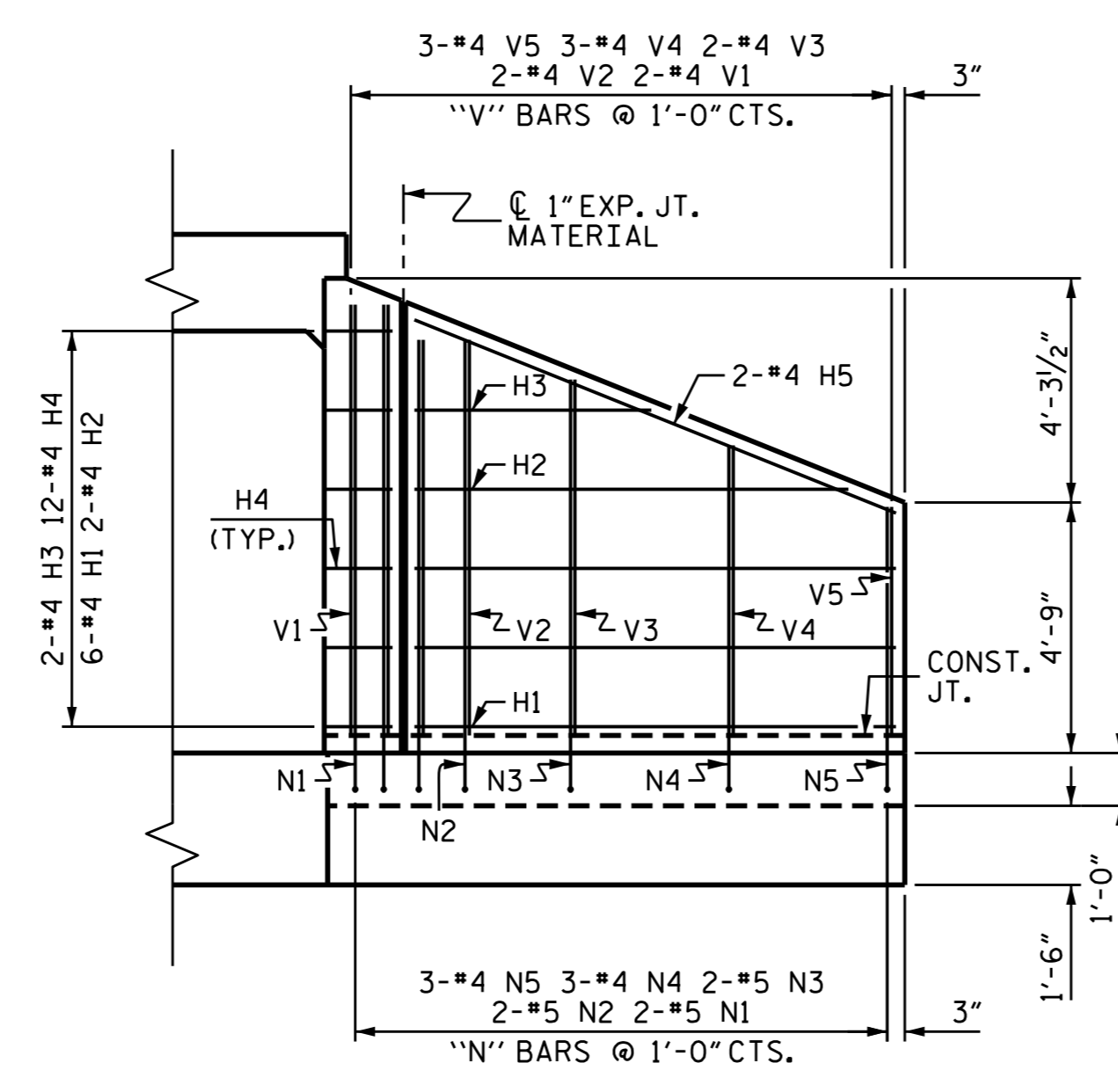
PLAN W1



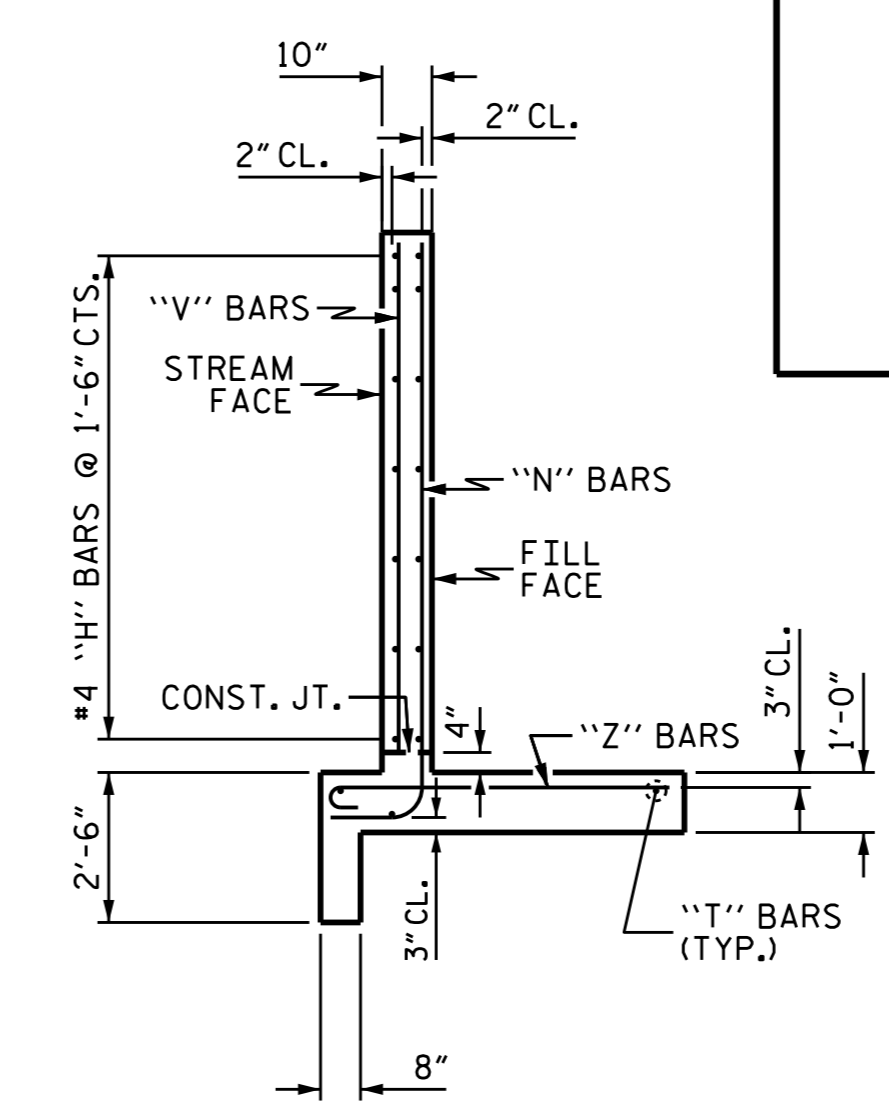
PLAN W2



ELEVATION W1



ELEVATION W2



TYPICAL WING SECTION

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.

BAR NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	#4	STR	9'-1"	36
H2	#4	STR	8'-2"	11
H3	#4	STR	4'-5"	6
H4	#4	STR	3'-3"	26
H5	#4	STR	9'-10"	13
H6	#4	STR	12'-7"	50
H7	#4	STR	11'-4"	15
H8	#4	STR	6'-5"	9
H9	#4	STR	3'-3"	26
H10	#4	STR	13'-2"	18
N1	#5	STR	10'-2"	21
N2	#5	STR	9'-7"	20
N3	#5	STR	8'-9"	18
N4	#4	STR	7'-7"	15
N5	#4	STR	6'-4"	13
N6	#5	STR	10'-3"	21
