

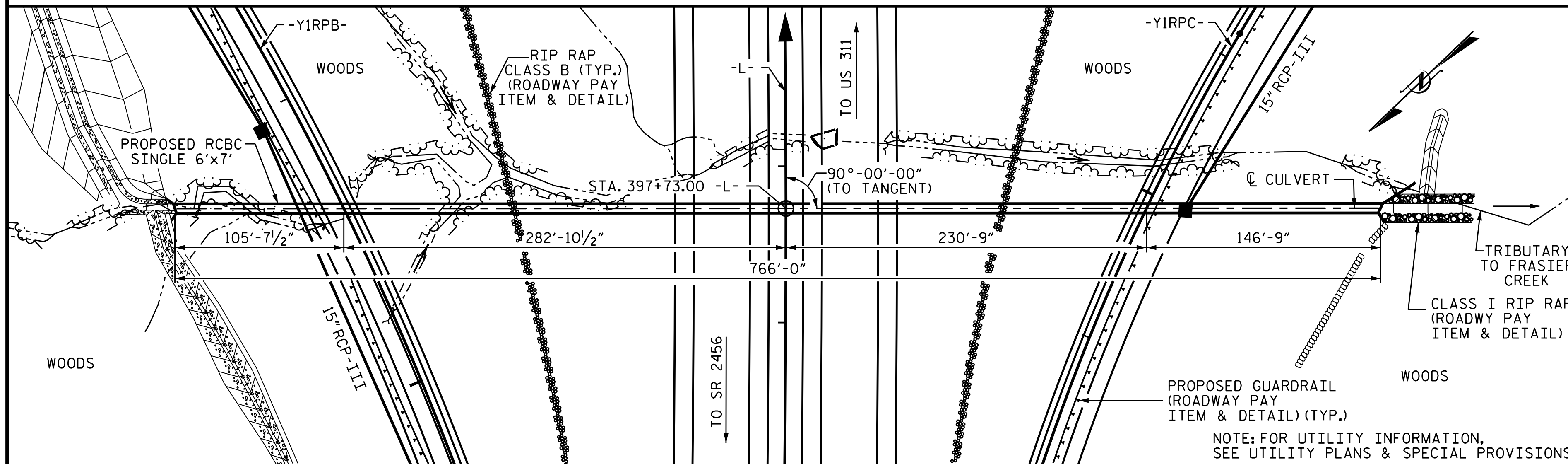
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BENCHMARK #4: RAILROAD SPIKE SET IN BASE OF 36" SWEET GUM TREE
STA. 37+41.94 -BL-, 875' RIGHT, EL.=910.16

F. A. PROJECT No.: NHP-0918(062)



LOCATION SKETCH

ROADWAY DATA

GRADE POINT ELEV. @ STA. 397+73.00 -L- = 978.60
BED ELEV. @ STA. 397+73.00 -L- = 918.40
ROADWAY SLOPES = 2:1

HYDRAULIC DATA

DESIGN DISCHARGE = 235 C.F.S.
FREQUENCY OF DESIGN FLOOD = 50 YR.
DESIGN HIGH WATER ELEV. = 932.30
DRAINAGE AREA = 80 AC.
BASE DISCHARGE (Q100) = 270 C.F.S.
BASE HIGH WATER ELEV. = 932.80

OVERTOPPING FLOOD DATA

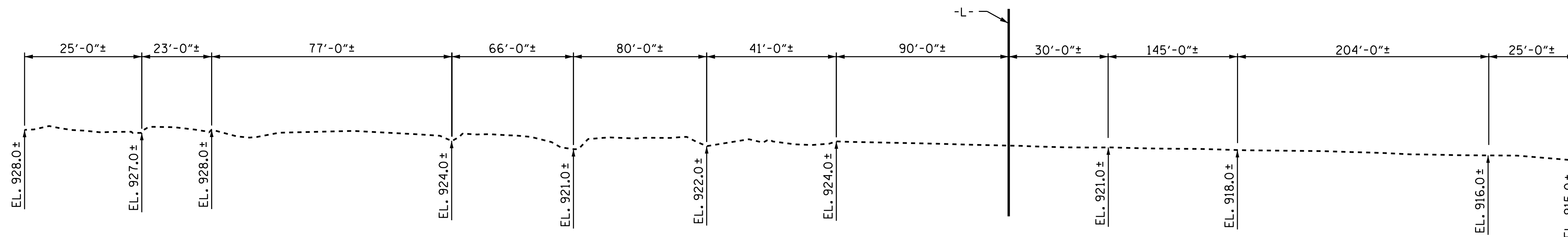
OVERTOPPING DISCHARGE = 460 C.F.S.
FREQUENCY OF OVERTOPPING FLOOD = 500+ YR.
OVERTOPPING FLOOD ELEV. = 935.80

TOTAL STRUCTURE QUANTITIES

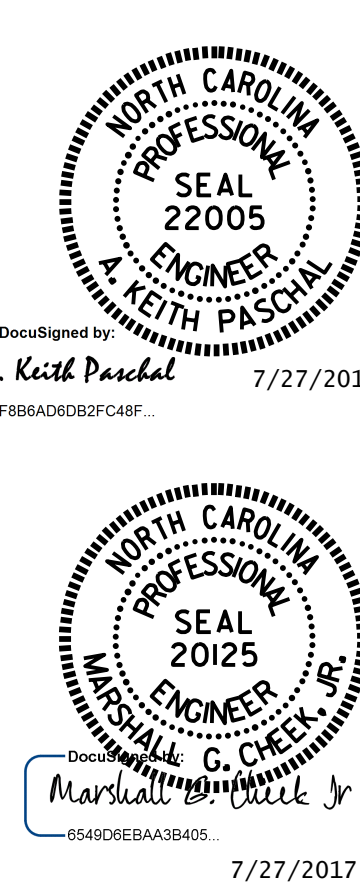
ITEM	QUANTITY	UNIT
CULVERT EXCAVATION	LUMP SUM	
FOUNDATION CONDITIONING MATERIAL	644	TONS
CLASS A CONCRETE		
BARREL @ 1.307 CY/FT	1,001.2	C.Y.
WINGS, ETC.	21.4	C.Y.
SILLS	3.0	C.Y.
TOTAL	1,025.6	C.Y.
REINFORCING STEEL		
BARREL	78,974	LBS.
WINGS, ETC.	1,321	LBS.
TOTAL	80,295	LBS.

NOTES

- ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.
- DESIGN FILL = 55.2 FEET.
- FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTES SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.
- THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
- DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
- TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FT. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR 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.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR CULVERT EXCAVATION, SEE SECTION 414 OF THE STANDARD SPECIFICATIONS.
- THE REINFORCED CONCRETE BOX CULVERT SHALL BE PLACED ON THE STANDARD 1.0 FOOT BLANKET OF FOUNDATION CONDITIONING MATERIAL.
- THE REQUIRED BEARING CAPACITY AT THE BASE OF THE CULVERT IS 3 TSF. THE REQUIRED BEARING CAPACITY SHALL BE VERIFIED.
- 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 REINFORCED CONCRETE BOX CULVERT SHALL BE CONSTRUCTED WITH 6 INCHES OF CAMBER TO ACCOUNT FOR ANTICIPATED SETTLEMENT.



PROFILE ALONG CULVERT



PROJECT NO. U-2579C
FORSYTH COUNTY
STATION: 397+73.00 -L-

SHEET 1 OF 5
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
SINGLE 6 FT. X 7 FT.
CONCRETE BOX CULVERT

ASSEMBLED BY: N.D. AIUTO DATE: 3/31/16
CHECKED BY: H.A. LOCKLEAR DATE: 4/6/16
DESIGN ENGINEER OF RECORD: J.K. BOWLES DATE: 4/6/16

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

LOAD FACTORS

DESIGN LOAD RATING FACTORS

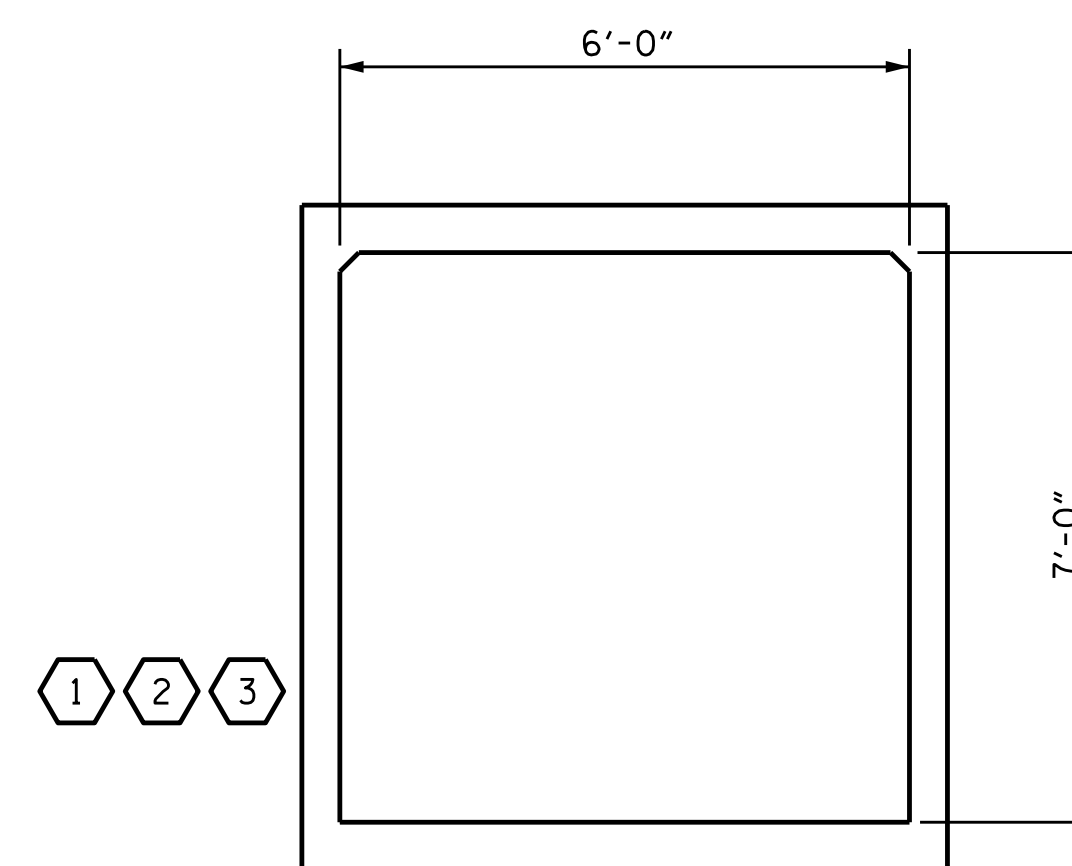
LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS																
LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER		
						LIVE-LOAD FACTORS (γ _L)	MOMENT				SHEAR					
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING	HL-93 (INVENTORY)	N/A	①	3.52	--	1.75	5.35	1	EXTERIOR WALL	4.19	3.52	1	EXTERIOR WALL	6.99		
	HL-93 (OPERATING)	N/A		4.56	--	1.35	6.93	1	EXTERIOR WALL	4.19	4.56	1	EXTERIOR WALL	6.99		
	HS-20 (INVENTORY)	36.000	②	3.52	126.61	1.75	5.35	1	EXTERIOR WALL	4.19	3.52	1	EXTERIOR WALL	6.99		
	HS-20 (OPERATING)	36.000		4.56	164.13	1.35	6.93	1	EXTERIOR WALL	4.19	4.56	1	EXTERIOR WALL	6.99		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SH	12.500	③	4.40	54.95	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S3C	21.500		4.40	94.52	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S3A	22.750		4.40	100.01	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S4A	26.750		4.40	117.60	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S5A	30.500		4.40	134.09	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S6A	34.500		4.40	151.67	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S7B	38.500		4.40	169.26	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		S7A	40.000		4.40	175.85	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	T4A	28.250		4.40	124.19	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		T5B	32.000		4.40	140.68	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		T6A	36.000		4.40	158.27	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
		T7A	40.000		4.40	175.85	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99	
	T7B	40.000		4.40	175.85	1.40	6.69	1	EXTERIOR WALL	4.19	4.40	1	EXTERIOR WALL	6.99		

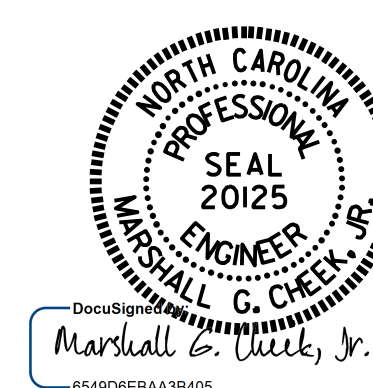
③	CONTROLLING LOAD RATING
①	DESIGN LOAD RATING (HL-93)
②	DESIGN LOAD RATING (HS-20)
③	LEGAL LOAD RATING **
** SEE CHART FOR VEHICLE TYPE	



