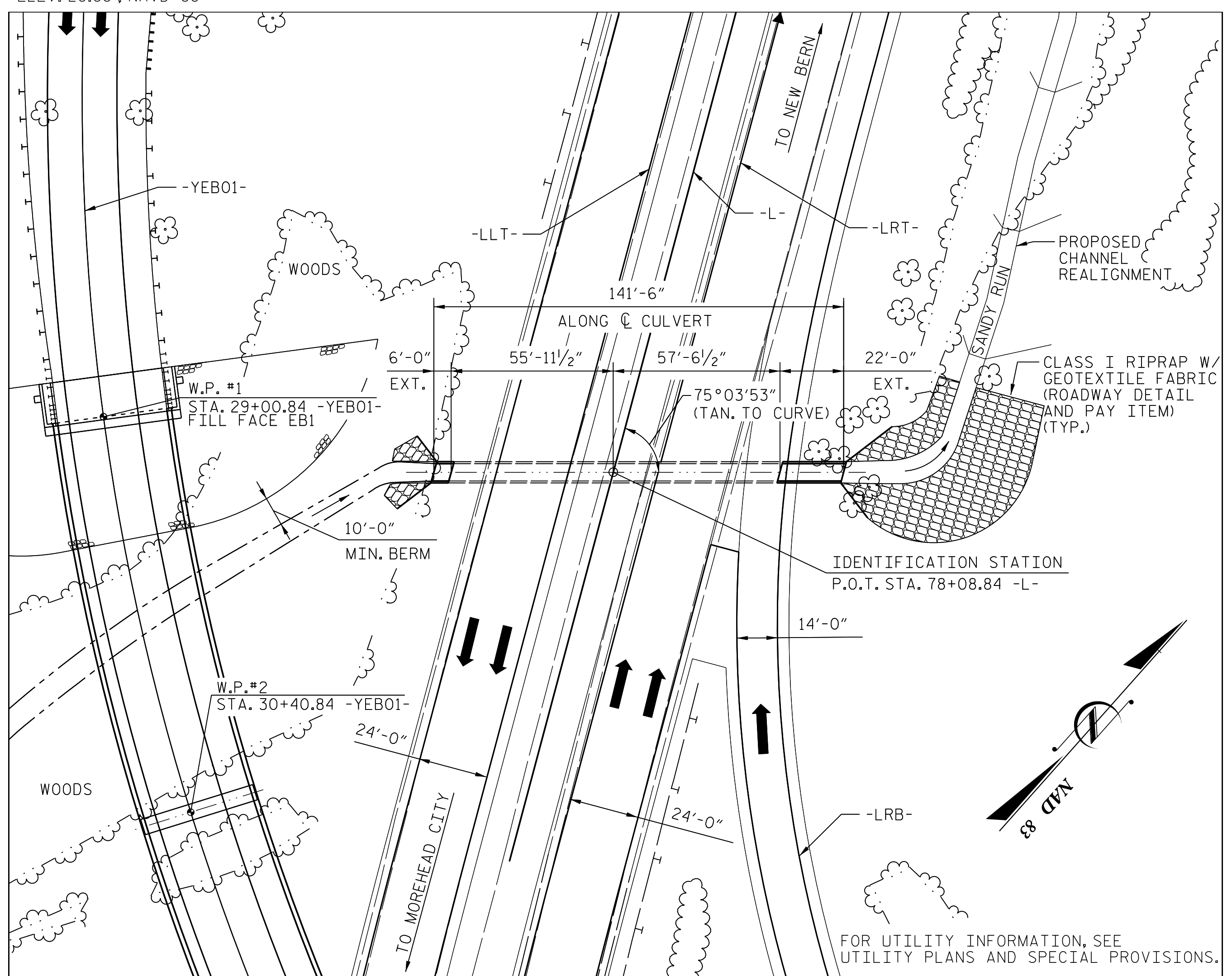


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BENCH MARK: BM #8 - RR SPIKE IN LIGHT POLE ID# 129M02. -L- STA. 70+55.80, 137.2' RT  
ELEV. 28.88', NAVD 88



GRADE PT. ELEV. @ STA. 78+08.84 -L- = 27.70  
BED ELEV. @ STA. 78+08.84 -L- = 19.44  
ROADWAY SLOPES = 3:1 LT; 4:1 RT

LOCATION SKETCH

### HYDRAULIC DATA

DESIGN DISCHARGE	120	CFS
FREQUENCY OF DESIGN FLOOD	50	YR.
DESIGN HIGH WATER ELEVATION	23.4	FT.
BASE DISCHARGE (Q 100)	150	CFS
BASE FREQUENCY	100	YR.
BASE HIGH WATER ELEVATION	23.8	FT.

### OVERTOPPING FLOOD DATA

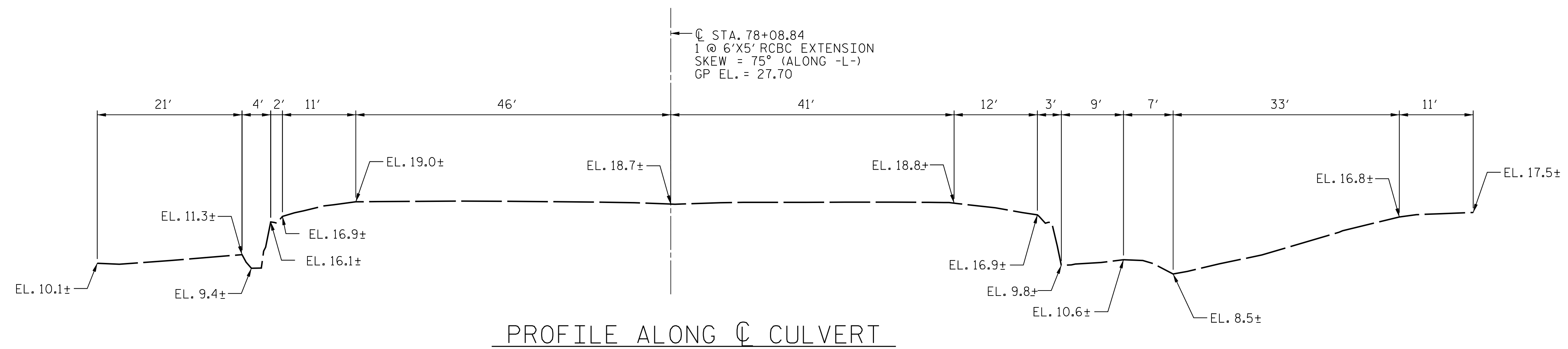
OVERTOPPING DISCHARGE	415	CFS
FREQUENCY OF OVERTOPPING FLOOD	500	YR.
OVERTOPPING FLOOD ELEVATION	29.2	FT.

### TOTAL STRUCTURE QUANTITIES

CLASS A CONCRETE		
BARREL @ 0.6173	CY/FT	17.3 C.Y.
EDGE BEAMS		1.2 C.Y.
WING ETC.		21.0 C.Y.
TOTAL		39.5 C.Y.
EPOXY COATED REINFORCING STEEL		
BARREL		4181 LBS.
WINGS ETC.		1922 LBS.
TOTAL		6105 LBS.
FOUNDATION CONDITIONING MATERIAL		14.5 TONS
CULVERT EXCAVATION		LUMP SUM

**NOTES:**

- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- DESIGN FILL----- 5 FT.
- 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 SHEETS.
- TRANSVERSE CONSTRUCTION JOINTS SHALL BE USED IN THE BARREL. SPACED TO LIMIT THE POURS TO A MAXIMUM OF 70 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL AND BOTH FACES OF INTERIOR WALLS ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- DOWELS SHALL BE USED TO CONNECT THE CULVERT EXTENSION TO THE EXISTING CULVERT AS SHOWN. FOR NOTE REGARDING SETTING OF DOWELS, SEE SHEET SN.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- ALL BAR SUPPORTS USED IN THE CULVERT BARREL AND WINGS AND ALL INCIDENTAL REINFORCING STEEL SHALL BE EPOXY COATED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
- FOR OTHER DESIGN DATA AND GENERAL NOTES, SEE SHEET SN.



PROFILE ALONG CULVERT

DRAWN BY : NKB DATE : 03/16  
CHECKED BY : JCM DATE : 03/16  
DESIGN E.O.R. : JCM DATE : 05/16

DOCUMENT NOT CONSIDERED  
FINAL UNLESS ALL  
SIGNATURES COMPLETED



PROJECT NO. R-5516  
CRAVEN COUNTY  
STATION: 78+08.84 -L-  
SHEET 1 OF 7

STATE OF NORTH CAROLINA  
**DEPARTMENT OF TRANSPORTATION**  
RALEIGH  
BARREL STANDARD

SINGLE 6 FT. X 5 FT.  
CONCRETE BOX CULVERT EXTENSION  
75° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			C1-1 TOTAL SHEETS 7
2			4			

DATE: 4/7/2017 TIME: 2:46:38 PM  
USER: jcm16032454-Strucum Road400\_Technical\408\_Structure\Cadd\Culverts\411\_005\_01-L\_R5516\_S1U\_L0C.dgn



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

LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM FACTORS	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER		
						LIVE-LOAD FACTORS (γ <sub>LL</sub> )	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	1.53	--	1.75	1.53	1	TOP SLAB	5.67	2.63	1	BOTT. SLAB	0.67		
	HL-93 (OPERATING)	N/A		1.99	--	1.35	1.99	1	TOP SLAB	5.67	3.42	1	BOTT. SLAB	0.67		
	HS-20 (INVENTORY)	36.000	②	1.65	59.4	1.75	1.65	1	TOP SLAB	5.67	2.32	1	BOTT. SLAB	0.67		
	HS-20 (OPERATING)	36.000		2.14	77.0	1.35	2.14	1	TOP SLAB	5.67	3.01	1	BOTT. SLAB	0.67		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		2.23	30.04	1.40	2.23	1	TOP SLAB	5.67	3.83	1	BOTT. SLAB	0.67	1	
		SNGARBS2	20.000		2.08	41.67	1.40	2.08	1	TOP SLAB	5.67	3.58	1	BOTT. SLAB	0.67	1
		SNAGRIS2	22.000		2.23	48.96	1.40	2.23	1	TOP SLAB	5.67	3.83	1	BOTT. SLAB	0.67	1
		SNCOTTS3	27.250	③	1.53	41.69	1.40	1.53	1	TOP SLAB	5.67	2.63	1	BOTT. SLAB	0.67	1
		SNAGGRS4	34.925		2.01	70.3	1.40	2.01	1	TOP SLAB	5.67	3.46	1	BOTT. SLAB	0.67	1
		SNS5A	35.550		1.82	64.8	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		SNS6A	39.950		1.82	72.8	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		SNS7B	42.000		1.82	76.5	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.23	73.44	1.40	2.23	1	TOP SLAB	5.67	3.83	1	BOTT. SLAB	0.67	1
		TNT4A	33.075		1.82	60.2	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		TNT6A	41.600		1.82	75.8	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		TNT7A	42.000		1.82	76.5	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		TNT7B	42.000		1.82	76.5	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		TNAGRIT4	43.000		1.82	78.3	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
		TNAGT5A	45.000		1.82	82.0	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1
TNAGT5B	45.000		1.82	82.0	1.40	1.82	1	TOP SLAB	5.67	3.13	1	BOTT. SLAB	0.67	1		

**LOAD FACTORS:**

DESIGN LOAD RATING FACTORS

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

**NOTE:**

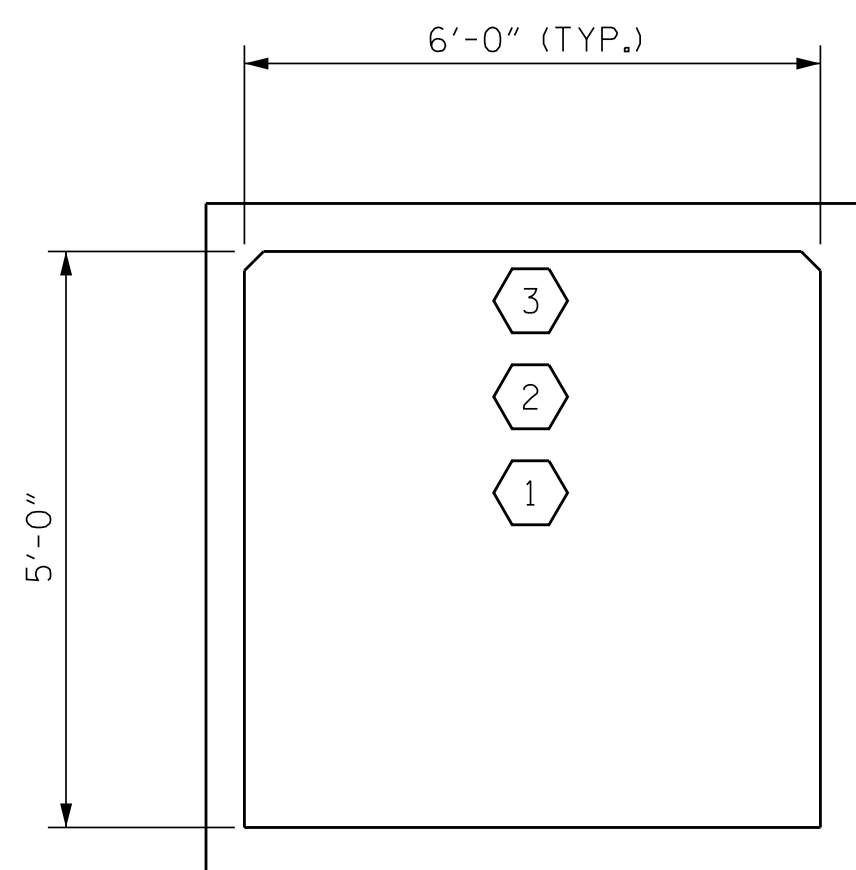
RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

**COMMENTS:**

1. FILL DEPTH IS SUCH THAT, PER LRFD 3.6.1.2.6, LIVE LOAD IS NOT CONSIDERED TO CONTRIBUTE. THEREFORE, LEGAL LOAD RATING CORRESPONDS TO HL-93 DESIGN LOAD RATING.

- 2.
- 3.
- 4.

