16-MAR-2017 09:09
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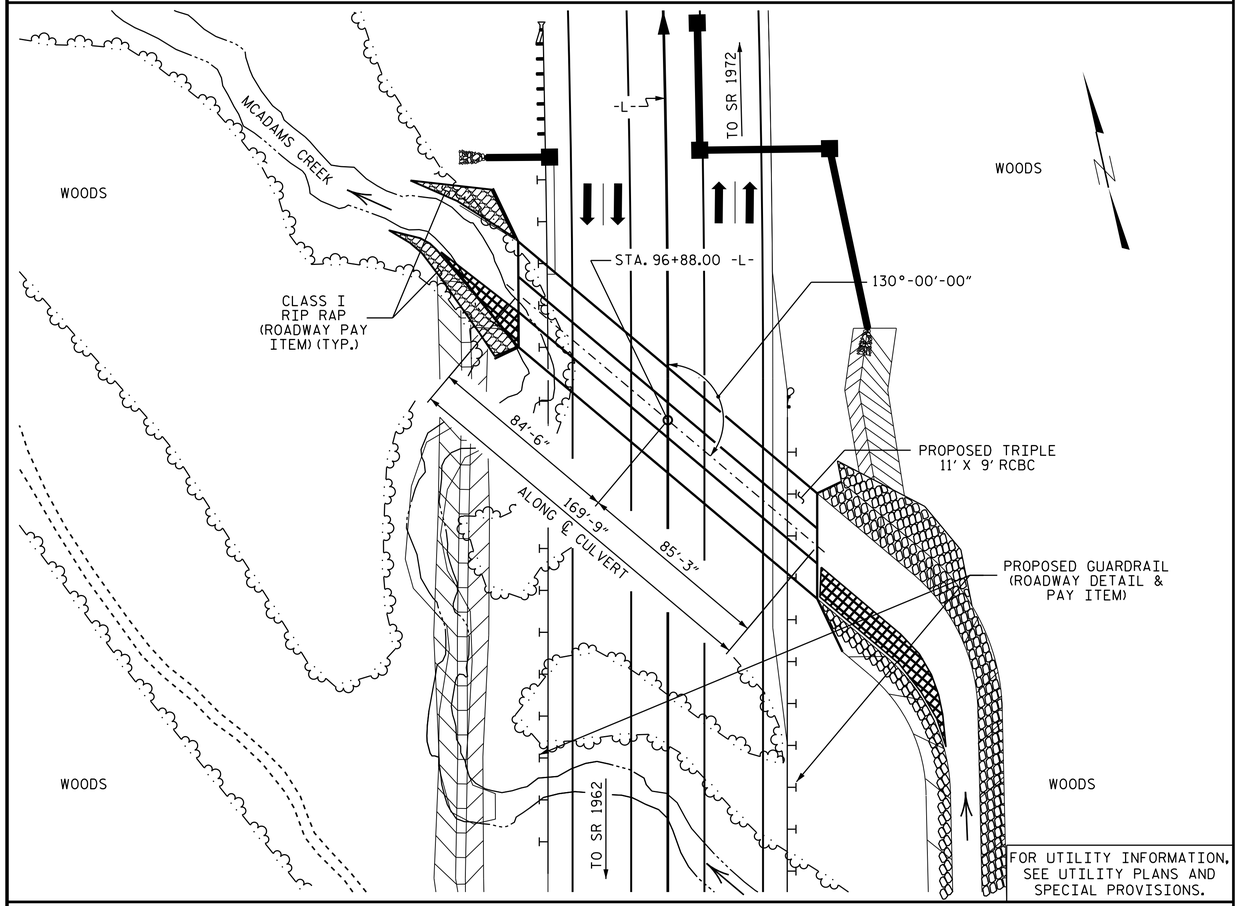
kalford

BENCH MARK #6: RAILROAD SPIKE IN BASE OF 18" POPLAR, 208' LEFT STA 103+58, EL. 593.11



LOCATION SKETCH

NOTES

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

DESIGN FILL---------- 6.42'

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 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.

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 OF BARREL AS USED ON THE CAST-IN-PLACE DESIGN. FOR OPTIONAL PRECAST REINFORCED CONCRETE BOX CULVERT, SEE SPECIAL PROVISIONS.

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.

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.

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 SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

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

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

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

DO NOT SET ELEVATION OF HIGH SILL ABOVE BANK FULL.

F.A. PROJECT NO.: STP-0119(9)

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 3.378 CY/FT	573.4	C.Y.
WINGS, ETC.	46.5	C.Y.
SILLS	1.6	C.Y.
TOTAL	621.5	C.Y.
REINFORCING STEEL		
BARREL	71,561	LBS.
WINGS, ETC.	2,516	LBS.
TOTAL	74,077	LBS.
FOUNDATION CONDITIONING MATERIAL	475	TONS
CULVERT EXCAVATION	LUMP SUM	

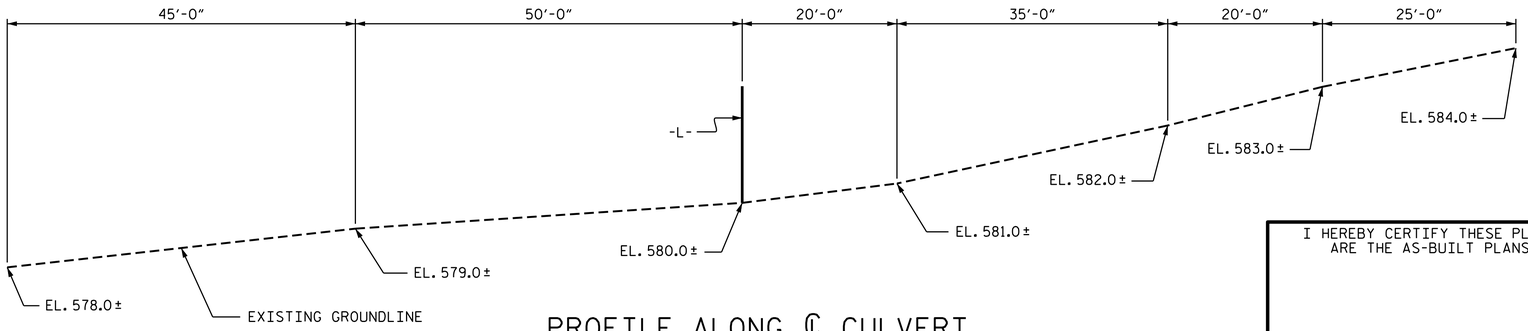
HYDRAULIC DATA

DESIGN DISCHARGE	= 1420 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 582.40
DRAINAGE AREA	= 2.08 SQ. MI.
BASE DISCHARGE (Q100)	= 1700 CFS
BASE HIGH WATER ELEVATION	= 583.39

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 2570+ CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 586.80 ✳

✳ OVERTOPS PROPOSED ROADWAY AT STA. 98+00 -L-



PROFILE ALONG ℄ CULVERT

GRADE DATA

GRADE POINT ELEVATION @ STA. 96+88.00 -L-	= 587.39'
BED ELEVATION @ STA. 96+88.00 -L-	= 571.43'
ROADWAY FILL SLOPES	= 2:1

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F2458380930BF40E...

3/16/2017

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 96+88.00 -L-

SHEET 1 OF 5 CULVERT NO. 437

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. X 9 FT. CONCRETE BOX CULVERT 130° SKEW

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

ASSEMBLED BY : A. SORSENGINH DATE : 4/2014
CHECKED BY : S. B. WILLIAMS DATE : 4/2014
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE : 4/2014

STD. NO. CB443A

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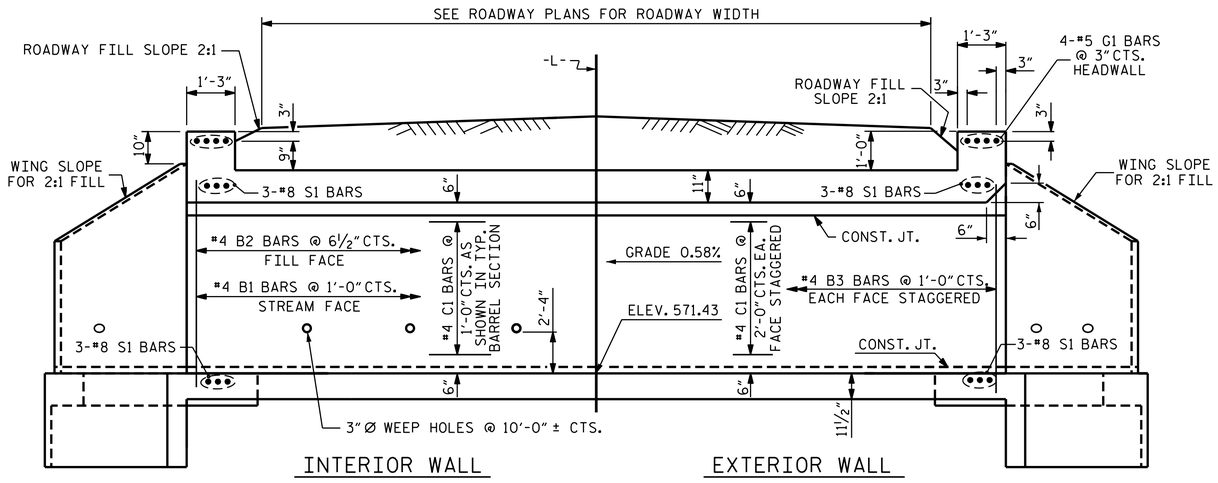
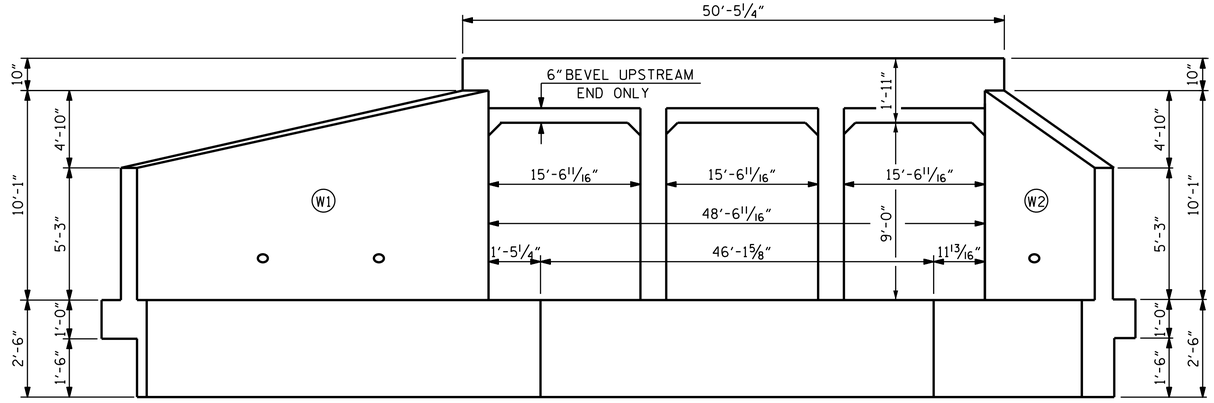
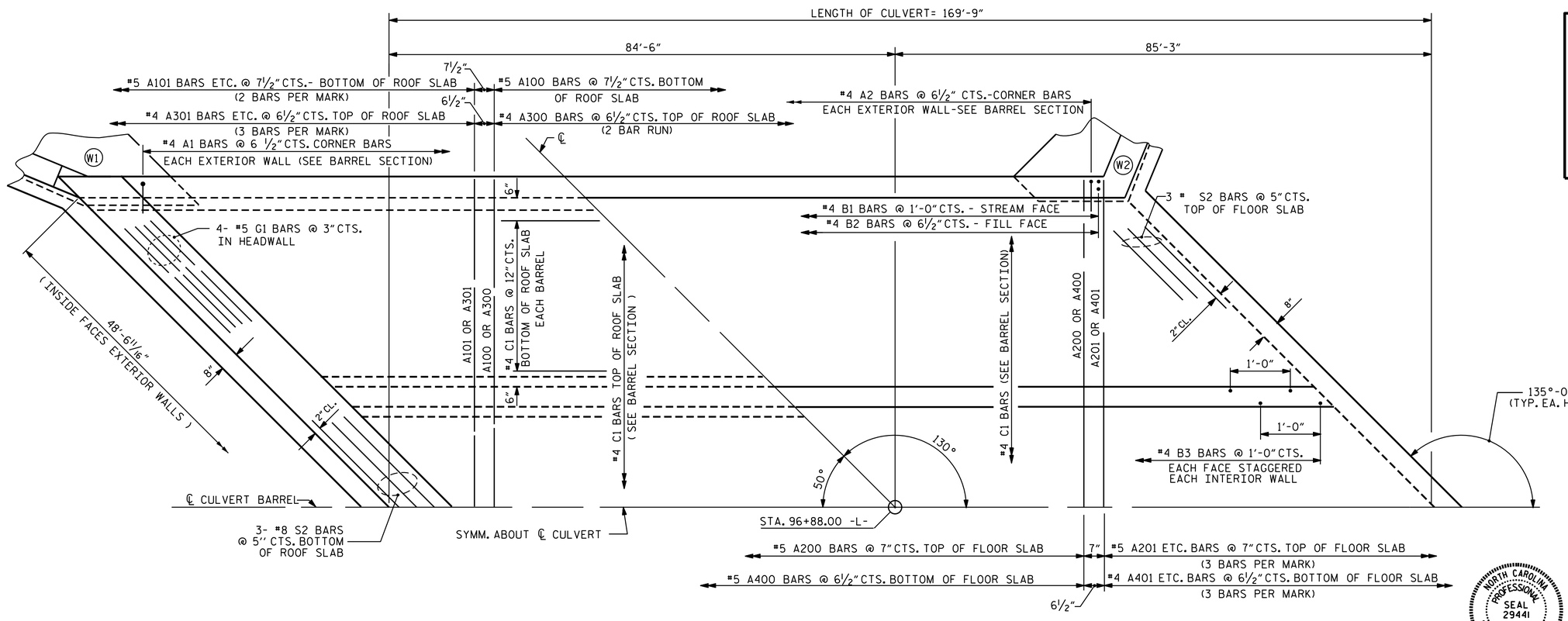
kalford



CULVERT SECTION NORMAL TO ROADWAY



INLET END ELEVATION NORMAL TO SKEW



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F24583893OBF40E...