LRFR SUMMARY

PROJECT NO. U-2579C
FORSYTH COUNTY
 STATION: 397+73.00 -L-

SHEET 2 OF 5



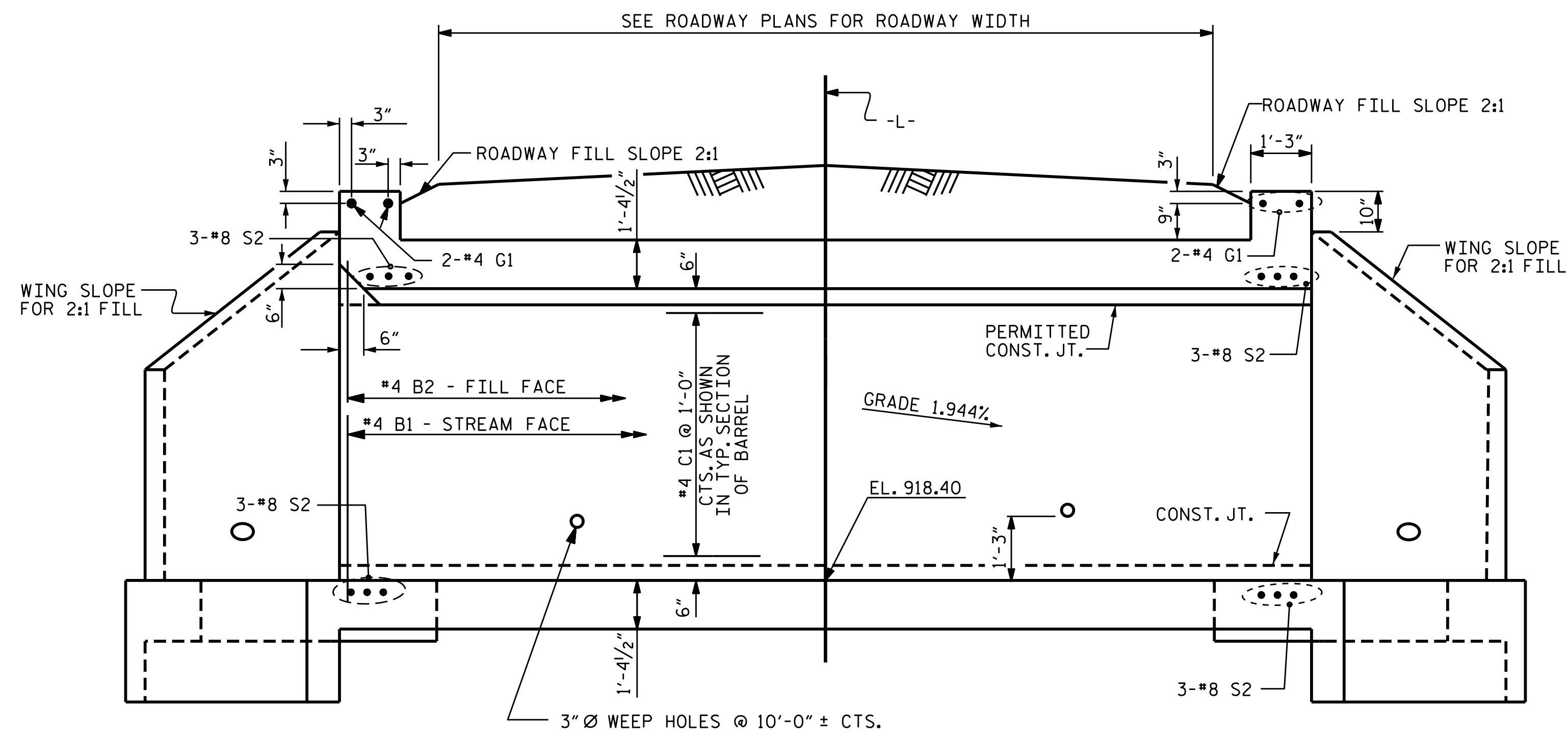
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD
 LRFR SUMMARY FOR
 REINFORCED CONCRETE
 BOX CULVERTS
 (INTERSTATE TRAFFIC)

7/27/2017

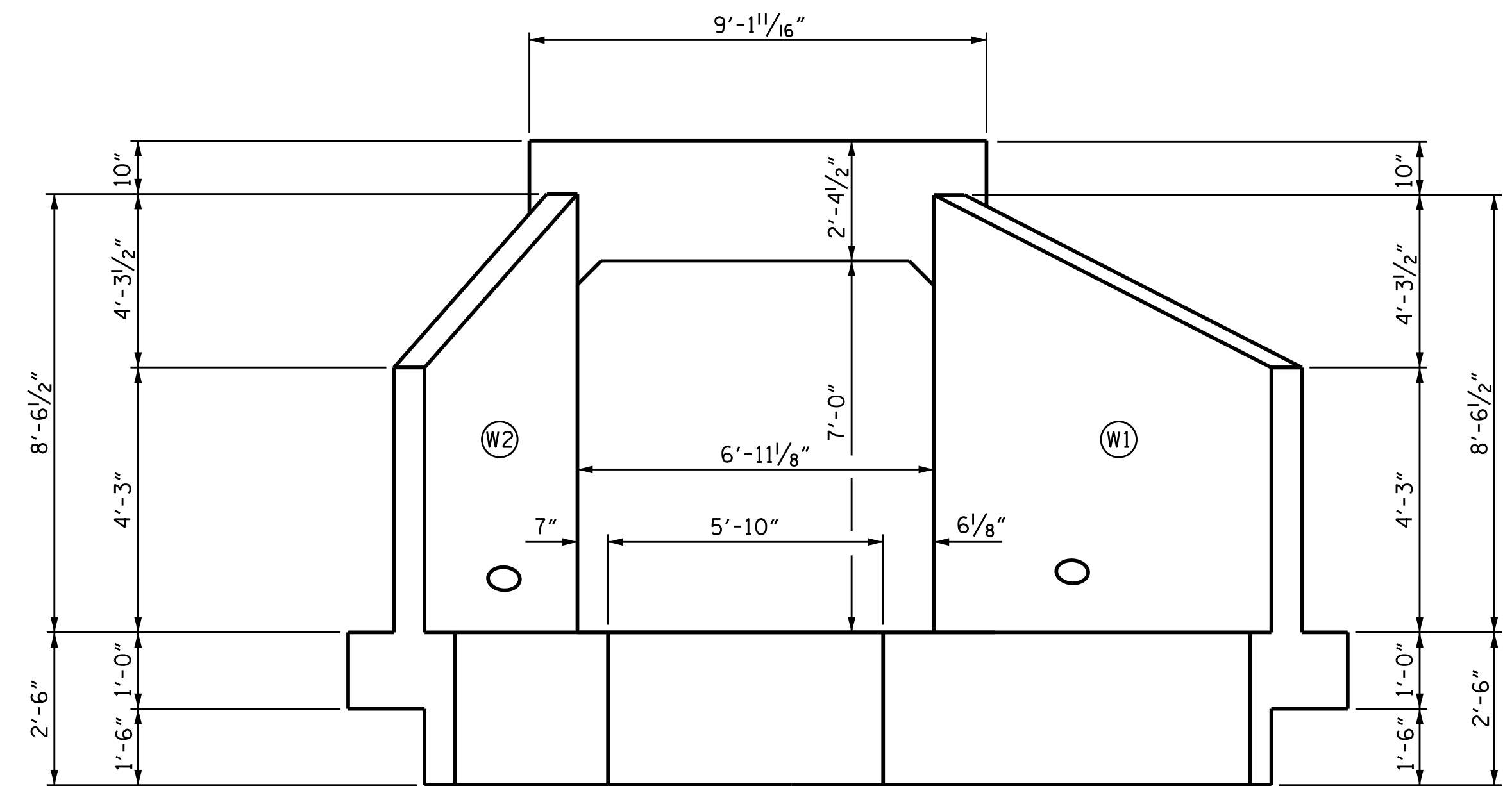
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NO.	BY:	DATE:	NO.	BY:	DATE:	C1-2
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2			4			5

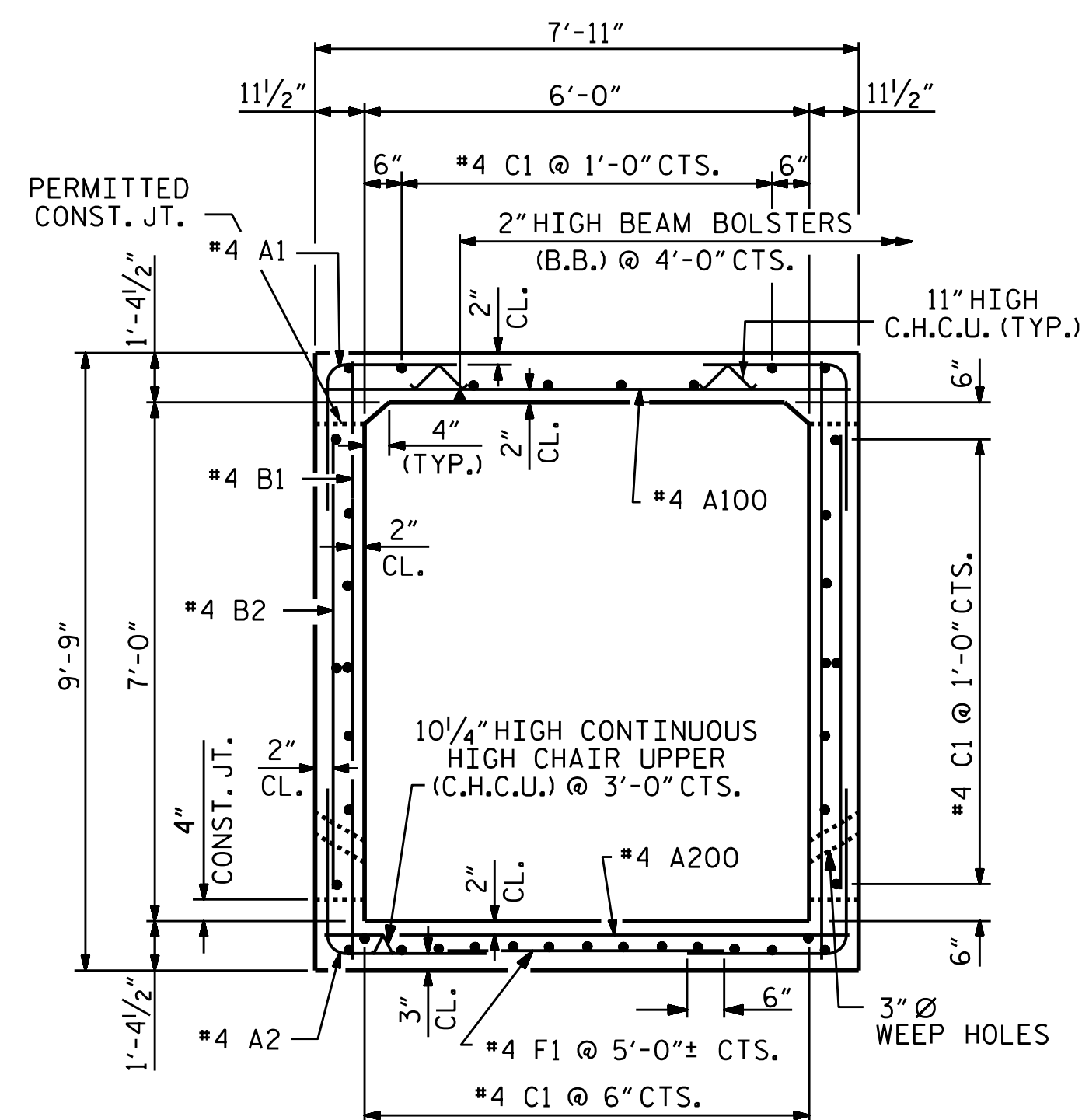
ASSEMBLED BY : N.D'ALUIO	DATE : 3/31/16
CHECKED BY : H.A.LOCKLEAR	DATE : 4/6/16
DRAWN BY : WMC	7/11
CHECKED BY : GM	7/11
REV. 10/1/11	MAA/GM



