

TIP PROJECT: B-4988

CONTRACT: C203352

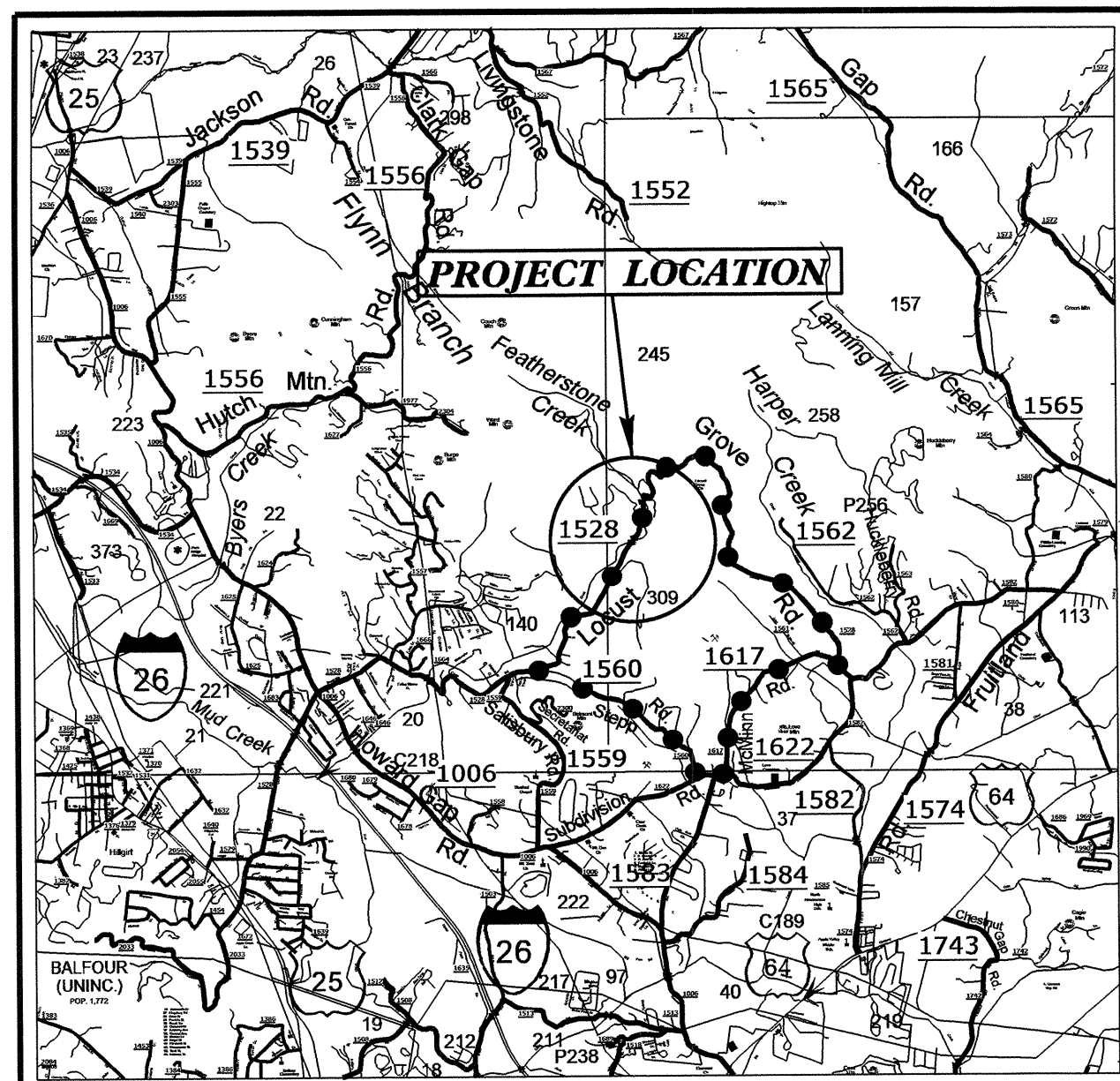
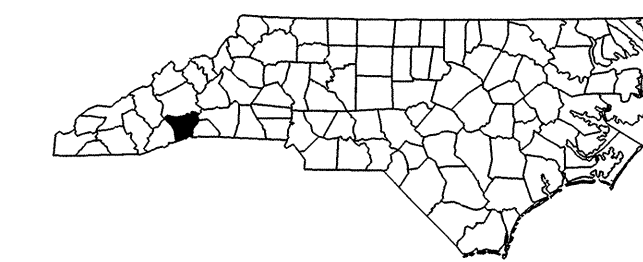
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

HENDERSON COUNTY

**LOCATION: REPLACEMENT OF BRIDGE 309 ON SR 1528
OVER FEATHERSTONE CREEK**

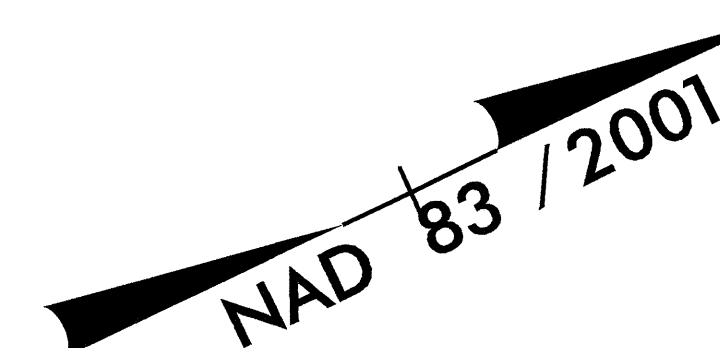
TYPE OF WORK: GRADING, DRAINAGE, PAVING, AND CULVERT

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	B-4988		
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
40156.1.1	BRZ-1528(6)	PE	
40156.2.1	BRZ-1528(6)	RW & UTIL	
40156.3.FD1	BRZ-1528(6)	CONST.	

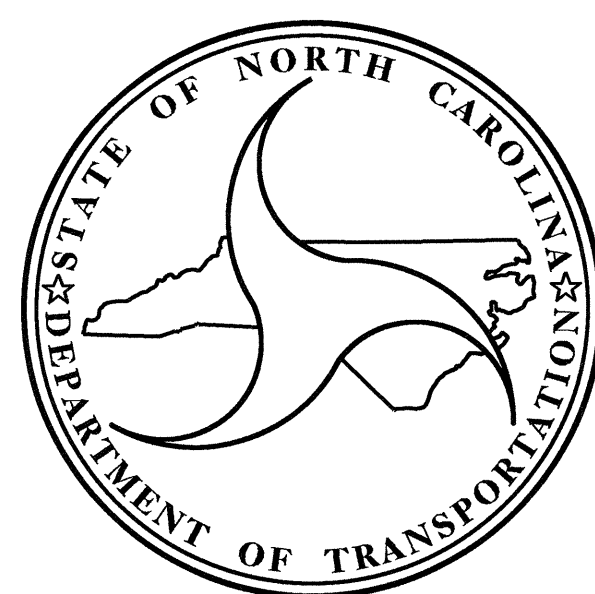
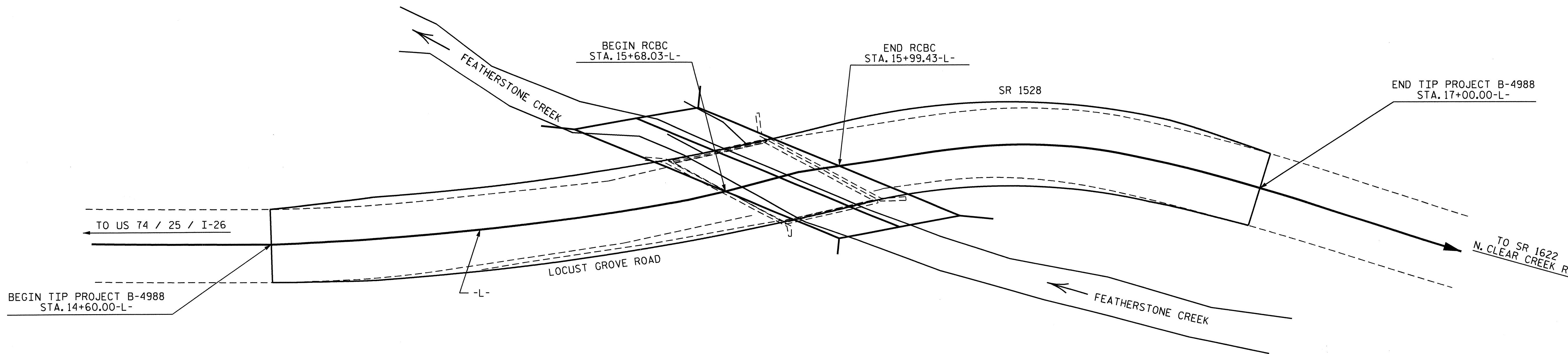


VICINITY MAP

--- DENOTES OFF-SITE DETOUR



CULVERT



DESIGN DATA

ADT 2014 =	775
ADT 2035 =	1,900
K =	12 %
D =	70 %
T =	8 % *
V =	25 MPH
* TTST =	1% DUAL 7%
FUNC CLASS =	LOCAL
	SUB REGIONAL TIER

PROJECT LENGTH

LENGTH ROADWAY TIP PROJECT B-4988 =	0.039 MILES
LENGTH STRUCTURE TIP PROJECT B-4988 =	0.006 MILES
TOTAL LENGTH TIP PROJECT B-4988 =	0.045 MILES

Prepared in the Office of:
DIVISION OF HIGHWAYS
1000 Birch Ridge Dr., Raleigh NC, 27610

2012 STANDARD SPECIFICATIONS

LETTING DATE:
FEBRUARY 18, 2014

QUANG NGUYEN, P.E.
PROJECT ENGINEER

Wael S. Arafat, P.E.
PROJECT DESIGN ENGINEER

STRUCTURE MANAGEMENT UNIT
1000 BIRCH RIDGE DR.
RALEIGH, N.C. 27610

DIVISION OF HIGHWAYS
STATE OF NORTH CAROLINA

STATE DESIGN ENGINEER _____ P.E.
DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED ENGINEER DIVISION ADMINISTRATION _____ DATE _____

BM #2: 8" SPIKE SET IN BASE OF 18" BIRCH TREE,
STA. 17+34.69 -L-, 31.52' LEFT, EL. 2251.52', NAVD 88.

NOTES

HYDRAULIC DATA

DESIGN DISCHARGE = 480 CFS
 FREQUENCY OF DESIGN FLOOD = 25 YRS.
 DESIGN HIGH WATER ELEVATION = 2250.5
 DRAINAGE AREA = 1.30 SQ. MI.
 BASE DISCHARGE (Q100) = 700 CFS
 BASE HIGH WATER ELEVATION = 2251.3

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE = 700 CFS
 FREQUENCY OF OVERTOPPING FLOOD = 100 YRS. ±
 OVERTOPPING FLOOD ELEVATION = 2246.0

GRADE DATA

GRADE POINT ELEVATION @ STA. 15+84.00 -L- = 2246.84
 BED ELEVATION @ STA. 15+84.00 -L- = 2237.90
 ROADWAY FILL SLOPES = VARIES SEE ROADWAY PLANS

ASSUMED LIVE LOAD -----HL-93 OR ALTERNATE LOADING.
 MAXIMUM DESIGN FILL-----3.74 FT.
 MINIMUM DESIGN FILL-----1.71 FT.