3/16/2017

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 96+88.00 -L-

SHEET 2 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. X 9 FT. CONCRETE BOX CULVERT 130° SKEW

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

REVISED 11-19-99 BY M.M. CHECKED BY R.W.W.
REDRAWN NOV.1990 BY D.P.D. CHECKED BY M.A.J.

ASSEMBLED BY : A. SORSENGINH DATE : 4/2014
CHECKED BY : S. B. WILLIAMS DATE : 4/2014
DRAWN BY : H. A. JUDEH DATE : 4/12/72
CHECKED BY : RALPH D. UNDERWOOD DATE : APR. 1972

SPECIAL
STANDARD

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

STD. NO. CB443

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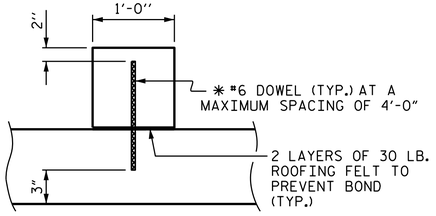
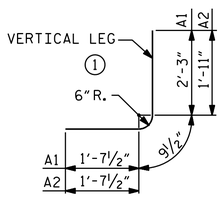


SECTION THROUGH SILL

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

BAR TYPE



BAR DIMENSIONS ARE OUT TO OUT

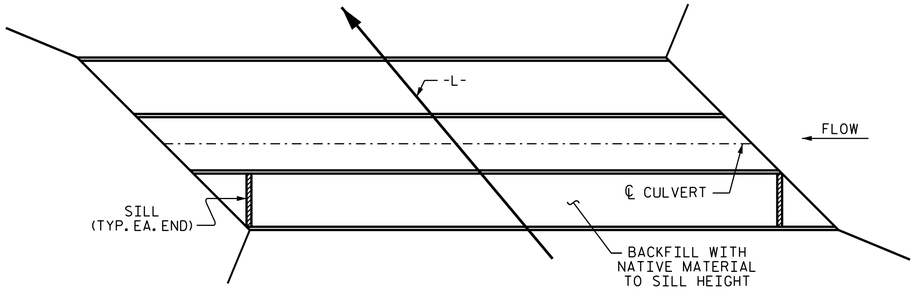
SPLICE LENGTH CHART

BAR	SIZE	LENGTH
A200	#5	1'-9"
A300	#4	1'-5"
A400	#5	1'-9"
B1	#4	1'-5"
B3	#4	1'-5"
C1	#4	1'-11"

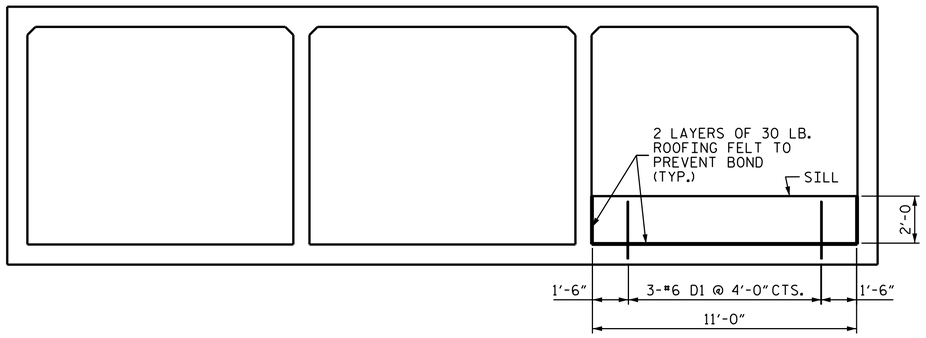
BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	215	#5	STR	35'-3"	7905
A101	4	#5	STR	34'-0"	142
A102	4	#5	STR	32'-9"	137
A103	4	#5	STR	31'-6"	131
A104	4	#5	STR	30'-3"	126
A105	4	#5	STR	29'-0"	121
A106	4	#5	STR	27'-9"	116
A107	4	#5	STR	26'-6"	111
A108	4	#5	STR	25'-3"	105
A109	4	#5	STR	24'-0"	100
A110	4	#5	STR	22'-9"	95
A111	4	#5	STR	21'-6"	90
A112	4	#5	STR	20'-3"	84
A113	4	#5	STR	19'-0"	79
A114	4	#5	STR	17'-9"	74
A115	4	#5	STR	16'-6"	69
A116	4	#5	STR	15'-3"	64
A117	4	#5	STR	14'-0"	58
A118	4	#5	STR	12'-9"	53
A119	4	#5	STR	11'-6"	48
A120	4	#5	STR	10'-3"	43
A121	4	#5	STR	9'-0"	38
A122	4	#5	STR	7'-9"	32
A123	4	#5	STR	6'-6"	27
A124	4	#5	STR	5'-3"	22
A125	4	#5	STR	4'-0"	17
A126	4	#5	STR	2'-9"	11
A200	230	#5	STR	35'-3"	8456
A201	6	#5	STR	33'-6"	210
A202	6	#5	STR	31'-9"	199
A203	6	#5	STR	30'-0"	188
A204	6	#5	STR	28'-3"	177
A205	6	#5	STR	26'-6"	166
A206	6	#5	STR	24'-9"	155
A207	6	#5	STR	23'-0"	144
A208	6	#5	STR	21'-3"	133
A209	6	#5	STR	19'-6"	122
A210	6	#5	STR	17'-9"	111
A211	6	#5	STR	16'-0"	100
A212	6	#5	STR	14'-3"	89
A213	6	#5	STR	12'-6"	78
A214	6	#5	STR	10'-9"	67
A215	6	#5	STR	9'-0"	56
A216	6	#5	STR	7'-3"	45
A217	6	#5	STR	5'-6"	34
A218	6	#5	STR	3'-9"	23
A219	6	#5	STR	2'-0"	13
A300	496	#4	STR	18'-4"	6074
A301	12	#4	STR	17'-9"	142
A302	12	#4	STR	16'-11"	135
A303	12	#4	STR	16'-1"	129
A304	6	#4	STR	28'-9"	115
A305	6	#4	STR	27'-1"	109
A306	6	#4	STR	25'-6"	102
A307	6	#4	STR	23'-10"	96
A308	6	#4	STR	22'-3"	89
A309	6	#4	STR	20'-7"	82
A310	6	#4	STR	19'-0"	76
A311	6	#4	STR	17'-4"	69
A312	6	#4	STR	15'-9"	63
A313	6	#4	STR	14'-1"	56
A314	6	#4	STR	12'-6"	50
A315	6	#4	STR	10'-10"	43
A316	6	#4	STR	9'-3"	37
A317	6	#4	STR	7'-7"	30
A318	6	#4	STR	6'-0"	24
A319	6	#4	STR	4'-4"	17
A320	6	#4	STR	2'-9"	11
A400	248	#5	STR	35'-3"	9118
A401	6	#5	STR	33'-7"	210
A402	6	#5	STR	32'-0"	200
A403	6	#5	STR	30'-4"	190
A404	6	#5	STR	28'-9"	180
A405	6	#5	STR	27'-1"	169
A406	6	#5	STR	25'-6"	160
A407	6	#5	STR	23'-10	149
A408	6	#5	STR	22'-3"	139
A409	6	#5	STR	20'-7"	129
A410	6	#5	STR	19'-0"	119
A411	6	#5	STR	17'-4"	108
A412	6	#5	STR	15'-9"	99
A413	6	#5	STR	14'-1"	88
A414	6	#5	STR	12'-6"	78
A415	6	#5	STR	10'-10"	68
A416	6	#5	STR	9'-3"	58
A417	6	#5	STR	7'-7"	47
A418	6	#5	STR	6'-0"	38
A419	6	#5	STR	4'-4"	27
A420	6	#5	STR	2'-9"	17
A1	628	#4	1	4'-8"	1958
A2	628	#4	1	4'-4"	1818
B1	340	#4	STR	10'-4"	2347
B2	628	#4	STR	8'-4"	3496
B3	680	#4	STR	10'-4"	4694
C1	910	#4	STR	26'-0"	15805
D1	6	#6	STR	2'-6"	23
G1	8	#5	STR	49'-11"	417
S1	12	#8	STR	49'-11"	1599

REINFORCING STEEL = 71,561 LBS



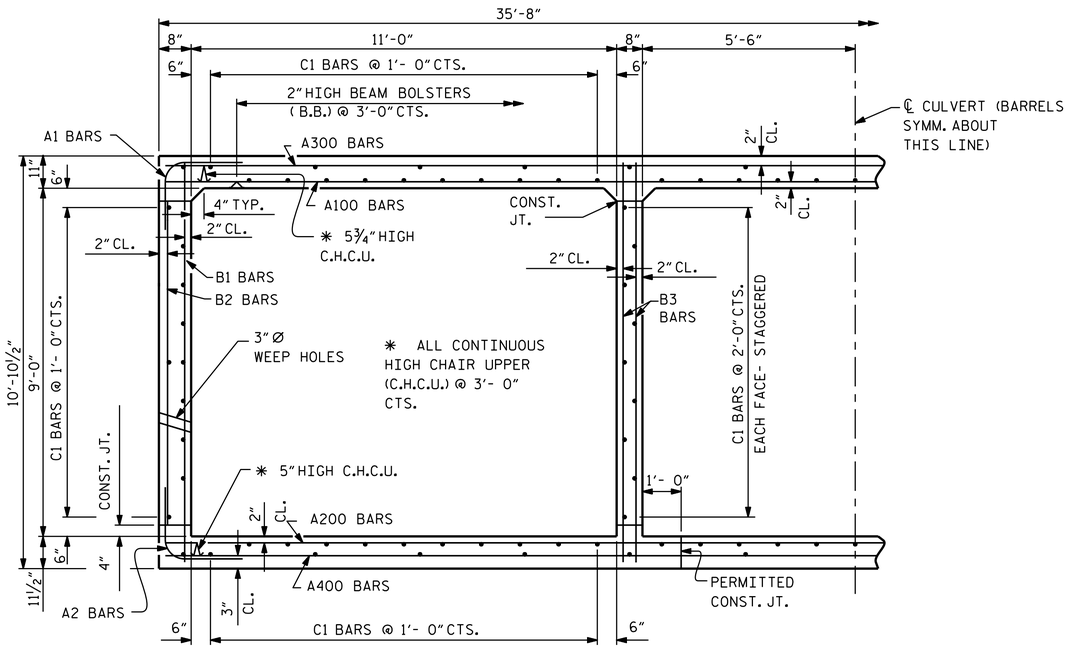
PLAN OF SILL LOCATION



ELEVATION

CULVERT SILL DETAILS

LOOKING UPSTREAM



RIGHT ANGLE SECTION OF BARREL

THERE ARE 130 "C" BARS IN SECTION OF BARREL.
(7 BAR RUN)

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 96+88.00 -L-

SHEET 3 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

TRIPLE 11 FT. X 9 FT. CONCRETE BOX CULVERT 130° SKEW

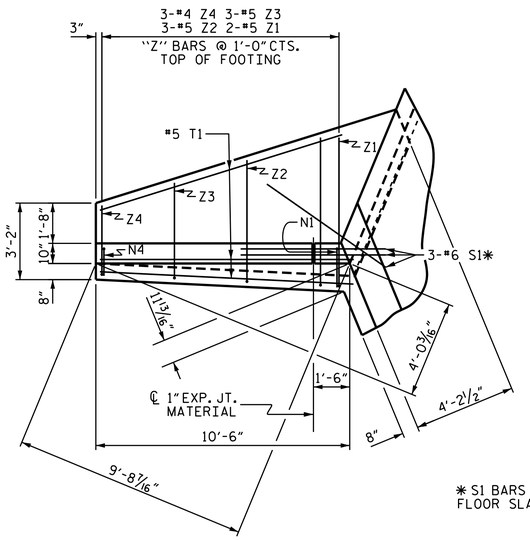
NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

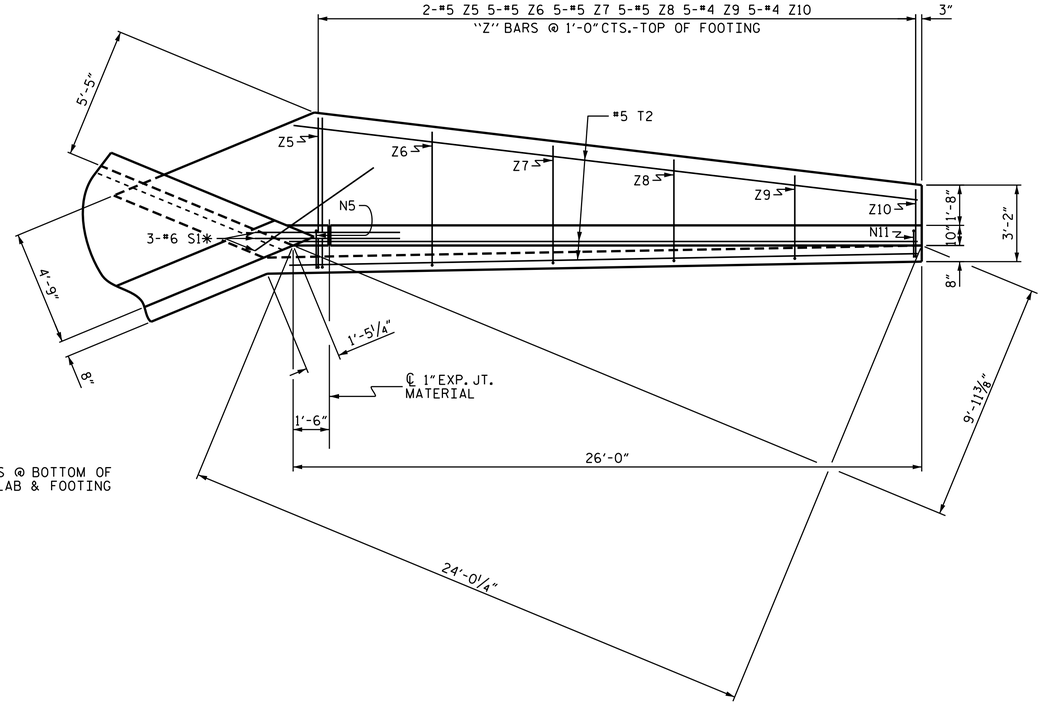
DocuSigned by:
F24583893OBF40E...
3/16/2017

ASSEMBLED BY : A. SORSENGINH DATE : 4/2014
CHECKED BY : S. B. WILLIAMS DATE : 4/2014
DESIGN ENGINEER OF RECORD:
A. SORSENGINH DATE : 4/2014