N7	#5	STR	9'-8"	30
N8	#5	STR	9'-1"	19
N9	#4	STR	8'-2"	16
N10	#4	STR	7'-3"	15
N11	#4	STR	6'-4"	13
S1	#6	STR	6'-0"	54
T1	#5	STR	11'-0"	34
T2	#5	STR	14'-6"	45
V1	#4	STR	8'-2"	11
V2	#4	STR	7'-6"	10
V3	#4	STR	6'-9"	9
V4	#4	STR	5'-6"	11
V5	#4	STR	4'-4"	9
V6	#4	STR	8'-3"	11
V7	#4	STR	7'-8"	15
V8	#4	STR	7'-0"	9
V9	#4	STR	6'-1"	12
V10	#4	STR	5'-2"	11
V11	#4	STR	4'-3"	9
Z1	#5	STR	6'-0"	13
Z2	#5	STR	5'-7"	12
Z3	#5	STR	5'-0"	10
Z4	#4	STR	4'-0"	8
Z5	#4	STR	3'-1"	6
Z6	#5	STR	6'-1"	13
Z7	#5	STR	5'-8"	18
Z8	#5	STR	5'-2"	11
Z9	#4	STR	4'-5"	9
Z10	#4	STR	3'-9"	8
Z11	#4	STR	3'-1"	6