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



**LRFR SUMMARY**  
(LOOKING DOWNSTREAM)

PROJECT NO. R-5516  
CRAVEN COUNTY  
 STATION: 78+08.84 -L-  
 SHEET 2 OF 7

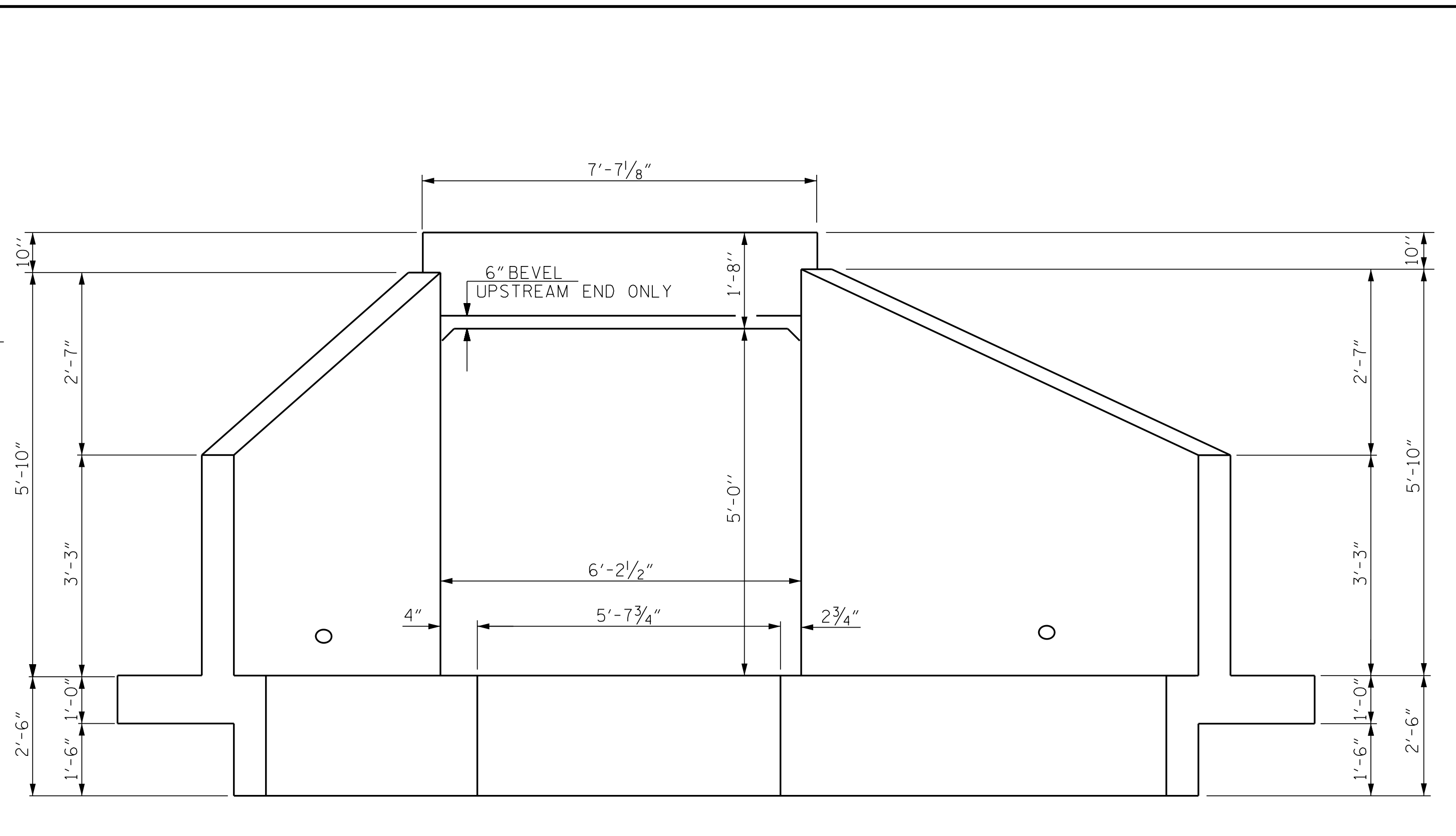
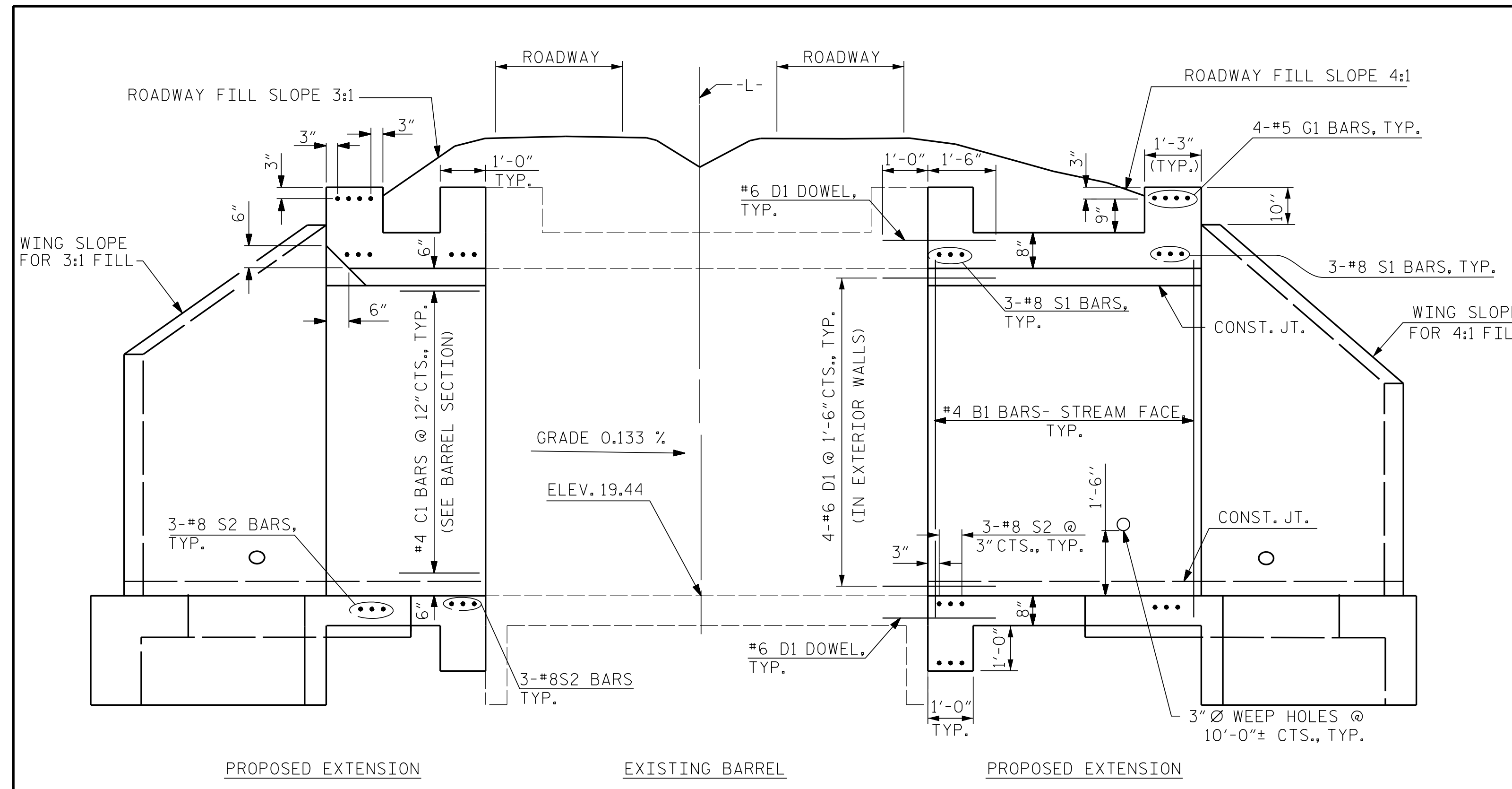
 <small>AECOM TECHNICAL SERVICES, INC. 701 CORPORATE CENTER DRIVE, SUITE 475 RALEIGH, NC 27607 (919) 854-8200 www.aecom.com AECOM License No. F-0352</small>		STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH STANDARD LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)	
		REVISIONS	
NO.	BY:	DATE:	NO.
1			3
2			4
			SHEET NO. <b>C1-2</b> TOTAL SHEETS <b>7</b>

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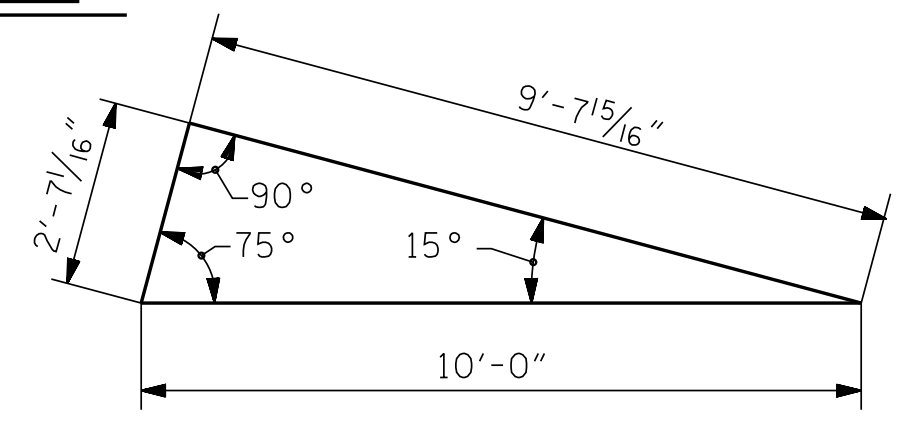
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ASSEMBLED BY : NKB	DATE : 03/16
CHECKED BY : JCM	DATE : 03/16
DRAWN BY : DST 02/15	REV.
CHECKED BY : JCM 02/15	

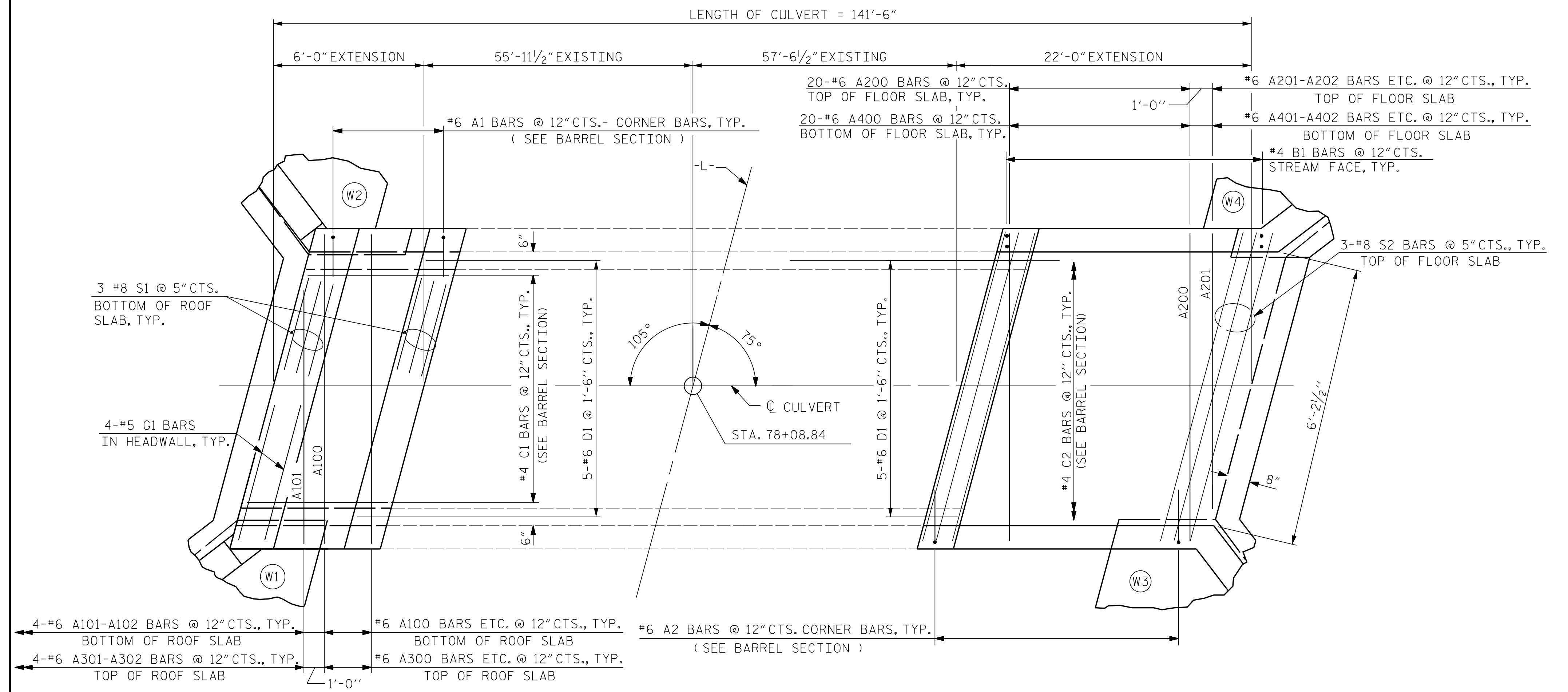


CULVERT SECTION NORMAL TO ROADWAY

END ELEVATION NORMAL TO SKEW



SKEW TRIANGLE



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB

PROJECT NO. R-5516  
 CRAVEN COUNTY  
 STATION: 78+08.84 -L-  
 SHEET 3 OF 7

**AECOM**  
 AECOM TECHNICAL SERVICES, INC.  
 701 CORPORATE CENTER DRIVE, SUITE 475  
 RALEIGH, NC 27607  
 (919) 854-6200 www.aecom.com  
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4/12/2017

NORTH CAROLINA PROFESSIONAL SEAL  
 030474  
 JOHN C. MORRISON  
 ENGINEER

DocuSign Envelope ID: A2FDE142C82F4AB

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
SINGLE 6FT. X 5FT. CONCRETE BOX CULVERT 75° SKEW					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		
SHEET NO.					C1-3
TOTAL SHEETS					7

DRAWN BY : NKB DATE : 03/16  
 CHECKED BY : JCM DATE : 03/16  
 DESIGN E.O.R. : JCM DATE : 05/16

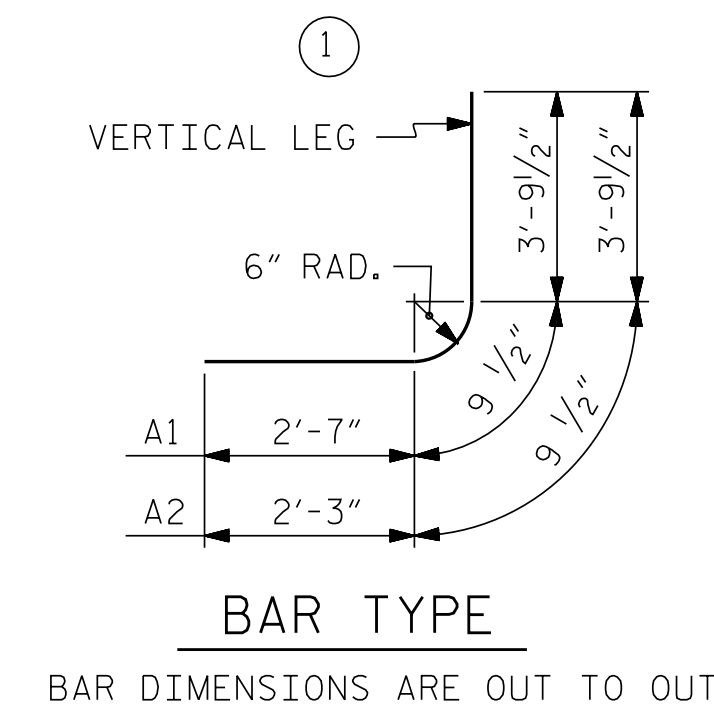
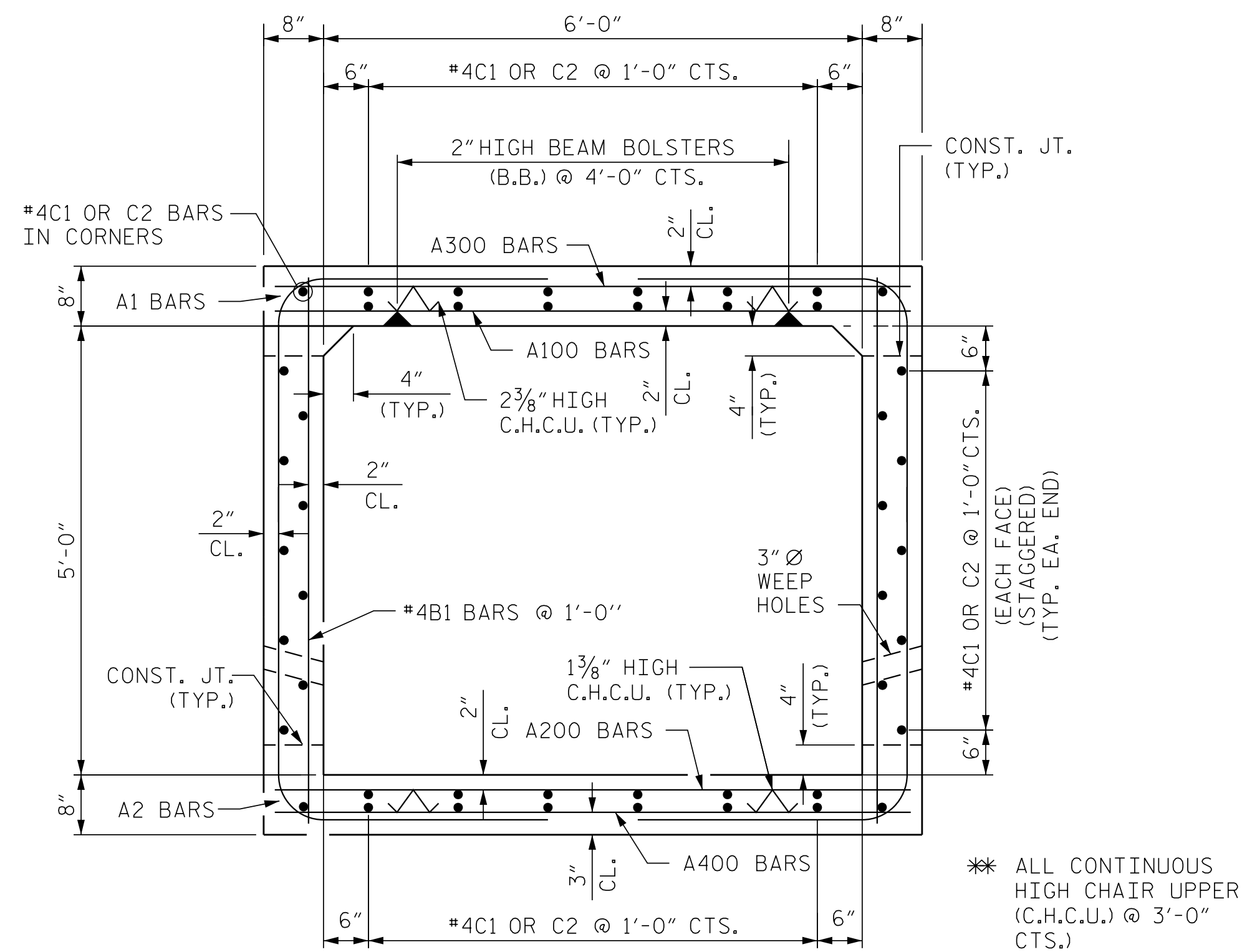
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REINFORCING STEEL SCHEDULE (LEFT EXTENSION)					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	12	#6	①	7'-2"	129
A2	12	#6	①	6'-10"	123
A100	4	#6	STR	7'-0"	43
A101	2	#6	STR	4'-8"	15
A102	2	#6	STR	1'-1"	4
A200	4	#6	STR	7'-0"	43
A201	2	#6	STR	4'-8"	15
A202	2	#6	STR	1'-1"	4
A300	4	#6	STR	7'-0"	43
A301	2	#6	STR	4'-8"	15
A302	2	#6	STR	1'-1"	4
A400	4	#6	STR	7'-0"	43
A401	2	#6	STR	4'-8"	15
A402	2	#6	STR	1'-1"	4
B1	12	#4	STR	6'-1"	49
C1	46	#4	STR	5'-8"	173
D1	18	#6	STR	2'-6"	68
G1	4	#5	STR	7'-3"	30
S1	6	#8	STR	7'-3"	117
S2	9	#8	STR	7'-3"	174
TOTAL EPOXY COATED REINFORCING STEEL					1111

REINFORCING STEEL SCHEDULE (RIGHT EXTENSION)					
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	44	#6	①	7'-2"	474
A2	44	#6	①	6'-10"	452
A100	20	#6	STR	7'-0"	211
A101	2	#6	STR	4'-9"	15
A102	2	#6	STR	1'-0"	4
A200	20	#6	STR	7'-0"	211
A201	2	#6	STR	4'-9"	15
A202	2	#6	STR	1'-0"	4
A300	20	#6	STR	7'-0"	211
A301	2	#6	STR	4'-9"	15
A302	2	#6	STR	1'-0"	4
A400	20	#6	STR	7'-0"	211
A401	2	#6	STR	4'-9"	15
A402	2	#6	STR	1'-0"	4
B1	44	#4	STR	6'-1"	177
C2	46	#4	STR	21'-8"	658
D1	18	#6	STR	2'-6"	68
G1	4	#5	STR	7'-3"	30
S1	6	#8	STR	7'-3"	117
S2	9	#8	STR	7'-3"	174
TOTAL EPOXY COATED REINFORCING STEEL					3070



RIGHT ANGLE SECTION OF BARREL  
(THERE ARE 46 "C" BARS IN SECTION OF BARREL)