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

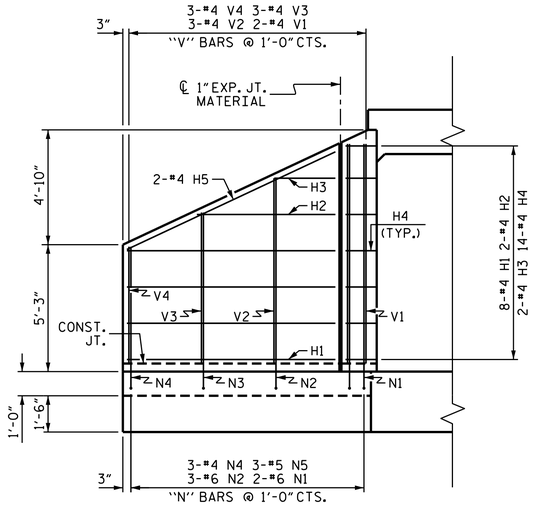


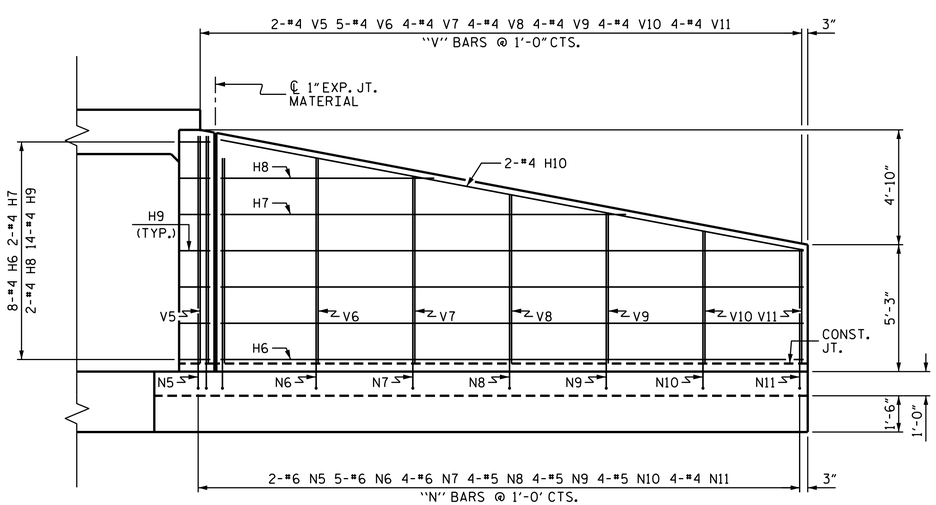


* S1 BARS @ BOTTOM OF FLOOR SLAB & FOOTING

PLAN W2

PLAN W1



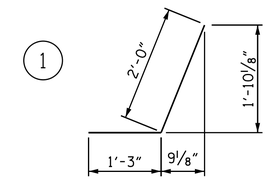


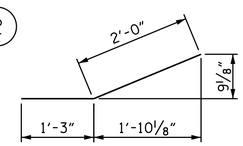
ELEVATION W2

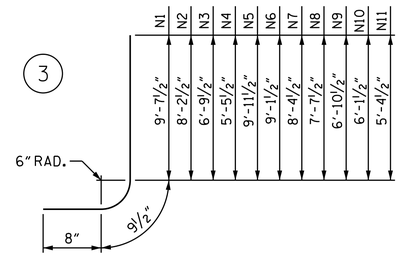
ELEVATION W1

BAR TYPES

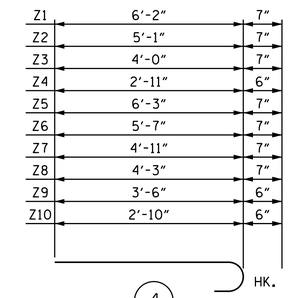
ALL BAR DIMENSIONS ARE OUT TO OUT.







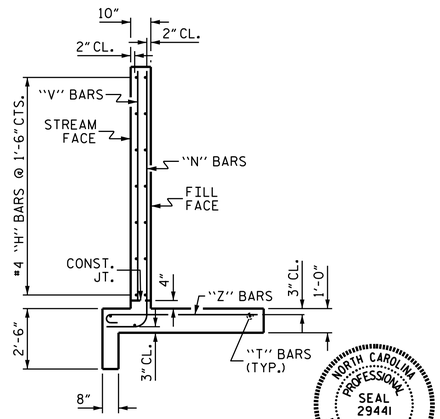
Z1	6'-2"	7"
Z2	5'-1"	7"
Z3	4'-0"	7"
Z4	2'-11"	6"
Z5	6'-3"	7"
Z6	5'-7"	7"
Z7	4'-11"	7"
Z8	4'-3"	7"
Z9	3'-6"	6"
Z10	2'-10"	6"



BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	16	#4	STR	8'-7"	92
H2	4	#4	STR	5'-8"	15
H3	4	#4	STR	2'-6"	7
H4	28	#4	1	3'-3"	61
H5	4	#4	STR	9'-6"	25
H6	16	#4	STR	24'-1"	257
H7	4	#4	STR	16'-9"	45
H8	4	#4	STR	8'-10"	24
H9	28	#4	2	3'-3"	61
H10	4	#4	STR	24'-6"	65
N1	4	#6	3	11'-1"	67
N2	6	#6	3	9'-8"	87
N3	6	#5	3	8'-3"	52
N4	6	#4	3	6'-11"	28
N5	4	#6	3	11'-5"	69
N6	10	#6	3	10'-7"	159
N7	8	#6	3	9'-10"	118
N8	8	#5	3	9'-1"	76
N9	8	#5	3	8'-4"	70
N10	8	#5	3	7'-7"	63
N11	8	#4	3	6'-10"	37
S1	12	#6	STR	6'-0"	108
T1	6	#5	STR	10'-6"	66
T2	6	#5	STR	26'-0"	163
V1	4	#4	STR	9'-1"	24
V2	6	#4	STR	7'-8"	31
V3	6	#4	STR	6'-3"	25
V4	6	#4	STR	4'-10"	19
V5	4	#4	STR	9'-5"	25
V6	10	#4	STR	8'-6"	57
V7	8	#4	STR	7'-9"	41
V8	8	#4	STR	7'-0"	37
V9	8	#4	STR	6'-3"	33
V10	8	#4	STR	5'-6"	29
V11	8	#4	STR	4'-9"	25
Z1	4	#5	4	6'-9"	28
Z2	6	#5	4	5'-8"	35
Z3	6	#5	4	4'-7"	29
Z4	6	#4	4	3'-5"	14
Z5	4	#5	4	6'-10"	29
Z6	10	#5	4	6'-2"	64
Z7	10	#5	4	5'-6"	57
Z8	10	#5	4	4'-10"	50
Z9	10	#4	4	4'-0"	27
Z10	10	#4	4	3'-4"	22

REINFORCING STEEL FOR 4 WINGS	2516 LBS
CLASS A CONCRETE	
4 WINGS	36.1 CY
2 HEADWALLS	4.7 CY
2 END CURTAIN WALLS	5.7 CY
TOTAL	46.5 CY



TYPICAL WING SECTION

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F245838930BF40E...

3/16/2017

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 96+88.00 -L-

SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD WINGS FOR CONCRETE BOX CULVERT

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

135° SKEW

ASSEMBLED BY : A. SORSENGINH	DATE : 4/2014
CHECKED BY : S. B. WILLIAMS	DATE : 4/2014
DRAWN BY : CCJ	01/00
CHECKED BY : RWW	03/00

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

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STD. NO. CW4509

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

LEVEL		VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING (#)	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE									COMMENT NUMBER
							LIVE-LOAD FACTORS (γ_{LL})	MOMENT				SHEAR				
								RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING		HL-93 (INVENTORY)	N/A	1	1.16	--	1.75	1.16	1	TOP SLAB	5.25	1.26	1	TOP SLAB	10.67	
		HL-93 (OPERATING)	N/A		1.50	--	1.35	1.50	1	TOP SLAB	5.25	1.63	1	TOP SLAB	10.67	
		HS-20 (INVENTORY)	36.000	2	1.46	52.64	1.75	1.55	1	TOP SLAB	5.25	1.46	1	TOP SLAB	10.67	
		HS-20 (OPERATING)	36.000		1.90	68.23	1.35	2.01	1	TOP SLAB	5.25	1.90	1	TOP SLAB	10.67	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.76	37.20	1.40	2.82	1	TOP SLAB	5.25	2.76	1	TOP SLAB	10.67	
		SNGARBS2	20.000		2.51	50.15	1.40	2.63	1	TOP SLAB	5.25	2.51	1	TOP SLAB	10.67	
		SNAGRIS2	22.000		2.60	57.25	1.40	2.60	1	BOT CORNER WALL	9.69	2.64	1	TOP SLAB	10.67	
		SNCOTTS3	27.250	3	1.45	39.41	1.40	1.45	1	TOP SLAB	5.25	1.56	1	TOP SLAB	10.67	
		SNAGGRS4	34.925		1.66	57.82	1.40	1.71	1	TOP SLAB	5.25	1.66	1	TOP SLAB	10.67	
		SNS5A	35.550		1.63	57.82	1.40	1.63	1	TOP SLAB	5.25	1.63	1	TOP SLAB	10.67	
		SNS6A	39.950		1.62	64.71	1.40	1.63	1	TOP SLAB	5.25	1.62	1	TOP SLAB	10.67	
		SNS7B	42.000		1.57	66.05	1.40	1.69	1	TOP SLAB	5.25	1.57	1	TOP SLAB	10.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.30	75.76	1.40	2.30	1	BOT CORNER WALL	9.69	2.48	1	TOP SLAB	10.67	
		TNT4A	33.075		1.72	56.81	1.40	1.72	1	TOP SLAB	5.25	1.85	1	TOP SLAB	10.67	
		TNT6A	41.600		1.59	66.35	1.40	1.72	1	TOP SLAB	5.25	1.59	1	TOP SLAB	10.67	
		TNT7A	42.000		1.72	72.26	1.40	1.80	1	TOP SLAB	5.25	1.72	1	TOP SLAB	10.67	
		TNT7B	42.000		1.65	69.33	1.40	1.65	1	TOP SLAB	5.25	1.67	1	TOP SLAB	10.67	
		TNAGRIT4	43.000		1.64	70.66	1.40	1.64	1	TOP SLAB	5.25	1.77	1	TOP SLAB	10.67	
		TNAGT5A	45.000		1.68	75.58	1.40	1.68	1	TOP SLAB	5.25	1.77	1	TOP SLAB	10.67	
		TNAGT5B	45.000		1.70	76.72	1.40	1.72	1	TOP SLAB	5.25	1.73	1	TOP SLAB	10.67	

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	0.50 OR 0.90
ES	1.35	0.50 OR 0.90
LS	1.75	--
WA	1.00	--

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

1.
2.
3.
4.

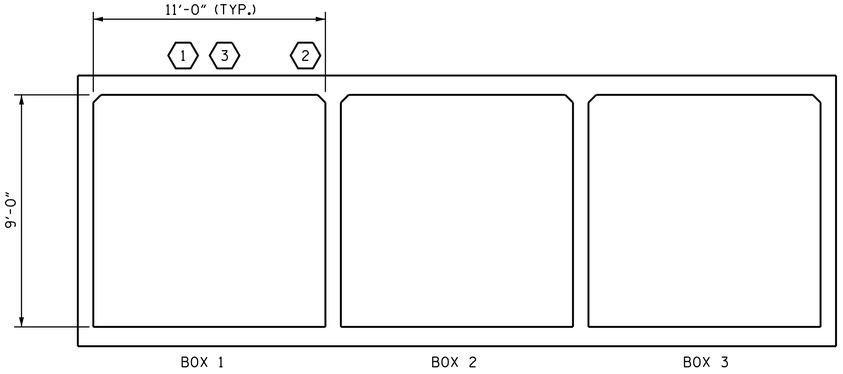
(#) CONTROLLING LOAD RATING

(1) DESIGN LOAD RATING (HL-93)

(2) DESIGN LOAD RATING (HS-20)

(3) LEGAL LOAD RATING **

** SEE CHART FOR VEHICLE TYPE



LRFR SUMMARY

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 96+88.00 -L-

SHEET 5 OF 5

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

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3/16/2017

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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:	C1-5
1			3			TOTAL SHEETS
2			4			5

STD. NO. LRFR5

ASSEMBLED BY :	A. SORSENGINH	DATE :	4/2014
CHECKED BY :	S. B. WILLIAMS	DATE :	4/2014
DRAWN BY : WMC	7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM	7/11		

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16-MAR-2017 12:00
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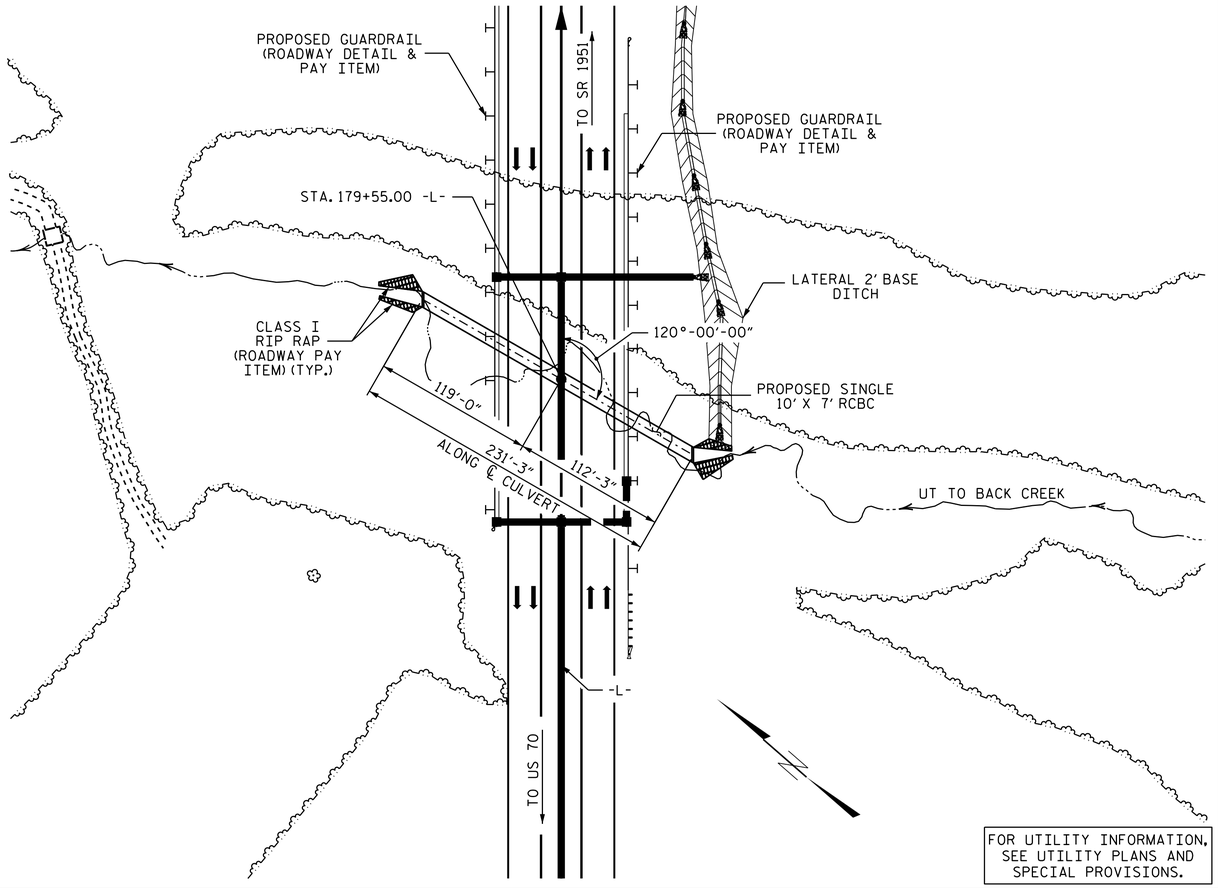
kalford

BENCHMARK #10: RAIL ROAD SPIKE IN BASE OF 15" MAPLE, STA. 184+72.00 -L-, 214' RIGHT, EL. 627.17



FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

LOCATION SKETCH

NOTES

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

DESIGN FILL---------- 26.90'

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 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.