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

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

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

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

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.

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 WILL BE PAID FOR BY THE CONTRACTOR.

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.

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.

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 GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

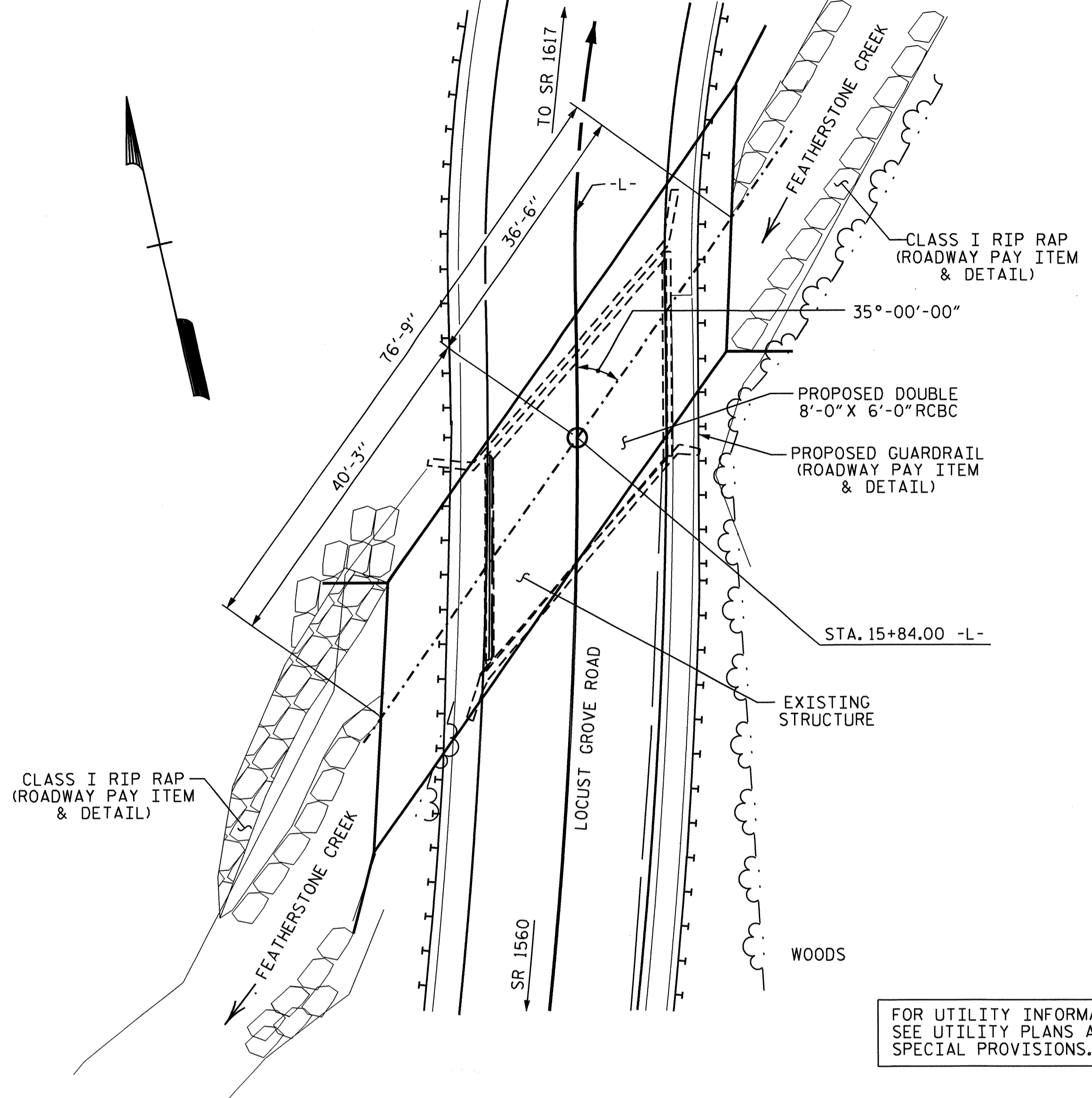
THE EXISTING STRUCTURE (CONSISTING OF ONE SPAN @ 25'-0" WITH A CLEAR ROADWAY WIDTH OF 19'-2" ON A TIMBER DECK ON STEEL I-BEAMS AND YOUNT MASONARY ABUTMENTS, LOCATED AT THE PROPOSED STRUCTURE SHALL BE REMOVED.

REMOVAL OF THE EXISTING BRIDGE SHALL BE PERFORMED IN A MANNER THAT PREVENTS DEBRIS FROM FALLING INTO THE WATER. THE CONTRACTOR SHALL SUBMIT DEMOLITION PLANS FOR REVIEW AND REMOVE THE BRIDGE IN ACCORDANCE WITH ARTICLE 402-2 OF THE STANDARD SPECIFICATIONS.

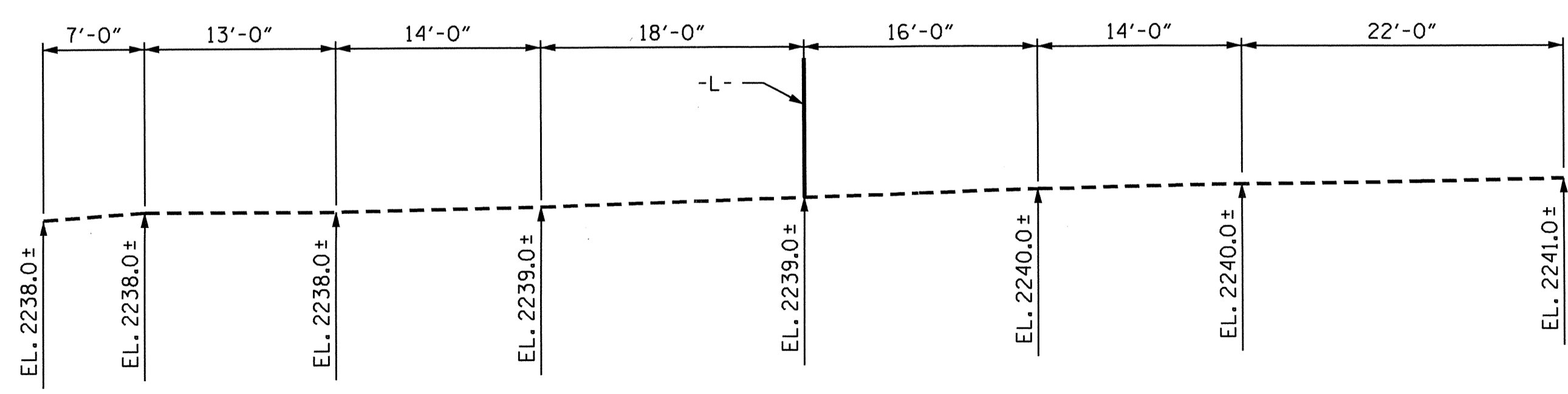
INASMUCH AS THE PAINT SYSTEM ON THE EXISTING STRUCTURAL STEEL CONTAINS LEAD, THE CONTRACTOR'S ATTENTION IS DIRECTED TO ARTICLE 107-1 OF THE STANDARD SPECIFICATIONS. ANY COSTS RESULTING FROM COMPLIANCE WITH APPLICABLE STATE OR FEDERAL REGULATIONS PERTAINING TO HANDLING OF MATERIALS CONTAINING LEAD BASED PAINT SHALL BE INCLUDED IN THE BID PRICE FOR "REMOVAL OF EXISTING STRUCTURE."

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

TOTAL STRUCTURE QUANTITIES	
CLASS A CONCRETE	
BARREL @ 1.675 CY/FT	128.6 C.Y.
WINGS, ETC.	24.9 C.Y.
SILLS	2.5 C.Y.
TOTAL	156.0 C.Y.
REINFORCING STEEL	
BARREL	16,155 LBS.
WINGS, ETC.	1,166 LBS.
TOTAL	17,321 LBS.
FOUNDATION COND. MAT'L	119 TONS
CULVERT EXCAVATION	LUMP SUM
REMOVAL OF EXISTING STRUCTURE	LUMP SUM

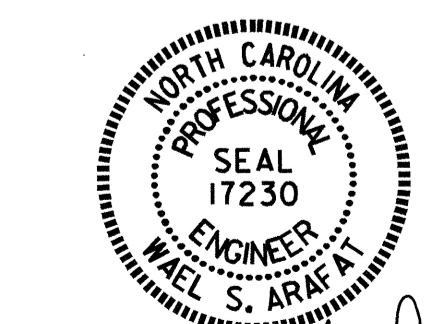


LOCATION SKETCH



PROFILE ALONG CULVERT

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS



PROJECT NO. B-4988
 HENDERSON COUNTY
 STATION: 15+84.00 -L-

SHEET 1 OF 8 REPLACES BRIDGE #309

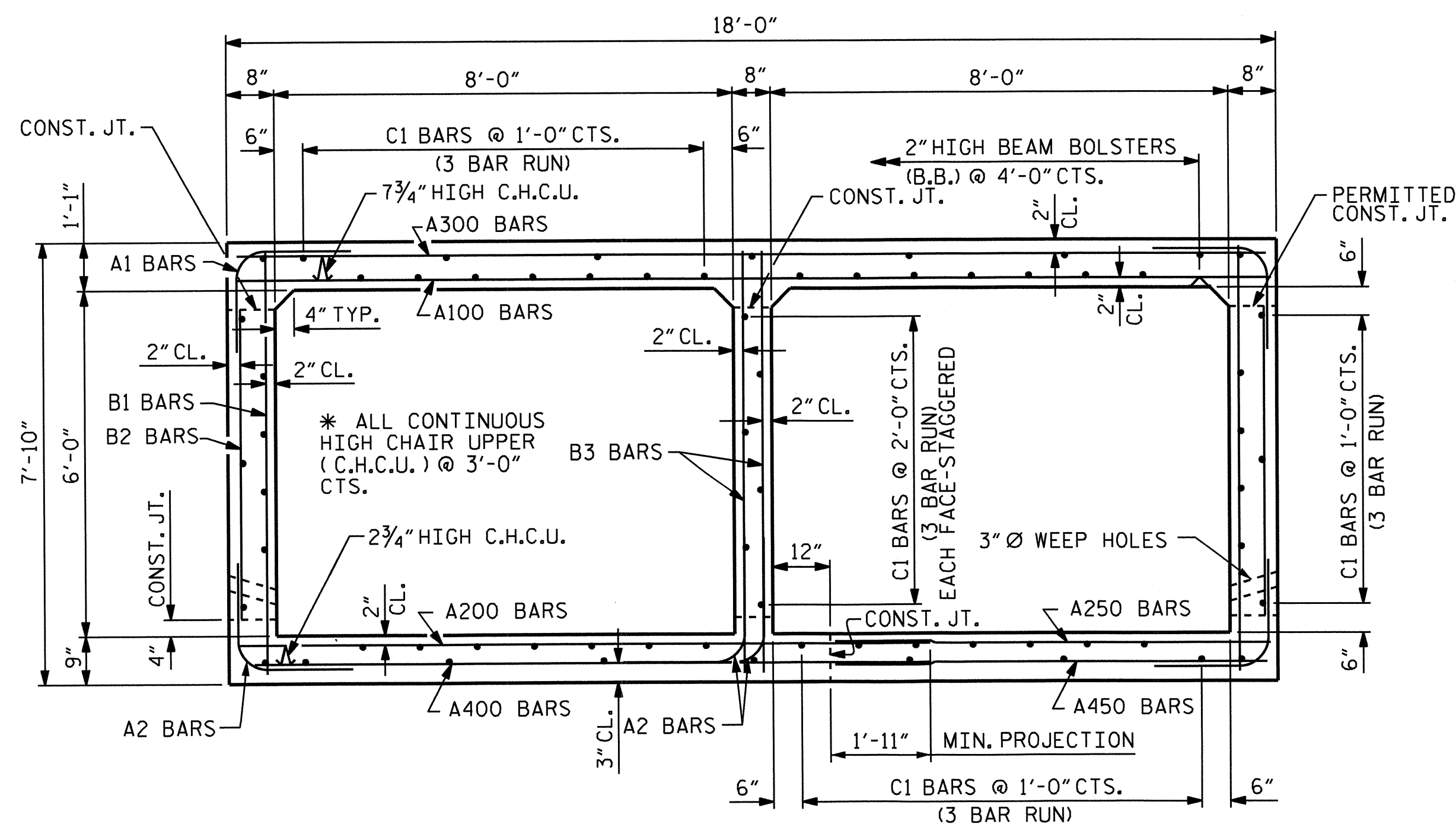
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