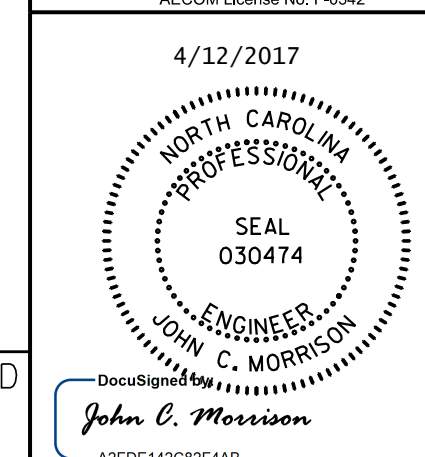
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DRAWN BY : NKB DATE : 03/16  
CHECKED BY : JCM DATE : 03/16  
DESIGN E.O.R. : JCM DATE : 05/16

PROJECT NO. R-5516  
CRAVEN COUNTY  
STATION: 78+08.84 -L-

SHEET 4 OF 7

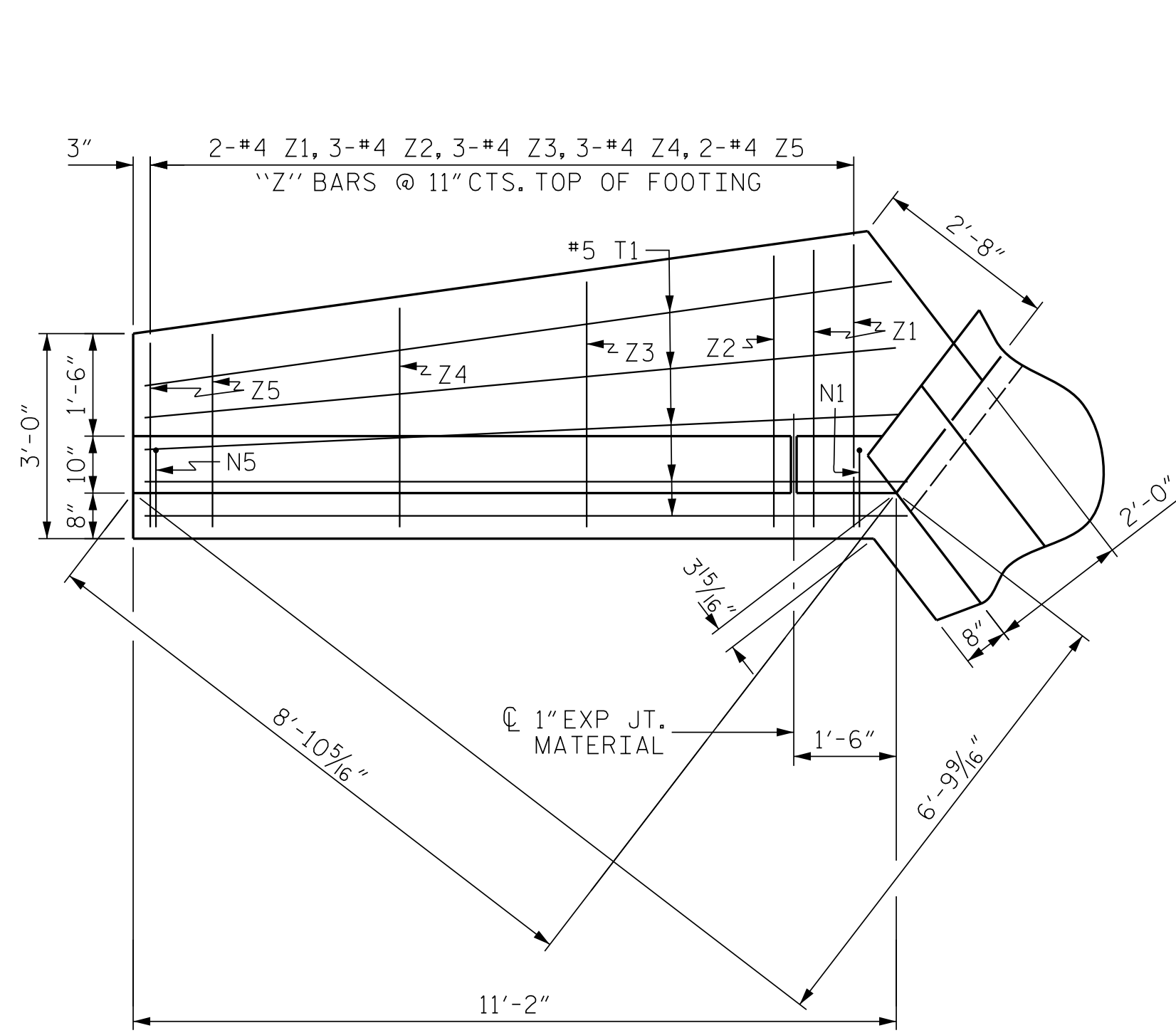


STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH

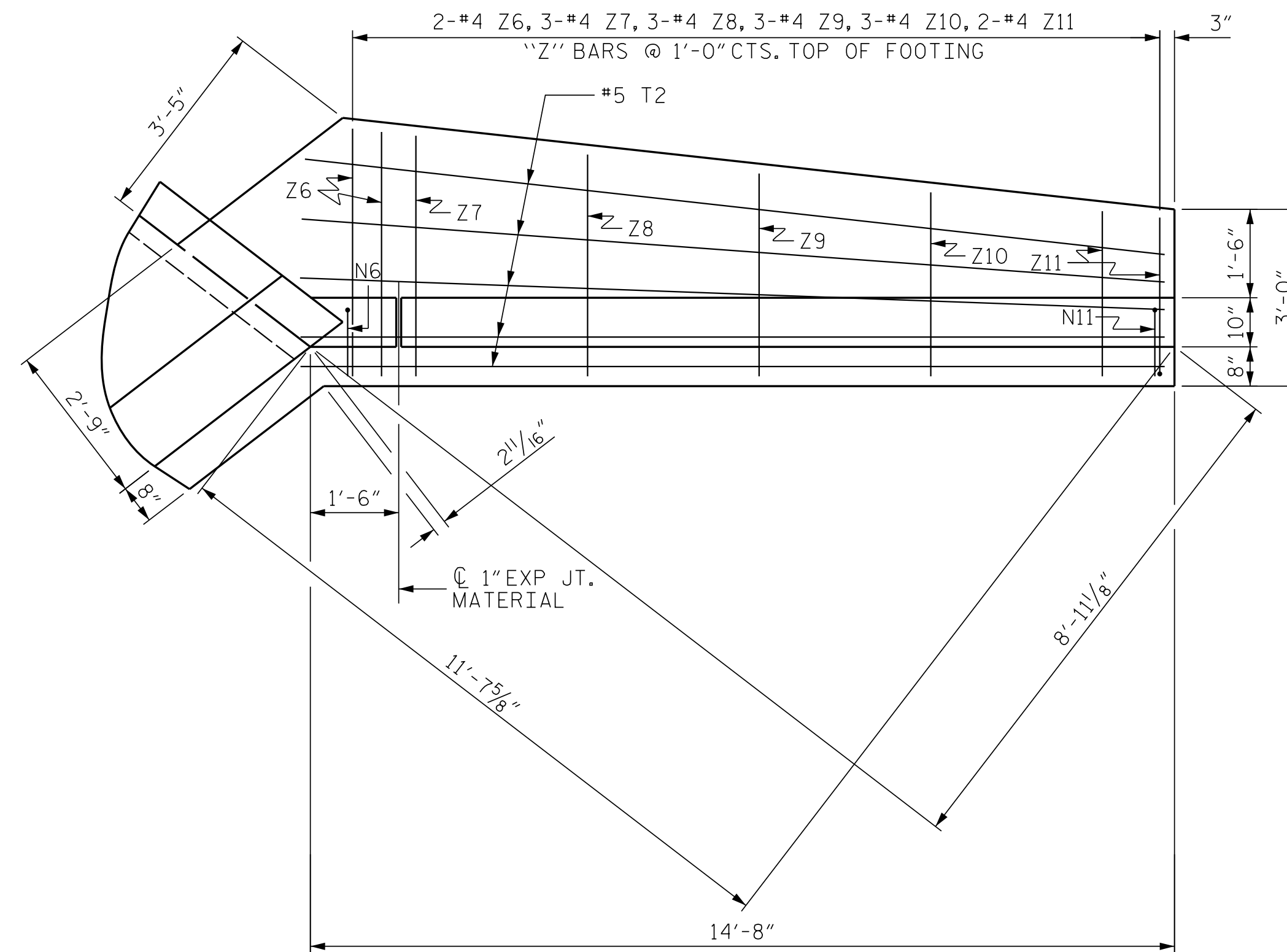
SINGLE 6FT. X 5FT.  
CONCRETE BOX CULVERT  
75° SKEW

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SIGNATURES COMPLETED

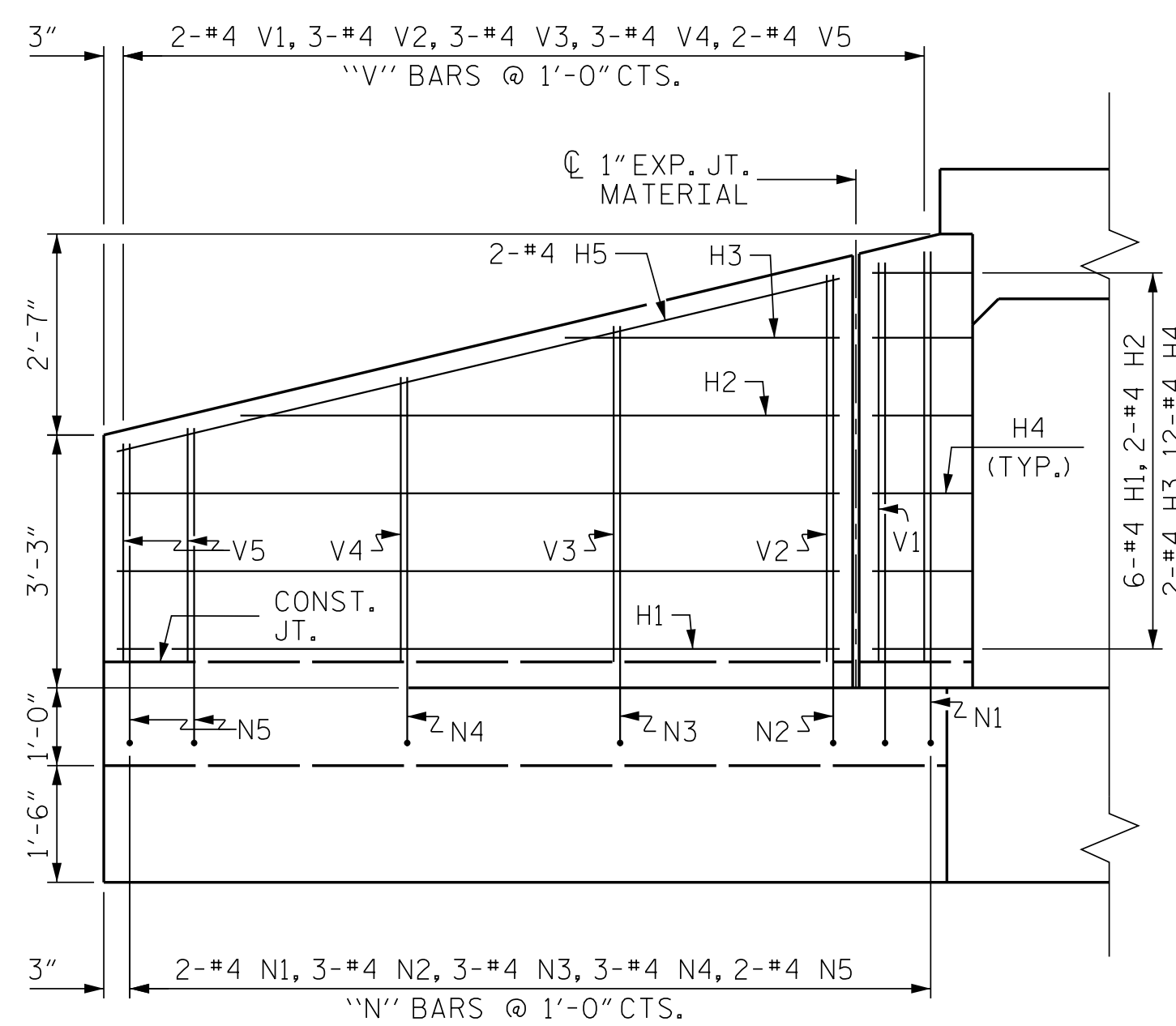
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NO.	BY:	DATE:	NO.	BY:	DATE:	C1-4
1			3			TOTAL SHEETS
2			4			7



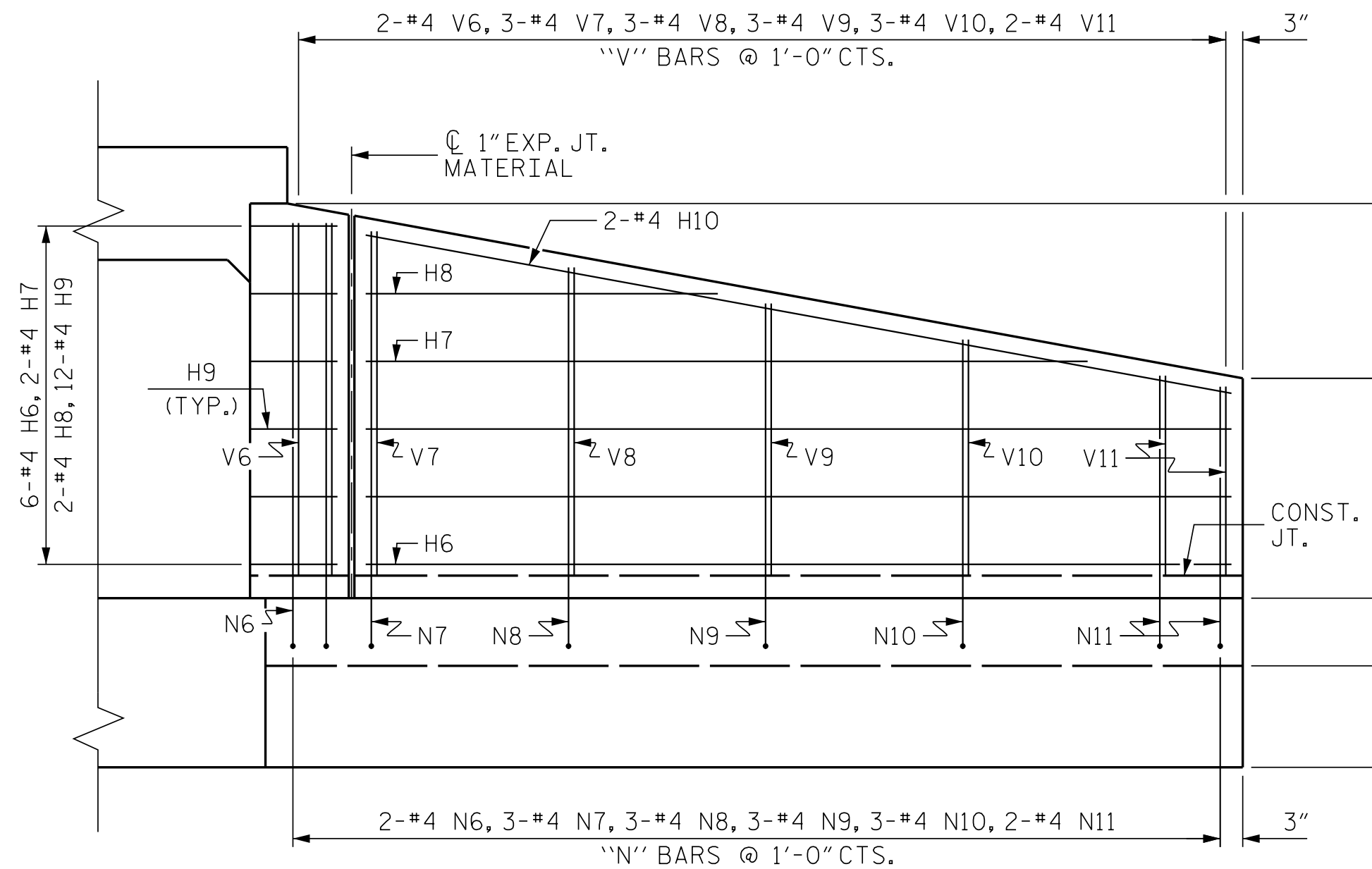
PLAN W2



PLAN W1

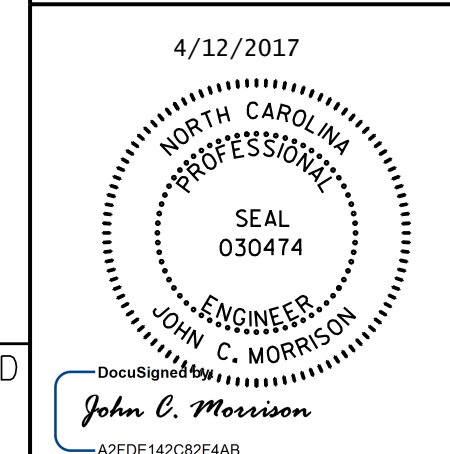


ELEVATION W2



ELEVATION W1

PROJECT NO. R-5516  
 CRAVEN COUNTY  
 STATION: 78+08.84 -L-  
 SHEET 5 OF 7



STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH  
 WINGS FOR  
 CONCRETE BOX CULVERT  
 H = 5'-0" SLOPE = 3:1  
 75° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C1-5
1			3			TOTAL SHEETS
2			4			7