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 OF BARREL AS USED ON THE CAST-IN-PLACE DESIGN. FOR OPTIONAL PRECAST REINFORCED CONCRETE BOX CULVERT, SEE SPECIAL PROVISIONS.

THE CONTRACTOR SHALL PROVIDE INDEPENDENT ASSURANCE SAMPLES OF REINFORCING STEEL AS FOLLOWS: FOR PROJECTS REQUIRING UP TO 400 TONS OF REINFORCING STEEL, ONE 30 INCH SAMPLE OF EACH SIZE BAR USED, AND FOR PROJECTS REQUIRING OVER 400 TONS OF REINFORCING STEEL, TWO 30 INCH SAMPLES OF EACH SIZE BAR USED. THE 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.

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 SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

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

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 1.458 CY/FT	337.2	C.Y.
WINGS, ETC.	22.3	C.Y.
SILLS AND BAFFLES	3.4	C.Y.
TOTAL	362.9	C.Y.
REINFORCING STEEL		
BARREL	41,436	LBS.
WINGS, ETC.	1,321	LBS.
TOTAL	42,757	LBS.
FOUNDATION CONDITIONING MATERIAL	253	TONS
CULVERT EXCAVATION	LUMP SUM	

HYDRAULIC DATA

DESIGN DISCHARGE	= 350 CFS
FREQUENCY OF DESIGN FLOOD	= 50 YRS.
DESIGN HIGH WATER ELEVATION	= 602.50
DRAINAGE AREA	= 0.19 SQ. MI.
BASE DISCHARGE (Q100)	= 400 CFS
BASE HIGH WATER ELEVATION	= 603.09

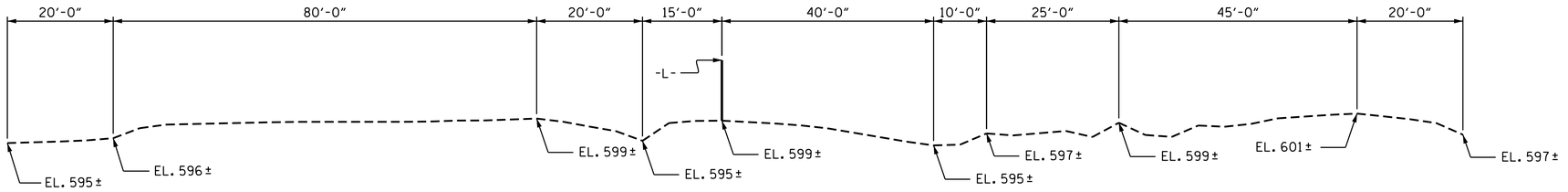
OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 1100 CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500+ YRS.
OVERTOPPING FLOOD ELEVATION	= 621.80*

*OVERTOPS ROADWAY DITCH AT 177+00 -L- RT

GRADE DATA

GRADE POINT ELEVATION @ STA. 179+55.00 -L-	= 627.83'
BED ELEVATION @ STA. 179+55.00 -L-	= 594.73'
ROADWAY FILL SLOPES	= 2:1



PROFILE ALONG ℄ CULVERT

F.A. PROJECT NO.: STP-0119(9)

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 179+55.00 -L-

SHEET 1 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 10 FT. X 7 FT. CONCRETE BOX CULVERT 120° SKEW

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F245838930BF40E...

3/16/2017

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REVISIONS						SHEET NO.
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ASSEMBLED BY : A. SORSENGINH DATE : 4/2014
CHECKED BY : K.W. ALFORD DATE : 2/2017
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE : 4/2014

STD. NO. CB331A

16-MAR-2017 09:57
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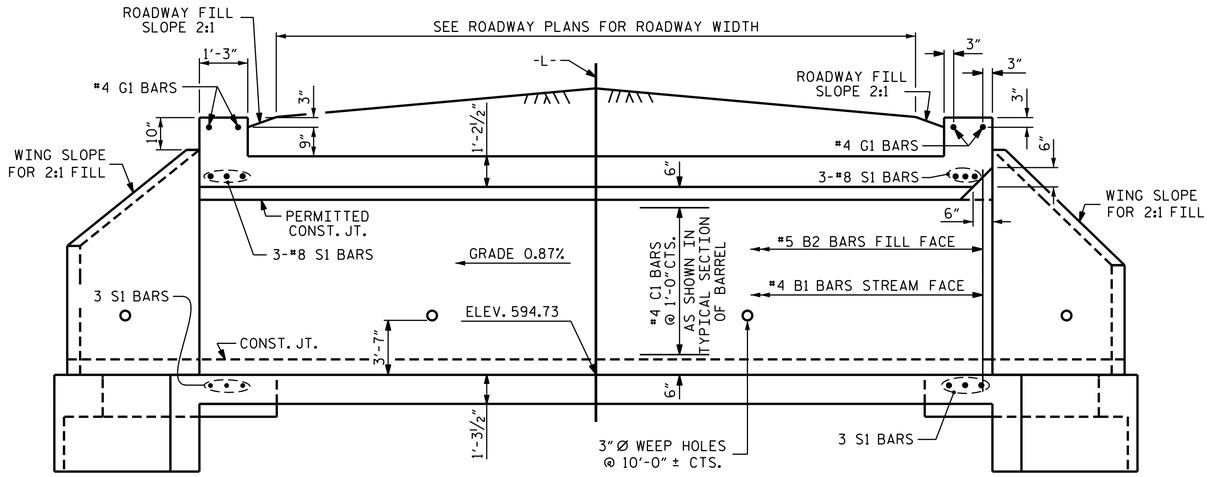
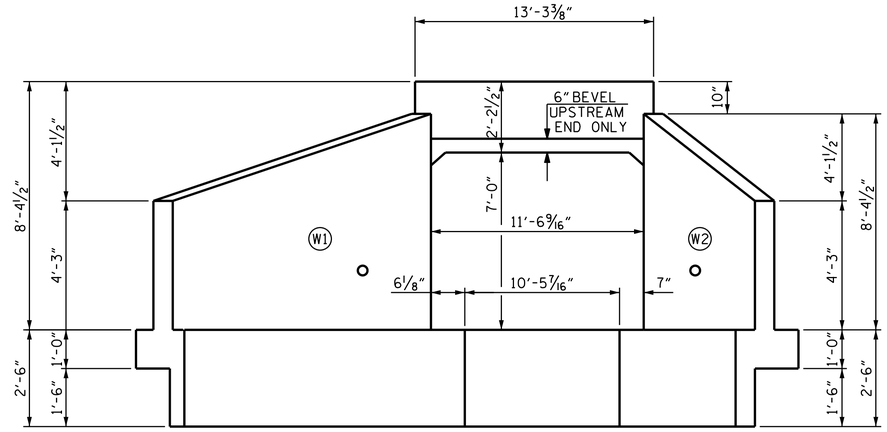
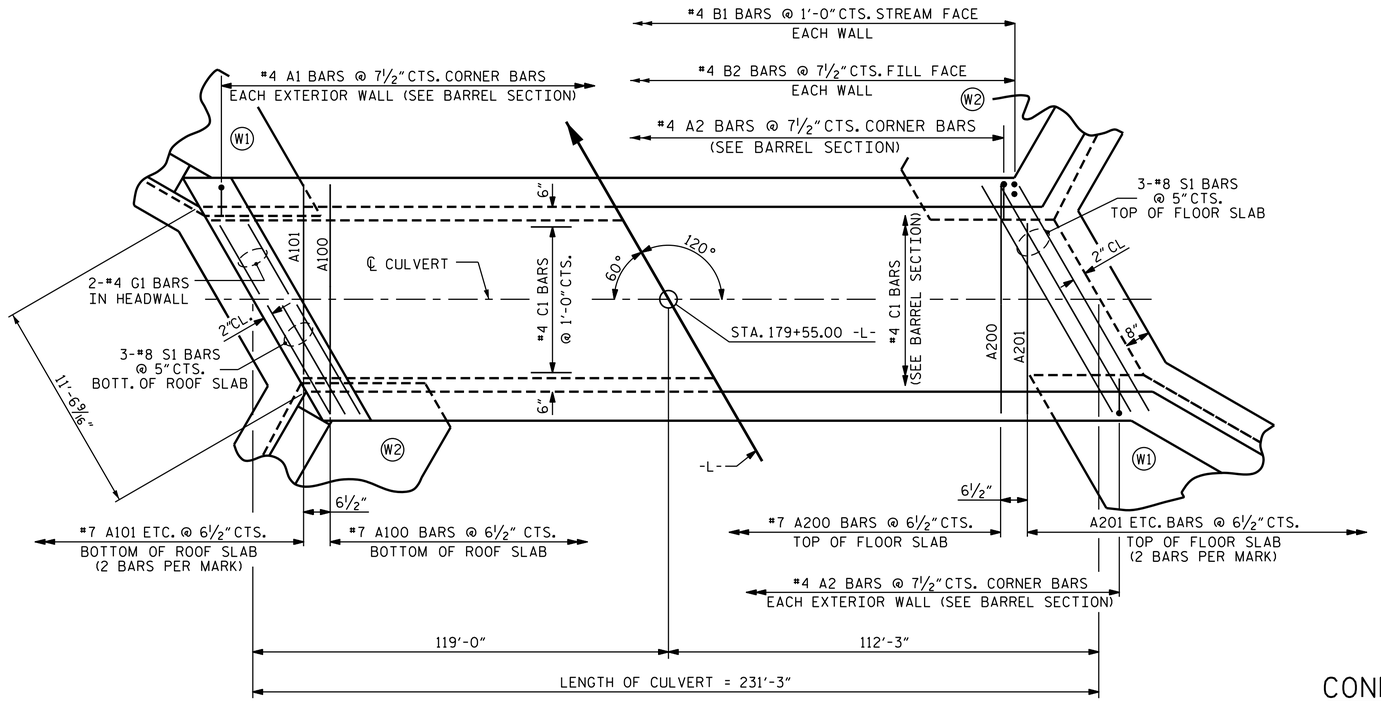


CULVERT SECTION NORMAL TO ROADWAY

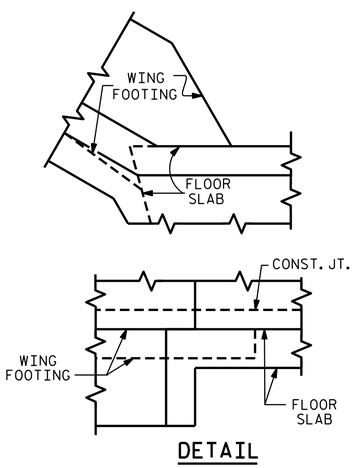


INLET END ELEVATION NORMAL TO SKEW



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB



DETAIL

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

PROJECT NO. U-3109A
ALAMANCE COUNTY
STATION: 179+55.00 -L-

SHEET 2 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BARREL STANDARD

SINGLE 10 FT. X 7 FT. CONCRETE BOX CULVERT 120° SKEW

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F24583893OBF40E...
3/16/2017

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STD. NO. CB331

ASSEMBLED BY : A. SORSENGINH	DATE : 4/2014	SPECIAL
CHECKED BY : K.W. ALFORD	DATE : 2/2017	
DRAWN BY : J.W. ROUSE	DATE : SEPT. 1989	STANDARD
CHECKED BY : A.R. BISSETTE	DATE : AUG. 1989	

REVISED 8-28-92 BY E.L.R. CHECKED BY G.R.P.
REVISED 8-22-89 BY A.R.B. CHECKED BY C.R.K.
REDRAWN 8-22-89
REVISED 11-19-99 BY M.M. CHECKED BY R.W.W.

