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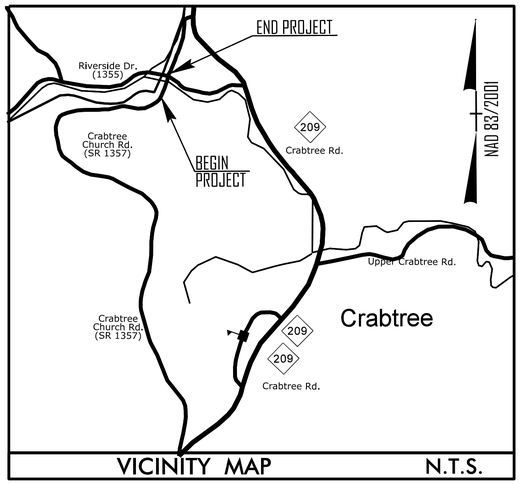
PROJECT: 18314.1044073

CONTRACT: DN01146



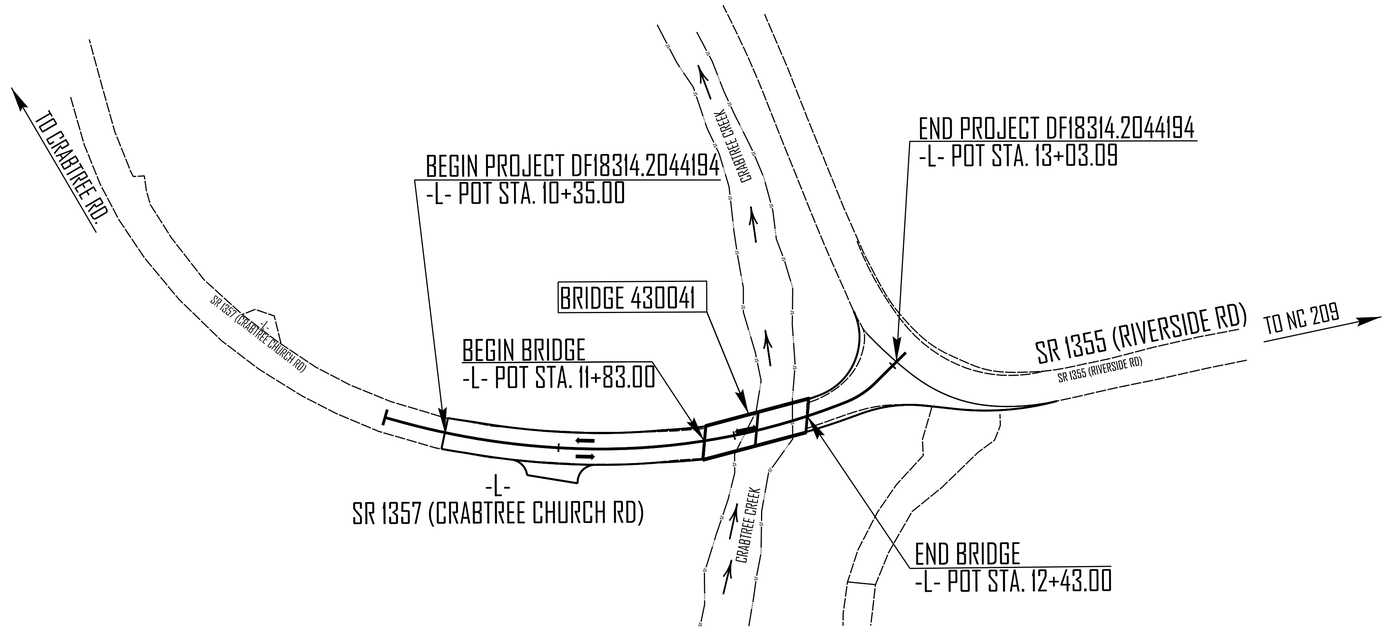
STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

HAYWOOD COUNTY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	18314.1044073		
STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION	
18314.1044073		PE, ROW, UTIL. & CONST.	

LOCATION: *REPLACE BRIDGE 41 ON SR 1357 (CRABTREE CHURCH RD) OVER CRABTREE CREEK*

TYPE OF WORK: *GRADING, DRAINAGE, PAVING, AND STRUCTURE*



STRUCTURES

DESIGN DATA

ADT 2025 = 200
K = N/A %
D = N/A %
T = 7 % *
V = 30 MPH
* (TTST = 4% + DUAL 3%)

FUNC CLASS =
MAJOR COLLECTOR
SUBREGIONAL TIER

PROJECT LENGTH

LENGTH OF ROADWAY PROJECT 18314.1044073 = 0.040 MILES
LENGTH STRUCTURE PROJECT 18314.1044073 = 0.011 MILE

TOTAL LENGTH PROJECT 18314.1044073 = 0.051 MILES

Prepared for the Office of:
DIVISION OF HIGHWAYS
STRUCTURES MANAGEMENT UNIT
1000 BIRCH RIDGE DR.
RALEIGH, N.C. 27610

2024 STANDARD SPECIFICATIONS

LETTING DATE :
JANUARY 13, 2026

Scott D. Blevins, P.E.
PROJECT ENGINEER
Bruce D. Klappenbach, P.E.
PROJECT STRUCTURE ENGINEER

NCDOT CONTACT:
Andrew Buchanan

PLANS PREPARED BY:

RK&K
P: (919) 878-9560
8601 Six Forks Road, Forum 1 Suite 700
Raleigh, North Carolina 27615 | NC License No. F-0112
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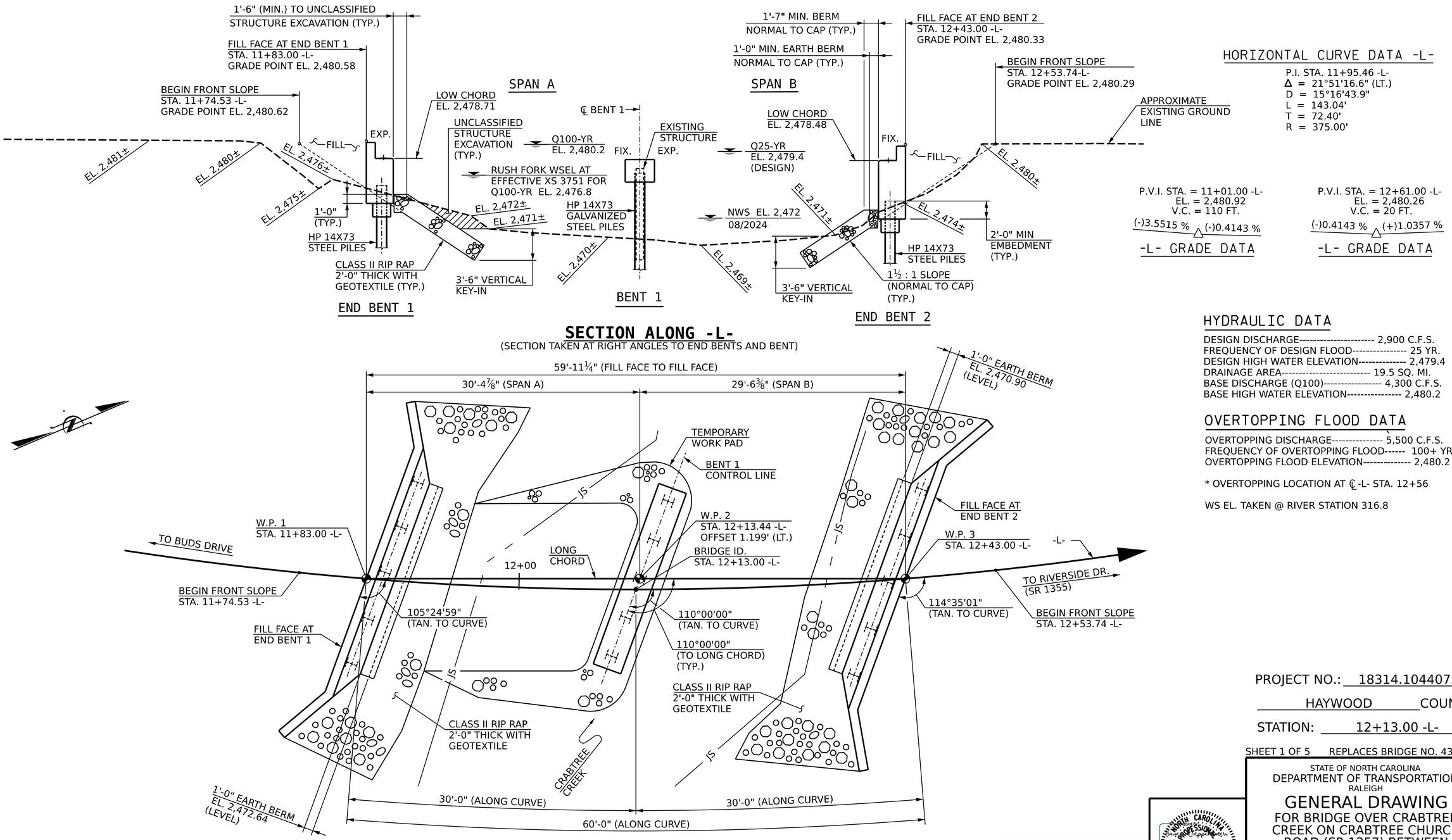
NORTH CAROLINA PROFESSIONAL SEAL 15825 ENGINEER BRUCE D. KLAPPENBACH
12/15/2025



HYDRAULIC DATA

DESIGN DISCHARGE---------- 2,900 C.F.S.
FREQUENCY OF DESIGN FLOOD---------- 25 YR.
DESIGN HIGH WATER ELEVATION---------- 2,479.4
DRAINAGE AREA---------- 19.5 SQ. MI.
BASE DISCHARGE (Q100)---------- 4,300 C.F.S.
BASE HIGH WATER ELEVATION---------- 2,480.2

OVERTOPPING FLOOD DATA

OVERTOPPING DISCHARGE---------- 5,500 C.F.S.
FREQUENCY OF OVERTOPPING FLOOD------ 100+ YRS.
OVERTOPPING FLOOD ELEVATION---------- 2,480.2 *

* OVERTOPPING LOCATION AT ℄ -L- STA. 12+56

WS EL. TAKEN @ RIVER STATION 316.8

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 1 OF 5 REPLACES BRIDGE NO. 430041

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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12/15/2025

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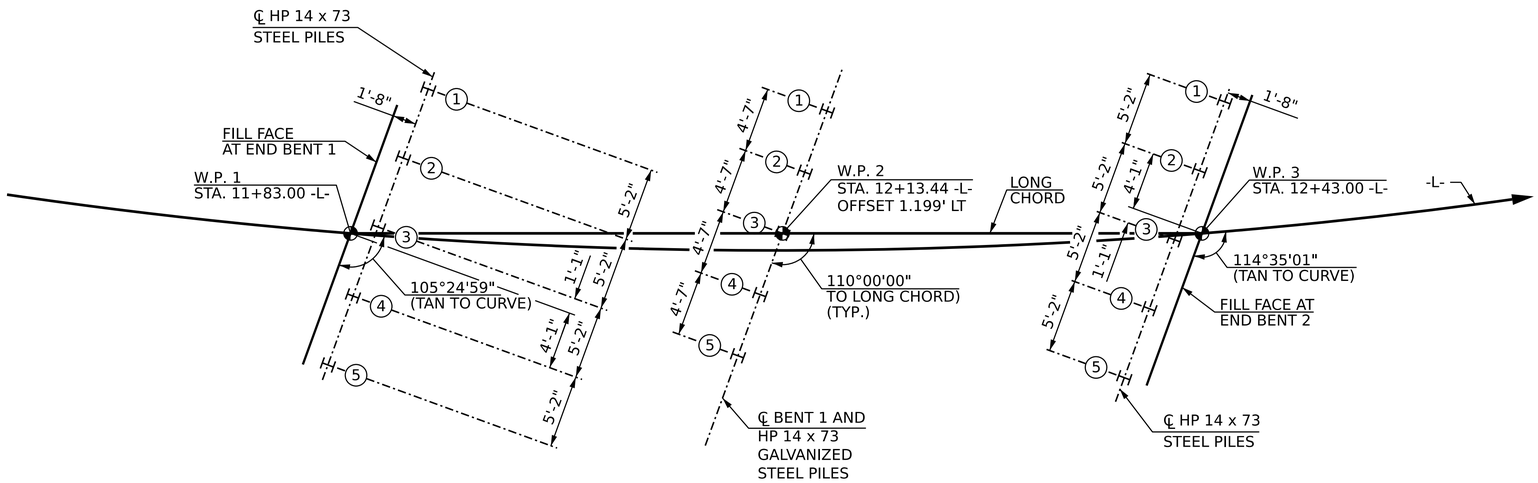
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING

FOR BRIDGE OVER CRABTREE CREEK ON CRABTREE CHURCH ROAD (SR 1357) BETWEEN BUDS DRIVE AND RIVERSIDE DRIVE (SR 1355)

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



END BENT 1 BENT 1 END BENT 2

FOUNDATION LAYOUT

ALL HP PILES ARE VERTICAL
DIMENSIONS LOCATING PILES ARE SHOWN TO THE CENTERLINE OF PILES

FOUNDATION NOTES:

FOR PILES, SEE SECTION 450 OF THE STANDARD SPECIFICATIONS.

IT HAS BEEN ESTIMATED THAT A HAMMER WITH AN EQUIVALENT RATED ENERGY IN THE RANGE OF 30,000-45,000 FT-LBS PER BLOW WILL BE REQUIRED TO DRIVE PILES AT END BENT 1, END BENT 2, AND BENT 1. THIS ESTIMATED ENERGY RANGE DOES NOT RELEASE THE CONTRACTOR FROM PROVIDING DRIVING EQUIPMENT IN ACCORDANCE WITH SUBARTICLE 450-3(D)(2) OF THE STANDARD SPECIFICATIONS.

TEMPORARY STEEL CASINGS ARE REQUIRED FOR PILE EXCAVATION AT END BENT 1, BENT 1, AND END BENT 2.

BEFORE FILLING HOLES FOR PILE EXCAVATION AT END BENT 1, BENT 1, AND END BENT 2, DRIVE PILES TO REQUIRED DRIVING RESISTANCE.

FILL HOLES FOR PILE EXCAVATION AT END BENT 1, BENT 1, AND END BENT 2 WITH CONCRETE.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 2 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING
FOUNDATION LAYOUT
AND GEOTECH NOTES

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

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

SUMMARY OF PILE INFORMATION/INSTALLATION

(BLANK ENTRIES INDICATE ITEM IS NOT APPLICABLE TO STRUCTURE)

END BENT/BENT NO. PILE(S) #(-#) (E.G., "BENT 1, PILES 1-5")	NUMBER OF PILES PER LINE	FACTORED RESISTANCE PER PILE	PILE CUT-OFF (TOP OF PILE) ELEVATION	ESTIMATED PILE LENGTH PER PILE	SCOUR CRITICAL ELEVATION	DRIVEN PILES			PREDRILLING FOR PILES * *			DRILLED-IN PILES		
						MIN. PILE TIP (TIP NO HIGHER THAN) ELEV.	REQUIRED DRIVING RESISTANCE (RDR)* PER PILE	PILE REDRIVES QUANTITY	PREDRILLING LENGTH PER PILE	PREDRILLING ELEVATION (ELEV. NOT TO PREDRILL BELOW)	MAXIMUM PREDRILLING DIAMETER	PILE EXCAVATION BOTTOM OF HOLE) ELEV.	PILE EXCAVATION NOT IN SOIL PER PILE	PILE EXCAVATION IN SOIL PER PILE
		KIPS	FT.	FT.	FT.	FT.	KIPS	EA.	LIN.FT.	FT.	INCHES	FT.	LIN.FT.	LIN.FT.
END BENT 1, PILES 1-3	3	70	2,475.64	25		2,452.00	120					2,452.00	6.0	15.6
END BENT 1, PILES 4-5	2	70	2,475.64	35		2,445.00	120					2,470.00	2.0	1.6
BENT 1, PILES 1-3	3	110	2,477.01	40	2,461.00	2,442.00	240					2,442.00	3.0	31.0
BENT 1, PILES 4-5	2	110	2,477.01	30	2,461.00	2,451.00	240					2,451.00	6.0	19.0
END BENT 2, PILES 1-3	3	70	2,473.90	35		2,441.00	120					2,470.00	2.0	0.0
END BENT 2, PILES 4-5	2	70	2,473.90	25		2,450.00	120					2,450.00	7.0	14.9
TOTAL QUANTITY:													63.0	210.8

* RDR = $\frac{\text{FACTORED RESISTANCE + FACTORED DRAG LOAD + FACTORED DEAD LOAD}}{\text{DYNAMIC RESISTANCE FACTOR}}$ + NOMINAL DRAG LOAD RESISTANCE + NOMINAL RESISTANCE FROM SCOURABLE MATERIAL

* * PREDRILLING FOR PILES IS REQUIRED FOR END BENTS/BENTS WITH A PREDRILLING LENGTH AND AT THE CONTRACTOR'S OPTION FOR END BENTS/BENTS WITH PREDRILLING INFORMATION BUT NO PREDRILLING LENGTH.

PILE DESIGN INFORMATION

(BLANK ENTRIES INDICATE ITEM IS NOT APPLICABLE TO STRUCTURE)

END BENT/BENT NO. PILE(S) #(-#) (E.G., "BENT 1, PILES 1-5")	FACTORED AXIAL LOAD PER PILE	FACTORED DRAG LOAD PER PILE	FACTORED DEAD LOAD * PER PILE	DYNAMIC RESISTANCE FACTOR	NOMINAL DRAG RESISTANCE PER PILE	NOMINAL SCOUR RESISTANCE PER PILE
	KIPS	KIPS	KIPS		KIPS	KIPS
END BENT 1, PILES 1-3	70			0.60		
END BENT 1, PILES 4-5	70			0.60		
BENT 1, PILES 1-3	110			0.60		38
BENT 1, PILES 4-5	110			0.60		50
END BENT 2, PILES 1-3	70			0.60		
END BENT 2, PILES 4-5	70			0.60		

* FACTORED DEAD LOAD IS FACTORED WEIGHT OF PILE ABOVE THE GROUND LINE.