DOUBLE 8 FT. X 6 FT.
 CONCRETE BOX CULVERT
 35° SKEW

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

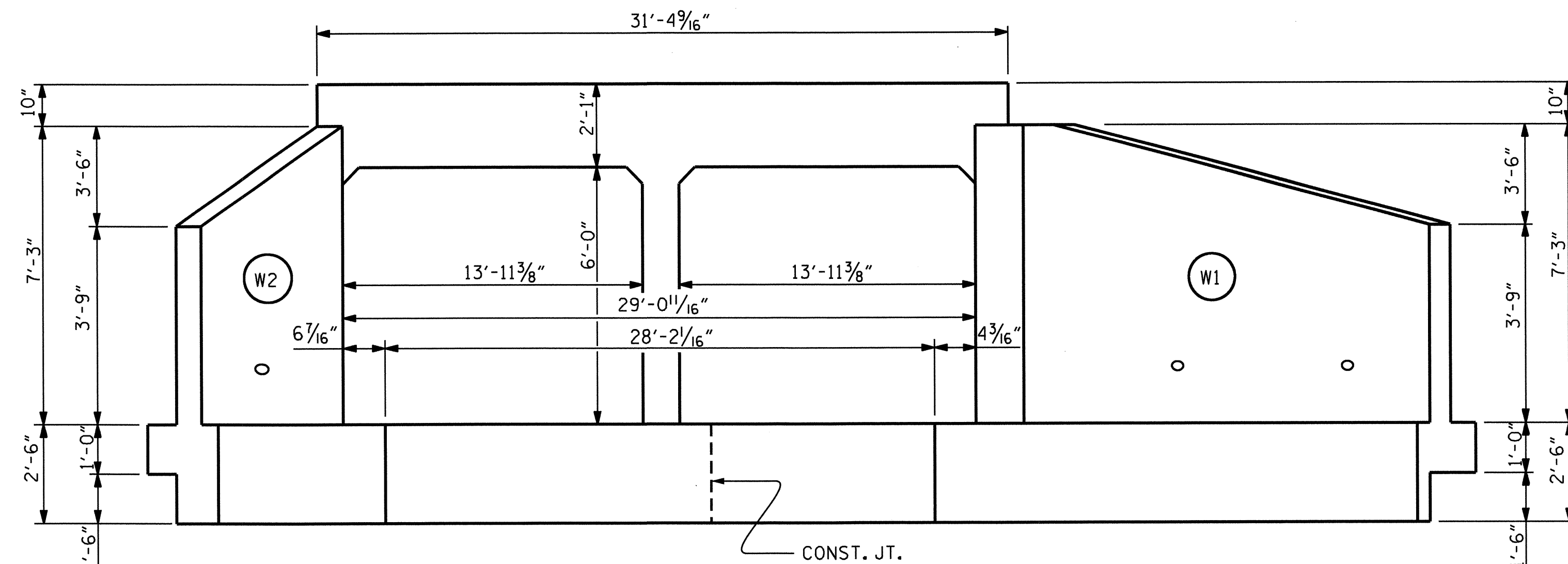
ASSEMBLED BY : V.X.N./H. T. B. DATE : 8-5-13
 CHECKED BY : R. P. PATEL DATE : 10-4-13
 DRAWN BY : C.O. CUEVAS DATE : 8-28-90
 CHECKED BY : M.A.J. DATE : 10-2-90

SPECIAL
 STANDARD



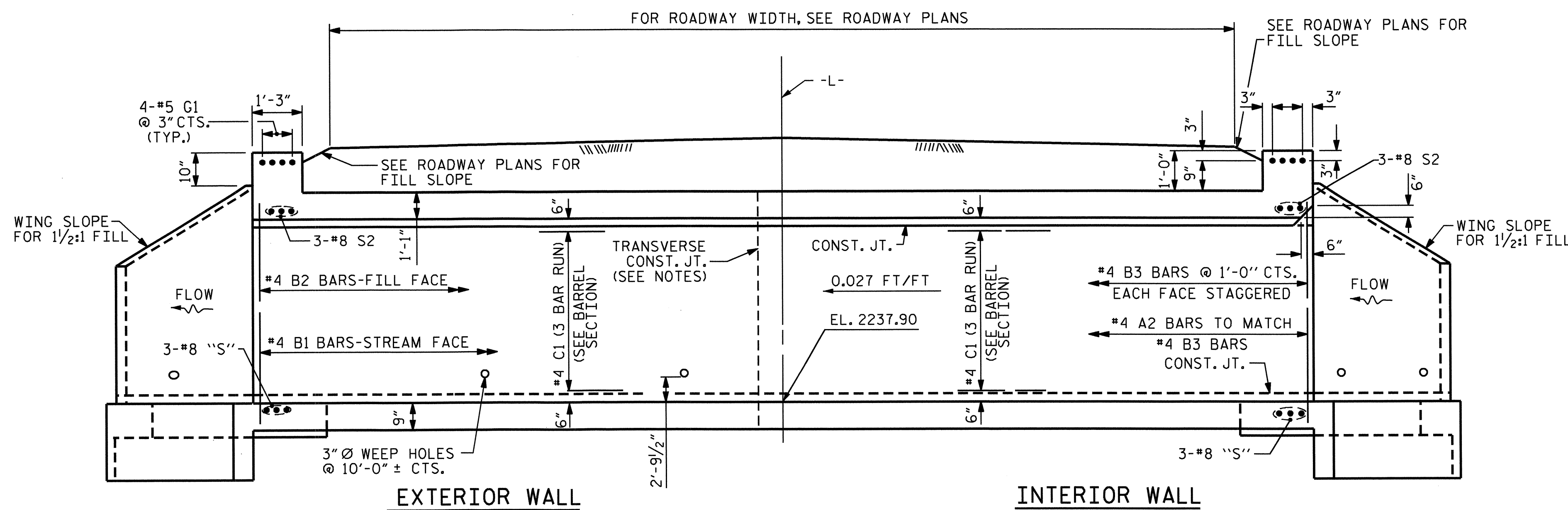
RIGHT ANGLE SECTION OF BARREL

THERE ARE 66 "C" BARS IN SECTION OF BARREL.
 (LOOKING UPSTREAM)



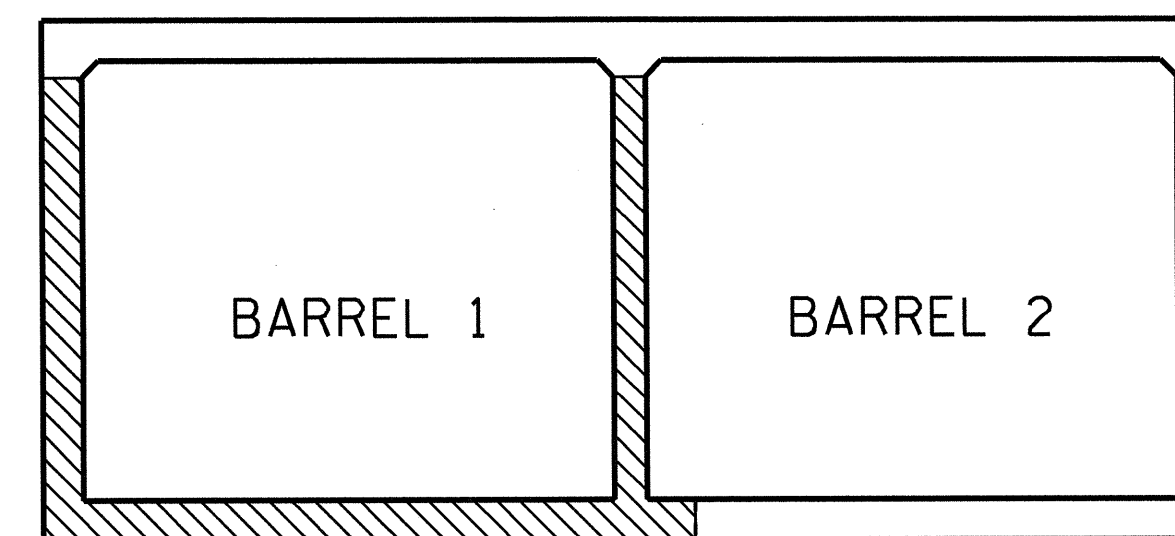
END ELEVATION NORMAL TO SKEW

(LOOKING UPSTREAM)



CULVERT SECTION NORMAL TO ROADWAY

HEADWALL DIMENSIONS ARE TYPICAL INLET AND OUTLET ENDS.