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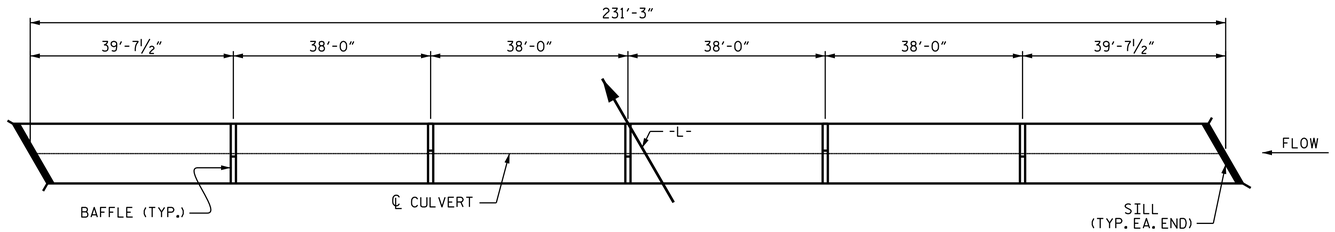
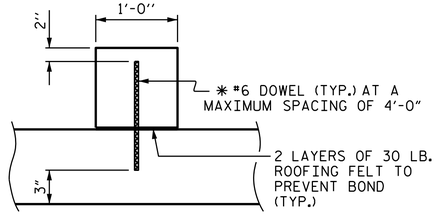
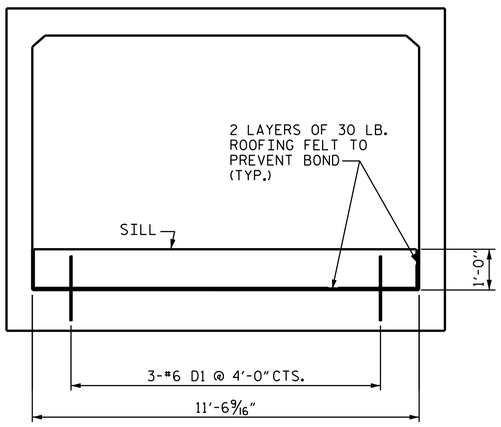


PLAN OF SILL LOCATION



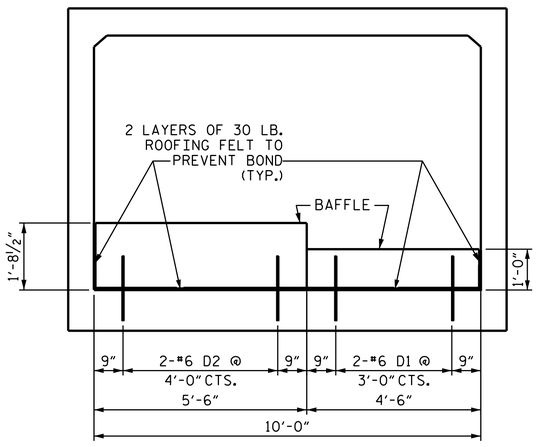
SECTION THROUGH SILL AND BAFFLE

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



ELEVATION

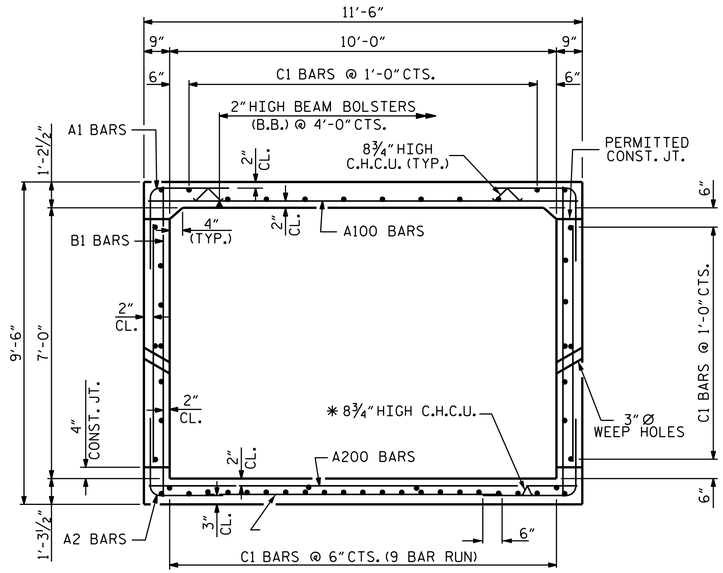
CULVERT SILL DETAILS



ELEVATION

CULVERT BAFFLE DETAILS

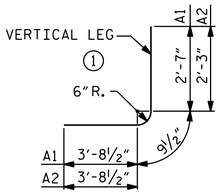
ALTERNATE HIGH SIDE OF BATTLE ALONG CULVERT LENGTH



RIGHT ANGLE SECTION OF BARREL

THERE ARE 53 C1 BARS IN SECTION OF BARREL (9 BAR RUN)

BAR TYPE



BAR DIMENSIONS ARE OUT TO OUT

SPLICE LENGTH CHART

BAR	SIZE	LENGTH
C1	#4	1'-11"

BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	415	#7	STR	11'-1"	9402
A101	4	#7	STR	9'-1"	74
A102	4	#7	STR	7'-2"	59
A103	4	#7	STR	5'-4"	44
A104	4	#7	STR	3'-5"	28
A200	415	#7	STR	11'-1"	9402
A201	4	#7	STR	9'-1"	74
A202	4	#7	STR	7'-2"	59
A203	4	#7	STR	5'-4"	44
A204	4	#7	STR	3'-5"	28
A1	740	#4	1	7'-1"	3501
A2	740	#4	1	6'-9"	3337
B1	464	#4	STR	9'-0"	2790
B2	740	#4	STR	6'-4"	3131
C1	477	#4	STR	27'-7"	8789
D1	16	#6	STR	1'-10"	44
D2	10	#6	STR	2'-7"	39
F1	46	#4	STR	4'-9"	146
G1	4	#4	STR	12'-10"	34
S1	12	#8	STR	12'-10"	411
REINFORCING STEEL				= 41,436	LBS

NOTES:

BED MATERIAL BETWEEN BAFFLES IN THE CULVERT SHALL PROVIDE A CONTINUOS LOW FLOW CHANNEL.

THE BED MATERIAL SHALL BE NATIVE MATERIAL, WHICH CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STEAM BED AT THE PROJECT SITE DURING CULVERT CONSTRUCTION. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAYBE SUBJECT TO PERMIT CONDITIONS.

TOP OF SILLS SHOULD MATCH STREAM BED ELEVATION IN LOW FLOW CHANNEL OF STREAM.

CLASS B RIP RAP MAY BE USED TO SUPPLEMENT NATIVE MATERIAL. NATIVE MATERIAL SHOULD BE PLACED ON TOP TO FILL VOIDS AND PROVIDE A FLAT SURFACE FOR ANIMAL PASSAGE.

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 179+55.00 -L-

SHEET 3 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SINGLE 10 FT. X 7 FT. CONCRETE BOX CULVERT 120° SKEW

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F24583893OBF40E...
3/16/2017

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

ASSEMBLED BY : A. SORSENGINH DATE : 4/2014
CHECKED BY : K.W. ALFORD DATE : 2/2017
DESIGN ENGINEER OF RECORD: A. SORSENGINH DATE : 4/2014

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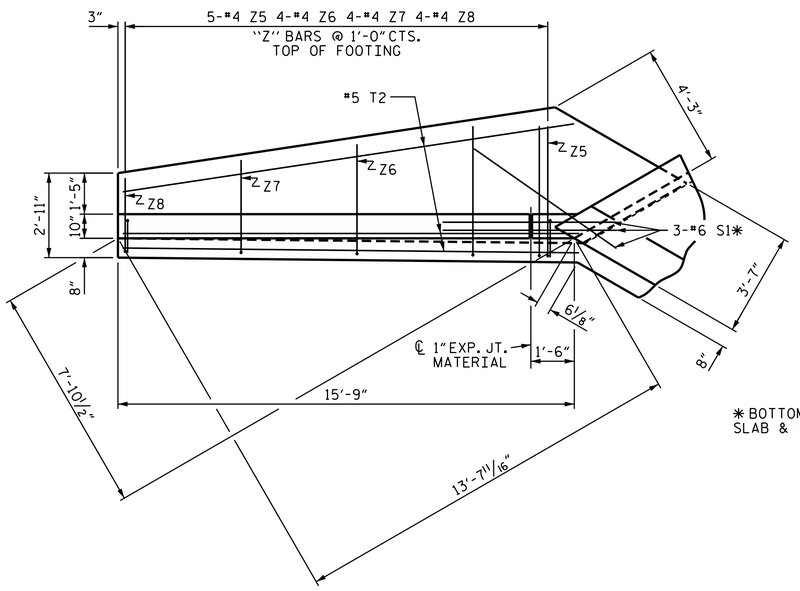
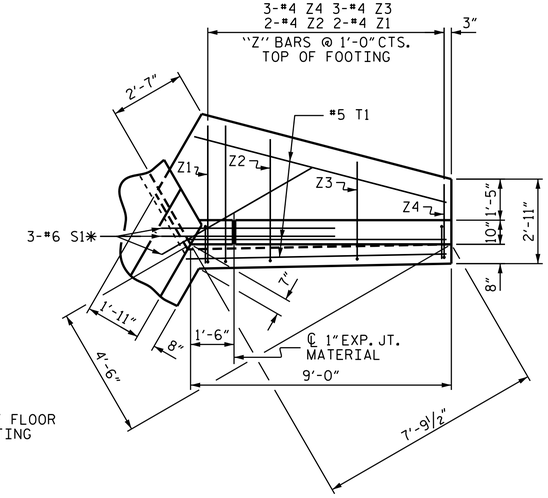
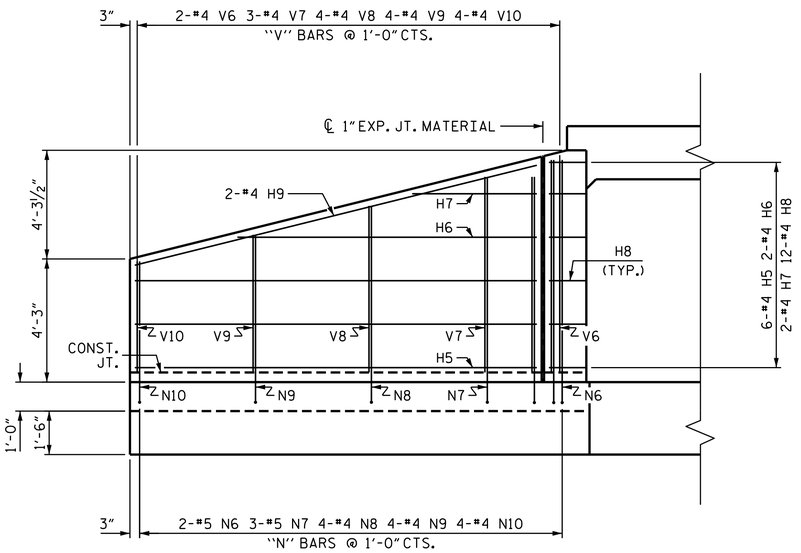


PLAN W1

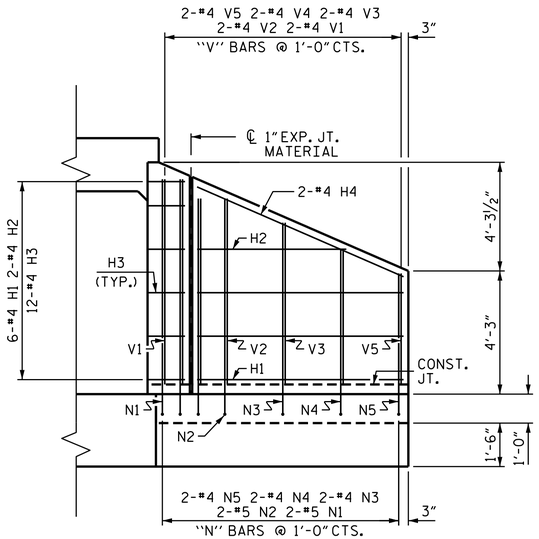


PLAN W2

* BOTTOM OF FLOOR SLAB & FOOTING



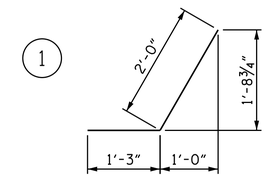
ELEVATION W1

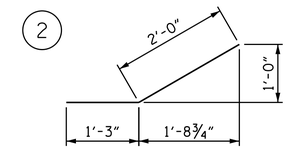


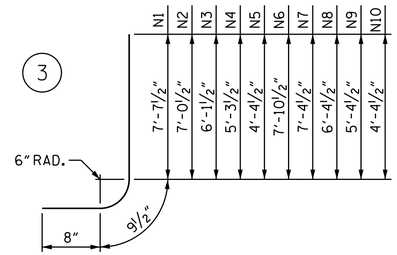
ELEVATION W2

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.







Z1	4'-9"	6"
Z2	4'-3"	6"
Z3	3'-5"	6"
Z4	2'-7"	6"
Z5	4'-6"	6"
Z6	3'-10"	6"
Z7	3'-3"	6"
Z8	2'-7"	6"

HK.

4

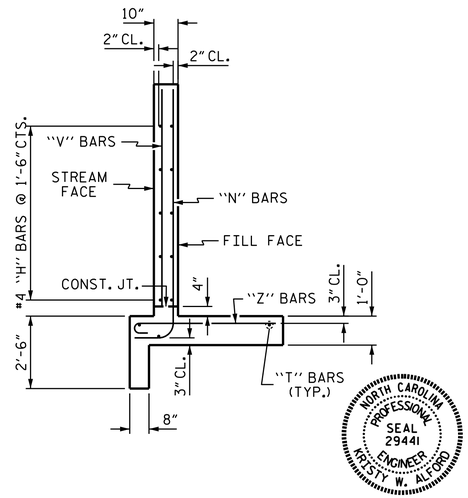
BILL OF MATERIAL

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 1321 LBS

CLASS A CONCRETE

4 WINGS	19.8 CY
2 HEADWALLS	1.2 CY
2 END CURTAIN WALLS	1.3 CY
TOTAL	22.3 CY



TYPICAL WING SECTION

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F245838930BF40E...

3/16/2017

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 179+55.00 -L-

SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD WINGS FOR CONCRETE BOX CULVERT

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

120° SKEW

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

ASSEMBLED BY :	A. SORSENGINH	DATE : 4/2014
CHECKED BY :	K.W. ALFORD	DATE : 2/2017
DRAWN BY :	CCJ	11/99
CHECKED BY :	RWW	03/00

STD. NO. CW6007

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

LEVEL		VEHICLE	WEIGHT (W) (TONS)	(#) CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE									COMMENT NUMBER
							LIVE-LOAD FACTORS (γ_{LL})	MOMENT				SHEAR				
								RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING		HL-93 (INVENTORY)	N/A	1	4.34	--	1.75	4.34	1	BOT. CORNER WALL	7.63	6.52	1	EXTERIOR WALL	7.06	
		HL-93 (OPERATING)	N/A		5.62	--	1.35	5.62	1	BOT. CORNER WALL	7.63	8.45	1	EXTERIOR WALL	7.06	
		HS-20 (INVENTORY)	36.000	2	4.34	156.08	1.75	4.34	1	BOT. CORNER WALL	7.63	6.52	1	EXTERIOR WALL	7.06	
		HS-20 (OPERATING)	36.000		5.62	202.32	1.35	5.62	1	BOT. CORNER WALL	7.63	8.45	1	EXTERIOR WALL	7.06	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500	3	5.42	73.16	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNGARBS2	20.000		5.42	108.39	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNAGRIS2	22.000		5.42	119.22	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNCOTTS3	27.250		5.42	147.68	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNAGGRS4	34.925		5.42	189.27	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNS5A	35.550		5.42	192.66	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNS6A	39.950		5.42	216.50	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		SNS7B	42.000		5.42	227.61	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		5.42	178.84	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNT4A	33.075		5.42	179.24	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNT6A	41.600		5.42	225.44	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNT7A	42.000		5.42	227.61	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNT7B	42.000		5.42	227.61	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNAGRIT4	43.000		5.42	233.03	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNAGT5A	45.000		5.42	243.87	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	
		TNAGT5B	45.000		5.42	243.87	1.40	5.42	1	BOT. CORNER WALL	7.63	8.15	1	EXTERIOR WALL	7.06	

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	0.50 OR 0.90
ES	1.35	0.50 OR 0.90
LS	1.75	--
WA	1.00	--

NOTE:

RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

1.
2.
3.
4.