CULVERT SECTION NORMAL TO ROADWAY

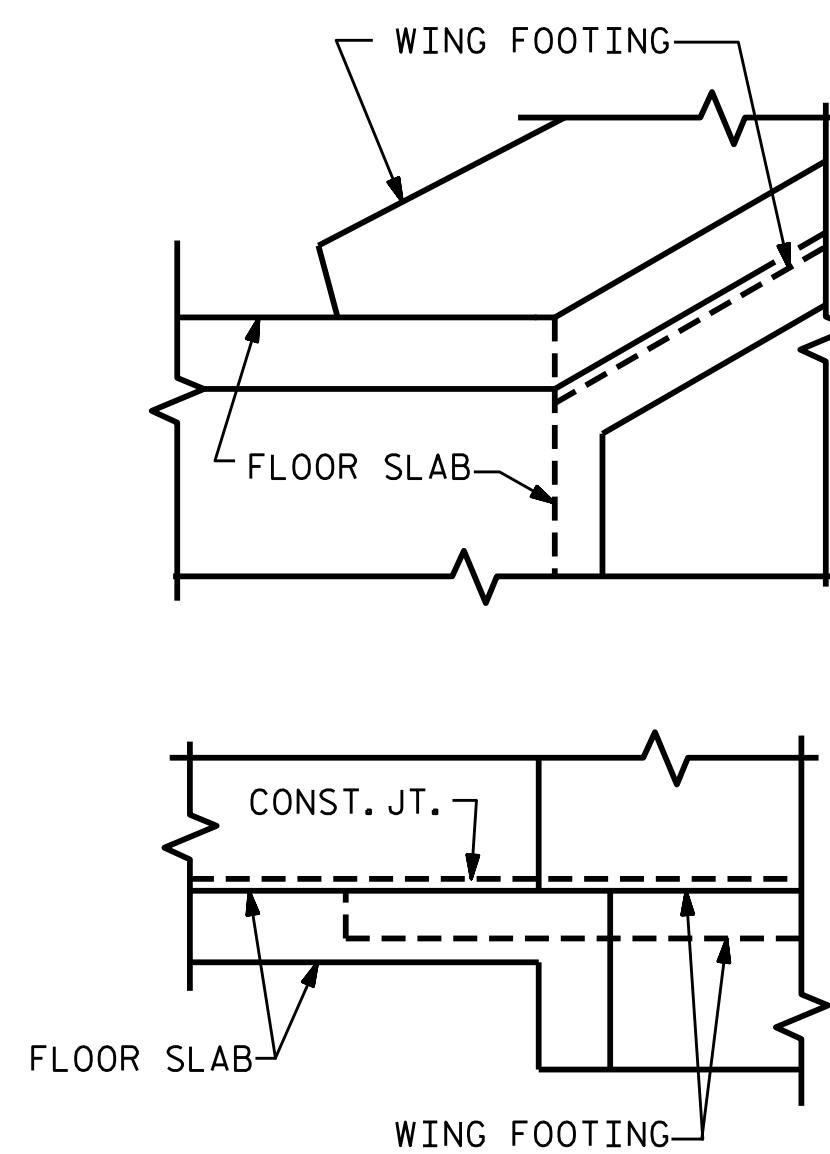


OUTLET END ELEVATION NORMAL TO SKEW

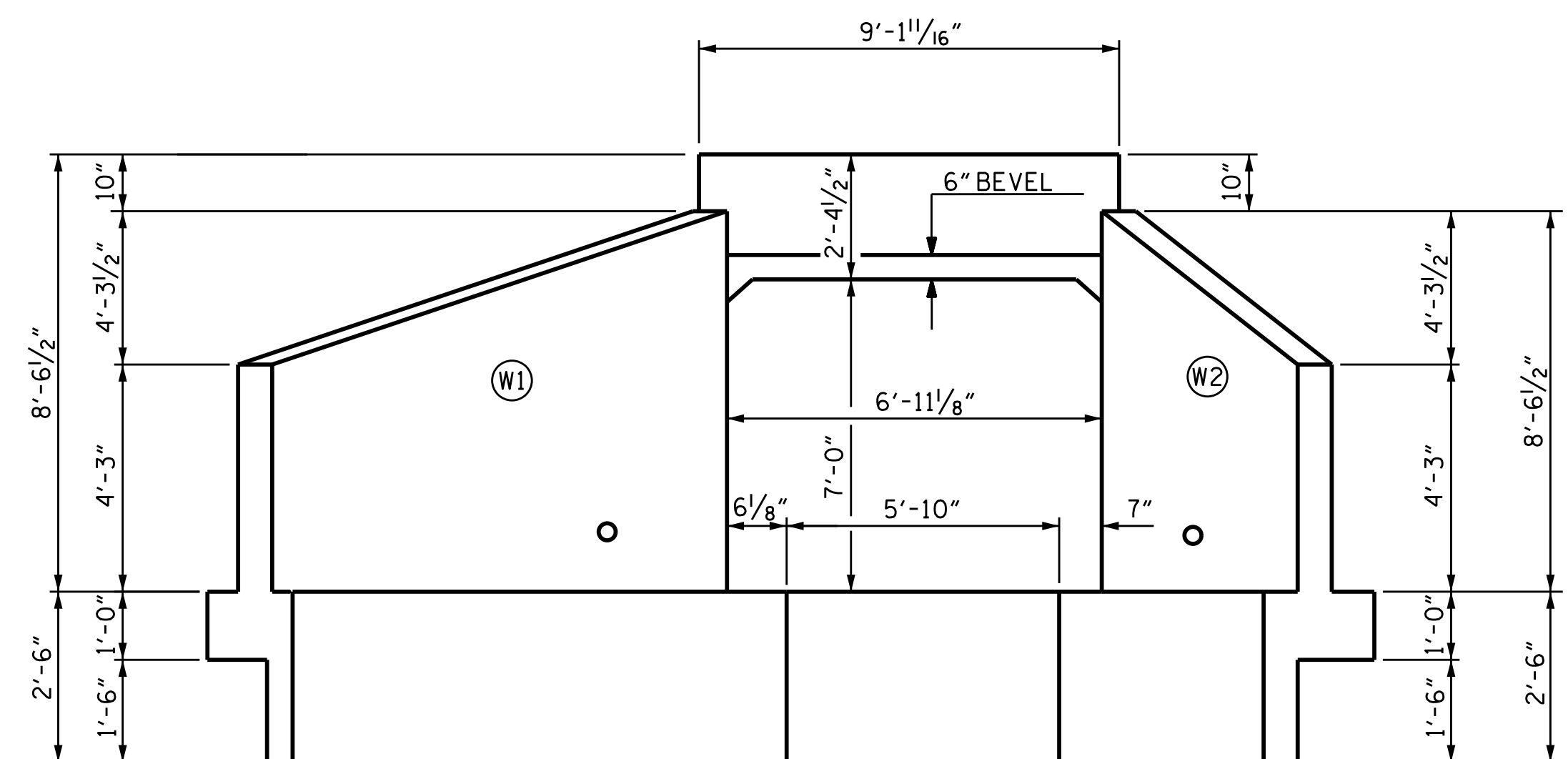


RIGHT ANGLE SECTION OF BARREL

THERE ARE 40 C1 BARS IN SECTION OF BARREL



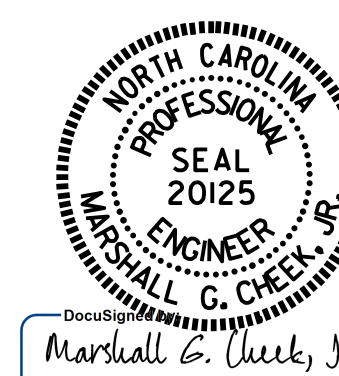
DETAIL
CONNECTION OF WING FOOTING
AND FLOOR SLAB WHEN SLAB
IS THICKER THAN FOOTING



INLET END ELEVATION NORMAL TO SKEW

PROJECT NO. U-2579C
FORSYTH COUNTY
STATION: 397+73.00 -L-

SHEET 3 OF 5



7/27/2017

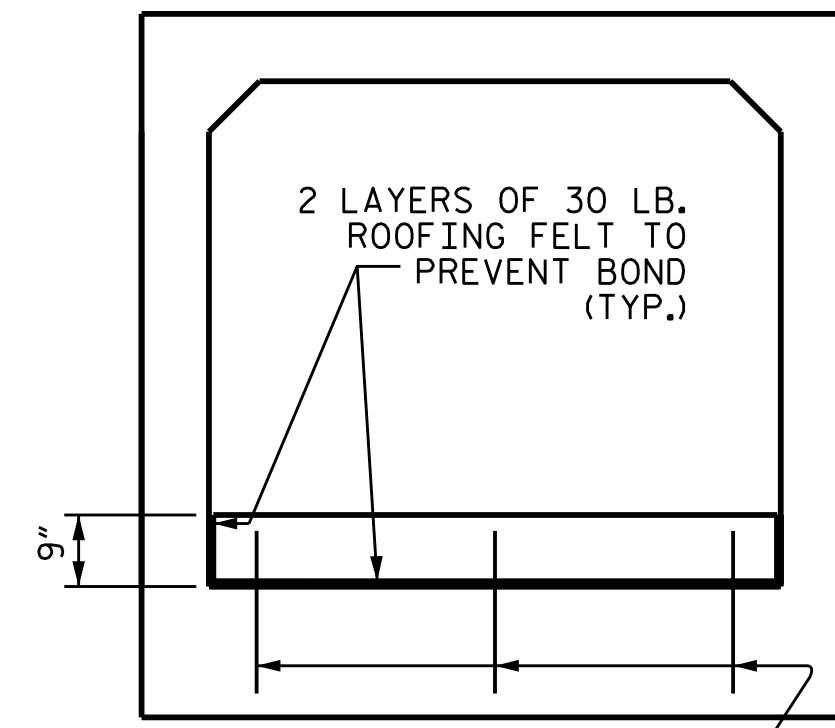
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
SINGLE 6 FT. X 7 FT.
CONCRETE BOX CULVERT

ASSEMBLED BY : N.D.AIUTO DATE : 3/31/16
CHECKED BY : H.A.LOCKLEAR DATE : 4/6/16
DESIGN ENGINEER OF RECORD : J.K.BOWLES DATE : 4/6/16

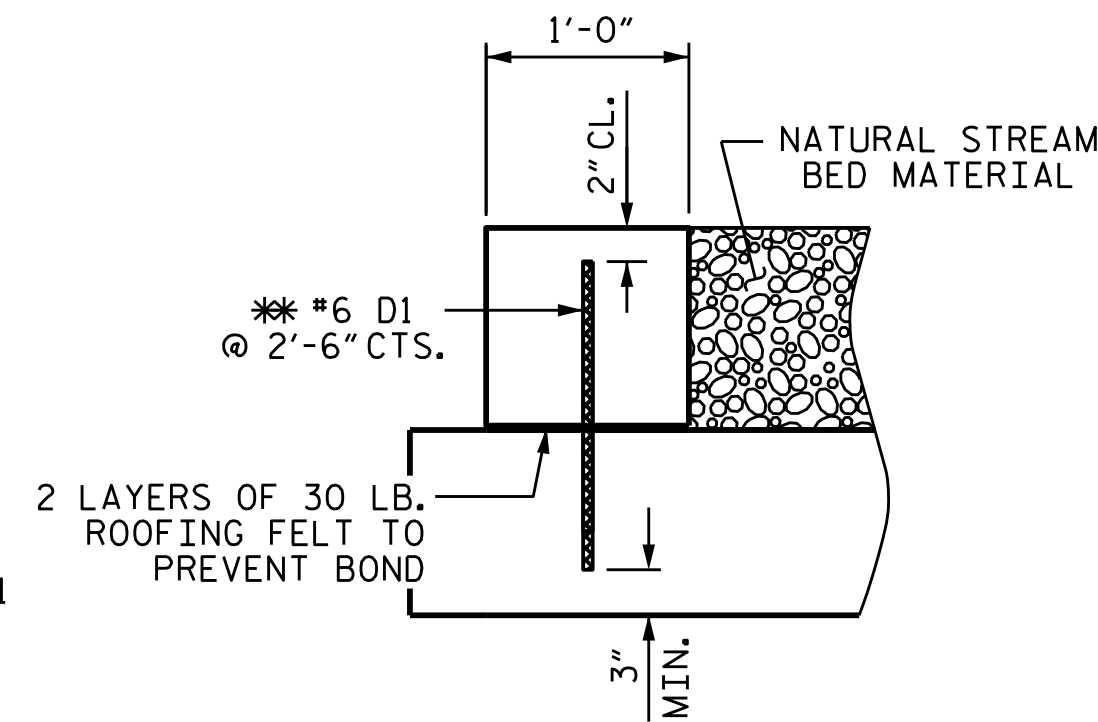
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REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-3
1			3			TOTAL SHEETS
2			4			5

STR.#5



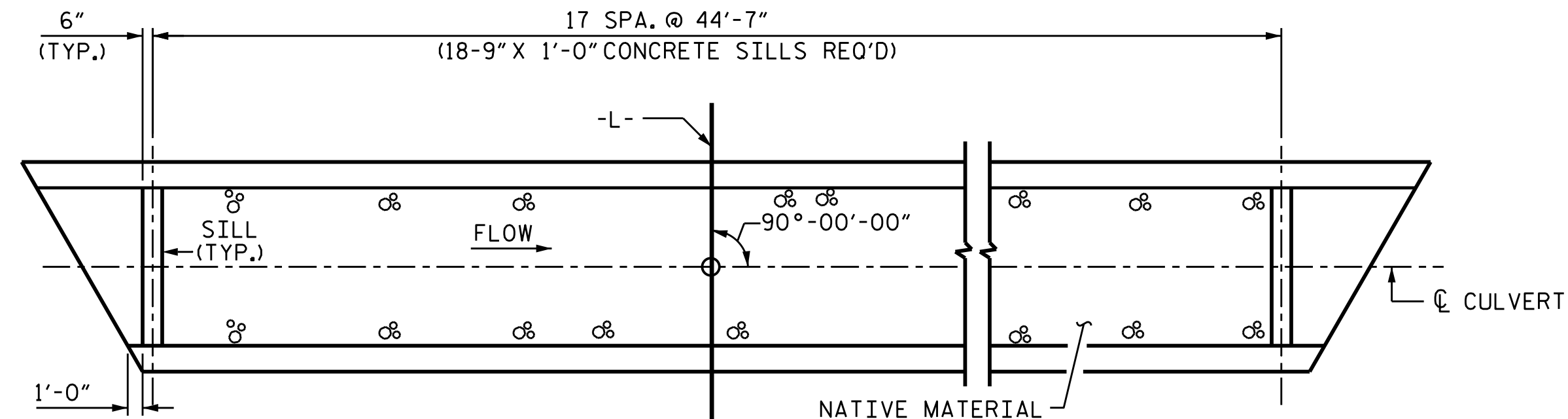
ELEVATION
(LOOKING DOWNSTREAM)



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

NOTES
MATERIAL EXCAVATED FROM THE EXISTING BED SHALL BE STOCKPILED FOR USE IN THE PROPOSED CULVERT AS SHOWN IN THE "PLAN VIEW". BED MATERIAL SHALL BE SUPPLEMENTED WITH CLASS "B" RIP RAP AS NECESSARY. IF CLASS "B" RIP RAP IS USED, NATURAL MATERIAL SHALL BE PLACED ON TOP AND LEVELED TO FACILITATE ANIMAL PASSAGE. BED MATERIAL SHALL BE SUBJECT TO APPROVAL BY THE ENGINEER.
THE ENTIRE COST OF WORK REQUIRED TO PLACE THE EXCAVATED MATERIAL OR SUPPLEMENTAL MATERIAL AS SHOWN ON THE PLANS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE BID FOR CULVERT EXCAVATION.

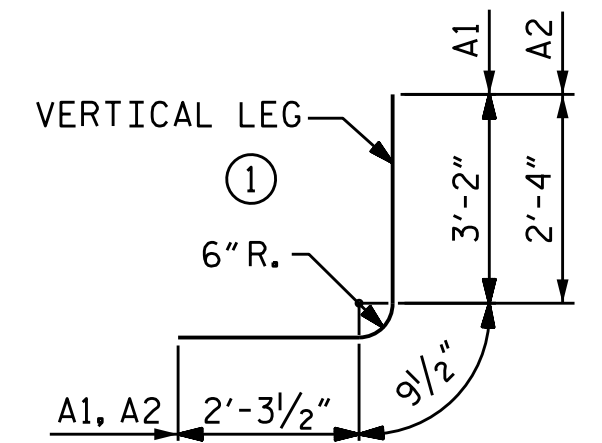
THE ENTIRE COST OF WORK REQUIRED TO CONSTRUCT THE SILLS SHALL BE INCLUDED IN THE VARIOUS PAY ITEMS.



PLAN

CULVERT SILL DETAILS

BAR TYPE



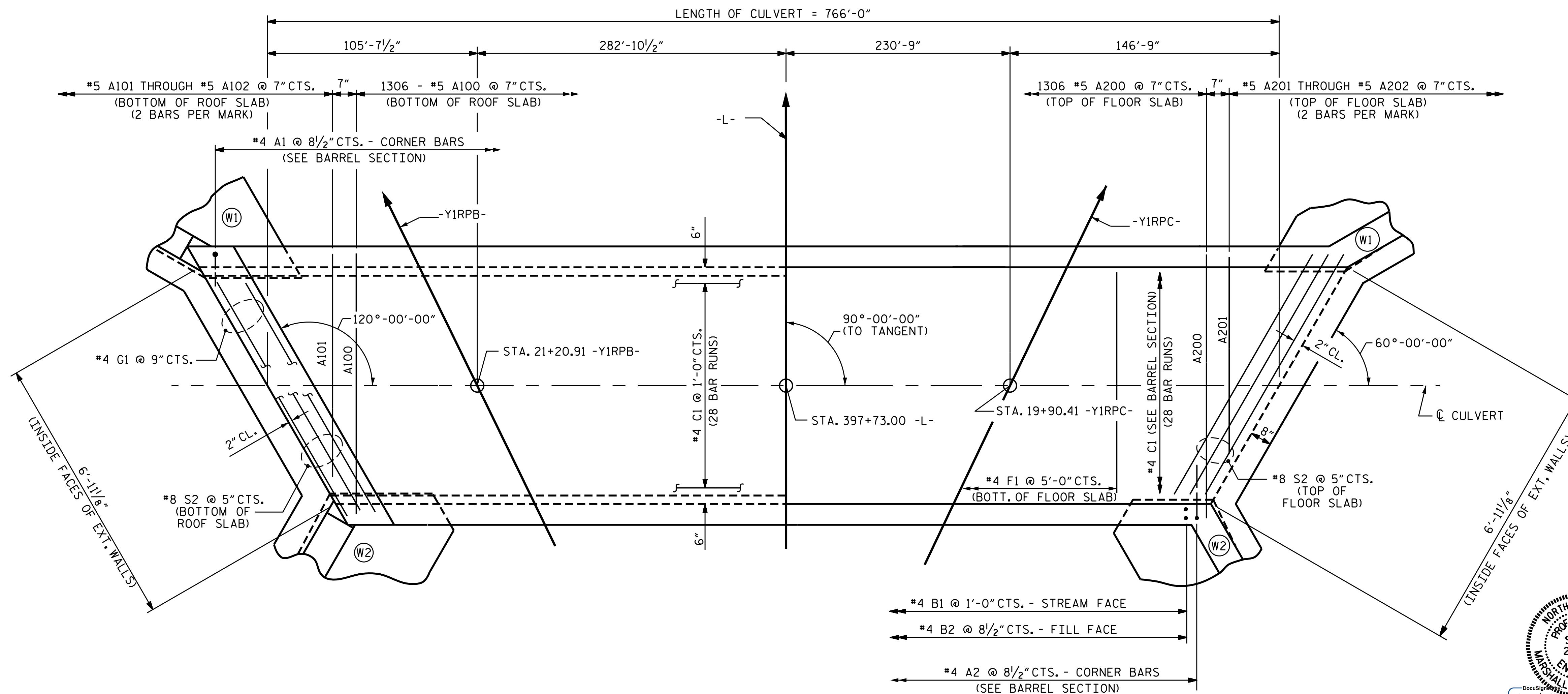
BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	#4	1	6'-3"	9035
A2	#4	1	5'-5"	7830
A100	#5	STR.	7'-6"	10216
A101	#5	STR.	5'-7"	23
A102	#5	STR.	3'-7"	15
A200	#5	STR.	7'-6"	10216
A201	#5	STR.	5'-7"	23
A202	#5	STR.	3'-7"	15
B1	#4	STR.	9'-3"	9466
B2	#4	STR.	6'-4"	9155
C1	#4	STR.	29'-7"	22133
D1	#6	STR.	1'-8"	135
F1	#4	STR.	4'-0"	409
G1	#4	STR.	8'-9"	23
S2	#8	STR.	8'-9"	280
REINFORCING STEEL				LBS. 78,974