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BILL OF MATERIAL

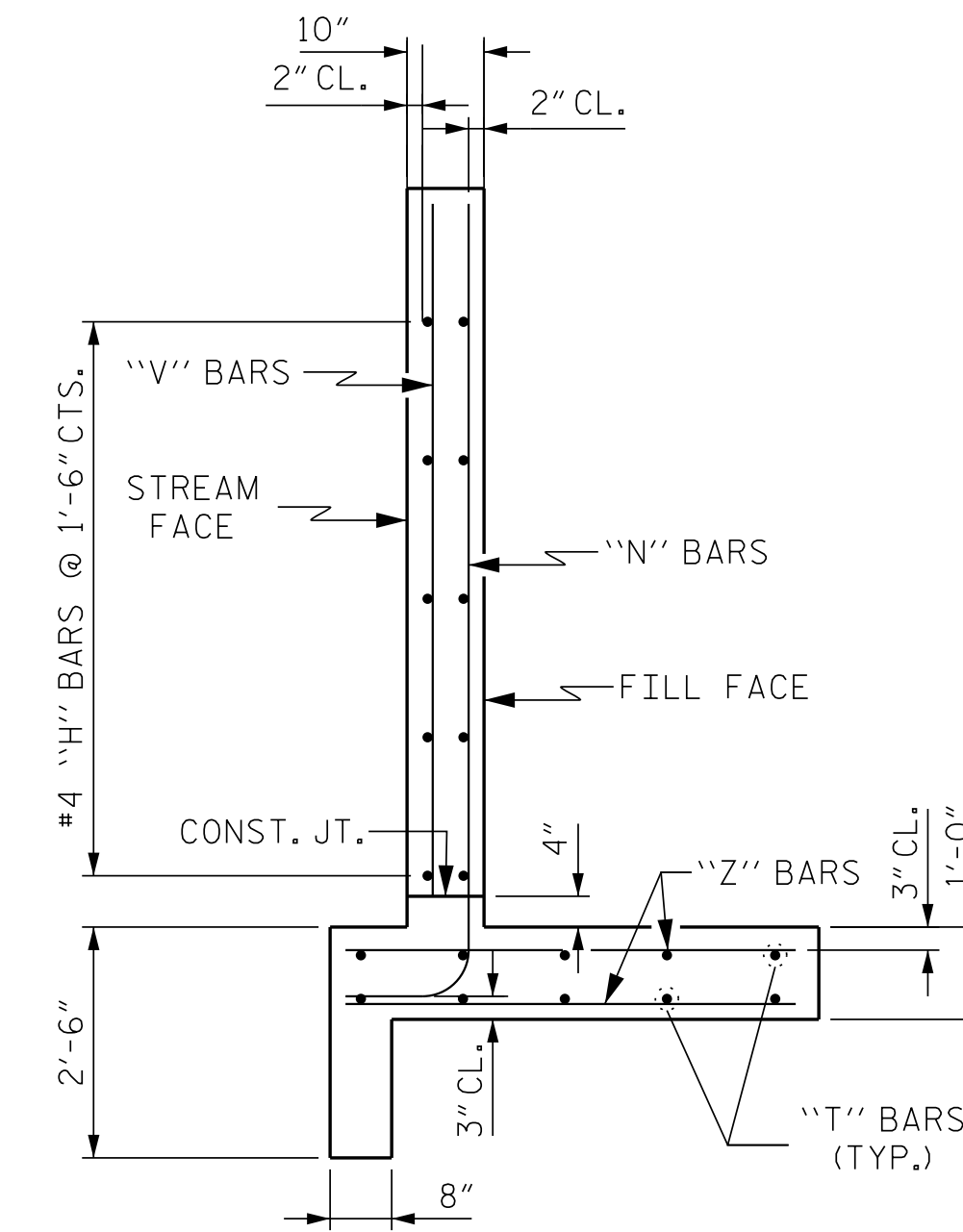
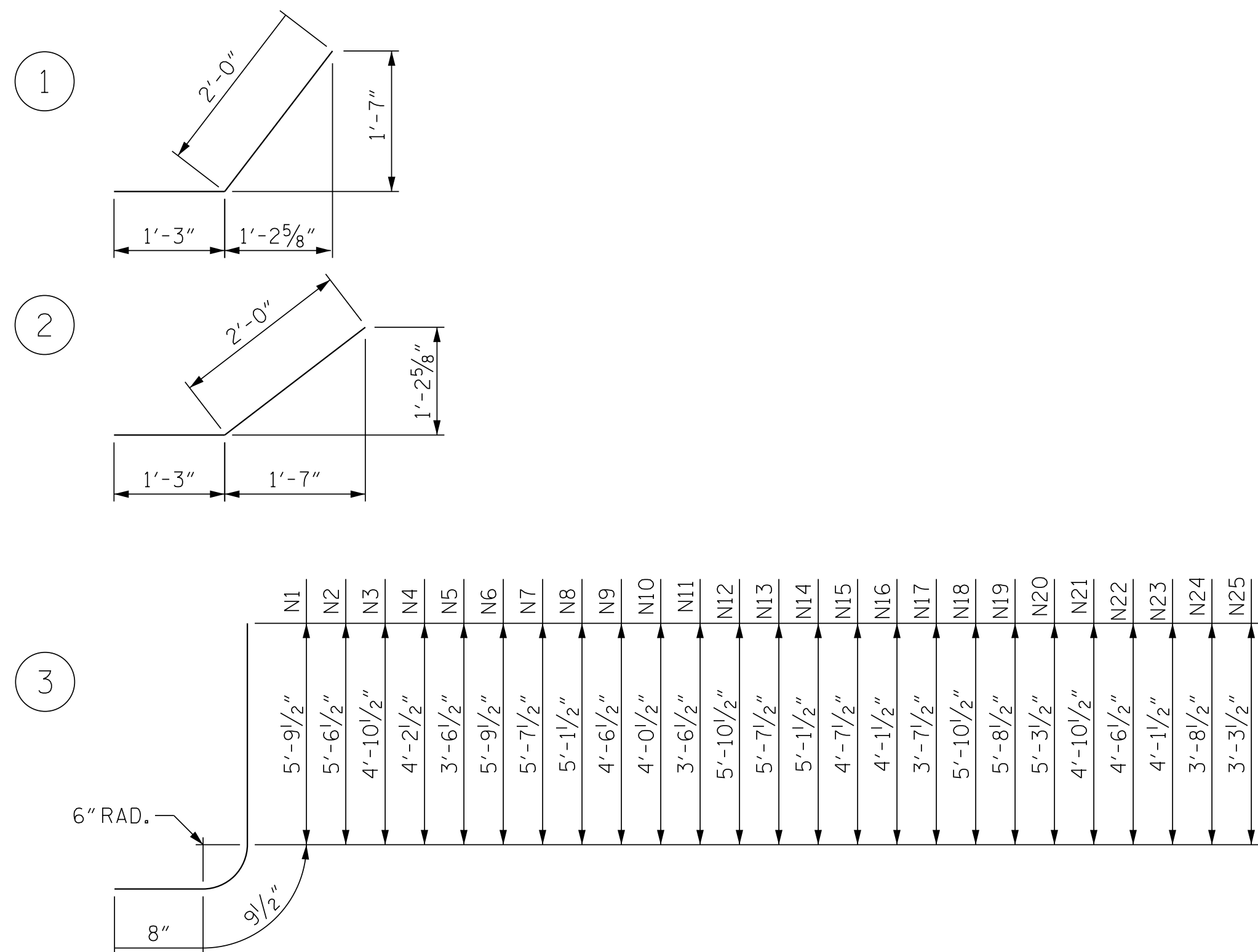
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	6	#4	STR	9'-4"	37	V1	2	#4	STR	5'-3"	7
H2	2	#4	STR	7'-8"	10	V2	3	#4	STR	5'-0"	10
H3	2	#4	STR	3'-6"	5	V3	3	#4	STR	4'-4"	9
H4	12	#4	1	3'-3"	26	V4	3	#4	STR	3'-8"	7
H5	2	#4	STR	9'-7"	13	V5	2	#4	STR	3'-0"	4
H6	6	#4	STR	12'-10"	51	V6	2	#4	STR	5'-3"	7
H7	2	#4	STR	10'-8"	14	V7	3	#4	STR	5'-1"	10
H8	2	#4	STR	5'-2"	7	V8	3	#4	STR	4'-7"	9
H9	12	#4	2	3'-3"	26	V9	3	#4	STR	4'-0"	8
H10	2	#4	STR	13'-0"	17	V10	3	#4	STR	3'-6"	7
H11	6	#4	STR	13'-8"	54	V11	2	#4	STR	3'-0"	4
H12	2	#4	STR	11'-4"	15	V12	2	#4	STR	5'-4"	7
H13	2	#4	STR	5'-6"	7	V13	3	#4	STR	5'-1"	10
H14	12	#4	1	3'-3"	26	V14	3	#4	STR	4'-7"	9
H15	2	#4	STR	13'-10"	18	V15	3	#4	STR	4'-1"	8
H16	6	#4	STR	18'-0"	71	V16	3	#4	STR	3'-7"	7
H17	2	#4	STR	15'-1"	20	V17	3	#4	STR	3'-1"	6
H18	2	#4	STR	7'-7"	10	V18	2	#4	STR	5'-4"	7
H19	12	#4	2	3'-3"	26	V19	3	#4	STR	5'-2"	10
H20	2	#4	STR	18'-2"	24	V20	3	#4	STR	4'-9"	9
						V21	3	#4	STR	4'-4"	9
N1	2	#4	3	7'-3"	10	V22	3	#4	STR	4'-0"	8
N2	3	#4	3	7'-0"	14	V23	3	#4	STR	3'-7"	7
N3	3	#4	3	6'-4"	13	V24	3	#4	STR	3'-2"	6
N4	3	#4	3	5'-8"	11	V25	1	#4	STR	2'-9"	2
N5	2	#4	3	5'-0"	7						
N6	2	#4	3	7'-3"	10	Z1	4	#4	STR	4'-2"	11
N7	3	#4	3	7'-1"	14	Z2	6	#4	STR	4'-0"	16
N8	3	#4	3	6'-7"	13	Z3	6	#4	STR	3'-7"	14
N9	3	#4	3	6'-0"	12	Z4	6	#4	STR	3'-3"	13
N10	3	#4	3	5'-6"	11	Z5	4	#4	STR	3'-0"	8
N11	2	#4	3	5'-0"	7	Z6	4	#4	STR	4'-3"	11
N12	2	#4	3	7'-4"	10	Z7	6	#4	STR	4'-1"	16
N13	3	#4	3	7'-1"	14	Z8	6	#4	STR	3'-9"	15
N14	3	#4	3	6'-7"	13	Z9	6	#4	STR	3'-5"	14
N15	3	#4	3	6'-1"	12	Z10	6	#4	STR	3'-1"	12
N16	3	#4	3	5'-7"	11	Z11	4	#4	STR	2'-10"	7
N17	3	#4	3	5'-1"	10	Z12	4	#4	STR	4'-2"	11
N18	2	#4	3	7'-4"	10	Z13	6	#4	STR	4'-0"	16
N19	3	#4	3	7'-2"	14	Z14	6	#4	STR	3'-9"	15
N20	3	#4	3	6'-9"	13	Z15	6	#4	STR	3'-5"	14
N21	3	#4	3	6'-4"	13	Z16	6	#4	STR	3'-2"	13
N22	3	#4	3	6'-0"	12	Z17	6	#4	STR	2'-10"	11
N23	3	#4	3	5'-7"	11	Z18	4	#4	STR	4'-2"	11
N24	3	#4	3	5'-2"	10	Z19	6	#4	STR	4'-1"	16
N25	1	#4	3	4'-9"	3	Z20	6	#4	STR	3'-11"	16
						Z21	6	#4	STR	3'-8"	15
T1	10	#5	STR	11'-1"	116	Z22	6	#4	STR	3'-5"	14
T2	10	#5	STR	14'-8"	153	Z23	6	#5	STR	3'-2"	20
T3	10	#5	STR	15'-1"	157	Z24	6	#6	STR	2'-11"	26
T4	10	#5	STR	19'-11"	208	Z25	2	#7	STR	2'-8"	11

EPOXY COATED REINFORCING STEEL FOR 4 WINGS 1922 LBS

CLASS A CONCRETE		
4 WINGS	19.7	CY
2 HEADWALLS	0.6	CY
2 END CURTAIN WALLS	0.7	CY
<b>TOTAL</b>	<b>21.0</b>	<b>CY</b>

BAR TYPES

ALL BAR DIMENSIONS ARE OUT TO OUT.



TYPICAL WING SECTION

DATE: 4/12/2017  
TIME: 2:35:37 PM

USER: jcm16036454\_Sigum Road400\_Technical\08\_Structure\Culverts\41\_035\_01\_T\_R5516\_SML\_WING.dgn

DRAWN BY : NKB DATE : 03/16  
CHECKED BY : JCM DATE : 03/16  
DESIGN E.O.R. : JCM DATE : 05/16

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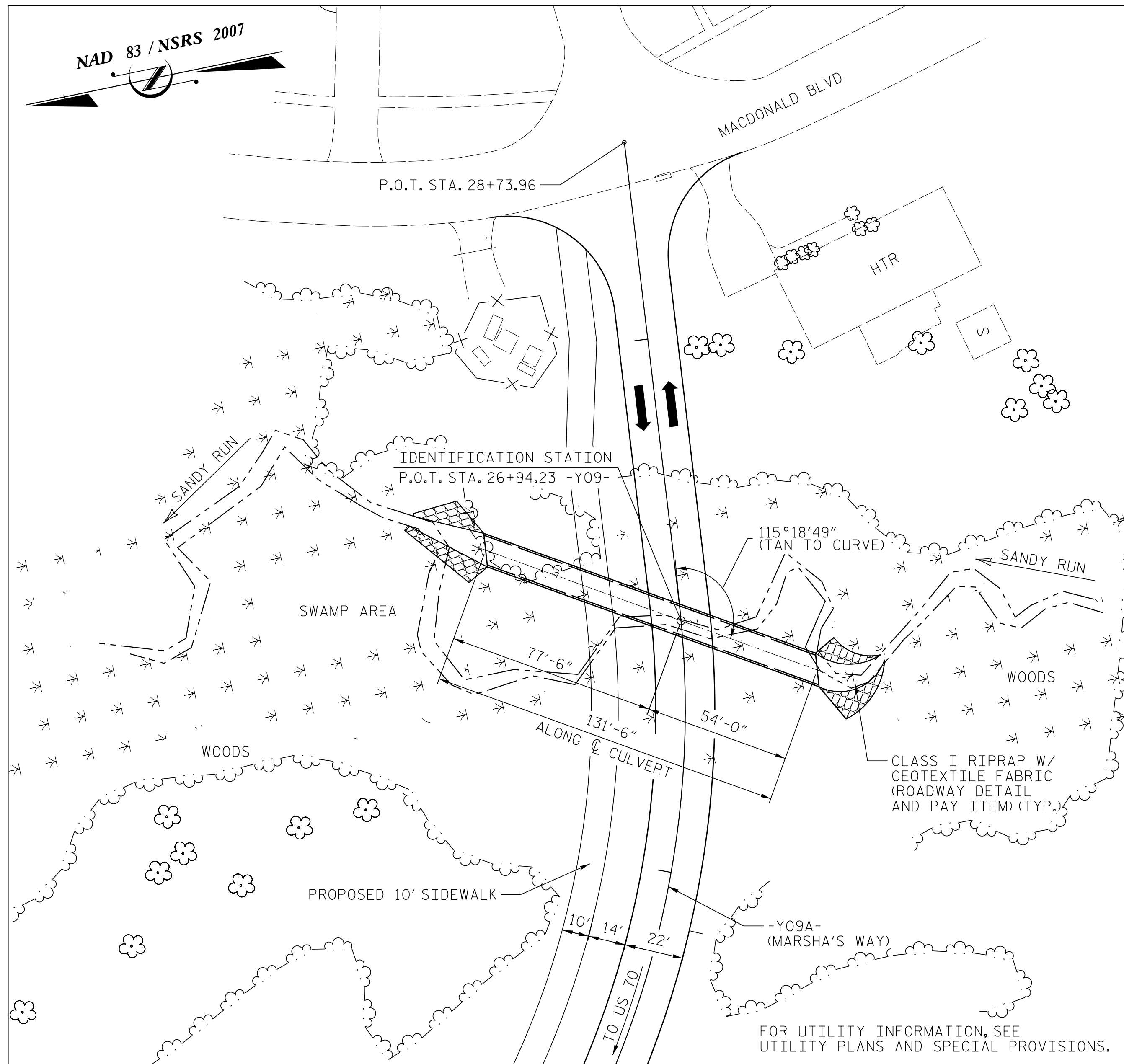
PROJECT NO. R-5516  
CRAVEN COUNTY  
STATION: 78+08.84 -L-  
SHEET 7 OF 7

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

STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION  
RALEIGH  
WINGS FOR  
CONCRETE BOX CULVERT  
H = 5'-0" SLOPE = 3:1; 4:1  
75° SKEW



BENCH MARK: BM #7 - PK NAIL OVER 36" RCP IN MACDONALD BLVD. -Y09A- STA. 28+81.53, 171.3' RT.  
ELEV. 26.55', NAVD 88



GRADE PT. ELEV. @ STA. 26+94.23 -Y09A- = 26.70  
BED ELEV. @ STA. 26+94.23 -Y09A- = 7.91  
ROADWAY SLOPES = 3:1

**LOCATION SKETCH**

HYDRAULIC DATA		
DESIGN DISCHARGE	410	CFS
FREQUENCY OF DESIGN FLOOD	50	YR.
DESIGN HIGH WATER ELEVATION	16.5	FT.
BASE DISCHARGE (Q 100)	490	CFS
BASE FREQUENCY	100	YR.
BASE HIGH WATER ELEVATION	17.4	FT.

OVERTOPPING FLOOD DATA		
OVERTOPPING DISCHARGE	1150	CFS
FREQUENCY OF OVERTOPPING FLOOD	500+	YR.
OVERTOPPING FLOOD ELEVATION	24.8	FT.