SUMMARY OF PILE ACCESSORIES

(BLANK ENTRIES INDICATE ITEM IS NOT APPLICABLE TO STRUCTURE)

END BENT/BENT NO. PILE(S) #(-#) (E.G., "BENT 1, PILES 1-5")	PIPE PILE PLATES	STEEL PILE POINTS		
		PIPE PILE CUTTING SHOES	PIPE PILE CONICAL POINTS	H-PILE POINTS
	EA.	EA.	EA.	EA.
END BENT 1, PILES 1-5				5
BENT 1, PILES 1-5				5
END BENT 2, PILES 1-5				5
TOTAL QUANTITY:				15

NOTES:

1. THE PILE FOUNDATION TABLES ARE BASED ON THE BRIDGE SUBSTRUCTURE DESIGN AND FOUNDATION RECOMMENDATIONS SEALED BY A NORTH CAROLINA PROFESSIONAL ENGINEER(ATEFEH ASOUDEH, PE#043747) ON 08/14/2025.
2. TOTAL PILE DRIVING EQUIPMENT SETUP QUANTITY (NOT SHOWN IN PILE FOUNDATION TABLES)EQUALS THE NUMBER OF DRIVEN PILES, I.E., THE NUMBER OF PILES WITH A REQUIRED DRIVING RESISTANCE.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 3 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

PILE FOUNDATION TABLES

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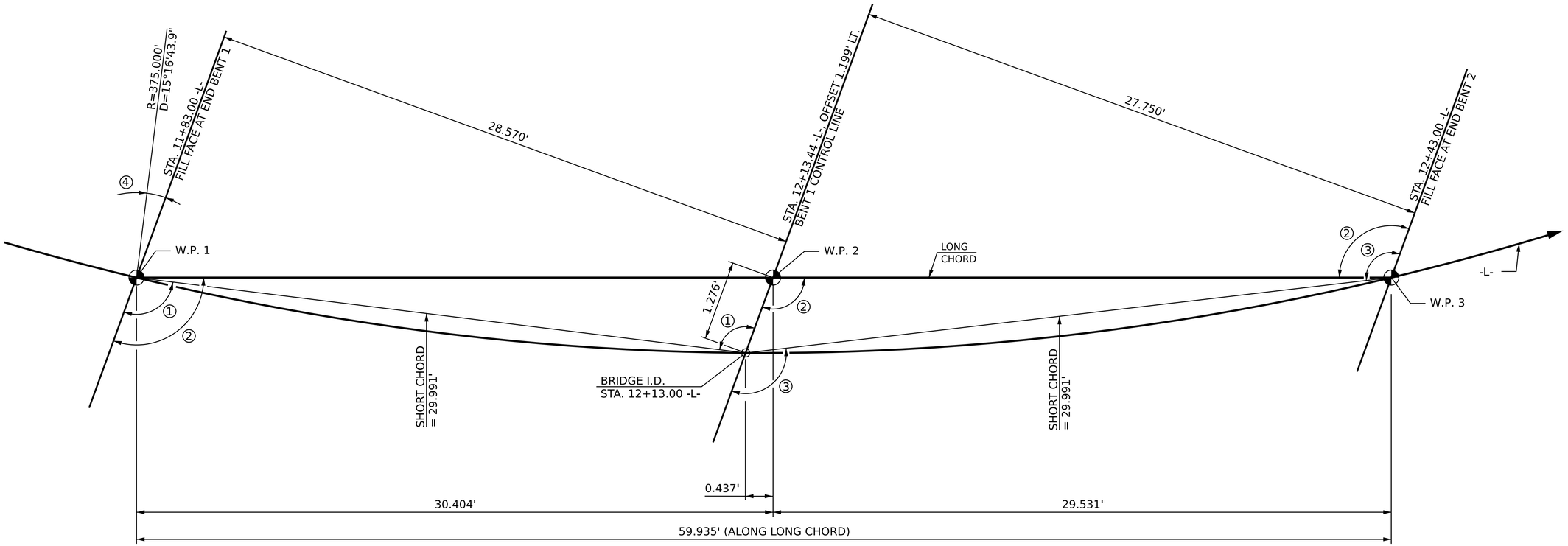
NORTH CAROLINA PROFESSIONAL SEAL 15825 ENGINEER BRUCE D. KLAPPENBACH
12/15/2025

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025



LONG CHORD LAYOUT

NOTE: END BENTS AND BENT ARE PARALLEL

HORIZONTAL CURVE DATA -L-

P.I. STA. 11+95.46 -L-
Δ = 21°51'16.6" (LT.)
D = 15°16'43.9"
L = 143.04'
T = 72.40'
R = 375.00'

ANGLES

① 107°42'29.0"
② 110°00'00.0"
③ 112°17'30.0"
④ 15°24'59.0"

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 4 OF 5

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING
LONG CHORD LAYOUT

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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12/15/2025

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

NOTES:

ASSUMED LIVE LOAD = HL-93 OR ALTERNATE LOADING.

FOR OTHER DESIGN DATA AND GENERAL NOTES, SEE SHEET SN.

THIS BRIDGE IS LOCATED IN SEISMIC ZONE 1.

THIS BRIDGE HAS BEEN DESIGNED IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

THE EXISTING STRUCTURE CONSISTS OF 2 SPANS AT 30 FT. ON A TIMBER FLOOR ON STEEL I-BEAMS WITH AN ASPHALT WEARING SURFACE AND A CLEAR ROADWAY OF 17'-8". THE SUBSTRUCTURE CONSISTS OF TIMBER CAPS ON TIMBER POST & SILLS AT THE BENT AND END BENTS. THE EXISTING BRIDGE WAS LOCATED AS THE PROPOSED STRUCTURE AND WAS WASHED AWAY DURING A 2024 STORM EVENT. ANY REMAINING SUBSTRUCTURE ELEMENTS 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.

THE SUBSTRUCTURE OF THE EXISTING BRIDGE INDICATED ON THE PLANS IS FROM THE BEST INFORMATION AVAILABLE. SINCE THIS INFORMATION IS SHOWN FOR THE CONVENIENCE OF THE CONTRACTOR, THE CONTRACTOR SHALL HAVE NO CLAIM WHATSOEVER AGAINST THE DEPARTMENT OF TRANSPORTATION FOR ANY DELAYS OR ADDITIONAL COST INCURRED BASED ON DIFFERENCES BETWEEN THE EXISTING BRIDGE SUBSTRUCTURE SHOWN ON THE PLANS AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

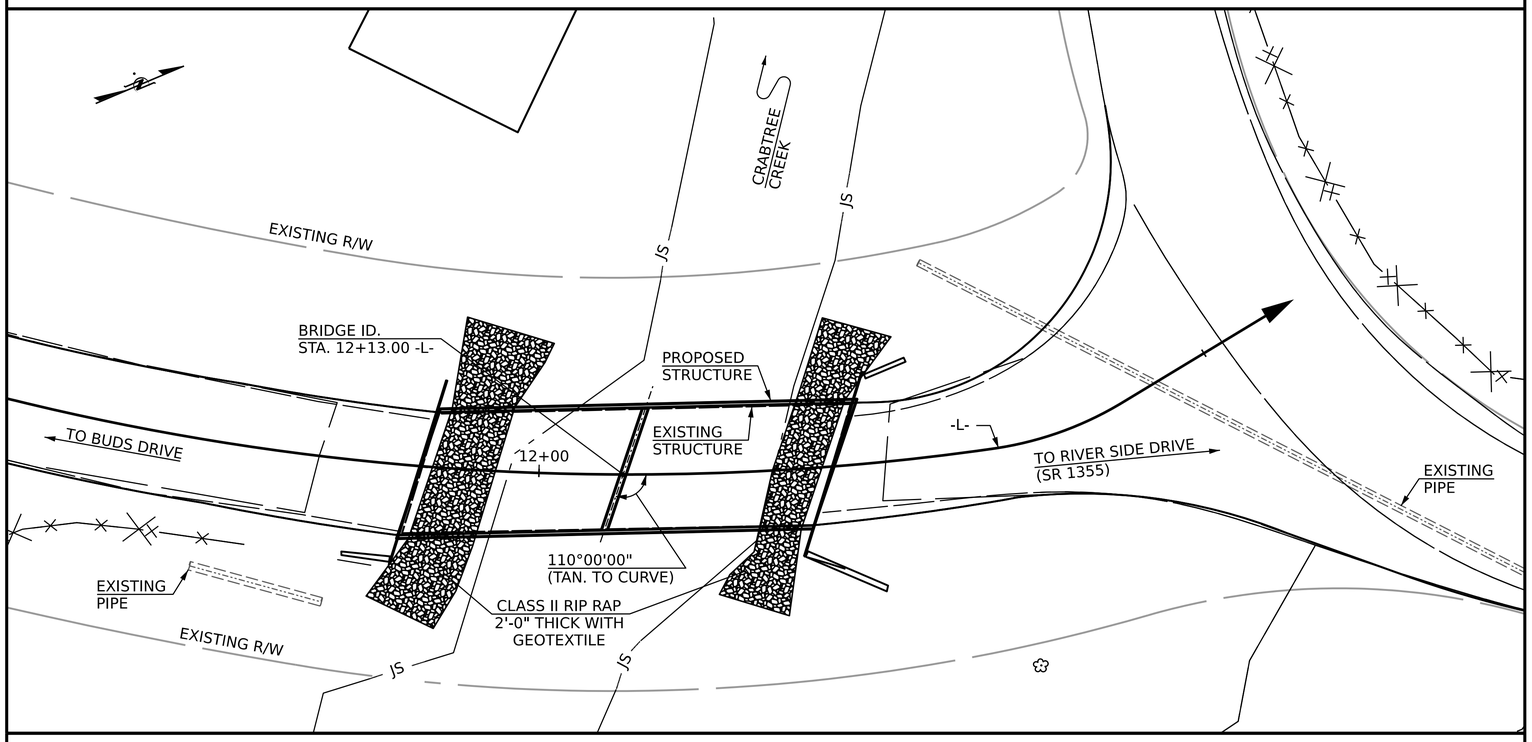
FOR SUBMITTAL OF WORKING DRAWINGS, SEE SPECIAL PROVISIONS.

FOR EROSION CONTROL MEASURES, SEE EROSION CONTROL PLANS.

TOTAL BILL OF MATERIAL

	CONSTRUCTION MAINTENANCE & REMOVAL OF TEMP.ACCESS	REMOVAL OF EXISTING STRUCTURE	ASBESTOS ASSESSMENT	PILE EXCAVATION IN SOIL	PILE EXCAVATION NOT IN SOIL	UNCLASSIFIED STRUCTURE EXCAVATION	CLASS A CONCRETE	REINFORCING STEEL	APPROX. 32,400 LBS. STRUCTURAL STEEL	PILE DRIVING EQUIPMENT SETUP FOR HP 14x73 STEEL PILES	PILE DRIVING EQUIPMENT SETUP FOR HP 14x73 GALVANIZED STEEL PILES	HP 14x73 STEEL PILES	HP 14x73 GALVANIZED STEEL PILES	STEEL PILE POINTS	RIP RAP CALSS II (2'-0" THICK)	GEOTEXTILE FOR DRAINAGE	ELASTOMERIC BEARINGS	TIMBER BRIDGE DECK SYSTEM	TIMBER BRIDGE RAIL SYSTEM
	LUMP SUM	LUMP SUM	LUMP SUM	LIN. FT.	LIN. FT.	LUMP SUM	CU. YDS.	LBS.	LUMP SUM	EA.	EA.	LIN. FT.	LIN. FT.	EA.	TON	SQ. YDS.	LUMP SUM	LUMP SUM	LIN. FT.
SUPERSTRUCTURE									LUMP SUM								LUMP SUM	LUMP SUM	115.26
END BENT 1				50.0	22.0	LUMP SUM	21.4	2,646		5		145		5	90	100			
BENT 1				131.0	21.0		6.4	1,212			5		180	5					
END BENT 2				29.8	20.0		26.7	2,998		5		155		5	60	65			
TOTAL	LUMP SUM	LUMP SUM	LUMP SUM	210.8	63.0	LUMP SUM	54.5	6,856	LUMP SUM	10	5	300	180	15	150	165	LUMP SUM	LUMP SUM	115.26

BENCH MARK BM#1 AT -L- STA. 12+69, 36' RT, RR SPIKE IN BASE OF 7" WALNUT, N 697563, E 829397, EL. 2480.3 NAVD88



LOCATION SKETCH

FOR UTILITY INFORMATION, SEE UTILITY PLANS AND SPECIAL PROVISIONS.

FOR FALSEWORK AND FORMWORK, SEE SPECIAL PROVISIONS.

FOR CRANE SAFETY, SEE SPECIAL PROVISIONS.

FOR GROUT FOR STRUCTURES, SEE SPECIAL PROIVISIONS.

FOR ASBESTOS ASSESSMENT, SEE SPECIAL PROVISIONS.

THIS STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH HEC 18, "EVALUATING SCOUR AT BRIDGES".

ALL STRUCTURAL STEEL SHALL BE AASHTO M270 GRADE 50 AND PAINTED WITH SYSTEM 1 OR HOT DIPPED GALVANIZED IN ACCORDANCE WITH THE STRUCTURAL STEEL COATINGS PROGRAM AND SECTION 442-8 OF THE STANDARD SPECIFICATIONS, UNLESS OTHERWISE NOTED ON THE PLANS.

COATING APPLICATION FOR ALL STRUCTURAL STEEL SHALL NOT BE PERFORMED UNTIL SHOP FABRICATION INCLUDING CUTTING, DRILLING AND WELDING HAS BEEN COMPLETED.

ALL TIMBER AND LUMBER MEMBERS SHALL BE TREATED SOUTHERN PINE AND CONFORM TO SECTION 1082 OF THE STANDARD SPECIFICATIONS.

ALL TIMBER DIMENSIONS SHOWN ON THE PLANS ARE NOMINAL DIMENSIONS.

WHEN FIELD CUTTING TIMBER MEMBERS, TREAT NEWLY EXPOSED SURFACES WITH EITHER A BITUMINOUS ASPHALT-BASED ROOFING CEMENT, COPPER NAPHTHENATE PASTE, OR APPROVED PRESERVATIVE SYSTEM BEFORE INSTALLING.

TREAT ALL DRILLED OR NEWLY EXPOSED HOLES IN TIMBER MEMBERS BY PUMPING WITH BITUMINOUS ASPHALT-BASED ROOFING CEMENT, OR APPROVED PRESERVATIVE SYSTEM BEFORE INSTALLING HARDWARE.

PRE-DRILL HOLES IN TIMBER AND LUMBER MEMBERS ACCEPTING BOLTS TO ELIMINATE SPLITTING.

ALL HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 1076 OF THE STANDARD SPECIFICATION, UNLESS OTHERWISE NOTED ON THE PLANS.

DO NOT DRIVE LAG/STRUCTURAL SCREWS WITH A HAMMER, SCREW OR TORQUE LAG/STRUCTURAL SCREWS.

SCREWS SHALL PROVIDE SUFFICIENT LENGTH SO THAT SCREW SHANK WILL PENETRATE RECEIVING MEMBERS.

FOR TIMBER BRIDGE RAIL SYSTEM, INCLUDING LUMBER, DELINEATORS, HARDWARE FOR BOLT CONNECTIONS, HARDWARE FOR SCREW CONNECTIONS AND ALUMINUM DRIP EDGE, SEE TIMBER BRIDGE SUPERSTRUCTURE ON STEEL BEAMS SPECIAL PROVISION.

FOR TIMBER BRIDGE DECK SYSTEM, INCLUDING HARDWARE FOR BOLT CONNECTIONS AND HARDWARE FOR SCREW CONNECTIONS, SEE TIMBER BRIDGE SUPERSTRUCTURE ON STEEL BEAM SPECIAL PROVISION.

ASPHALT WEARING SURFACE IS INCLUDED IN ROADWAY QUANTITY ON ROADWAY PLANS.

FOR TIMBER BRIDGE FLASHING MEMBRANE, SEE SPECIAL PROVISIONS.

FOR TIMBER BRIDGE DECK WATERPROOFING MEMBRANE, SEE SPECIAL PROVISIONS.

THE MATERIAL IN THE CROSS-HATCHED AREA SHALL BE EXCAVATED FOR A DISTANCE OF 18.0 FT. EACH SIDE OF CENTERLINE ROADWAY AS DIRECTED BY THE ENGINEER. THIS WORK WILL BE PAID FOR AT THE CONTRACT LUMP SUM PRICE FOR UNCLASSIFIED STRUCTURE EXCAVATION. SEE SECTION 412 OF THE STANDARD SPECIFICATIONS.

THE SCOUR CRITICAL EXCAVATION FOR BENT 1 IS ELEVATION 2461.0. SCOUR CRITICAL ELEVATIONS ARE USED TO MONITOR POSSIBLE SCOUR PROBLEMS DURING THE LIFE OF THE STRUCTURE.

AT THE CONTRACTOR'S OPTION, AND UPON REMOVAL OF THE WORK PAD, THE CLASS II RIP RAP USED FOR THE WORK PAD MAY BE PLACED AS RIP RAP SLOPE PROTECTION. SEE SPECIAL PROVISIONS FOR CONSTRUCTION, MAINTENANCE AND REMOVAL OF TEMPORARY ACCESS AT STATION 12+13.00 -L-.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 5 OF 5

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 15825 BRUCE D. KLAPPENBACH
12/15/2025

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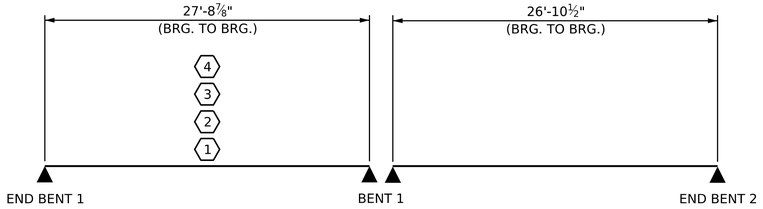
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING
LOCATION SKETCH, NOTES , AND TOTAL BILL OF MATERIAL

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-5
1			3			TOTAL SHEETS
2			4			21

LOAD AND RESISTANCE FACTOR RATING (LRFR) STEEL GIRDERS (W 12 X 65)