SPLICE LENGTH CHART

BAR	SIZE	SPLICE LENGTH
B1	#4	1'-5"
C1	#4	1'-11"



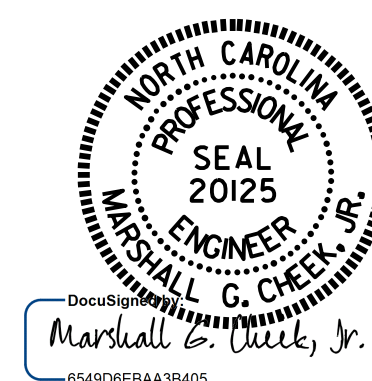
PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB

PROJECT NO. U-2579C
FORSYTH COUNTY
STATION: 397+73.00 -L-

SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
SINGLE 6 FT. X 7 FT. CONCRETE BOX CULVERT



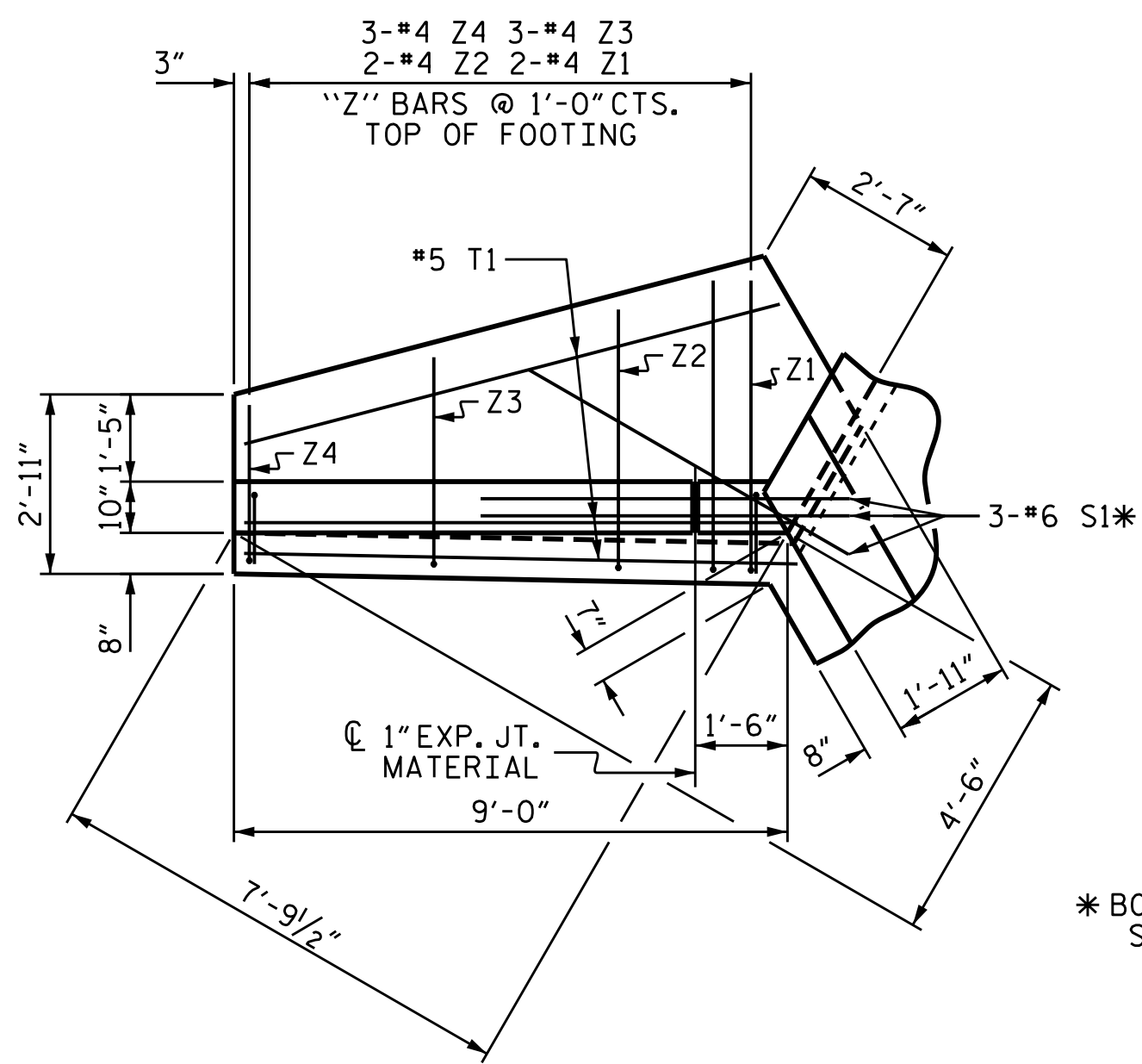
7/27/2017

ASSEMBLED BY: N.D. AIUTO DATE: 3/31/16
CHECKED BY: H.A. LOCKLEAR DATE: 4/6/16
DESIGN ENGINEER OF RECORD: J.K. BOWLES DATE: 4/6/16

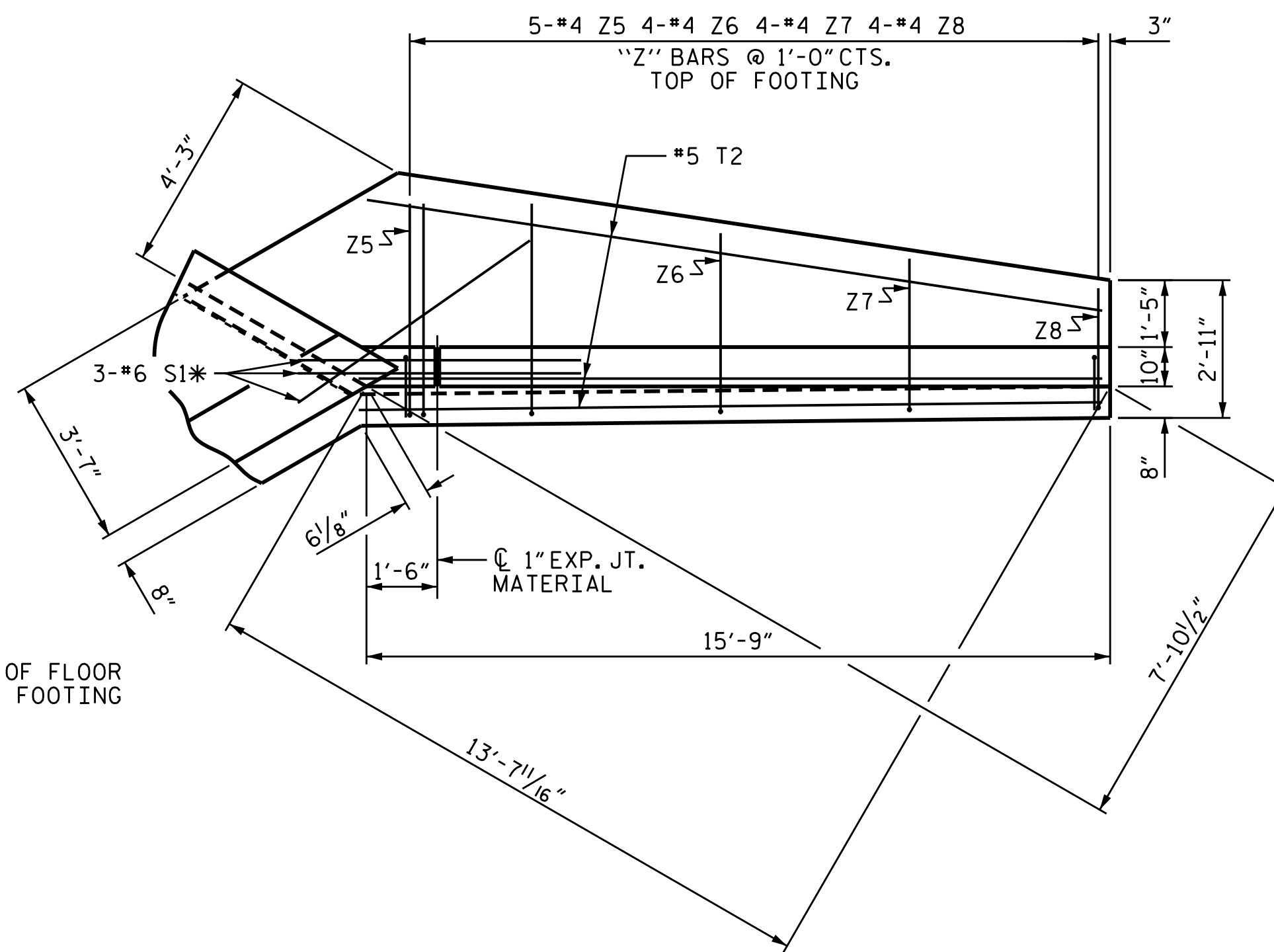
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REVISIONS						SHEET NO. C1-4
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			TOTAL SHEETS 5
2			4			