BILL OF MATERIAL

BAR NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	#4	STR	9'-1"	36
H2	#4	STR	8'-2"	11
H3	#4	STR	4'-5"	6
H4	#4	STR	3'-3"	26
H5	#4	STR	9'-10"	13
H6	#4	STR	12'-7"	50
H7	#4	STR	11'-4"	15
H8	#4	STR	6'-5"	9
H9	#4	STR	3'-3"	26
H10	#4	STR	13'-2"	18
N1	#5	STR	10'-2"	21
N2	#5	STR	9'-7"	20
N3	#5	STR	8'-9"	18
N4	#4	STR	7'-7"	15
N5	#4	STR	6'-4"	13
N6	#5	STR	10'-3"	21
N7	#5	STR	9'-8"	30
N8	#5	STR	9'-1"	19
N9	#4	STR	8'-2"	16
N10	#4	STR	7'-3"	15
N11	#4	STR	6'-4"	13
S1	#6	STR	6'-0"	54
T1	#5	STR	11'-0"	34
T2	#5	STR	14'-6"	45
V1	#4	STR	8'-2"	11
V2	#4	STR	7'-6"	10
V3	#4	STR	6'-9"	9
V4	#4	STR	5'-6"	11
V5	#4	STR	4'-4"	9
V6	#4	STR	8'-3"	11
V7	#4	STR	7'-8"	15
V8	#4	STR	7'-0"	9
V9	#4	STR	6'-1"	12
V10	#4	STR	5'-2"	11
V11	#4	STR	4'-3"	9
Z1	#5	STR	6'-0"	13
Z2	#5	STR	5'-7"	12
Z3	#5	STR	5'-0"	10
Z4	#4	STR	4'-0"	8
Z5	#4	STR	3'-1"	6
Z6	#5	STR	6'-1"	13
Z7	#5	STR	5'-8"	18
Z8	#5	STR	5'-2"	11
Z9	#4	STR	4'-5"	9
Z10	#4	STR	3'-9"	8
Z11	#4	STR	3'-1"	6

REINFORCING STEEL 775 LBS
 FOR 2 WINGS

CLASS A CONCRETE

2 WINGS	11.3	CY
1 HEADWALL	0.4	CY
1 END CURTAIN WALL	0.4	CY
TOTAL	12.1	CY

PROJECT NO. U-2524D
 GUILFORD COUNTY
 STATION: 505+19.00 -L-
 SHEET 5 OF 7

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
**STANDARD WINGS
 FOR
 CONCRETE BOX CULVERT**
 H = 8'-0" SLOPE = 2:1
 105° SKEW @ INLET END