LOAD TYPE		VEHICLE	WEIGHT (W) (TONS)	④ CONTROLLING LOAD RATING	MINIMUM RATING FACTORS (RF)	TONS = W x RF	STRENGTH I LIMIT STATE										SERVICE II LIMIT STATE						COMMENT NUMBER
							LIVE-LOAD FACTORS (γ LL)	MOMENT					SHEAR						LIVE-LOAD FACTORS (γ LL)	MOMENT					
								DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)		DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	
DESIGN LOAD		HL-93 (INVENTORY)	N/A	①	1.19	-	1.75	0.348	1.19	A	I	13.9	0.348	3.16	A	I	25.0	1.30	0.348	1.29	A	I	13.9	
		HL-93 (OPERATING)	N/A		1.55	-	1.35	0.348	1.55	A	I	13.9	0.348	4.09	A	I	25.0	N/A	-	-	-	-	-	
		HS-20 (INVENTORY)	36.000	②	1.54	55.44	1.75	0.348	1.54	A	I	13.9	0.348	3.16	A	I	25.0	1.30	0.348	1.67	A	I	13.9	
		HS-20 (OPERATING)	36.000		1.99	71.64	1.35	0.348	1.99	A	I	13.9	0.348	4.10	A	I	25.0	N/A	-	-	-	-	-	
LEGAL LOAD	SINGLE VEHICLE (SV)	SNSH	13.500		2.93	39.56	1.40	0.348	3.27	A	I	13.9	0.348	8.22	A	I	25.0	1.30	0.348	2.93	A	I	13.9	
		SNGARBS2	20.000		2.75	55.00	1.40	0.348	3.06	A	I	13.9	0.348	6.47	A	I	25.0	1.30	0.348	2.75	A	I	13.9	
		SNAGRIS2	22.000		2.93	64.46	1.40	0.348	3.27	A	I	13.9	0.348	6.28	A	I	25.0	1.30	0.348	2.93	A	I	13.9	
		SNCOTTS3	27.250		1.47	40.06	1.40	0.348	1.63	A	I	13.9	0.348	4.18	A	I	25.0	1.30	0.348	1.47	A	I	13.9	
		SNAGGRS4	34.925		1.43	49.94	1.40	0.348	1.59	A	I	13.9	0.348	3.93	A	I	25.0	1.30	0.348	1.43	A	I	13.9	
		SNS5A	35.550		1.38	49.06	1.40	0.348	1.54	A	I	13.9	0.348	4.14	A	I	25.0	1.30	0.348	1.38	A	I	13.9	
		SNS6A	39.950		1.30	51.94	1.40	0.348	1.45	A	I	13.9	0.348	3.91	A	I	25.0	1.30	0.348	1.30	A	I	13.9	
		SNS7B	42.000	③	1.27	53.34	1.40	0.348	1.41	A	I	13.9	0.348	3.97	A	I	25.0	1.30	0.348	1.27	A	I	13.9	
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		1.72	56.76	1.40	0.348	1.91	A	I	13.9	0.348	4.70	A	I	25.0	1.30	0.348	1.72	A	I	13.9	
		TNT4A	33.075		1.60	52.92	1.40	0.348	1.78	A	I	13.9	0.348	4.37	A	I	25.0	1.30	0.348	1.60	A	I	13.9	
		TNT6A	41.600		1.47	61.15	1.40	0.348	1.63	A	I	13.9	0.348	4.16	A	I	25.0	1.30	0.348	1.47	A	I	13.9	
		TNT7A	42.000		1.52	63.84	1.40	0.348	1.69	A	I	13.9	0.348	4.05	A	I	25.0	1.30	0.348	1.52	A	I	13.9	
		TNT7B	42.000		1.41	59.22	1.40	0.348	1.57	A	I	13.9	0.348	3.93	A	I	25.0	1.30	0.348	1.41	A	I	13.9	
		TNAGRIT4	43.000		1.47	63.21	1.40	0.348	1.64	A	I	13.9	0.348	3.87	A	I	25.0	1.30	0.348	1.47	A	I	13.9	
		TNAGT5A	45.000		1.44	64.80	1.40	0.348	1.60	A	I	13.9	0.348	4.03	A	I	25.0	1.30	0.348	1.44	A	I	13.9	
		TNAGT5B	45.000		1.42	63.90	1.40	0.348	1.59	A	I	13.9	0.348	3.60	A	I	25.0	1.30	0.348	1.42	A	I	13.9	
EMERGENCY VEHICLE (EV)		EV2	28.750		2.39	68.71	1.30	0.348	2.39	A	I	13.9	0.348	5.18	A	I	25.0	N.A.	-	-	-	-	-	
		EV3	43.000	④	1.50	64.50	1.30	0.348	1.50	A	I	13.9	0.348	3.54	A	I	25.0	N.A.	-	-	-	-	-	



LRFR SUMMARY

LOAD FACTORS:

DESIGN LOAD RATING FACTORS	LIMIT STATE	γDC	γDW
	STRENGTH I	1.25	1.50
	SERVICE II	1.00	1.00

NOTES:

MINIMUM RATING FACTORS ARE BASED ON THE STRENGTH I AND SERVICE II LIMIT STATES.

ALLOWABLE STRESSES FOR SERVICE II LIMIT STATE ARE AS REQUIRED FOR DESIGN.

COMMENTS:

1.

2.

3.

4.

CONTROLLING LOAD RATING
① DESIGN LOAD RATING (HL-93)
② DESIGN LOAD RATING (HS-20)
③ LEGAL LOAD RATING * *
④ EMERGENCY VEHICLE LOAD RATING
* * SEE CHART FOR VEHICLE TYPE
GIRDER LOCATION
I - INTERIOR GIRDER
EL - EXTERIOR LEFT GIRDER
ER - EXTERIOR RIGHT GIRDER

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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12/15/2025

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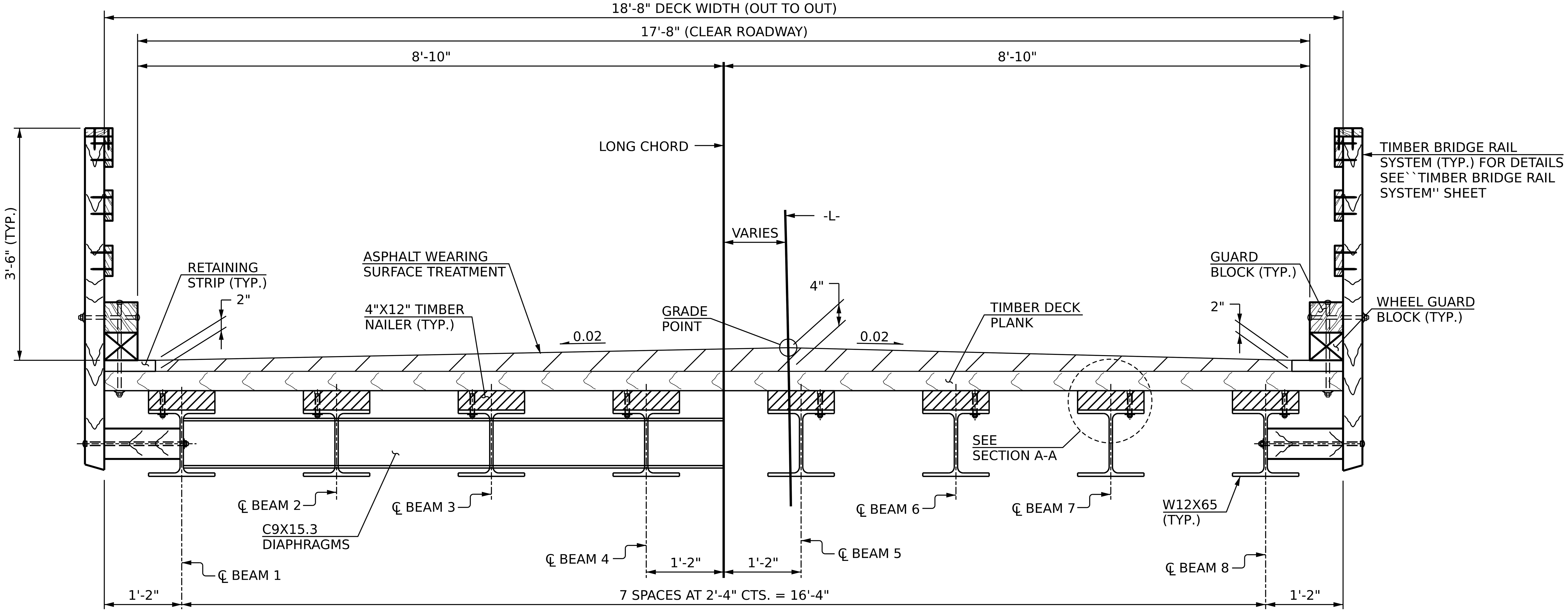
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH
STANDARD

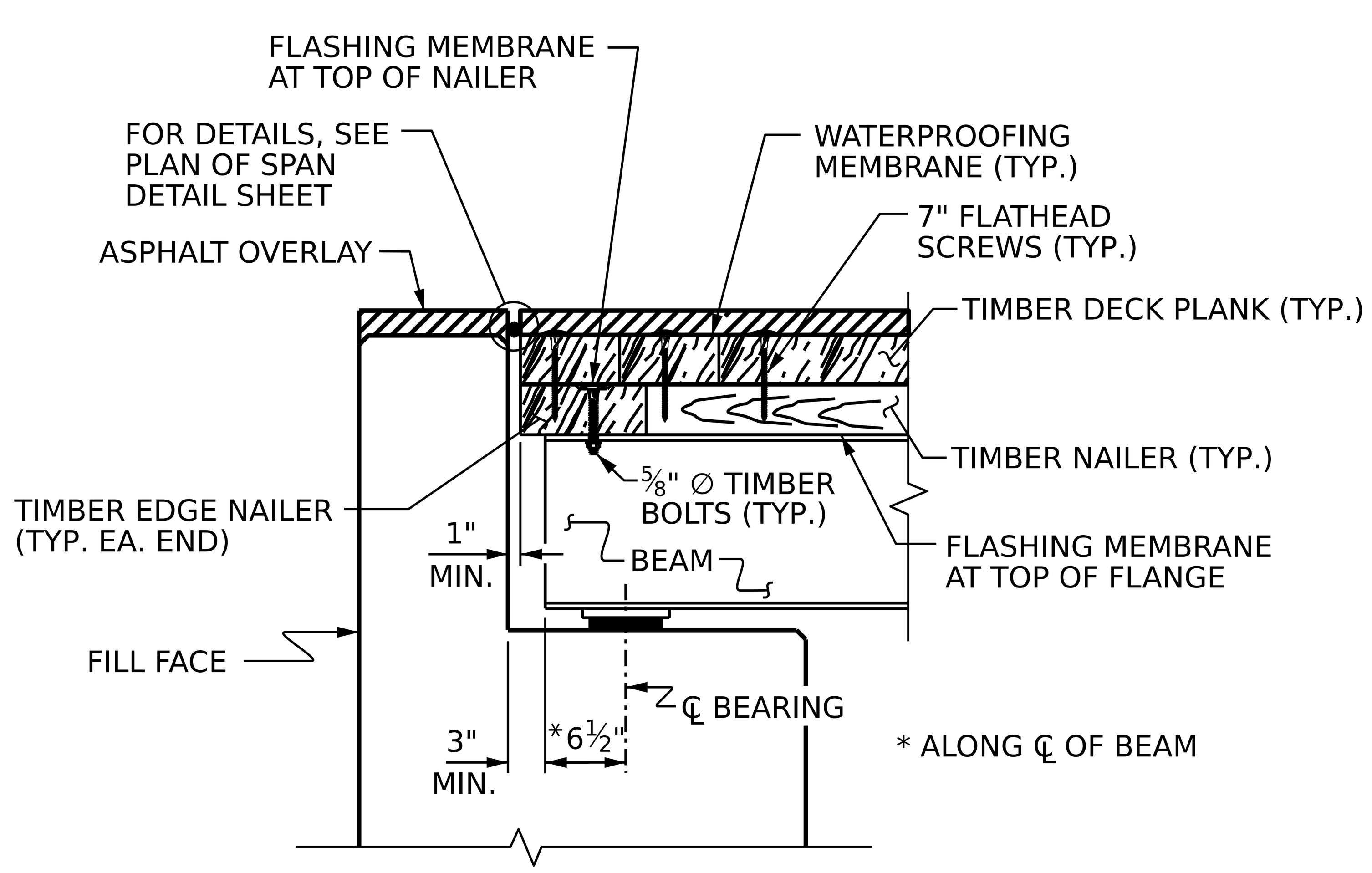
LRFR SUMMARY FOR 30FT STEEL GIRDERS

(NON-INTERSTATE TRAFFIC)

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-6
1			3			TOTAL SHEETS
2			4			21



TYPICAL SECTION



SECTION AT ABUTMENT

NOTES

FOR TIMBER BRIDGE DECK SYSTEM DETAILS, SEE PLAN OF SPAN.

FOR TIMBER BRIDGE RAIL SYSTEM DETAILS, SEE TIMBER BRIDGE RAIL SYSTEM PLAN SHEET.

PRIOR TO PLACING TIMBER BEAM NAILER AND EDGE NAILER MEMBERS, PLACE A FLASHING MEMBRANE ON THE TOP SIDE OF THE STEEL BEAMS.

PRIOR TO PLACING TIMBER PLANK MEMBERS, PLACE A SELF-ADHERING FLASHING MEMBRANE ON THE TOP SIDE OF THE TIMBER NAILERS.

FOR BEAM AND DIAPHRAGM DETAILS, SEE FRAMING PLAN SHEET.

FOR SECTION A-A, SEE "PLAN OF SPAN A AND SPAN B" SHEET 1 OF 2.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE
TYPICAL SECTION

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REVISIONS								SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:			S-7
1			3					TOTAL SHEETS
2			4					21

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CHECKED BY :	B. D. KLAPPENBACH	DATE :	JUL 2025
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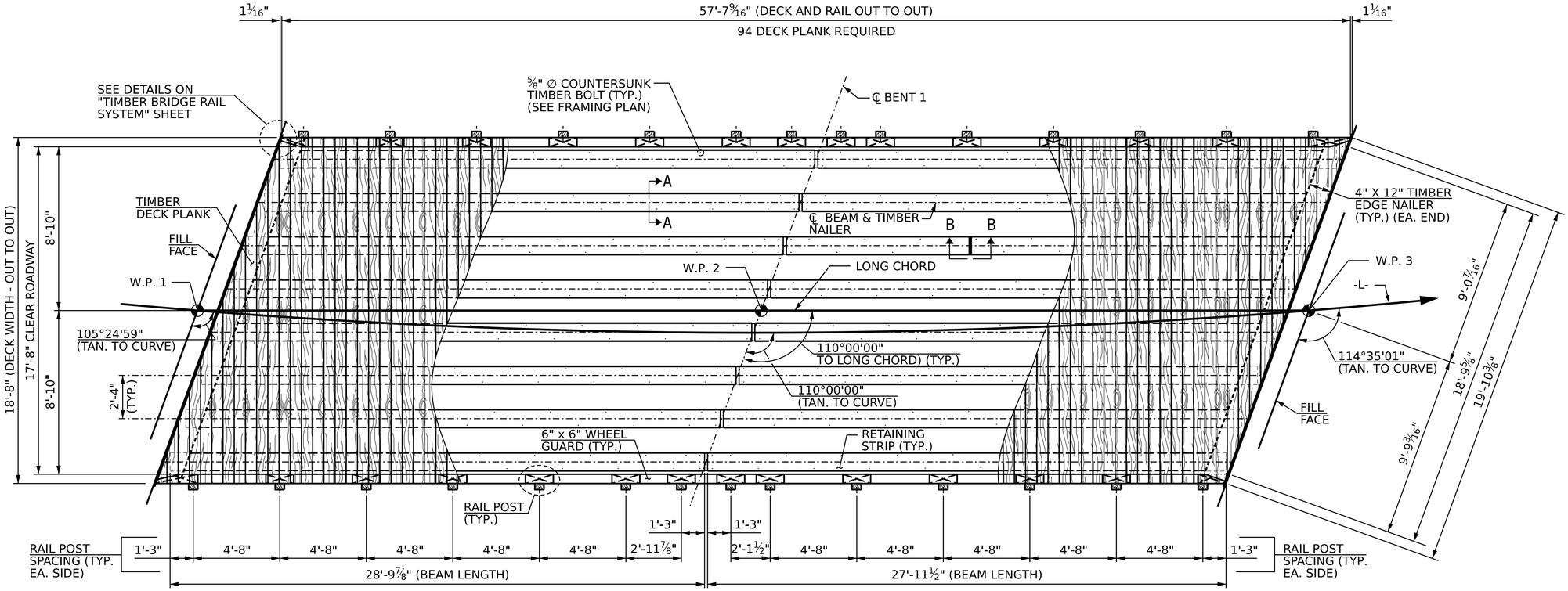
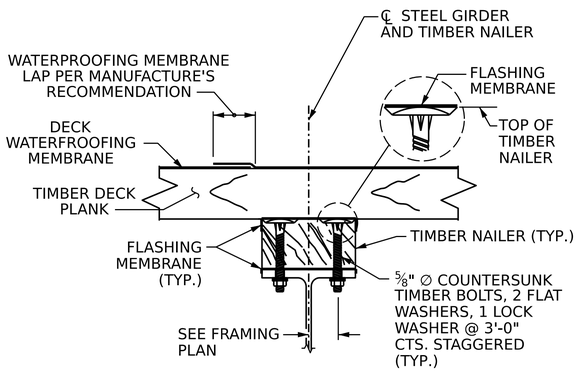
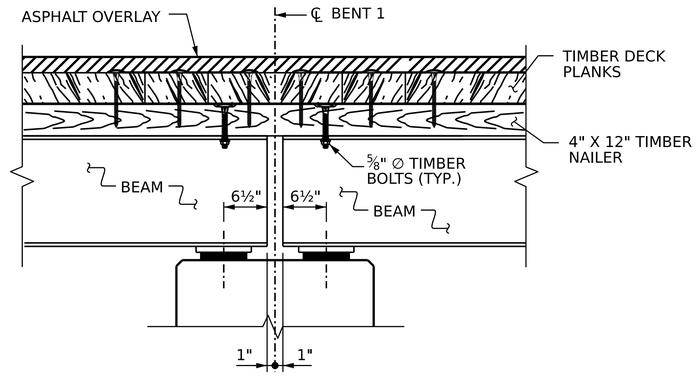


DECK LAYOUT



SECTION A-A

TIMBER NAILER ATTACHMENT DETAIL



SECTION AT BENT 1

NOTES

FOR ADDITIONAL NOTES, SEE TYPICAL SECTION AND GENERAL DRAWING SHEETS.

STAGGER TIMBER DECK PLANKS BUTT JOINTS AT 4FT MINIMUMS FROM ADJACENT RUNS.

ATTACH TIMBER DECK PLANKS TO NAILERS WITH TWO STRUCTURAL SCREWS PER TIMBER DECK PLANK.

AVOID HITTING NAILER BOLT WHEN DRIVING TIMBER DECK SCREWS.

SEE BEAM DETAILS FOR SPACING OF TIMBER BOLTS IN TOP FLANGE OF ROLLED BEAM.

COUNTERSINK TIMBER BOLT AND STRUCTURAL SCREW HEADS TO BE FLUSH WITH TIMBER SURFACE.

TRIM THE EDGE NAILER FLUSH WITH THE EDGE OF DECK.

DECK PLANK WIDTH MAY BE CUT TO 6" (MIN.) TO FIT WITHIN LIMITS OF TIMBER DECK. ALL DECK PLANKS ATTACHED TO THE EDGE NAILER SHALL BE FULL WIDTH. CUT BOARDS WILL NOT BE PERMITTED TO BE PLACED ADJACENT TO ONE ANOTHER.

FINAL JOINT SEALS SHALL NOT BE INSTALLED UNTIL THE OVERLAY IS COMPLETE.

THE MANUFACTURER IS TO PROVIDE THE NOMINAL UNCOMPRESSED SEAL WIDTH OF THE BACKER ROD FOR THE SIZE OF THE OPENING ON THE PLANS AND ACCOMODATE THE MINIMUM EXPANSION SHOWN ON THE PLANS.

POURABLE SILICONE JOINT SEALANT SHALL BE INSTALLED AS PER THE MANUFACTURER'S RECOMMENDATIONS.

THE CONTRACTOR WILL NOT BE PERMITTED TO FORM THE JOINTS IN LIEU OF SAWING THE JOINT.

TIMBER NAILER SHALL BE CONTINUOUS ACROSS THE SPANS TO PROVIDE A CONTINUOUS NAILING SURFACE FOR A CONTINUOUS DECK.