CONSTRUCTION PHASING

(LOOKING UPSTREAM)

- PHASE I CONSTRUCTION
- PHASE II CONSTRUCTION

PROJECT NO. B-4988
HENDERSON COUNTY
 STATION: 15+84.00 -L-

SHEET 2 OF 8

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

**DOUBLE 8 FT. X 6 FT.
 CONCRETE BOX CULVERT
 35° SKEW**

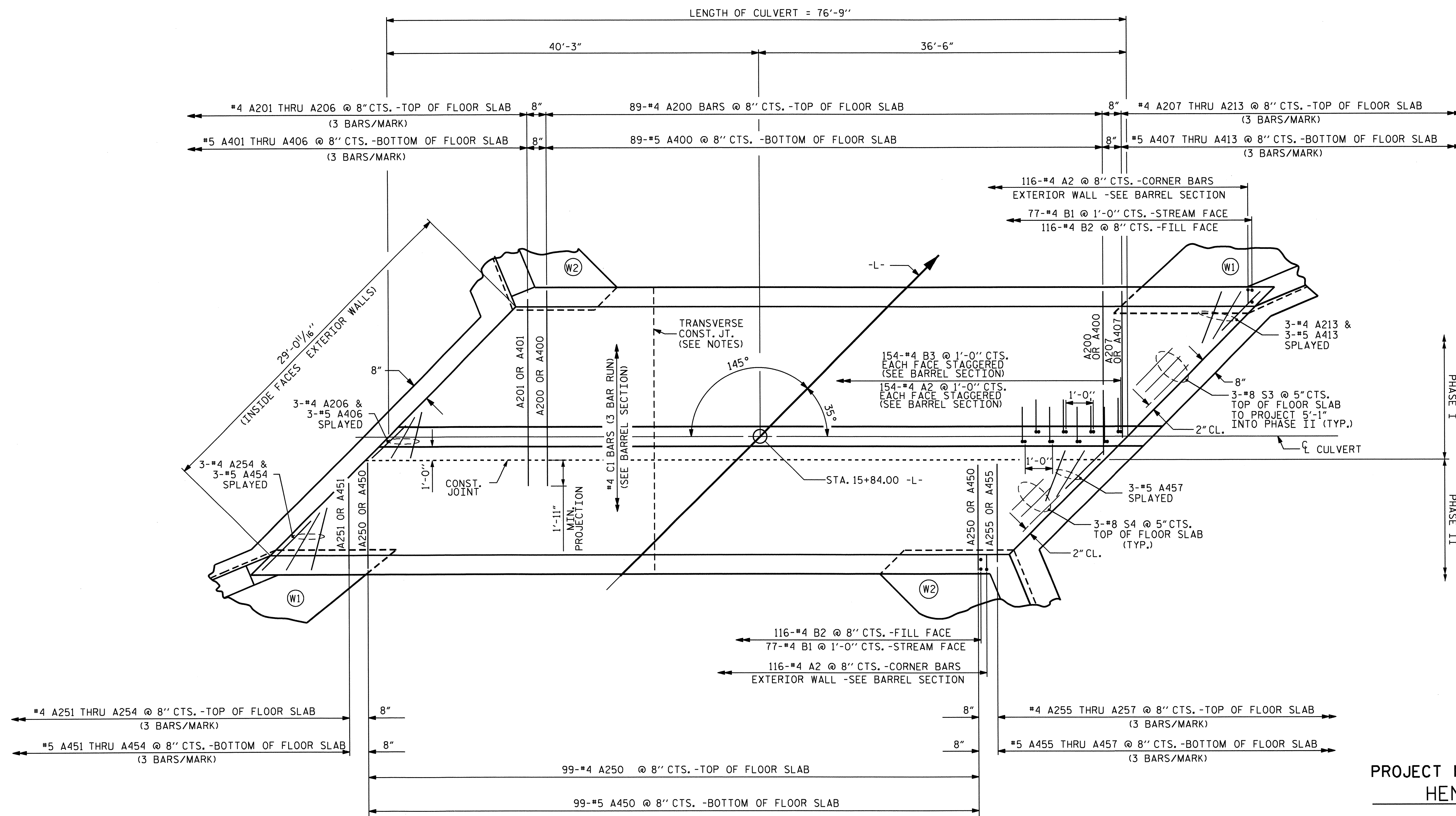


Wael S. Arafa
 12-19-13

DESIGN ENGINEER OF RECORD: H. KIM	DATE: 11-13
ASSEMBLED BY: V.X. NGUYEN/H.T.B.	DATE: 8-5-13
CHECKED BY: R.P. PATEL	DATE: 10-4-13
DRAWN BY: DANNY SHERRED	DATE: 4-11-72
CHECKED BY: HASON A. JUDEH	DATE: 4-17-72

SPECIAL
STANDARD

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



PLAN OF FLOOR SLAB

PROJECT NO. B-4988
HENDERSON COUNTY
 STATION: 15+84.00 -L-

SHEET 3 OF 8

STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

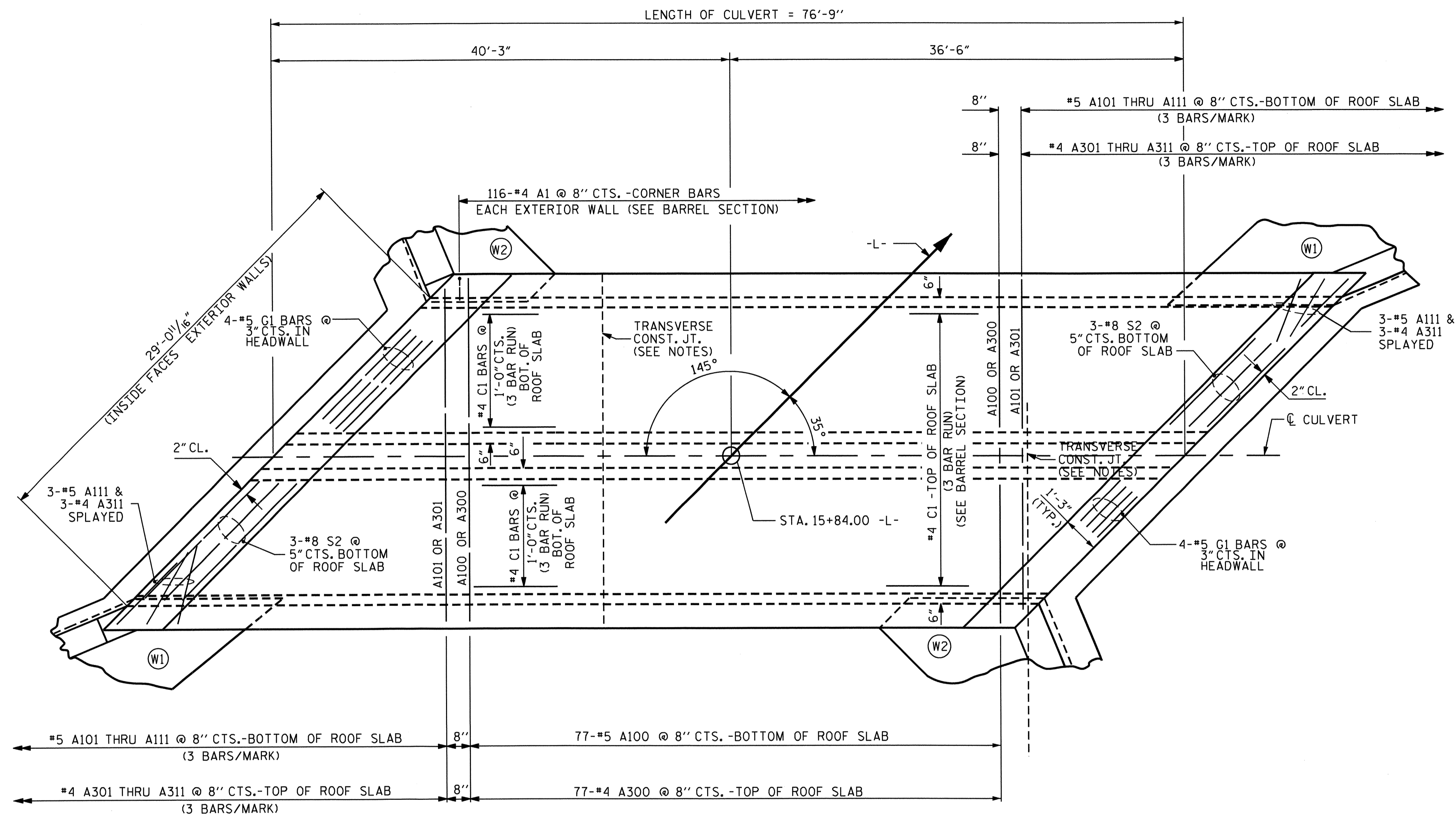
DOUBLE 8 FT. X 6 FT.
 CONCRETE BOX CULVERT
 35° SKEW

Wael S. Arafat
 12-19-13

DRAWN BY : V.X. NGUYEN/H.T.B. DATE : 8-5-13
 CHECKED BY : R.P. PATEL DATE : 10-4-13
 DESIGN ENGINEER OF RECORD: H. KIM DATE : 11-13

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



PLAN OF ROOF SLAB

PROJECT NO. B-4988
HENDERSON COUNTY
 STATION: 15+84.00 -L-

SHEET 4 OF 8



Wael S. Arafat
 12-19-13

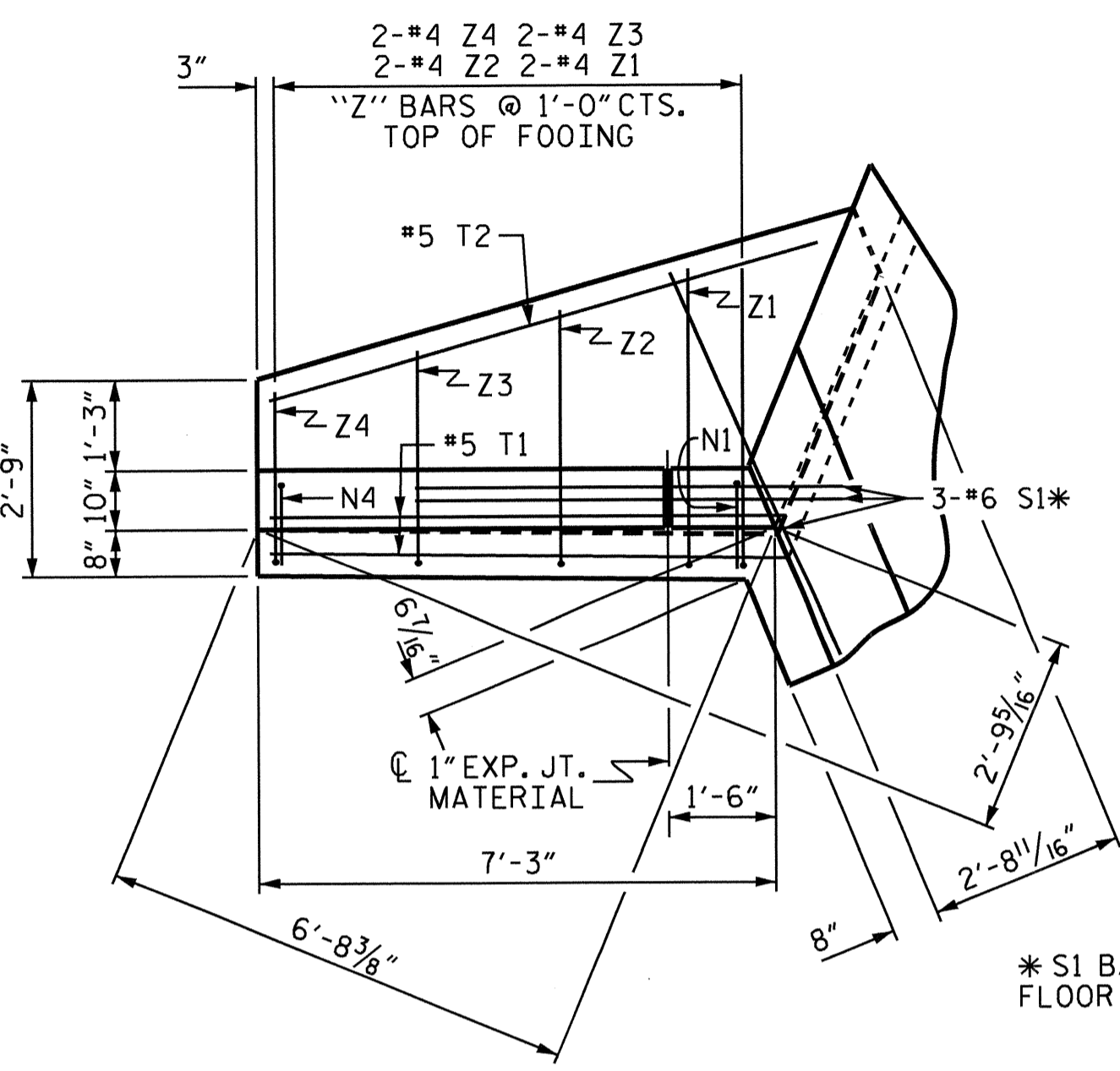
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