STR. #5

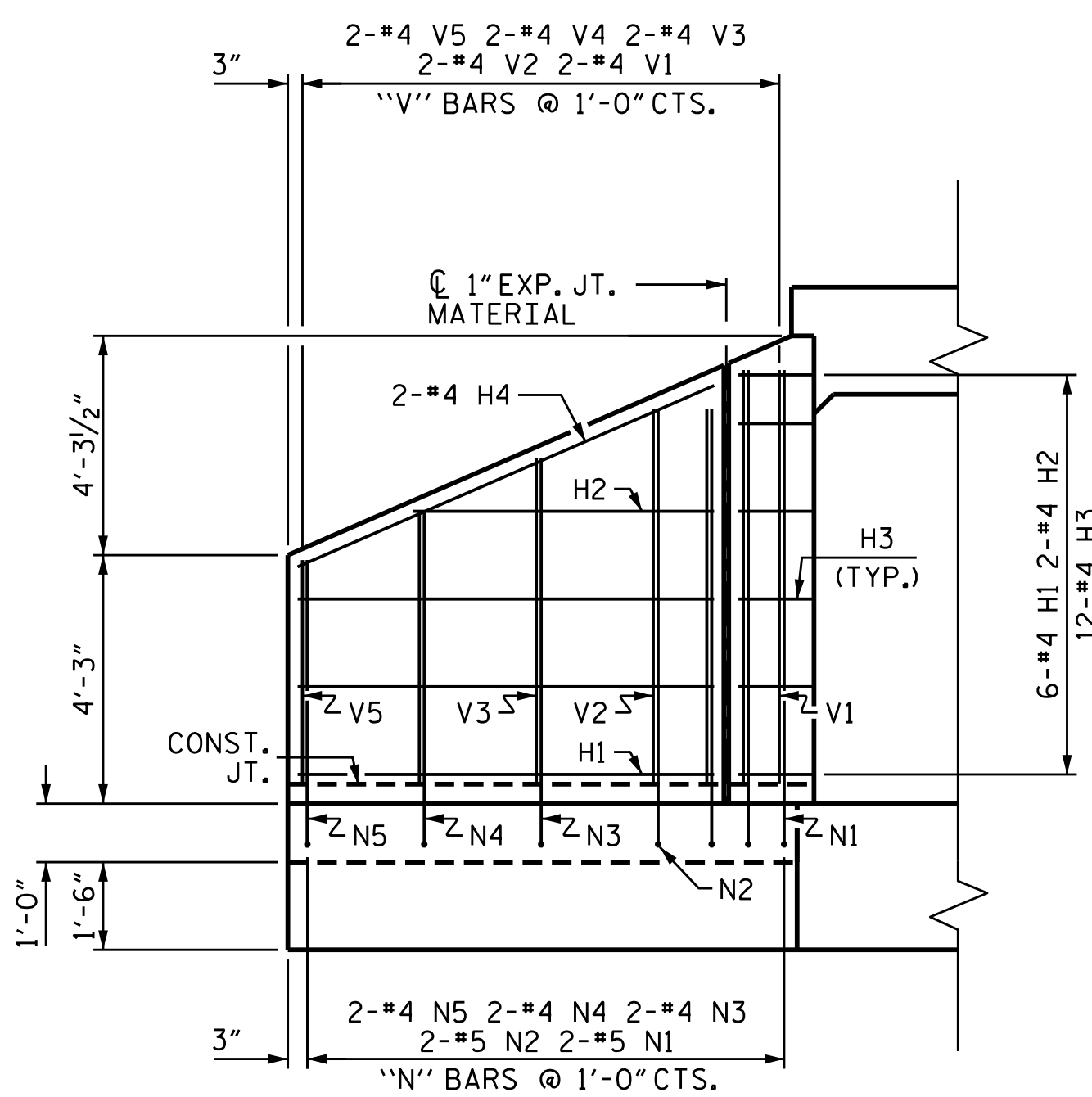


PLAN W2

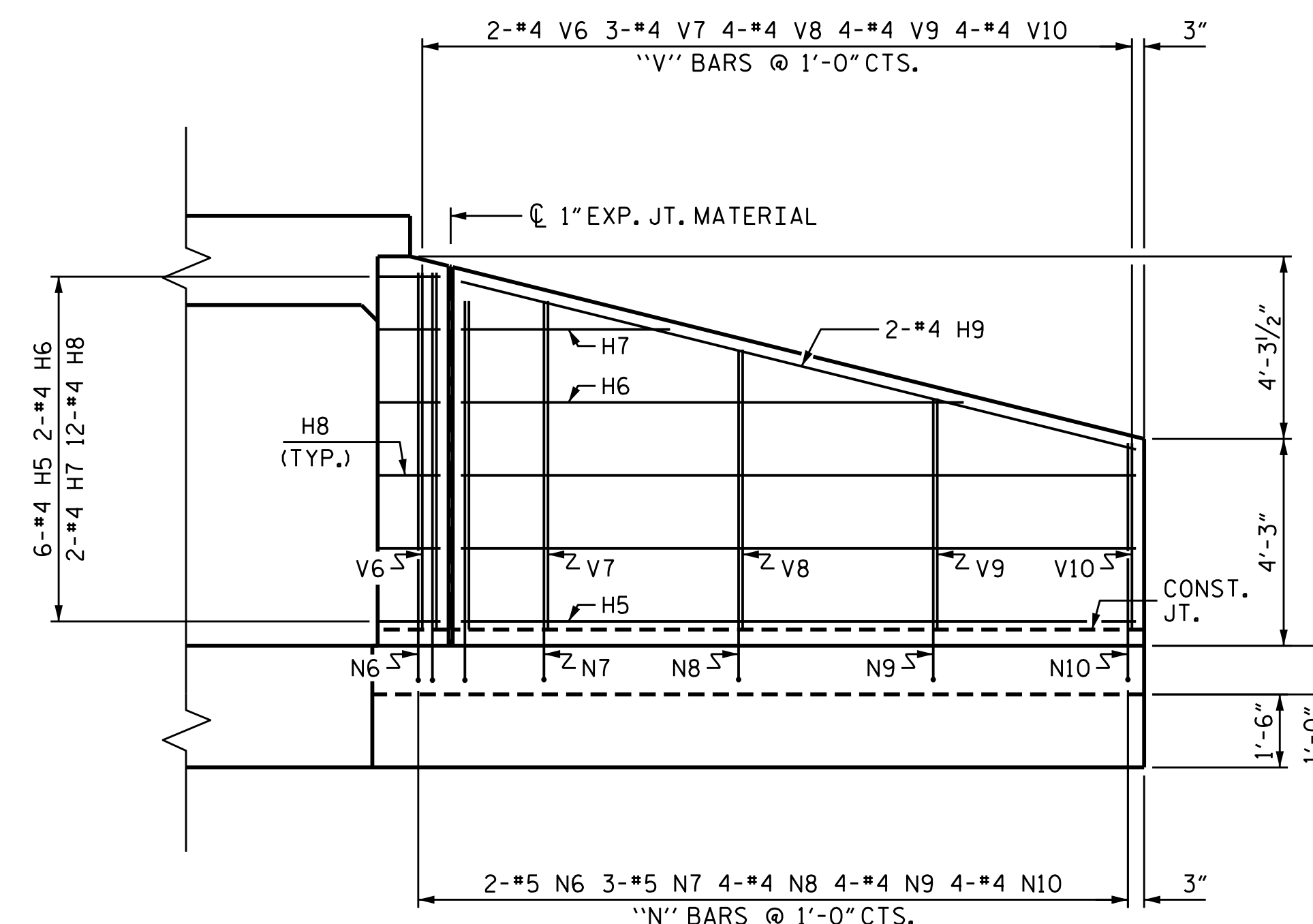


PLAN W1

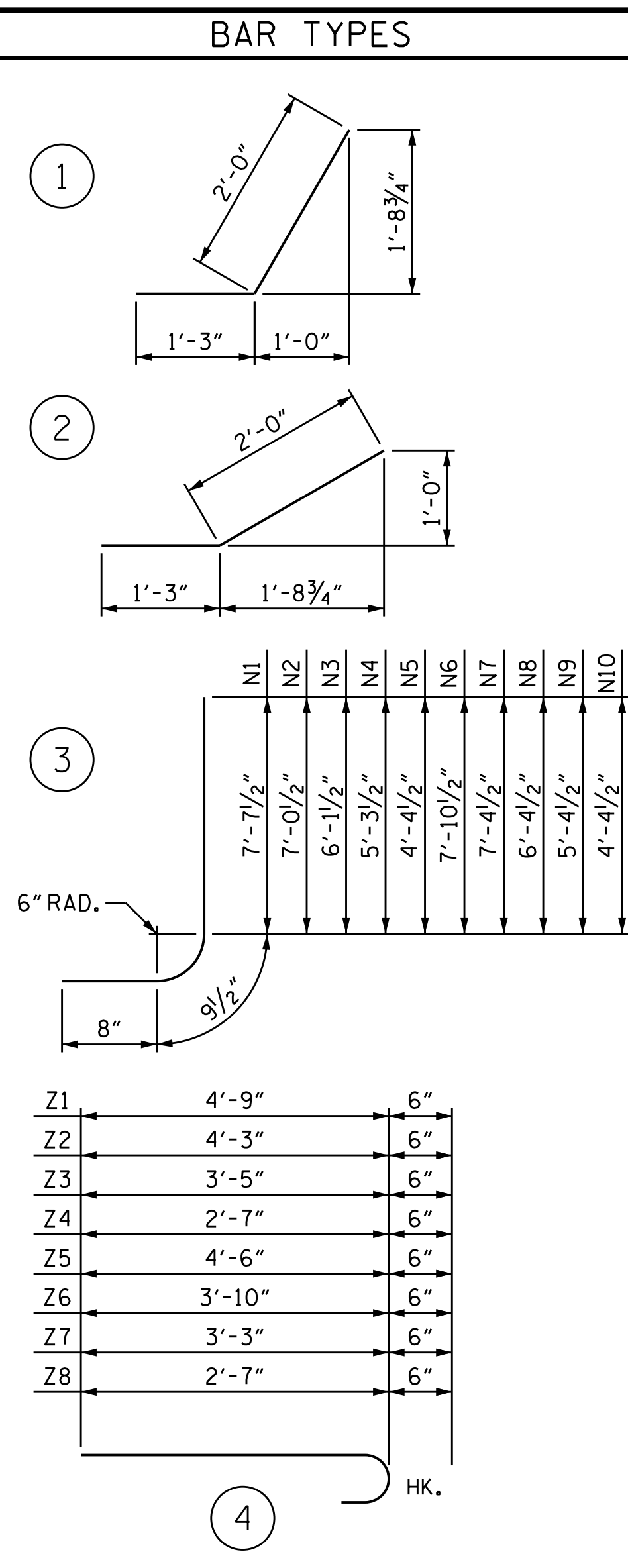
A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.



ELEVATION W2

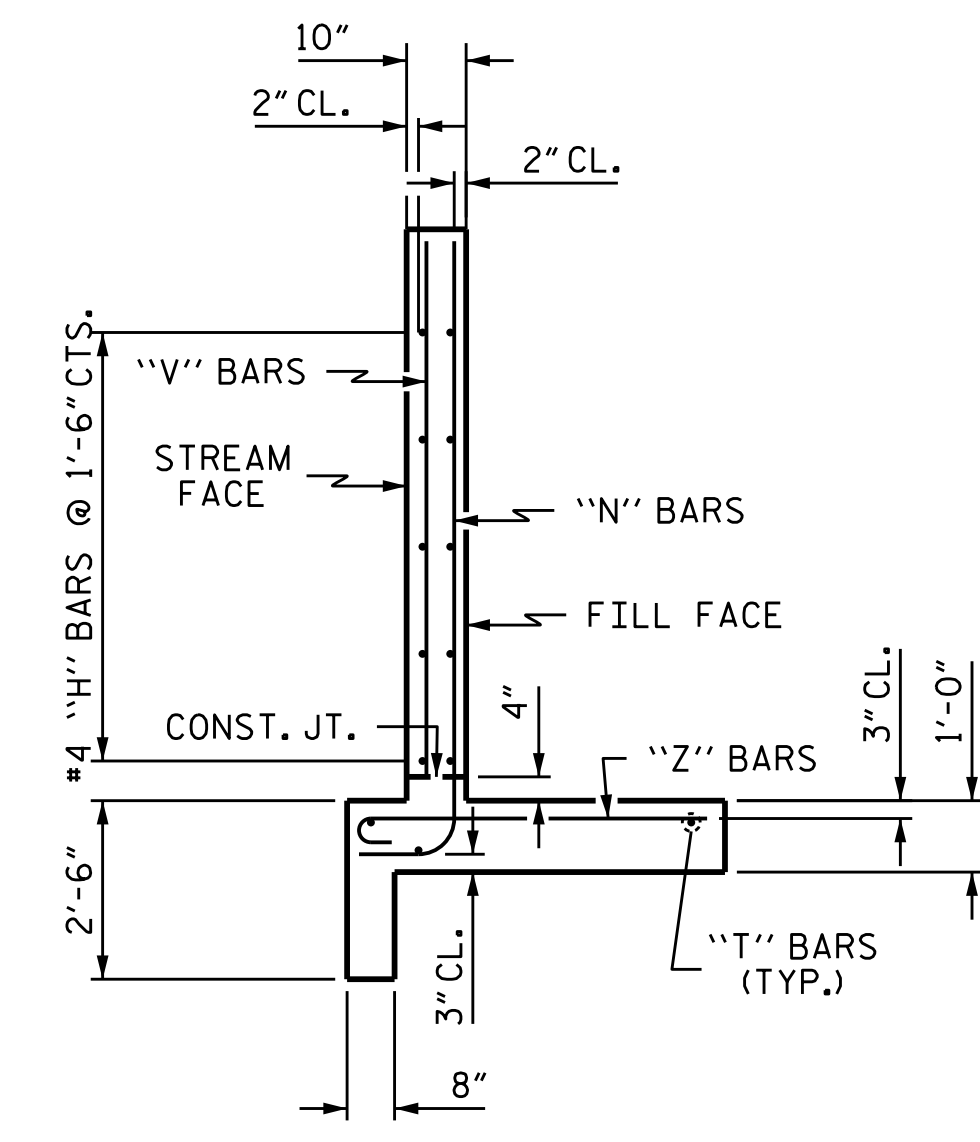


ELEVATION W1



ALL BAR DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	7'-1"	57
H2	4	#4	STR	5'-2"	14
H3	24	#4	1	3'-3"	52
H4	4	#4	STR	7'-9"	21
H5	12	#4	STR	13'-10"	111
H6	4	#4	STR	10'-4"	28
H7	4	#4	STR	4'-3"	11
H8	24	#4	2	3'-3"	52
H9	4	#4	STR	14'-3"	38
N1	4	#5	3	9'-1"	38
N2	4	#5	3	8'-6"	35
N3	4	#4	3	7'-7"	20
N4	4	#4	3	6'-9"	18
N5	4	#4	3	5'-10"	16
N6	4	#5	3	9'-4"	39
N7	6	#5	3	8'-10"	55
N8	8	#4	3	7'-10"	42
N9	8	#4	3	6'-10"	37
N10	8	#4	3	5'-10"	31
S1	12	#6	STR	6'-0"	108
T1	6	#5	STR	9'-0"	56
T2	6	#5	STR	15'-9"	99
V1	4	#4	STR	7'-1"	19
V2	4	#4	STR	6'-5"	17
V3	4	#4	STR	5'-7"	15
V4	4	#4	STR	4'-8"	12
V5	4	#4	STR	3'-10"	10
V6	4	#4	STR	7'-4"	20
V7	6	#4	STR	6'-9"	27
V8	8	#4	STR	5'-9"	31
V9	8	#4	STR	4'-9"	25
V10	8	#4	STR	3'-10"	20
Z1	4	#4	4	5'-3"	14
Z2	4	#4	4	4'-9"	13
Z3	6	#4	4	3'-11"	16
Z4	6	#4	4	3'-1"	12
Z5	10	#4	4	5'-0"	33
Z6	8	#4	4	4'-4"	23
Z7	8	#4	4	3'-9"	20
Z8	8	#4	4	3'-1"	16
REINFORCING STEEL FOR 4 WINGS				LBS.	1,321
CLASS A CONCRETE					
4 WINGS				C.Y.	19.8
2 HEADWALLS				C.Y.	0.9
2 END CURTAIN WALLS				C.Y.	0.7
TOTAL				C.Y.	21.4



TYPICAL WING SECTION



PROJECT NO. U-2579C
 FORSYTH COUNTY
 STATION: 397+73.00 -L-

SHEET 5 OF 5
 STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD WINGS
 FOR
 CONCRETE BOX CULVERT
 H = 7'-0" SLOPE = 2:1
 60° OR 120° SKEW