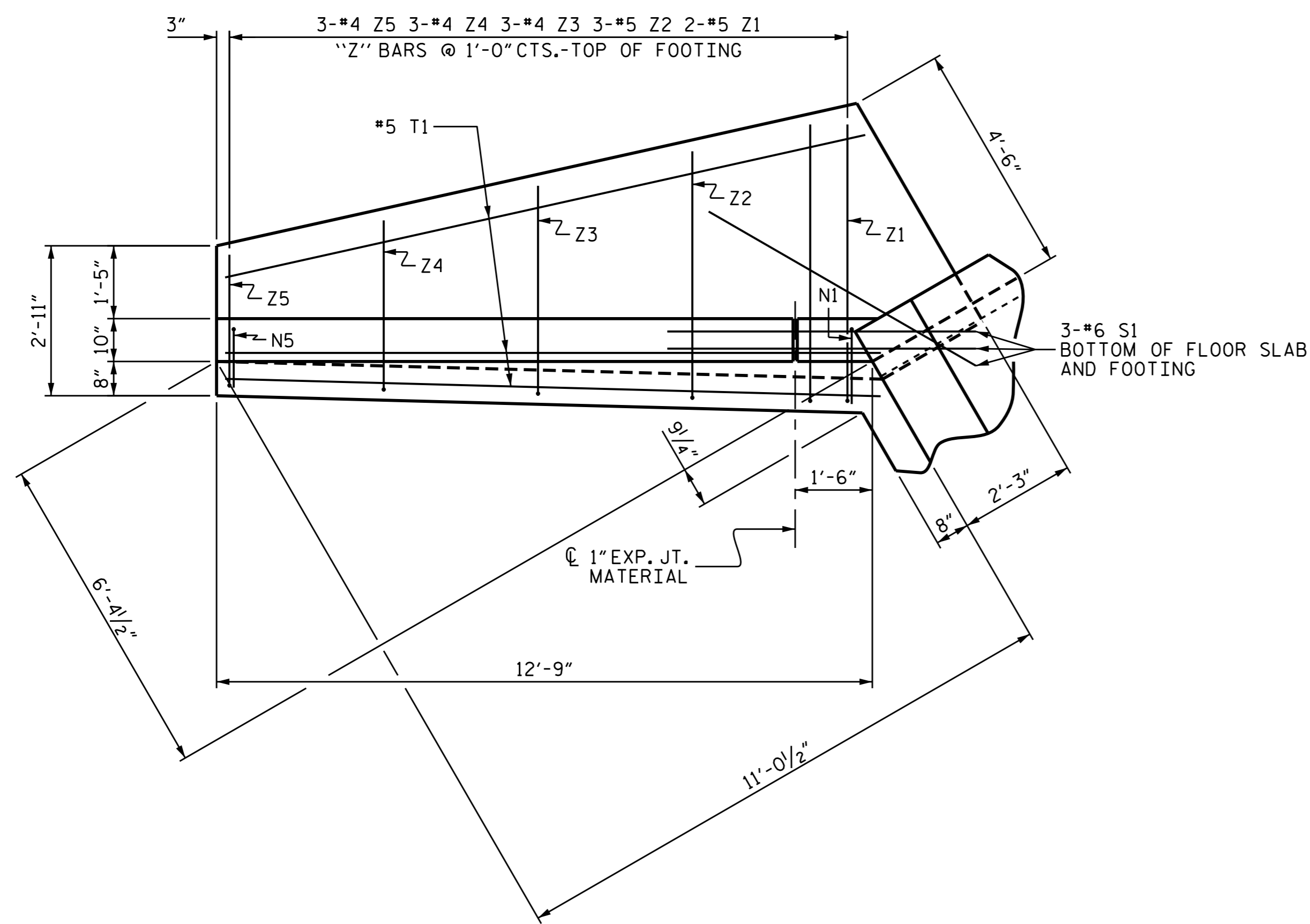
DocuSigned by:
 Ting Fang 7/14/2016
 E7208800977435

DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
 SIGNATURES COMPLETED

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

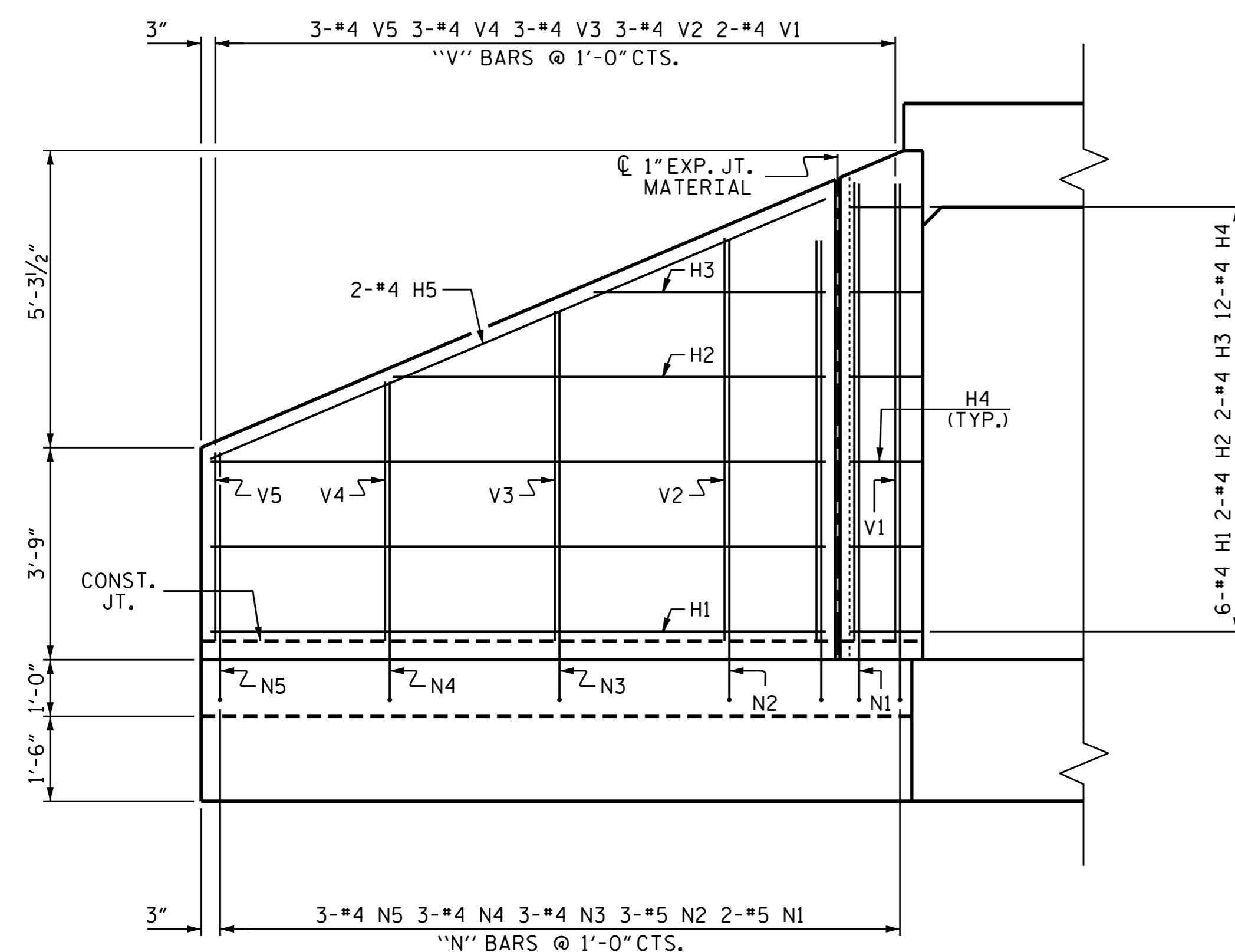
TOTAL SHEETS 34

ASSEMBLED BY : REZA KOUCHEKI DATE : 1/13/16
 CHECKED BY : S.B.WILLIAMS DATE : 4/12/16
 DRAWN BY : CCJ 01/00
 CHECKED BY : RWW 03/00