FOR CONNECTIONS OF RAIL POST, SEE ``TIMBER BRIDGE RAIL SYSTEM'' SHEET.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 1 OF 2

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUPERSTRUCTURE

PLAN OF SPAN A AND SPAN B
17'-8" CLEAR ROADWAY
110° SKEW

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12/15/2025

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2			4			21

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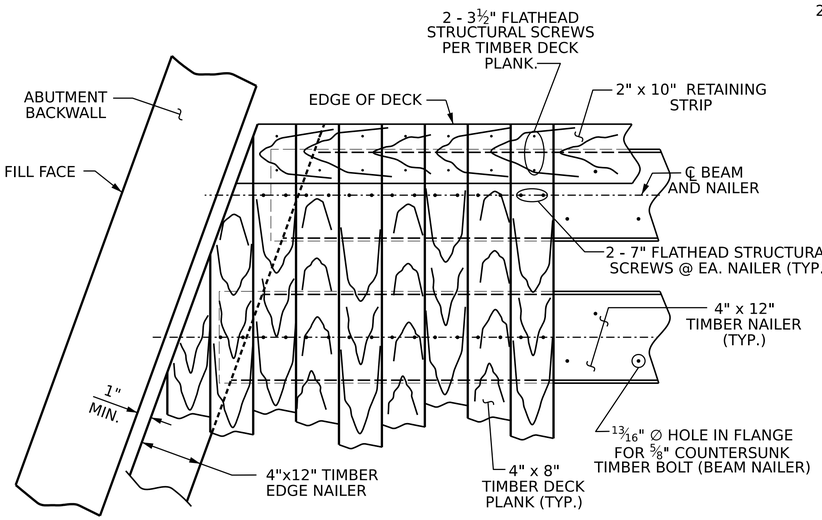
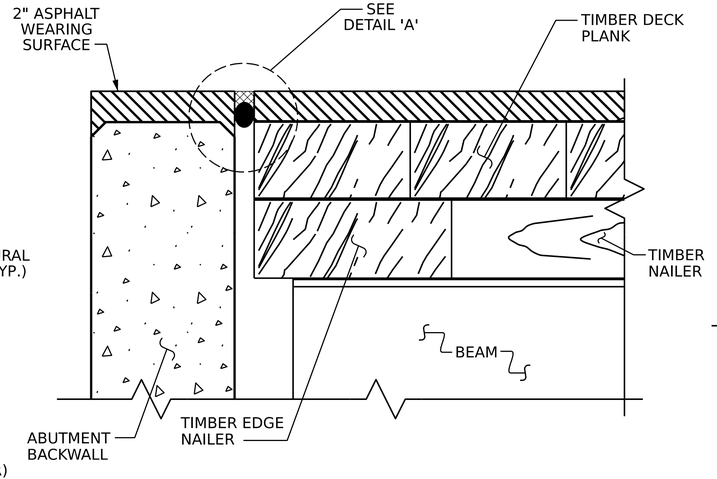
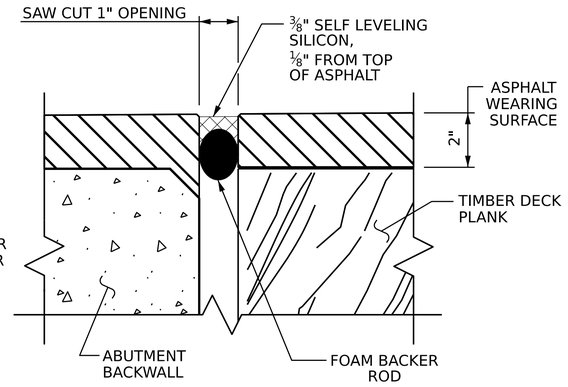


TYPICAL DECK DETAIL AT ABUTMENT



PROPOSED POURABLE SILICONE JOINT DETAIL



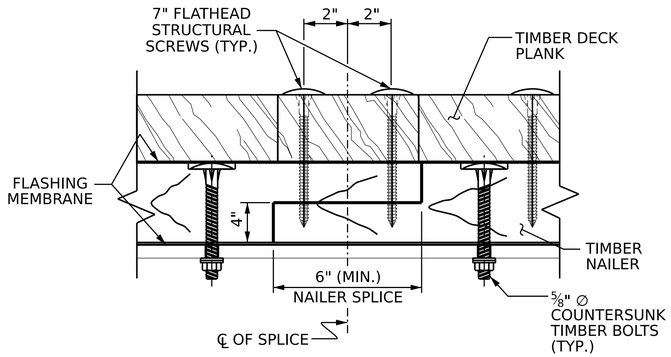
DETAIL 'A'

BILL OF MATERIAL FOR 2-30 FT. SPANS		
TREATED LUMBER		
ITEM	SIZE	LIN. FT.
TIMBER DECK PLANKS	4"x8"	1,722.0
TIMBER NAILERS	4"x12"	456.0
TIMBER EDGE NAILERS	4"x12"	41.0
RETAINING STRIP	2"x10"	116.0
TOTAL TREATED LUMBER	2,335.0	LIN. FT.
FLASHING MEMBRANE		
ITEM	SIZE	LIN. FT.
TOP OF BEAM	25 MILS	455.0
TOP OF TIMBER NAILERS	25 MILS	446.0
TOP OF TIMBER EDGE NAILERS	25 MILS	40.0
FLASHING MEMBRANE	941.0	LIN. FT.

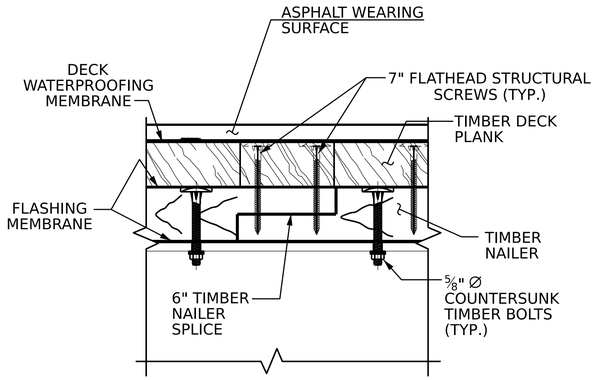
HARDWARE			
ITEM	Nos.	SIZE	LBS.
5/8" ∅ TIMBER BOLTS	368	5/8"	264.6
HEAVY HEX NUTS	368	5/8"	43.8
STANDARD WASHER	736	5/8"	235.5
LOCK WASHER	368	5/8"	8.8
FLAT HEAD STR. SCREWS	1660	7"	110.7
HARDWARE FOR CONNECTIONS			663.4 LBS.

DECK WATERPROOFING MEMBRANE		
ITEM	SIZE	SQ. YDS
DECK WATERPROOFING MEMBRANE	65 MILS.	127.0

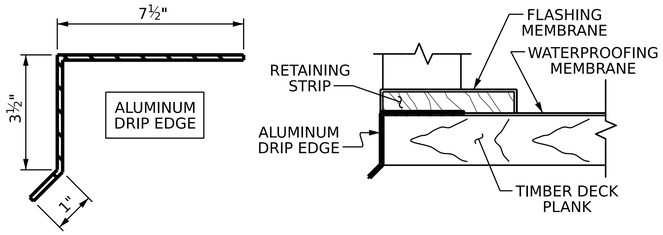
DRIP EDGE		
	SIZE	LIN. FT.
22 GA. ALUMINUM DRIP EDGE	1'-0"	116.0



NAILER SPLICE DETAILS



SECTION B-B



DRIP EDGDE DETAILS

POST AND BOLTS NOT SHOWN FOR CLARITY

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 2 OF 2

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUPERSTRUCTURE
PLAN OF SPAN DETAILS

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12/15/2025

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REVISIONS						SHEET NO.
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1			3			TOTAL SHEETS
2			4			21

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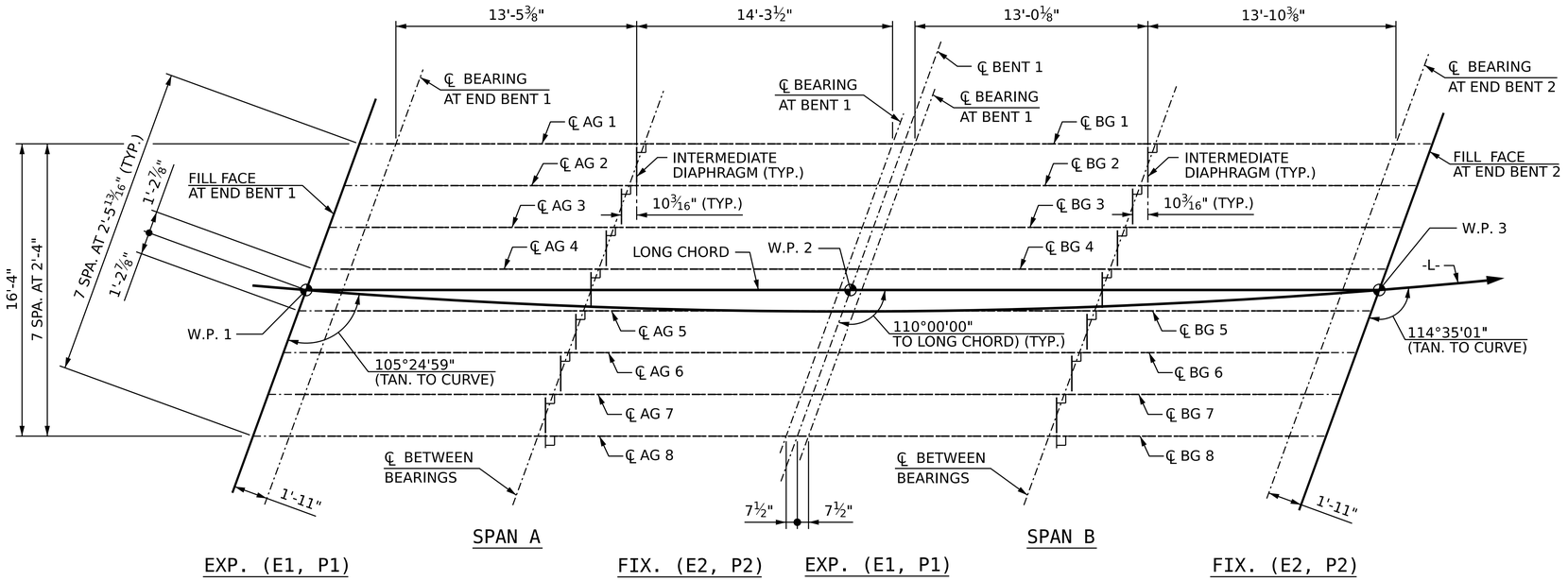
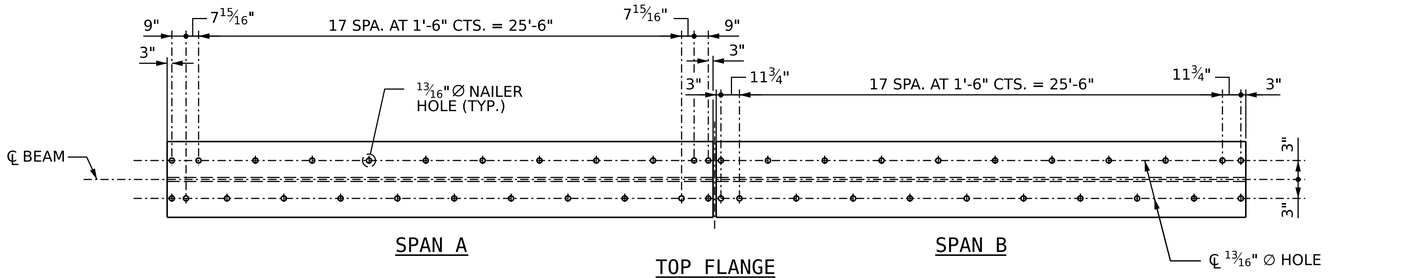
CHECKED BY :	B. D. KLAPPENBACH	DATE :	JUL 2025
DESIGN ENGINEER OF RECORD:	B. D. KLAPPENBACH	DATE :	JUL 2025



FRAMING PLAN



ELEVATION
(SHOWING RAIL POST HOLES FOR EXTERIOR BEAMS
INTERIOR BEAMS ARE SIMILAR BUT WITHOUT RAIL POST HOLES)

BEAM DETAILS

* * INTERIOR BEAMS SHOWN, FOR EXTERIOR BEAMS, PLACE REQUIRED HOLES AS SHOWN IN THE FRAMING PLAN

NOTES

NO SALVAGED BEAMS SHALL BE USED, UNLESS OTHERWISE NOTED ON THE PLANS.

NO SHOP CAMBER REQUIRED, TURN NATURAL MILL CAMBER UP.

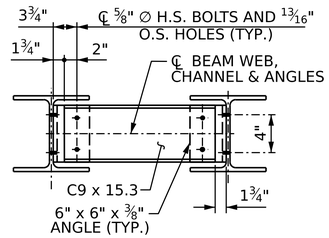
ALL STRUCTURAL STEEL FIELD CONNECTIONS SHALL BE ⅝" DIA. GALVANIZED HIGH STRENGTH BOLTS UNLESS OTHERWISE NOTED.

BEAMS SHALL BE PLACED PARALLEL TO THE CHORD.

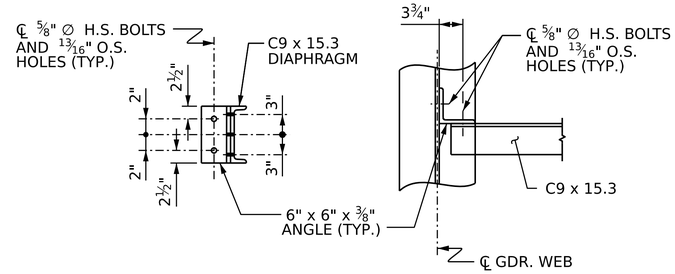
CONTRACTORS OPTION TO WELD CONNECTOR TO BEAM PRIOR TO SHOP COATING.

SEE GENERAL DRAWING NOTES FOR COATING.

* FOR SIZE AND LOCATION OF OPTIONAL BOLTED SOLE PLATE, SEE BEARING DETAILS SHEET.



INTERIOR DIAPHRAGM DETAIL



ANGLE DETAIL

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUPERSTRUCTURE

FRAMING PLAN AND DIAPHRAGM DETAILS
110° SKEW

DRAWN BY : B. H. GONFA	DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH	DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH	DATE : JUL 2025

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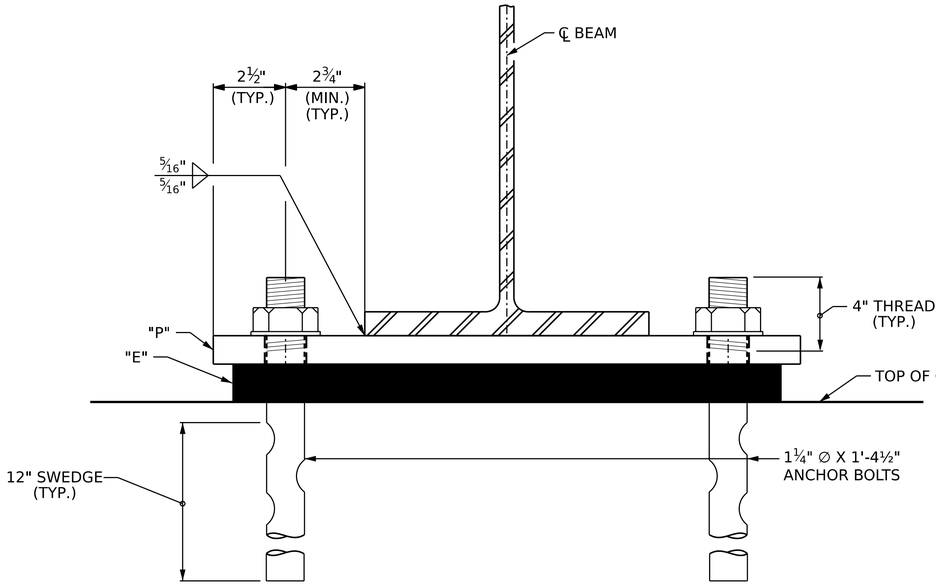
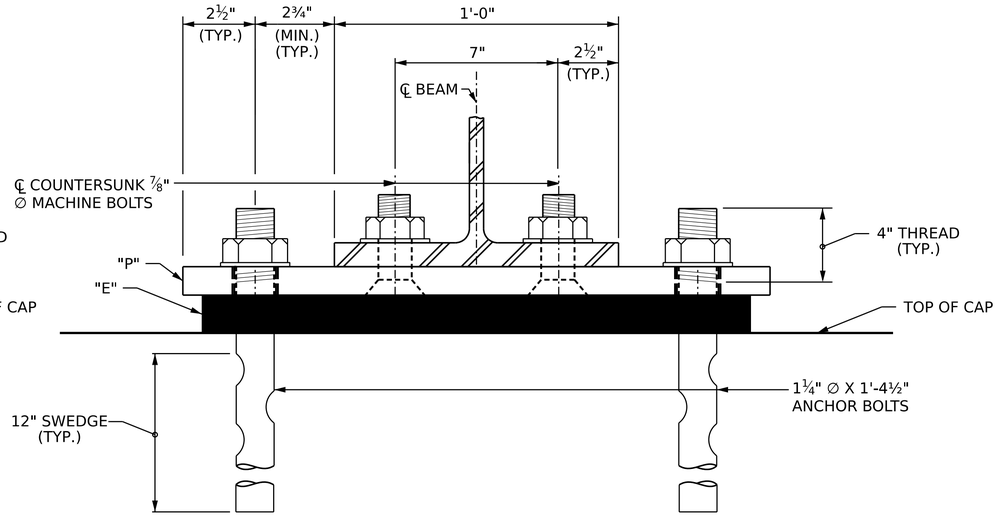


END VIEW

WELDED



END VIEW

OPTIONAL BOLTED

NOTES

ELASTOMER IN ALL BEARINGS SHALL BE 50 DUROMETER HARDNESS IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

AT ALL SUPPORTS, NUTS FOR ANCHOR BOLTS ARE TO BE TIGHTENED FINGER TIGHT AND THEN BACKED OFF ½ TURN. THE THREAD OF THE NUT AND BOLT SHALL THEN BE BURRED WITH A SHARP POINTED TOOL.

SOLE PLATES, ANCHOR BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.

ALL BEARING PLATES SHALL BE AASHTO M270 GRADE 36.

ANCHOR BOLTS SHALL MEET THE REQUIREMENTS OF ASTM A449. NUTS SHALL MEET THE REQUIREMENTS OF AASHTO M291-DH OR AASHTO M292-2H. WASHERS SHALL MEET THE REQUIREMENTS OF AASHTO M293. SHOP DRAWINGS ARE NOT REQUIRED FOR ANCHOR BOLTS, NUTS, AND WASHERS. SHOP INSPECTION IS REQUIRED.

AT THE APPROVAL OF THE ENGINEER, SOLE PLATES AT THE EXPANSION END MAY BE FIELD WELDED.