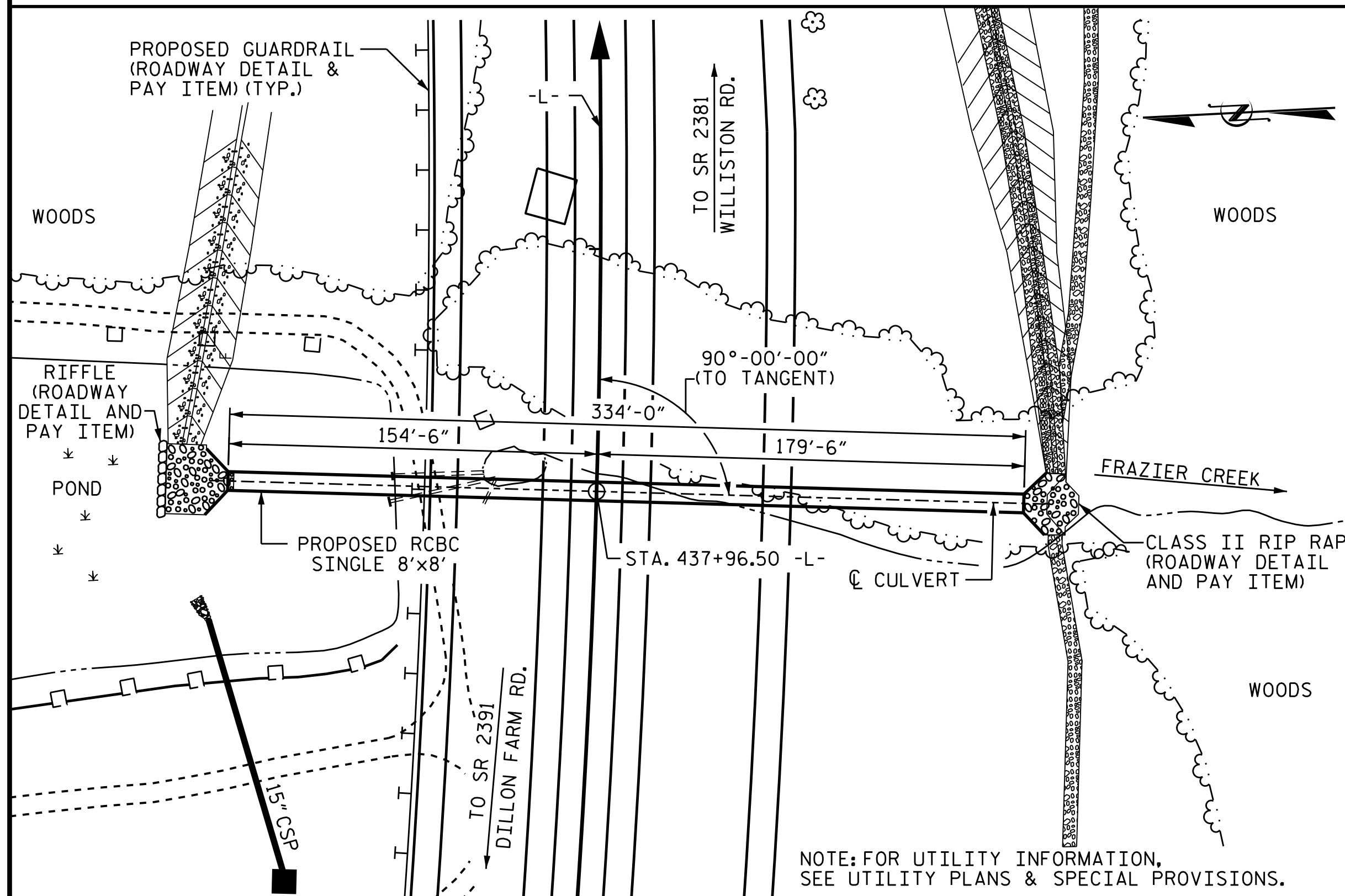
ASSEMBLED BY : N.D.AIUTO DATE : 3/31/16
 CHECKED BY : H.A.LOCKLEAR DATE : 4/6/16
 DRAWN BY : CCJ 11/99
 CHECKED BY : RWW 03/00

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

TOTAL SHEETS 5

BENCHMARK #3: RAILROAD SPIKE SET IN BASE OF 30" WHITE OAK TREE
STA. 31+99.00 -Y2-, 120' LT, EL.=957.76



LOCATION SKETCH

ROADWAY DATA

GRADE POINT ELEV. @ STA. 437+96.50 -L-	= 901.03
BED ELEV. @ STA. 437+96.50 -L-	= 893.57
ROADWAY SLOPES	= 2:1

HYDRAULIC DATA

DESIGN DISCHARGE	= 385 C.F.S.
FREQUENCY OF DESIGN FLOOD	= 50 YR.
DESIGN HIGH WATER ELEV.	= 902.3
DRAINAGE AREA	= 0.259 SQ. MI.
BASE DISCHARGE (Q100)	= 445 C.F.S.
BASE HIGH WATER ELEV.	= 902.9

OVERTOPPING FLOOD DATA

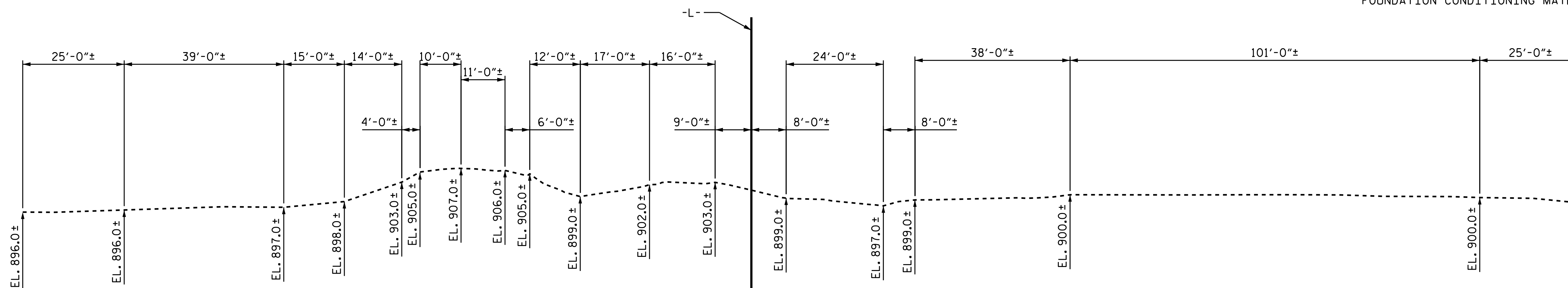
OVERTOPPING DISCHARGE	= N/A
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YR.
OVERTOPPING FLOOD ELEV.	= 910.0

TOTAL STRUCTURE QUANTITIES

CULVERT EXCAVATION	LUMP SUM
FOUNDATION CONDITIONING MATERIAL	330 TONS
CLASS A CONCRETE	
BARREL @ 1.677 CY/FT	560.1 C.Y.
WINGS, ETC.	23.1 C.Y.
SILLS	0.6 C.Y.
TOTAL	583.8 C.Y.
REINFORCING STEEL	
BARREL @	48,618 LBS.
WINGS, ETC.	1,463 LBS.
TOTAL	50,081 LBS.

NOTES

- ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.
- DESIGN FILL = 46.87 FEET.
- FOR OTHER DESIGN DATA AND NOTES, SEE STANDARD NOTE SHEET.
- 3" Ø WEEP HOLES INDICATED TO BE IN ACCORDANCE WITH THE SPECIFICATIONS.
- CONCRETE IN CULVERTS TO BE POURED IN THE FOLLOWING ORDER:
 1. WING FOOTINGS AND FLOOR SLAB INCLUDING 4" OF ALL VERTICAL WALLS.
 2. THE REMAINING PORTIONS OF THE WALLS AND WINGS FULL HEIGHT FOLLOWED BY ROOF SLAB AND HEADWALLS.
- THE RESIDENT ENGINEER SHALL CHECK THE LENGTH OF CULVERT BEFORE STAKING IT OUT TO MAKE CERTAIN THAT IT WILL PROPERLY TAKE CARE OF THE FILL.
- DIMENSIONS FOR WING LAYOUT AS WELL AS ADDITIONAL REINFORCING STEEL EMBEDDED IN BARREL ARE SHOWN ON WING SHEET.
- TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL, SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FT. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL 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.
- NO PRECAST REINFORCED BOX CULVERT OPTION WILL BE ALLOWED.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- 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 REINFORCED CONCRETE BOX CULVERT SHALL BE PLACED ON THE STANDARD 1.0 FOOT BLANKET OF FOUNDATION CONDITIONING MATERIAL. SEE SECTION 414 OF THE STANDARD SPECIFICATIONS.
- CONSTRUCT THE REINFORCED CONCRETE BOX CULVERT WITH 9 INCHES OF CAMBER TO ACCOUNT FOR ANTICIPATED SETTLEMENT.
- UNDERCUT SOFT/LOOSE SOILS THAT MAY BE ENCOUNTERED BENEATH THE BOTTOM OF THE FOUNDATION CONDITIONING MATERIAL. BACKFILL UNDERCUT AREAS WITH FOUNDATION CONDITIONING MATERIAL.



PROFILE ALONG CULVERT

PROJECT NO. U-2579C
FORSYTH COUNTY
STATION: 437+96.50 -L-
SHEET 1 OF 5



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 8 FT. X 8 FT. CONCRETE BOX CULVERT

90° SKEW

DRAWN BY: N.D. AIUTO DATE: 3/30/16
CHECKED BY: H.A. LOCKLEAR DATE: 4/6/16
DESIGN ENGINEER OF RECORD: J.K. BOWLES DATE: 4/6/2016

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

LOAD FACTORS

DESIGN LOAD RATING FACTORS

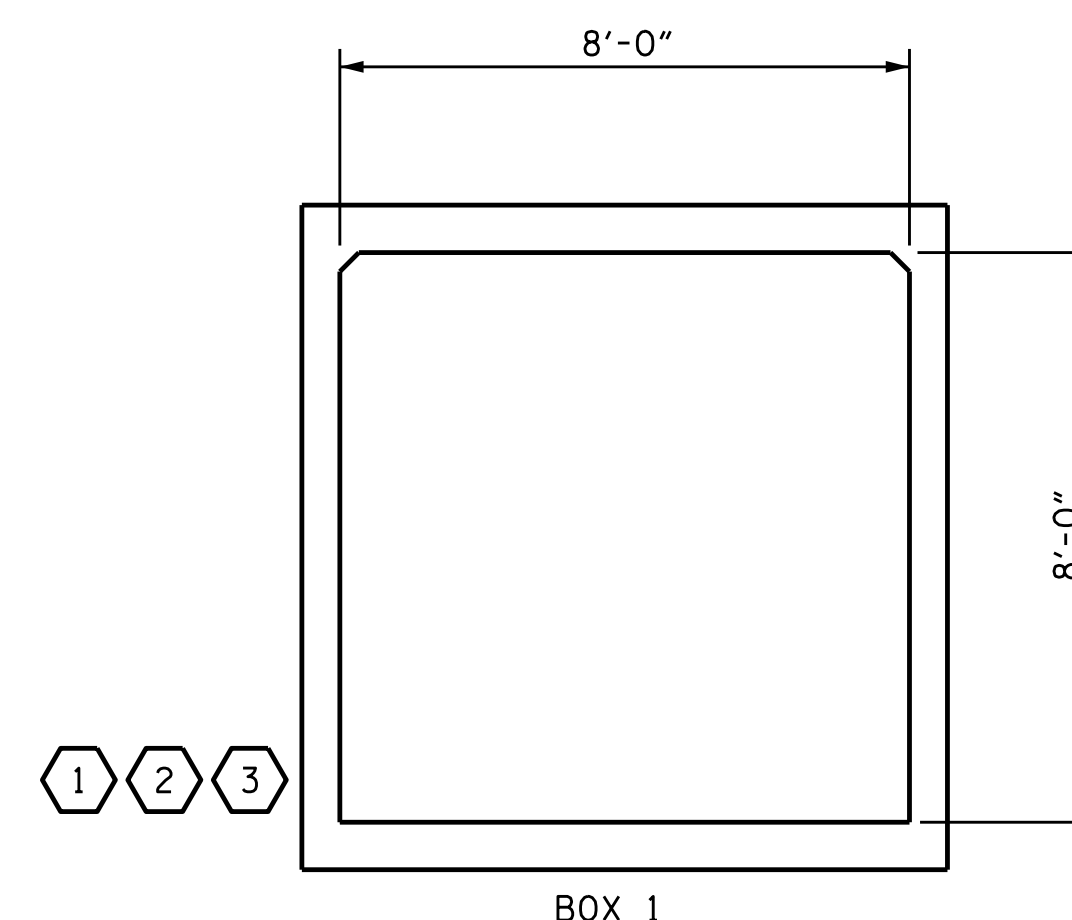
LOAD TYPE	MAX FACTOR	MIN FACTOR
DC	1.25	0.90
DW	1.50	0.65
EV	1.30	0.90
EH	1.35	0.90
ES	1.35	0.90
LS	1.75	--
WA	1.00	--

NOTE

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS																
LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER		
						LIVE-LOAD FACTORS (γ _L)	MOMENT				SHEAR					
							RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE		DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING	HL-93 (INVENTORY)	N/A	①	4.16	--	1.75	5.44	1	BOT. CORNER WALL	8.75	4.16	1	EXTERIOR WALL	7.98		
	HL-93 (OPERATING)	N/A		5.39	--	1.35	7.05	1	BOT. CORNER WALL	8.75	5.39	1	EXTERIOR WALL	7.98		
	HS-20 (INVENTORY)	36.000	②	4.16	149.81	1.75	5.44	1	BOT. CORNER WALL	8.75	4.16	1	EXTERIOR WALL	7.98		
	HS-20 (OPERATING)	36.000		5.39	194.20	1.35	7.05	1	BOT. CORNER WALL	8.75	5.39	1	EXTERIOR WALL	7.98		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SH	12.500	③	5.20	65.02	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S3C	21.500		5.20	111.84	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S3A	22.750		5.20	118.34	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S4A	26.750		5.20	139.15	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S5A	30.500		5.20	158.66	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S6A	34.500		5.20	179.46	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S7B	38.500		5.20	200.27	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		S7A	40.000		5.20	208.07	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	T4A	28.250		5.20	146.95	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		T5B	32.000		5.20	166.46	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		T6A	36.000		5.20	187.27	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
		T7A	40.000		5.20	208.07	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98	
	T7B	40.000		5.20	208.07	1.40	6.80	1	BOT. CORNER WALL	8.75	5.20	1	EXTERIOR WALL	7.98		

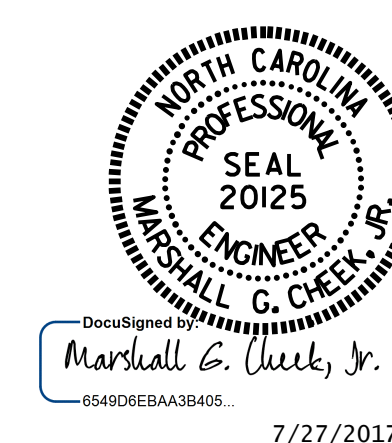
①	CONTROLLING LOAD RATING
①	DESIGN LOAD RATING (HL-93)
②	DESIGN LOAD RATING (HS-20)
③	LEGAL LOAD RATING **
** SEE CHART FOR VEHICLE TYPE	



LRFR SUMMARY
(LOOKING DOWNSTREAM)