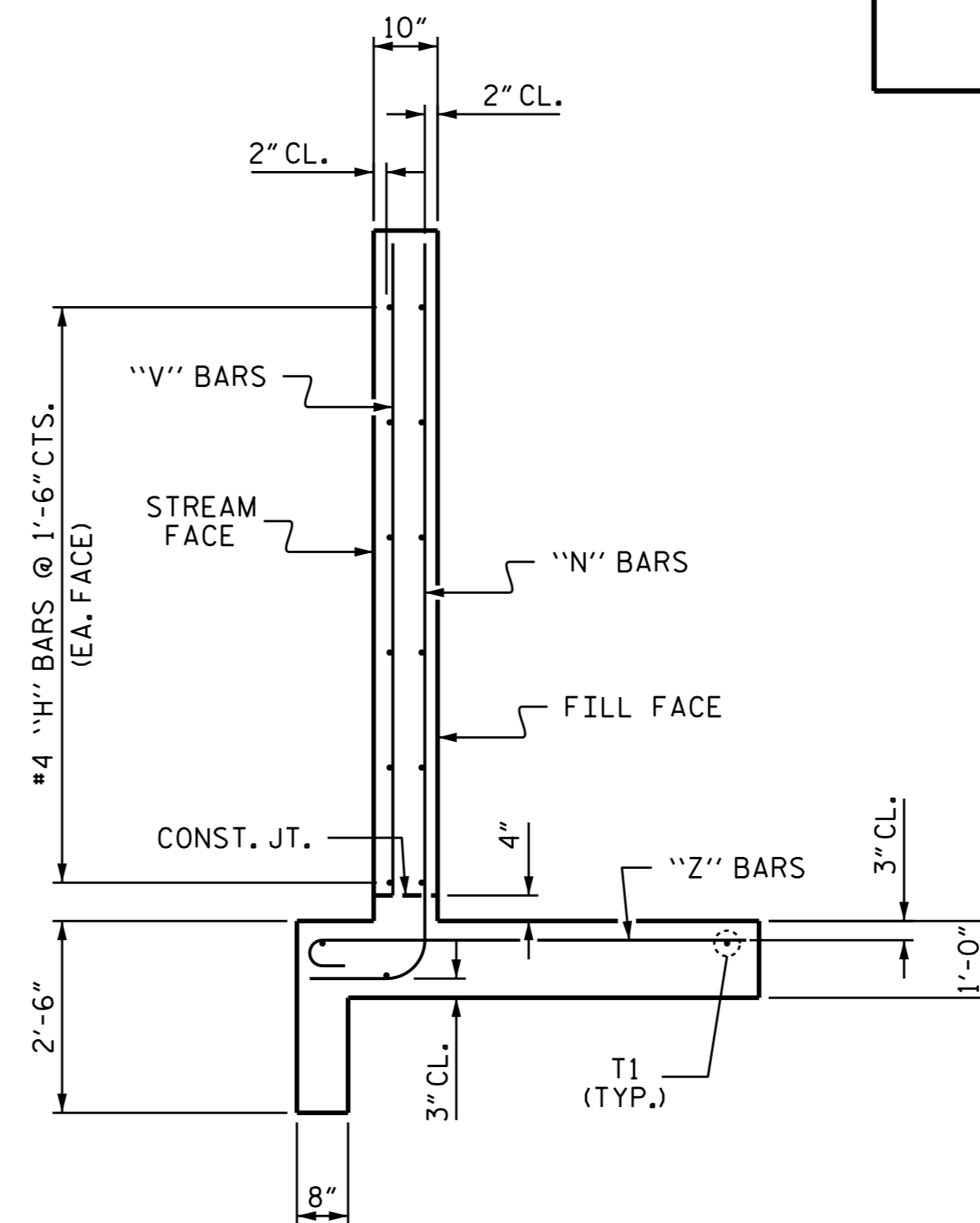
PLAN W3

(LEFT WING SHOWN, RIGHT WING SIMILAR)



ELEVATION W3

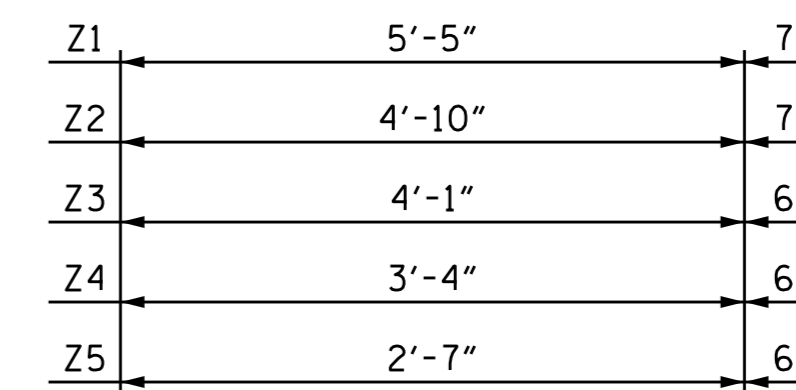
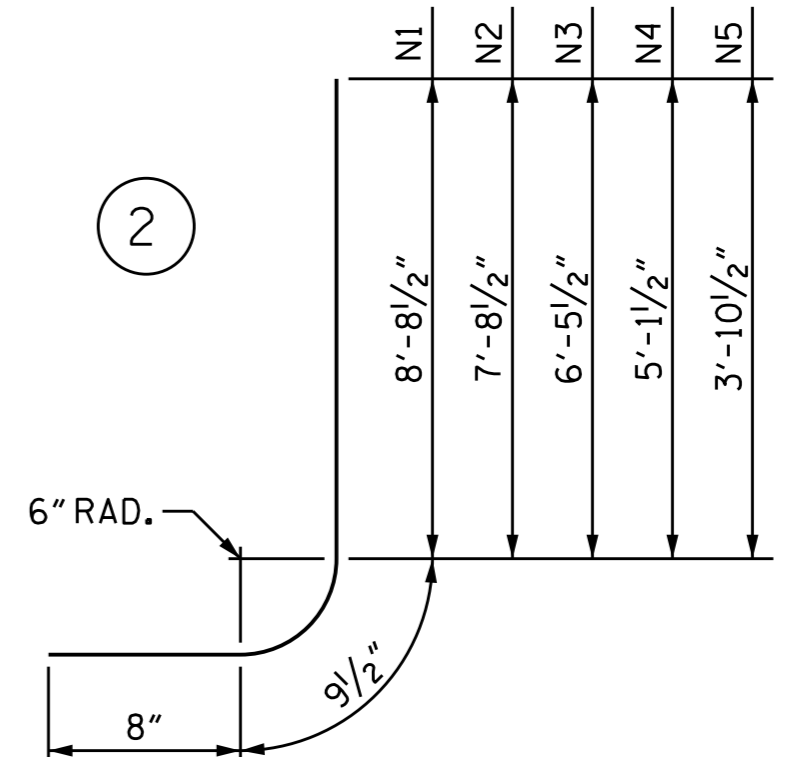
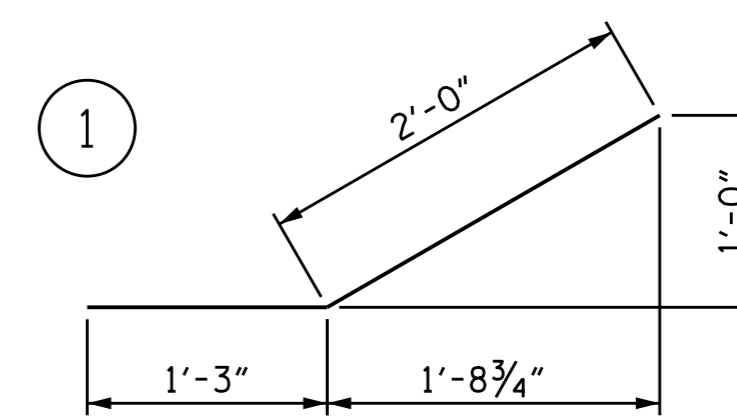
(LEFT WING SHOWN, RIGHT WING SIMILAR)