DOUBLE 8 FT. X 6 FT.
 CONCRETE BOX CULVERT
 35° SKEW

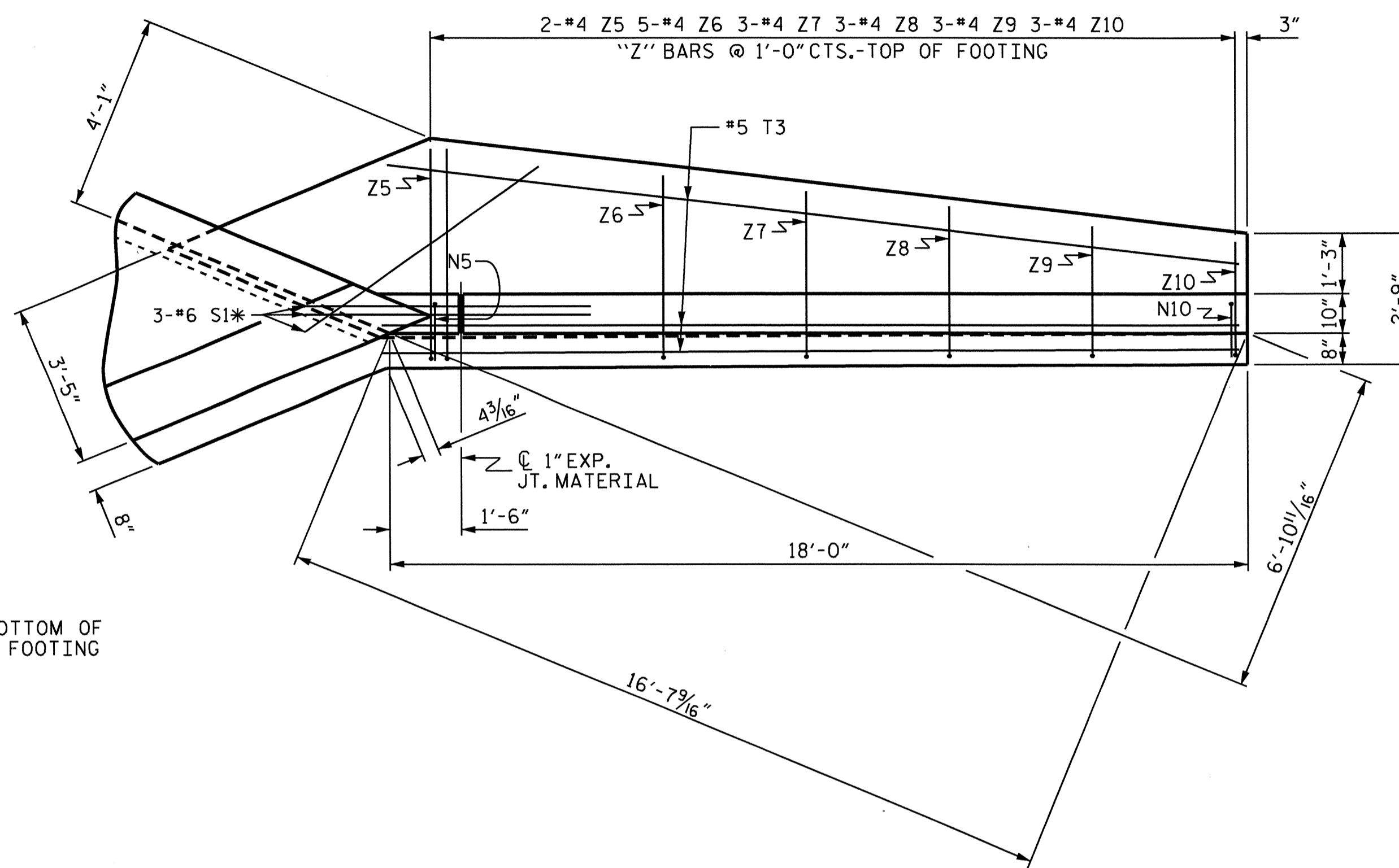
DRAWN BY : V.X. NGUYEN/H.T.B. DATE : 8-5-13
 CHECKED BY : R.P. PATEL DATE : 10-4-13
 DESIGN ENGINEER OF RECORD: H. KIM DATE : 11-13

19-DEC-2013 08:35
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 amlee

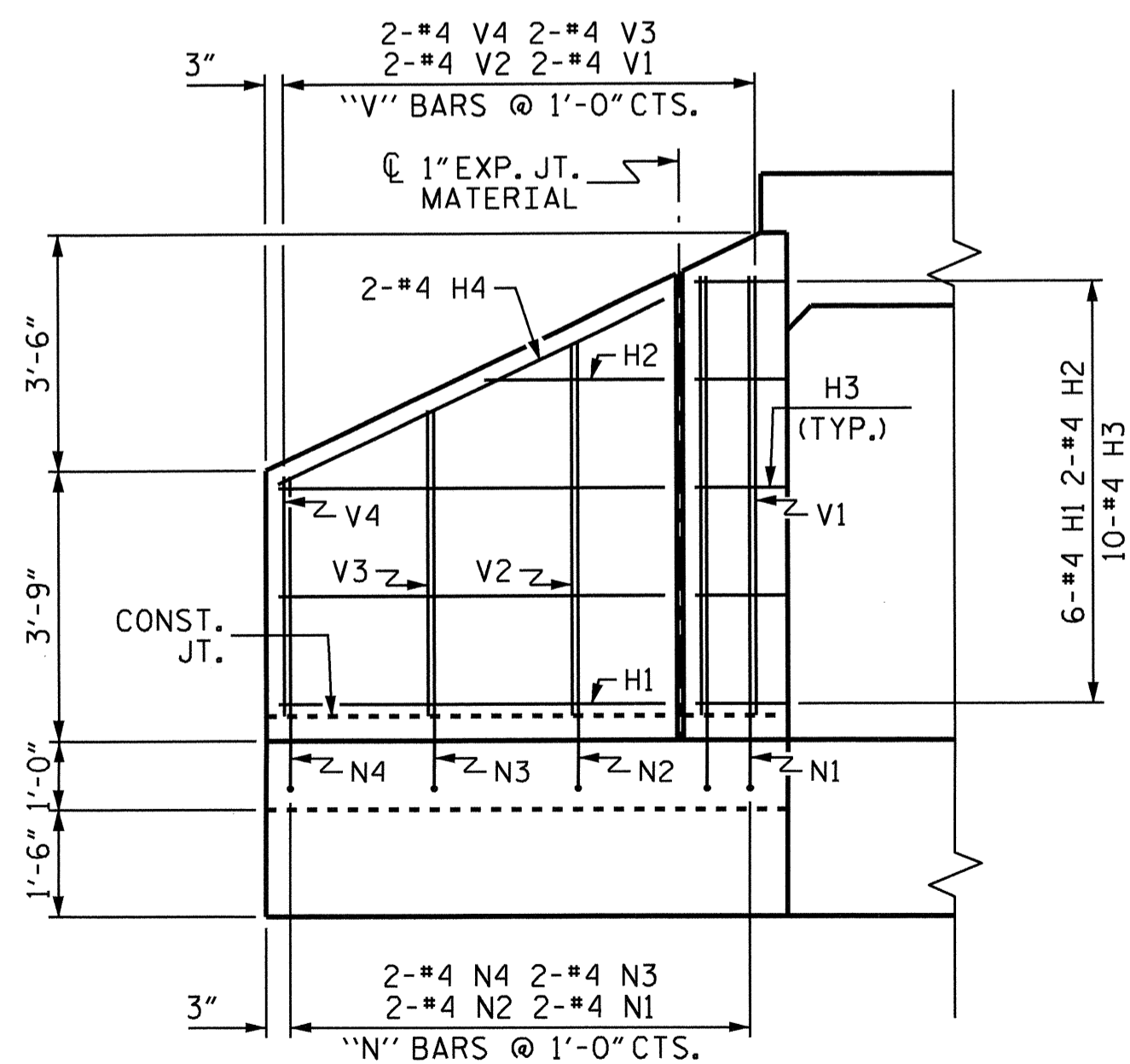
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NO.	BY:	DATE:	NO.	BY:	DATE:	C-4
1			3			TOTAL SHEETS
2			4			8