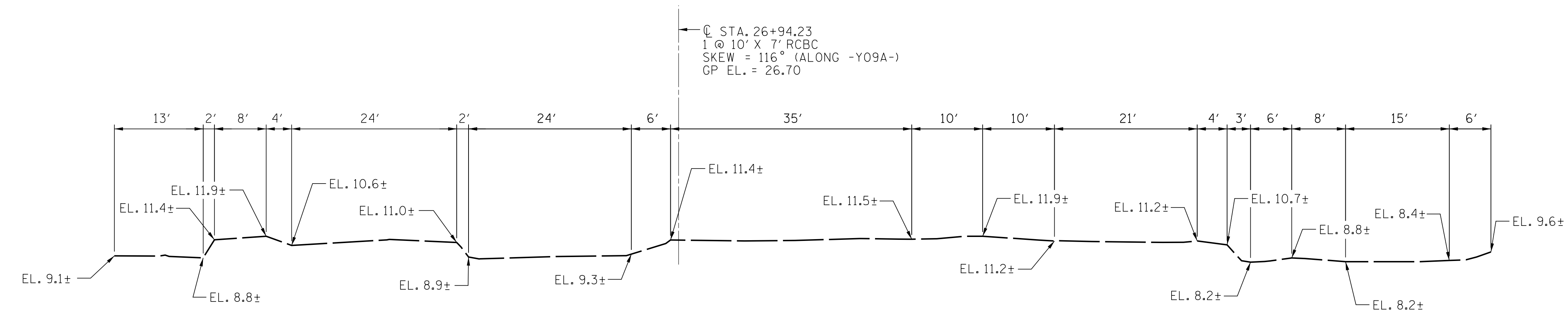
TOTAL STRUCTURE QUANTITIES		
CLASS A CONCRETE		
BARREL @ 1.049	CY/FT	137.9 C.Y.
SILLS		1.1 C.Y.
EDGE BEAMS		1.5 C.Y.
WING ETC.		31.2 C.Y.
TOTAL		140.5 C.Y.
EPOXY COATED REINFORCING STEEL		
BARREL		32589 LBS.
WINGS ETC.		2420 LBS.
TOTAL		35009 LBS.
FOUNDATION CONDITIONING MATERIAL		105.1 TONS
CULVERT EXCAVATION		LUMP SUM

**NOTES:**

- ASSUMED LIVE LOAD ----- HL-93 OR ALTERNATE LOADING.
- DESIGN FILL----- 11.5 FT.
- 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 FEET. LOCATION OF JOINTS SHALL BE SUBJECT TO APPROVAL OF THE ENGINEER.
- AT THE CONTRACTOR'S OPTION, HE MAY SPLICE THE VERTICAL REINFORCING STEEL IN THE INTERIOR FACE OF EXTERIOR WALL AND BOTH FACES OF INTERIOR WALLS ABOVE LOWER WALL CONSTRUCTION JOINT. THE SPLICE LENGTH SHALL BE AS PROVIDED IN THE SPLICE LENGTH CHART SHOWN ON THE PLANS. EXTRA WEIGHT OF STEEL DUE TO THE SPLICES SHALL BE PAID FOR BY THE CONTRACTOR.
- FOR CULVERT DIVERSION DETAILS AND PAY ITEM, SEE EROSION CONTROL PLANS.
- A 3 FOOT STRIP OF FILTER FABRIC SHALL BE ATTACHED TO THE FILL FACE OF THE WING COVERING THE ENTIRE LENGTH OF THE EXPANSION JOINT.
- FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.
- FOR GROUT FOR STRUCTURES, SEE SPECIAL PROVISIONS.
- FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.
- FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.
- ALL BAR SUPPORTS USED IN THE CULVERT BARREL AND WINGS AND ALL INCIDENTAL REINFORCING STEEL SHALL BE EPOXY COATED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
- NATIVE MATERIAL PLACED BETWEEN SILLS IN THE CULVERT SHALL PROVIDE A CONTINUOUS LOW FLOW CHANNEL. NATIVE MATERIAL CONSISTS OF MATERIAL THAT IS EXCAVATED FROM THE STREAM BED AT THE PROJECT SITE DURING CONSTRUCTION. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.
- FOR OTHER DESIGN DATA AND GENERAL NOTES, SEE SHEET SN.

DATE: 4/7/2017  
TIME: 2:37:40 PM

USER: nrc1503  
DIR: R:\6352444-5\csm Road\MOI\_Technical\MOI\_Structure\Culverts\412\_005\_C2-LR5516\_LOC.dgn



**PROFILE ALONG CULVERT**

DRAWN BY : NKB  
CHECKED BY : JCM  
DESIGN E.O.R. : JCM

DATE : 03/16  
DATE : 03/16  
DATE : 05/16

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AECOM License No. F-0342

4/12/2017

NORTH CAROLINA PROFESSIONAL SEAL  
030474  
ENGINEER  
JOHN C. MORRISON  
DocuSign Envelope ID: A3FDE142C82F4A8

PROJECT NO. R-5516  
CRAVEN COUNTY  
STATION: 26+94.23 -Y09A-  
SHEET 1 OF 6

STATE OF NORTH CAROLINA  
**DEPARTMENT OF TRANSPORTATION**  
RALEIGH  
BARREL STANDARD

SINGLE 10 FT. X 7 FT.  
CONCRETE BOX CULVERT  
116° SKEW

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	
1			3			C2-1
2			4			TOTAL SHEETS 6

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

LEVEL	VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE								COMMENT NUMBER		
						LIVE-LOAD FACTORS (g <sub>LL</sub> )	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	3.98	--	1.75	3.98	1	TOP SLAB	5.67	6.98	1	BOTT. SLAB	1.29		
	HL-93 (OPERATING)	N/A		5.16	--	1.35	5.16	1	TOP SLAB	5.67	9.05	1	BOTT. SLAB	1.29		
	HS-20 (INVENTORY)	36.000	②	2.81	101.2	1.75	2.81	1	TOP SLAB	5.67	4.95	1	BOTT. SLAB	1.29		
	HS-20 (OPERATING)	36.000		3.64	131.0	1.35	3.64	1	TOP SLAB	5.67	6.41	1	BOTT. SLAB	1.29		
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH		5.79	78.15	1.40	5.79	1	TOP SLAB	5.67	10.15	1	BOTT. SLAB	1.29	1	
		SNGARBS2	20.000		5.42	108.39	1.40	5.42	1	TOP SLAB	5.67	9.50	1	BOTT. SLAB	1.29	1
		SNAGRIS2	22.000		5.79	127.36	1.40	5.79	1	TOP SLAB	5.67	10.15	1	BOTT. SLAB	1.29	1
		SNCOTTS3	27.250		3.98	108.46	1.40	3.98	1	TOP SLAB	5.67	6.98	1	BOTT. SLAB	1.29	1
		SNAGGRS4	34.925		4.58	160.1	1.40	4.58	1	TOP SLAB	5.67	8.39	1	BOTT. SLAB	1.29	1
		SNS5A	35.550		4.43	157.5	1.40	4.43	1	TOP SLAB	5.67	7.95	1	BOTT. SLAB	1.29	1
		SNS6A	39.950		4.43	176.9	1.40	4.43	1	TOP SLAB	5.67	7.94	1	BOTT. SLAB	1.29	1
	SNS7B	42.000		4.43	186.0	1.40	4.43	1	TOP SLAB	5.67	7.94	1	BOTT. SLAB	1.29	1	
	TRUCK TRACTOR SEMI- TRAILER (TTST)	TNAGRIT3	33.000		4.09	134.88	1.40	4.09	1	TOP SLAB	5.67	6.57	1	BOTT. SLAB	1.29	1
		TNT4A	33.075		3.35	110.6	1.40	3.35	1	TOP SLAB	5.67	5.89	1	BOTT. SLAB	1.29	1
		TNT6A	41.600		3.35	139.2	1.40	3.35	1	TOP SLAB	5.67	5.89	1	BOTT. SLAB	1.29	1
		TNT7A	42.000		3.35	140.5	1.40	3.35	1	TOP SLAB	5.67	5.89	1	BOTT. SLAB	1.29	1
		TNT7B	42.000		3.35	140.5	1.40	3.35	1	TOP SLAB	5.67	5.89	1	BOTT. SLAB	1.29	1
		TNAGRIT4	43.000		3.14	134.9	1.40	3.14	1	TOP SLAB	5.67	5.64	1	BOTT. SLAB	1.29	1
TNAGT5A		45.000		3.24	145.8	1.40	3.24	1	TOP SLAB	5.67	5.77	1	BOTT. SLAB	1.29	1	
TNAGT5B	45.000		③	3.13	140.9	1.40	3.13	1	TOP SLAB	5.67	5.64	1	BOTT. SLAB	1.29	1	

LOAD FACTORS:

DESIGN LOAD RATING FACTORS

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

NOTE:

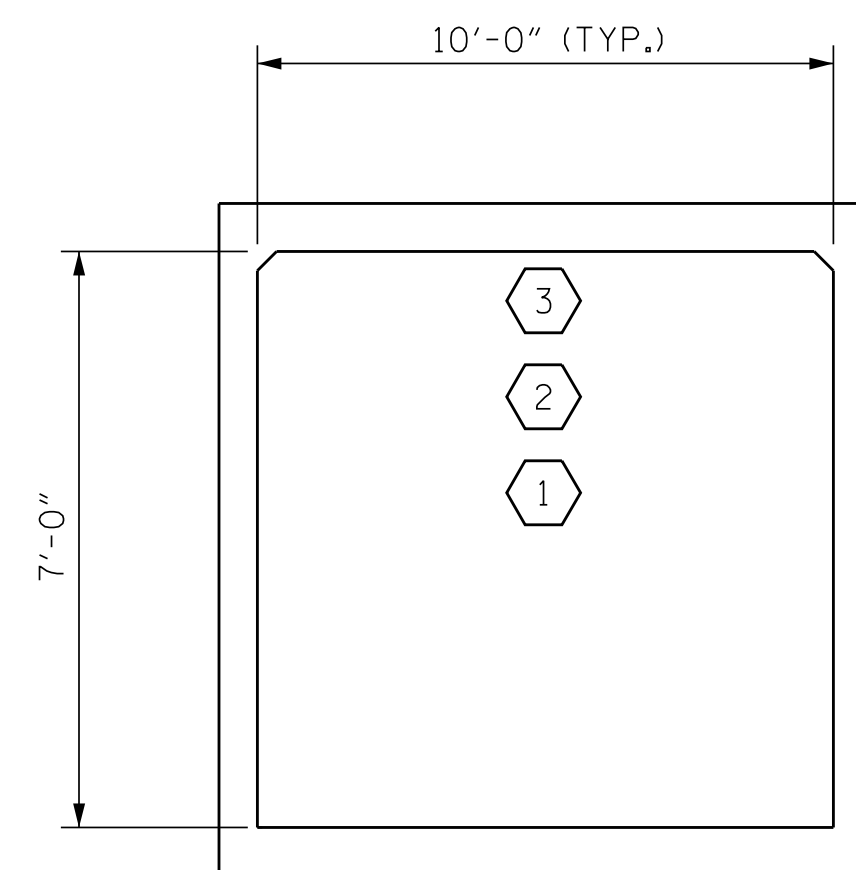
RATING FACTORS ARE BASED ON THE STRENGTH I LIMIT STATE.

COMMENTS:

1. FILL DEPTH IS SUCH THAT, PER LRFD 3.6.1.2.6, LIVE LOAD IS NOT CONSIDERED TO CONTRIBUTE. THEREFORE, LEGAL LOAD RATING CORRESPONDS TO HL-93 DESIGN LOAD RATING.

- 2.
- 3.
- 4.

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



**LRFR SUMMARY**  
(LOOKING DOWNSTREAM)

PROJECT NO. R-5516

CRAVEN COUNTY

STATION: 26+94.23 -Y09A-

SHEET 2 OF 6

ASSEMBLED BY : NKB	DATE : 03/16
CHECKED BY : JCM	DATE : 03/16
DRAWN BY : DST	02/15
CHECKED BY : JCM	02/15

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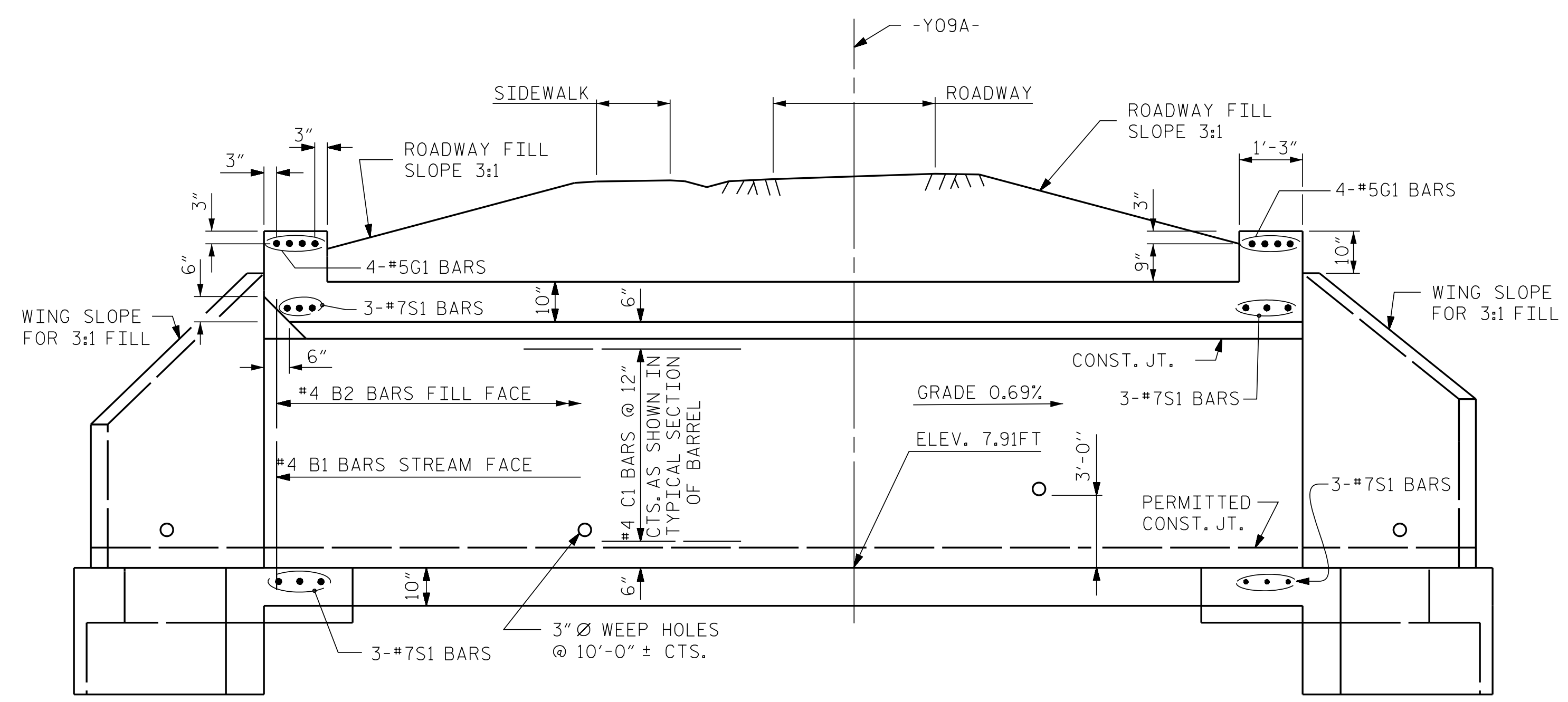
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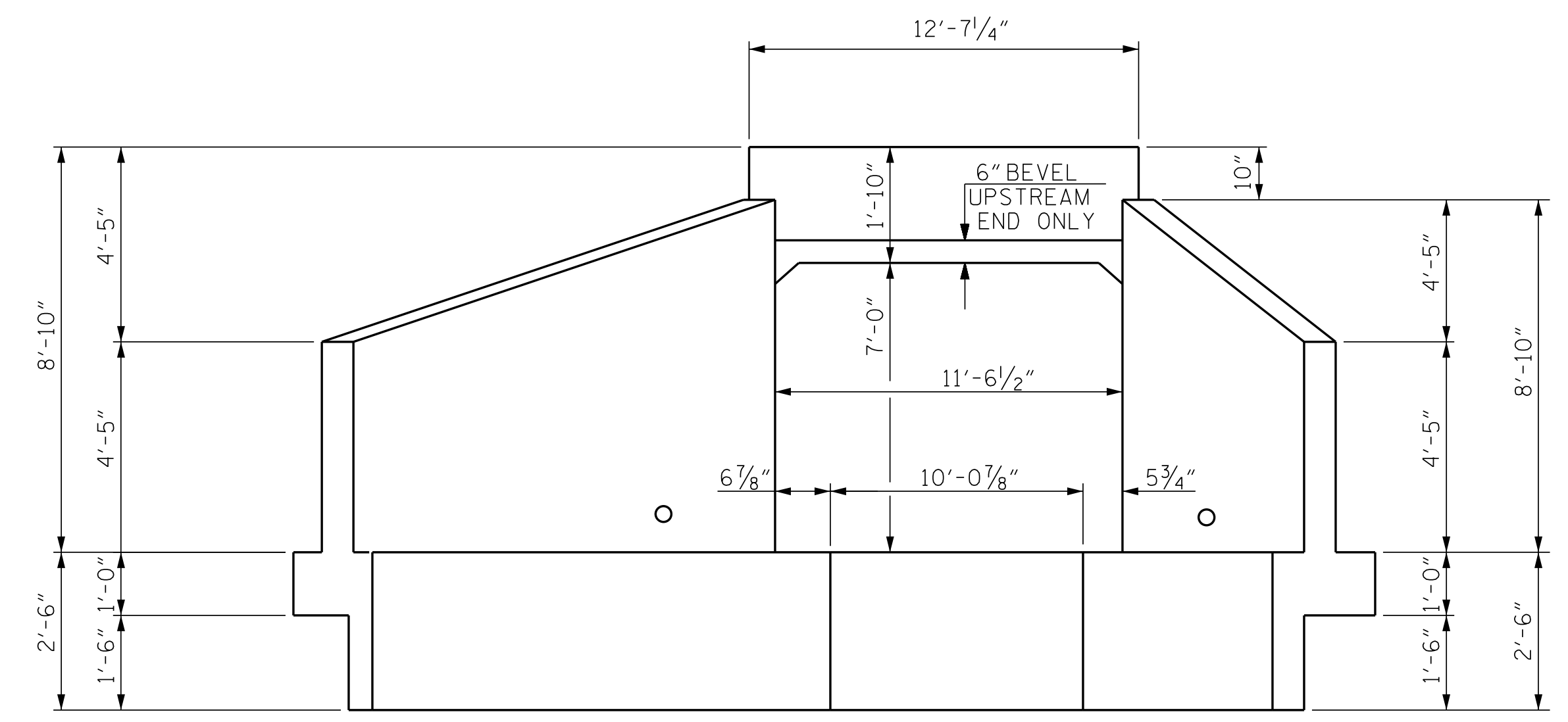
NORTH CAROLINA  
PROFESSIONAL  
ENGINEER  
SEAL  
030474  
John C. Morrison