TYPICAL WING SECTION

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



3

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	10'-10"	87
H2	4	#4	STR	7'-8"	21
H3	4	#4	STR	4'-1"	11
H4	24	#4	1	3'-3"	52
H5	4	#4	STR	11'-9"	31
N1	4	#5	2	10'-2"	42
N2	6	#5	2	9'-2"	57
N3	6	#4	2	7'-11"	32
N4	6	#4	2	6'-7"	26
N5	6	#4	2	5'-4"	21
S1	6	#6	STR	6'-0"	54
T1	6	#5	STR	12'-9"	80
V1	4	#4	STR	8'-1"	22
V2	6	#4	STR	7'-1"	28
V3	6	#4	STR	5'-10"	23
V4	6	#4	STR	4'-7"	18
V5	6	#4	STR	3'-4"	13
Z1	4	#5	3	6'-0"	25
Z2	6	#5	3	5'-5"	34
Z3	6	#4	3	4'-7"	18
Z4	6	#4	3	3'-10"	15
Z5	6	#4	3	3'-1"	12

REINFORCING STEEL FOR 2 WINGS		722 LBS
CLASS A CONCRETE		
2 WINGS		10.7 CY
1 HEADWALL		0.4 CY
1 END CURTAIN WALL		0.3 CY
TOTAL		11.4 CY

PROJECT NO. U-2524D
GUILFORD COUNTY
 STATION: 505+19.00 -L-

SHEET 6 OF 7



DocuSigned by:
Ting Fang 7/14/2016

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
STANDARD WINGS
 FOR
CONCRETE BOX CULVERT
 H = 8'-0" SLOPE = 2:1
 90° SKEW @ OUTLET END

REVISIONS						SHEET NO.	
NO.	BY:	DATE:	NO.	BY:	DATE:	C-33	
1			3			TOTAL SHEETS	
2			4			34	

ASSEMBLED BY : REZA KOUCHEKI DATE : 1/13/16
 CHECKED BY : S.B.WILLIAMS DATE : 4/13/16
 DRAWN BY : CCJ 10/99
 CHECKED BY : RWW 03/00

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		
						MOMENT				SHEAR						
						LIVE-LOAD FACTORS (LL)	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	1.90	--	1.75	2.17	1	Exterior Wall	4.47	1.90	1	Exterior Wall	7.96		
	HL-93 (OPERATING)	N/A		2.46	--	1.35	2.81	1	Exterior Wall	4.47	2.46	1	Exterior Wall	7.96		
	HS-20 (INVENTORY)	36.000	②	1.90	68.45	1.75	2.17	1	Exterior Wall	4.47	1.90	1	Exterior Wall	7.96		
	HS-20 (OPERATING)	36.000		2.46	88.73	1.35	2.81	1	Exterior Wall	4.47	2.46	1	Exterior Wall	7.96		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500	③	2.38	32.08	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNGARBS2	20.000		2.38	47.53	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNAGRIS2	22.000		2.38	52.29	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNCOTTS3	27.250		2.38	64.76	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNAGGRS4	34.925		2.38	83	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNS5A	35.550		2.38	84.49	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNS6A	39.950		2.38	94.95	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		SNS7B	42.000		2.38	99.82	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.38	78.43	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNT4A	33.075		2.38	78.61	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNT6A	41.600		2.38	98.87	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNT7A	42.000		2.38	99.82	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNT7B	42.000		2.38	99.82	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNAGRIT4	43.000		2.38	102.2	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNAGT5A	45.000		2.38	106.95	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	
		TNAGT5B	45.000		2.38	106.95	1.40	2.71	1	Exterior Wall	4.47	2.38	1	Exterior Wall	7.96	