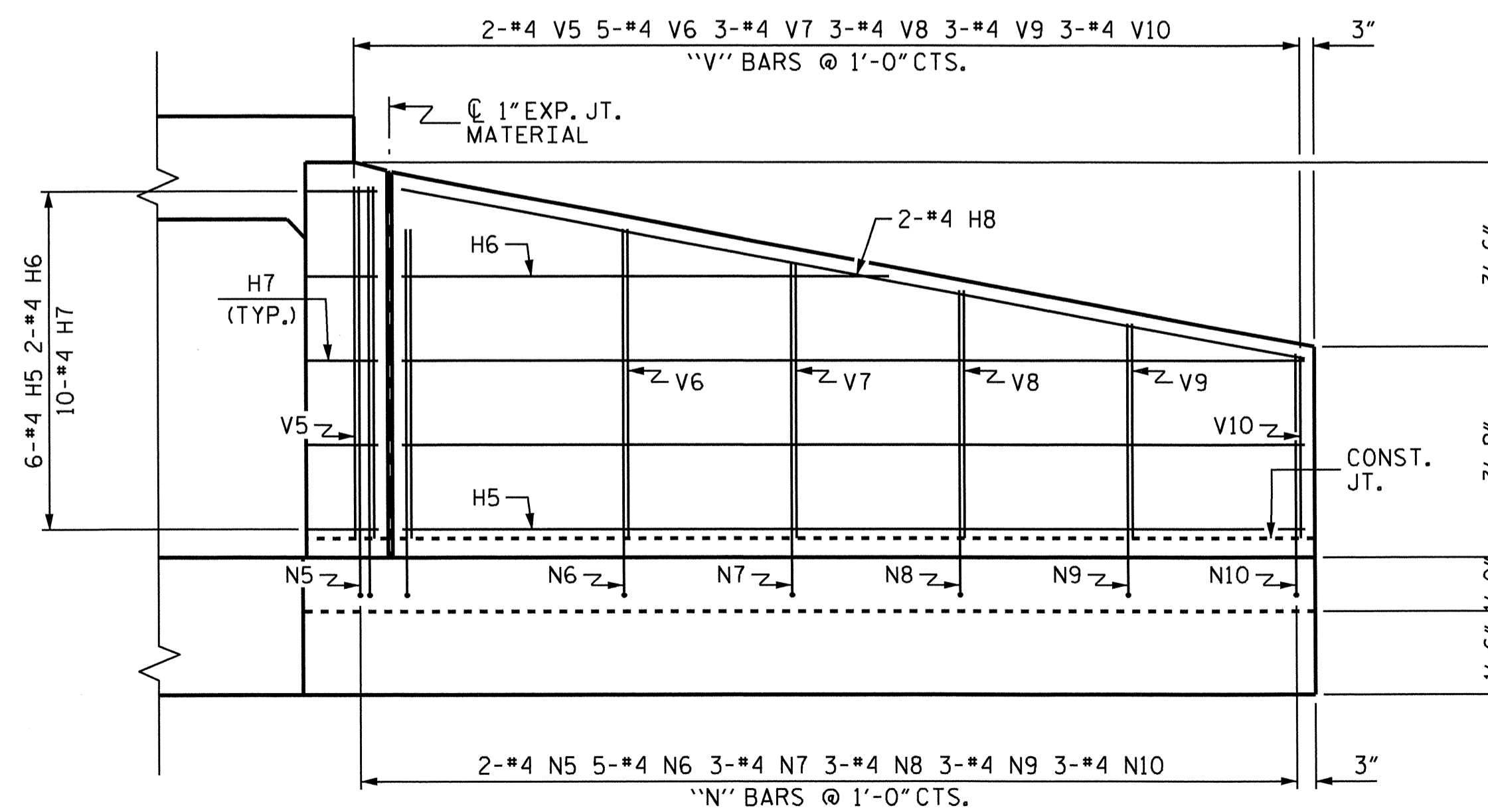
PLAN W2



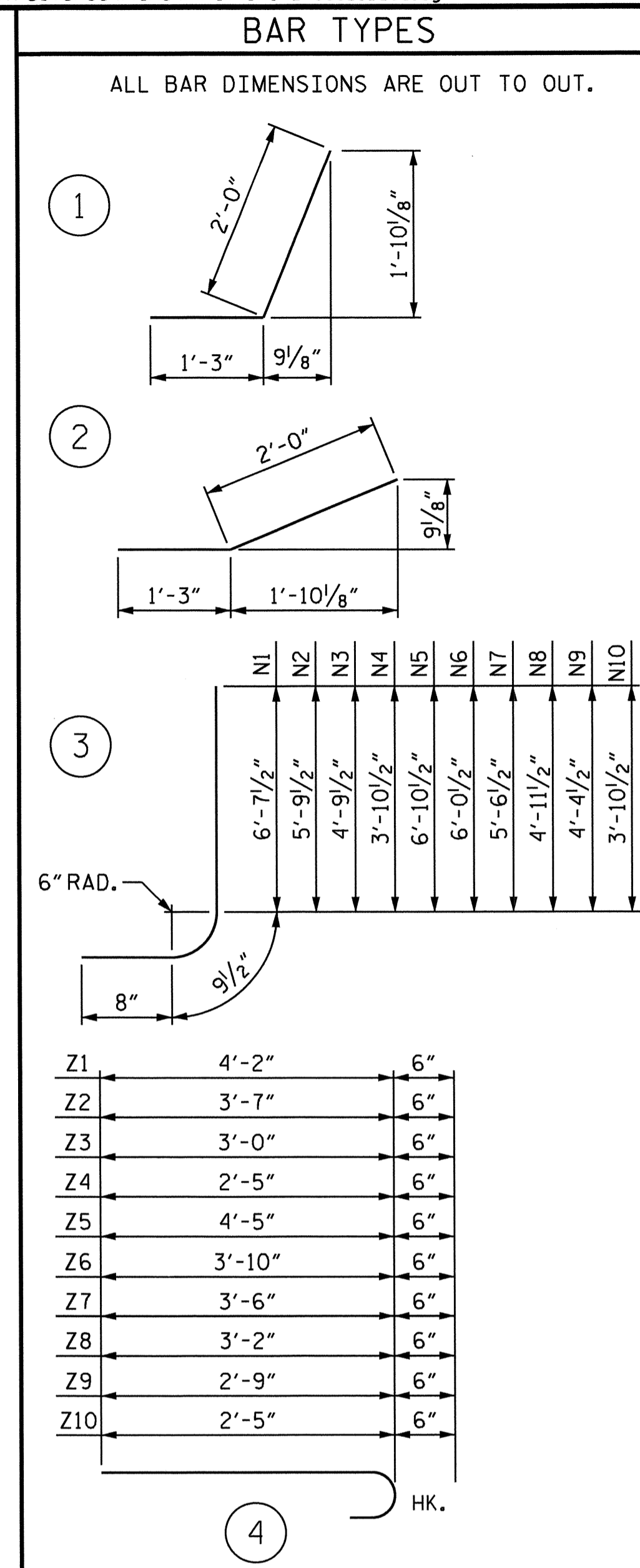
PLAN W1



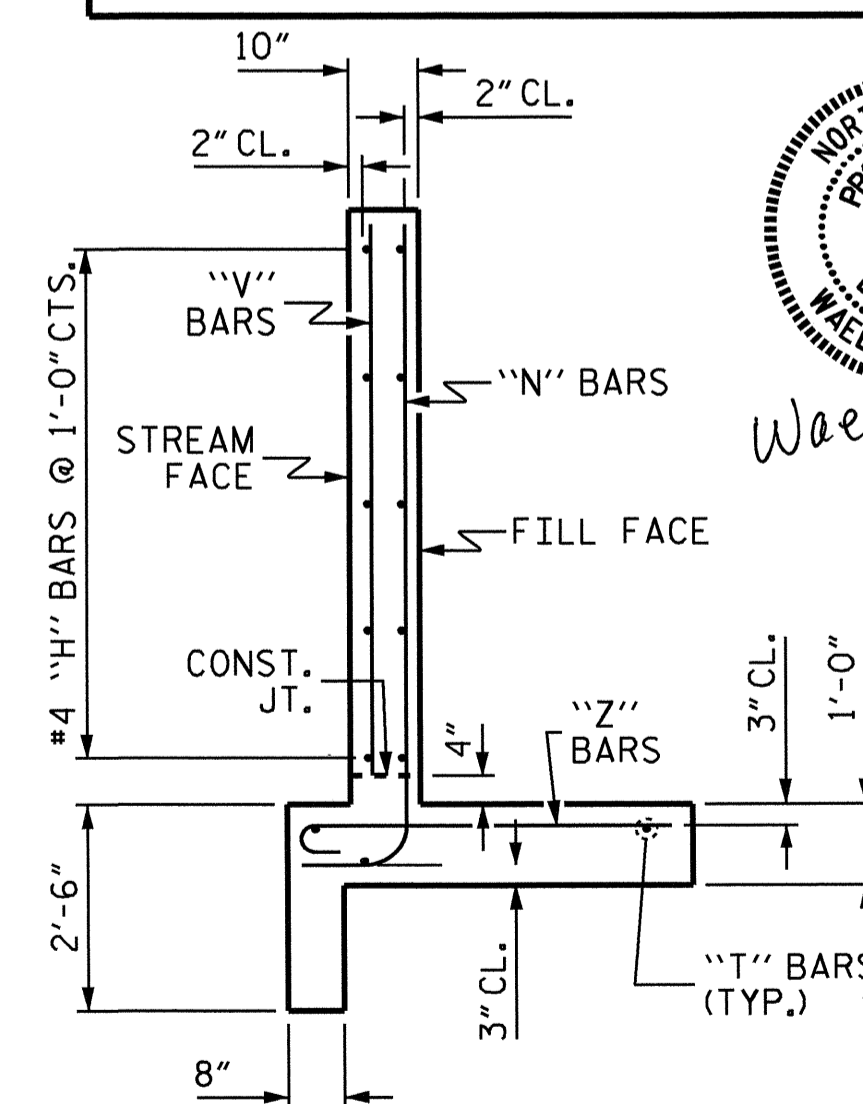
ELEVATION W2



ELEVATION W1



BILL OF MATERIAL					
BAR NO.	SIZE	TYPE	LENGTH	WEIGHT	
H1	12	#4	STR	5'-4"	43
H2	4	#4	STR	2'-6"	7
H3	20	#4	1	3'-3"	43
H4	4	#4	STR	5'-11"	16
H5	12	#4	STR	16'-1"	129
H6	4	#4	STR	8'-8"	23
H7	20	#4	2	3'-3"	43
H8	4	#4	STR	16'-4"	44
N1	4	#4	3	8'-1"	22
N2	4	#4	3	7'-3"	19
N3	4	#4	3	6'-3"	17
N4	4	#4	3	5'-4"	14
N5	4	#4	3	8'-4"	22
N6	10	#4	3	7'-6"	50
N7	6	#4	3	7'-0"	28
N8	6	#4	3	6'-5"	26
N9	6	#4	3	5'-10"	23
N10	6	#4	3	5'-4"	21
S1	12	#6	STR	6'-0"	108
T1	4	#5	STR	7'-3"	30
T2	2	#5	STR	8'-0"	17
T3	6	#5	STR	18'-0"	113
V1	4	#4	STR	6'-1"	16
V2	4	#4	STR	5'-2"	14
V3	4	#4	STR	4'-3"	11
V4	4	#4	STR	3'-4"	9
V5	4	#4	STR	6'-3"	17
V6	10	#4	STR	5'-6"	37
V7	6	#4	STR	4'-11"	20
V8	6	#4	STR	4'-5"	18
V9	6	#4	STR	3'-10"	15
V10	6	#4	STR	3'-3"	13
Z1	4	#4	4	4'-8"	12
Z2	4	#4	4	4'-1"	11
Z3	4	#4	4	3'-6"	9
Z4	4	#4	4	2'-11"	8
Z5	4	#4	4	4'-11"	13
Z6	10	#4	4	4'-4"	29
Z7	6	#4	4	4'-0"	16
Z8	6	#4	4	3'-8"	15
Z9	6	#4	4	3'-3"	13
Z10	6	#4	4	2'-11"	12
REINFORCING STEEL FOR 4 WINGS				1166	LBS
CLASS A CONCRETE					
4 WINGS				18.5	CY
2 HEADWALLS				2.9	CY
2 END CURTAIN WALLS				3.5	CY
TOTAL				24.9	CY