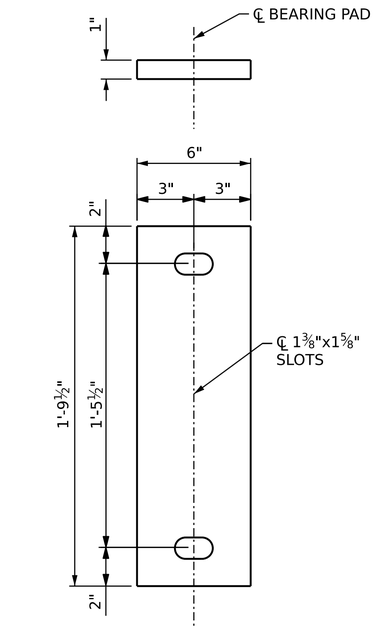
WHEN FIELD WELDING THE SOLE PLATE TO THE GIRDER FLANGE, USE TEMPERATURE INDICATING WAX PENS, OR OTHER SUITABLE MEANS, TO ENSURE THAT THE TEMPERATURE OF THE SOLE PLATE DOES NOT EXCEED 300° F. TEMPERATURES ABOVE THIS MAY DAMAGE THE ELASTOMER.

ALL SURFACES OF BEARING PLATES SHALL BE SMOOTH AND STRAIGHT.

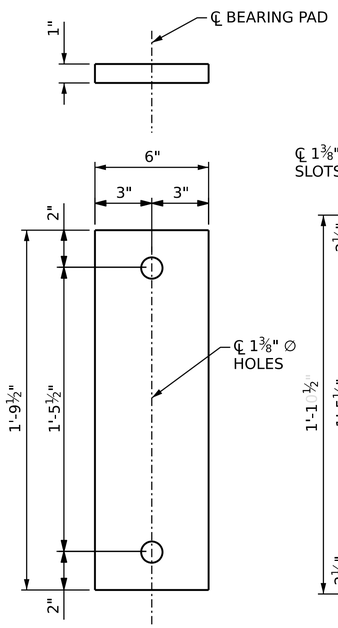
AT NO ADDITIONAL COST TO THE DEPARTMENT, THE CONTRACTOR MAY USE ADHESIVELY ANCHORED ANCHOR BOLTS IN PLACE OF CAST-IN-PLACE ANCHORS. LEVEL 1 FIELD TESTING IS REQUIRED, AND THE YIELD LOAD OF THE ANCHOR BOLT IS 30 KIPS. FOR ADHESIVELY ANCHORED ANCHOR BOLTS OR DOWELS, SEE STANDARD SPECIFICATIONS.

ADHESIVELY ANCHORED ANCHOR BOLTS SHALL BE THREADED FULL LENGTH.

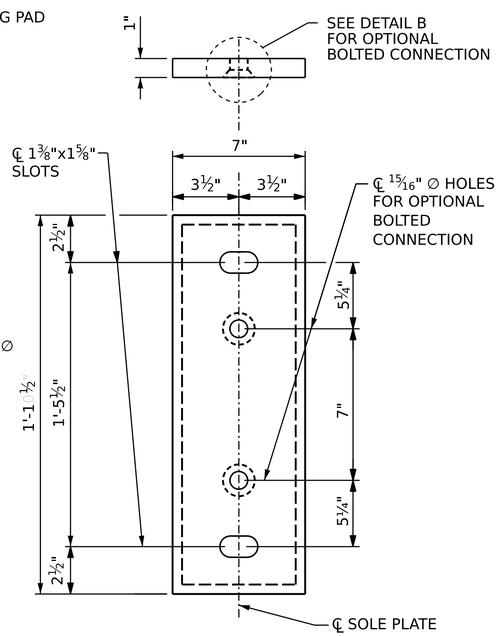
AT THE APPROVAL OF THE ENGINEER, THE OPTIONAL BOLTED SOLE PLATE MAY BE USED AT NO ADDITIONAL COST TO THE DEPARTMENT.



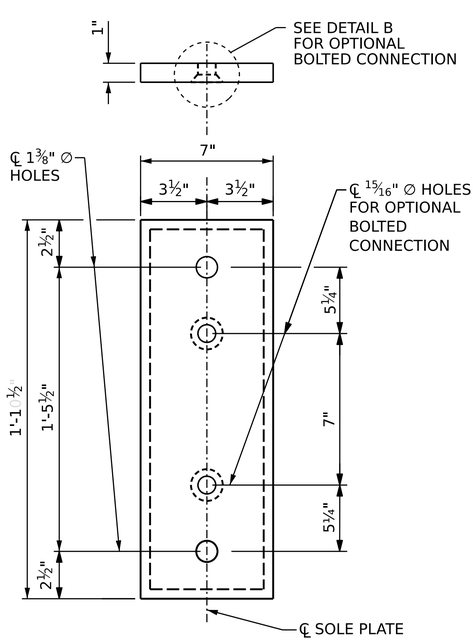
E1 ELASTOMERIC BEARING DETAILS
(16 REQ'D)
EXPANSION



E2 ELASTOMERIC BEARING DETAILS
(16 REQ'D)
FIXED



P1 SOLE PLATE DETAILS
(16 REQ'D)
EXPANSION



P2 SOLE PLATE DETAILS
(16 REQ'D)
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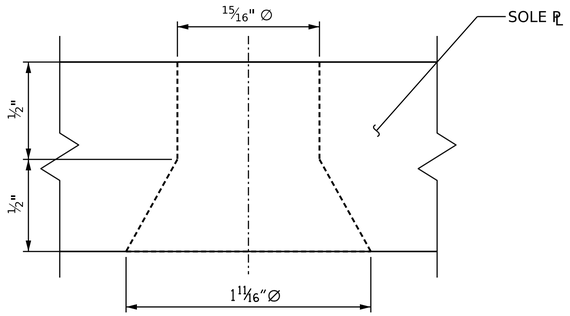

DETAIL B

BEARING PLATE DETAILS

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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NORTH CAROLINA PROFESSIONAL SEAL 15825 ENGINEER BRUCE D. KLAPPENBACH
12/15/2025

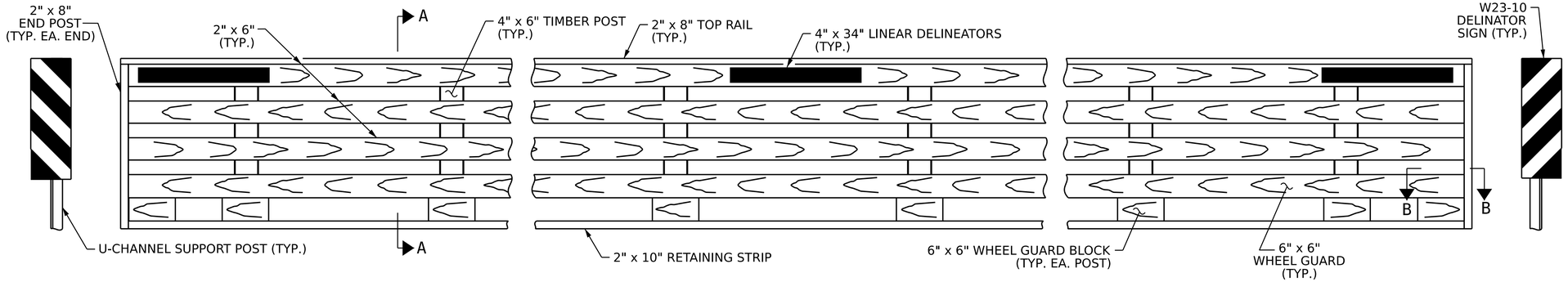
STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD

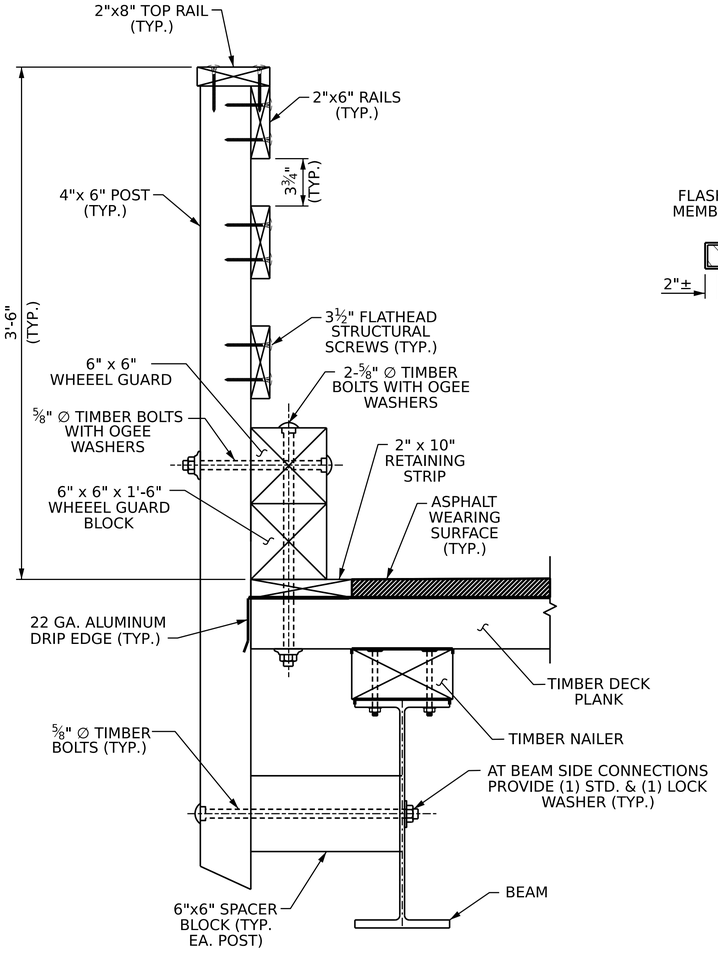
BEARING DETAILS TYPE IV

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-11
1			3			TOTAL SHEETS
2			4			21

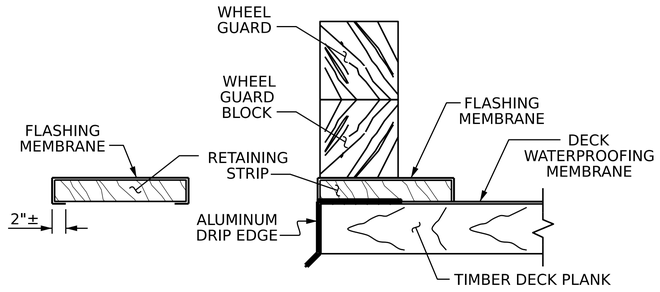
STD. TB_BRG_TYPEIV



ELEVATION

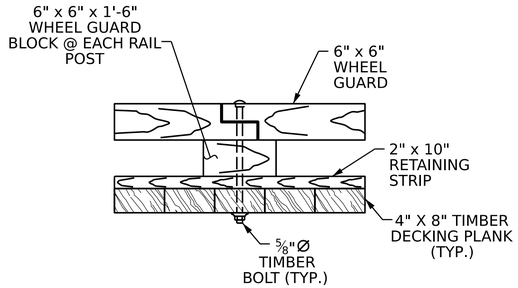


SECTION A-A

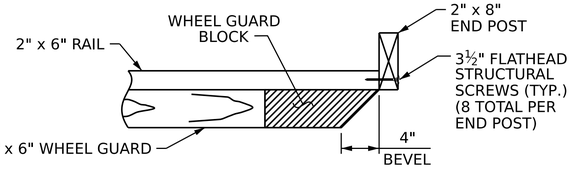


RETAINING STRIP DETAILS

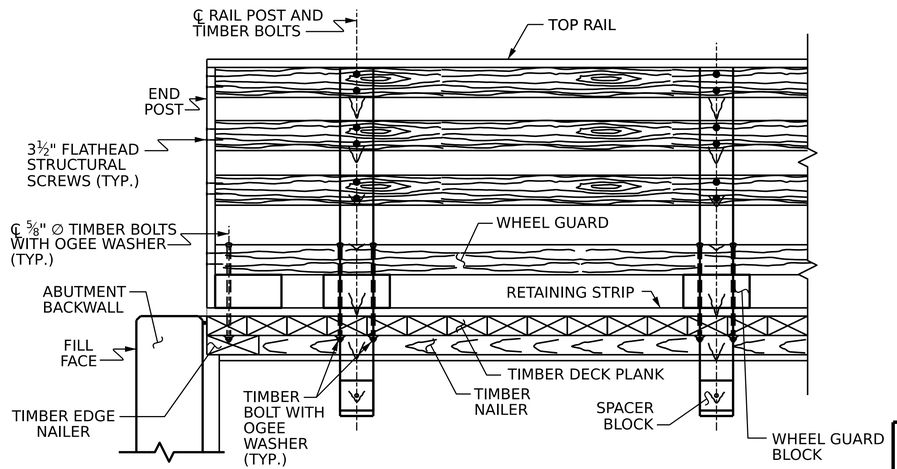
POST AND BOLTS NOT SHOWN FOR CLARITY



WHEEL GUARD SPLICE DETAIL



VIEW B-B



RAIL DETAIL AT ABUTMENTS

BILL OF MATERIAL
TIMBER BRIDGE RAIL SYSTEM

TREATED LUMBER

ITEM	SIZE	LIN. FT.
RAILS	2"x 6"	346.0
RAIL POSTS	4"x6"	148.0
TOP RAIL	2"x8"	116.0
WHEEL GUARD	6"x6"	116.0
WHEEL GUARD BLOCK	6"x6"	48.0
RETAINER STRIP	2"x10"	116.0
END POSTS	2"x8"	13.5
SPACER BLOCK	6"x6"	33.0

FLASHING MEMBRANE

ITEM	SIZE	LIN. FT.
MEMBRANE FOR RETAINER STRIP	1'-6"	116.0

HARDWARE

ITEM	Nos.	SIZE	LBS.
TIMBER BOLTS (WHEEL GUARD)	60	⅝" ∅	62.0
TIMBER BOLTS (SPACER BLOCK)	28	⅝" ∅	42.8
TIMBER BOLTS (RAIL)	28	⅝" ∅	48.7
HEAVY HEX NUTS	116	⅝" ∅	13.8
FLATHEAD STR. SCREWS	256	3½"	10.0
STANDARD WASHER	28	⅝" ∅	9.0
LOCK WASHER	28	⅝" ∅	1.0
OGEE WASHERS	88	⅝" ∅	54.6
HARDWARE FOR CONNECTIONS			APPROX. 241.9 LBS.

ACCESSORIES

ITEM	Nos.
4 X 34 LINEAR DELINEATOR	12
W23-10 12x36 DELINEATOR	4
U-CHANNEL SUPPORT POST	4

PAY LENGTH = 115.26 LIN. FT.

NOTES

THE TIMBER BRIDGE RAIL SYSTEM SHALL NOT BE ATTACHED TO THE TIMBER BRIDGE DECK SYSTEM PRIOR TO THE TIMBER DECK WATERPROOFING MEMBRANE BEING INSTALLED.

BRIDGE RAILS SHALL BE CONTINUOUS FROM END POST TO END POST WITH NO GAPS. RAIL LUMBER LENGTHS SHALL BE ATTACHED TO A MINIMUM OF THREE POSTS.

TREAT ALL DRILLED OR NEWLY EXPOSED HOLES IN TIMBER MEMBERS BY PUMPING WITH BITUMINOUS ASPHALT-BASED ROOFING CEMENT, OR APPROVED PRESERVATIVE SYSTEM BEFORE INSTALLING HARDWARE.

SEE PLAN OF SPAN SHEET FOR NUMBER OF POSTS AND POST SPACING.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

DRAWN BY : B. H. GONFA DATE : JUL 2025
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DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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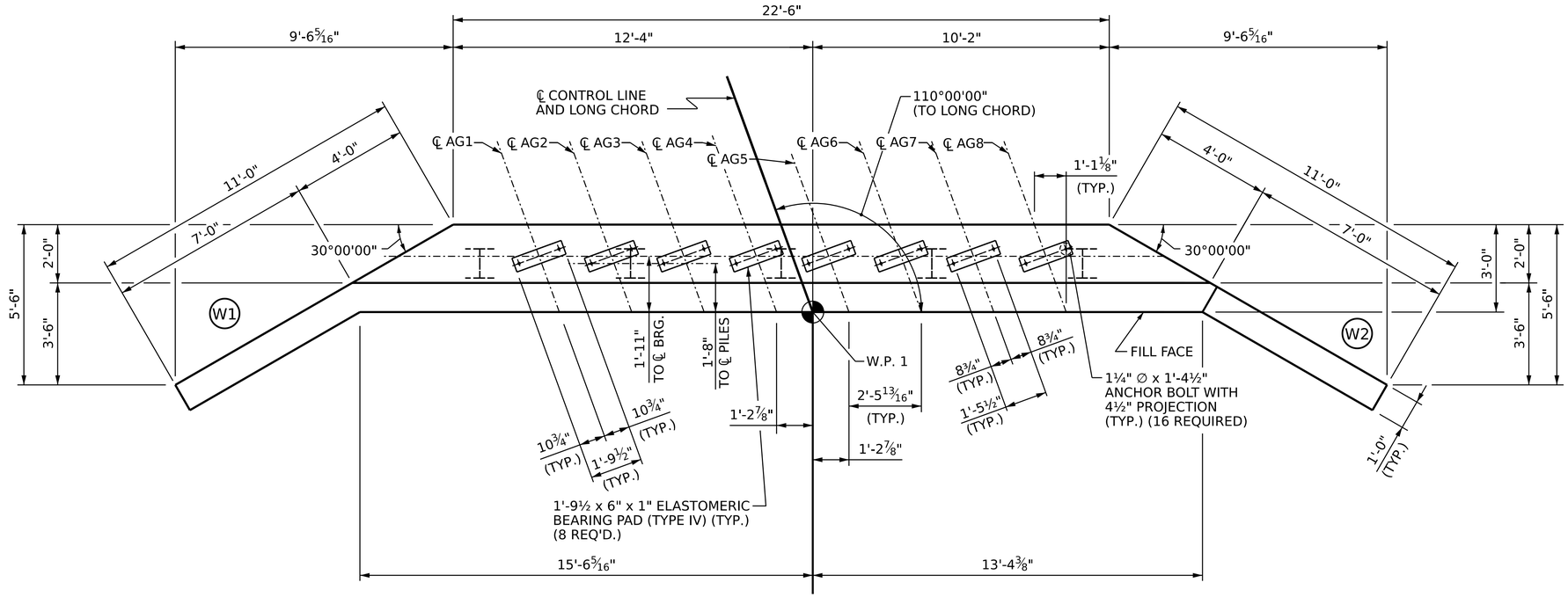
DEPARTMENT OF TRANSPORTATION
RALEIGH

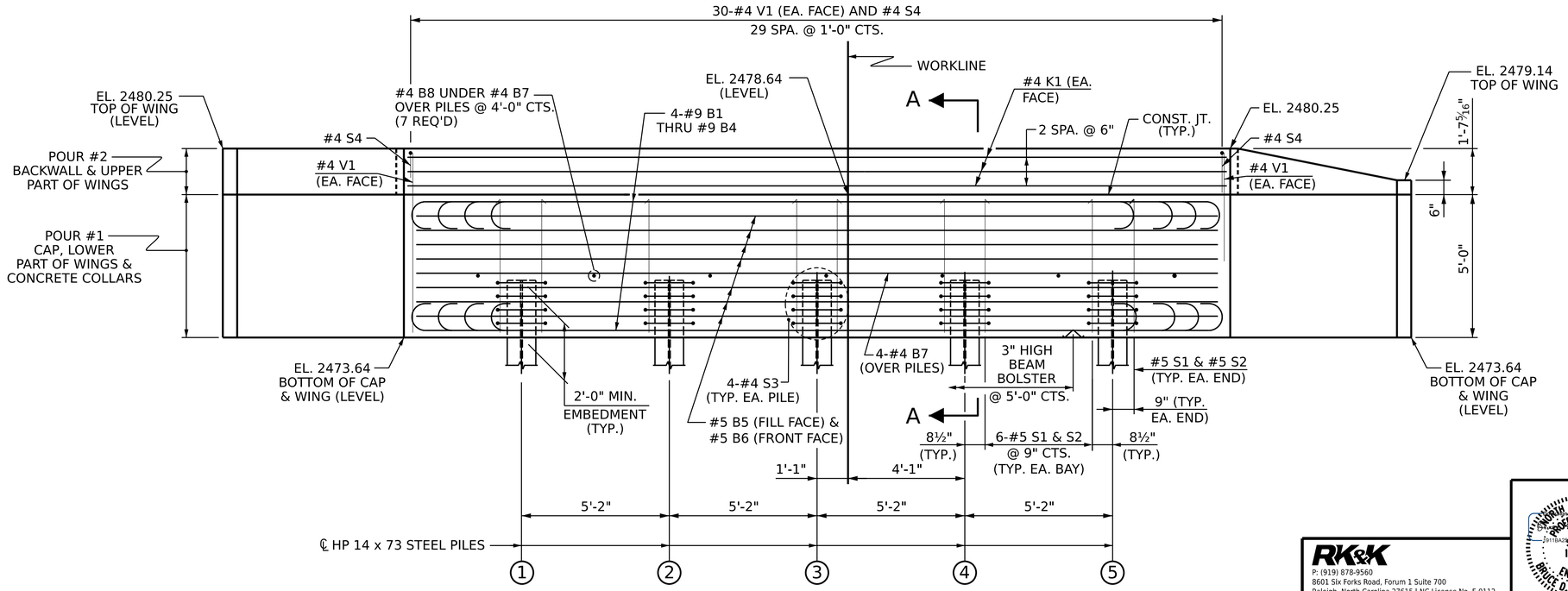
STANDARD

TIMBER BRIDGE RAIL SYSTEM

REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-12
1			3			TOTAL SHEETS
2			4			21



PLAN



ELEVATION

CONCRETE COLLARS FOR STEEL PILES NOT SHOWN IN PLAN AND ELEVATION VIEWS FOR CLARITY. SEE "CORROSION PROTECTION FOR STEEL PILES DETAIL", SHEET 3 OF 3.

NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO ANCHOR BOLTS.

FOR PILE SPLICE DETAILS, SEE SHEET 3 OF 3.

FOR WING DETAILS, SEE SHEET 2 OF 3.

FOR SECTION A-A, SEE SHEET 3 OF 3.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 1 OF 3

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE
END BENT 1
PLAN AND ELEVATION

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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12/15/2025

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REVISIONS						SHEET NO.
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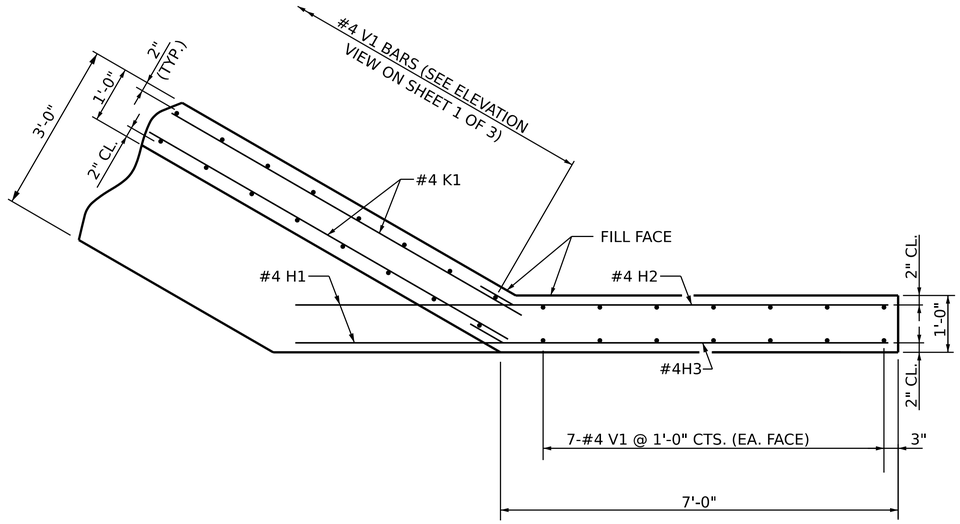
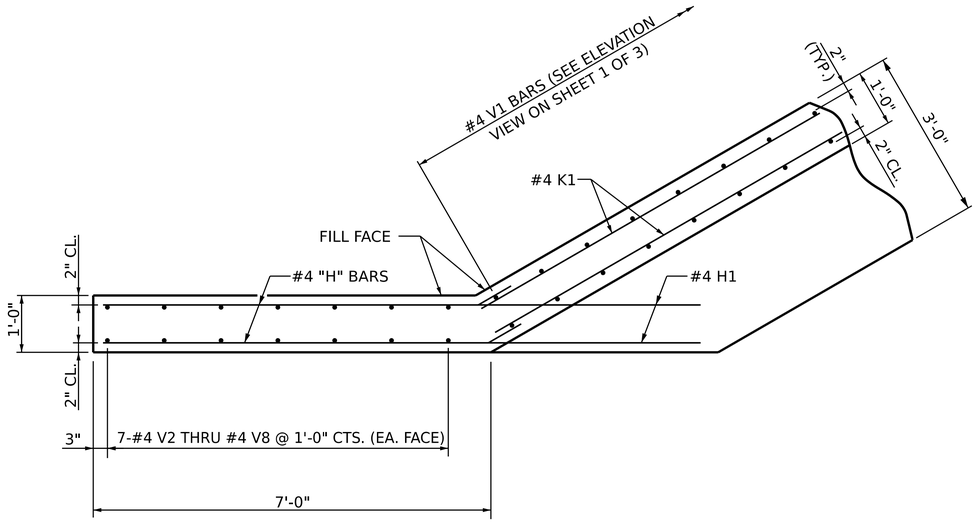
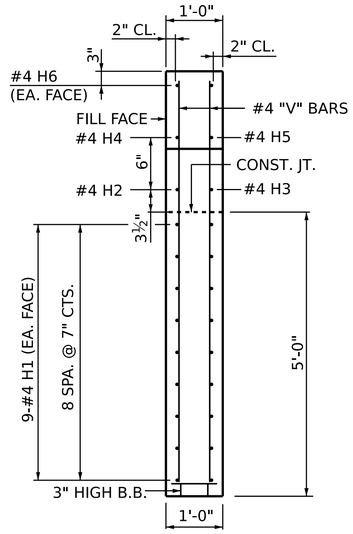
1			3			TOTAL SHEETS 21
2			4			



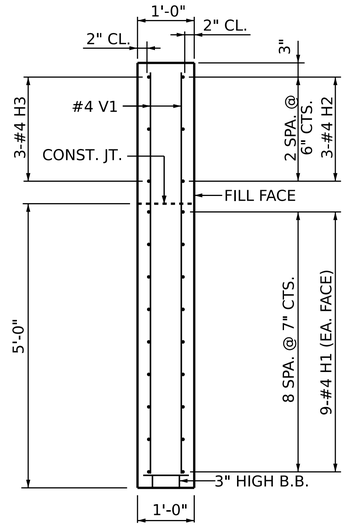
PLAN OF WING W1



PLAN OF WING W2



SECTION Y-Y



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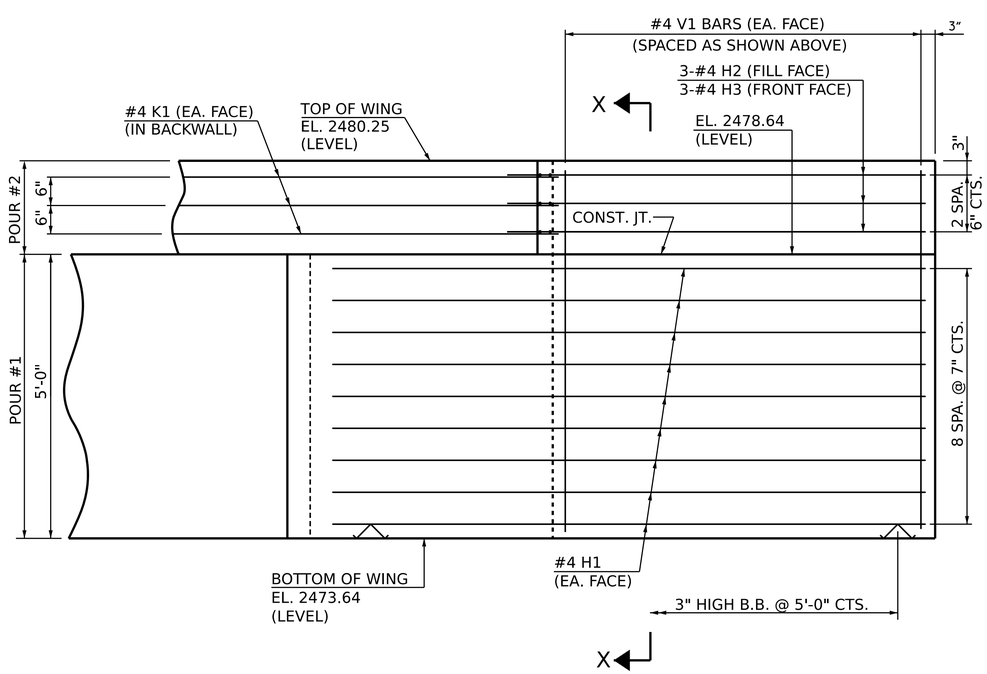
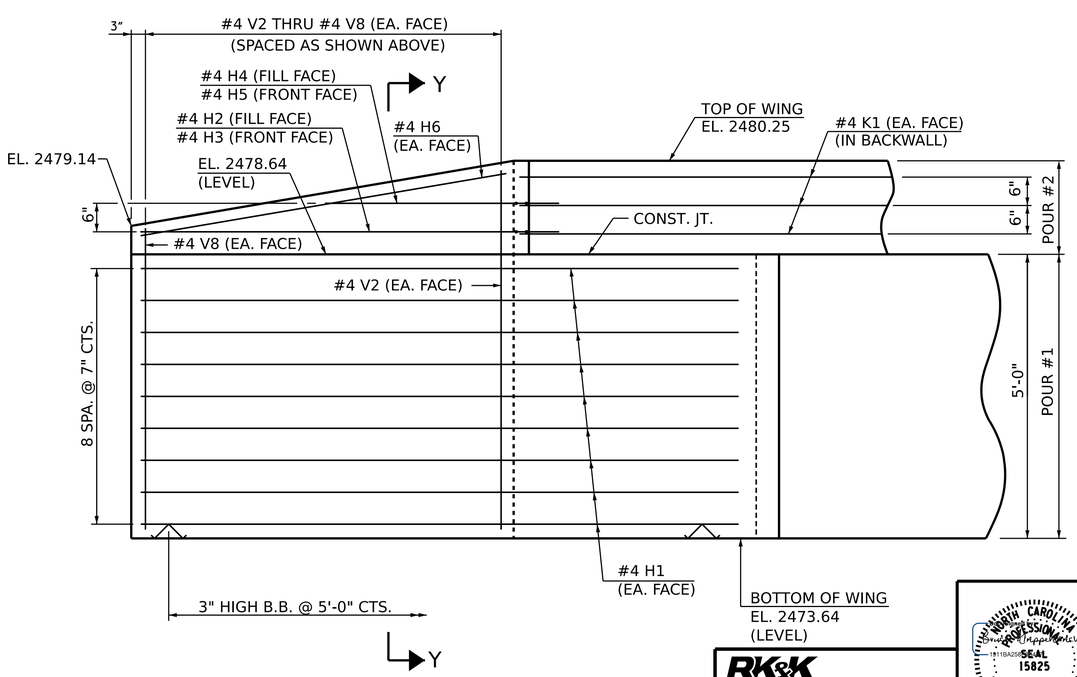


ELEVATION OF WING W1



ELEVATION OF WING W2

WING DETAILS

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 2 OF 3

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE
END BENT 1
WINGWALL DETAILS

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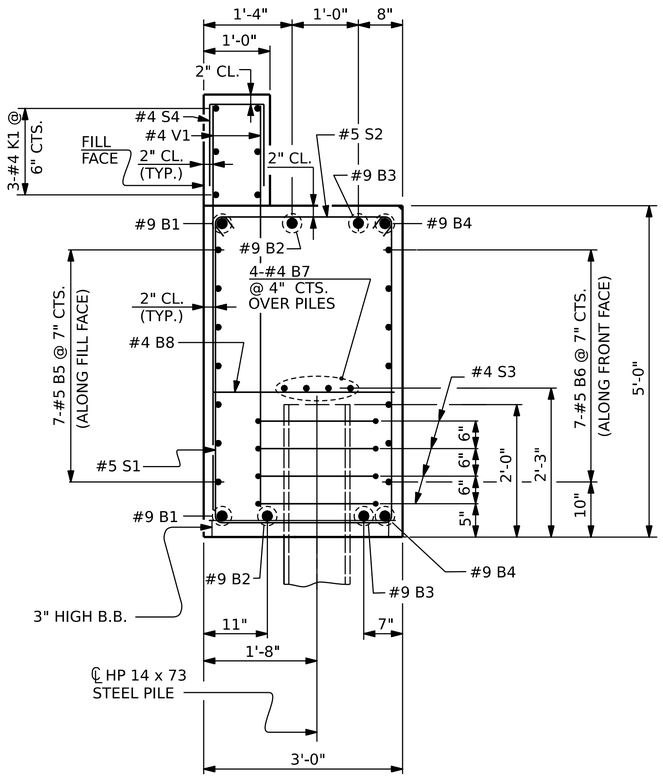
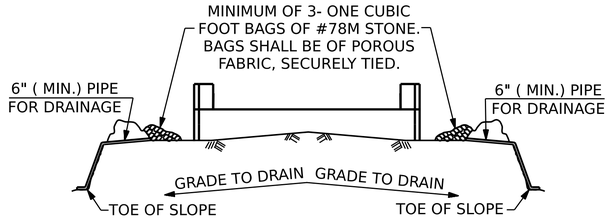
2			4			21



SECTION A-A

(CONCRETE COLLAR NOT SHOWN FOR CLARITY.
SEE ``CORROSION PROTECTION FOR STEEL PILES DETAIL.'')

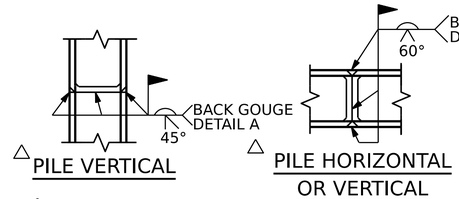


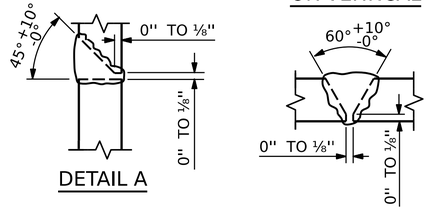
BAGGED STONE AND PIPE SHALL BE PLACED IMMEDIATELY AFTER COMPLETION OF END BENT EXCAVATION. PIPE MAY BE EITHER CONCRETE, CORRUGATED STEEL, CORRUGATED ALUMINUM ALLOY, OR CORRUGATED PLASTIC. PERFORATED PIPE WILL NOT BE ALLOWED.

BAGGED STONE SHALL REMAIN IN PLACE UNTIL THE ENGINEER DIRECTS THAT IT BE REMOVED. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF SILT ACCUMULATIONS AT BAGGED STONE WHEN SO DIRECTED BY THE ENGINEER. BAGS SHALL BE REMOVED AND REPLACED WHENEVER THE ENGINEER DETERMINES THAT THEY HAVE DETERIORATED AND LOST THEIR EFFECTIVENESS.

NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK AND THE ENTIRE COST OF THIS WORK SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR THE SEVERAL PAY ITEMS.

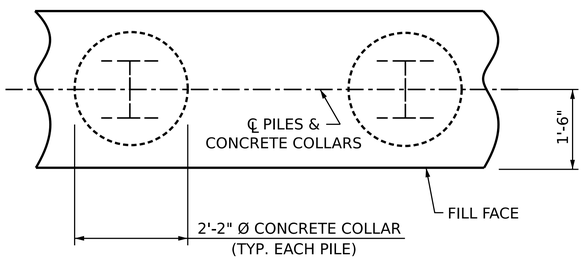
TEMPORARY DRAINAGE AT END BENT



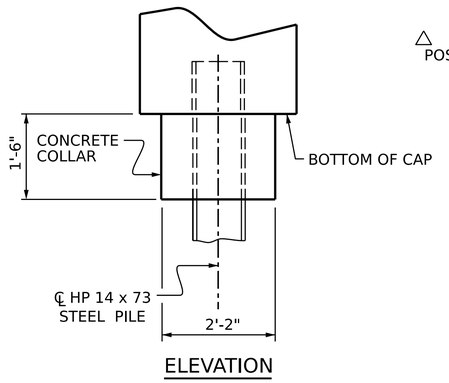


△ POSITION OF PILE DURING WELDING.