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	--

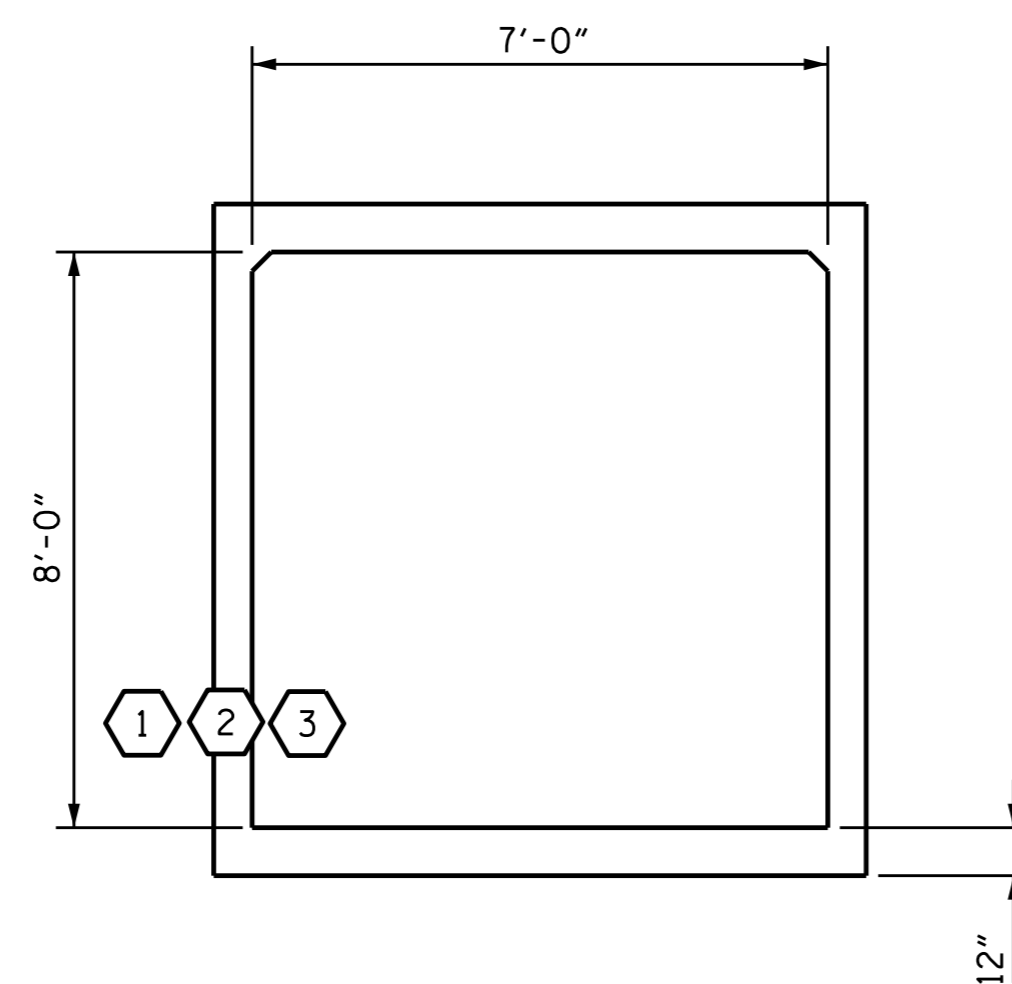
NOTE:

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. U-2524D
GUILFORD COUNTY
 STATION: 505+19.00 -L-

SHEET 7 OF 7



Designed by:
Ting Fang
7/15/2016

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

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C-34
1			3			TOTAL SHEETS
2			4			34

DOCUMENT NOT CONSIDERED
 FINAL UNLESS ALL
 SIGNATURES COMPLETED

CUL #4 STD. NO. LRFR5

ASSEMBLED BY : G.KOUCHEKI DATE : 1/29/16
 CHECKED BY : S.B.WILLIAMS DATE : 4/16
 DRAWN BY : WMC 7/11 REV. 10/1/11 MAA/GM
 CHECKED BY : CM 7/11