TYPICAL WING SECTION



PROJECT NO. B-4988
 HENDERSON COUNTY
 STATION: 15+84.00 -L-

SHEET 6 OF 8

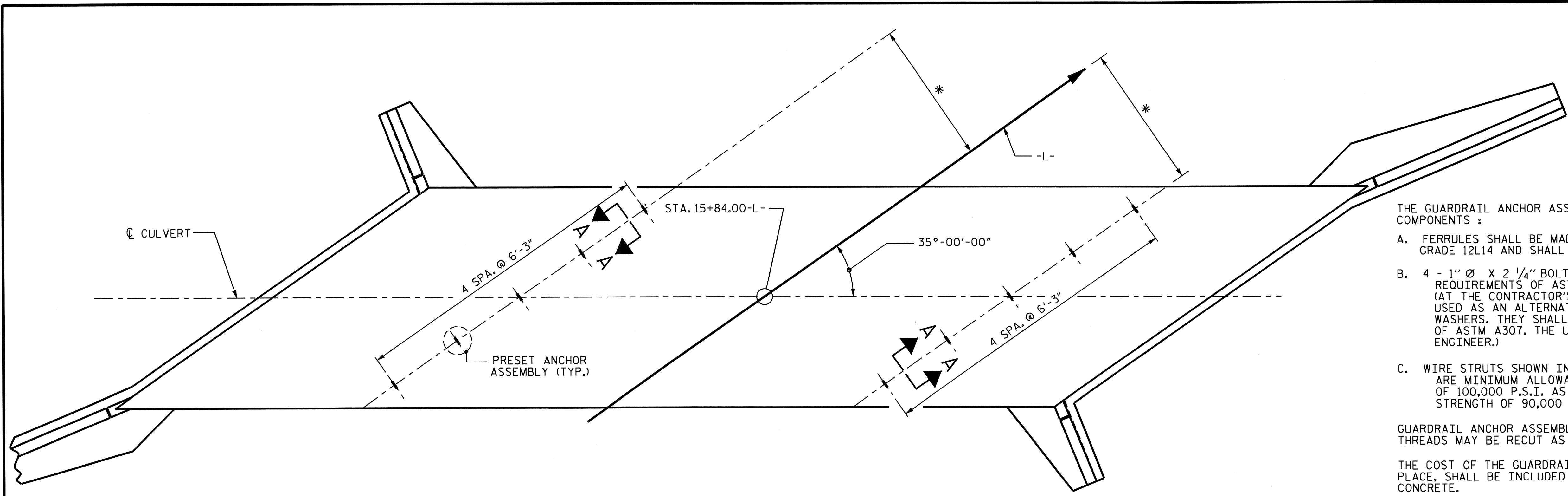
STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH

STANDARD WINGS
 FOR
 CONCRETE BOX CULVERT

ASSEMBLED BY : V.X. NGUYEN/H.T.B. DATE : 8-21-13
 CHECKED BY : R. P. PATEL DATE : 10-4-13
 DRAWN BY : CCJ 01/00
 CHECKED BY : RWW 03/00