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION RALEIGH					
STANDARD LRFR SUMMARY FOR REINFORCED CONCRETE BOX CULVERTS (NON-INTERSTATE TRAFFIC)					
REVISIONS					
NO.	BY:	DATE:	NO.	BY:	DATE:
1			3		
2			4		
					SHEET NO. <b>C2-2</b> TOTAL SHEETS <b>6</b>

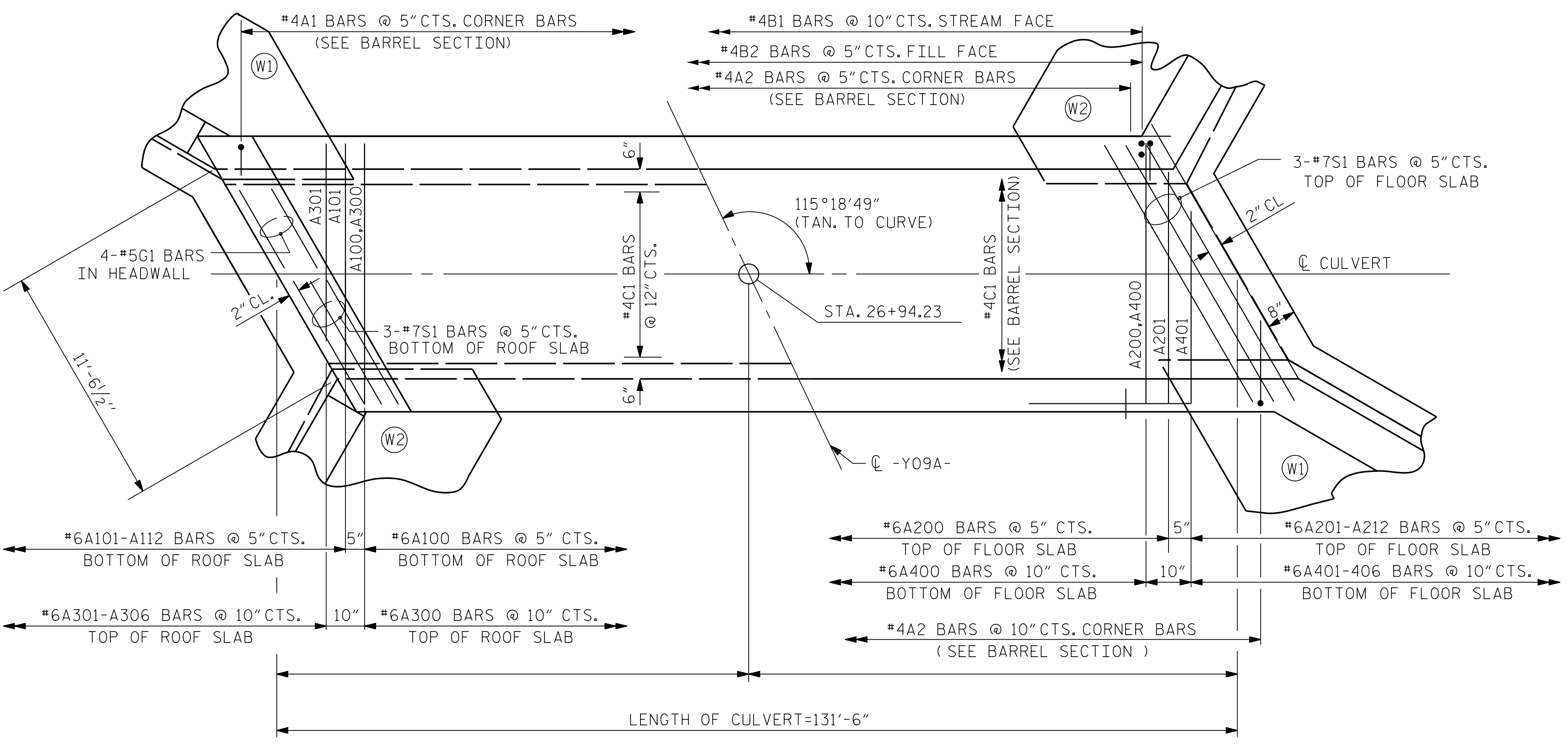




CULVERT SECTION NORMAL TO ROADWAY

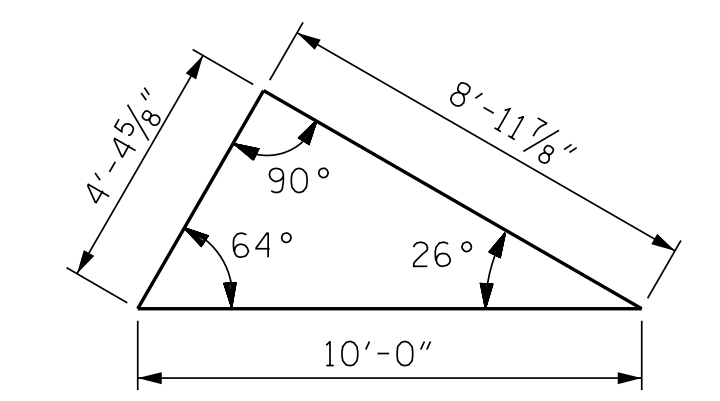


END ELEVATION NORMAL TO SKEW



PART PLAN - ROOF SLAB

PART PLAN - FLOOR SLAB



SKEW TRIANGLE

PROJECT NO. R-5516  
CRAVEN COUNTY  
 STATION: 26+94.23 -Y09A-  
 SHEET 3 OF 6

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**SEAL**  
 030474  
 JOHN C. MORRISON  
 ENGINEER

DocuSign Envelope ID: A2FDE142C82F4AB

STATE OF NORTH CAROLINA  
**DEPARTMENT OF TRANSPORTATION**  
RALEIGH

**SINGLE 10FT. X 7FT.  
 CONCRETE BOX CULVERT  
 116° SKEW**

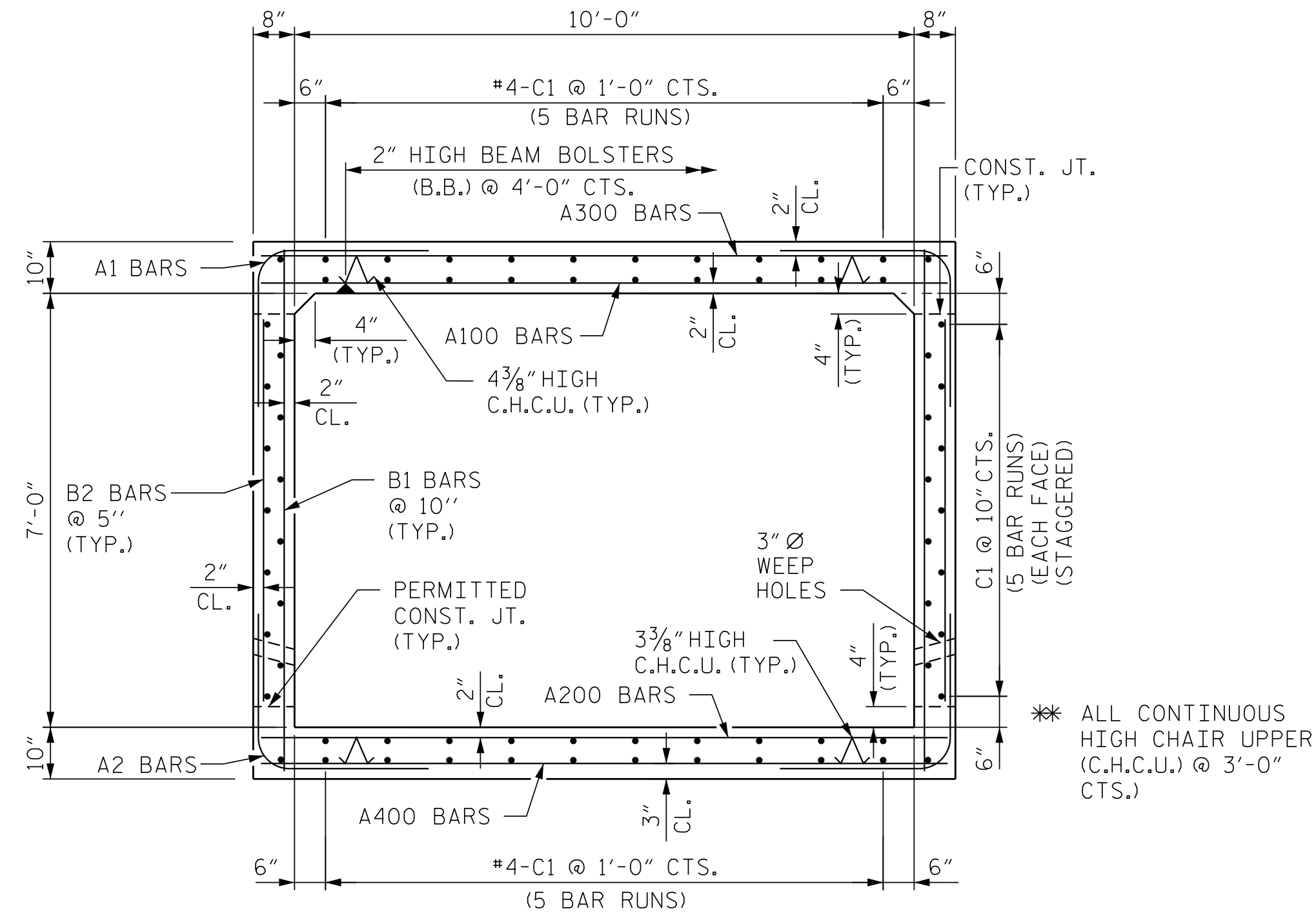
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NO.	BY:	DATE:	NO.	BY:	DATE:	C2-3
1			3			TOTAL SHEETS
2			4			6

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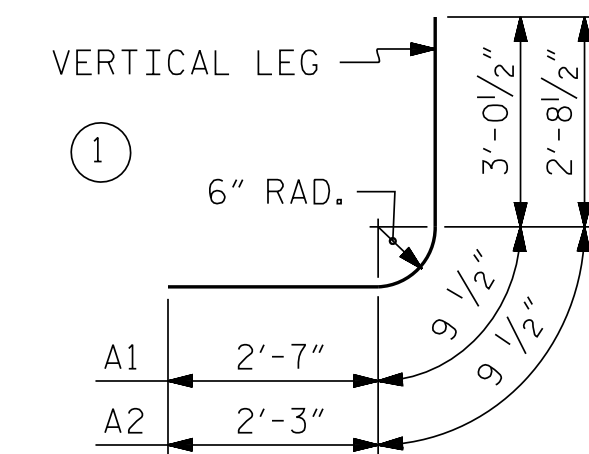
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REINFORCING STEEL SCHEDULE											
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT	BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
A1	316	#4	(1)	6'-5"	1354	A300	152	#6	STR	11'-0"	2512
A2	316	#4	(1)	5'-9"	1214	A301	2	#6	STR	9'-4"	29
A100	303	#6	STR	11'-0"	5007	A302	2	#6	STR	7'-7"	23
A101	2	#6	STR	10'-2"	31	A303	2	#6	STR	5'-11"	18
A102	2	#6	STR	9'-4"	29	A304	2	#6	STR	4'-2"	13
A103	2	#6	STR	8'-5"	26	A305	2	#6	STR	2'-6"	8
A104	2	#6	STR	7'-7"	23	A306	2	#6	STR	0'-9"	3
A105	2	#6	STR	6'-9"	21	A400	152	#6	STR	11'-0"	2512
A106	2	#6	STR	5'-11"	18	A401	2	#6	STR	9'-4"	29
A107	2	#6	STR	5'-0"	16	A402	2	#6	STR	7'-7"	23
A108	2	#6	STR	4'-2"	13	A403	2	#6	STR	5'-11"	18
A109	2	#6	STR	3'-4"	11	A404	2	#6	STR	4'-2"	13
A110	2	#6	STR	2'-6"	8	A405	2	#6	STR	2'-6"	8
A111	2	#6	STR	1'-7"	5	A406	2	#6	STR	0'-9"	3
A112	2	#6	STR	0'-9"	3	B1	316	#4	STR	8'-5"	1756
A200	303	#6	STR	11'-0"	5007	B2	630	#4	STR	6'-2"	5836
A201	2	#6	STR	10'-2"	31	C1	350	#4	STR	27'-5"	6334
A202	2	#6	STR	9'-4"	29	D1	13	#6	STR	1'-5"	28
A203	2	#6	STR	8'-5"	26	D2	8	#6	STR	2'-5"	30
A204	2	#6	STR	7'-7"	23	G1	8	#5	STR	12'-3"	102
A205	2	#6	STR	6'-9"	21	S1	12	#7	STR	12'-3"	301
A206	2	#6	STR	5'-11"	18						
A207	2	#6	STR	5'-0"	16						
A208	2	#6	STR	4'-2"	13						
A209	2	#6	STR	3'-4"	11						
A210	2	#6	STR	2'-6"	8						
A211	2	#6	STR	1'-7"	5						
A212	2	#6	STR	0'-9"	3						
TOTAL EPOXY COATED REINFORCING STEEL										32589	

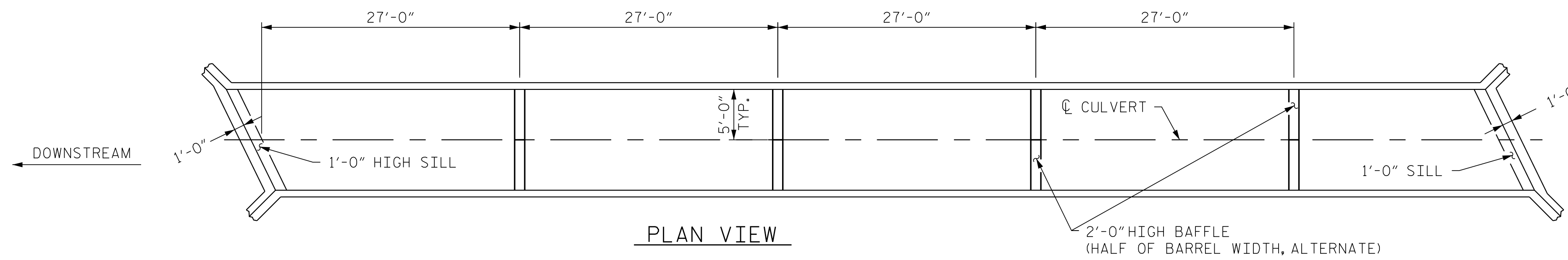


RIGHT ANGLE SECTION OF BARREL  
(THERE ARE 70 "C" BARS IN SECTION OF BARREL)

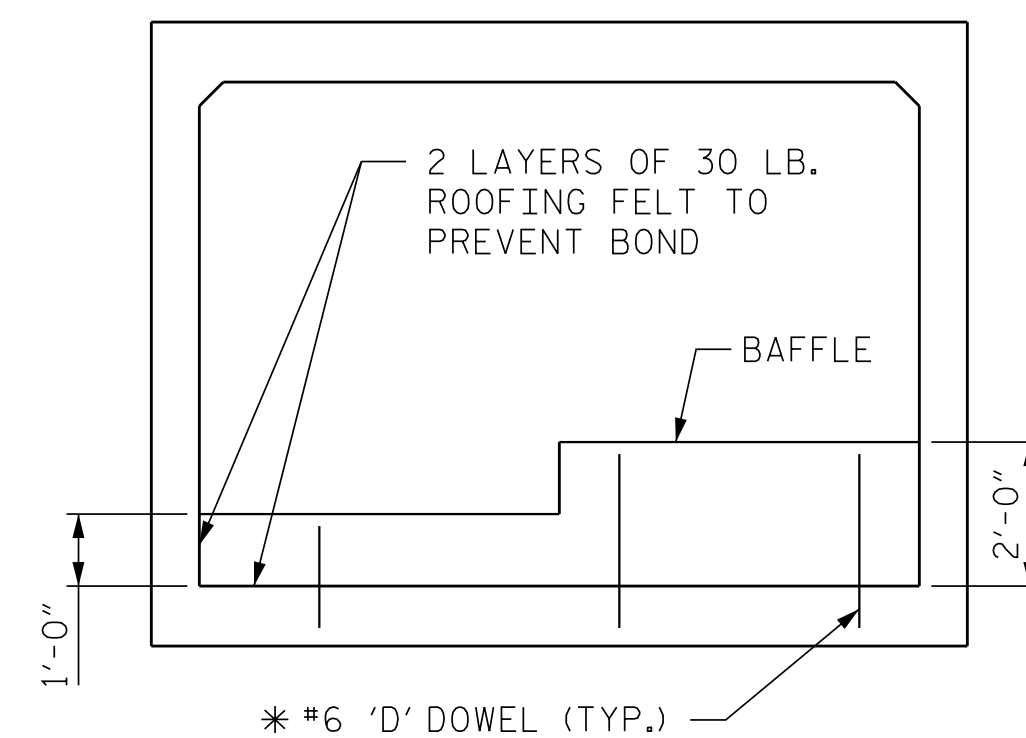
SPLICE LENGTH CHART	
SIZE	SPLICE LENGTH
#4	1'-5"
#5	1'-9"
#6	2'-3"
#7	3'-1"
#8	4'-1"