PROJECT NO. U-2579C
FORSYTH COUNTY
 STATION: 437+96.50 -L-

SHEET 2 OF 5



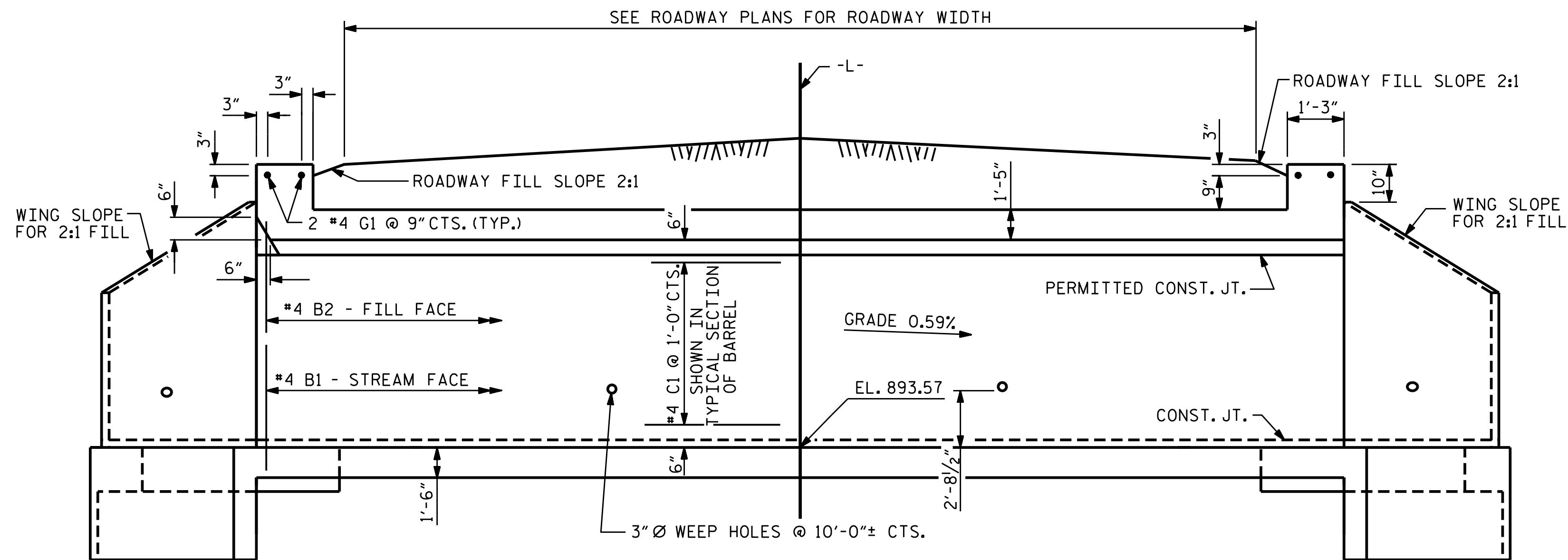
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD
 LRFR SUMMARY FOR
 REINFORCED CONCRETE
 BOX CULVERTS
 (INTERSTATE TRAFFIC)

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

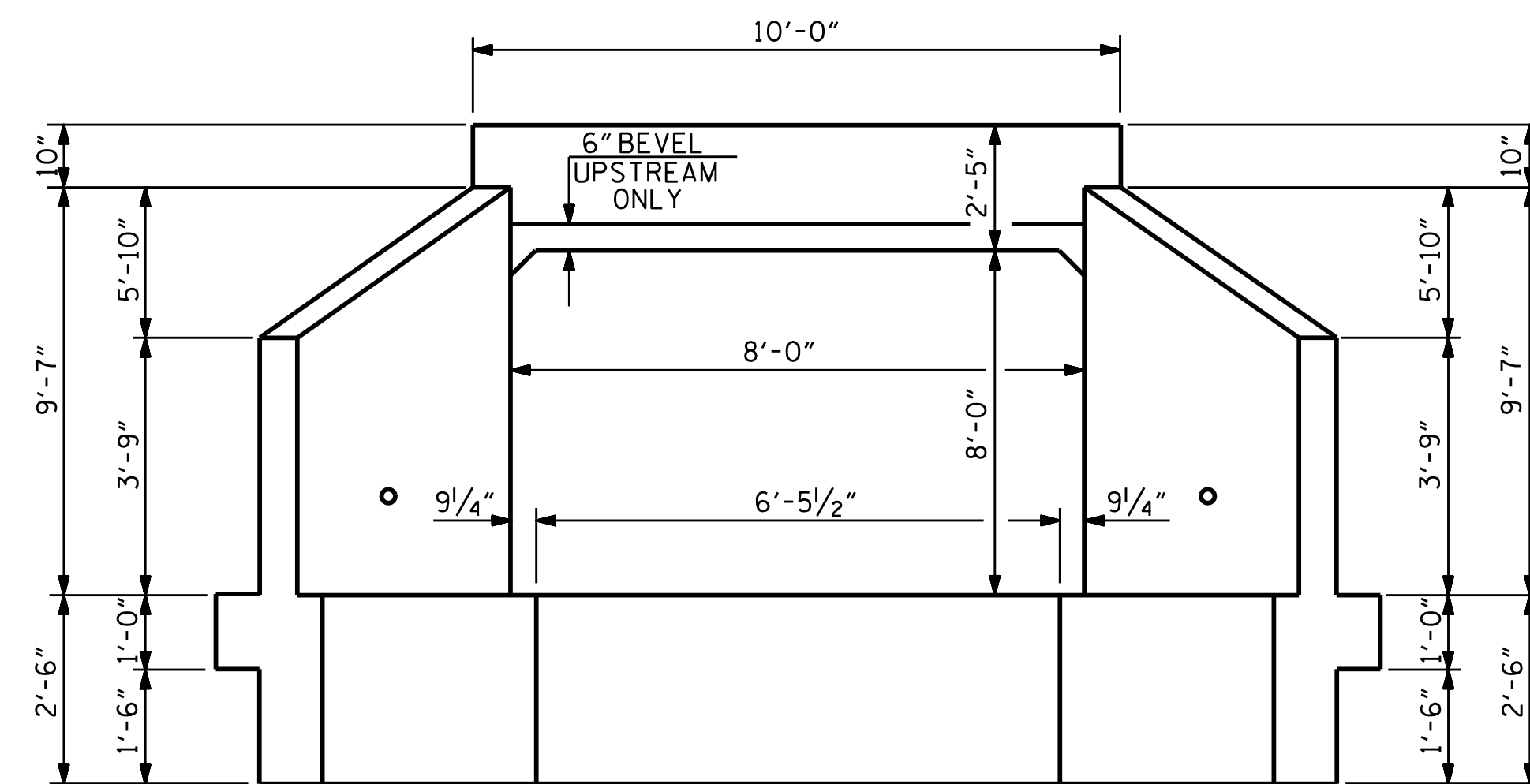
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 SIGNATURES COMPLETED

STR. #6 STD. NO. LRFR6

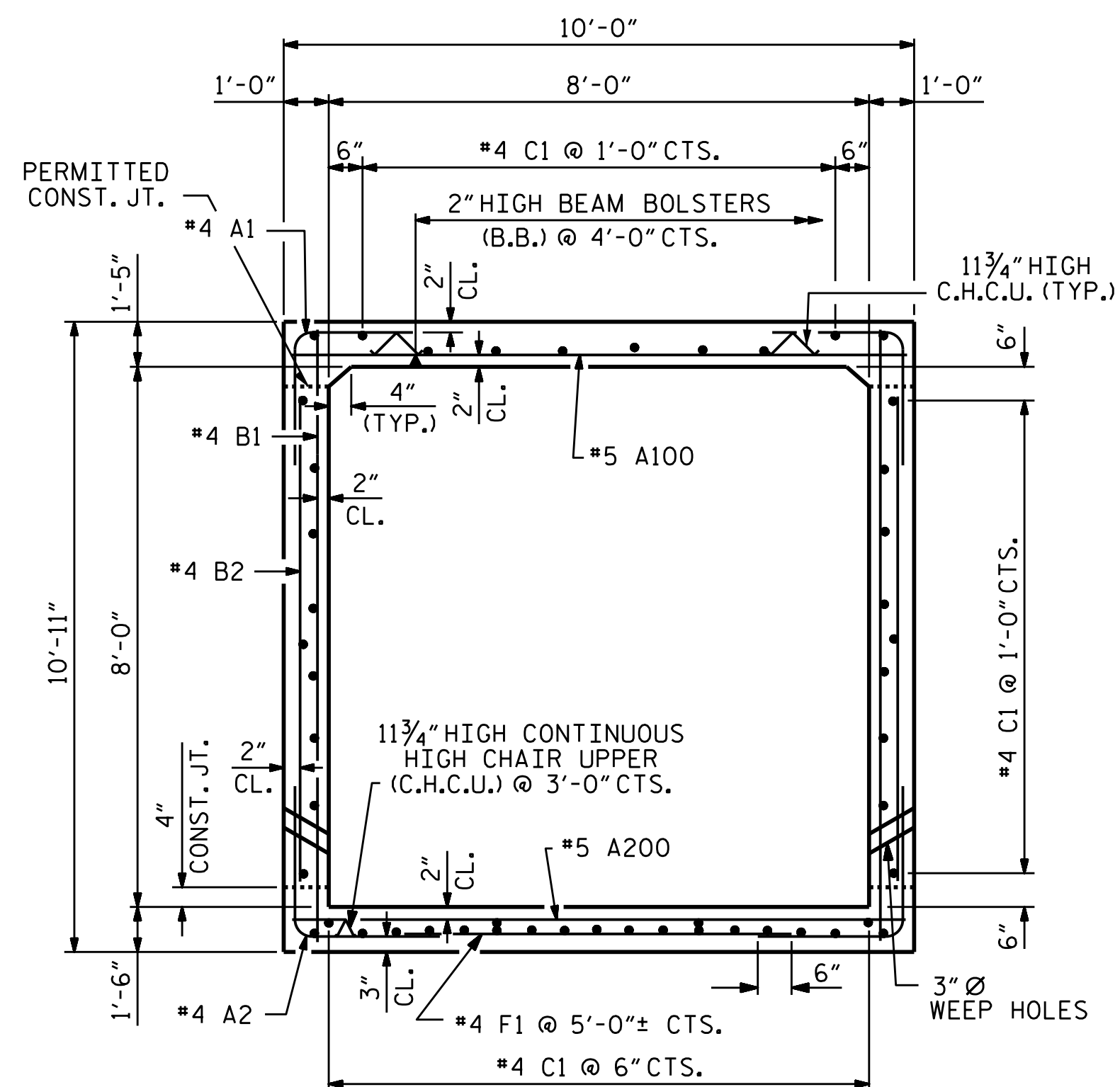
ASSEMBLED BY : N.D.AIUTO	DATE : 3/30/16
CHECKED BY : H.A.LOCKLEAR	DATE : 4/6/16
DRAWN BY : WMC 7/11	REV. 10/1/11
CHECKED BY : GM 7/11	MAA/GM



CULVERT SECTION NORMAL TO ROADWAY

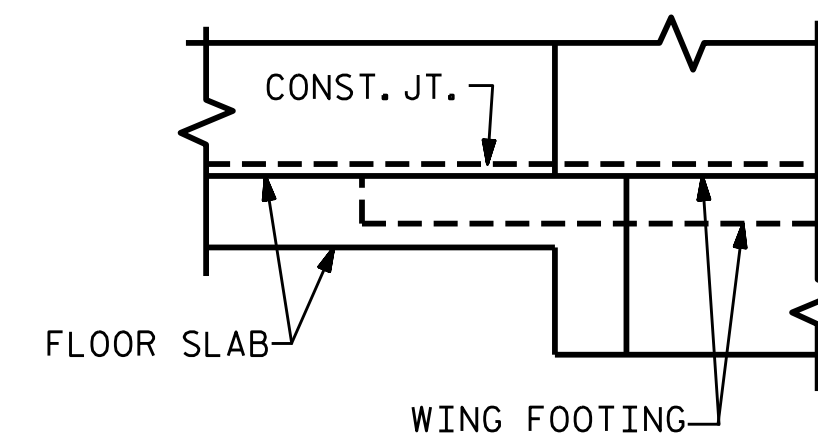
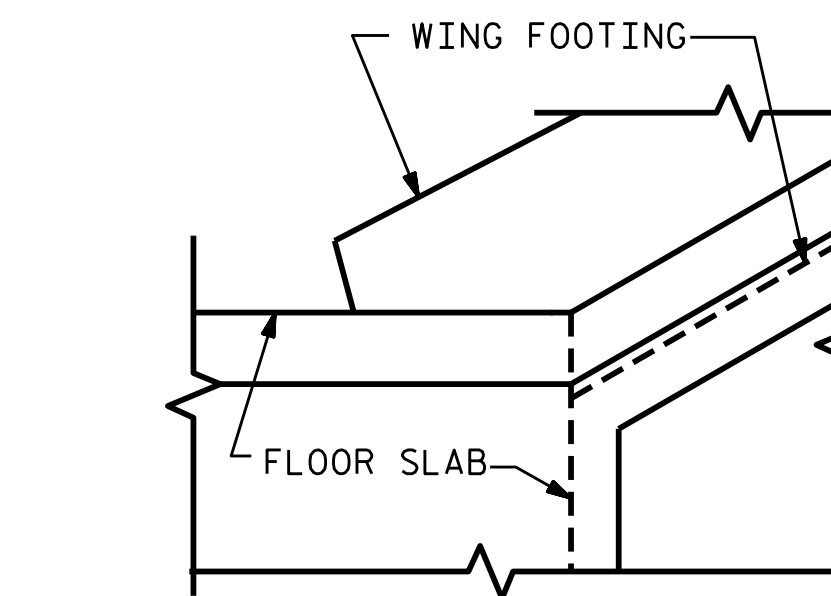