PILE SPLICE DETAILS



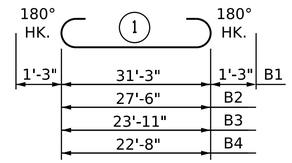
PLAN

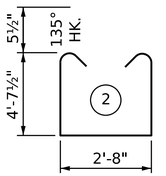


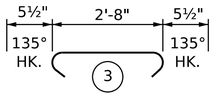
ELEVATION

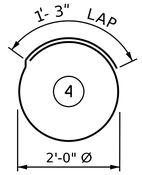
CORROSION PROTECTION FOR STEEL PILES DETAIL

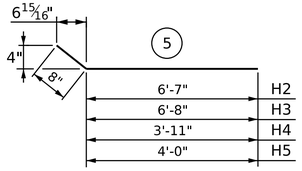
BAR TYPES

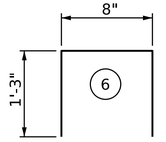












ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL

END BENT 1

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	2	#9	1	33'-9"	230
B2	2	#9	1	30'-0"	204
B3	2	#9	1	26'-5"	180
B4	2	#9	1	25'-2"	171
B5	7	#5	STR.	31'-3"	228
B6	7	#5	STR.	22'-8"	165
B7	4	#4	STR.	23'-11"	64
B8	7	#4	STR.	2'-8"	12
H1	36	#4	STR.	10'-3"	246
H2	4	#4	5	7'-3"	19
H3	4	#4	5	7'-4"	20
H4	1	#4	5	4'-7"	3
H5	1	#4	5	4'-8"	3
H6	2	#4	STR.	6'-11"	9
K1	6	#4	STR.	29'-4"	118
S1	26	#5	2	12'-10"	348
S2	26	#5	3	3'-7"	97
S3	20	#4	4	7'-7"	101
S4	30	#4	6	3'-2"	63
V1	74	#4	STR.	6'-4"	313
V2	2	#4	STR.	6'-1"	8
V3	2	#4	STR.	5'-11"	8
V4	2	#4	STR.	5'-9"	8
V5	2	#4	STR.	5'-7"	7
V6	2	#4	STR.	5'-5"	7
V7	2	#4	STR.	5'-3"	7
V8	2	#4	STR.	5'-1"	7

REINFORCING STEEL	
TOTAL	2,646 LBS.
CLASS A CONCRETE	
POUR #1 (CAP, LOWER PART OF WINGS & COLLARS)	19.0 CU. YDS.
POUR #2 (UPPER PART OF WINGS AND BACKWALL)	2.4 CU. YDS.
TOTAL	21.4 CU. YDS.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 3 OF 3

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE
END BENT 1
DETAILS AND BILL OF MATERIAL

DRAWN BY : B. H. GONFA DATE : JUL 2025
CHECKED BY : B. D. KLAPPENBACH DATE : JUL 2025
DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

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Bruce Klappenbach
12/15/2025

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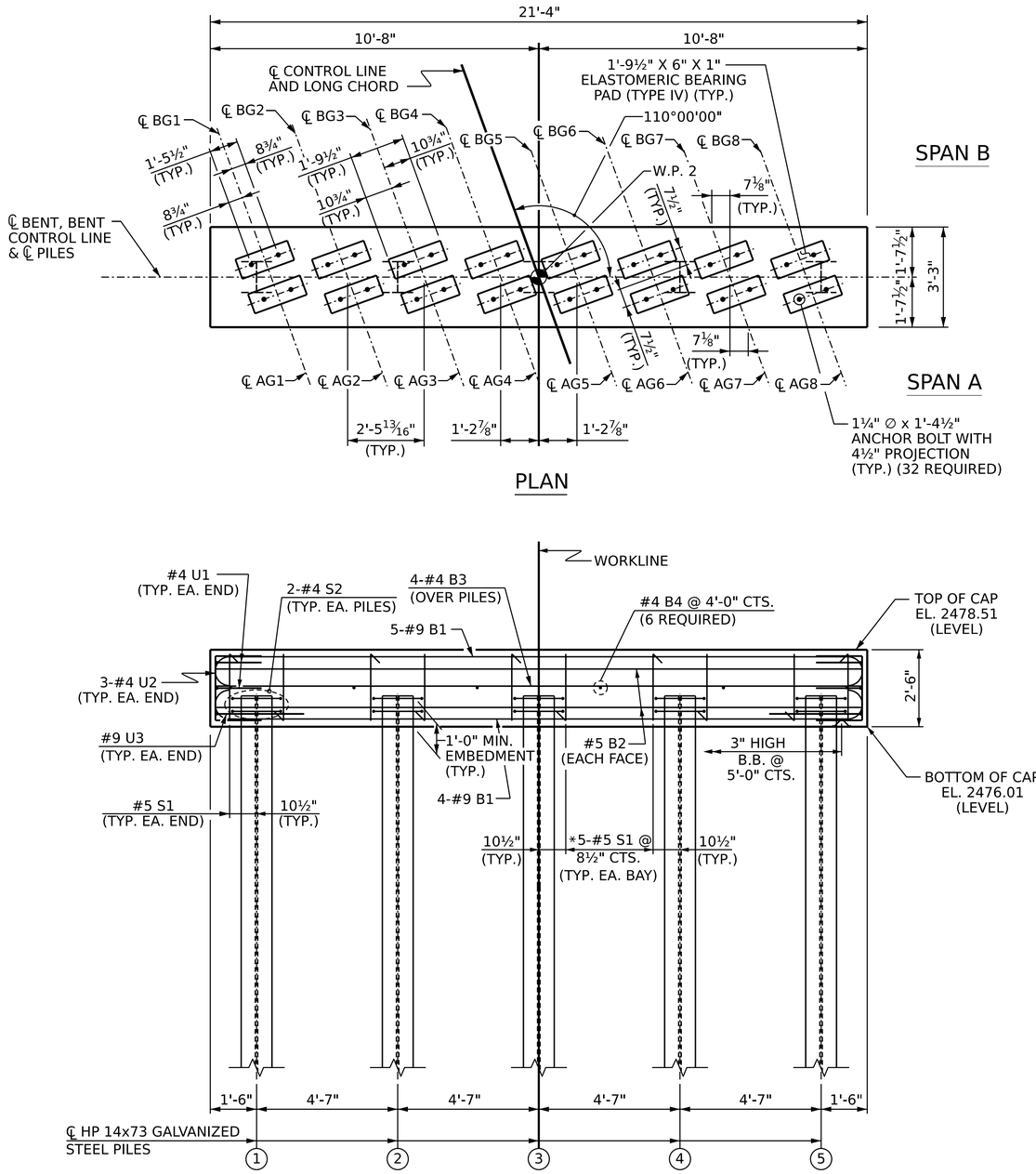
2			4			21



NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO CLEAR ANCHOR BOLTS.

* INVERT ALTERNATE STIRRUPS.

GALVANIZE THE FULL LENGTH OF EACH INTERIOR BENT PILE IN ACCORDANCE WITH SECTION 1076 OF THE STANDARD SPECIFICATIONS.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 1 OF 2

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE
BENT 1
PLAN AND ELEVATION

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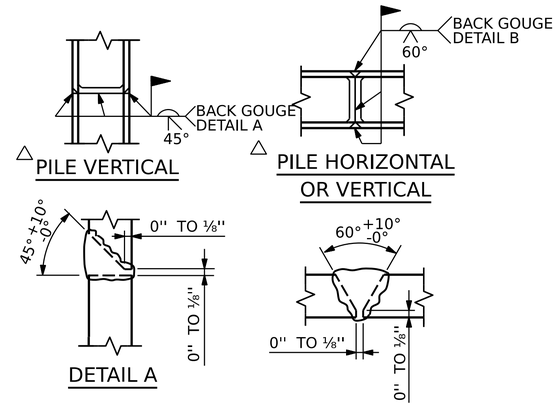
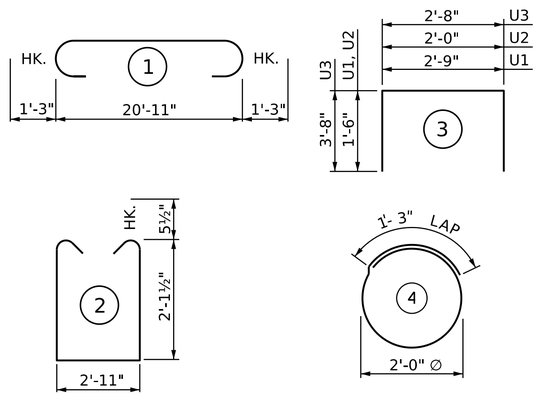
2			4			21

DRAWN BY :	B. H. GONFA	DATE : JUL 2025
CHECKED BY :	B. D. KLAPPENBACH	DATE : JUL 2025
DESIGN ENGINEER OF RECORD:	B. D. KLAPPENBACH	DATE : JUL 2025



PILE SPLICE DETAILS

BAR TYPES



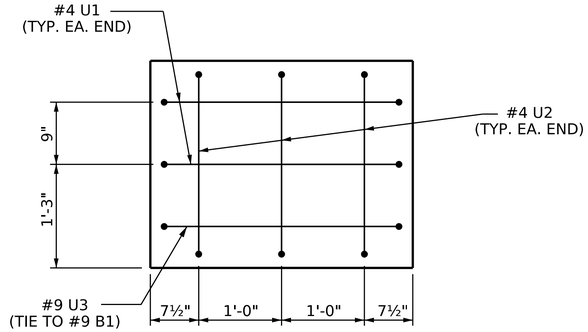
ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL

BENT 1

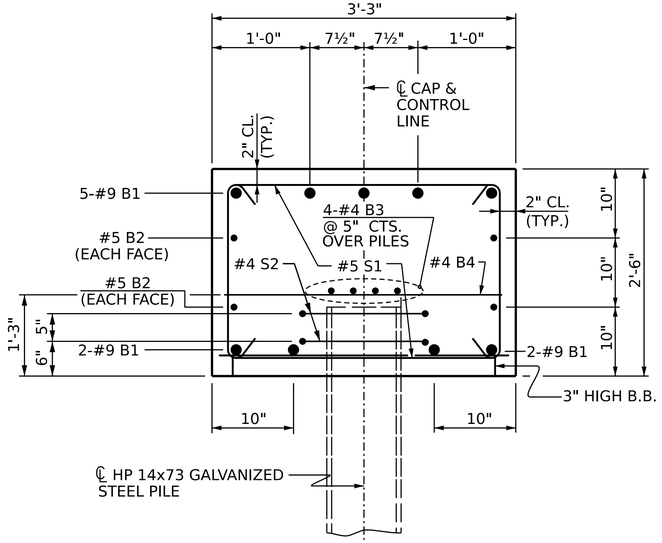
BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	9	#9	1	23'-5"	717
B2	4	#5	STR	21'-0"	88
B3	4	#4	STR	21'-0"	56
B4	6	#4	STR	2'-11"	12
S1	22	#5	2	8'-1"	185
S2	10	#4	4	7'-7"	51
U1	4	#4	3	5'-9"	15
U2	6	#4	3	5'-0"	20
U3	2	#9	3	10'-0"	68
REINFORCING STEEL					1,212 LBS.

CLASS A CONCRETE BREAKDOWN	
POUR #3 (CAP)	6.4 C.Y.
TOTAL CLASS A CONCRETE	6.4 C.Y.



END OF CAP VIEW

(TYPICAL BOTH ENDS)



SECTION THRU CAP

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 2 OF 2

STATE OF NORTH CAROLINA
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RALEIGH

SUBSTRUCTURE
BENT 1
DETAILS AND
BILL OF MATERIAL

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12/15/2025

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REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-17
1			3			TOTAL SHEETS
2			4			21

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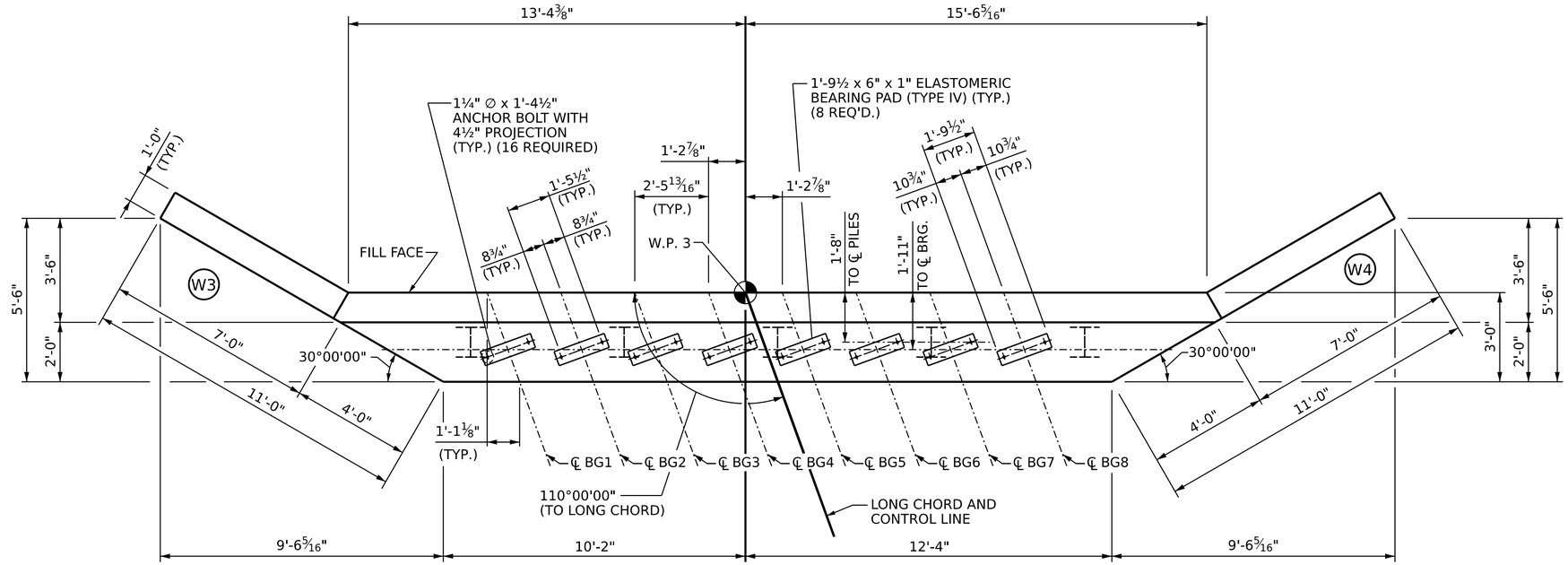
NOTES

STIRRUPS IN CAP MAY BE SHIFTED AS NECESSARY TO ANCHOR BOLTS.

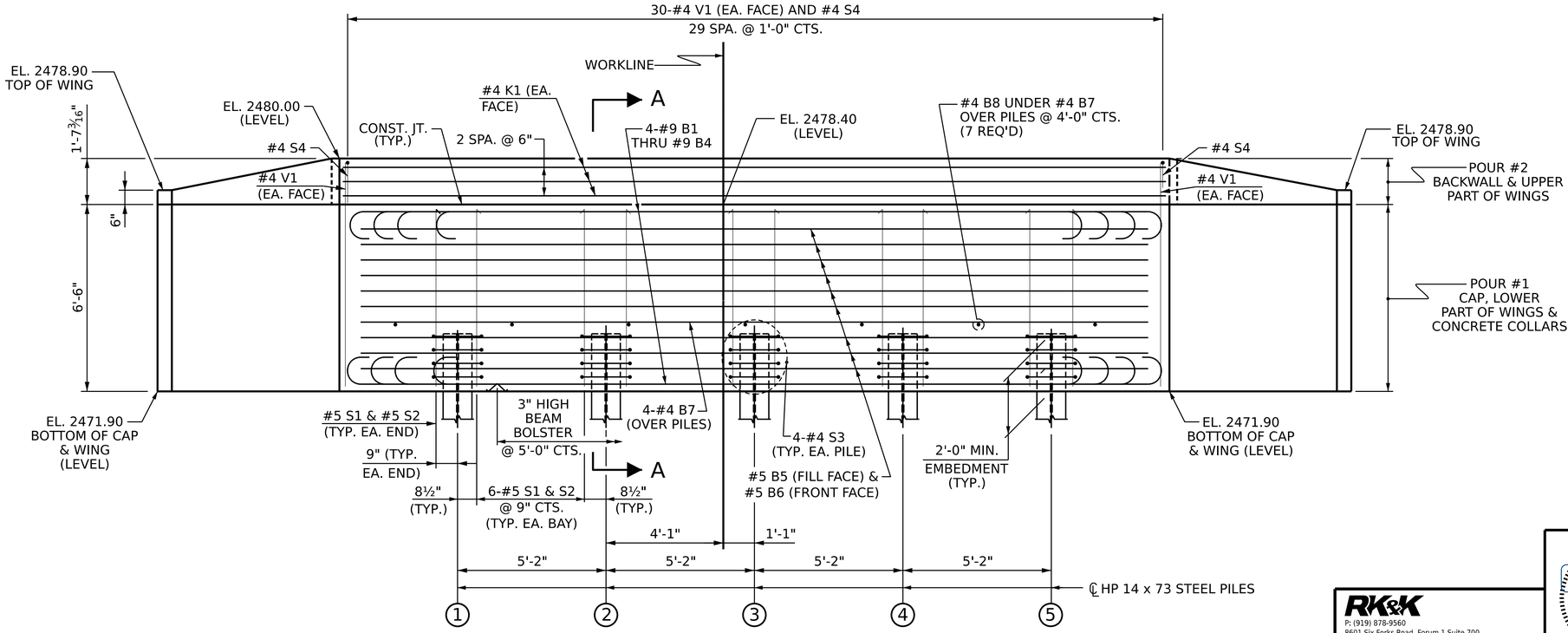
FOR PILE SPLICE DETAILS, SEE SHEET 3 OF 3.

FOR WING DETAILS, SEE SHEET 2 OF 3.

FOR SECTION A-A, SEE SHEET 3 OF 3.



PLAN



ELEVATION

CONCRETE COLLARS FOR STEEL PILES NOT SHOWN IN PLAN AND ELEVATION VIEWS FOR CLARITY, SEE ''CORROSION PROTECTION FOR STEEL PILES DETAIL'', SHEET 3 OF 3.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 1 OF 3

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE
END BENT 2
PLAN AND ELEVATION

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12/15/2025

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1			3			TOTAL SHEETS
2			4			21

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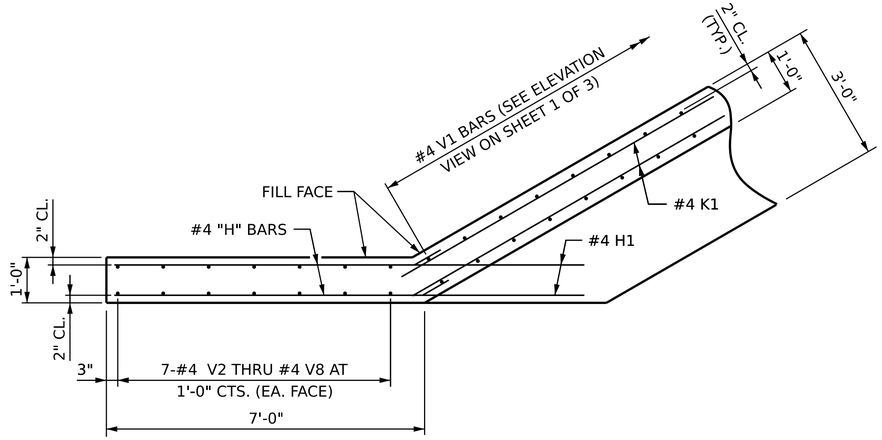
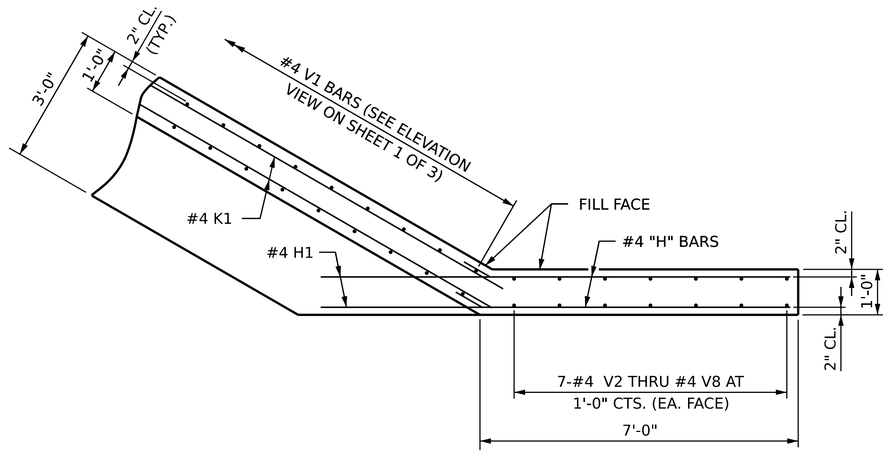
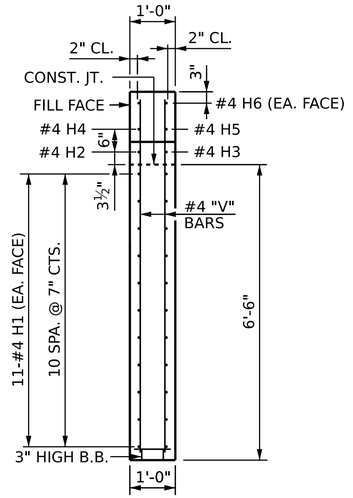