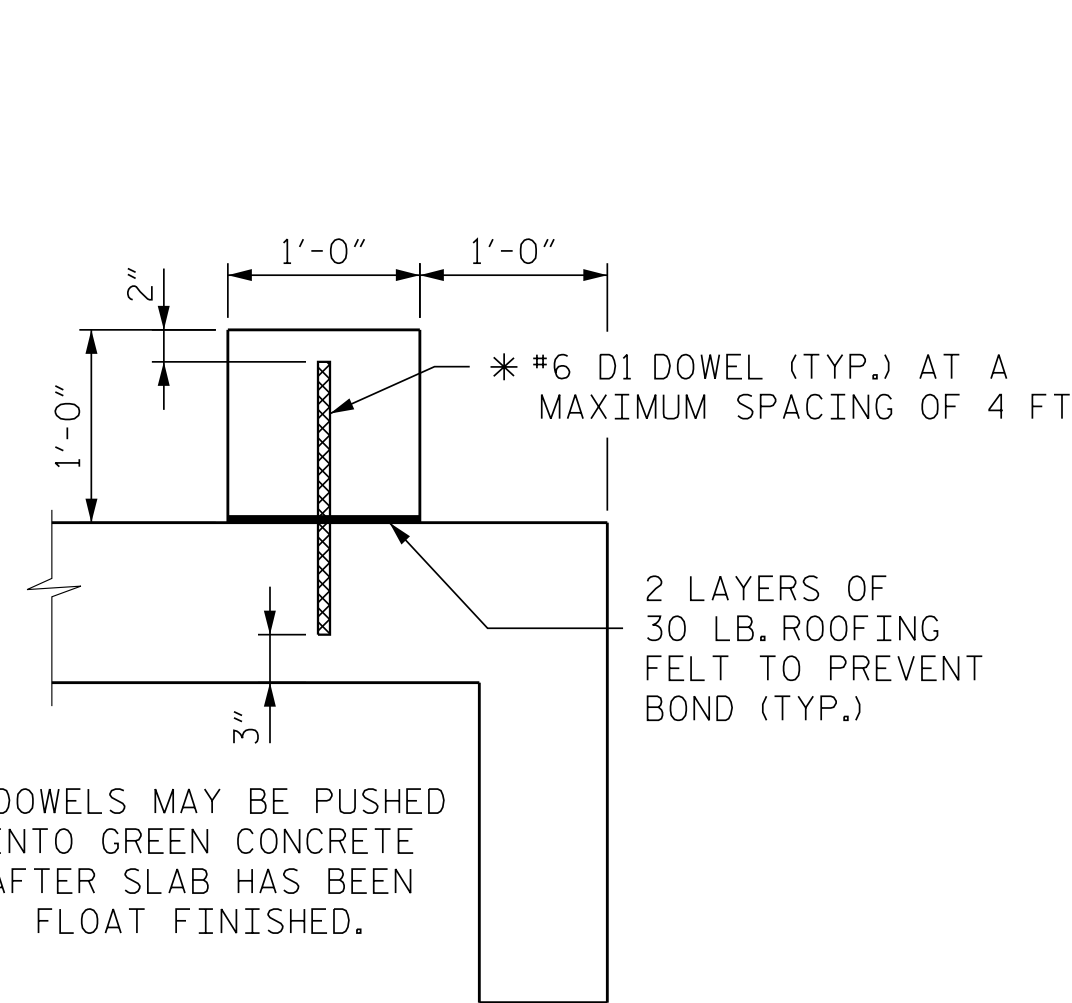
BAR TYPE  
BAR DIMENSIONS ARE OUT TO OUT



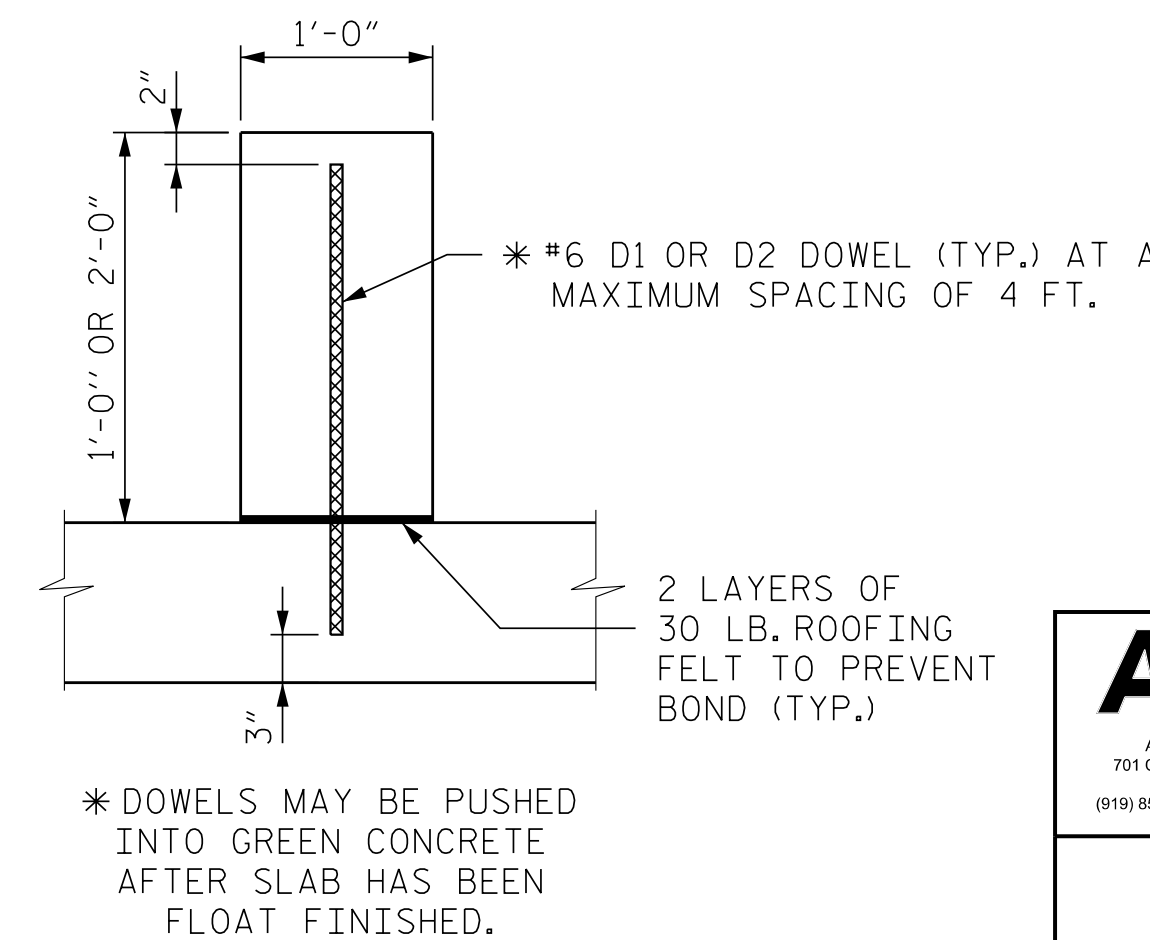
NOTE:  
BACKFILL TO SILL HEIGHT WITH NATIVE BED MATERIAL EXCAVATED FROM STREAM BED DURING CULVERT EXCAVATION. ONLY MATERIAL EXCAVATED FROM STREAM BED MAY BE USED TO LINE THE CULVERT BARREL. NATIVE MATERIAL IS SUBJECT TO APPROVAL BY THE ENGINEER AND MAY BE SUBJECT TO PERMIT CONDITIONS.



ELEVATION



SECTION THROUGH SILL



SECTION THROUGH BAFFLE

CULVERT SILL AND BAFFLE DETAILS

PROJECT NO. R-5516  
 CRAVEN COUNTY  
 STATION: 26+94.23 -Y09A-  
 SHEET 4 OF 6

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4/12/2017  
 NORTH CAROLINA PROFESSIONAL SEAL  
 030474  
 JOHN C. MORRISON  
 ENGINEER

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	C2-4
1			3			TOTAL SHEETS
2			4			6

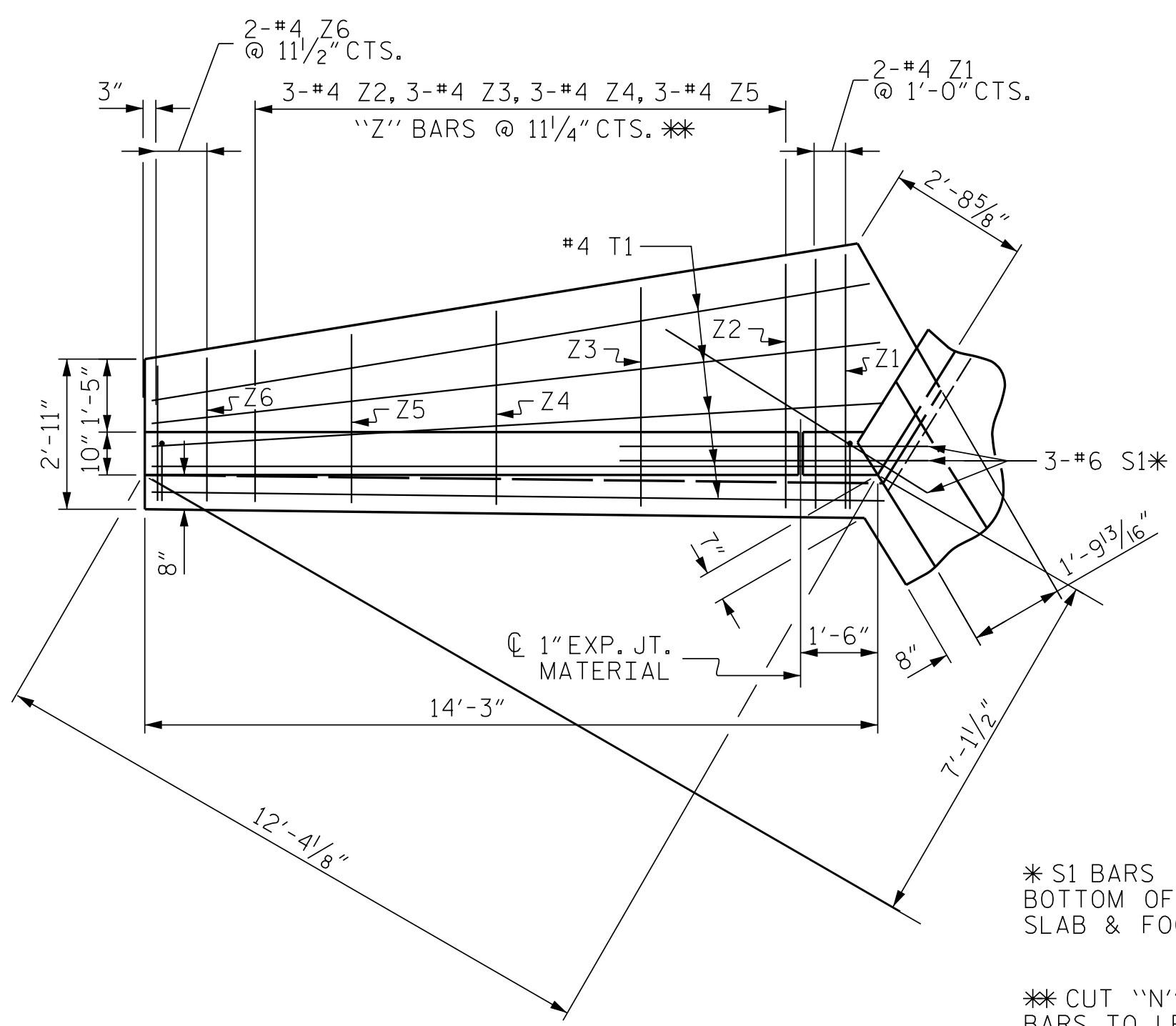
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 CHECKED BY : JCM DATE : 03/16  
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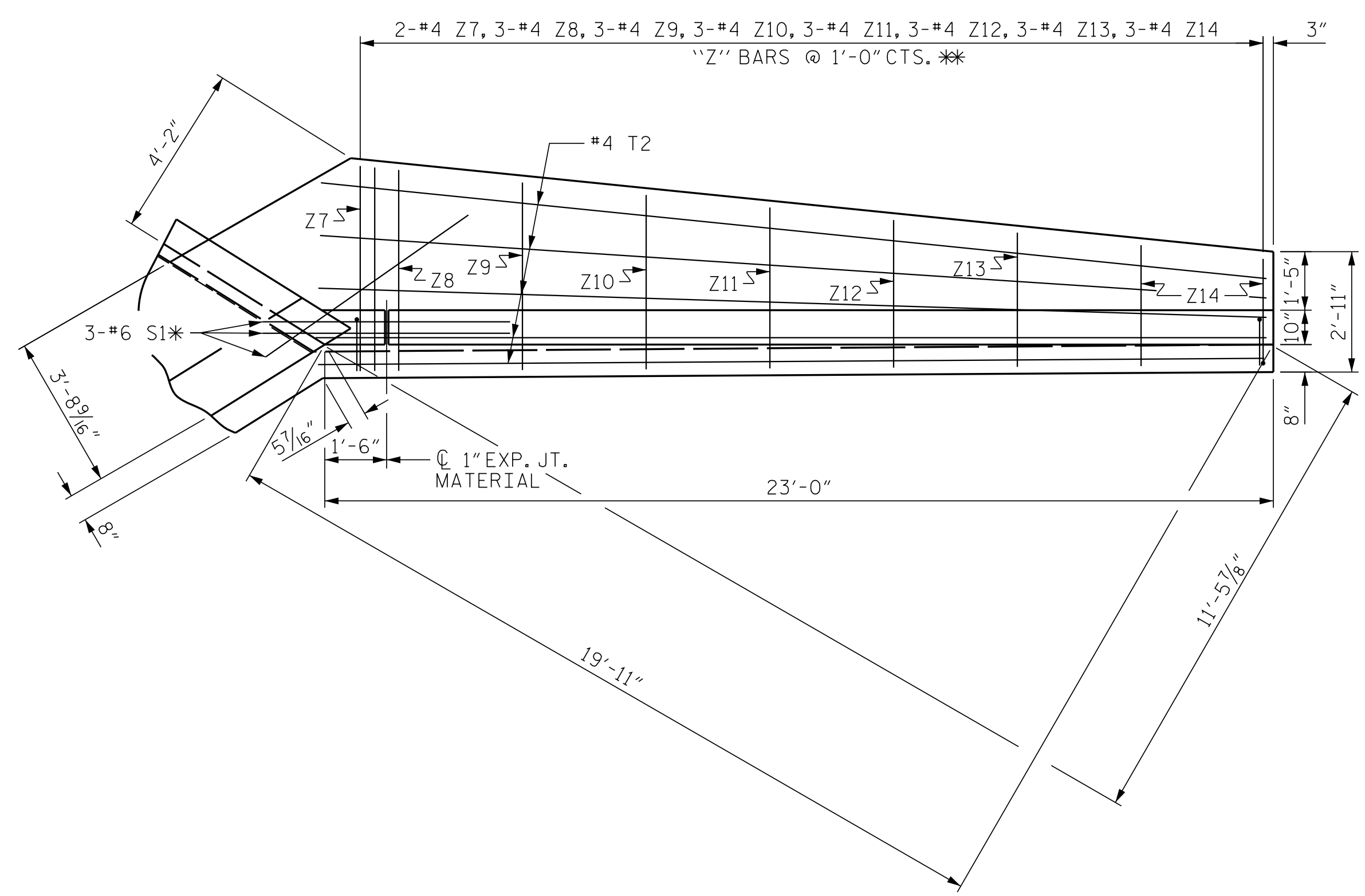
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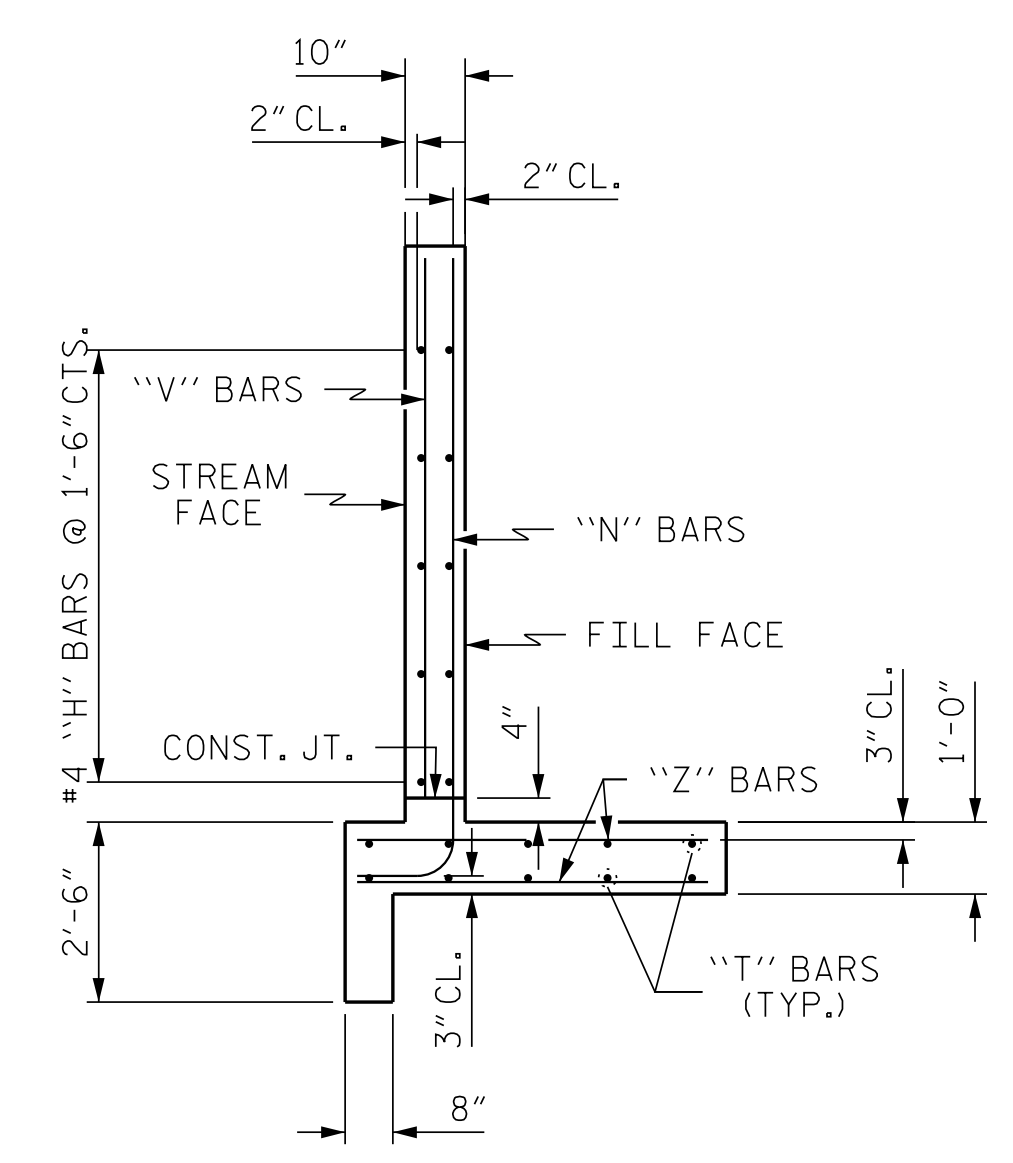