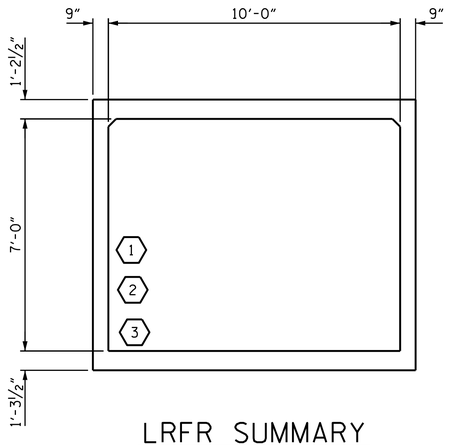
(#) CONTROLLING LOAD RATING

(1) DESIGN LOAD RATING (HL-93)

(2) DESIGN LOAD RATING (HS-20)

(3) LEGAL LOAD RATING **

** SEE CHART FOR VEHICLE TYPE



LRFR SUMMARY

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 179+55.00 -L-

SHEET 5 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

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

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F245838930BF40E...

3/16/2017

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

STD. NO. LRFR5

ASSEMBLED BY : A. SORSENGINH	DATE : 4/2014	
CHECKED BY : K.W. ALFORD	DATE : 2/2017	
DRAWN BY : WMC 7/11	REV. 10/1/11	MAA/GM
CHECKED BY : GM 7/11		

16-MAR-2017 11:36
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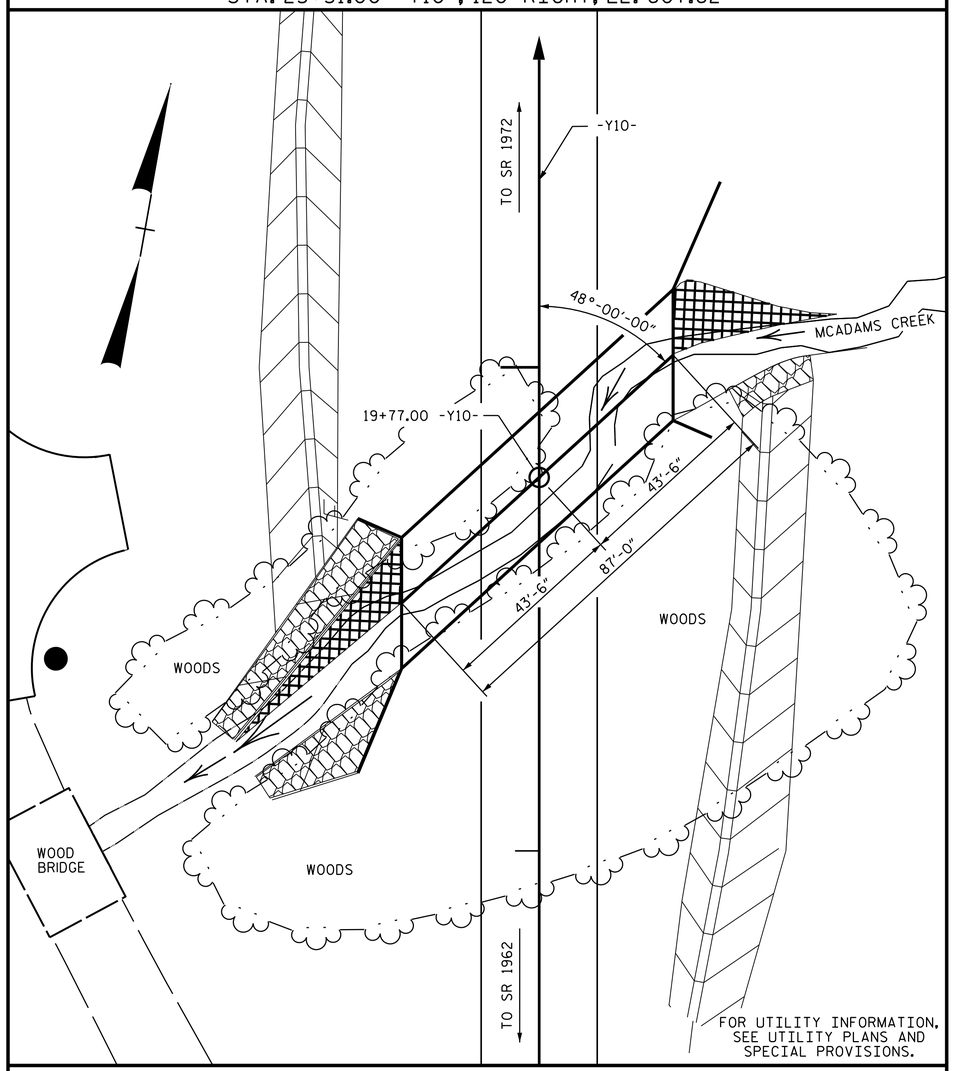
kalford

F.A. PROJECT NO.: STP-0119(9)

BENCHMARK #22, RAILROAD SPIKE IN BASE OF 18" SWEETGUM,
STA. 23+31.00 -Y10-, 120' RIGHT, EL. 607.62



LOCATION SKETCH

TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 2.061 CY/FT	179.3	C.Y.
SILLS	1.5	C.Y.
WING ETC.	35.4	C.Y.
TOTAL	216.2	C.Y.
REINFORCING STEEL		
BARREL	23735	LBS.
WINGS ETC.	1876	LBS.
TOTAL	25611	LBS.
FOUNDATION CONDITIONING MATERIAL	160	TONS
CULVERT EXCAVATION	LUMP SUM	
REMOVAL OF EXISTING STRUCTURE	LUMP SUM	

HYDRAULIC DATA

DESIGN DISCHARGE	= 800 CFS
FREQUENCY OF DESIGN FLOOD	= 25 YRS.
DESIGN HIGH WATER ELEVATION	= 605.4
DRAINAGE AREA	= 0.94 SQ. MI.
BASE DISCHARGE (Q100)	= 1220 CFS
BASE HIGH WATER ELEVATION	= 607.6

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE	= 1720 + CFS
FREQUENCY OF OVERTOPPING FLOOD	= 500 + YRS.
OVERTOPPING FLOOD ELEVATION	= 611.0 *

GRADE DATA

GRADE POINT ELEVATION @ STA. 19+77.00 -Y10-	= 612.02'
BED ELEVATION @ STA. 19+77.00 -Y10-	= 597.74'
ROADWAY FILL SLOPES	= 2:1

*OVERTOPS PROP. ROADWAY @ STA. 18+40 -Y10-

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

NOTES

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

MINIMUM DESIGN FILL---------- 5.94'

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.

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.

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

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 SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR CONSTRUCTION SEQUENCE, SEE EROSION CONTROL PLANS.

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 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.

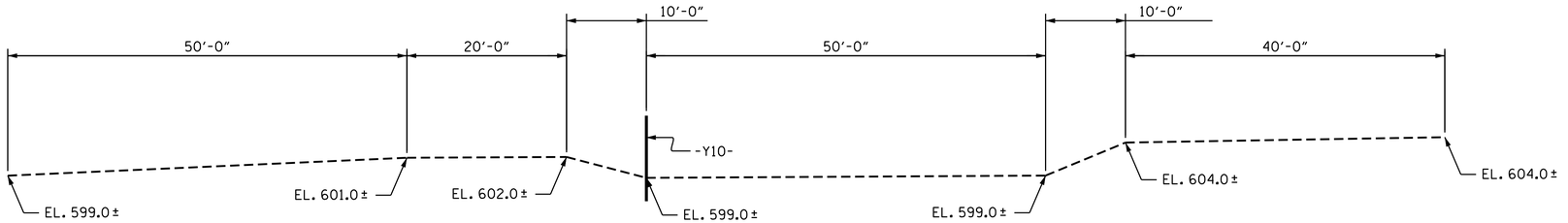
FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.

THE EXISTING WOODEN BRIDGE LOCATED 125' DOWNSTREAM FROM 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.

PROJECT NO. U-3109A
ALAMANCE COUNTY
STATION: 19+77.00 -Y10-

SHEET 1 OF 5 CULVERT #438



PROFILE ALONG ℄ CULVERT

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD
DocuSigned by: F24583893OBF40E...
3/16/2017

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BARREL STANDARD
DOUBLE 10 FT.X 8 FT.
CONCRETE BOX CULVERT

48° SKEW

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

ASSEMBLED BY : A.C. OUTLAW	DATE : 4/25/14	SPECIAL
CHECKED BY : W. F. PARKER	DATE : 5/14	
DRAWN BY : C.O. CUEVAS	DATE : 8-28-90	STANDARD
CHECKED BY : M.A.J.	DATE : 10-2-90	

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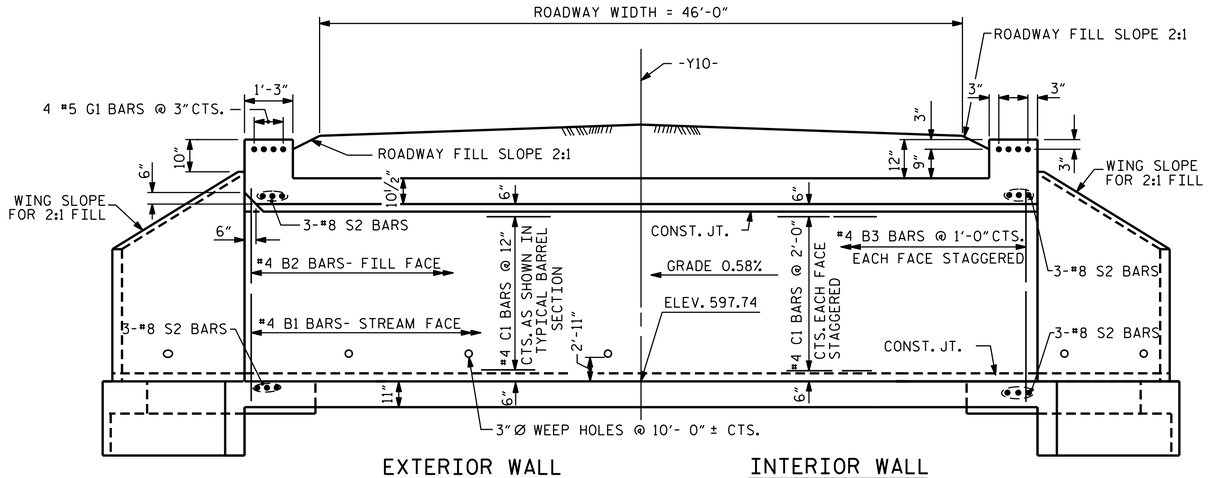
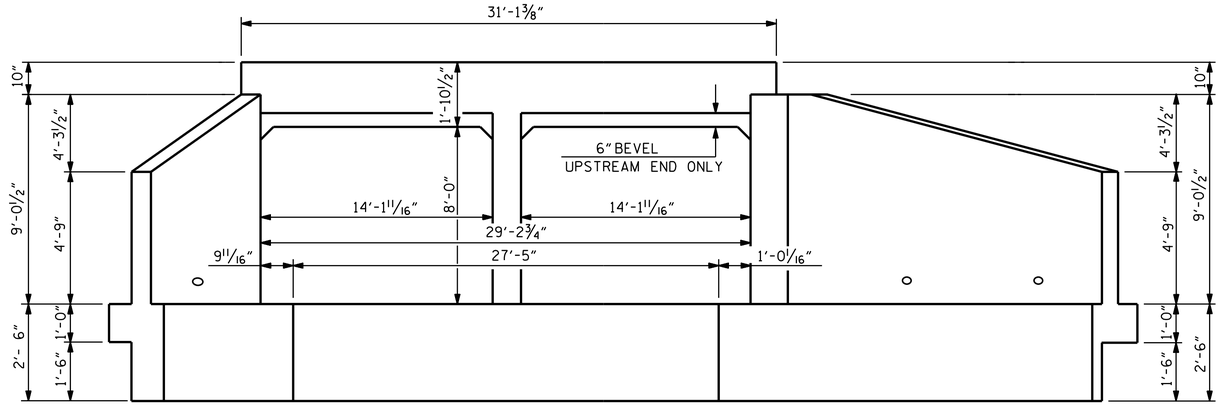
kalford