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

STD. NO. CW4506

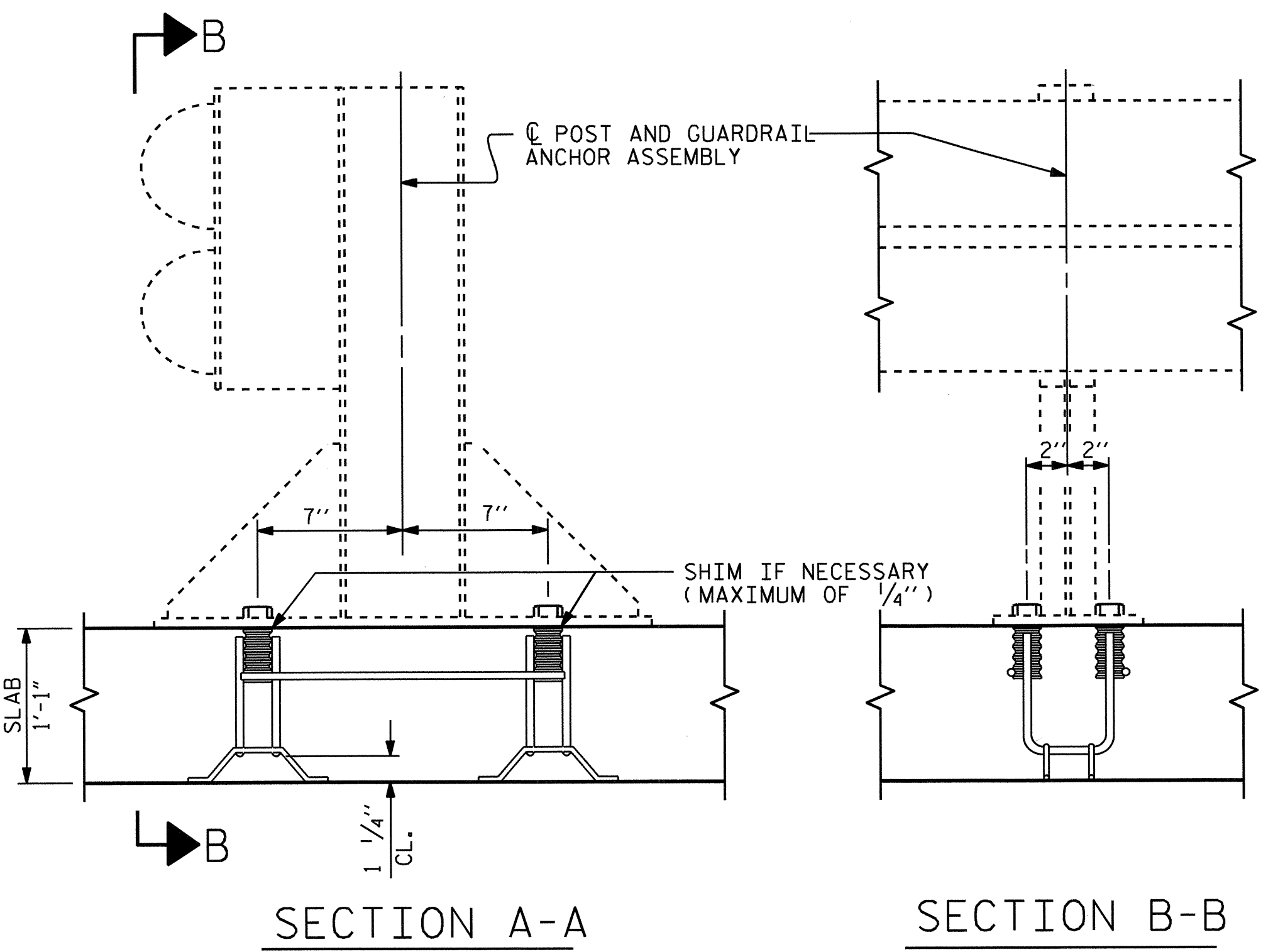


PLAN

SHOWING : GUARDRAIL ANCHOR ASSEMBLY SPACING.
 *THIS DIMENSION TO BE FURNISHED BY THE ENGINEER

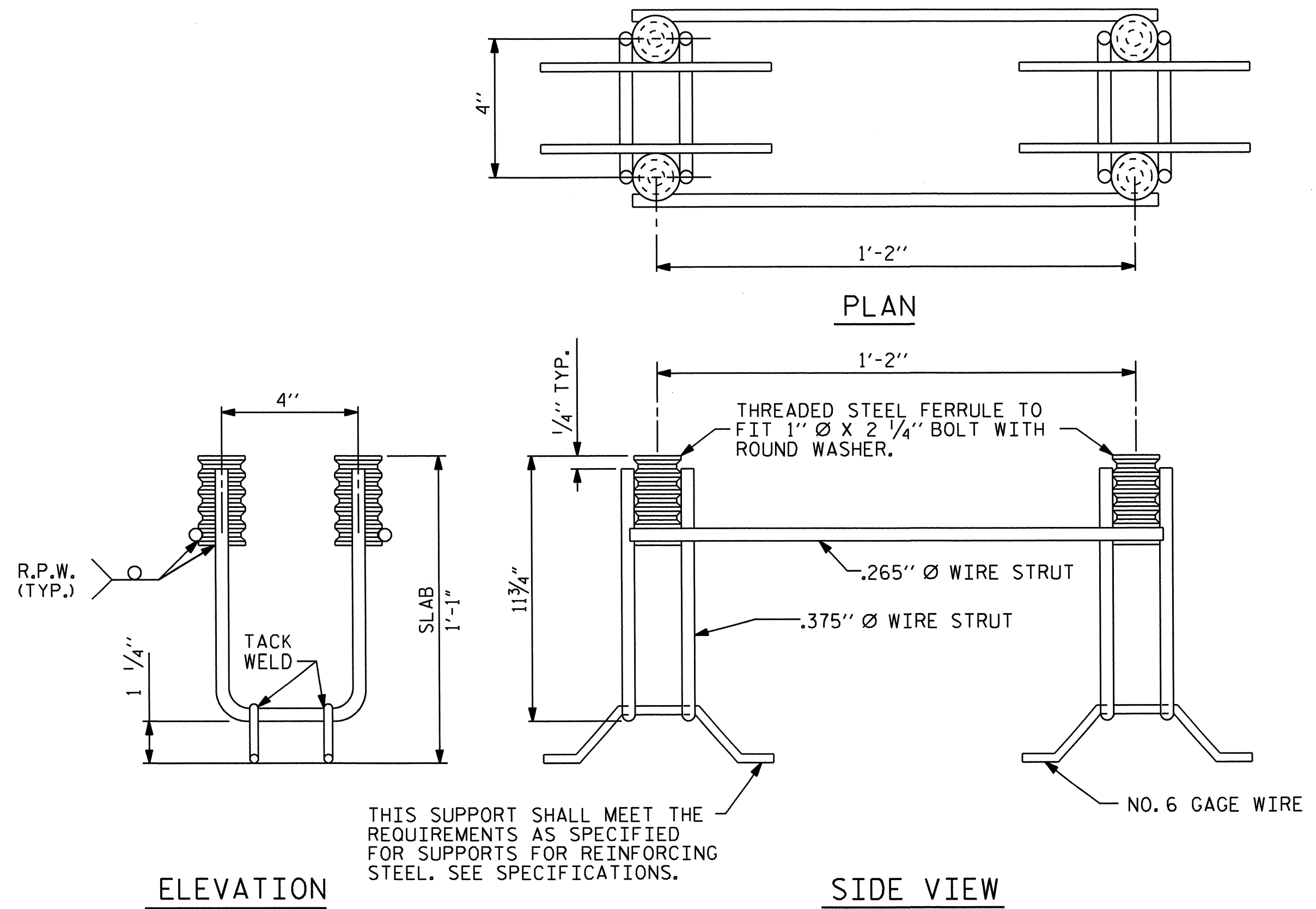
NOTES

- THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS SHALL CONSIST OF THE FOLLOWING COMPONENTS :
- A. FERRULES SHALL BE MADE FROM STEEL MEETING THE REQUIREMENTS OF AASHTO M169, GRADE 12L14 AND SHALL HAVE A MINIMUM LENGTH OF THREADS OF 2 1/2".
 - B. 4 - 1" Ø X 2 1/4" BOLTS WITH WASHERS, BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307. BOLTS AND WASHERS SHALL BE GALVANIZED. (AT THE CONTRACTOR'S OPTION, STAINLESS STEEL BOLTS AND WASHERS MAY BE USED AS AN ALTERNATE FOR THE 1" Ø X 2 1/4" GALVANIZED BOLTS AND WASHERS. THEY SHALL CONFORM TO OR EXCEED THE MECHANICAL REQUIREMENTS OF ASTM A307. THE USE OF THIS ALTERNATE SHALL BE APPROVED BY THE ENGINEER.)
 - C. WIRE STRUTS SHOWN IN THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS DETAIL ARE MINIMUM ALLOWABLE SIZE AND SHALL HAVE A MINIMUM TENSILE STRENGTH OF 100,000 P.S.I. AS AN OPTION, A 1/16" Ø WIRE STRUT WITH A MINIMUM TENSILE STRENGTH OF 90,000 PSI IS ACCEPTABLE.
- GUARDRAIL ANCHOR ASSEMBLY WITH BOLTS SHALL BE ASSEMBLED IN THE SHOP. BOLT THREADS MAY BE RECUT AS NECESSARY TO INSURE FIT.
- THE COST OF THE GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS COMPLETE IN PLACE, SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR CLASS "A" CONCRETE.
- FERRULES TO BE PLUGGED DURING POURING OF SLAB AS RECOMMENDED BY THE MANUFACTURER.
- AT THE CONTRACTOR'S OPTION, FERRULES WITH OPEN OR CLOSED ENDS MAY BE USED.
- PAYMENT FOR GUARDRAIL, POSTS, AND POST BASE PLATES IS INCLUDED IN ROADWAY PAY ITEMS.
- SLAB REINFORCING STEEL MAY BE SHIFTED AS NECESSARY TO CLEAR GUARDRAIL ANCHOR ASSEMBLY. CARE SHOULD BE TAKEN TO KEEP THE SHIFTING OF REINFORCING STEEL TO A MINIMUM.
- THE CONTRACTOR MAY USE ADHESIVELY ANCHORED ANCHOR BOLTS IN PLACE OF GUARDRAIL ANCHOR ASSEMBLY. LEVEL TWO FIELD TESTING IS REQUIRED, AND THE YIELD LOAD OF THE 1" Ø BOLT IS 21.8 KIPS. FOR ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS, SEE STANDARD SPECIFICATIONS.



SECTION A-A

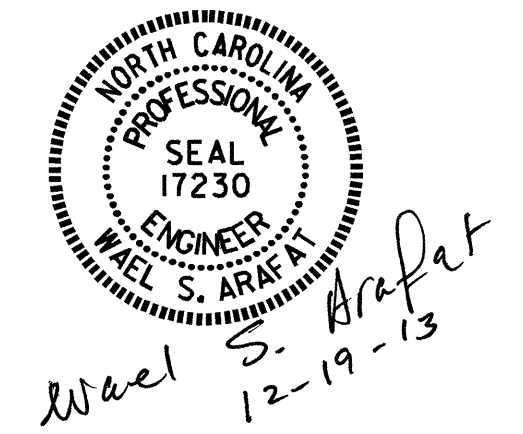
SECTION B-B



ELEVATION

SIDE VIEW

GUARDRAIL ANCHOR ASSEMBLY FOR CULVERTS



PROJECT NO. B-4988
 HENDERSON COUNTY
 STATION: 15+84.00-L-

SHEET 7 OF 8
 STATE OF NORTH CAROLINA
 DEPARTMENT OF TRANSPORTATION
 RALEIGH
 STANDARD
 ANCHORAGE DETAILS FOR
 GUARDRAIL ANCHOR ASSEMBLY
 FOR CULVERTS

ASSEMBLED BY : H. T. BARBOUR	DATE : 10-15-13
CHECKED BY : R. PATEL	DATE : 11-4-13
DRAWN BY : FCJ 6/88	REV. 5/7/03 RWW/JTE
CHECKED BY : ARB 6/88	REV. 5/1/06R KMM/GM
	REV. 10/1/11 MAA/GM

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

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	1.03	--	1.75	1.44	1	TOP SLAB	3.68	1.03	1	TOP SLAB	7.53		
	HL-93 (OPERATING)	N/A		1.33	--	1.35	1.87	1	TOP SLAB	3.68	1.33	1	TOP SLAB	7.53		
	HS-20 (INVENTORY)	36.000	②	1.14	41.03	1.75	1.45	1	TOP SLAB	3.68	1.14	1	TOP SLAB	7.53		
	HS-20 (OPERATING)	36.000		1.48	53.19	1.35	1.87	1	TOP SLAB	3.68	1.48	1	TOP SLAB	7.53		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13,500		2.07	27.96	1.40	2.64	1	TOP SLAB	3.68	2.07	1	TOP SLAB	7.53	
		SNGARBS2	20,000		1.94	38.79	1.40	2.47	1	TOP SLAB	3.68	1.94	1	TOP SLAB	7.53	
		SNAGRIS2	22,000		2.07	45.57	1.40	2.64	1	TOP SLAB	3.68	2.07	1	TOP SLAB	7.53	
		SNCOTTS3	27,250	③	1.29	35.20	1.40	1.96	1	TOP SLAB	3.47	1.29	1	TOP SLAB	7.53	
		SNAGRS4	34,925		1.65	57.62	1.40	2.29	1	BOTTOM SLAB	8.02	1.65	1	BOTTOM SLAB	7.79	
		SNS5A	35,550		1.46	51.98	1.40	2.22	1	BOTTOM SLAB	8.02	1.46	1	TOP SLAB	7.53	
		SNS6A	39,950		1.36	54.35	1.40	1.99	1	BOTTOM SLAB	8.02	1.36	1	BOTTOM SLAB	7.79	
	SNS7B	42,000		1.40	59.00	1.40	1.99	1	BOTTOM SLAB	8.02	1.40	1	BOTTOM SLAB	7.79		
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33,000		1.99	65.57	1.40	2.64	1	TOP SLAB	3.68	1.99	1	TOP SLAB	7.53	
		TNT4A	33,075		1.55	51.13	1.40	2.34	1	BOTTOM SLAB	8.02	1.55	1	TOP SLAB	7.53	
		TNT6A	41,600		1.51	62.87	1.40	2.36	1	TOP SLAB	3.47	1.51	1	TOP SLAB	7.53	
		TNT7A	42,000		1.51	63.33	1.40	2.37	1	TOP SLAB	3.47	1.51	1	TOP SLAB	7.53	
		TNT7B	42,000		1.55	64.93	1.40	2.18	1	BOTTOM SLAB	8.02	1.55	1	TOP SLAB	7.53	
		TNAGRIT4	43,000		1.43	61.29	1.40	1.98	1	BOTTOM SLAB	8.02	1.43	1	BOTTOM SLAB	7.79	
TNAGT5A		45,000		1.45	65.10	1.40	2.02	1	BOTTOM SLAB	8.02	1.45	1	BOTTOM SLAB	7.79		
TNAGT5B	45,000		1.37	61.87	1.40	1.99	1	BOTTOM SLAB	8.02	1.37	1	BOTTOM SLAB	7.79			

LOAD FACTORS:

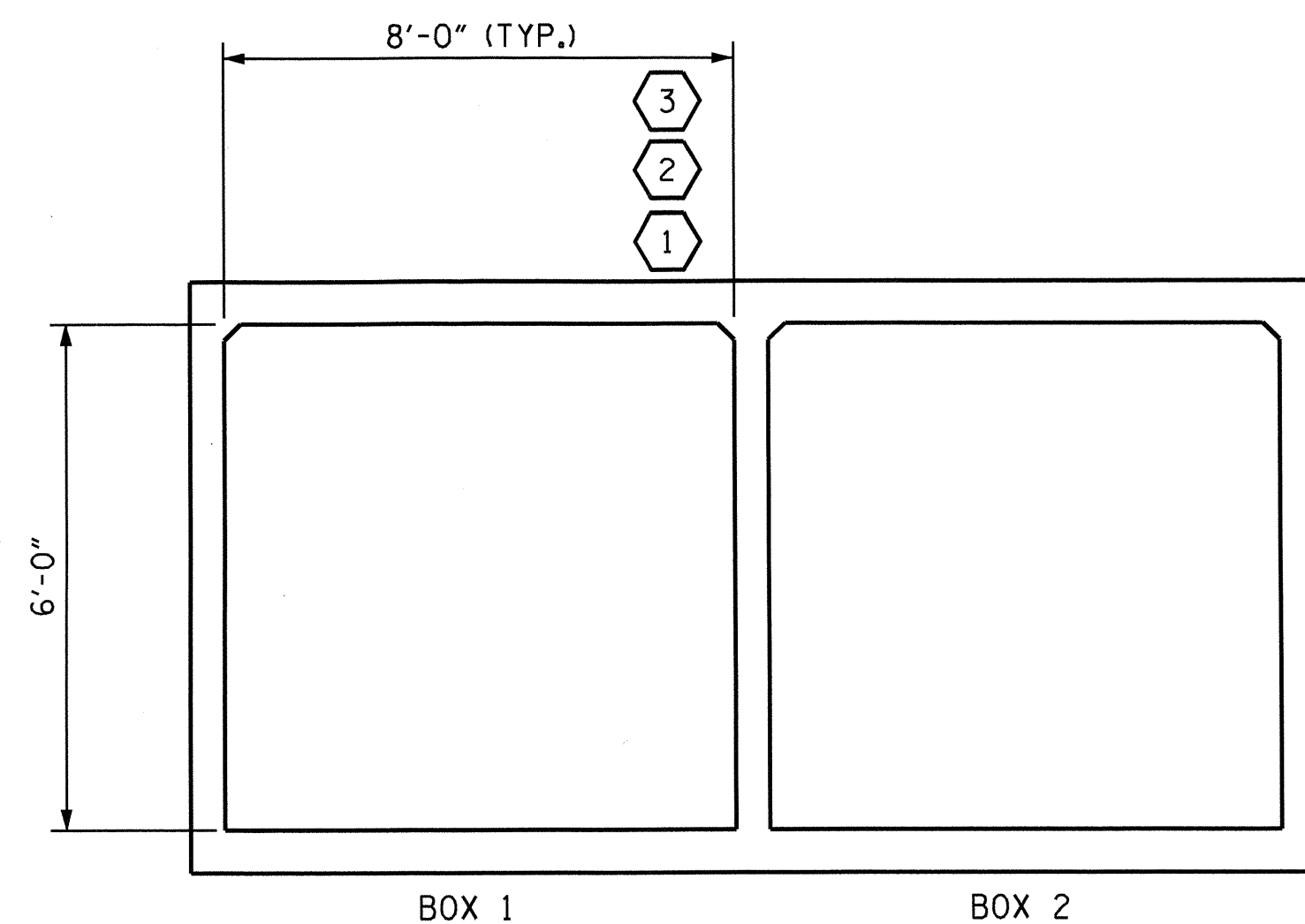
DESIGN LOAD RATING FACTORS

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

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

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



LRFR SUMMARY

(LOOKING UPSTREAM)

DESIGN ENGINEER OF RECORD: H. KIM	DATE: 11/13
ASSEMBLED BY: R. P. PATEL	DATE: 10/10/13
CHECKED BY: H. T. BARBOUR	DATE: 10-15-13
DRAWN BY: WMC	7/11
CHECKED BY: GM	7/11
REV. 10/1/11	MAA/GM

19-DEC-2013 09:10
R:\Structures\Plans\FinalPlans\B4988_SD_CU.dgn
amlee

PROJECT NO. B-4988
HENDERSON COUNTY
STATION: 15+84.00 -L-

SHEET 8 OF 8



Wael S. Arafat
12-19-13

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-8
1			3			TOTAL SHEETS
2			4			8

STD. NO. LRFR5

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