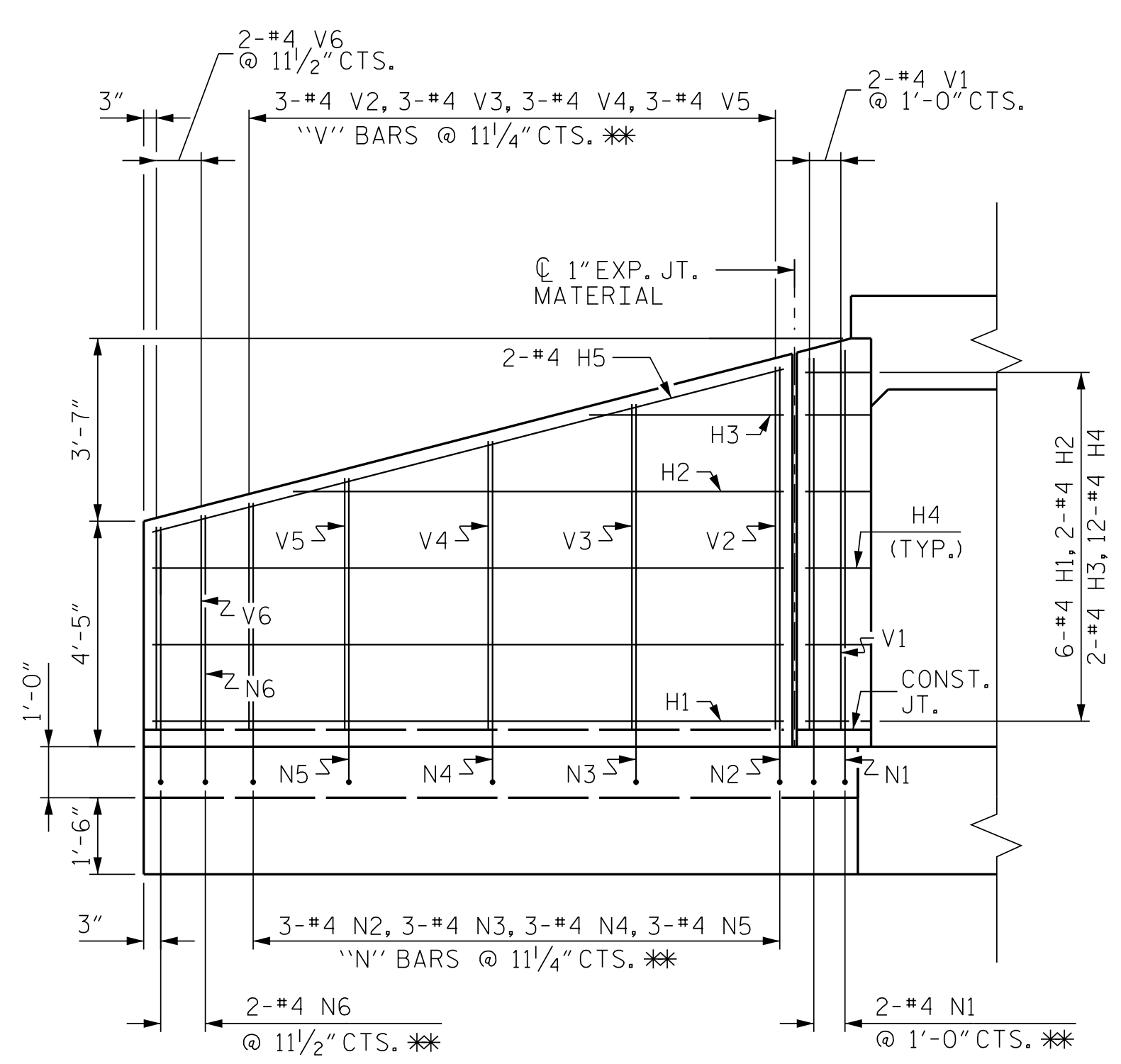
PLAN W2



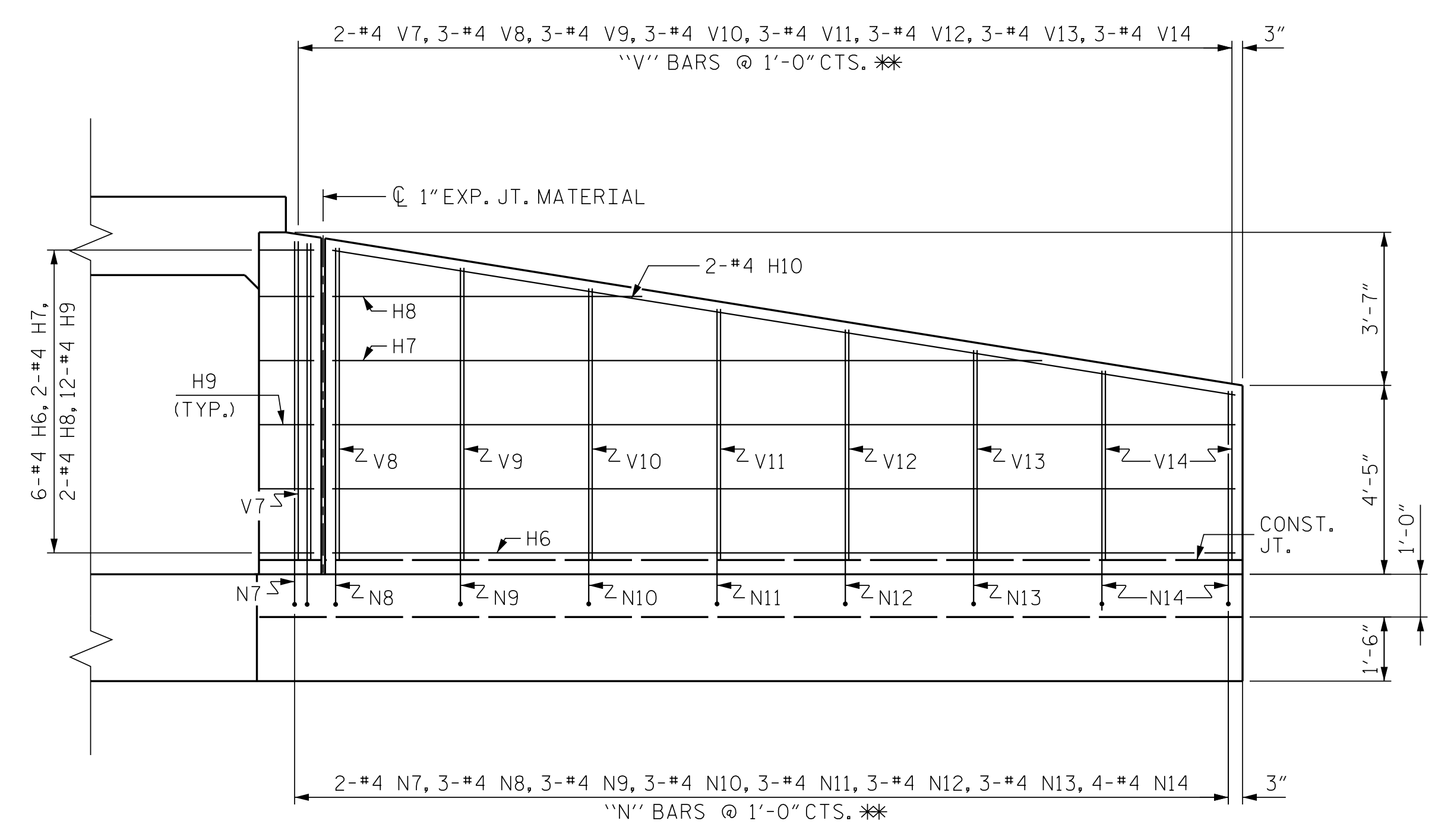
PLAN W1



TYPICAL WING SECTION



ELEVATION W2



ELEVATION W1

PROJECT NO. R-5516  
 CRAVEN COUNTY  
 STATION: 26+94.23 -Y09A-  
 SHEET 5 OF 6

**AECOM**  
 AECOM TECHNICAL SERVICES, INC.  
 701 CORPORATE CENTER DRIVE, SUITE 475  
 RALEIGH, NC 27607  
 (919) 854-6200 www.aecom.com  
 AECOM License No. F-0342

4/12/2017

NORTH CAROLINA  
 PROFESSIONAL SEAL  
 030474  
 JOHN C. MORRISON  
 ENGINEER

DocuSign  
 John C. Morrison  
 A3FDE142C82F4AB

STATE OF NORTH CAROLINA  
 DEPARTMENT OF TRANSPORTATION  
 RALEIGH

WINGS FOR  
 CONCRETE BOX CULVERT  
 H = 7'-0" SLOPE = 3:1  
 116° SKEW

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

DRAWN BY : NKB DATE : 03/16  
 CHECKED BY : JCM DATE : 03/16  
 DESIGN E.O.R. : JCM DATE : 05/16

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DATE: 4/7/2017 TIME: 2:36:55 PM  
 USER: jcm1635444-5incum RoadM00\_Technical\W08\_Structure\Cadd\Culverts\412\_025\_C2-5\_A5B16\_WING.dgn

**BILL OF MATERIAL**

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
H1	12	#4	STR	12'-5"	98
H2	4	#4	STR	9'-7"	25
H3	4	#4	1	3'-10"	10
H4	24	#4	STR	3'-2"	50
H5	4	#4	STR	12'-9"	34
H6	12	#4	STR	21'-2"	168
H7	4	#4	STR	16'-7"	44
H8	4	#4	2	7'-3"	19
H9	24	#4	STR	3'-2"	50
H10	4	#4	STR	21'-5"	57

N1	4	#4	3	9'-6"	25
N2	6	#4	3	9'-2"	36
N3	6	#4	3	8'-5"	33
N4	6	#4	3	7'-8"	30
N5	6	#4	3	7'-0"	28
N6	4	#4	3	6'-3"	17
N7	4	#4	3	9'-6"	25
N8	6	#4	3	9'-4"	37
N9	6	#4	3	8'-11"	35
N10	6	#4	3	9'-5"	37
N11	6	#4	3	7'-11"	31
N12	6	#4	3	7'-5"	29
N13	6	#4	3	7'-0"	28
N14	8	#4	3	6'-6"	34

S1	24	#6	STR	6'-0"	216
T1	20	#4	STR	14'-3"	188
T2	20	#4	STR	23'-0"	304

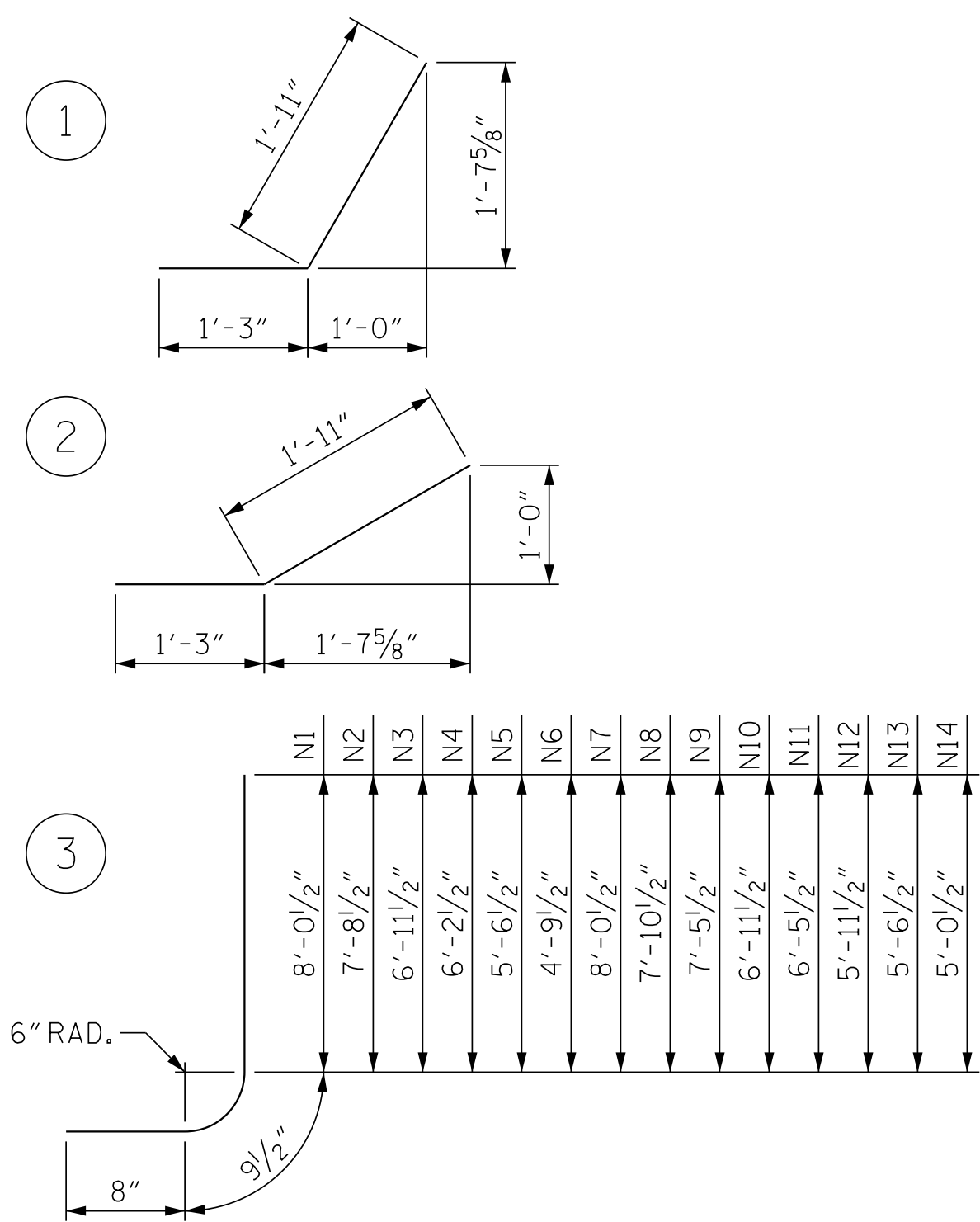
V1	4	#4	STR	7'-5"	20
V2	6	#4	STR	7'-1"	28
V3	6	#4	STR	6'-5"	25
V4	6	#4	STR	5'-8"	22
V5	6	#4	STR	4'-11"	19
V6	4	#4	STR	4'-2"	11
V7	4	#4	STR	7'-6"	20
V8	6	#4	STR	7'-4"	29
V9	6	#4	STR	6'-10"	27
V10	6	#4	STR	6'-4"	25
V11	6	#4	STR	5'-11"	23
V12	6	#4	STR	5'-5"	21
V13	6	#4	STR	4'-11"	19
V14	8	#4	STR	4'-5"	23

Z1	8	#4	STR	4'-11"	26
Z2	12	#4	STR	4'-9"	38
Z3	12	#4	STR	4'-3"	34
Z4	12	#4	STR	3'-9"	30
Z5	12	#4	STR	3'-3"	26
Z6	8	#4	STR	2'-10"	15
Z7	8	#4	STR	5'-0"	26
Z8	12	#4	STR	4'-11"	39
Z9	12	#4	STR	4'-7"	36
Z10	12	#4	STR	4'-3"	34
Z11	12	#4	STR	3'-11"	31
Z12	12	#4	STR	3'-7"	28
Z13	12	#4	STR	3'-3"	26
Z14	16	#4	STR	2'-11"	31

EPOXY COATED REINFORCING	2420 LBS
STEEL FOR 4 WINGS	
CLASS A CONCRETE	
4 WINGS	29.0 CY
2 HEADWALLS	1.0 CY
2 END CURTAIN WALLS	1.2 CY
TOTAL	31.2 CY

**BAR TYPES**

ALL BAR DIMENSIONS ARE OUT TO OUT.



DATE: 4/7/2017 TIME: 2:46:28 PM USER: jcm1503c D:\N:\R\6032444\_5\ncum Road\MOI\_Technical\MOI\_Structure\Culverts\412\_030\_C2-6\_R5B6.WING.dgn

DRAWN BY : NKB DATE : 03/16  
 CHECKED BY : JCM DATE : 03/16  
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PROJECT NO. R-5516  
CRAVEN COUNTY  
 STATION: 26+94.23 -Y09A-  
 SHEET 6 OF 6

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C2-6

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