STD. NO. CB42A

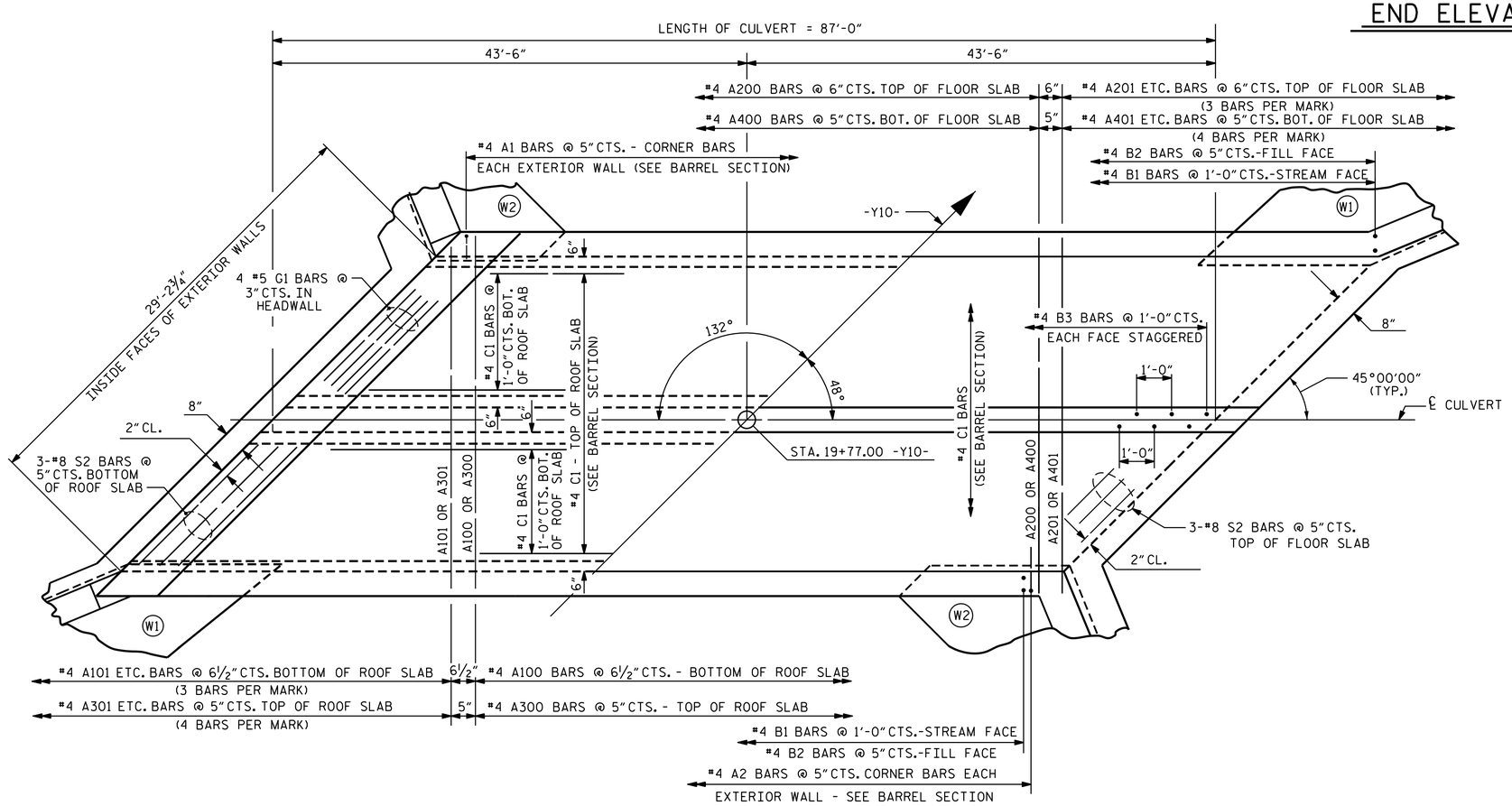


EXTERIOR WALL INTERIOR WALL

CULVERT SECTION NORMAL TO ROADWAY



END ELEVATION NORMAL TO SKEW



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB

SILLS NOT SHOWN FOR CLARITY
SEE SHEET 3 OF 5 FOR SILL DETAILS

I HEREBY CERTIFY THESE PLANS ARE THE AS-BUILT PLANS

PROJECT NO. U-3109A
ALAMANCE COUNTY
STATION: 19+77.00 -Y10-

SHEET 2 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

BARREL STANDARD DOUBLE 10 FT. X 8 FT. CONCRETE BOX CULVERT

48° SKEW

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KEITH W. ALFORD

DocuSigned by: F245838930BF40E...
3/16/2017

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

STD. NO. CB42

ASSEMBLED BY : A.C. OUTLAW	DATE : 4/25/14	SPECIAL
CHECKED BY : W. F. PARKER	DATE : 5/14	
DRAWN BY : DANNY SHERRED	DATE : 4-11-72	STANDARD
CHECKED BY : HASON A. JUDEH	DATE : 4-17-72	

REVISED 11-19-99 BY M.M. CHECKED BY R.W.W.
REDRAWN 11-90 BY C.O.C. CHECKED BY M.A.J.

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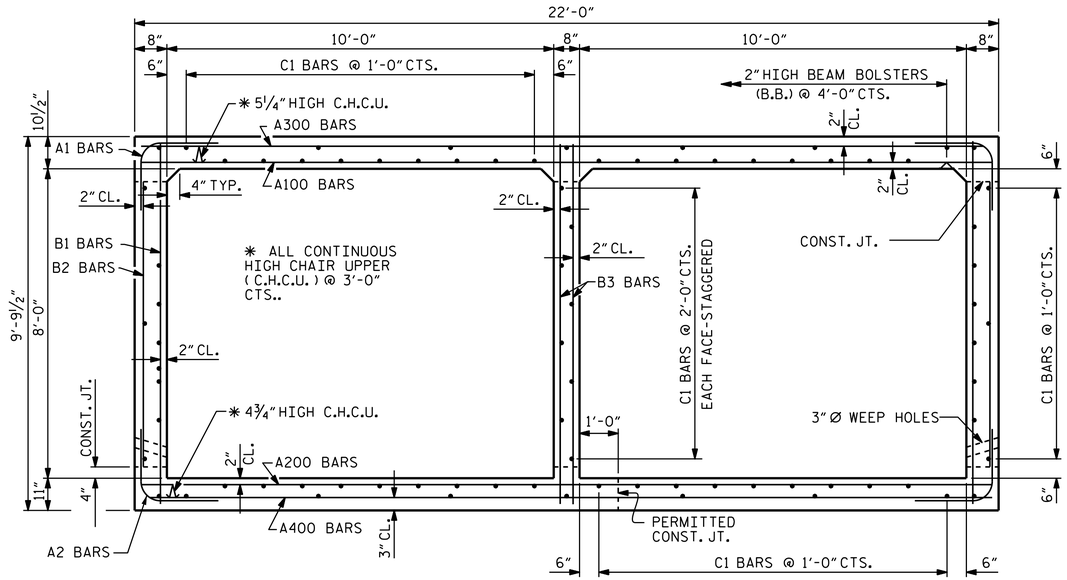
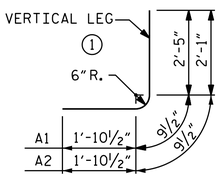


RIGHT ANGLE SECTION OF BARREL

THERE ARE 80 "C" BARS IN SECTION OF BARREL.
(4 BAR RUNS)

BAR TYPE



BAR DIMENSIONS ARE OUT TO OUT

SPLICE LENGTH CHART

BAR	SIZE	SPLICE LENGTH
A200	4	1'-5"
A400	4	1'-9"
B1	4	1'-5"
B3	4	1'-5"
C1	4	1'-11"

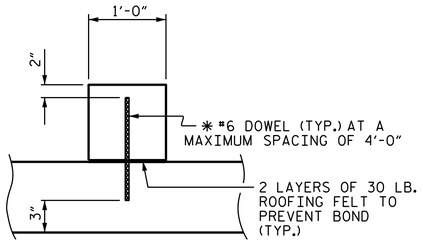
REINFORCING STEEL BAR SCHEDULE

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A100	120	4	STR	21'-7"	1730	A400	156	4	STR	21'-7"	2249
A101	6	4	STR	19'-11"	80	A401	8	4	STR	19'-11"	106
A102	6	4	STR	18'-4"	73	A402	8	4	STR	18'-3"	98
A103	6	4	STR	16'-8"	67	A403	8	4	STR	16'-7"	89
A104	6	4	STR	15'-1"	60	A404	8	4	STR	14'-11"	80
A105	6	4	STR	13'-5"	54	A405	8	4	STR	13'-3"	71
A106	6	4	STR	11'-10"	47	A406	8	4	STR	11'-7"	62
A107	6	4	STR	10'-2"	41	A407	8	4	STR	9'-11"	53
A108	6	4	STR	8'-7"	34	A408	8	4	STR	8'-3"	44
A109	6	4	STR	6'-11"	28	A409	8	4	STR	6'-7"	35
A110	6	4	STR	5'-4"	21	A410	8	4	STR	4'-11"	26
A111	6	4	STR	3'-8"	15	A411	8	4	STR	3'-3"	17
A112	6	4	STR	2'-1"	8						
						A1	418	4	1	5'-1"	1419
A200	130	4	STR	21'-7"	1874	A2	418	4	1	4'-9"	1326
A201	6	4	STR	20'-1"	80						
A202	6	4	STR	18'-7"	74	B1	174	4	STR	9'-3"	1075
A203	6	4	STR	17'-1"	68	B2	418	4	STR	7'-4"	2048
A204	6	4	STR	15'-7"	62	B3	174	4	STR	9'-3"	1075
A205	6	4	STR	14'-1"	56						
A206	6	4	STR	12'-7"	50	C1	320	4	STR	23'-3"	4970
A207	6	4	STR	11'-1"	44						
A208	6	4	STR	9'-7"	38	D1	6	6	STR	2'-6"	23
A209	6	4	STR	8'-1"	32						
A210	6	4	STR	6'-7"	26	G1	8	5	STR	30'-7"	255
A211	6	4	STR	5'-1"	20						
A212	6	4	STR	3'-7"	14	S2	12	8	STR	30'-7"	980
A213	6	4	STR	2'-1"	8						
						REINFORCING STEEL				LBS.	23735
A300	156	4	STR	21'-7"	2249						
A301	8	4	STR	19'-11"	106						
A302	8	4	STR	18'-3"	98						
A303	8	4	STR	16'-7"	89						
A304	8	4	STR	14'-11"	80						
A305	8	4	STR	13'-3"	71						
A306	8	4	STR	11'-7"	62						
A307	8	4	STR	9'-11"	53						
A308	8	4	STR	8'-3"	44						
A309	8	4	STR	6'-7"	35						
A310	8	4	STR	4'-11"	26						
A311	8	4	STR	3'-3"	17						

NOTES

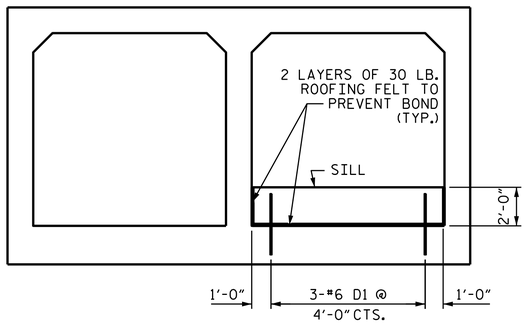
NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM OR FLOODPLAIN AT THE PROJECT SITE DURING CONSTRUCTION. RIP-RAP MAY BE USED TO SUPPLEMENT THE NATIVE MATERIAL IN THE HIGH FLOW CULVERT BARREL(S). IF RIP-RAP IS USED TO LINE THE HIGH FLOW CULVERT BARREL(S), NATIVE MATERIAL SHOULD BE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

DO NOT SET ELEVATION OF HIGH SILL ABOVE THE BANK FULL.

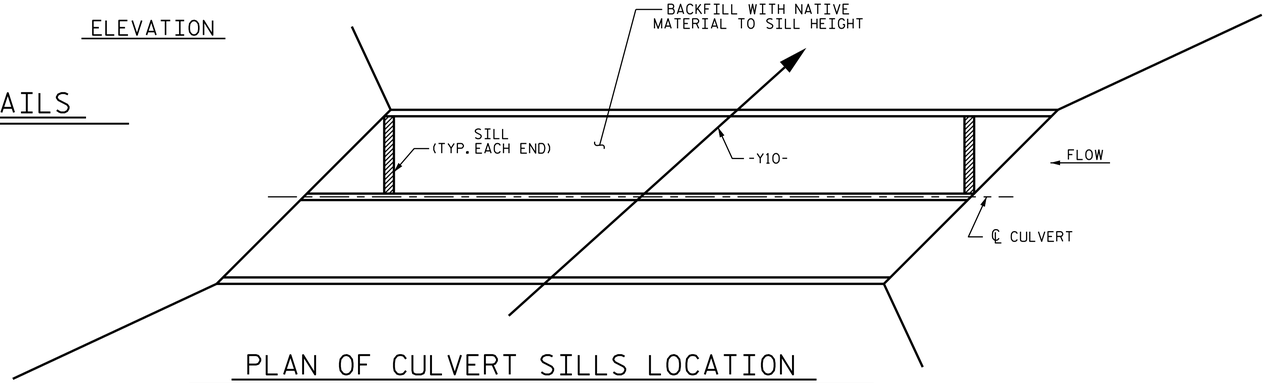


SECTION THROUGH SILL

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



ELEVATION



PLAN OF CULVERT SILLS LOCATION

CULVERT SILL DETAILS

PROJECT NO. U-3109A
ALAMANCE COUNTY
STATION: 19+77.00 -Y10-

SHEET 3 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

CULVERT DETAILS

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F2458389 0BF40E...
3/16/2017

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REVISIONS						SHEET NO.
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DRAWN BY : A.C. OUTLAW DATE : 4/25/14
CHECKED BY : W. F. PARKER DATE : 5/14
DESIGN ENGINEER OF RECORD: K.W. ALFORD DATE : 2/17