END ELEVATION



RIGHT ANGLE SECTION OF BARREL

THERE ARE 49 "C" BARS IN SECTION OF BARREL

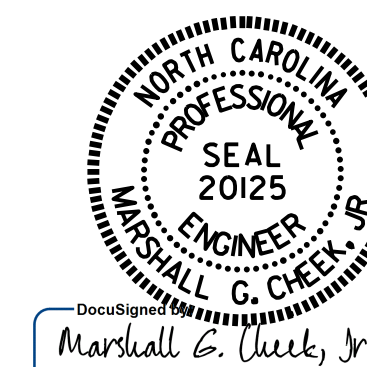


DETAIL
CONNECTION OF WING FOOTING
AND FLOOR SLAB WHEN SLAB
IS THICKER THAN FOOTING

PROJECT NO. U-2579C
FORSYTH COUNTY
STATION: 437+96.50 -L-

SHEET 3 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
SINGLE 8 FT. X 8 FT.
CONCRETE BOX CULVERT
90° SKEW



Marshall G. Check, Jr.
65490REBA-38465

7/27/2017

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

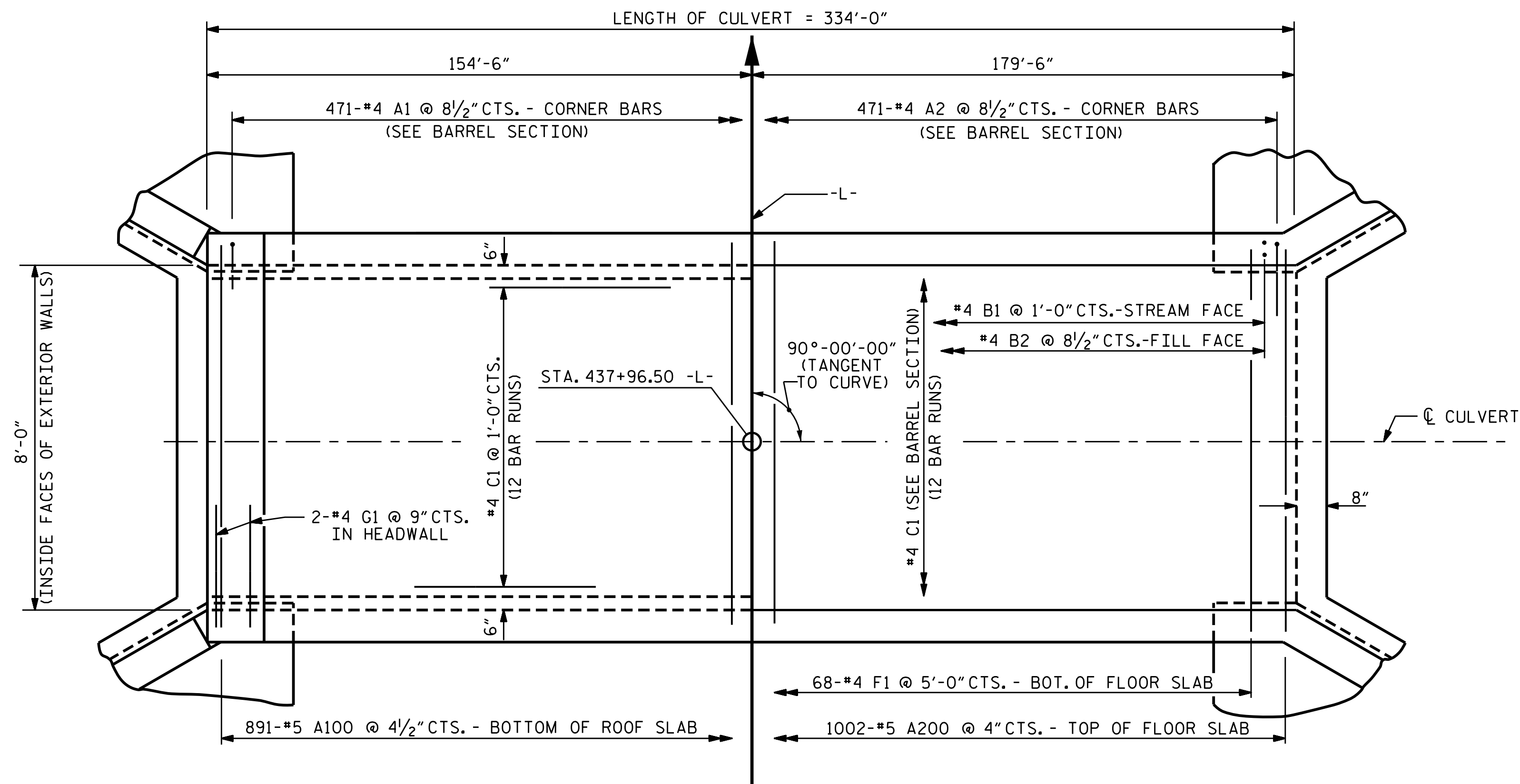
DOCUMENT NOT CONSIDERED
FINAL UNLESS ALL
SIGNATURES COMPLETED

STR. #6 STD. NO. CB11

REVISED 8-28-92 BY E.L.R. CHECKED BY G.R.P.
REVISED 6-25-98 BY A.N.B. CHECKED BY C.R.K.
REDRAWN 8-22-1983
REVISED 11-19-99 BY M.M. CHECKED BY R.W.W.

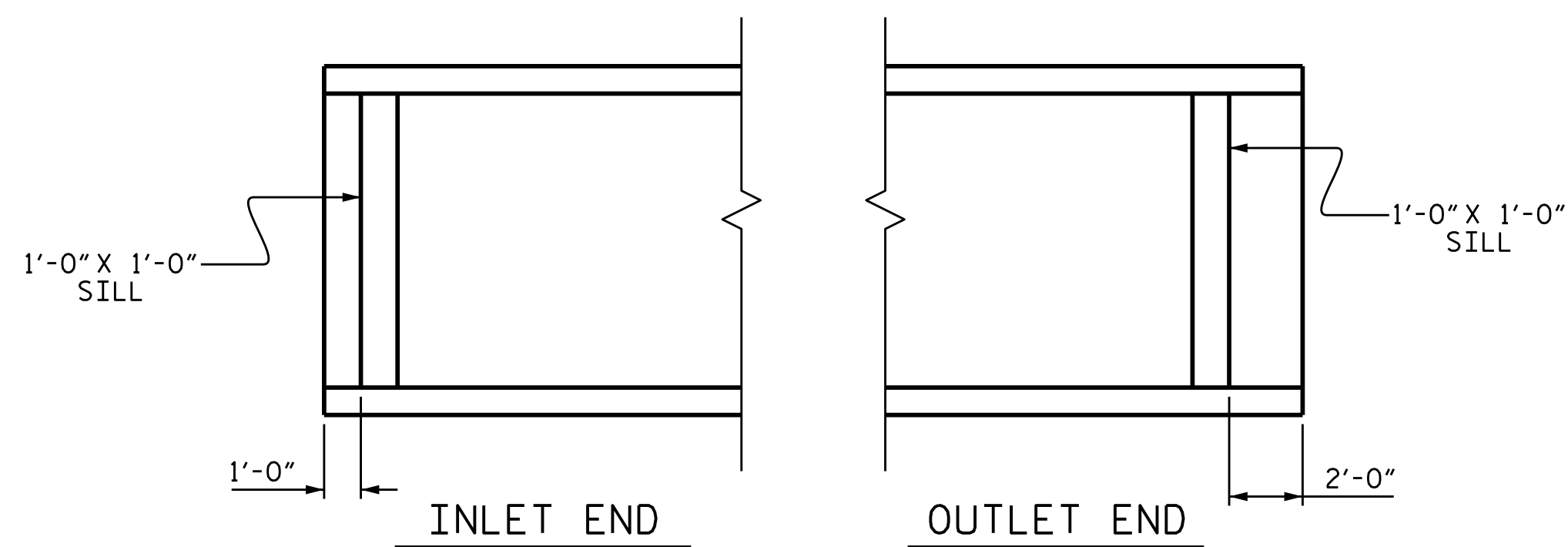
DRAWN BY : N.D. AIUTO DATE : 3/30/16
CHECKED BY : H.A. LOCKLEAR DATE : 4/6/16
DESIGN ENGINEER OF RECORD: J.K. BOWLES DATE : 4/6/16

26-JUL-2017 15:10
R:\S\structures\FINAL PLANS\412.005.U2579C.SMU.CU.003.330000.dgn
mcheck

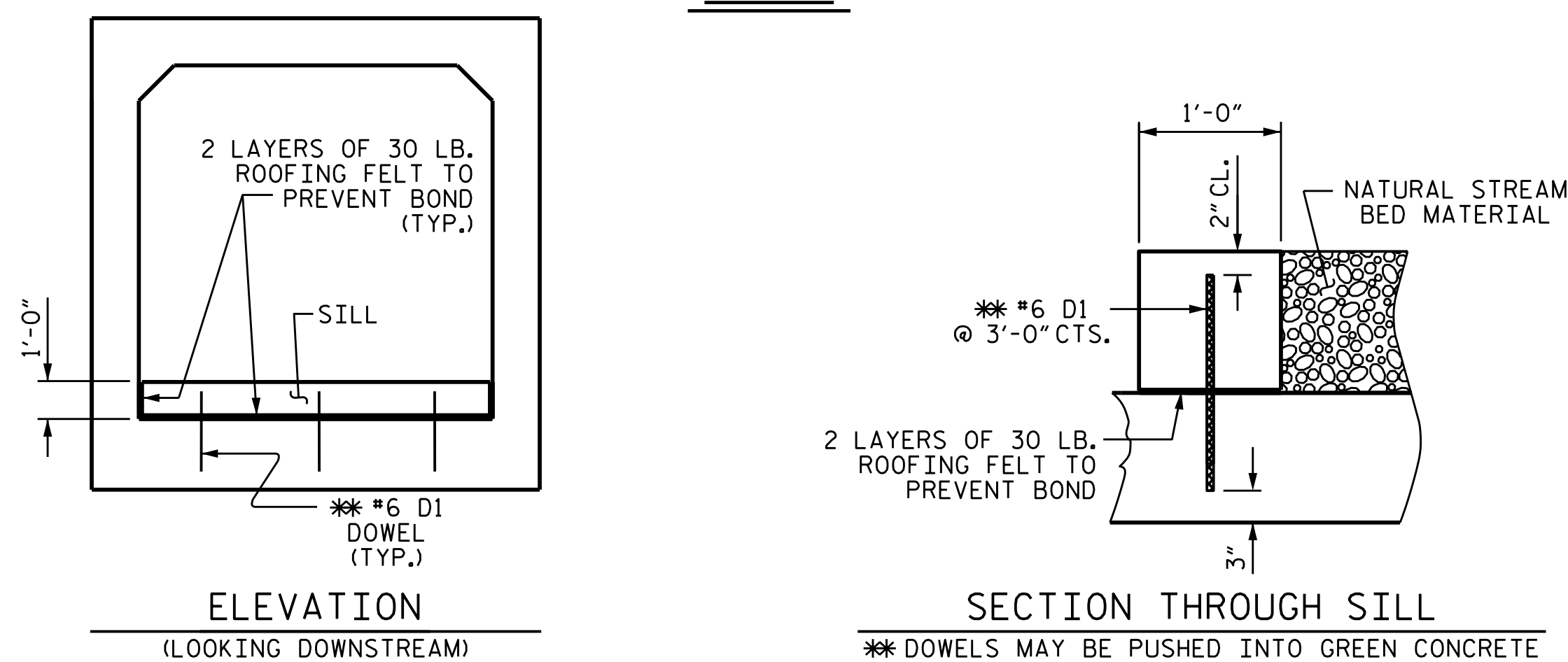


PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB



PLAN



ELEVATION
(LOOKING DOWNSTREAM)

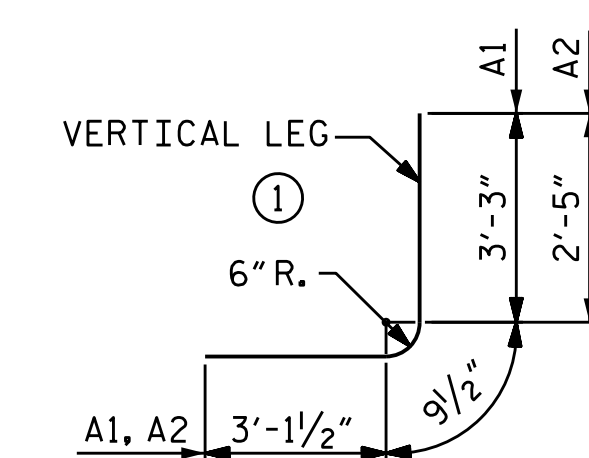
SECTION THROUGH SILL

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

CULVERT SILL DETAILS

SPLICE LENGTH CHART		
BAR	SIZE	SPLICE LENGTH
B1	#4	1'-5"
C1	#4	1'-11"

BAR TYPE



DIMENSIONS ARE OUT TO OUT.

BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	944	#4	1	7'-2"	4519
A2	944	#4	1	6'-4"	3994
A100	890	#5	STR.	9'-7"	8896
A200	1002	#5	STR.	9'-7"	10015
B1	668	#4	STR.	10'-5"	4648
B2	942	#4	STR.	7'-4"	4615
C1	588	#4	STR.	29'-9"	11685
D1	6	#6	STR.	2'-1"	19
F1	68	#4	STR.	4'-5"	201
G1	4	#4	STR.	9'-8"	26
REINFORCING STEEL					LBS. 48,618

NOTES

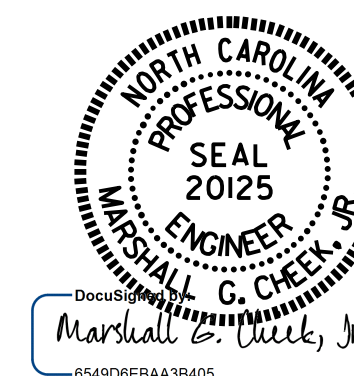
MATERIAL EXCAVATED FROM THE EXISTING BED SHALL BE STOCKPILED FOR USE IN THE PROPOSED CULVERT AS SHOWN IN THE "PLAN VIEW". BED MATERIAL SHALL BE SUPPLEMENTED WITH CLASS "B" RIP RAP AS NECESSARY. IF CLASS "B" RIP RAP IS USED, NATURAL MATERIAL SHALL BE PLACED ON TOP AND LEVELED TO FACILITATE ANIMAL PASSAGE. BED MATERIAL SHALL BE SUBJECT TO APPROVAL BY THE ENGINEER.

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

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

PROJECT NO. U-2579C
 FORSYTH COUNTY
 STATION: 437+96.50 -L-

SHEET 4 OF 5



7/27/2017

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 SINGLE 8 FT. X 8 FT.
 CONCRETE BOX CULVERT
 90° SKEW

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

ASSEMBLED BY : N.D'AIUTO DATE : 3/31/16
 CHECKED BY : H.A.LOCKLEAR DATE : 4/6/16
 DESIGN ENGINEER OF RECORD: J.K.BOWLES DATE : 4/6/16

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STR. #6

STANDARD NOTES

DESIGN DATA:

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

MATERIAL AND WORKMANSHIP:

EXCEPT AS MAY OTHERWISE BE SPECIFIED ON PLANS OR IN THE SPECIAL PROVISIONS, ALL MATERIAL AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE 2012 "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES" OF THE N. C. DEPARTMENT OF TRANSPORTATION.

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

CONCRETE:

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

CONCRETE CHAMFERS:

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

DOWELS:

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

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

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

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

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

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

REINFORCING STEEL:

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

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

STRUCTURAL STEEL:

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

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

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

HANDRAILS AND POSTS:

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

METAL HANDRAILS SHALL BE IN ACCORDANCE WITH THE PLANS. RAILS SHALL BE AS MANUFACTURED FOR BRIDGE RAILING. CASTINGS SHALL BE OF A UNIFORM APPEARANCE. FINIS AND OTHER DEFORMATIONS RESULTING FROM CASTING OR OTHERWISE SHALL BE REMOVED IN A MANNER SO THAT A UNIFORM COLORING OF THE COMPLETED CASTING SHALL BE OBTAINED. CASTINGS WITH DISCOLORATIONS OR OF NON-UNIFORM COLORING WILL NOT BE ACCEPTED. CERTIFIED MILL REPORTS ARE REQUIRED FOR METAL RAILS AND POSTS.

SPECIAL NOTES:

GENERALLY, IN CASE OF DISCREPANCY, THIS STANDARD SHEET OF NOTES SHALL GOVERN OVER THE SPECIFICATIONS, BUT THE REMAINDER OF THE PLANS SHALL GOVERN OVER NOTES HEREON, AND SPECIAL PROVISIONS SHALL GOVERN OVER ALL. SEE SPECIFICATIONS ARTICLE 105-4.

ENGLISH

JANUARY, 1990