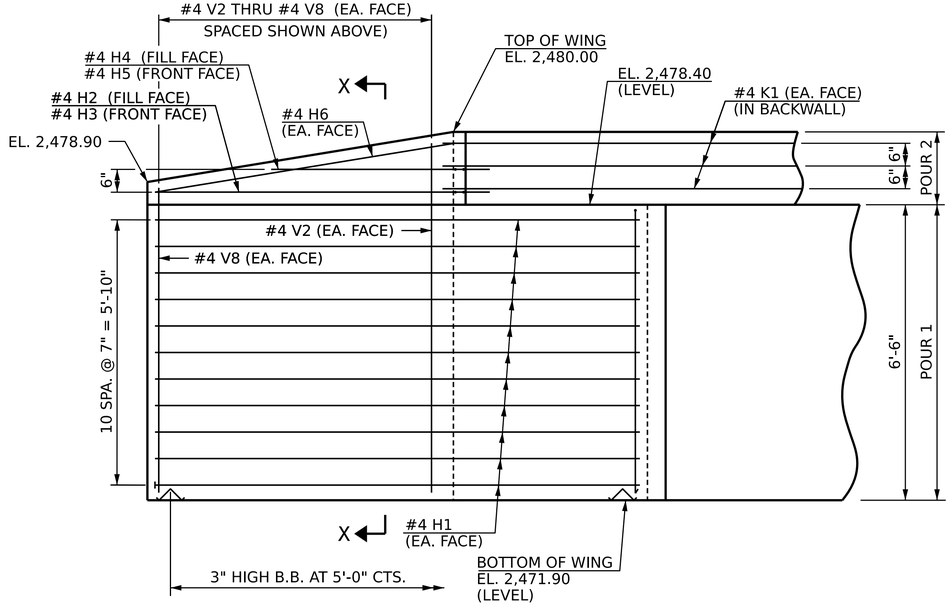
PLAN OF WING (W3)



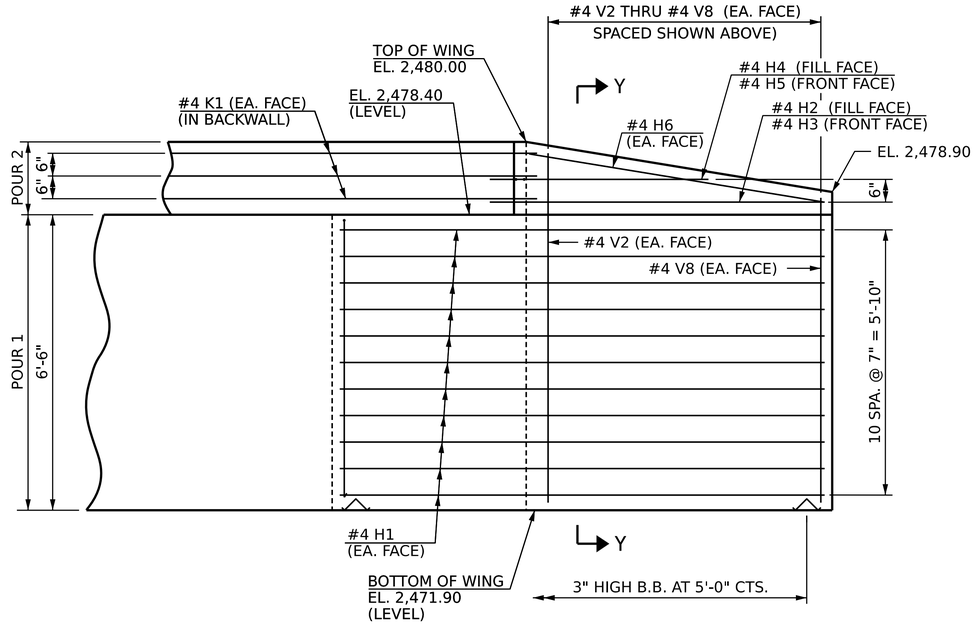
PLAN OF WING (W4)



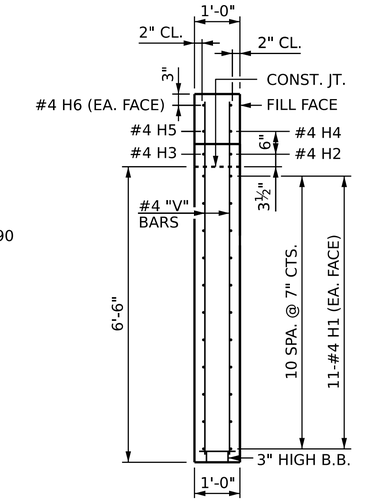
SECTION Y-Y



ELEVATION OF WING (W3)



ELEVATION OF WING (W4)



SECTION X-X

WING DETAILS

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

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SHEET 2 OF 3

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SUBSTRUCTURE
END BENT 2
WINGWALL DETAILS

REVISIONS						SHEET NO.
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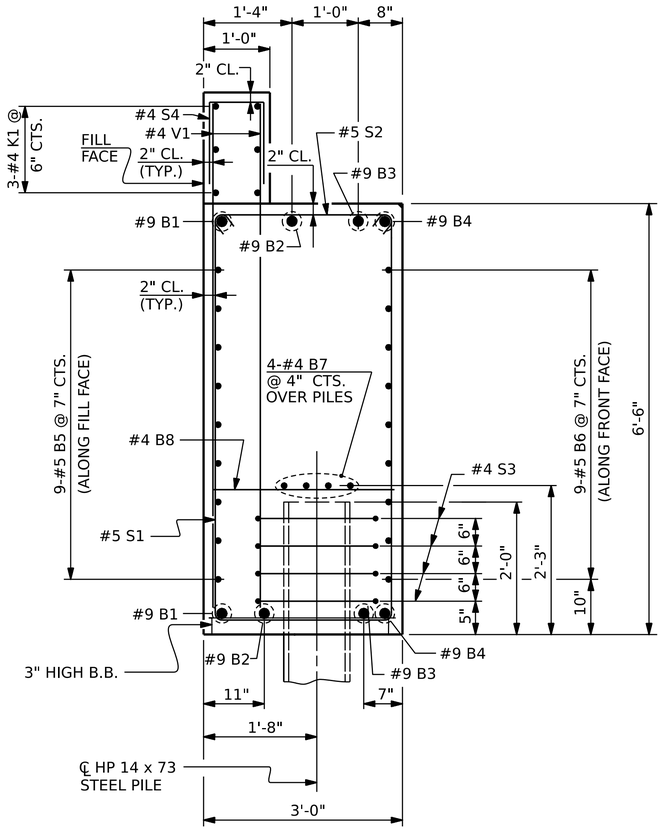
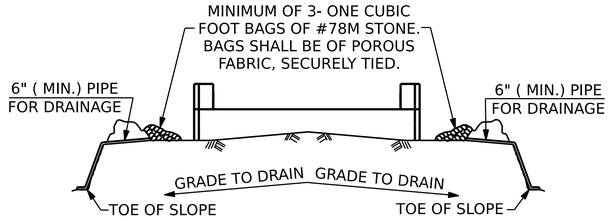
1			3			TOTAL SHEETS
2			4			21



SECTION A-A

(CONCRETE COLLAR NOT SHOWN FOR CLARITY.
SEE ``CORROSION PROTECTION FOR STEEL PILES DETAIL.'')

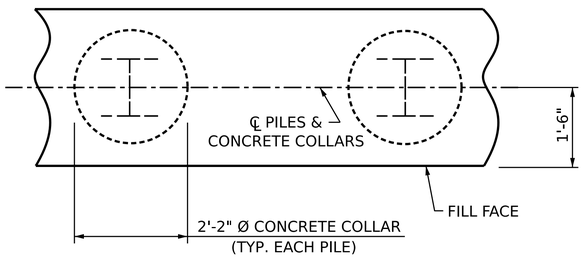


BAGGED STONE AND PIPE SHALL BE PLACED IMMEDIATELY AFTER COMPLETION OF END BENT EXCAVATION. PIPE MAY BE EITHER CONCRETE, CORRUGATED STEEL, CORRUGATED ALUMINUM ALLOY, OR CORRUGATED PLASTIC. PERFORATED PIPE WILL NOT BE ALLOWED.

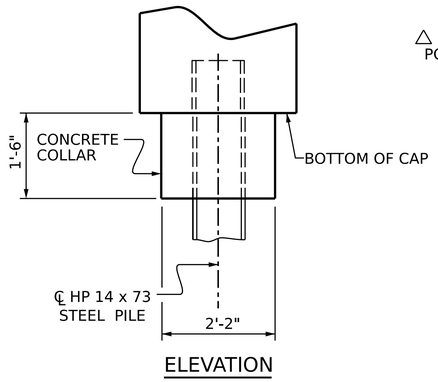
BAGGED STONE SHALL REMAIN IN PLACE UNTIL THE ENGINEER DIRECTS THAT IT BE REMOVED. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF SILT ACCUMULATIONS AT BAGGED STONE WHEN SO DIRECTED BY THE ENGINEER. BAGS SHALL BE REMOVED AND REPLACED WHENEVER THE ENGINEER DETERMINES THAT THEY HAVE DETERIORATED AND LOST THEIR EFFECTIVENESS.

NO SEPARATE PAYMENT WILL BE MADE FOR THIS WORK AND THE ENTIRE COST OF THIS WORK SHALL BE INCLUDED IN THE UNIT CONTRACT PRICE BID FOR THE SEVERAL PAY ITEMS.

TEMPORARY DRAINAGE AT END BENT

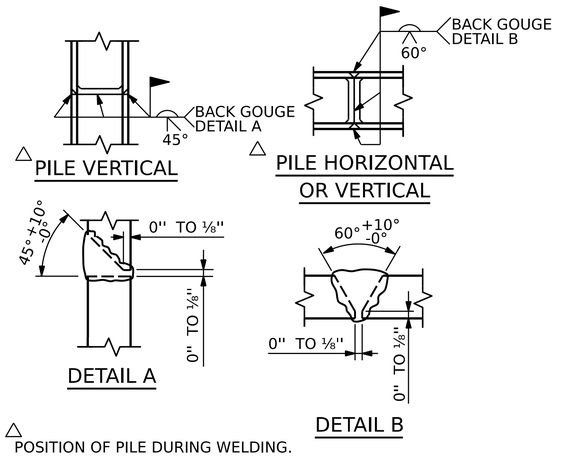


PLAN



ELEVATION

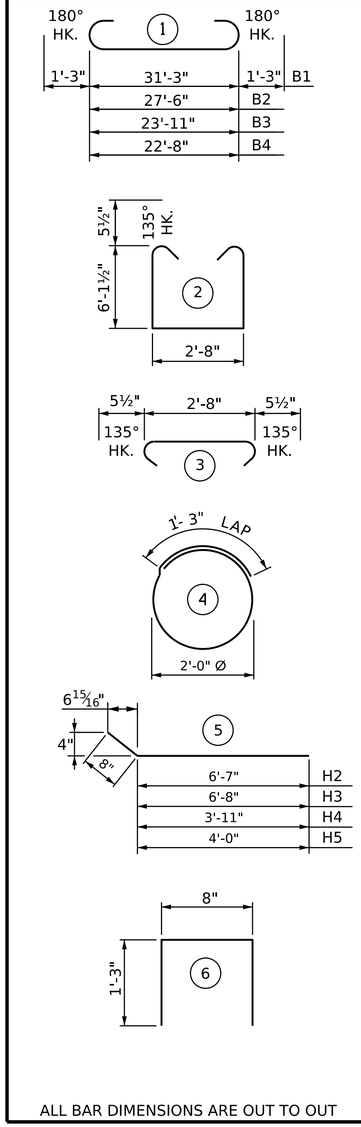
CORROSION PROTECTION FOR STEEL PILES DETAIL



△ POSITION OF PILE DURING WELDING.

PILE SPLICE DETAILS

BAR TYPES



ALL BAR DIMENSIONS ARE OUT TO OUT

BILL OF MATERIAL

END BENT 2

BAR	NO.	SIZE	TYPE	LENGTH	WEIGHT
B1	2	#9	1	33'-9"	230
B2	2	#9	1	30'-0"	204
B3	2	#9	1	26'-5"	180
B4	2	#9	1	25'-2"	171
B5	9	#5	STR.	31'-3"	293
B6	9	#5	STR.	22'-8"	213
B7	4	#4	STR.	23'-11"	64
B8	7	#4	STR.	2'-8"	12
H1	44	#4	STR.	10'-3"	301
H2	2	#4	5	7'-3"	10
H3	2	#4	5	7'-4"	10
H4	2	#4	5	4'-7"	6
H5	2	#4	5	4'-8"	6
H6	4	#4	STR.	6'-11"	18
K1	6	#4	STR.	29'-4"	118
S1	26	#5	2	15'-10"	429
S2	26	#5	3	3'-7"	97
S3	20	#4	4	7'-7"	101
S4	30	#4	6	3'-2"	63
V1	60	#4	STR.	7'-8"	307
V2	4	#4	STR.	7'-7"	20
V3	4	#4	STR.	7'-5"	20
V4	4	#4	STR.	7'-3"	19
V5	4	#4	STR.	7'-1"	19
V6	4	#4	STR.	6'-11"	18
V7	4	#4	STR.	6'-9"	18
V8	4	#4	STR.	6'-7"	18

REINFORCING STEEL	
TOTAL	2,998 LBS.
CLASS A CONCRETE	
POUR #1 (CAP, LOWER PART OF WINGS & COLLARS)	24.4 CU. YDS.
POUR #2 (UPPER PART OF WINGS AND BACKWALL)	2.3 CU. YDS.
TOTAL	26.7 CU. YDS.

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

SHEET 3 OF 3

DRAWN BY :	B. H. GONFA	DATE :	JUL 2025
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SUBSTRUCTURE
END BENT 2
DETAILS AND BILL OF MATERIAL

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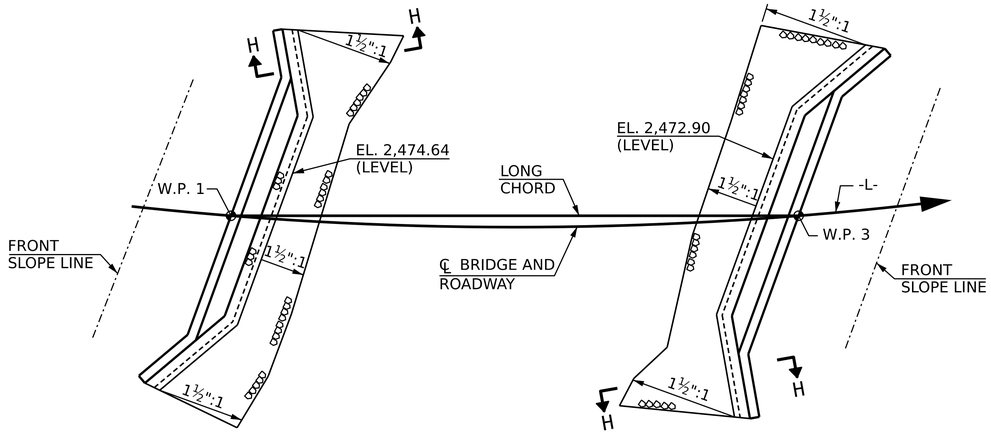
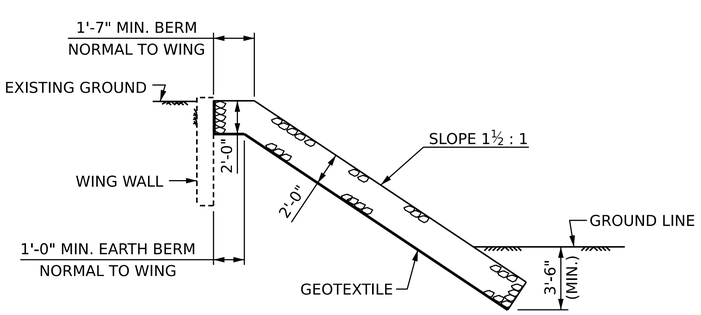
1			3			TOTAL SHEETS
2			4			21



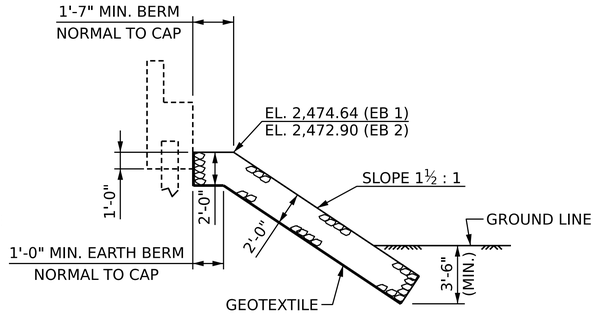
END BENT 1 END BENT 2

PLAN

ESTIMATED QUANTITIES		
BRIDGE @ STA. 12+13.00 -L-	RIP RAP CLASS II (2'-0" THICK)	GEOTEXTILE FOR DRAINAGE
	TONS	SQUARE YARDS
END BENT 1	90	100
END BENT 2	60	65



SECTION H-H



℄ SECTION

BERM RIP RAPPED

PROJECT NO.: 18314.1044073

HAYWOOD COUNTY

STATION: 12+13.00 -L-

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RALEIGH

MISCELLANEOUS
RIP RAP DETAILS

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1			3			TOTAL SHEETS
2			4			21

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DESIGN ENGINEER OF RECORD: B. D. KLAPPENBACH DATE : JUL 2025

8/26/21

STANDARD NOTES

DESIGN DATA:

SPECIFICATIONS	AASHTO (CURRENT)
LIVE LOAD	SEE PLANS
IMPACT ALLOWANCE	SEE AASHTO
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 AASHTO
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 2024 "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 ¾" WITH THE FOLLOWING EXCEPTIONS: TOP CORNERS OF CURBS MAY BE ROUNDED TO 1½" RADIUS WHICH IS BUILT INTO CURB FORMS; CORNERS OF TRANSVERSE FLOOR EXPANSION JOINTS SHALL BE ROUNDED WITH A ¼" 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 ¼" 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 ⅞" ∅ SHEAR STUDS FOR THE ¾" ∅ STUDS SPECIFIED ON THE PLANS. THIS SUBSTITUTION SHALL BE MADE AT THE RATE OF 3 - ⅞" ∅ STUDS FOR 4 - ¾" ∅ STUDS, AND STUD SPACING CHANGES SHALL BE MADE AS NECESSARY TO PROVIDE THE SAME EQUIVALENT NUMBER OF ⅞" ∅ STUDS ALONG THE BEAM AS SHOWN FOR ¾" ∅ STUDS BASED ON THE RATIO OF 3 - ⅞"∅ STUDS FOR 4 - ¾" ∅ 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 $\frac{5}{16}$" 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 $\frac{1}{16}$" 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. FINS 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.