16-MAR-2017 11:40
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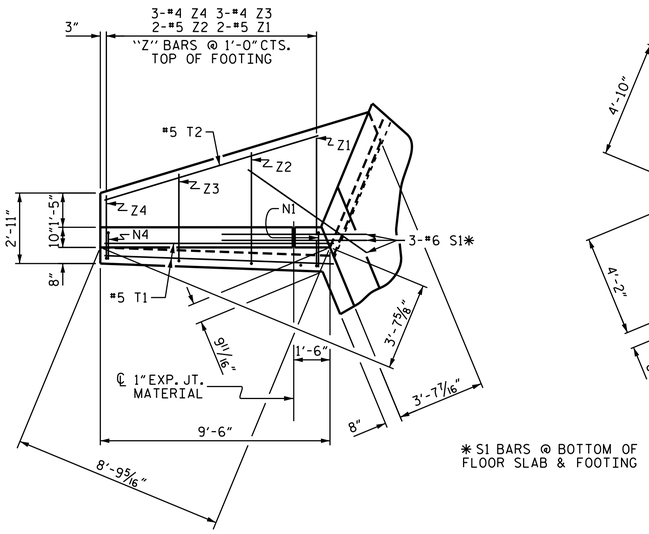
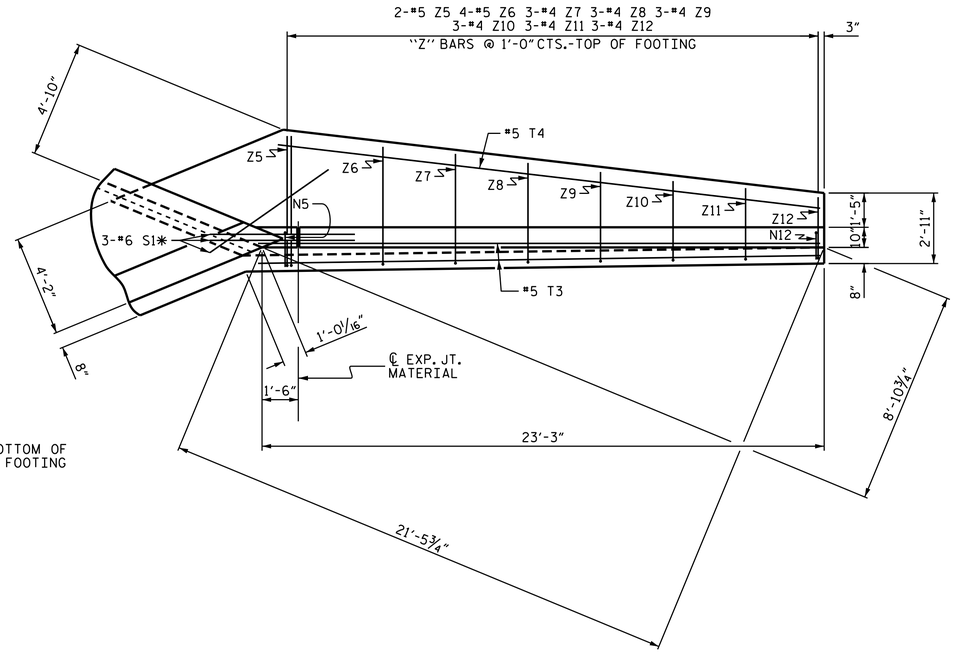
kalford

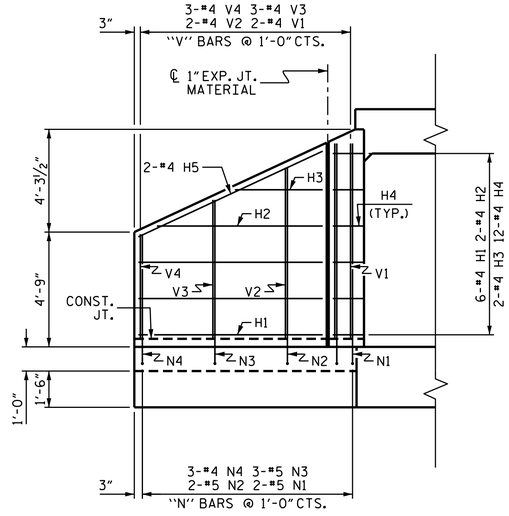


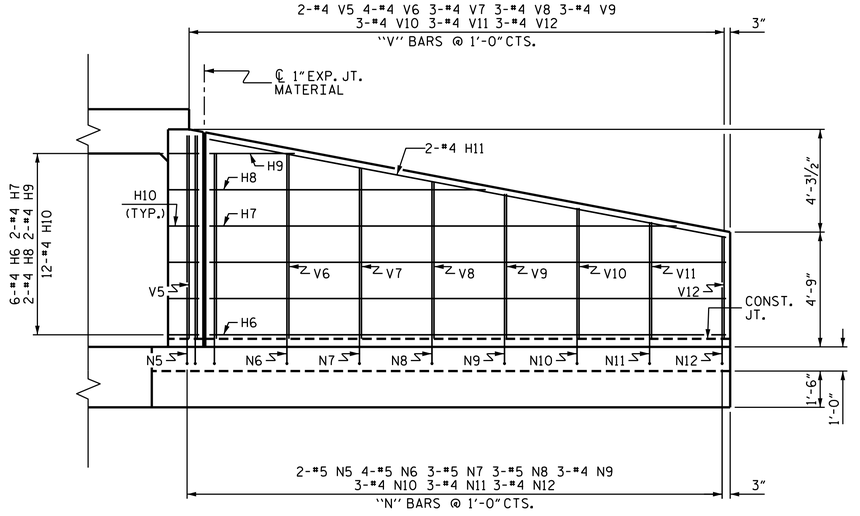


* S1 BARS @ BOTTOM OF FLOOR SLAB & FOOTING

PLAN W2

PLAN W1



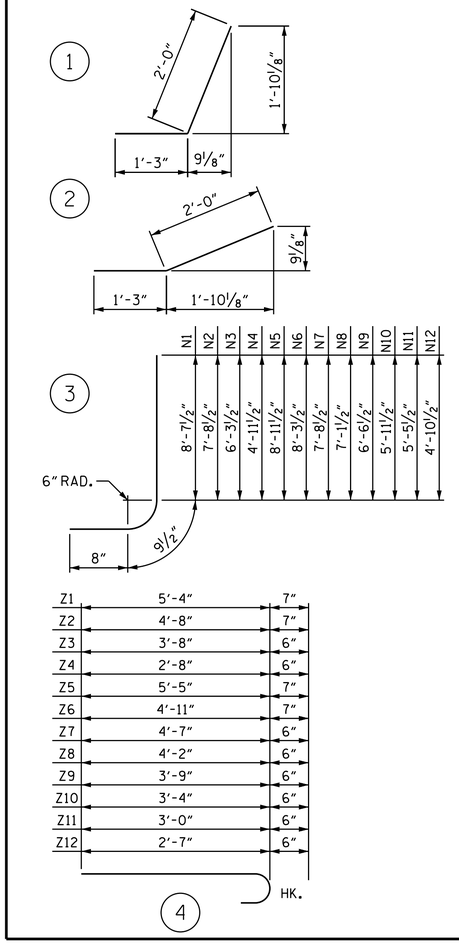


ELEVATION W2

ELEVATION W1

BAR TYPES

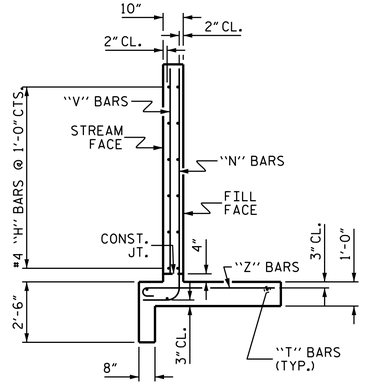
ALL BAR DIMENSIONS ARE OUT TO OUT.



BILL OF MATERIAL

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	7'-7"	61
H2	4	#4	STR	6'-10"	18
H3	4	#4	STR	3'-7"	10
H4	24	#4	1	3'-3"	52
H5	4	#4	STR	8'-5"	22
H6	12	#4	STR	21'-4"	171
H7	4	#4	STR	19'-4"	52
H8	4	#4	STR	11'-5"	31
H9	4	#4	STR	3'-6"	9
H10	24	#4	2	3'-3"	52
H11	4	#4	STR	21'-9"	58
N1	4	#5	3	10'-1"	42
N2	4	#5	3	9'-2"	38
N3	6	#5	3	7'-9"	48
N4	6	#4	3	6'-5"	26
N5	4	#5	3	10'-5"	43
N6	8	#5	3	9'-9"	81
N7	6	#5	3	9'-2"	57
N8	6	#5	3	8'-7"	54
N9	6	#4	3	8'-0"	32
N10	6	#4	3	7'-5"	30
N11	6	#4	3	6'-11"	28
N12	6	#4	3	6'-4"	25
S1	12	#6	STR	6'-0"	108
T1	4	#5	STR	9'-6"	40
T2	2	#5	STR	9'-3"	19
T3	4	#5	STR	23'-3"	97
T4	2	#5	STR	22'-7"	47
V1	4	#4	STR	8'-1"	22
V2	4	#4	STR	7'-1"	19
V3	6	#4	STR	5'-9"	23
V4	6	#4	STR	4'-4"	17
V5	4	#4	STR	8'-5"	22
V6	8	#4	STR	7'-8"	41
V7	6	#4	STR	7'-1"	28
V8	6	#4	STR	6'-6"	26
V9	6	#4	STR	6'-0"	24
V10	6	#4	STR	5'-5"	22
V11	6	#4	STR	4'-10"	19
V12	6	#4	STR	4'-3"	17
Z1	4	#5	4	5'-11"	25
Z2	4	#5	4	5'-3"	22
Z3	6	#4	4	4'-2"	17
Z4	6	#4	4	3'-2"	13
Z5	4	#5	4	6'-0"	25
Z6	8	#5	4	5'-6"	46
Z7	6	#4	4	5'-1"	20
Z8	6	#4	4	4'-8"	19
Z9	6	#4	4	4'-3"	17
Z10	6	#4	4	3'-10"	15
Z11	6	#4	4	3'-6"	14
Z12	6	#4	4	3'-1"	12

REINFORCING STEEL FOR 4 WINGS	1876 LBS
CLASS A CONCRETE	
4 WINGS	29.1 CY
2 HEADWALLS	2.9 CY
2 END CURTAIN WALLS	3.4 CY
TOTAL	35.4 CY



TYPICAL WING SECTION

PROJECT NO. U-3109A

ALAMANCE COUNTY

STATION: 19+77.00 -Y10-

SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD WINGS FOR CONCRETE BOX CULVERT

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

45° OR 135° SKEW

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

DocuSigned by: F245838930BF40E...

3/16/2017

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REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C3-4
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ASSEMBLED BY :	A.C. OUTLAW	DATE : 4/25/14
CHECKED BY :	W.F. PARKER	DATE : 5/14
DRAWN BY :	CCJ 01/00	
CHECKED BY :	RWW 03/00	

16-MAR-2017 11:41
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kalford

STD. NO. CW4508

LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS

LEVEL		VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING (#)	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE									COMMENT NUMBER
							LIVE-LOAD FACTORS (γ_{LL})	MOMENT				SHEAR				
								RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	RATING FACTOR	BOX NO.	ELEMENT TYPE	DISTANCE FROM LEFT END OF ELEMENT (ft)	
DESIGN LOAD RATING		HL-93 (INVENTORY)	N/A	1	1.02	--	1.75	1.02	1	TOP SLAB	4.80	1.34	1	TOP SLAB	9.70	
		HL-93 (OPERATING)	N/A		1.32	--	1.35	1.32	1	TOP SLAB	4.80	1.74	1	TOP SLAB	9.70	
		HS-20 (INVENTORY)	36.000	2	1.33	47.70	1.75	1.33	1	TOP SLAB	4.53	1.44	1	BOTTOM SLAB	9.67	
		HS-20 (OPERATING)	36.000		1.72	61.84	1.35	1.72	1	TOP SLAB	4.53	1.86	1	BOTTOM SLAB	9.67	
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		2.40	32.40	1.40	2.40	1	TOP SLAB	4.53	2.87	1	TOP SLAB	9.70	
		SNGARBS2	20.000		2.25	44.96	1.40	2.25	1	TOP SLAB	4.53	2.64	1	TOP SLAB	9.70	
		SNAGRIS2	22.000		2.40	52.79	1.40	2.40	1	TOP SLAB	4.53	2.63	1	BOTTOM SLAB	9.67	
		SNCOTTS3	27.250	3	1.27	34.67	1.40	1.27	1	TOP SLAB	4.53	1.66	1	TOP SLAB	9.70	
		SNAGGRS4	34.925		1.57	54.73	1.40	1.57	1	TOP SLAB	4.80	1.80	1	BOTTOM SLAB	9.67	
		SNS5A	35.550		1.47	52.32	1.40	1.47	1	TOP SLAB	4.53	1.73	1	TOP SLAB	9.70	
		SNS6A	39.950		1.47	58.80	1.40	1.47	1	TOP SLAB	4.53	1.71	1	BOTTOM SLAB	9.67	
		SNS7B	42.000		1.53	64.10	1.40	1.53	1	TOP SLAB	4.53	1.68	1	BOTTOM SLAB	9.67	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.12	69.92	1.40	2.40	1	TOP SLAB	4.53	2.12	1	BOTTOM SLAB	9.67	
		TNT4A	33.075		1.51	50.04	1.40	1.51	1	TOP SLAB	4.53	1.97	1	TOP OF SLAB	9.70	
		TNT6A	41.600		1.57	65.13	1.40	1.57	1	TOP SLAB	4.80	1.73	1	TOP OF SLAB	9.70	
		TNT7A	42.000		1.63	68.58	1.40	1.63	1	TOP SLAB	4.53	1.84	1	TOP OF SLAB	9.70	
		TNT7B	42.000		1.51	63.54	1.40	1.51	1	TOP SLAB	4.53	1.80	1	TOP OF SLAB	9.70	
		TNAGRIT4	43.000		1.44	62.11	1.40	1.44	1	TOP SLAB	4.53	1.77	1	BOTTOM SLAB	9.67	
		TNAGT5A	45.000		1.48	66.42	1.40	1.48	1	TOP SLAB	4.53	1.60	1	BOTTOM SLAB	9.67	
		TNAGT5B	45.000		1.51	67.74	1.40	1.51	1	TOP SLAB	4.53	1.51	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.

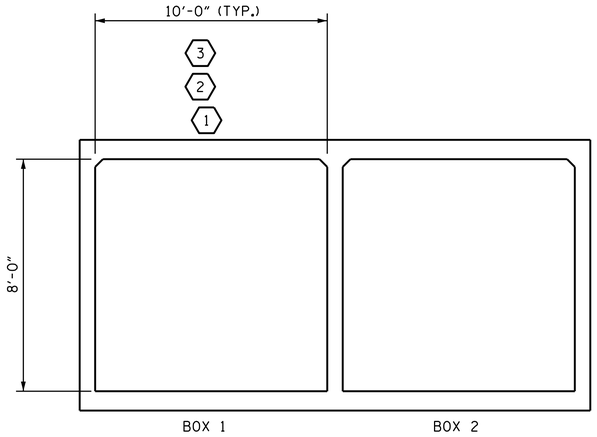
(#) CONTROLLING LOAD RATING

(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-3109A

ALAMANCE COUNTY

STATION: 19+77.00 -Y10-

SHEET 5 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

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

NORTH CAROLINA PROFESSIONAL SEAL 29441 ENGINEER KRISTY W. ALFORD

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3/16/2017

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2			4			5

STD. NO. LRFR5

ASSEMBLED BY : A.C OUTLAW DATE : 4/24/14
CHECKED BY : K.W. ALFORD DATE : 2/17

DRAWN BY : WMC 7/11
CHECKED BY : GM 7/11

REV. 10/1/11 MAA/GM

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